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Diamonds in the rough: *Ibotyporanga* (Araneae, Pholcidae) spiders in semi-arid Neotropical environments

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Contents

Abstract. Ninetinae are a group of small and short-legged pholcids that are largely restricted to dry habitats where they lead reclusive lives in and under objects on the ground. They have long been rare in collections and poorly studied. The genus *Ibotyporanga* Mello-Leitão, 1944 previously contained five species: four from the Brazilian Cerrado and Caatinga biomes, and one from northern Venezuela. Based on recent focused collecting in Brazil and northern Colombia, we describe 19 new species, all based on males and females: *Ibotyporanga ziruma* Huber sp. nov., *I. walekeru* Huber sp. nov., *I. piojo* Huber sp. nov., *I. itatim* Huber sp. nov., *I. xakriaba* Huber sp. nov., *I. xique* Huber sp. nov., *I. camarai* Huber sp. nov., *I. kanoe* Huber sp. nov., *I. imale* Huber sp. nov., *I. sertao* Huber sp. nov., *I. guanambi* Huber sp. nov., *I. capivara* Huber sp. nov., *I. payaya* Huber sp. nov., *I. tuxa* Huber sp. nov., *I. atikum* Huber sp. nov., *I. kiriri* Huber sp. nov., *I. ouro* Huber sp. nov., *I. itajubaquara* Huber sp. nov. and *I. canudos* Huber sp. nov. In addition, we describe the previously unknown females of *I. diroa* Huber & Brescovit, 2003, and *I. ramosae* Huber & Brescovit, 2003, and present comprehensive SEM data of eight species. We analyze CO1 barcodes of 41 *Ibotyporanga* specimens representing 21 described and one undescribed species. Genetic distances among specimens and a species delimitation analysis suggest that some nominal species may in fact represent two or more species. A first morphological cladistic analysis of the genus strongly supports the monophyly of *Ibotyporanga* and suggests several clades within the genus, including one that is characterized by a strong elongation of the male palpal procursus. Geographically, the genus shows a disjunct distribution in Brazil and northern South America, separated by the Amazon biome. While plesiomorphic taxa (with a short procursus) are found in both regions, derived taxa (with an elongated procursus) are limited to Brazil. Species distribution modeling suggests that *Ibotyporanga* might also occur in poorly sampled regions of Ecuador, Peru, and Venezuela. In addition, a strong sampling bias towards the proximity of access routes suggests that the genus is much more diverse even in Brazil and Colombia. Two karyotyped species shared the diploid number of 2n♂ = 30 and an $X_1X_2X_3Y$ sex chromosome system.

Keywords. Ninetinae, Brazil, Colombia, CO1 barcodes, sampling bias, distribution modeling, karyotype, sex chromosomes.

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Introduction

Several species of daddy long-legs spiders (Pholcidae C.L. Koch, 1850) are common guests in human buildings around the world and thus widely known to the general public. However, the large majority of the almost 2000 currently known species are restricted and adapted to tropical and subtropical forests, where they occupy a wide range of niches (Eberle *et al.* 2018). Different forest microhabitats such as leaf litter, larger, sheltered spaces near the ground, live leaves, and the open space among the vegetation are usually inhabited by superficially very different pholcid species. For example, leaf litter-dwellers tend to be dark, small, and short-legged, while live leaf-dwellers are pale and long-legged, and species in large, sheltered spaces tend to be dark, large, and long-legged. In several cases, closely related species have adapted to these different niches, resulting in congeneric yet superficially highly dissimilar spiders (e.g., in *Mecolaesthus* Simon, 1893, *Metagonia* Simon, 1893, *Mesabolivar* González-Sponga, 1998, *Pholcus* Walckenaer 1805, *Uthina* Simon, 1893; Huber & Dimitrov 2014; Huber 2018; Huber & Villarreal 2020; Huber *et al.* 2019, 2022, 2023d).

Most of these 'humid environment pholcids' are representatives of just two subfamilies: the Modisiminae Simon, 1893 that are restricted to the New World, and the Pholcinae C.L. Koch, 1850 that are most diverse in the Old World (Huber 2011). Representatives of the other three currently recognized subfamilies (Arteminae Simon, 1893, Ninetinae Simon, 1890, Smeringopinae Simon, 1893) are also largely restricted to tropical and subtropical regions, but to their drier parts. In such biomes, the numbers of different microhabitats are limited, and, presumably because of this, congeneric species are usually very similar to each other in size, body shape, and coloration (e.g., in *Artema* Walckenaer, 1837, *Pholcophora* Banks, 1896, *Crossopriza* Simon, 1893; Aharon *et al.* 2017; Huber 2022; Huber *et al.* 2023b). While this aspect of diversity is thus low, as expected, it is not yet clear whether the apparent low species richness in Arteminae, Ninetinae, and Smeringopinae is to some degree an artifact from sampling biases. Several factors might contribute to a bias against these 'dry environment pholcids': (1) collectors' preferences for generally species-rich environments; (2) difficult access, e.g., because of poor infrastructure or for political reasons; (3) small body size and cryptic lifestyle of certain taxa.

In the case of Ninetinae, recent evidence suggests that this subfamily is indeed considerably more diverse than previously thought. However, with now 77 species (including those newly described herein), this subfamily is still the least species-rich among Pholcidae. Most species are tiny, with body lengths of 1–2 mm. They live reclusive lives under stones, in dry branches, dead cacti, and other objects on the ground; and they often foil the collector's effort by running and escaping rapidly (e.g., Gertsch 1982; Huber *et al.* 2023b, 2023c, 2024b). Some species have been found in extremely inhospitable environments that seemed to support very few other macroscopic animals (e.g., *Magana velox* Huber, 2019 in the Omani desert; *Nerudia centaura* Huber, 2023 at 4450 m a.s.l. in the Argentinean Andes; Huber & Carvalho 2019; Huber *et al.* 2023a). As a result, Ninetinae are very rare in collections, and several species are known from a few specimens or even a single specimen only. Recent focused collecting campaigns have shown that these spiders are actually often abundant in the proper microhabitats, and some genera are unexpectedly species-rich. For example, a revision of the previously monotypic genus *Nerudia* Huber, 2000 resulted in ten new species, based on more than 400 adult specimens (Huber *et al.* 2023a). The genus *Kambiwa* Huber, 2000, currently counting two species based on less than ten specimens in total, is now represented in collections by more than 1100 adult specimens representing approximately a dozen species (B.A. Huber & L.S. Carvalho, unpubl. data).

The present paper deals with yet another such genus that turns out to be unexpectedly species-rich and relatively easy to find in the proper environments. For more than a half century, *Ibotyporanga* Mello-Leitão, 1944 was monotypic, known from females only, originating from a single locality in Brazil. In 2000, the male of the type species was finally described (Huber 2000), and a few years later, three further species were added, from semi-arid environments in the Brazilian state of Bahia (Huber & Brescovit 2003). In 2020, the first non-Brazilian species were discovered, in semi-arid northwestern Venezuela (Huber & Villarreal 2020). Our new collections from Brazil and northern Colombia make *Ibotyporanga* the currently most species-rich genus in Ninetinae. Beyond that, the fresh material and the numerous new records allow for a first extensive survey of SEM characters, a first CO1 barcode library, analyses of potential distribution and sampling biases, and the first karyological data.

Material and methods

Material examined

The taxonomic part of this study is based on the examination of more than 800 adult specimens mostly deposited in the following three collections: Coleção de História Natural da Universidade Federal do Piauí, Floriano, Brazil (CHNUFPI); Museo de Entomología de la Universidad del Valle, Cali, Colombia (MUSENUV); and Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany (ZFMK). A few additional specimens studied are deposited in Departamento de Zoologia of the Universidade de Brasília (DZUNB); Instituto Butantan, São Paulo, Brazil (IBSP); Institut royal des Sciences naturelles de Belgique, Brussels, Belgium (IRSNB); Muséum d'histoire naturelle de Genève, Geneva, Switzerland (MHNG); Museu Paraense Emílio Goeldi, Belém, Brazil (MPEG); and Universidade Federal de Minas Gerais, Brazil (UFMG).

Taxonomy and morphology

Taxonomic descriptions follow the style of recent publications on Ninetinae (e.g., Huber *et al.* 2023a, 2023b, 2023c; based on Huber 2000). Species descriptions are arranged as in the cladogram in Fig. 1. Measurements were done under a dissecting microscope with an ocular grid and are in mm unless otherwise noted; eye measurements are ± 5 µm. Photos were made with a Nikon Coolpix 995 digital camera (2048×1536 pixels) mounted on a Nikon SMZ 18 stereo microscope or a Leitz Dialux 20 compound microscope. CombineZP (https://combinezp.software.informer.com/) was used for stacking photos. Drawings are partly based on photos that were traced on a light table and finalized under a dissecting microscope, or they were directly drawn with a Leitz Dialux 20 compound microscope using a drawing tube. Cleared epigyna were stained with chlorazol black. For scanning electron microscope (SEM) photos, specimens were dried in hexamethyldisilazane (HMDS) (Brown 1993) and photographed with a Zeiss Sigma 300 VP scanning electron microscope. SEM data are presented within the descriptions but are usually not based on the specific specimen described. Specimens studied with SEM are earmarked in the material examined sections. The number of decimals in coordinates gives a rough indication about the accuracy of the locality data: four decimals means that the collecting site is within about 10 m of the indicated spot; three decimals: within ~100 m; two decimals: within ~1 km; one decimal: within ~10 km. Distribution maps were generated with ArcMap 10.0 (Environmental Systems Research Institute, Redlands, CA).

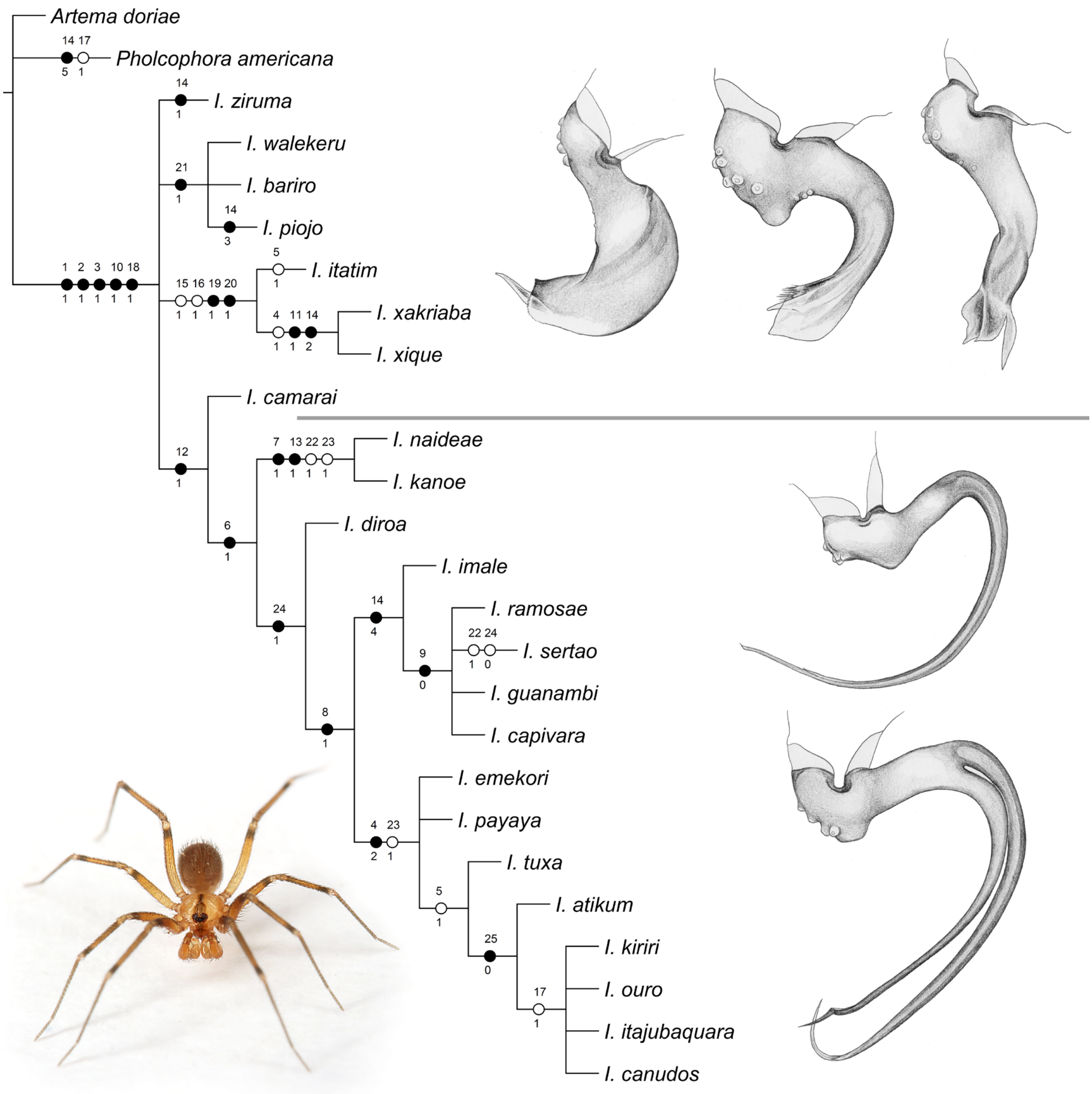

Fig. 1. Single most parsimonious cladogram of *Ibotyporanga* Mello-Leitão, 1944, resulting from analyses of the matrix in Appendix 1. Only unambiguous character changes are shown; black hash marks indicate unique character changes, white hash marks indicate homoplasious changes or reversals; numbers above hash marks indicate character numbers and below character states. Male palpal procursi on the right show one particular result of this tree: it suggests that strongly elongated procursi are derived. Top row: *I. piojo* Huber sp. nov., *I. itatim* Huber sp. nov., *I. xique* Huber sp. nov.; center: *I. diroa* Huber & Brescovit, 2003; bottom: *I. canudos* Huber sp. nov.; live spider: *I. imale* Huber sp. nov., male from Brazil, E of São Félix do Coribe.

Abbreviations:

ALE	=	anterior lateral eye(s)
ALS	=	anterior lateral spinneret(s)
AME	=	anterior median eye(s)
AMS	=	anterior median spinneret(s)
a.s.l.	=	above sea level
L/d	=	length/diameter
PLS	=	posterior lateral spinneret(s)
PME	=	posterior median eye(s)
PMS	=	posterior median spinneret(s)

Abbreviations used in figures only are explained in the figure legends.

Phylogenetic analyses of morphological data

The numerical cladistic analyses of morphological data were done using NONA, version 2 (Goloboff 1993), and TNT, version 1.1 (Goloboff *et al.* 2004, 2008). The matrix is shown in Appendix 1; it can be downloaded from http://www.pholcidae.de/matrices.html; terminal taxa and characters scored are listed in Appendices 2 and 3. Of the 25 characters, 23 are binary; the two non-binary characters (4, 14) are treated as non-additive. Cladogram analysis was done with Winclada, version 1.00.08 (Nixon 2002). See below for details of the analyses.

In addition, we calculated a maximum likelihood (ML) tree based on the morphological matrix using IQ-TREE (version 2.1.3) (Minh *et al.* 2020); see below for details on ML analyses with IQ-TREE.

Molecular data and analyses

Taxon sampling

As outgroup taxa, we chose three species of Ninetinae, plus *Artema doriae* Thorell, 1881 to root the tree; these were taken from Eberle *et al.* (2018) (specimen code: S326, GenBank code: MG268738), Huber *et al.* (2023b) (N051, ON970474; N059, ON970481), and Huber *et al.* 2024a (UH345, OR269902). Two published CO1 sequences of *Ibotyporanga* were taken from Astrin *et al.* (2007) (JA123, DQ667852) and Eberle *et al.* (2018) (S443, MG268742). In addition, we newly sequenced 41 specimens of *Ibotyporanga*. Table 1 lists all sequenced *Ibotyporanga* specimens.

DNA extraction, amplification, and sequencing

Two to four legs of specimens stored in non-denatured pure ethanol (~99%) at -20°C were used for DNA extraction. Extracted genomic DNA is deposited at and is available from the LIB Biobank, Museum Koenig, Bonn. DNA was extracted using the BioSprint® 96 DNA Blood Kit (Qiagen). The CO1 primers used were LCO1490-JJ and HCO2198-JJ (Astrin *et al.* 2016; primer versions JJ2 served as backup). The 20 µl reaction volume consisted of 4.4 µl H_2O, 2 µl DNA template, 2 µl Q-Solution, 10 µl Qiagen Multiplex-Mix, 0.8 µl forward primer and 0.8 µl reverse primer. The PCR program ran two cycle sets, as a combination of a ‘touchdown’ and a ‘step-up’ routine: (1) 15 min hot start Taq activation at 95°C; (2) first cycle set (15 repeats): 35 s denaturation at 94°C, 90 s annealing at 55°C (−1°C per cycle) and 90 s extension at 72°C; (3) second cycle set (25 repeats): 35 s denaturation at 94°C, 90 s annealing at 40°C, and 90 s extension at 72°C; (4) final elongation 10 min at 72°C. PCR products were sent for bidirectional Sanger sequencing to BGI (Hong Kong, China).

Sequence assembly and contamination check

The CO1 barcodes were assembled with Geneious Prime® 2023.1.2 (https://www.geneious.com), and taxonomic assignments were checked by: (1) blasting assembled sequences against a local NT database (downloaded from https://ftp.ncbi.nlm.nih.gov/blast/db/ on August 23, 2021); (2) the identification engine of the Barcode of Life Data System (BOLD) (http://www.boldsystems.org/index.php) (Ratnasingham & Hebert 2007; Yang *et al.* 2020).

Multiple sequence alignment (MSA)

The CO1 barcodes were translated into protein sequences using BioPython (version 1.78) (Cock *et al.* 2009) with invertebrate mitochondrial genetic code. Next, protein-MSAs were constructed using the mafft-linsi algorithm of MAFFT (version 7.487) (Katoh & Standley 2013), which then assisted the construction of nucleotide level MSAs with PAL2NAL (Suyama *et al.* 2006). This helps avoid the introduction of biologically meaningless frameshifts to the alignments (Suyama *et al.* 2006).

Molecular species delimitation

The online tool ASAP Web (https://bioinfo.mnhn.fr/abi/public/asap/; Puillandre *et al.* 2021) was used for species delimitation using the CO1 MSA. All parameters were set as default values except that the Kimura 2-parameter (K2P) model (Kimura 1980) was applied for genetic distance calculation. Ten delimitation schemes with best scores (the smaller the better) were kept.

Molecular tree construction

We constructed two trees based on the CO1 MSA. (1) A neighbor-joining (NJ) tree (Saitou & Nei 1987) using the K2P model (Kimura 1980) in MEGA 11 (Tamura *et al.* 2021), during which pairwise deletion of gaps in the alignment was applied. The NJ tree was assessed with 5000 bootstrap replications (Felsenstein 1985). The genetic distances (K2P) among specimens were generated at the same time. (2) A maximum likelihood (ML) tree using IQ-TREE (version 2.1.3) (Minh *et al.* 2020). For the ML analyses with IQ-TREE, the best-fit models were chosen according to the Bayesian information criterion (BIC) using the ModelFinder algorithm (Kalyaanamoorthy *et al.* 2017) in IQ-TREE (-m MFP). To avoid tree search being stuck in local optima, we applied, for each analysis, 10 IQ-TREE runs (--runs 10) and smaller perturbation strength (-pers 0.2) and larger number of stop iterations (-nstop 500). Tree robustness was evaluated with 2000 ultrafast bootstrap (UFBoot) replicates (Hoang *et al.* 2017) and the -bnni option was applied to reduce the risk of overestimating branch supports due to severe model violation. The SH approximate likelihood ratio test (SH-aLRT) (Guindon *et al.* 2010) was also performed with 2000 replicates. The online tool iTOL (Letunic & Bork 2021) was used for tree visualization.

Combined morphological + molecular tree

In addition, and using the same parameters, we constructed a maximum likelihood tree from a combination of the morphological matrix and the CO1 MSA using IQ-TREE (version 2.1.3) (Minh *et al.* 2020).

Sampling biases

To evaluate a possible sampling bias regarding the proximity of points of occurrences to access routes, we calculated the extent of occurrence (EOO) as the convex hull that encompasses all known records of species of *Ibotyporanga* with at least three points of occurrences. Access routes were taken from the OpenStreetMap platform (https://www.openstreetmap.org/) and included only roads. Although there are some points of occurrences in the Amazon forest, none of them was based on localities accessible by rivers only. Therefore, waterways were excluded from this analysis. The distance from access routes was calculated using the function 'Near', and the EOO using the function 'Minimum boundary geometry' of the software ArcMap 10.8 (ESRI). A generalized linear model using Gaussian distribution of errors (hereafter 'Gaussian GLM') was performed to evaluate whether the EOO was explained by the distance from access routes, i.e., whether more common and widespread species are closer/more distant from roads (see Table S2). The distance of the *Ibotyporanga* points of occurrences to access routes was also compared with the distances of 200 points, randomly selected at a 20 km radius buffer around each point of occurrence (minimum of 100 m from each random point to others). The observed distances (i.e., distances of the points of occurrences from access routes) and expected distances (i.e., distances of the random points from access routes) were compared using a Gaussian GLM. All GLMs were written using base R functions and model quality was assessed by checking the dispersion parameters. Graphs were produced using functions of the packages 'ggplot2' (Wickham 2011), 'easyGgplot2' (Kassambara 2014), and base R commands using the software RStudio 2023.06.0 (https://posit.co/download/rstudio-desktop/).

Table 1 (continued on next page). Geographic origins and GenBank accession numbers of sequenced specimens. Specimens are sorted by Code. Two previously published sequences are included for the sake of completeness: JA123 (DQ667852) from Astrin *et al.* (2007), and S443 (MG268742) from Eberle *et al.* (2018).

Code	Genus	Species	Vial	Country	Admin	Locality	Lat.	Long.	CO1
BH58	*Ibotyporanga*	‘Ven18-182’	Ven18-182	Venezuela	Falcón	Peninsula de Paraguaná, near Cueva del Guano	11.9026	-69.9456	PP192789
JA123	*Ibotyporanga*	*naideae*	G117	Brazil	São Paulo	Campinas	-22.9000	-47.0700	DQ667852
N086	*Ibotyporanga*	‘Ven18-182’	Ven18-182	Venezuela	Falcón	Peninsula de Paraguaná, near Cueva del Guano	11.9026	-69.9456	PP192790
N088	*Ibotyporanga*	*bariro*	Ven20-141	Venezuela	Falcón	SE of Bariro	10.7304	-70.6957	PP192791
S443	*Ibotyporanga*	*kanoe*	Br16-303	Brazil	Rondônia	Floresta Nacional do Jamari, Pedra Grande	-9.1980	-63.0820	MG268742
UH047	*Ibotyporanga*	*naideae*	Br22-153	Brazil	Bahia	S of Contendas do Sincorá	-13.7826	-41.0507	PP192799
UH048	*Ibotyporanga*	*kiriri*	Br22-154	Brazil	Bahia	NE of Brumado	-14.1601	-41.5154	PP192800
UH051	*Ibotyporanga*	*guanambi*	Br22-158	Brazil	Bahia	N of Guanambi	-14.1797	-42.7812	PP192797
UH054	*Ibotyporanga*	*imale?*	Br22-162	Brazil	Minas Gerais	P.N. Cavernas do Peruaçu, near guest house	-15.1229	-44.2804	PP192792
UH056	*Ibotyporanga*	*imale?*	Br22-168	Brazil	Minas Gerais	P.N. Cavernas do Peruaçu, near visitor center	-15.1559	-44.2316	PP192795
UH061	*Ibotyporanga*	*imale*	Br22-180	Brazil	Bahia	E of São Félix do Coribe	-13.4040	-44.1100	PP192793
UH064	*Ibotyporanga*	*emekori*	Br22-183	Brazil	Bahia	W of Bom Jesus da Lapa, Fazenda Pedra Branca	-13.3150	-43.7950	PP192802
UH068	*Ibotyporanga*	*payaya*	Br22-192	Brazil	Bahia	SE of Bom Jesus da Lapa, ‘site 1’	-13.4398	-43.1643	PP192798
UH069	*Ibotyporanga*	*payaya*	Br22-193	Brazil	Bahia	SE of Bom Jesus da Lapa, ‘site 2’	-13.4383	-43.1645	PP192796
UH074	*Ibotyporanga*	*guanambi?*	Br22-198	Brazil	Bahia	NE of Marcolino Moura	-13.5883	-41.6635	PP192805
UH078	*Ibotyporanga*	*canudos*	Br22-203	Brazil	Bahia	SE of Lagoa do Boi	-11.9420	-41.7170	PP192806
UH079	*Ibotyporanga*	*tuxa*	Br22-204	Brazil	Bahia	W of Barra do Mendes	-11.7940	-42.2880	PP192807
UH082	*Ibotyporanga*	*canudos*	Br22-208	Brazil	Bahia	NW of Ibipeba	-11.5400	-42.1700	PP192794
UH083	*Ibotyporanga*	*itajubaquara*	Br22-212	Brazil	Bahia	N of Itajubaquara	-11.3607	-42.6810	PP192808
UH086	*Ibotyporanga*	*itajubaquara*	Br22-216	Brazil	Bahia	NW of Gameleira do Assuruá	-11.1942	-42.7165	PP192809
UH091	*Ibotyporanga*	*diroa*	Br22-225	Brazil	Bahia	near Mundinho, near Toca do Índio	-11.0195	-42.1564	PP192803
UH093	*Ibotyporanga*	*diroa*	Br22-227	Brazil	Bahia	W of Queimada Nova	-11.0343	-42.0682	PP192804
UH095	*Ibotyporanga*	*canudos*	Br22-230	Brazil	Bahia	W of Morro do Chapéu	-11.4750	-41.3690	PP192801
UH097	*Ibotyporanga*	*naideae*	Br22-236	Brazil	Bahia	SE of Jacobina	-11.2205	-40.4787	PP192812

Table 1 (continued).

Code	Genus	Species	Vial	Country	Admin	Locality	Lat.	Long.	CO1
UH098	*Ibotyporanga*	*canudos*	Br22-239	Brazil	Bahia	4 km SW of Andorinha	-10.3668	-39.8636	PP192813
UH177	*Ibotyporanga*	*sertao*	Carv60	Brazil	Piauí	Floriano, Residencial Angelim, Bairro Curtume	-6.7922	-43.0117	PP192810
UH179	*Ibotyporanga*	*sertao*	Carv74	Brazil	Piauí	P.N. da Serra da Capivara, near Boqueirão do Ferreira	-8.7476	-42.4870	PP192811
UH290	*Ibotyporanga*	*walekeru?*	Col292	Colombia	La Guajira	near Papayal	11.0029	-72.7708	PP192815
UH302	*Ibotyporanga*	*walekeru*	Col308	Colombia	Cesar	18 km ESE of Pueblo Bello	10.3449	-73.4349	PP192814
UH471	*Ibotyporanga*	*bariro*	Ven20-141	Venezuela	Falcón	SE of Bariro	10.7304	-70.6957	PP192817
UH473	*Ibotyporanga*	*ziruma*	Col273	Colombia	Magdalena	Santa Marta, at Cerro Ziruma	11.2126	-74.2307	PP192816
UH480	*Ibotyporanga*	*itatim*	Br22-148	Brazil	Bahia	W of Itatim	-12.7162	-39.7626	PP192826
UH484	*Ibotyporanga*	*imale?*	Br22-160	Brazil	Minas Gerais	NW of Itacarambi	-15.0555	-44.1715	PP192822
UH497	*Ibotyporanga*	*ouro*	Br22-209	Brazil	Bahia	E of Gentio do Ouro	-11.4242	-42.3394	PP192829
UH498	*Ibotyporanga*	*xique*	Br22-220	Brazil	Bahia	S of Xique-Xique	-11.0398	-42.7311	PP192820
UH499	*Ibotyporanga*	*emekori*	Br22-224	Brazil	Bahia	near Mundinho, near Toca do Índio	-11.0195	-42.1564	PP192819
UH505	*Ibotyporanga*	*camarai*	Br22-243	Brazil	Pernambuco	NE of Petrolina	-9.1957	-40.3832	PP192828
UH506	*Ibotyporanga*	*sertao*	Br22-246	Brazil	Pernambuco	NE of Lagoa Grande	-8.9117	-40.0547	PP192824
UH508	*Ibotyporanga*	*sertao*	Br22-253	Brazil	Pernambuco	NE of Cabrobó	-8.4200	-39.1760	PP192823
UH515	*Ibotyporanga*	*sertao*	Carv72	Brazil	Piauí	P.N. da Serra da Capivara, Baixão das Andorinhas	-8.8614	-42.6867	PP192818
UH516	*Ibotyporanga*	*ramosae*	Carv82	Brazil	Bahia	São Desiderio, Gruta da Passagem	-12.4177	-45.0743	PP192825
UH552	*Ibotyporanga*	*walekeru*	Col287	Colombia	La Guajira	5 km S of Riohacha	11.4848	-72.9051	PP192827
UH553	*Ibotyporanga*	*piojo*	Col316	Colombia	Atlántico	near Piojo, Reserva Natural Los Charcones	10.7570	-75.0950	PP192821

Considering the discontinuous geographic distribution of *Ibotyporanga*, we explored the environmental niche occupied by this genus using three approaches: (1) ordination with a principal component analysis (PCA; base R function 'prcomp'); (2) species distribution modeling (SDM); and (3) analysis of phylogenetic signal. All spatial analyses used 22 predictor layers: 19 climatic variables (WorldClim 2.1, taken from Fick & Hijmans 2017), the mean tree density (Crowther *et al.* 2015), the mean canopy height (Simard *et al.* 2011), and the global aridity index (Zomer *et al.* 2022), all at a 1-km^2 scale. The records of 25 species were included in all spatial analyses (i.e., 23 nominal species plus two undescribed and potential new species: *I.* "Ven18-182" and *I.* "Br22-182" – see 'Composition and species limits' section). Records of the widespread *I. naideae* were excluded from the comparative spatial analyses because most of them are from synanthropic environments.

The species distribution modeling aimed to evaluate the existence of areas with high environmental suitability but without known records of *Ibotyporanga*. Although this approach disregards environmental thresholds for individual species it serves as an exploratory analysis (see examples in Magalhães *et al.* 2016; Huber *et al.* 2023a, 2024b). This analysis was carried out with the same parameters as in Huber *et al.* (2024b). As a background, we used an area that encompasses around 700 km from any *Ibotyporanga* point of occurrence (except *I. naideae*). The phylogenetic signal related to the environmental niche occupied by *Ibotyporanga* representatives was tested to evaluate whether this feature evolved following the expectations of a Brownian motion, i.e., stochastic changes of a trait over time (Diniz-Filho *et al.* 2012), calculating the λ parameter (Pagel 1999), with the function 'phylosig' of the R package 'phytools' (Revell 2012). This analysis was carried out for each phylogenetic tree available: (1) molecular data, analyzed with IQ-TREE; (2) molecular data, analyzed with neighbor joining; (3) morphology and molecular data, analyzed with IQ-TREE; and (4) morphology data, analyzed with IQ-TREE. The significant PCA axes of the environmental layers based on the records of *Ibotyporanga* species present in the phylogenetic trees were used for this analysis.

Preparation of chromosome slides and their evaluation

Preparations were made from the testes of five males of *I. naideae* Mello-Leitão, 1944 (Bahia, SE of Jacobina; same collection data as ZFMK Ar 24357; vouchers lost) and one male of *Ibotyporanga* sp. (Bahia, Toca do Índio; same collection data as ZFMK Ar 24373; voucher lost). The latter specimen could not be identified to species because its palps were lost, and two species were collected at Toca do Índio (*I. emekori* Huber & Brescovit, 2003; *I. diroa* Huber & Brescovit, 2003). Chromosomes were prepared according to the technique described by Dolejš *et al.* (2011). Briefly, tissues were dissected, hypotonized with 0.075M KCl for 25 min, and fixed three times (6, 10, and 20 min) using ethanol:acetic acid fixation (3:1). A cell suspension was prepared from a piece of the fixed gonads, on a microscope slide (Superfrost, Menzel Ltd.) in three drops of 60% acetic acid using tungsten needles. The glass slide with the suspension was placed on a histological plate at 40º C. The drop was slid over the glass using a tungsten rod. During this process, the chromosome plates adhered to the glass surface. Finally, the slides were stained with 5% Giemsa solution in modified Sörensen buffer (4.54 g KH_2PO_4, 4.75 g $Na_2HPO_4 \cdot 12H_2O$, 1000 ml H_2O, pH 6.8) for 28 min.

Selected chromosome plates were photographed using an Olympus BX 50 microscope with a 100× immersion oil objective, connected to a DP 71 CCD camera and a computer equipped with the Cell^D program (Olympus). Mitotic metaphases and metaphases of the second meiotic division were used to determine chromosome morphology. Sex chromosomes were determined based on their specific behavior during meiosis. In addition to differentiated sex chromosomes, the karyotypes of araneomorph spiders also contain a specific pair that is probably formed by undifferentiated XY sex chromosomes (the so-called cryptic sex chromosome pair, CSCP) (Sember *et al.* 2020). We were not able to distinguish these chromosomes from autosomes at the phases of division used for determination of chromosome morphology. We therefore refer to autosomes and CSCPs together as chromosome pairs. The morphology of chromosomes was classified based on the ratio of the long to short arm of the chromosome (Levan *et al.* 1964), as metacentric (ratio 1.0–1.7), submetacentric (ratio 1.71–3.0), subtelocentric (ratio 3.01–7.0), and acrocentric (ratio >7.0). The first two categories were referred to as biarmed chromosomes. Chromosome measurements were performed using ImageJ software (https://imagej.net/ij/).

Results

Phylogenetic analyses

Using NONA with *hold/100*, *mult*200* (or *hold/10*; *mult*10000*), and *amb-* for the matrix in Appendix 1 and equal character weights resulted in a single most parsimonious cladogram with a length of 38 (Ci=78; Ri=92) (Fig. 1). Successive weighting in NONA (with the consistency index as weighting function) and the implicit enumeration algorithm in TNT both resulted in the same single tree. The same tree topology was also recovered using maximum likelihood in IQ-TREE (Fig. S1).

The ML trees based on CO1 sequences (Fig. S2) and on a combination of CO1 sequences and morphology (Fig. S3) recovered few clades that are identical to or compatible with the morphological tree. This conflict is briefly addressed in the Discussion section.

Taxonomy

Class Arachnida Lamarck, 1801
Order Araneae Clerck, 1757
Family Pholcidae C.L. Koch, 1850

Genus ***Ibotyporanga*** Mello-Leitão, 1944

Ibotyporanga Mello-Leitão, 1944: 6. Type species: *I. naideae* Mello-Leitão, 1944.

Ibotyporanga – Huber 2000: 94. — Huber & Brescovit 2003: 17. — Huber & Villarreal 2020: 62.

Diagnosis

Small short-legged pholcids with eight eyes and globular abdomen (Figs 25, 55, 73), similar in size and body shape to other New World Ninetinae in the genera *Pholcophora*, *Papiamenta* Huber, 2000, and *Gertschiola* Brignoli, 1981. Males are easily distinguished from these and from all other pholcids by single median process on chelicerae (e.g., Figs 29, 34, 40). Corresponding pockets on female epigyna (e.g., Figs 30, 35, 41) are diagnostic for females, but less unique among Pholcidae (similar median pockets occur in other subfamilies, e.g., in *Mesabolivar*). Males further distinguished by unique light prolateral band of unknown function on procursus (e.g., Figs 28, 33, 37).

Description

Male

Measurements. Total body length 1.5–2.7; carapace width 0.6–1.0. PME diameter 50–100 µm; AME diameter 30–80 µm. Leg 1 length 2.8–7.4; tibia 1 length 0.7–2.0; tibia 4 in most species longer than tibia 1, only in the relatively long-legged *I. xique* sp. nov. and *I. xakriaba* sp. nov., as well as in *I. itatim* sp. nov., shorter (tibia 4 / tibia 1 length: 0.94-0.98); leg femora diameters 0.13–0.22; leg tibiae diameters 0.09–0.12. Tibia 1 L/d in most species 8–15, only in the long-legged *I. xique* and *I. xakriaba* higher: 20 and 18, respectively.

Colour. In ethanol mostly ochre-yellow to light brown, carapace medially and ocular area often darker, legs usually with darker rings on femora (subdistally) and tibiae (proximally and subdistally); abdomen pale gray, usually with darker internal marks dorsally and laterally; ventrally with light ochre to brown plates in front of gonopore and in front of spinnerets. Live specimens often with slightly reddish or orange prosoma and legs.

Body. Habitus as in Figs 25, 55, and 73. Ocular area slightly raised. Carapace with distinct but shallow thoracic groove (Figs 2–3). Clypeus with sclerotized rim with median notch (Fig. 107A). Sternum

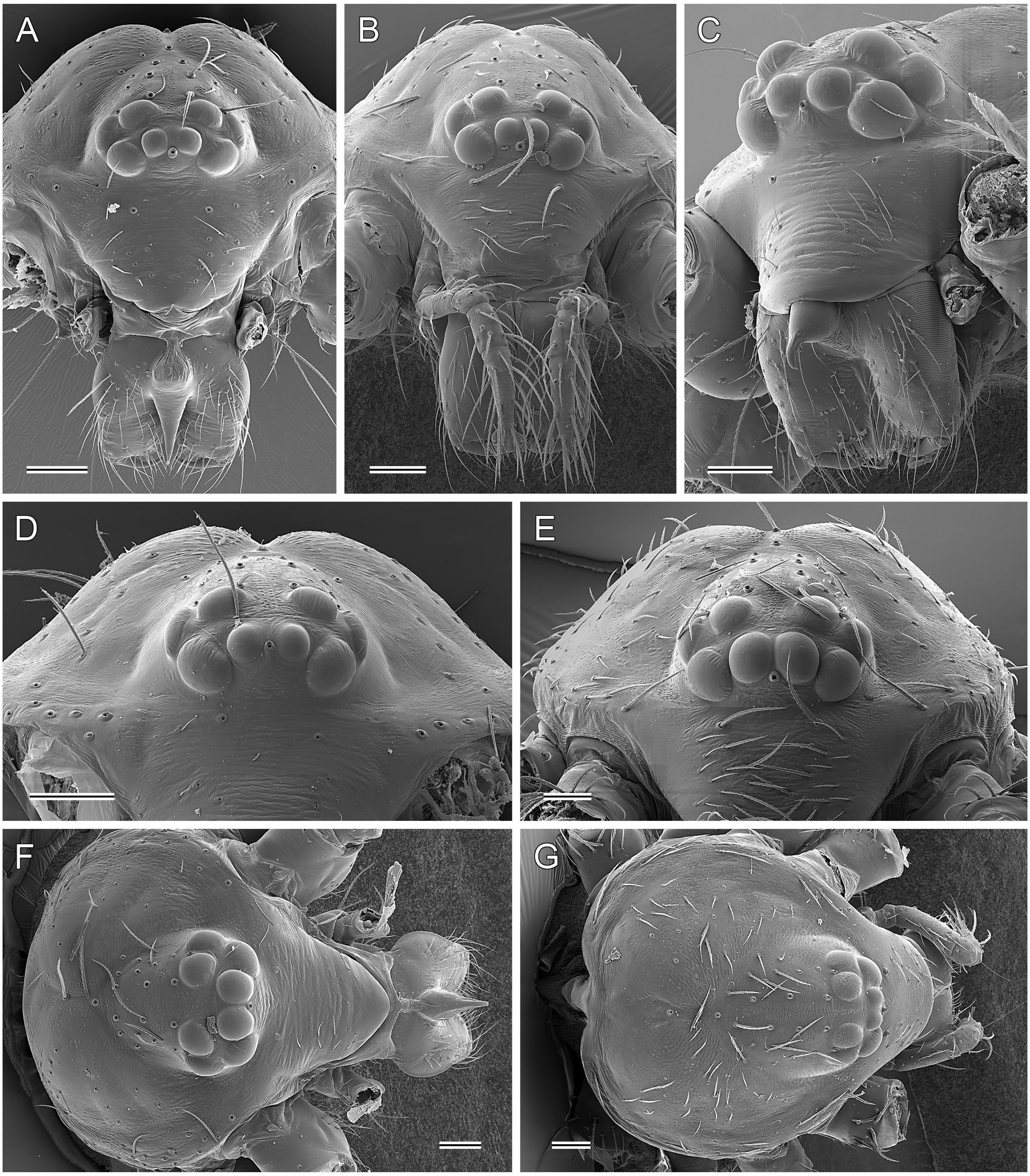

Fig. 2. *Ibotyporanga* spp., prosoma. **A–B**. *I. ziruma* Huber sp. nov., male and female prosomata, frontal views. **C**. *I. itatim* Huber sp. nov., male prosoma, oblique frontal view. **D**. *I. walekeru* Huber sp. nov., male, frontal view. **E–F**. *I. guanambi* Huber sp. nov., female, frontal view and male, frontal-dorsal view. **G**. *I. payaya* Huber sp. nov., female, dorsal view. Scale lines: 100 µm.

slightly wider than long, sometimes with pair of low and indistinct anterior processes near coxae 1 (Fig. 3G); processes without pores. Abdomen globular. Numerous rimmed pores (Fig. 18) at regular intervals on many body parts, especially on legs, but also on chelicerae and abdomen; outer diameter 2.2–4.2 µm; opening diameter: 0.35–0.45 µm. Gonopore with four epiandrous spigots in variable pattern (evenly spaced or in two pairs; Figs 4–5). Spinnerets general arrangement as usual in Pholcidae (Fig. 6);

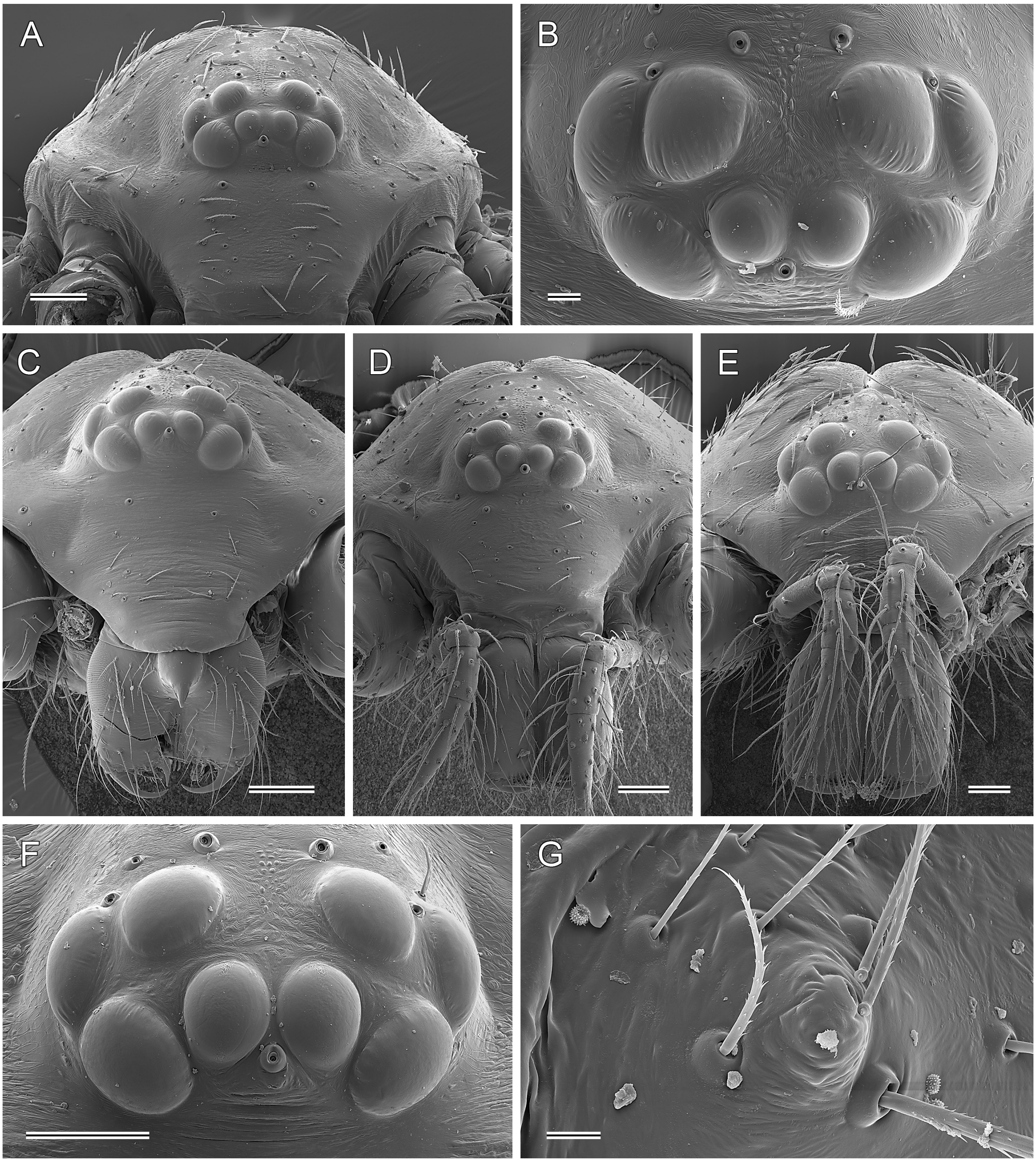

Fig. 3. *Ibotyporanga* spp., prosoma and ocular area. **A–B**. *I. payaya* Huber sp. nov., female, frontal view and male ocular area, frontal-dorsal view. **C–D**. *I. canudos* Huber sp. nov., male and female, frontal views. **E–F**. *I. naideae* Mello-Leitão, 1944, female, frontal view and male ocular area, frontal view. **G**. *I. ziruma* Huber sp. nov., hump on male sternum. Scale lines: A, C–F = 100 µm; B = 20 µm; G = 10 µm.

ALS with only two spigots (Figs 7–8): one strongly widened spigot and one long and slender spigot; PMS with two short conical spigots (Figs 6–8); PLS without spigots; AMS area with one or two median hairs and slightly modified sculptured area (Fig. 7A–B).

Chelicerae. With distinctive median frontal apophysis, usually in proximal position (e.g., Figs 34, 40), only in *I. ziruma* sp. nov. in distal position (Fig. 29); chelicerae width 0.25–0.40. Stridulatory files (Figs 9–10) very fine and poorly visible in dissecting microscope, with ~45–65 ridges, distances between ridges (in eight species studied with SEM) 1.7–3.1 µm, distances proximally in some species smaller than distally (e.g., *I. guanambi* sp. nov., *I. sertao* sp. nov.), in other species proximally larger than distally (e.g., *I. naideae* Mello-Leitão; *I. itatim* sp. nov.).

Palps. Coxa unmodified; trochanter with indistinct ventral protrusion; femur variably long, proximally with retrolateral process sometimes directed towards distal, with prolateral stridulatory pick (modified

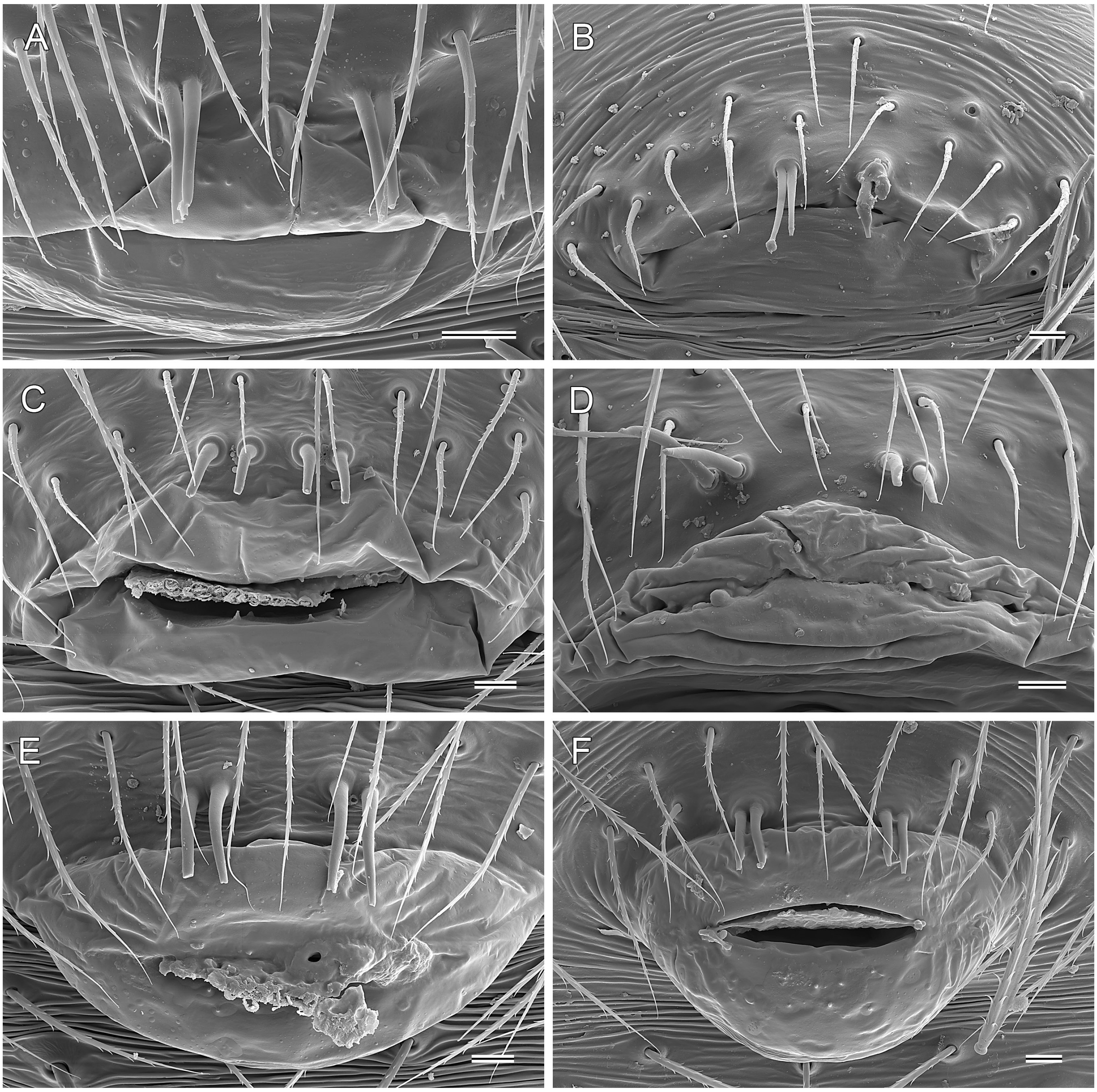

Fig. 4. *Ibotyporanga* spp., male gonopore and epiandrous spigots. **A**. *I. ziruma* Huber sp. nov. **B**. *I. walekeru* Huber sp. nov. **C**. *I. itatim* Huber sp. nov. **D**. *I. naideae* Mello-Leitão, 1944. **E**. *I. guanambi* Huber sp. nov. **F**. *I. payaya* Huber sp. nov. Scale lines: 10 µm.

hair; Fig. 12F), femur distally widened but unmodified; femur-patella joints usually not (or very slightly) shifted toward prolateral side; patella ranging from very short (e.g., Fig. 47) to very long (e.g., Fig. 109); tibia with two trichobothria; tibia-tarsus joints usually slightly shifted toward retrolateral side; palpal tarsal organ capsulate with small opening (Fig. 13), outer diameter 6–10 µm, opening diameter 1.3–2.5 µm; procursus shape highly variable, from short and wide (e.g., Figs 28, 33, 39) to very long and slender (e.g., Figs 62, 85, 102), always with light prolateral band of unknown function (Figs 28, 33, 37); distally often with tiny side branch (Fig. 12A–C), tip often semi-transparent (Figs 57, 76, 114); in some species with variably long dorsal side branch (e.g., Figs 81, 89, 98); genital bulb with proximal sclerite connecting to tarsus, strongly attached to tendon of muscle from tibia (sclerite thus usually breaks when

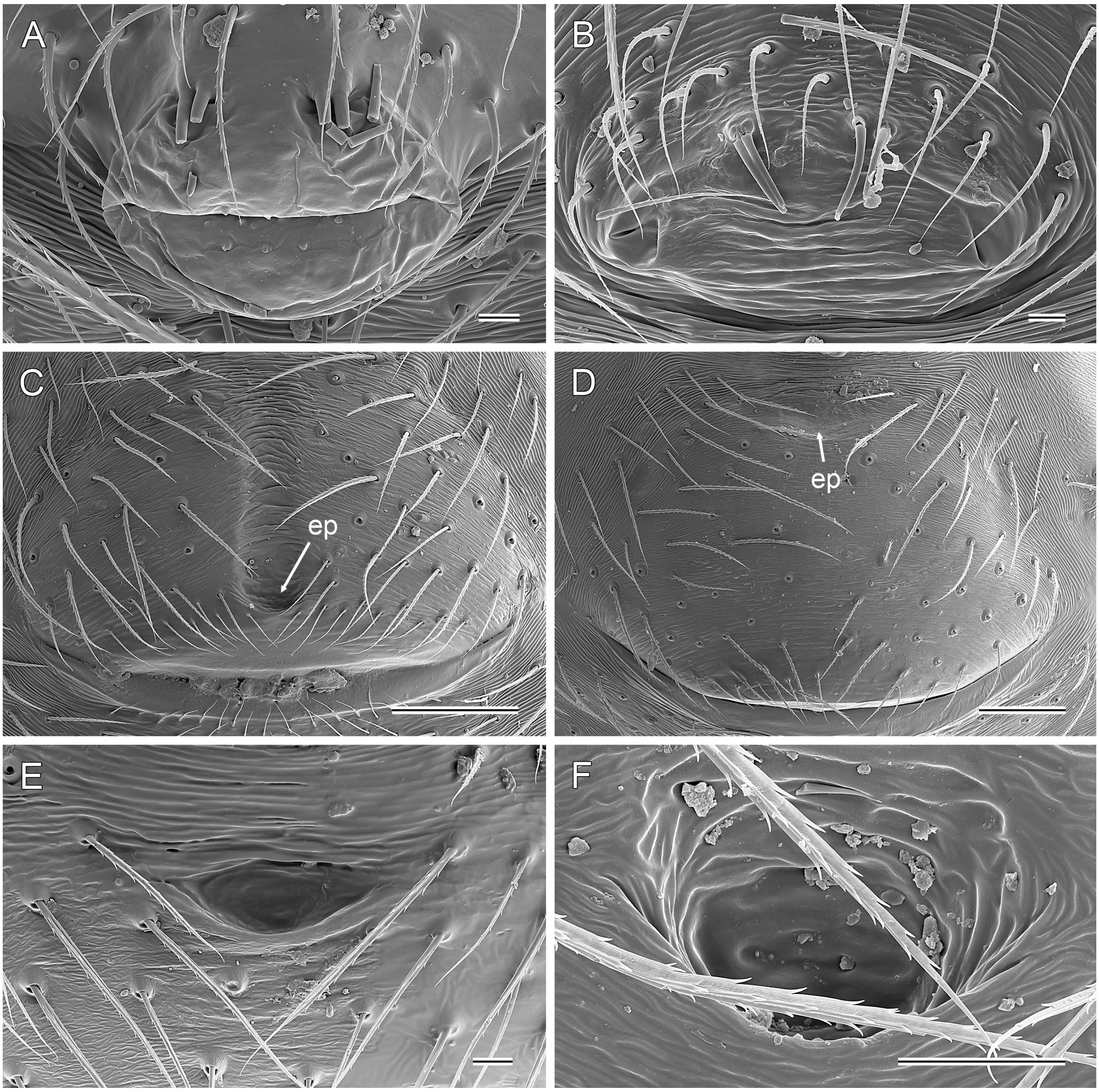

Fig. 5. *Ibotyporanga* spp., male gonopore and epiandrous spigots, and female epigynum. **A**. *I. sertao* Huber sp. nov., male gonopore. **B**. *I. canudos* Huber sp. nov., male gonopore. **C**. *I. ziruma* Huber sp. nov., epigynum, ventral view. **D**. *I. payaya* Huber sp. nov., epigynum, ventral view. **E**. *I. sertao* Huber sp. nov., epigynal pocket. **F**. *I. canudos* Huber sp. nov., epigynal pocket. Abbreviation: ep = epigynal pocket. Scale lines: A–B = 10 µm; C–D = 100 µm; E–F = 20 µm.

detaching bulb from palp; therefore often not drawn); bulbous part of genital bulb in most species with distinct prolateral sclerite (e.g., Figs 28, 33, 37), in several species with small ventral tubercles (prominent in *I. naideae*, Fig. 11E–F); bulbal process with variably complex tip consisting of sclerotized and membranous elements and presumably carrying sperm duct opening.

Legs. Without spines but with stronger hairs ventrally on all femora (Fig. 15A–B; stronger compared to neighboring leg hairs: diameter ~5 µm versus ~3 µm in neighboring hairs, but similar hairs occur on leg coxae, sternum, palps, carapace, and abdomen). Without curved hairs. Tibia 1 or tibia 1 + tibia 2 with sexually dimorphic short vertical hairs (Fig. 16), in several rows or bands, base diameter 4.1–6.3 µm,

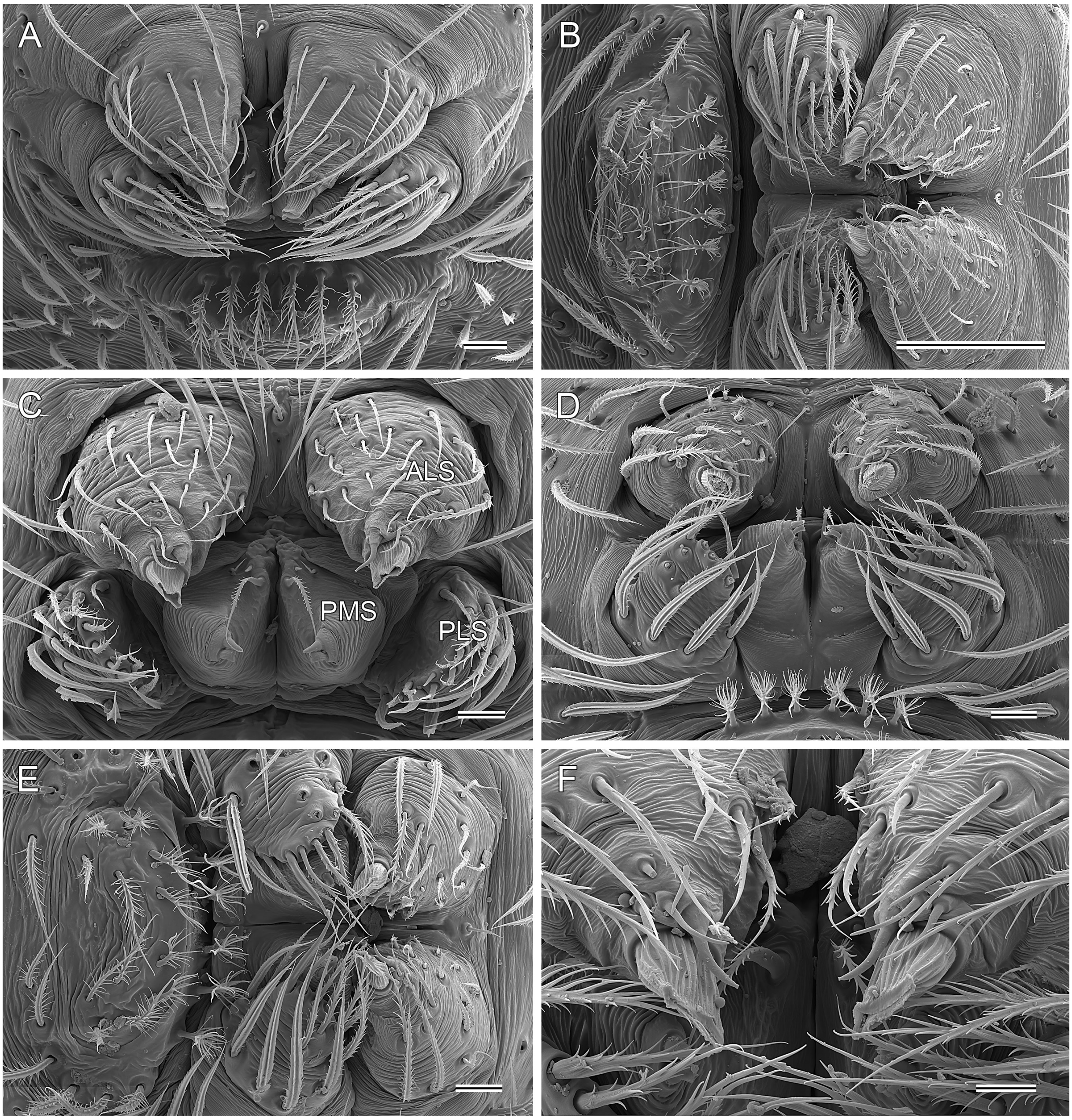

Fig. 6. *Ibotyporanga* spp., spinnerets. **A**. *I. ziruma* Huber sp. nov., female. **B**. *I. guanambi* Huber sp. nov., female. **C**. *I. naideae* Mello-Leitão, 1944, male. **D**. *I. payaya* Huber sp. nov., male. **E–F**. *I. sertao* Huber sp. nov., male. Abbreviations: ALS = anterior lateral spinneret; PLS = posterior lateral spinneret; PMS = posterior median spinneret. Scale lines: A, C–E = 20 µm; B = 100 µm; F = 10 µm.

length 17–34 µm (usually 17–25 µm), diameter proximally 1.6–2.1 µm, at half-length 0.9–1.0 µm. Distal leg segments (tarsi and metatarsi, also tibiae) with putative chemoreceptors (Fig. 17), in light microscope similar to sexually dimorphic short vertical hairs but with distal side branches, with regular oblique furrows, and flattened (i.e., with oval diameter); base diameter ~4.5–7.5 µm, length 20–40 µm, diameter proximally 1.7–2.8 µm, at half-length with oval cross section, ~1.5 × 2.5 µm. Femora, tibiae, metatarsi, and tarsi with round or oval cuticular plates (Fig. 18) at regular intervals, diameter ~4.5–7.5 µm. Base of trichobothria round but with distal bulge and usually with pair of variably distinct lateral humps (Fig. 15); outer diameter of base: 11–18 µm; proximal diameter of seta: 1.3–2.1 µm; retrolateral trichobothrium on tibia 1 at 51–66% of tibia length; prolateral trichobothrium absent on tibia 1. Without slender metatarsal hairs (as described in Huber *et al.* 2023c, 2024c). Tarsi with 3–4 distinct pseudosegments distally

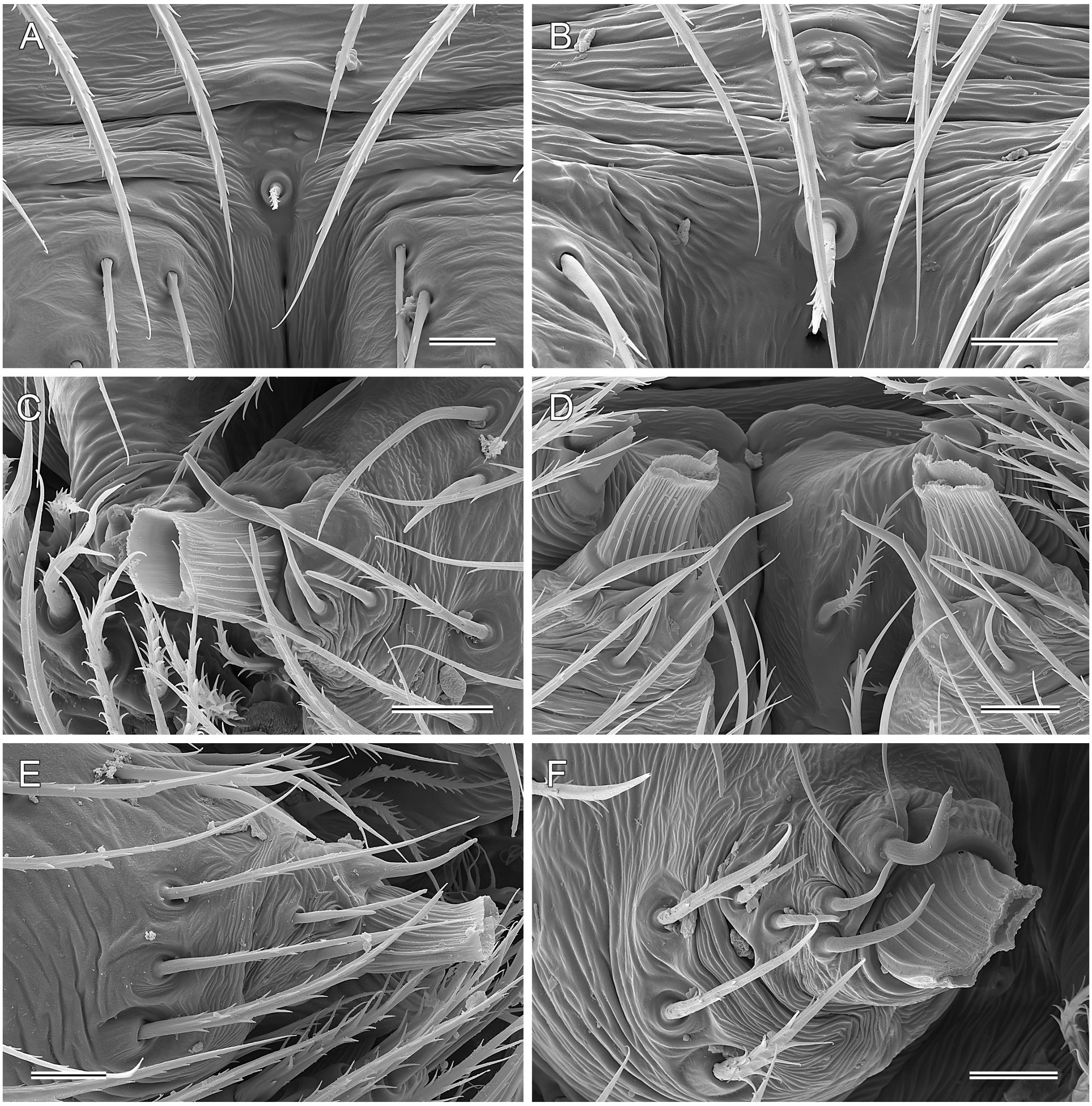

Fig. 7. *Ibotyporanga* spp., spinnerets. **A**. *I. walekeru* Huber sp. nov., female AMS area. **B**. *I. naideae* Mello-Leitão, 1944, female AMS area. **C–D**. *I. ziruma* Huber sp. nov., male and female ALS and PMS. **E**. *I. walekeru* Huber sp. nov., male ALS. **F**. *I. itatim* Huber sp. nov., male ALS. Scale lines: 10 µm.

(cf. Fig. 21C), proximally not pseudosegmented. Leg tarsal organs capsulate with small opening (Fig. 19), outer diameter 3.9–7.4 µm, opening diameter 1.0–1.5 µm. Tarsi 4 with two comb hairs distally on prolateral side (Fig. 20D–F). Tarsal claws as usual for family (Figs 20–21); main claws with 7–10 teeth; teeth on tarsus 4 slightly different (shorter and directed more towards distal).

Female

In general, similar to males; often larger; coloration often slightly darker; legs in some species longer than in males (especially in short-legged species; Fig. S4), in other species shorter (especially in long-legged species); without sexually dimorphic short vertical hairs on tibiae. Sternum and clypeus unmodified. Chelicerae without stridulatory files (Fig. 9). Palpal tarsal organ as in males (Fig. 14), usually oval rather than round, opening diameter 1.4–1.9 µm. Other sensory organs and comb hairs on tarsi 4 as

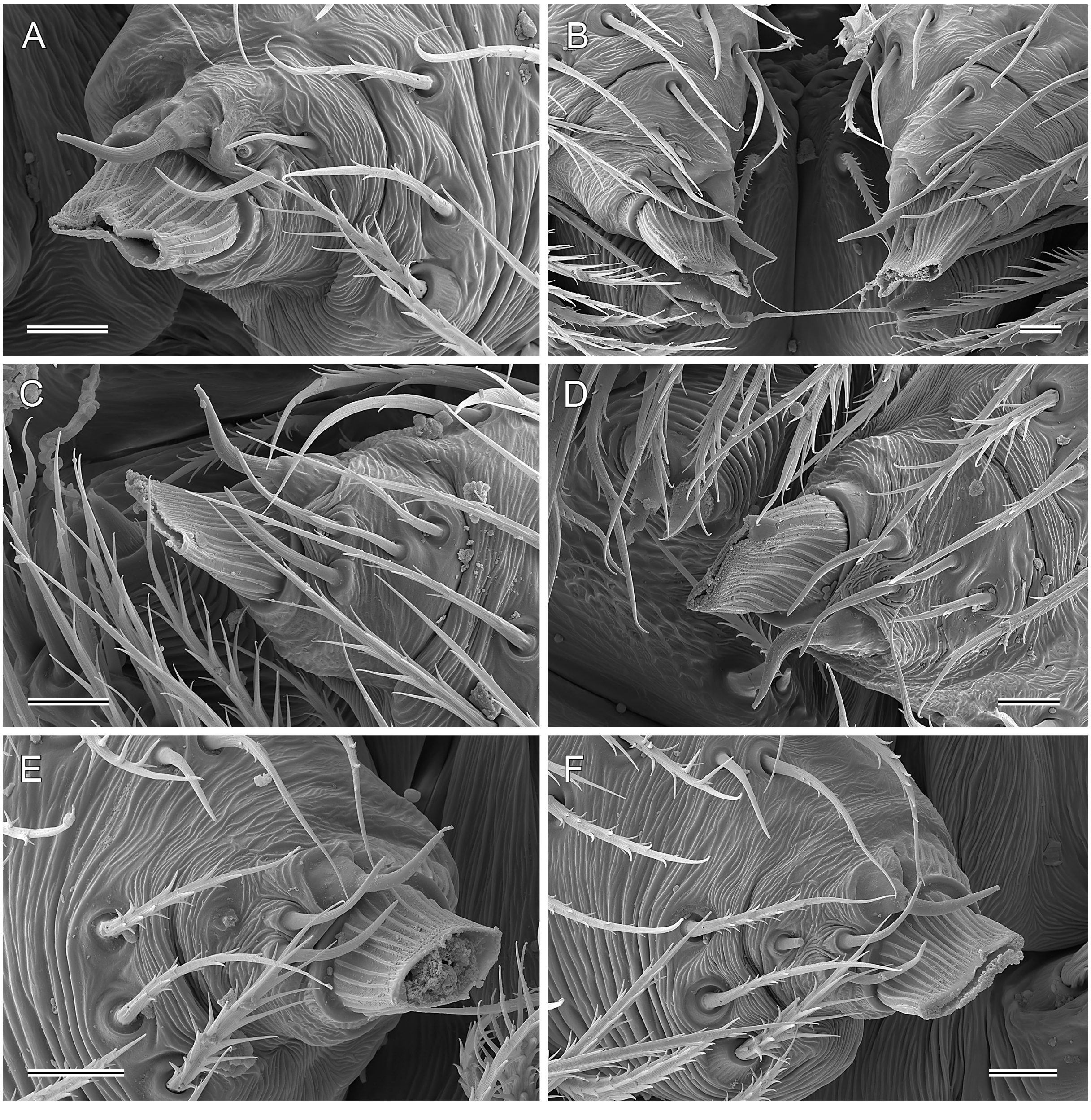

Fig. 8. *Ibotyporanga* spp., spinnerets. **A–B**. *I. naideae* Mello-Leitão, 1944, male ALS and female ALS and PMS. **C–D**. *I. guanambi* Huber sp. nov., male ALS and female ALS and PMS. **E–F**. *I. payaya* Huber sp. nov., male and female ALS. Scale lines: 10 µm.

in males. Spinnerets as in males (Figs 6–8). Tip of palp with simple pointed process and subterminal invagination (Fig. 14). Epigynum anterior plate trapezoidal to semicircular, with variably distinct pocket or ridge usually in anterior position (e.g., Figs 35, 41), only in *I. diroa* in central position (Fig. 72) and in *I. ziruma* sp. nov. in posterior position (Fig. 30). Posterior epigynal plate relatively large but simple, unmodified. Internal genitalia with distinct pore plates on posterior, weakly sclerotized arc (e.g., Figs 29, 36, 41), sometimes with distinct median sclerite (e.g., Figs 100, 104, 108), sometimes with membranous lateral pouches or tubes (e.g., Figs 46, 63, 77, 86), and sometimes with large and complex expandable median sac (e.g., Figs 100, 108, 112, 124, 128; cf. Appendix 3, character 24).

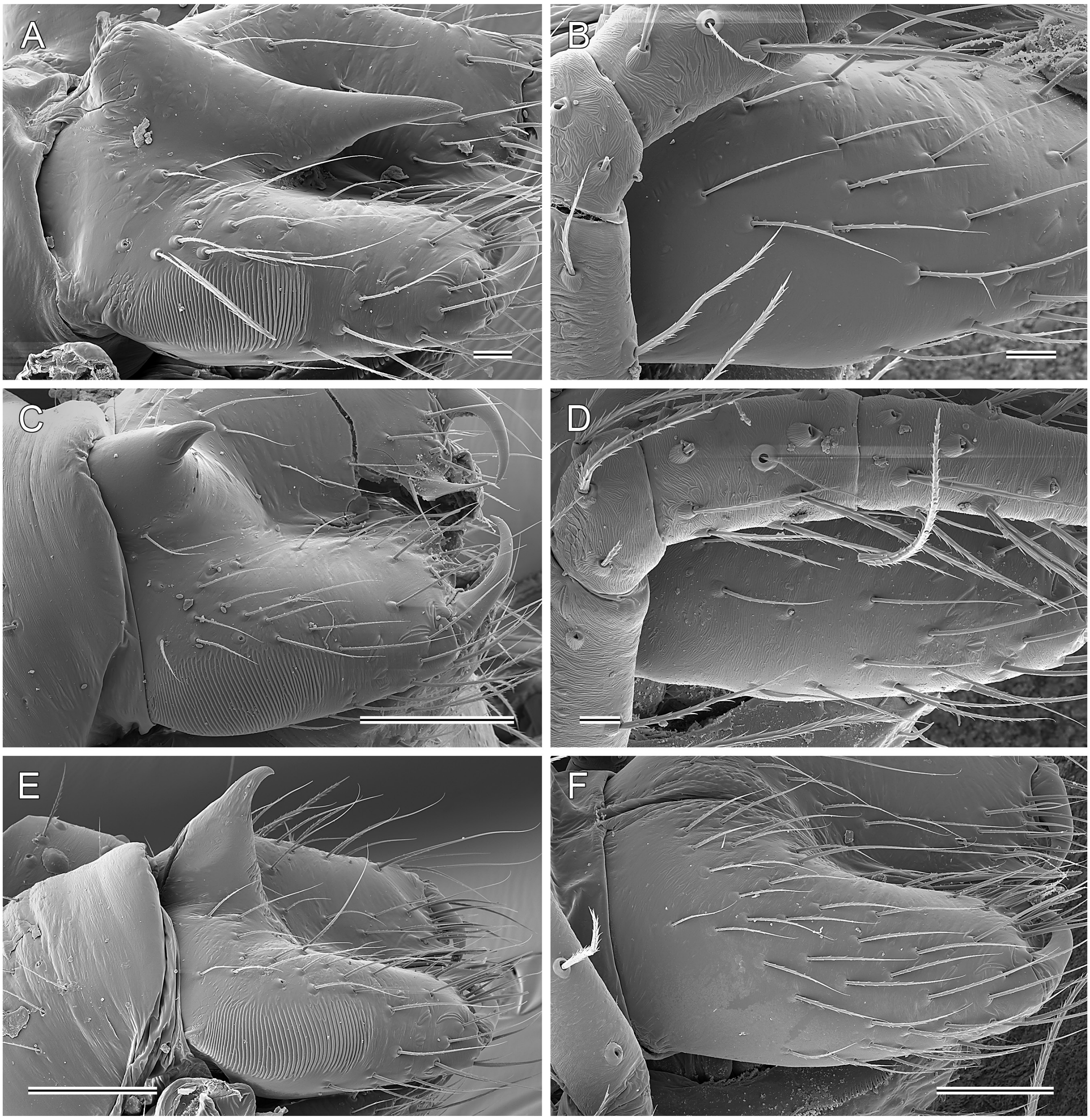

Fig. 9. *Ibotyporanga* spp., chelicerae, frontal-lateral views. **A–B**. *I. ziruma* Huber sp. nov., male and female. **C–D**. *I. canudos* Huber sp. nov., male and female. **E**. *I. sertao* Huber sp. nov., male. **F**. *I. guanambi* Huber sp. nov., female. Scale lines: A–B, D = 20 µm; C, E–F = 100 µm.

Relationships

The latest molecular phylogeny of Pholcidae (Eberle *et al.* 2018; Huber *et al.* 2018) resolved *Ibotyporanga* as sister to a North and Central American clade including the genera *Pholcophora* and *Papiamenta*. This sister group relationship received low support, but it is strongly supported by unpublished UCE data including more representatives of the mentioned genera, and many more representatives of other Ninetinae genera (G. Meng, L. Podsiadlowski, B.A. Huber, unpubl. data).

The monophyly of *Ibotyporanga* is well supported by several morphological synapomorphies (Fig. 1): median notch on male clypeus (char. 1); reduction of ALS spigots to only two (char. 2); single median apophysis on male chelicerae (char. 3); distinct light band on procursus (char. 10); and median pocket on female epigynal plate (char. 18). In addition, the prolateral sclerite on the bulbous part of the genital bulb (char. 13) might be a further synapomorphy (see Discussion).

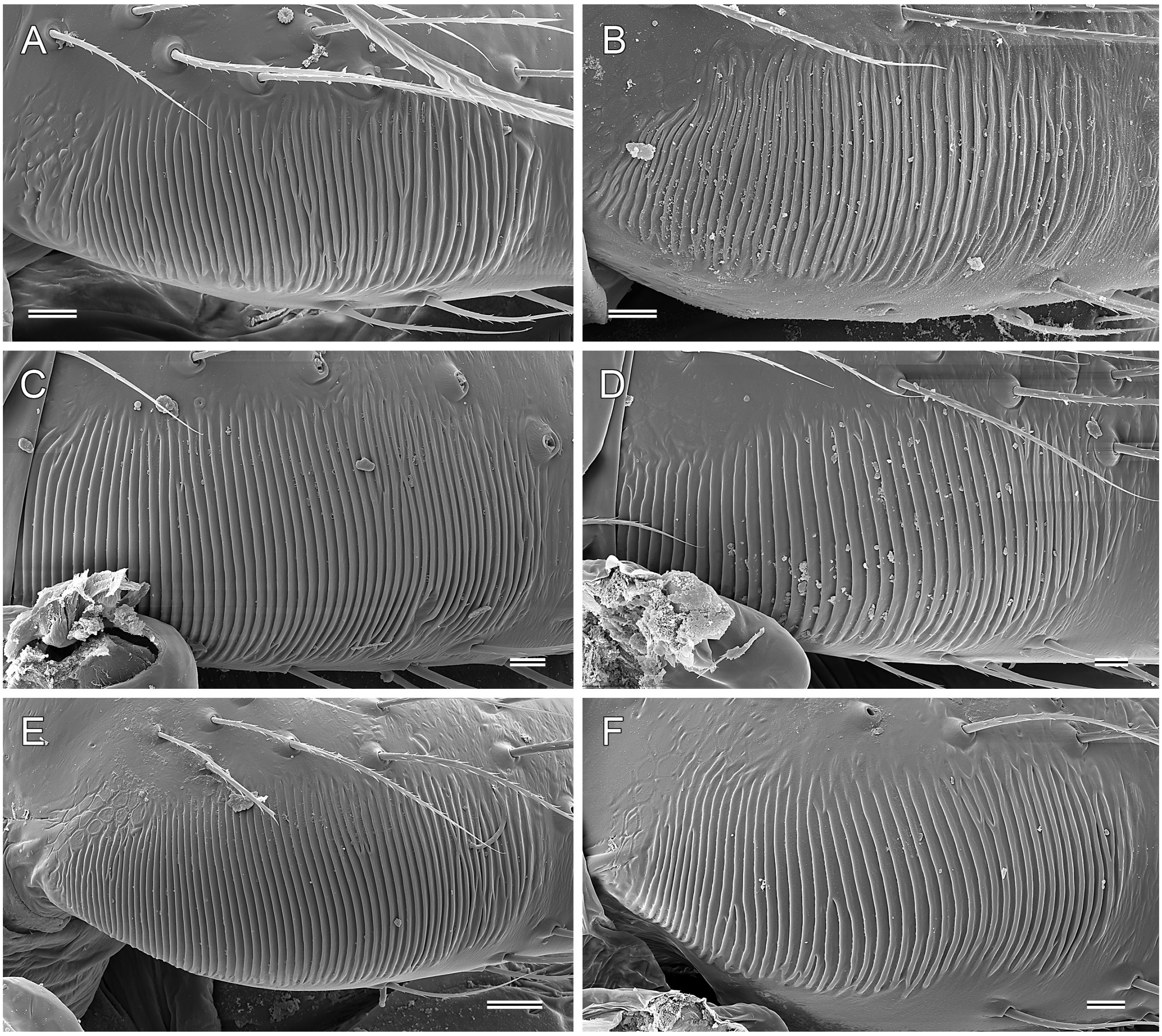

Fig. 10. *Ibotyporanga* spp., stridulatory files on male chelicerae, lateral views (A, B, E are mirror images of left chelicerae). **A**. *I. ziruma* Huber sp. nov. **B**. *I. walekeru* Huber sp. nov. **C**. *I. itatim* Huber sp. nov. **D**. *I. naideae* Mello-Leitão, 1944. **E**. *I. guanambi* Huber sp. nov. **F**. *I. sertao* Huber sp. nov. Scale lines: A–D, F = 10 µm; E = 20 µm.

Internal relationships appear reasonably well resolved in the morphological cladogram (Fig. 1) but ten of the 15 nodes in this tree are supported by a single character each, and very few groups receive additional support from CO1 sequences (cf. Fig. S2). The cladistic analysis suggests that species with a 'regular' procursus (i.e., not slender and elongated; char. 6) are plesiomorphic, while those with a slender elongated procursus are derived and monophyletic. Within this clade, species with a 'split' procursus, i.e., with a distinct dorsal branch in addition to the main branch (char. 8), are again resolved as a monophylum.

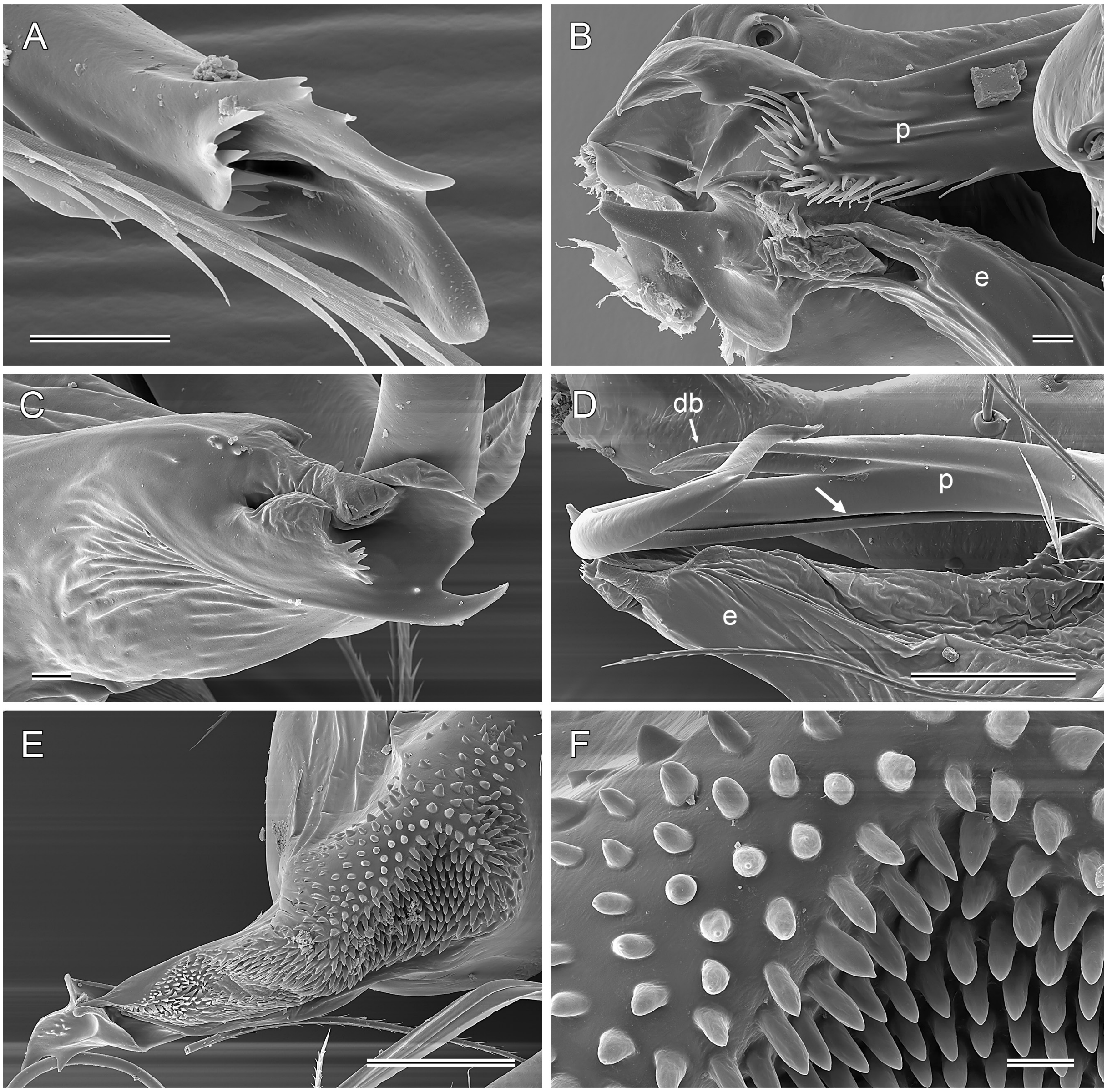

Fig. 11. *Ibotyporanga* spp., male palp. **A**. *I. ziruma* Huber sp. nov., tip of left procursus (and mechanoreceptive hair), distal view. **B**. *I. itatim* Huber sp. nov., tips of right procursus and embolus, dorsal view. **C**. *I. guanambi* Huber sp. nov., left embolus, dorsal-distal view. **D**. *I. guanambi*, right procursus and embolus, dorsal view; bold arrow points at longitudinal slit. **E**. *I. naideae* Mello-Leitão, 1944, left bulb and embolus, retrolateral view. **F**. Detail from preceding figure. Abbreviations: db = dorsal branch of procursus; e = embolus; p = procursus. Scale lines: A–C, F = 10 µm; D–E = 100 µm.

Natural history

Ibotyporanga spiders are typically found in dry habitats, dominated by low and thorny vegetation (Figs 22–23). Some species were found on bare rock outcrops, under rocks lying in the plain sun, while others were found in low and dry forests. They seem to avoid more humid habitats even when available nearby (see *I. kanoe* sp. nov.). Several species also occupy highly degraded and artificial habitats, such as roadside rocks, piles of construction materials, and pastures; two species are known to enter buildings, and of these, *I. naideae* has probably extended its original distribution by human transport.

Within these habitats, any sheltered space at ground level seems to be suitable for *Ibotyporanga*, but the most common microhabitat was under stones. The spiders were also found under and in other objects

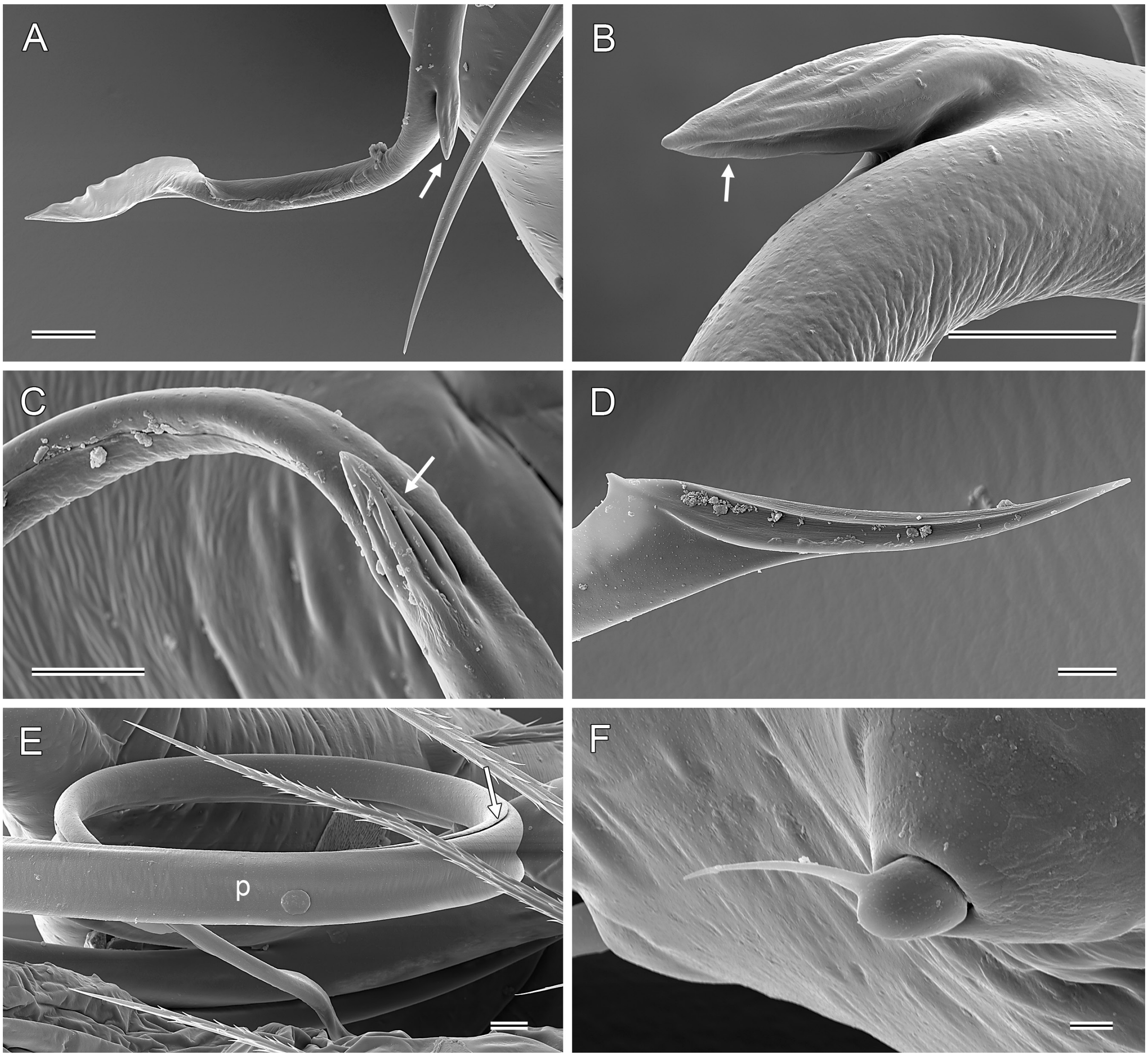

Fig. 12. *Ibotyporanga* spp., male palp. **A**. *I. payaya* Huber sp. nov., right procursus tip, distal view; arrow points at tiny side branch. **B**. *I. payaya*, tiny side branch (arrow) of left procursus, prolateral-dorsal view. **C**. *I. canudos* Huber sp. nov., tiny side branch (arrow) on main branch of right procursus. **D**. *I. canudos*, tip of dorsal branch of right procursus. **E**. *I. sertao* Huber sp. nov., right procursus, dorsal view; arrow points at longitudinal slit. **F**. *I. guanambi* Huber sp. nov., stridulatory pick on left femur. Abbreviation: p = procursus. Scale lines: A = 20 µm; B–E = 10 µm; F = 2 µm.

lying on the ground such as dead branches and tree trunks, cacti, bromeliads, and bark, and rarely even in the leaf litter or (*I. naideae* only) in the understory vegetation. Different species do not seem to be specialized to specific microhabitats: several species were found in a variety of different microhabitats.

In some cases, the microhabitat was shared with another species of Pholcidae, usually another representative of Ninetinae. In Brazil, this was usually a representative of *Kambiwa*; in northern South America, it was *Galapa* Huber, 2000. Highly degraded and artificial habitats were often shared with synanthropic species such as *Modisimus culicinus* (Simon, 1893) or *Physocyclus globosus* (Taczanowski, 1874). In a few cases, we found two species of *Ibotyporanga* to share a habitat or even a microhabitat. For example, *Ibotyporanga emekori* was found together with different congeners (*I. diroa*; *I. itajubaquara* sp. nov.; *I. tuxa* sp. nov.), apparently in identical microhabitats; *I. naideae* was found to share localities with *I. guanambi* sp. nov., *I. imale* sp. nov., and *I. sertao* sp. nov.; *I. sertao* sp. nov. was also found together with *I. xakriaba* sp. nov.

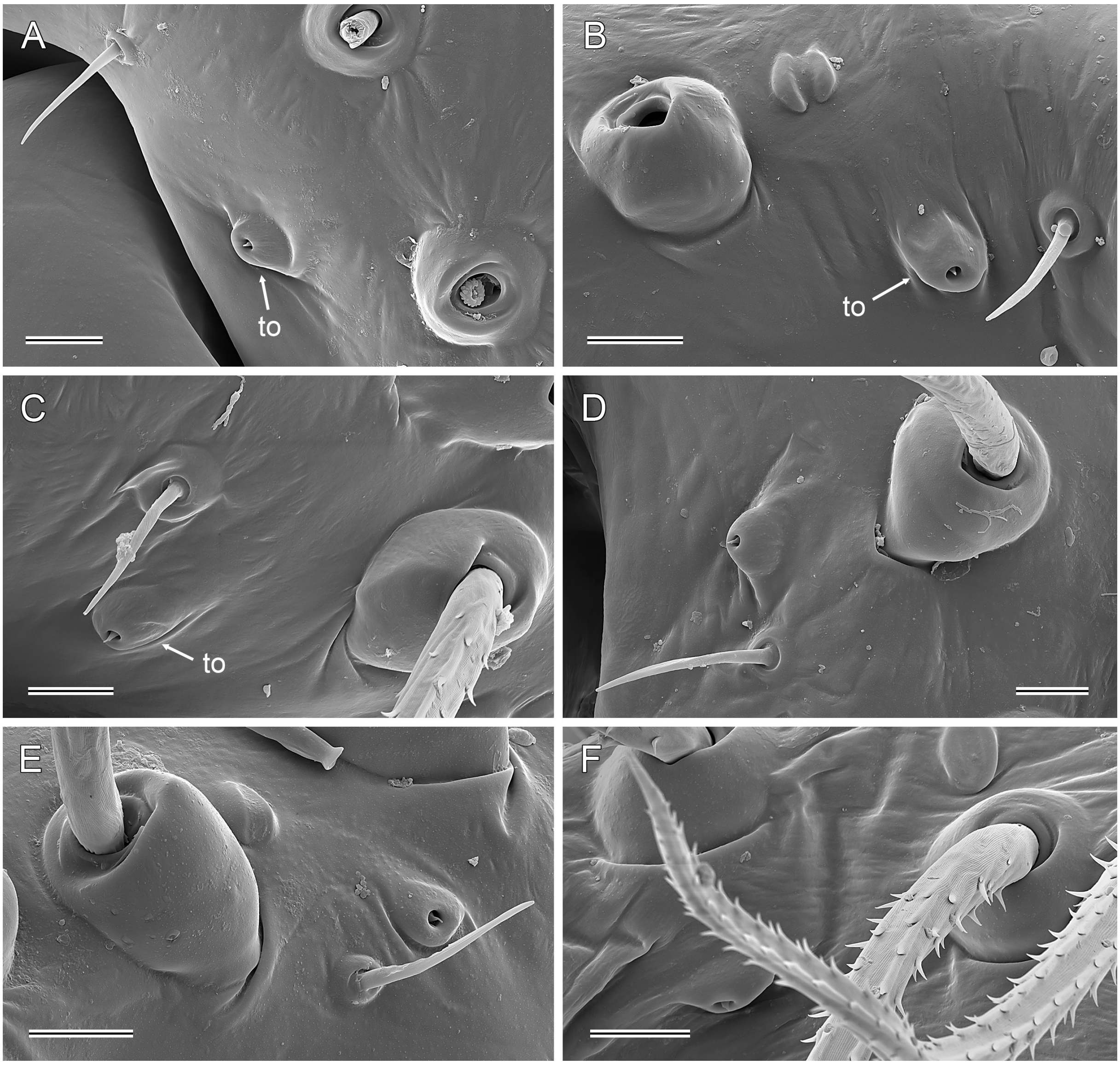

Fig. 13. *Ibotyporanga* spp., male palpal tarsal organs. **A**. *I. ziruma* Huber sp. nov. **B**. *I. itatim* Huber sp. nov. **C**. *I. naideae* Mello-Leitão, 1944. **D**. *I. guanambi* Huber sp. nov. **E**. *I. payaya* Huber sp. nov. **F**. *I. sertao* Huber sp. nov. Abbreviation: to = tarsal organ. Scale lines: 10 µm.

Upon disturbance, the spiders usually started to run rapidly until finding a new hiding place, often just a small depression in the rock. In some species, however, a sexual dimorphism in this behavior was observed, with males running but females remaining sitting on the rock or feigning death when beaten out of a branch or cactus.

Egg sacs were usually round but slightly flattened (Figs 25, 55), with a diameter of ~1.5–2.5. They were covered by a very sparse and poorly visible layer of silk. They contained ~10–40 eggs (in most cases 15–30). Egg diameters ranged from 0.46 to 0.62, with a positive correlation between egg diameter and body size (carapace width) (Fig. S5).

For further details on individual species, see species descriptions below.

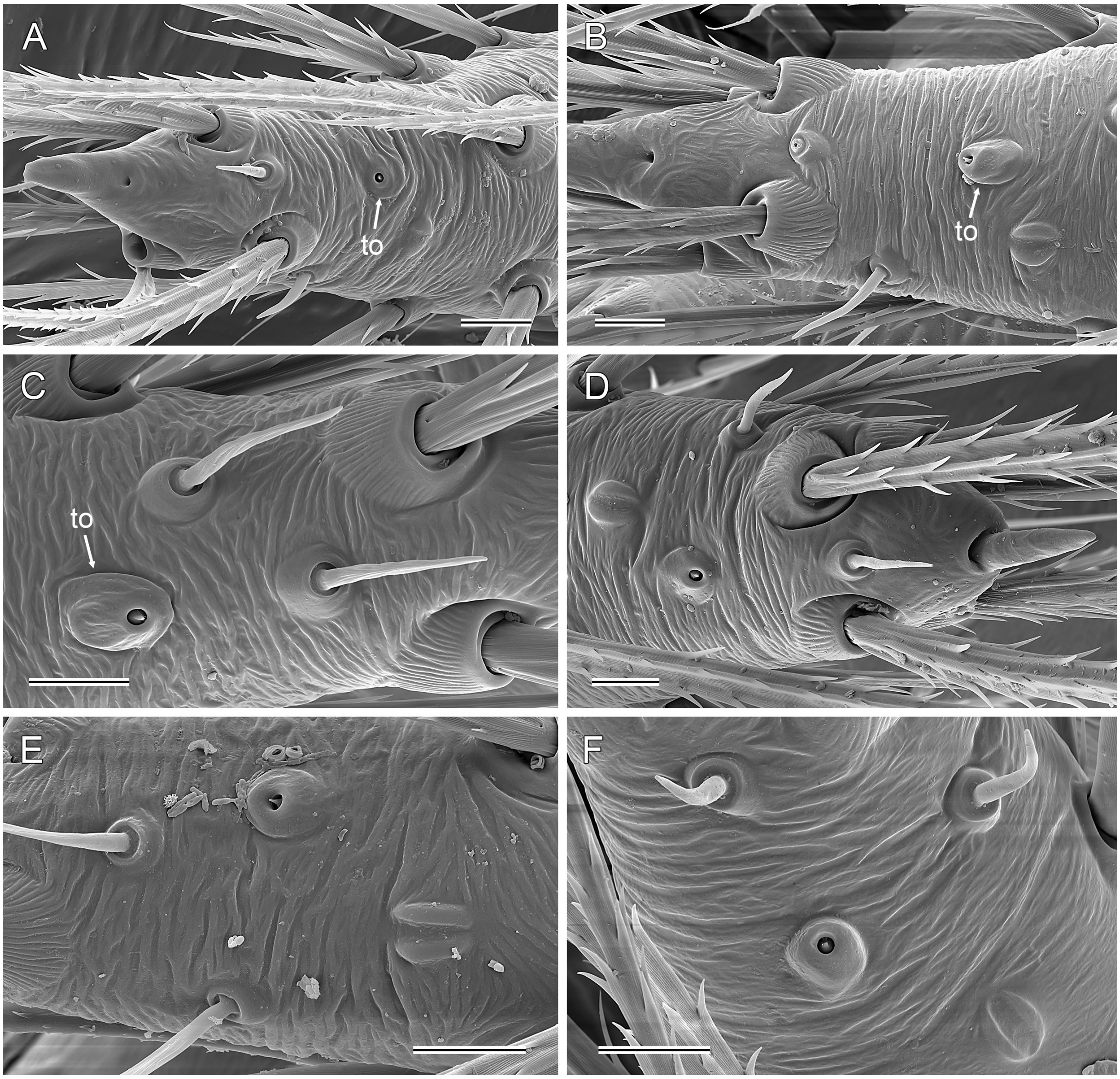

Fig. 14. *Ibotyporanga* spp., female palp tip. **A**. *I. ziruma* Huber sp. nov. **B**. *I. itatim* Huber sp. nov. **C**. *I. naideae* Mello-Leitão, 1944. **D**. *I. guanambi* Huber sp. nov. **E**. *I. payaya* Huber sp. nov. **F**. *I. sertao* Huber sp. nov. Abbreviation: to = tarsal organ. Scale lines: 10 µm.

Distribution

Ibotyporanga is apparently restricted to South America (Fig. 24). Here, it is largely limited to two areas dominated by dry and semi-arid environments: the northern South American coast, and the Brazilian Cerrado and Caatinga biomes. The genus seems to be absent from the Andes; the highest known record is at 1160 m a.s.l. *Ibotyporanga* is largely absent from the Amazon biome. The finding of *I. kanoe* sp. nov. in Rondônia suggests that within the Amazon biome, *Ibotyporanga* may be limited to small pockets

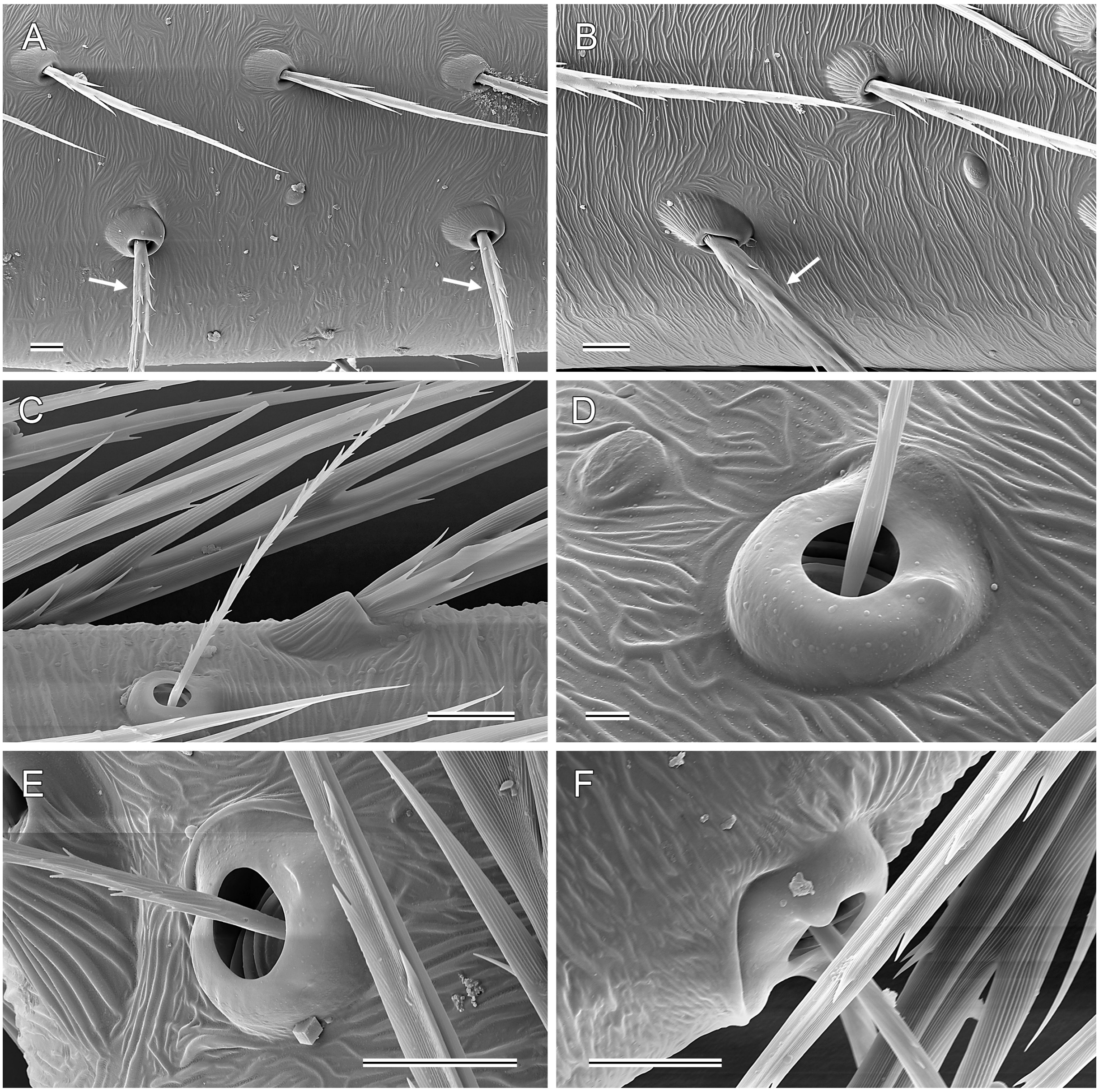

Fig. 15. *Ibotyporanga* spp., leg femora and trichobothria. **A**. *I. ziruma* Huber sp. nov., right male femur 1, retrolateral view; arrows point at slightly stronger ventral hairs. **B**. *I. guanambi* Huber sp. nov., right male femur 3, retrolateral view; arrow points at slightly stronger ventral hair. **C**. *I. ziruma*, retrolateral trichobothrium on right male tibia 3. **D**. *I. walekeru* Huber sp. nov., retrolateral trichobothrium on right female tibia 2. **E**. *I. itatim* Huber sp. nov., retrolateral trichobothrium on right female tibia 2. **F**. *I. naideae* Mello-Leitão, 1944, trichobothrium on right female metatarsus 1. Scale lines: 10 µm.

of relatively dry environments (cf. Fig. 22B). In northern South America, *Ibotyporanga* is remarkably absent from the Leeward Antilles (Huber *et al.* 2024a).

On lost types

It seems that the type specimens (and most non-type specimens) of all four previously described Brazilian *Ibotyporanga* species are lost. The type series of *I. naideae* Mello-Leitão, 1944 was apparently destroyed in the fire that burned a large part of the collection of the Museu Nacional do Rio de Janeiro on 2 Sep. 2018 (A. Kury, personal communication, 22 Nov. 2023). All specimens of the three species described in Huber & Brescovit (2003) (*I. diroa*, *I. emekori*, and *I. ramosae*) were apparently destroyed in the fire that burned a large part of the scorpion and spider collections at Instituto Butantan (São Paulo)

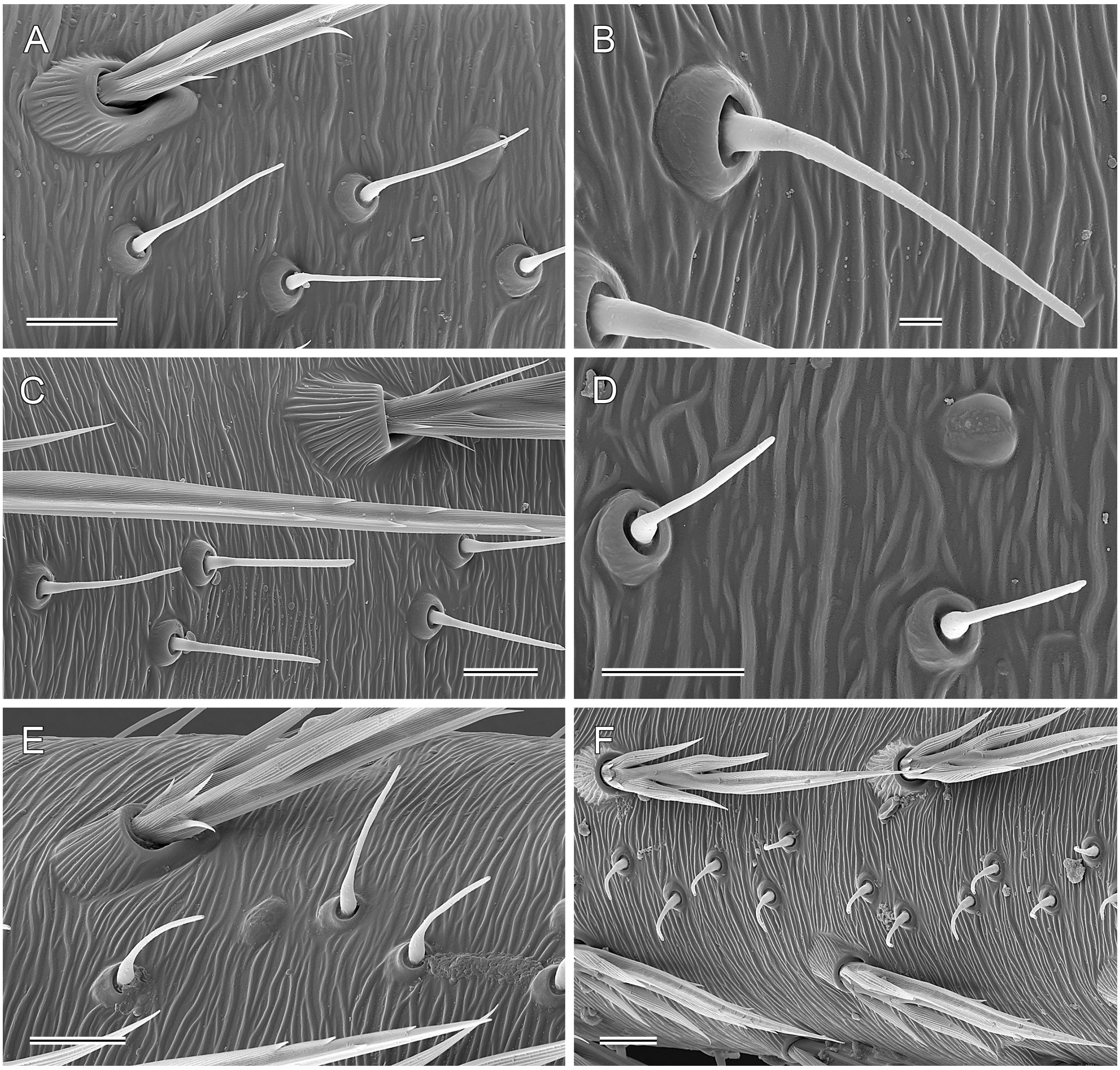

Fig. 16. *Ibotyporanga* spp., sexually dimorphic short vertical hairs on male tibiae. **A**. *I. ziruma* Huber sp. nov., right tibia 1, retrolateral view. **B–C**. *I. itatim* Huber sp. nov., right tibia 1, retrolateral views. **D**. *I. guanambi* Huber sp. nov., right tibia 1, retrolateral view. **E**. *I. payaya* Huber sp. nov., left tibia 1, prolateral view. **F**. *I. canudos* Huber sp. nov., left tibia 1, prolateral view. Scale lines: A, C–F = 10 µm; B = 2 µm.

on 15 May 2010 (A.D. Brescovit, personal communication, 1 Sep. 2023). We do not designate neotypes for these species as we see no "exceptional need" (ICZN Art. 75) for doing so.

Composition and species limits

The genus now includes 24 nominal species. Of these, a few show geographical morphological variation that may represent species limits, i.e., they need to be restudied with larger samples and more data (e.g., molecular). In some species, we found unusually high genetic distances among putative conspecifics (Figs S5–6, Table S1). Particularly problematic in this sense are the type species (*I. naideae*) and *I. imale* sp. nov.; but also *I. walekeru* sp. nov., *I. guanambi* sp. nov., *I. emekori*, *I. kiriri* sp. nov., and *I. canudos*

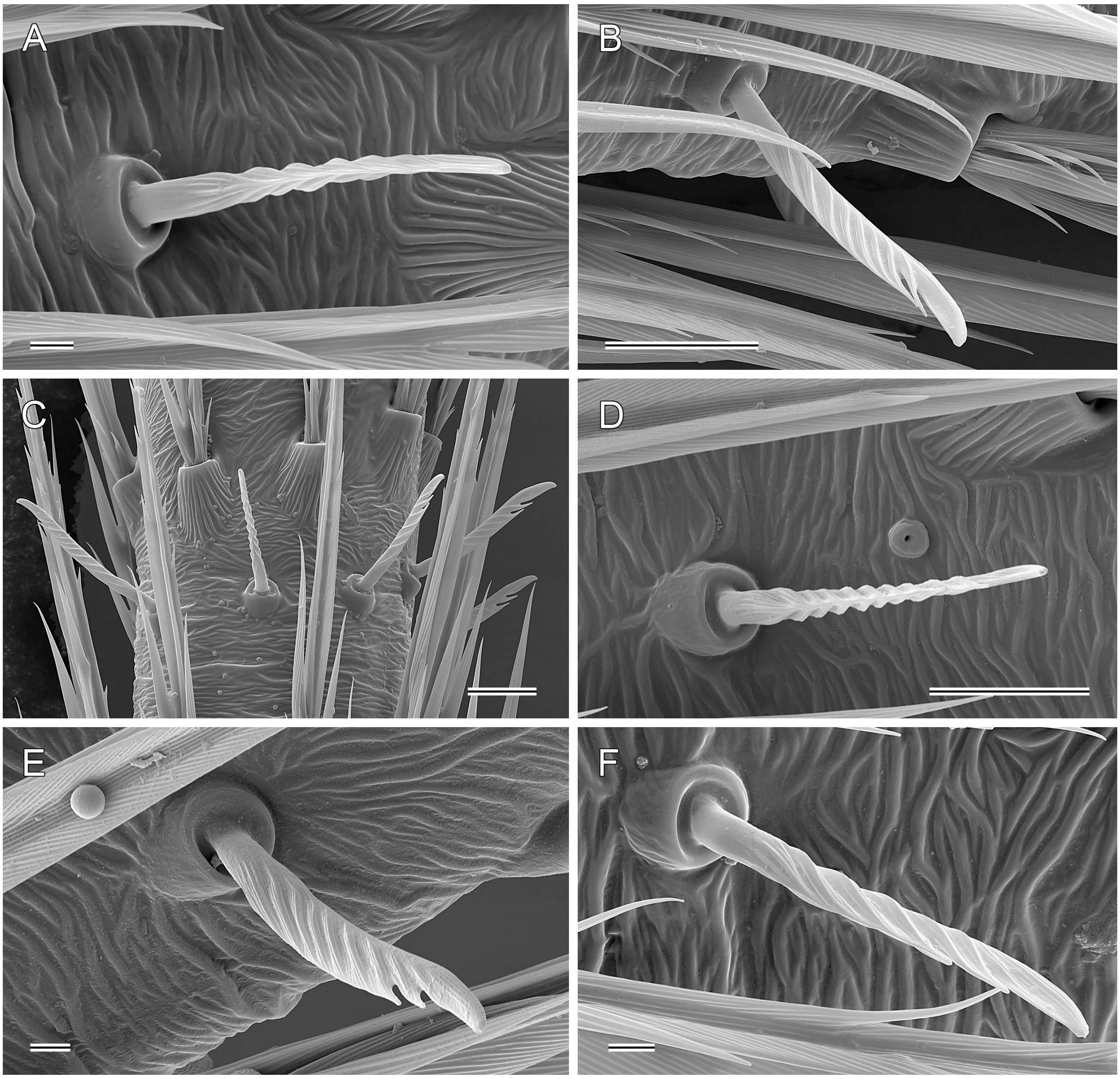

Fig. 17. *Ibotyporanga* spp., putative chemoreceptors on male and female legs. **A–B**. *I. ziruma* Huber sp. nov., right female tarsus 1 and right male metatarsus 1. **C**. *I. walekeru* Huber sp. nov., left female metatarsus 1, near tip, prolateral view. **D–E**. *I. itatim* Huber sp. nov., right female metatarsus 2 and right female metatarsus 3. **F**. *I. canudos* Huber sp. nov., left female tarsus 4. Scale lines: A, E–F = 2 µm; B–D = 10 µm.

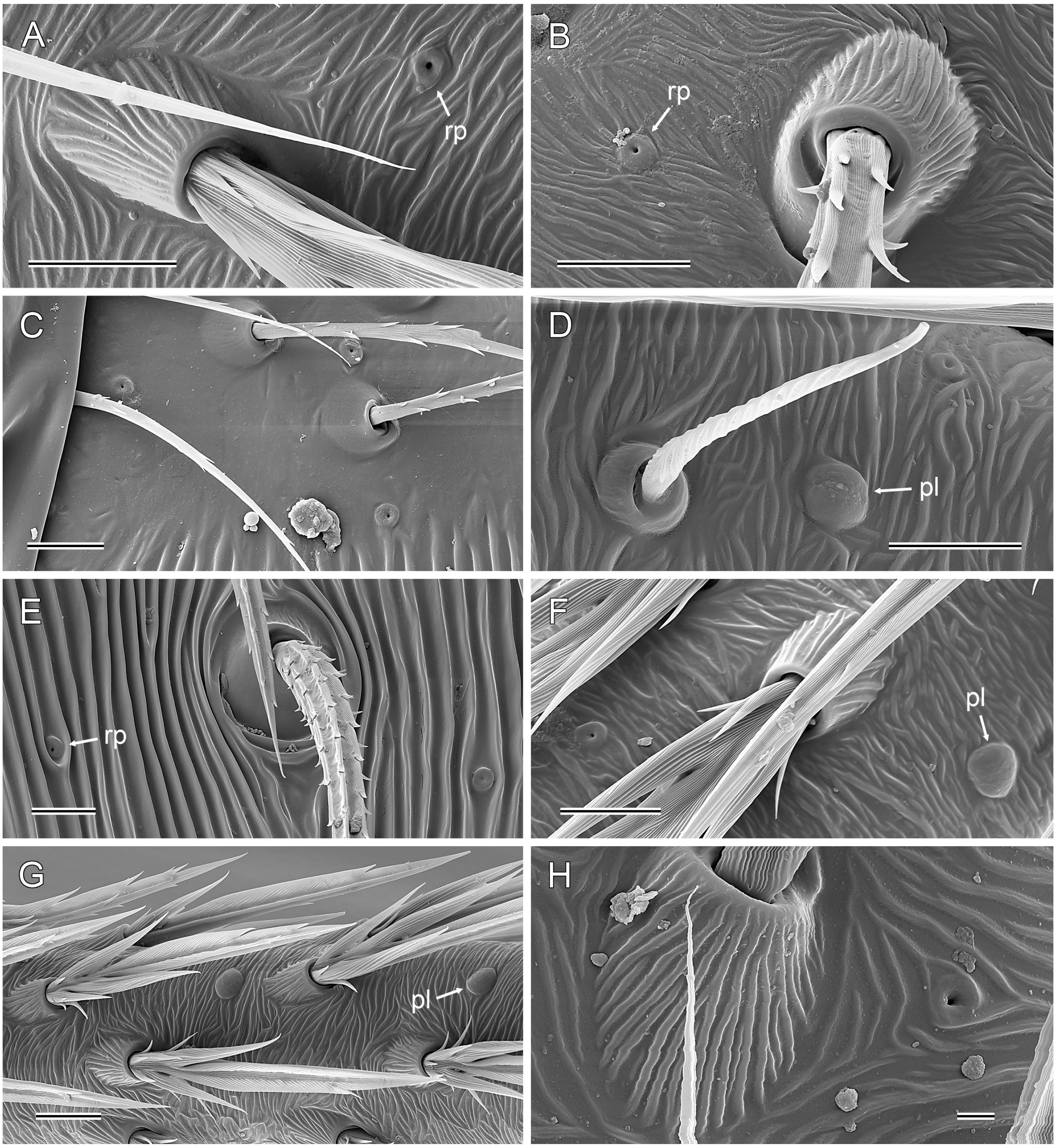

Fig. 18. *Ibotyporanga* spp., rimmed pores and cuticular plates. **A**. *I. ziruma* Huber sp. nov., left male tibia 1, prolateral view. **B**. *I. itatim* Huber sp. nov., left female tibia 1, dorsal view. **C**. *I. itatim*, right male chelicera. **D**. *I. guanambi* Huber sp. nov., right male tibia 3, retrolateral-ventral view. **E**. *I. guanambi*, male abdomen, above spinnerets. **F**. *I. naideae* Mello-Leitão, 1944, right female metatarsus 1. **G**. *I. payaya* Huber sp. nov., right female tarsus 4, retrolateral view. **H**. *I. canudos* Huber sp. nov., right female femur 4, retrolateral view. Abbreviations: pl = cuticular plate; rp = rimmed pore. Scale lines: A–G = 10 µm; H = 2 µm.

sp. nov.; see individual species descriptions below for evidence suggesting that each of these species may eventually need to be split into two or more species.

Three further probable species are available in collections but not formally described, either because no males are available, or because the material is in very poor condition: (1) *I.* "Ven18-182" from Venezuela (Falcón, Peninsula de Paraguaná, near Cueva del Guano, 11.9026° N, 69.9456° W; ZFMK Ar 21861; Fig. 26) is included in the trees in Figs S2, S3, and S6. The epigynum and internal genitalia of the

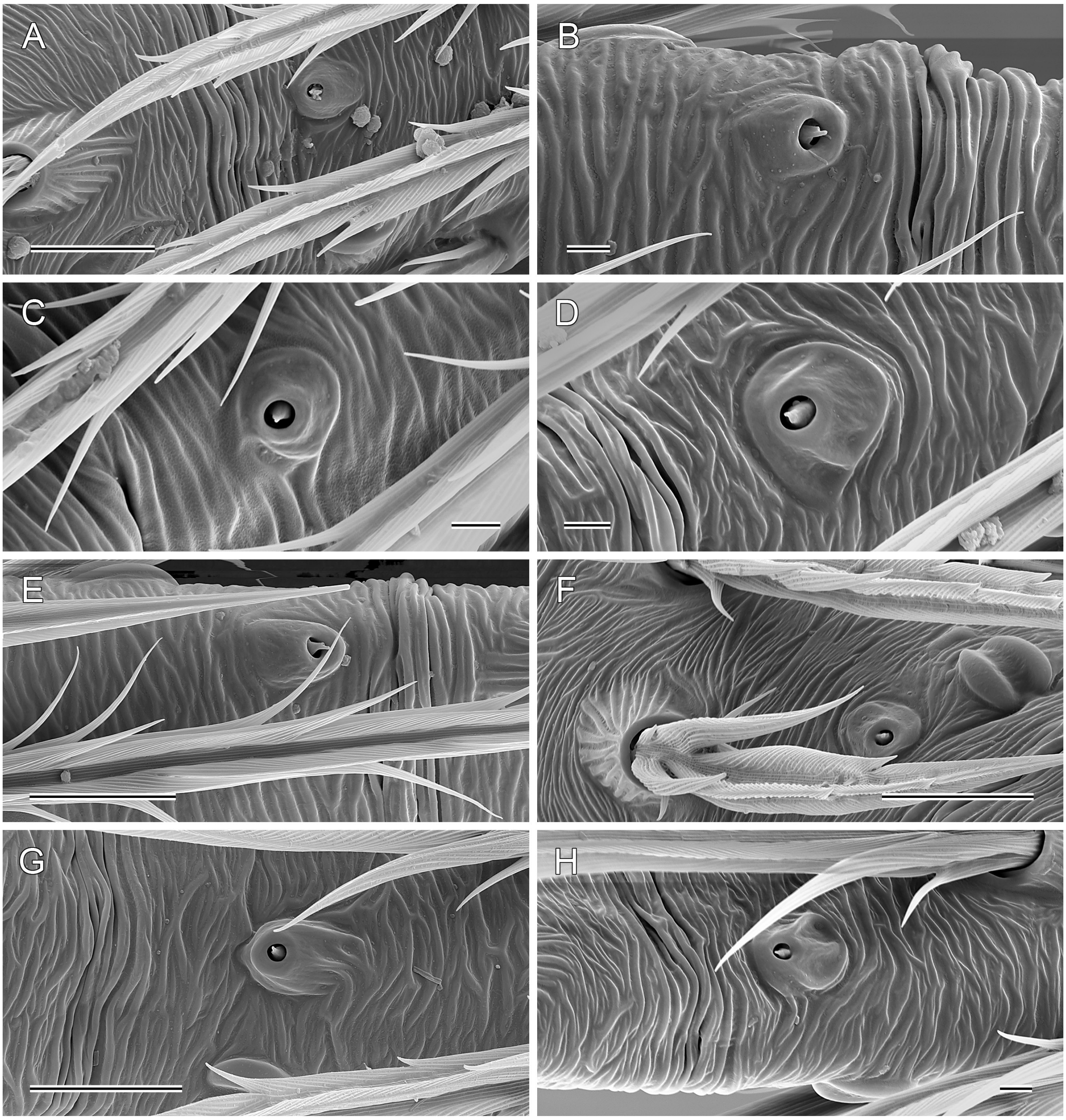

Fig. 19. *Ibotyporanga* spp., leg tarsal organs. **A**. *I. guanambi* Huber sp. nov., male tarsus 1. **B**. *I. sertao* Huber sp. nov., female tarsus 1. **C**. *I. ziruma* Huber sp. nov., male tarsus 2. **D**. *I. naideae* Mello-Leitão, 1944, male tarsus 2. **E**. *I. sertao*, female tarsus 2. **F**. *I. itatim* Huber sp. nov., female tarsus 3. **G**. *I. itatim*, male tarsus 4. **H**. *I. naideae*, male tarsus 4. Scale lines: A, E–G = 10 µm; B–D, H = 2 µm.

only available adult specimen were illustrated in Huber & Villarreal (2020: figs 197–199). (2) *I.* "Br22-182" from Brazil (Bahia, E of São Félix do Coribe, top of hill, 13.4040° S, 44.1100° W; CHNUFPI 9066 [deposited in ZFMK Br22-182]; Fig. 74) could not be sequenced (barcoding failed). The epigynum and internal genitalia of the only available adult specimen are similar to those of *I. imale* sp. nov. (which was found at the base of the same hill), but the legs are much longer (tibia 1: 1.60; in 54 females of *I. imale*: 0.95–1.33). (3) *I.* "Geneve453" from Colombia (Magdalena, Tayrona National Park, Bahia de Gairaca, 11.317° N, 74.108° W; MHNG; Fig. 26). The available specimens (3 ♂♂, 3 ♀♀, 1 juv.) are strongly bleached and difficult to study. The shape of the procursus (S-shaped) strongly suggests that it represents an additional species.

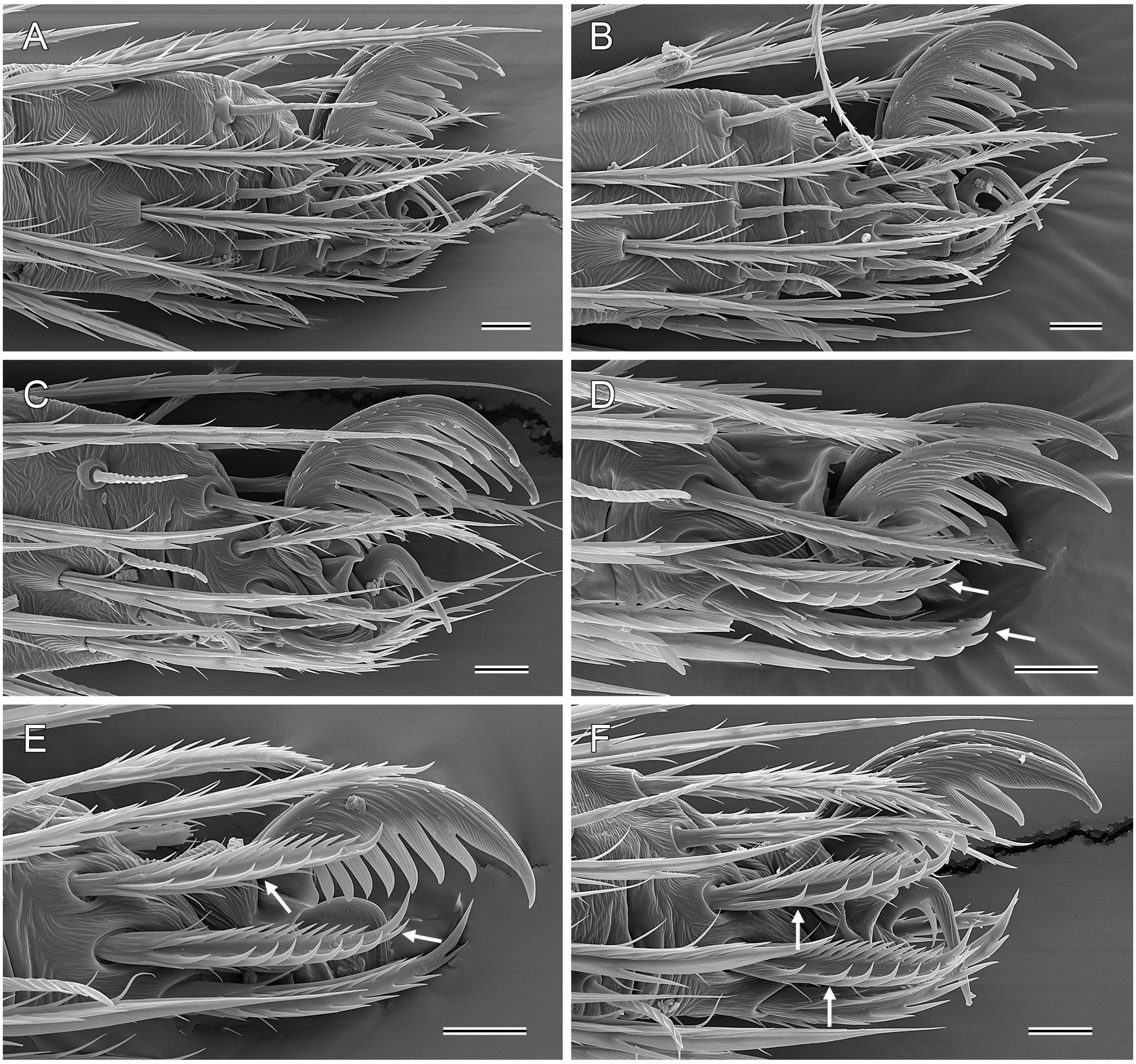

Fig. 20. *Ibotyporanga* spp., left leg tarsi, prolateral views. **A**. *I. sertao* Huber sp. nov., male tarsus 1. **B**. *I. canudos* Huber sp. nov., female tarsus 2. **C**. *I. naideae* Mello-Leitão, 1944, male tarsus 3. **D**. *I. ziruma* Huber sp. nov., female tarsus 4 (arrows: comb-hairs). **E**. *I. walekeru* Huber sp. nov., female tarsus 4 (arrows: comb-hairs). **F**. *I. naideae*, male tarsus 4 (arrows: comb-hairs). Scale lines: 10 µm.

Ibotyporanga ziruma Huber sp. nov.
urn:lsid:zoobank.org:act:6383A80B-49A0-4922-BB37-305706C33EE5
Figs 23A, 25A, 26–30; SEM Figs 2A–B, 3G, 4A, 5C, 6A, 7C–D, 9A–B, 10A, 11A, 13A, 14A, 15A, C, 16A, 17A–B, 18A, 19C, 20D

Diagnosis

Easily distinguished from all known congeners by male cheliceral armature (Fig. 29A–B; pointed median apophysis in distal position; proximal rounded process) and by posterior position of female epigynal pocket (Fig. 30). Also, by shape of procursus (Fig. 28A–C; very simple, wide in lateral view, distally narrower) and by slender apophysis dorsally on genital bulb (arrow in Fig. 28E).

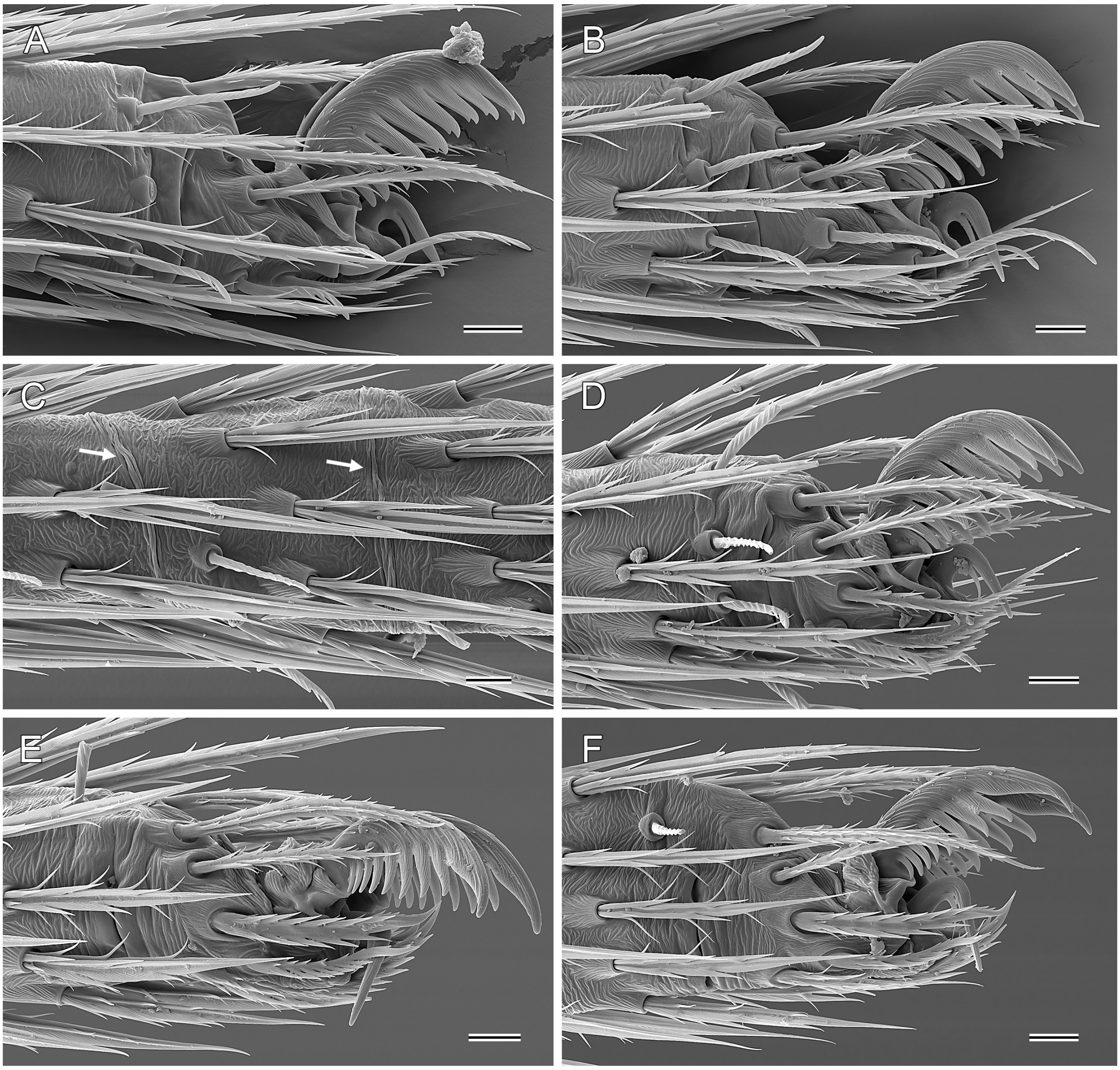

Fig. 21. *Ibotyporanga* spp., right leg tarsi, retrolateral views. **A**. *I. walekeru* Huber sp. nov., female tarsus 1. **B**. *I. itatim* Huber sp. nov., female tarsus 2. **C**. *I. naideae* Mello-Leitão, 1944, female tarsus 2 (arrows: membranous areas between pseudosegments). **D**. *I. itatim*, female tarsus 3. **E**. *I. itatim*, female tarsus 4. **F**. *I. naideae*, male tarsus 4. Scale lines: 10 µm.

Etymology

The species name is derived from the type locality; noun in apposition.

Type material

Holotype

COLOMBIA – **Magdalena** • ♂; Santa Marta, at Cerro Ziruma; 11.2126° N, 74.2307° W; 110 m a.s.l.; 16 Sep. 2022; B.A. Huber leg.; MUSENUV-Ar 2734.

Fig. 22. *Ibotyporanga* spp., typical habitats, part one (cf. Fig. 23): rock outcrops; all localities are in Brazil. **A**. Bahia, S of Xique-Xique (type locality of *I. xique* Huber sp. nov.). **B**. Rondônia, near Jamari (type locality of *I. kanoe* Huber sp. nov.). **C**. Bahia, W of Itatim (type locality of *I. itatim* Huber sp. nov.). **D**. Bahia, Guanambi (type locality of *I. guanambi* Huber sp. nov.). **E**. Bahia, NE of Morro do Chapéu (*I. canudos* Huber sp. nov.). **F**. Pernambuco, NE of Cabrobó (*I. sertao* Huber sp. nov.). Photos BAH.

Fig. 23. *Ibotyporanga* spp., typical habitats, part two (cf. Fig. 22); all localities except for A are in Brazil. **A**. Colombia, Santa Marta (type locality of *I. ziruma* Huber sp. nov.). **B**. Bahia, E of São Félix do Coribe (type locality of *I. imale* Huber sp. nov.). **C**. Bahia, SE of Bom Jesus da Lapa (type locality of *I. atikum* Huber sp. nov.). **D**. Bahia, W of Bom Jesus da Lapa (*I. emekori* Huber & Brescovit, 2003). **E**. Bahia, Paramirim (type locality of *I. kiriri* Huber sp. nov.). **F**. Pernambuco, NE of Lagoa Grande (type locality of *I. sertao* Huber sp. nov.). **G**. Bahia, near Toca do Índio (*I. emekori* Huber & Brescovit, 2003 and *I. diroa* Huber & Brescovit, 2003). **H**. Bahia, SW of Morro do Chapéu (*I. canudos* Huber sp. nov.). Photos BAH.

Paratypes

COLOMBIA – **Magdalena** • 2 ♂♂; same collection data as for holotype; MUSENUV-Ar 2735 • 1 ♂, 1 ♀; same collection data as for holotype; ZFMK Ar 24349.

Other material examined

COLOMBIA – **Magdalena** • 2 ♂♂, 5 ♀♀, in pure ethanol; same collection data as for holotype; ZFMK Col273 [1 ♂, 1 ♀ used for SEM].

Description

Male (holotype)

Measurements. Total body length 1.5, carapace width 0.66. Distance PME–PME 55 µm; diameter PME 55 µm; distance PME–ALE 20 µm; distance AME–AME 15 µm; diameter AME 40 µm. Leg 1: 3.42 (0.98 + 0.22 + 0.86 + 1.00 + 0.36), tibia 2: 0.74, tibia 3: 0.69, tibia 4: 1.02; tibia 1 L/d: 10; diameters of leg femora 0.16, of leg tibiae 0.09.

Colour (in ethanol). Prosoma and legs mostly light ochre-orange, carapace medially and ocular area posteriorly with distinct darker mark; legs without darker rings; abdomen pale ochre-gray with darker

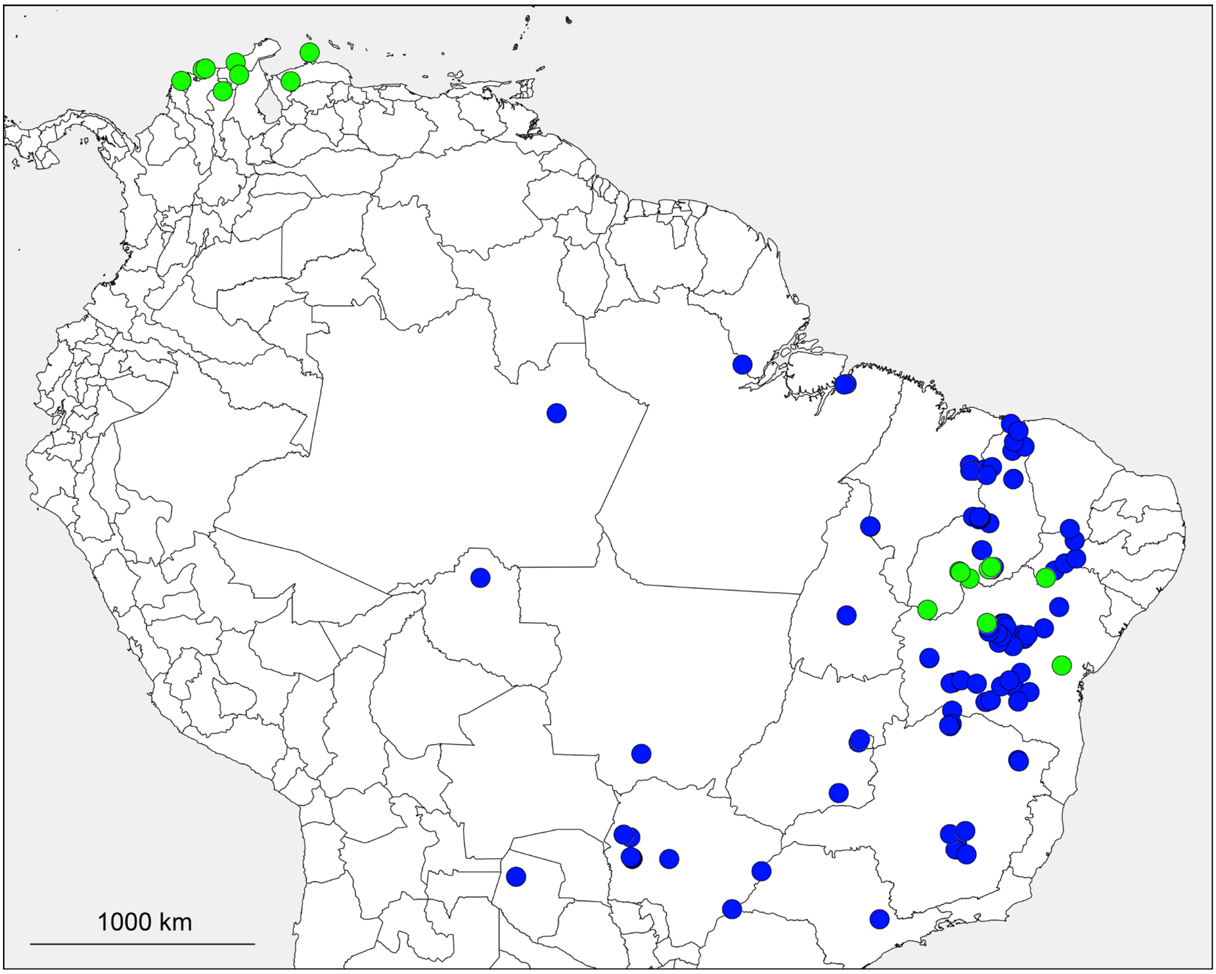

Fig. 24. Known geographic distribution of *Ibotyporanga* Mello-Leitão, 1944. Green: taxa with short plesiomorphic procursus; blue: taxa with long, derived procursus (cf. Fig. 1). For detailed distribution maps of individual species groups, see Figs 26, 42, 60, 74, and 96.

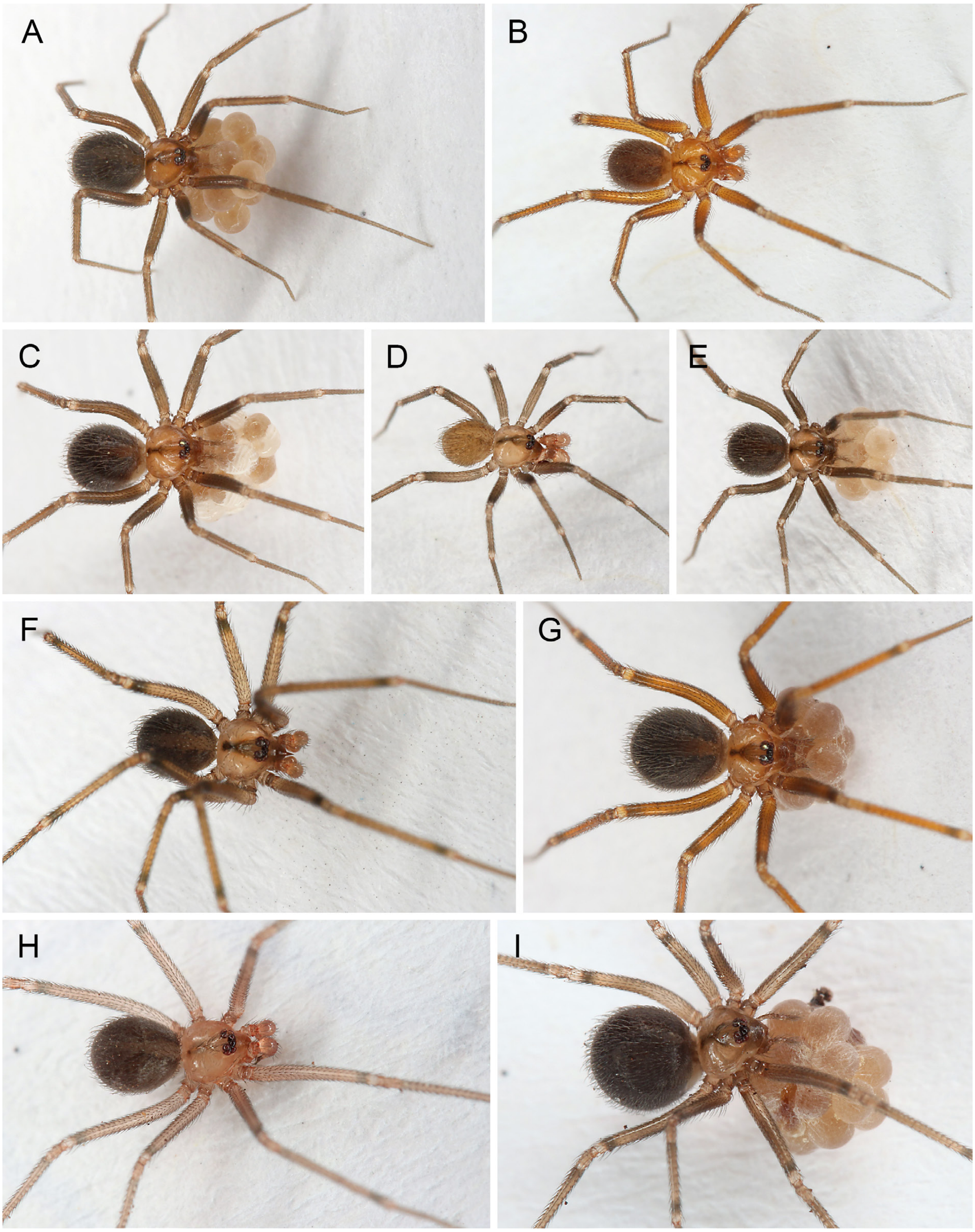

Fig. 25. *Ibotyporanga* spp., live specimens, part one (cf. Figs 55, 73). **A**. *I. ziruma* Huber sp. nov., female with egg sac from Colombia, Magdalena, Santa Marta. **B–C**. *I. walekeru* Huber sp. nov., male from Colombia, La Guajira, S of Riohacha, and female with egg sac from Colombia, Cesar, ESE of Pueblo Bello. **D–E**. *I. piojo* Huber sp. nov., male and female with egg sac from Colombia, Atlántico, near Piojo. **F–G**. *I. itatim* Huber sp. nov., male and female with egg sac from Brazil, Bahia, W of Itatim. **H–I**. *I. xique* Huber sp. nov., male and female with egg sac from Brazil, Bahia, S of Xique-Xique.

internal marks dorsally and laterally; ventrally with light ochre plates in front of gonopore and in front of spinnerets.

Body. Habitus as in female (cf. Fig. 25A). Ocular area slightly raised. Carapace with distinct but shallow thoracic groove (Fig. 2A). Clypeus with sclerotized rim with median notch. Sternum slightly wider than long (0.46/0.40), with small but distinct anterior processes near coxae 1 (Fig. 3G; ~30 µm high, 30 µm diameter at basis). Abdomen globular; gonopore with four epiandrous spigots in two groups (Fig. 4A); spinnerets as usual for genus (Fig. 7C).

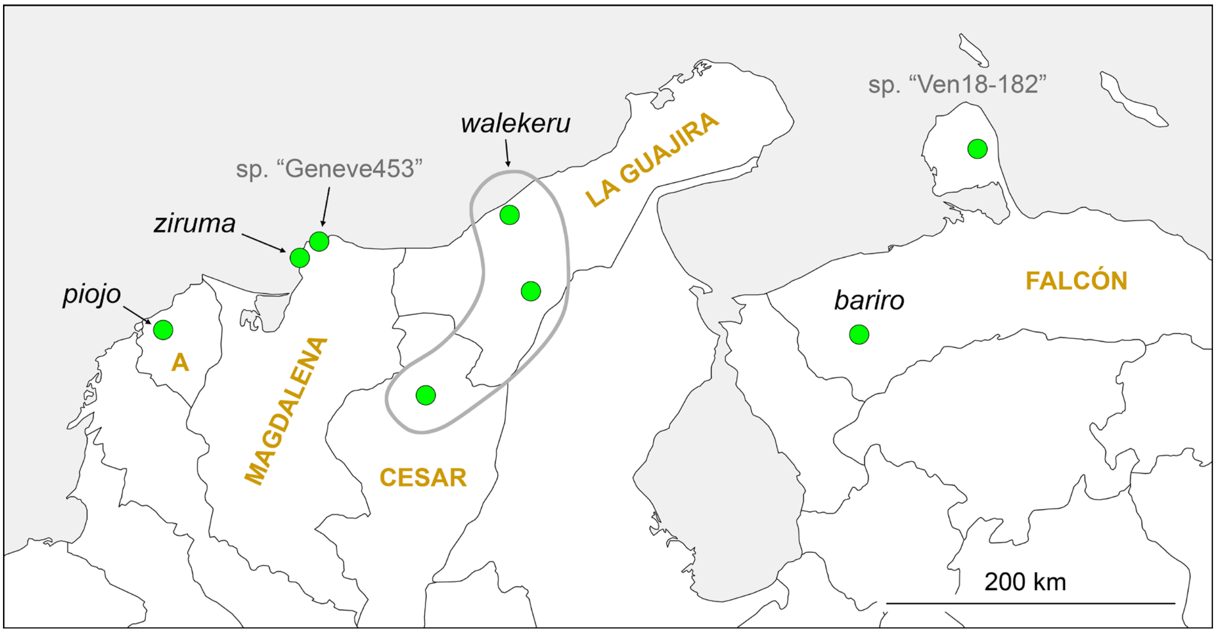

Fig. 26. Known geographic distribution of Northern South American species. Abbreviation: A = Atlántico.

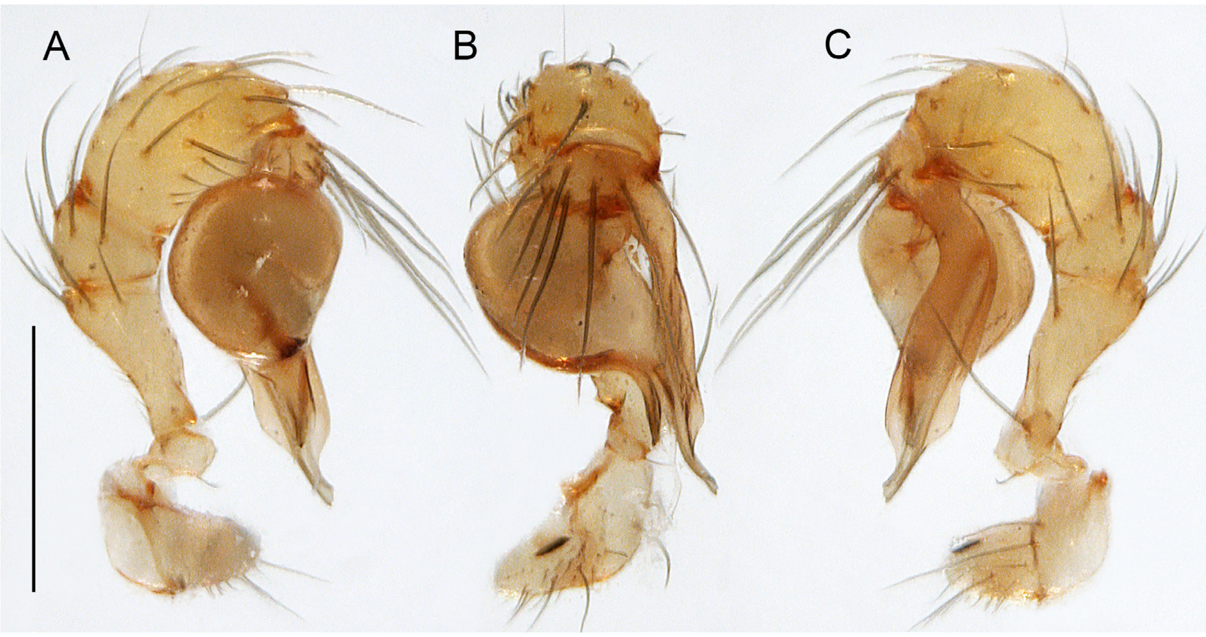

Fig. 27. *Ibotyporanga ziruma* Huber sp. nov., male from Colombia, Magdalena, Santa Marta, ZFMK Ar 24349. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

Chelicerae. As in Fig. 29A–B; with strong median frontal apophysis pointing towards distal and light proximal process directed towards frontal (see also Fig. 9A); stridulatory files (Fig. 10A) very fine and poorly visible in dissecting microscope.

Palps. As in Fig. 27; coxa unmodified; trochanter ventrally slightly protruding; femur proximally with retrolateral process not directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints not shifted toward one side; patella dorsally as long as medially wide; tibia-tarsus joints slightly shifted toward retrolateral side; tarsus without dorsal process, with small

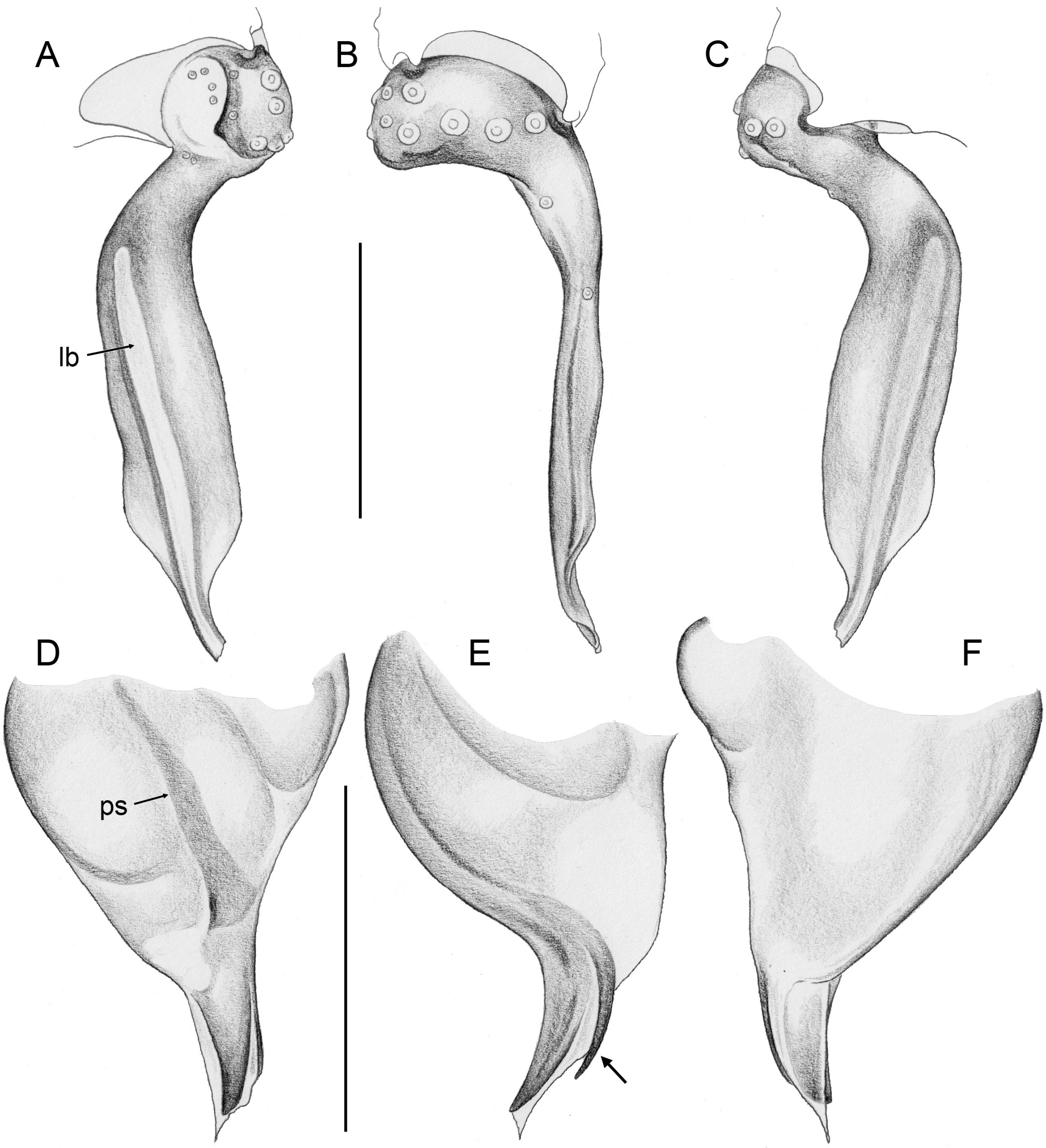

Fig. 28. *Ibotyporanga ziruma* Huber sp. nov., male from Colombia, Magdalena, Santa Marta, ZFMK Ar 24349. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views. **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views (bold arrow: distinctive apophysis on genital bulb). Abbreviations: lb = light band; ps = prolateral sclerite. Scale lines: 0.2 mm.

capsulate tarsal organ (Fig. 13A); procursus (Fig. 28A–C) wide in lateral view, distally slightly curved towards dorsal and retrolateral, with light prolateral band (also visible in retrolateral view) and fringed membranous tip (Fig. 11A); genital bulb (Fig. 28D–F) with distinct prolateral sclerite on bulbous part, with slender dorsal prolateral sclerite parallel to embolus.

Legs. Without spines but with longer and slightly stronger hairs ventrally on femora (Fig. 15A); without curved hairs; with many short vertical hairs on tibia 1 (Fig. 16A) and (fewer) on tibia 2; retrolateral trichobothrium of tibia 1 at 59%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~3–4 pseudosegments, distally fairly distinct.

Variation (male)

Tibia 1 in six males (incl. holotype): 0.86–0.95 (mean 0.90).

Female

In general, similar to male but slightly darker, carapace also laterally with light brown bands, legs light brown; clypeus and sternum unmodified, chelicerae without stridulatory files (Fig. 9B); tibiae with few short vertical hairs. Tibia 1 in five females: 0.83–0.91 (mean 0.87). Epigynum (Fig. 30A) anterior plate oval, slightly wider than long, posterior margin evenly curved, with wide and shallow pocket in posterior position (Fig. 5C); posterior plate wide and short. Internal genitalia (Fig. 30B–D) with pair of elongate pore plates, membranous posterior folds and transversal anterior structure (asterisk in Fig. 30C).

Distribution

Known from type locality only, in Colombia, Magdalena (Fig. 26).

Natural history

The spiders were found on an arid hill near the sea where they were beaten out of dead and dried columnar cacti lying on the ground (Fig. 23A). They shared this microhabitat with another species of Ninetinae, *Galapa gabito* Huber, 2024.

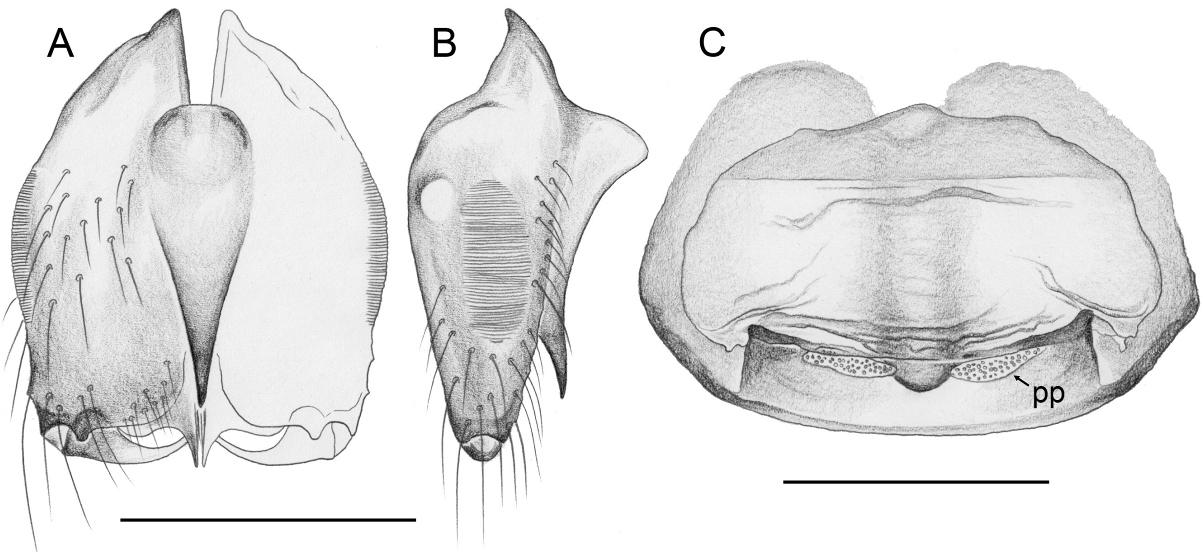

Fig. 29. *Ibotyporanga ziruma* Huber sp. nov., male and female from Colombia, Magdalena, Santa Marta, ZFMK Ar 24349. **A–B**. Male chelicerae, frontal and lateral views. **C**. Cleared female genitalia, dorsal view. Abbreviation: pp = pore plate. Scale lines: 0.2 mm.

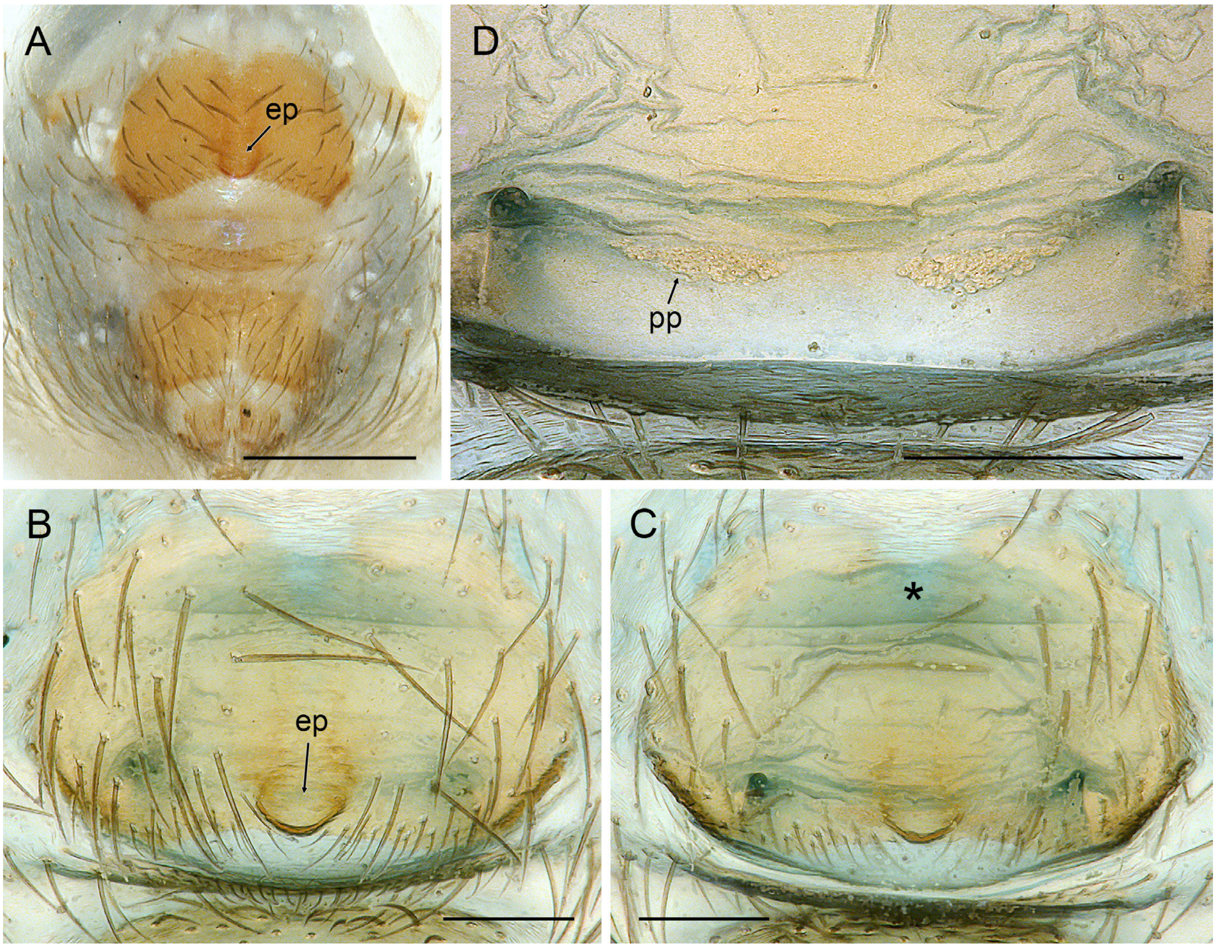

Fig. 30. *Ibotyporanga ziruma* Huber sp. nov., female from Colombia, Magdalena, Santa Marta, ZFMK Ar 24349. **A**. Abdomen, ventral view. **B–C**. Cleared female genitalia, ventral and dorsal views (asterisk: transversal membranous structure). **D**. Detail of cleared female genitalia, dorsal view. Abbreviations: ep = epigynal pocket; pp = pore plate. Scale lines: A = 0.3 mm; B–D = 0.1 mm.

Ibotyporanga walekeru Huber sp. nov.
urn:lsid:zoobank.org:act:295920A0-330E-42FD-B2D0-9982066BDB0B
Figs 25B–C, 26, 31, 32A–B, 33–35, 36A–C; SEM Figs 2D, 4B, 7A, E, 10B, 15D, 17C, 20E, 21A

Diagnosis

Males are easily distinguished from most known congeners by shape of procursus (Fig. 33A–C; short and wide, curved towards dorsal, without dorsal branch, distally with wide transparent membrane); from the very similar *I. bariro* Huber, 2020 by presence of only a few hair-like processes distally on procursus (many large fringes in *I. bariro*; compare Fig. 32A–B with Fig. 32 C–D); from the superficially similar *I. itatim* sp. nov. by much shorter legs (male tibia 1 < 1.1; in *I. itatim* > 1.5), and by absence of dorsal process on palpal tarsus. Females externally possibly indistinguishable from *I. bariro* but internal genitalia with pair of distinct tubes (Fig. 36A–C; very short and indistinct in *I. bariro*: Fig. 36D); *I. piojo* sp. nov. also with distinct internal tubes but with more strongly curved epigynal pocket and shorter legs (tibia 1 < 0.75); *I. itatim* with deeper triangular epigynal pocket, internal genitalia with distinct pair of lateral sacs, and longer legs (tibia 1 > 1.2).

Etymology

The species is named for Walekeru, a mythical spider that taught the Wayuu people of Northern Colombia the art of crocheting and weaving, eventually making Wayuu bags one of the most famous handicrafts of Colombia; noun in apposition.

Type material

Holotype

COLOMBIA – **Cesar** • ♂; 18 km ESE of Pueblo Bello; 10.3449° N, 73.4349° W; 240 m a.s.l.; 21 Sep. 2022; B.A. Huber leg.; MUSENUV-Ar 2736.

Paratypes

COLOMBIA – **Cesar** • 5 ♂♂, 4 ♀♀; same collection data as for holotype; MUSENUV-Ar 2737 [1 ♂ used for SEM] • 2 ♂♂, 2 ♀♀; same collection data as for holotype; ZFMK Ar 24350.

Other material examined

COLOMBIA – **Cesar** • 2 ♀♀, 6 juvs, in pure ethanol; same collection data as for holotype; ZFMK Col308 [1 ♀ used for SEM]. – **La Guajira** • 2 ♂♂; 5 km S of Riohacha; 11.4848° N, 72.9051° W; 30 m a.s.l.; 19 Sep. 2022; B.A. Huber leg.; MUSENUV-Ar 2738 • 1 ♂, 1 ♀; same collection data as for preceding; ZFMK Ar 24351 • 3 ♀♀, in pure ethanol; same collection data as for preceding; ZFMK Col287.

Assigned tentatively (no males available)

COLOMBIA – **La Guajira** • 1 ♀; near Papayal; 11.0029° N, 72.7708° W; 150 m a.s.l.; 19 Sep. 2022; B.A. Huber leg.; ZFMK Ar 24352 • 1 ♀, 3 juvs, in pure ethanol; same collection data as for preceding; ZFMK Col292.

Fig. 31. *Ibotyporanga walekeru* Huber sp. nov., male from Colombia, Cesar, ESE of Pueblo Bello, ZFMK Ar 24350. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

Description

Male (holotype)

MEASUREMENTS. Total body length 1.5, carapace width 0.70. Distance PME–PME 55 µm; diameter PME 55 µm; distance PME–ALE 20 µm; distance AME–AME 15 µm; diameter AME 30 µm. Leg 1: 3.65 (1.00 + 0.25 + 0.90 + 1.07 + 0.43), tibia 2: 0.77, tibia 3: 0.73, tibia 4: 1.08; tibia 1 L/d: 10; diameters of leg femora 0.17, of leg tibiae 0.09.

COLOUR (in ethanol). Prosoma and legs ochre-yellow, carapace medially with narrow brown mark widening posteriorly; legs without dark rings; abdomen gray with many dark internal marks dorsally and laterally; ventrally with indistinct light ochre plates in front of gonopore and in front of spinnerets.

BODY. Habitus as in Fig. 25B. Ocular area slightly raised. Carapace with distinct but shallow thoracic groove (Fig. 2D). Clypeus with sclerotized rim with median notch. Sternum slightly wider than long

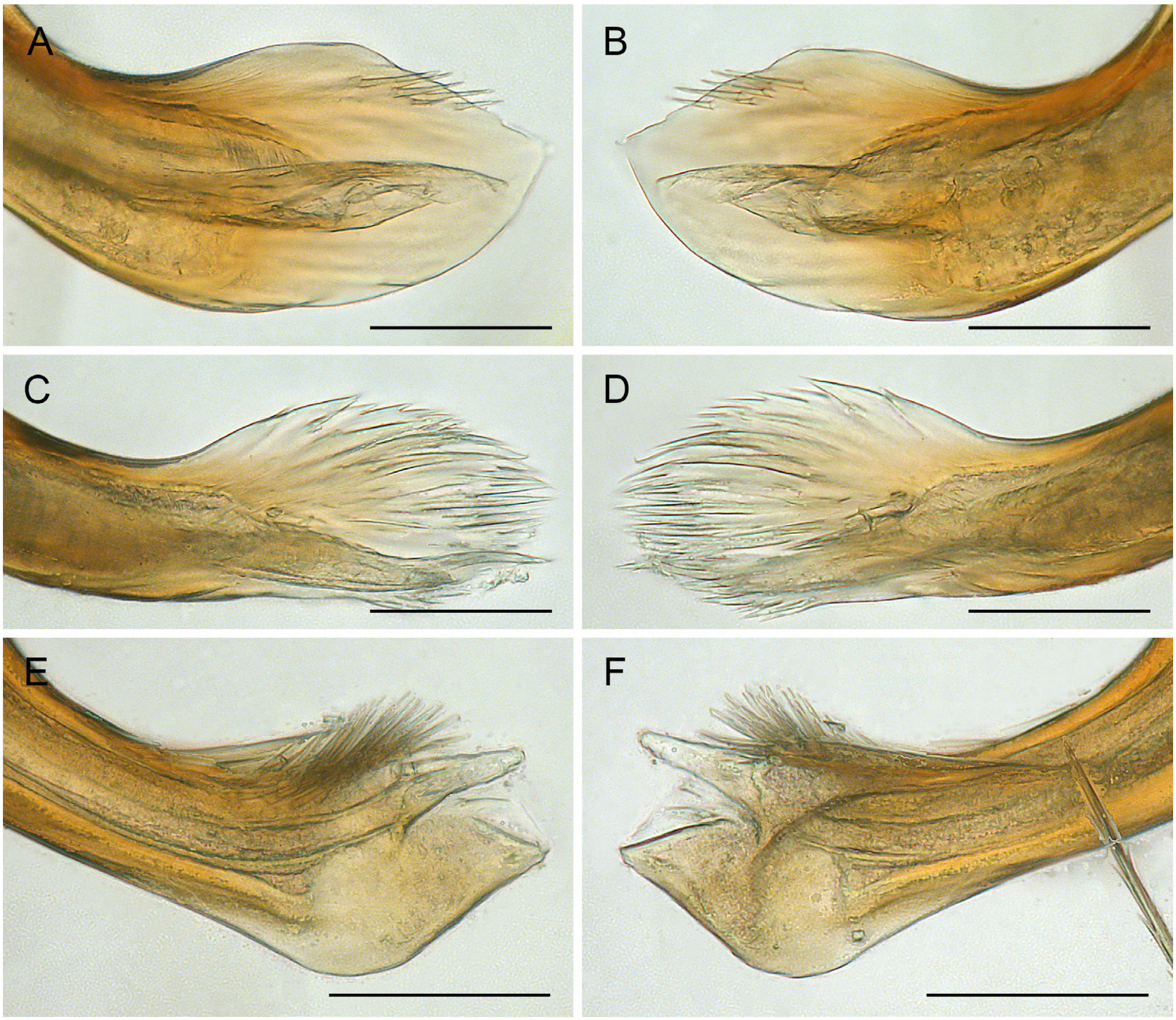

Fig. 32. *Ibotyporanga* spp., tips of left procursi, prolateral (A, C, E) and retrolateral (B, D, F) views **A–B**. *I. walekeru* Huber sp. nov., from Colombia, Cesar, ESE of Pueblo Bello, ZFMK Ar 24350. **C–D**. *I. bariro* Huber, 2020, holotype from Venezuela, Falcón, SE of Bariro, ZFMK Ar 21862. **E–F**. *I. itatim* Huber sp. nov., from Brazil, Bahia, W of Itatim, ZFMK Ar 24354. Scale lines: 0.05 mm.

(0.49/0.40), with very low and indistinct anterior processes near coxae 1. Abdomen globular; gonopore with four epiandrous spigots in two groups (Fig. 4B); spinnerets as in congeners (Fig. 7E).

CHELICERAE. As in Fig. 34A–B; width 0.27; with strong median frontal apophysis; stridulatory files (Fig. 10B) very fine and poorly visible in dissecting microscope.

PALPS. As in Fig. 31; coxa unmodified; trochanter with short rounded ventral protrusion; femur proximally with short retrolateral process not directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints not shifted toward one side; patella dorsally only slightly longer than medially wide; tibia-tarsus joints shifted toward retrolateral side; tarsus without dorsal process; procursus (Fig. 33A–C) evenly curved, with light prolateral band, distally widened and

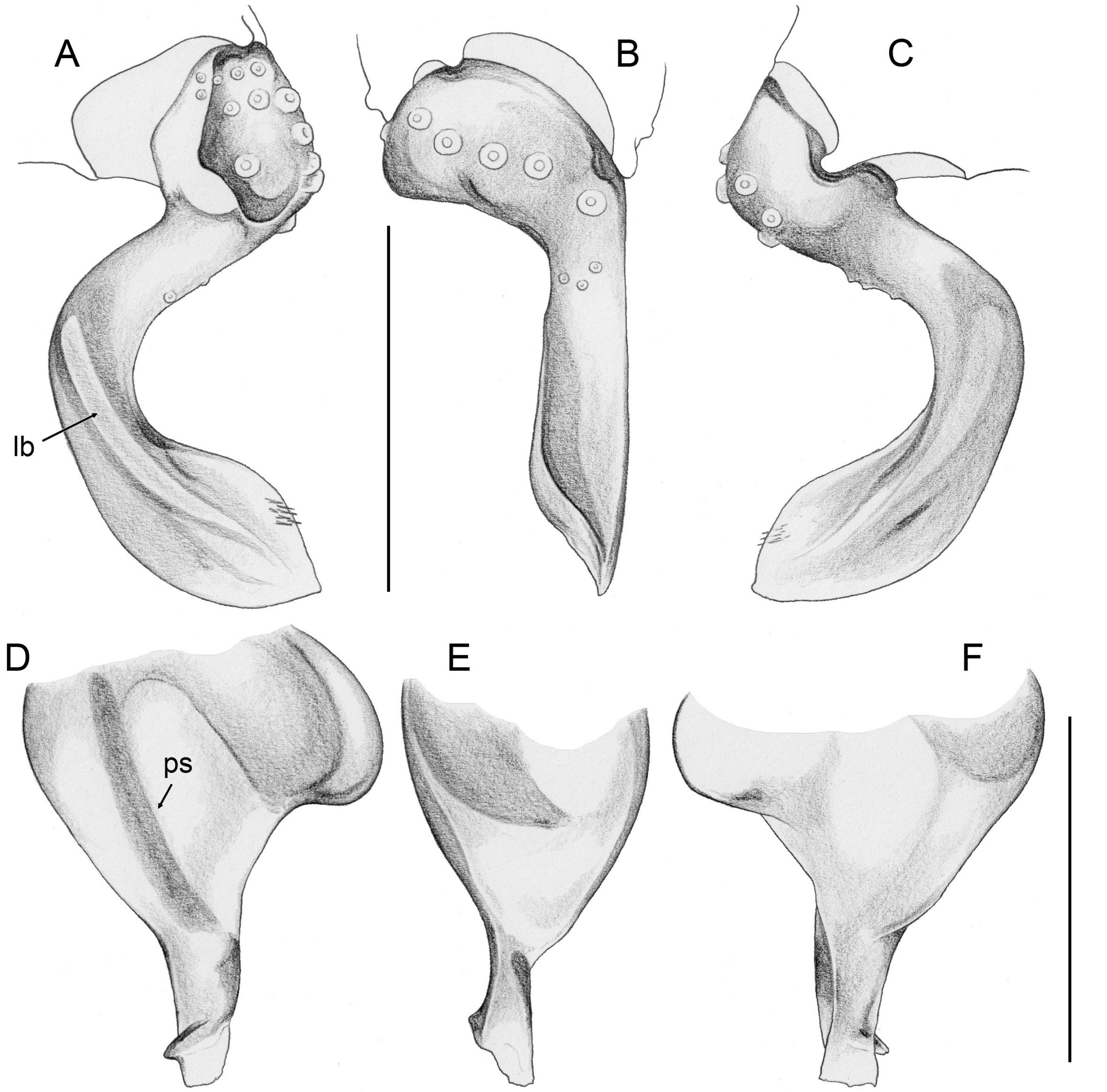

Fig. 33. *Ibotyporanga walekeru* Huber sp. nov., male from Colombia, Cesar, ESE of Pueblo Bello, ZFMK Ar 24350. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views. **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views. Abbreviations: lb = light band; ps = prolateral sclerite. Scale lines: 0.2 mm.

semitransparent, with few (~6) pseudotrichia (Fig. 32A–B; barely visible in dissecting microscope); genital bulb (Fig. 33D–F) with distinct prolateral sclerite on bulbous part, with simple embolus with indistinct prolateral process.

Legs. Without spines but with longer hairs ventrally on femora; without curved hairs; with many short vertical hairs on tibia 1; retrolateral trichobothrium of tibia 1 at 54%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~4 pseudosegments, distally fairly distinct.

Variation (male)

Tibia 1 in 11 males (incl. holotype): 0.83–1.07 (mean 0.93). Males from S of Riohacha with slightly more pseudotrichia distally on procursus (~10). The species delimitation analysis (Fig. S7) suggested that specimens from the three localities may in fact represent three distinct species. The K2P distances among them ranged from 11.0% to 13.9% (Table S1).

Female

In general, similar to male (Fig. 25C) but with darker brown legs, dark median band on carapace extending to ocular area and clypeus, sometimes carapace also laterally with light brown bands; clypeus unmodified; tibiae with few short vertical hairs. Tibia 1 in 13 females: 0.78–1.00 (mean 0.90). Epigynum (Fig. 35) anterior plate trapezoidal, posterior margin almost straight, with wide and shallow, weakly curved anterior pocket; posterior plate wide and short. Internal genitalia (Figs 34C, 35, 36A–C) with pair of elongate pore plates, with dome-shaped membranous structure from which pair of membranous tubes originate, apparently leading into very thin-walled globular 'receptacles'. Cleared female genitalia of female from near Papayal very similar to cleared females from other localities.

Distribution

Known from three localities in the Colombian departments of Cesar and La Guajira (Fig. 26). Females from Papayal (La Guajira) are assigned tentatively.

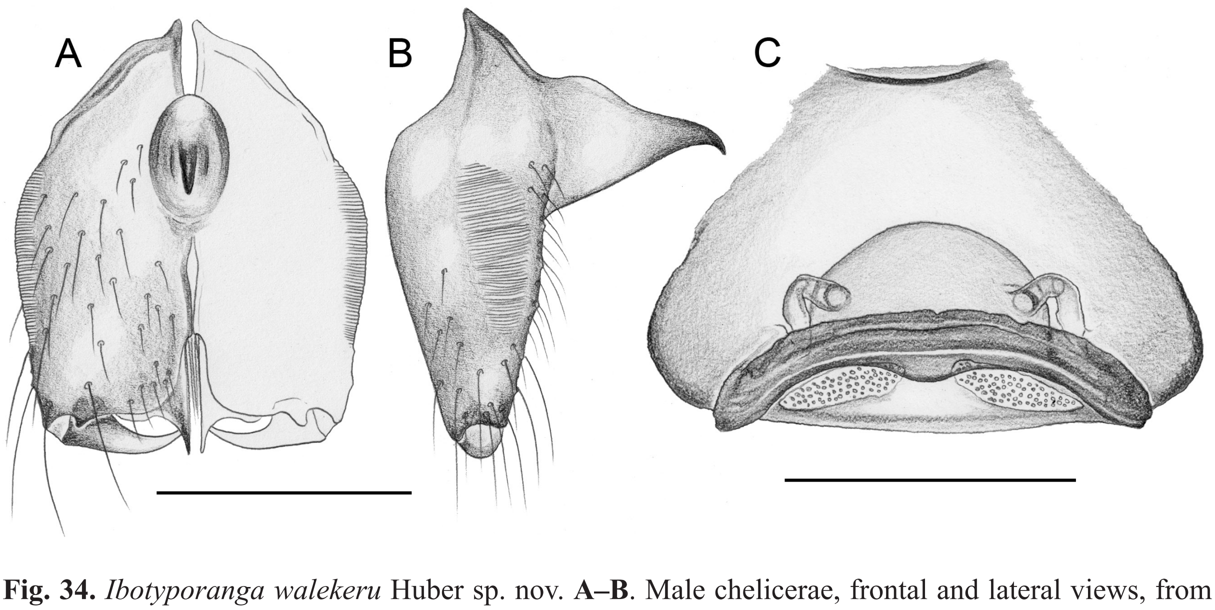

Fig. 34. *Ibotyporanga walekeru* Huber sp. nov. **A–B**. Male chelicerae, frontal and lateral views, from Colombia, Cesar, ESE of Pueblo Bello, ZFMK Ar 24350. **C**. Cleared female genitalia, dorsal view, female from Colombia, La Guajira, S of Riohacha, ZFMK Ar 24351. Scale lines: 0.2 mm.

Natural history

At the type locality, the spiders were found in a low, dry forest on a roadside hill. They were beaten from old dry branches lying on the ground and hollowed by termites. They shared this microhabitat with another species of Ninetinae, *Galapa spiniphila* Huber, 2020. The specimens from near Riohacha were beaten out of dead cactus branches lying on the ground on a degraded roadside with bushes and a few small trees. They shared this microhabitat with *Galapa spiniphila* and with *Modisimus culicinus* (Simon, 1893). Two egg sacs had diameters of 1.4–1.5, were slightly flattened, and contained about 12–15 eggs each, with an egg diameter of 0.46–0.52.

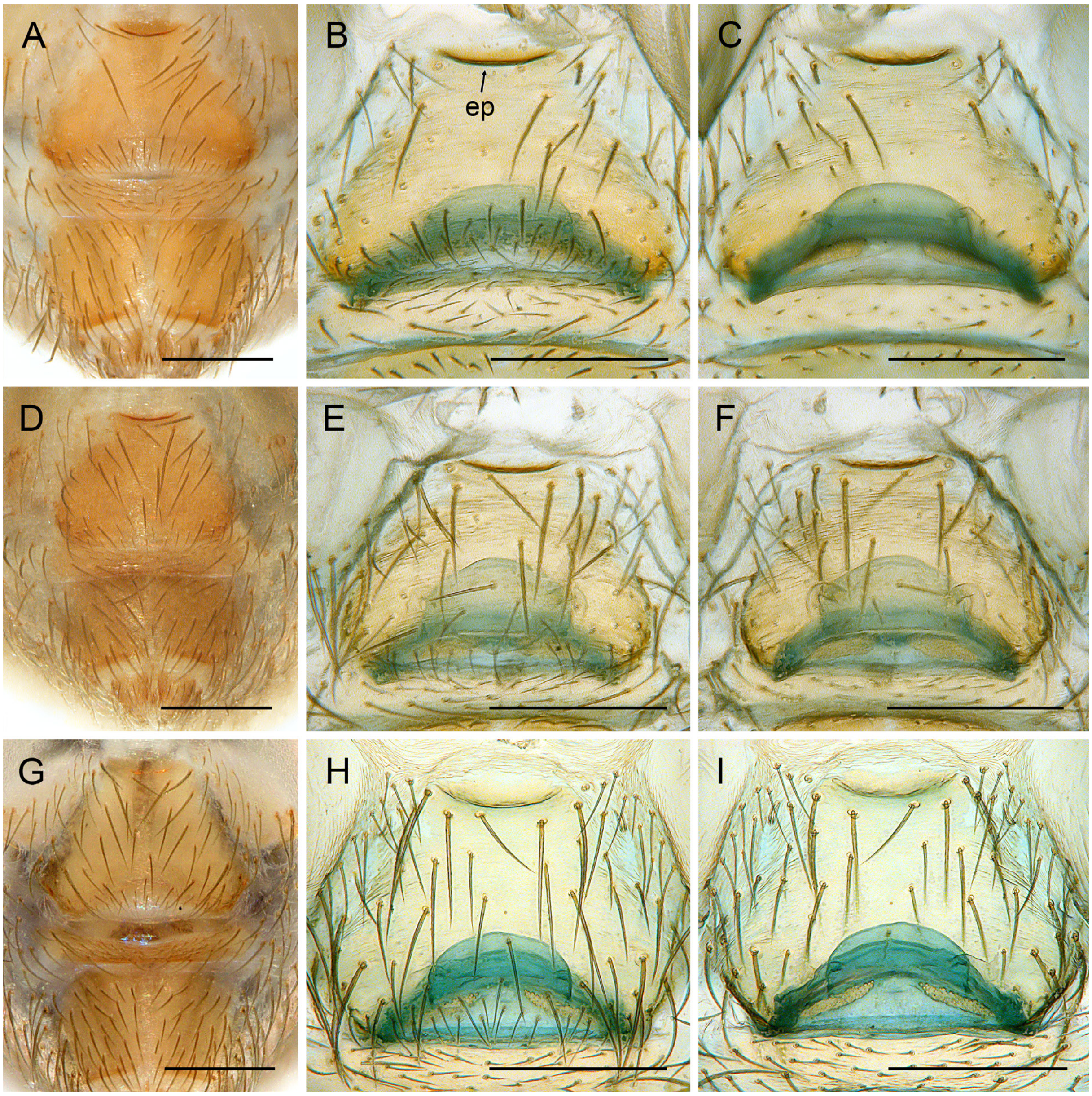

Fig. 35. *Ibotyporanga walekeru* Huber sp. nov. **A–C**. Abdomen, ventral view, and cleared female genitalia, ventral and dorsal views, female from Colombia, Cesar, ESE of Pueblo Bello, ZFMK Ar 24350. **D–F**. Same as for preceding, female from Colombia, La Guajira, S of Riohacha, ZFMK Ar 24351. **G–I**. Same as for preceding, female from Colombia, La Guajira, near Papayal, ZFMK Ar 24352. Abbreviation: ep = epigynal pocket. Scale lines: 0.2 mm.

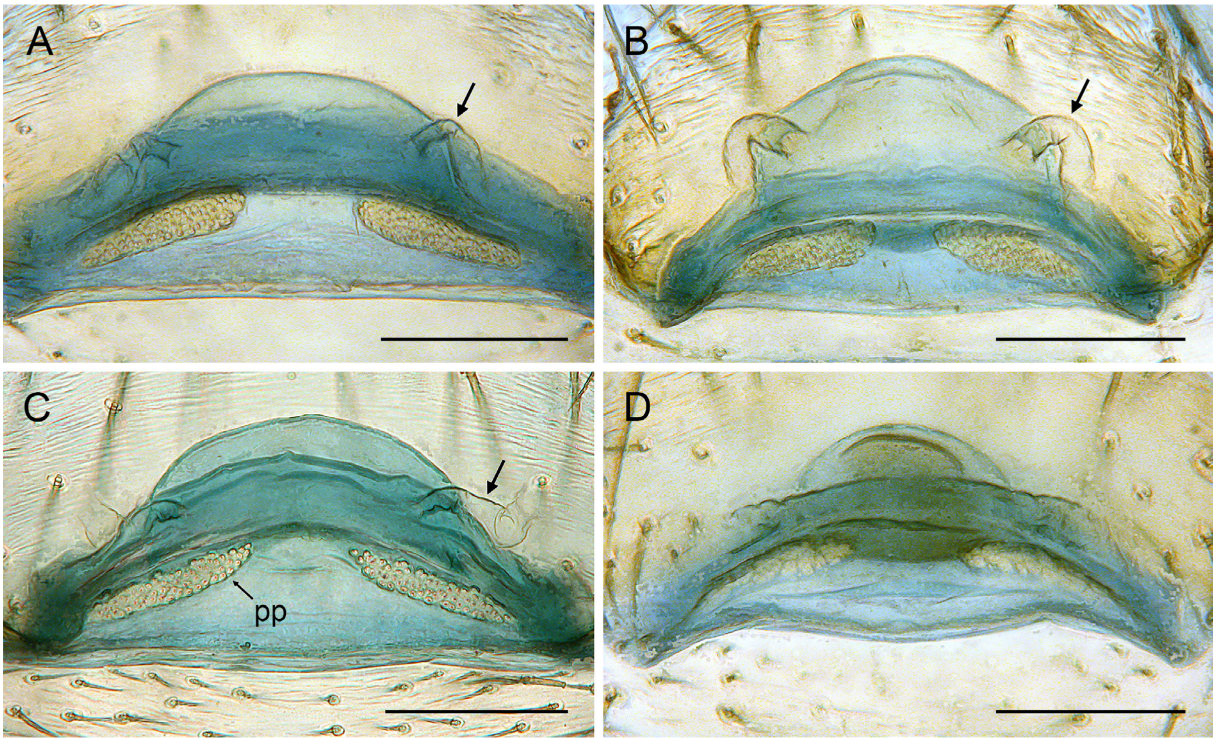

Fig. 36. *Ibotyporanga walekeru* Huber sp. nov. (A–C) and *I. bariro* Huber, 2020 (D), details of cleared female genitalia, dorsal views (arrows: internal tubes). **A**. Colombia, Cesar, ESE of Pueblo Bello, ZFMK Ar 24350. **B**. Colombia, La Guajira, S of Riohacha, ZFMK Ar 24351. **C**. Colombia, La Guajira, near Papayal, ZFMK Ar 24352. **D**. Venezuela, Falcón, SE of Bariro, ZFMK Ar 21863. Abbreviation: pp = pore plate. Scale lines: 0.1 mm.

Ibotyporanga bariro Huber, 2020
Figs 26, 32C–D, 36D, 37

Ibotyporanga bariro Huber in Huber & Villarreal, 2020: 62, figs 176–177, 189–196, 1031, 1040 (♂♀).

Remarks

We have no new material of this Venezuelan species but include it here to provide an updated diagnosis, comparing it with the very similar Colombian *I. walekeru* sp. nov. and other similar species. In the original description, the carapace width of the holotype was erroneously given as 0.95; the correct measure is 0.75.

Diagnosis

Males are easily distinguished from most known congeners by shape of procursus (Fig. 37A–C; short and wide, curved towards dorsal, without dorsal branch, distally with wide transparent membrane); from the very similar *I. walekeru* sp. nov. by presence of many large fringes distally on procursus (only a few hair-like processes in *I. walekeru*; compare Fig. 32A–B with Fig. 32 C–D); from the superficially similar *I. itatim* sp. nov. by much shorter legs (male tibia 1 < 1.1; in *I. itatim* > 1.5), and by absence of dorsal process on palpal tarsus. Females externally possibly indistinguishable from *I. walekeru*, but internal genitalia with very short and indistinct pair of tubes (Fig. 36D; long and distinct in *I. walekeru*); *I. piojo* sp. nov. with more strongly curved epigynal pocket and with distinct internal tubes; *I. itatim* with deeper triangular epigynal pocket and distinct pair of internal lateral sacs.

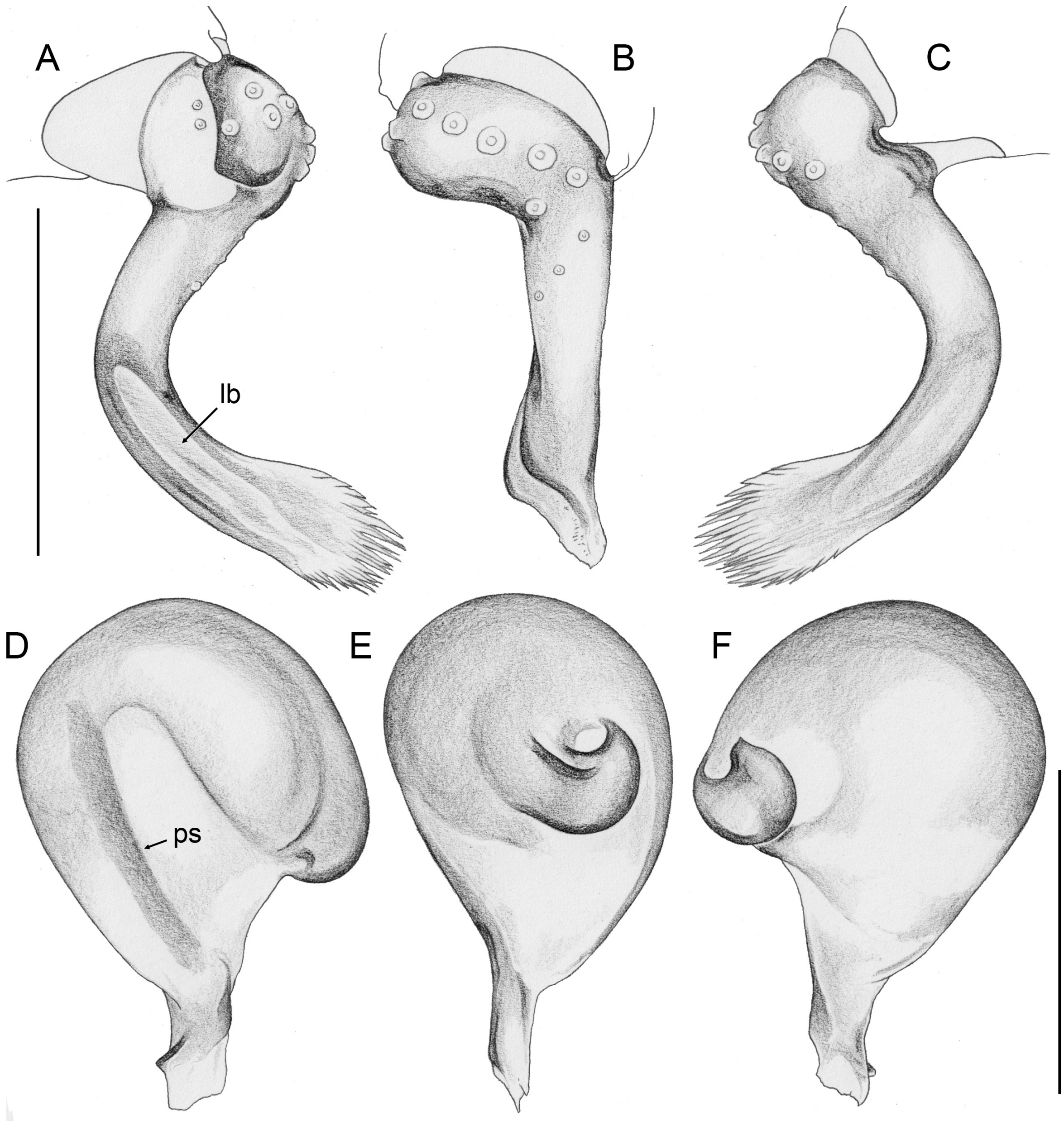

Fig. 37. *Ibotyporanga bariro* Huber, 2020, male holotype from Venezuela, Falcón, SE of Bariro, ZFMK Ar 21862. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views. **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views. Abbreviations: lb = light band; ps = prolateral sclerite. Scale lines: 0.2 mm.

Ibotyporanga piojo Huber sp. nov.
urn:lsid:zoobank.org:act:CB691C7E-37C2-4207-A748-34C3D49D578C
Figs 25D–E, 26, 38–41

Diagnosis

Males are easily distinguished from all known congeners by shape of procursus (Fig. 39A–C; strongly widened in lateral view, distally bent towards retrolateral, with semitransparent prolateral branch) and by strong prolateral apophysis on embolus (arrow in Fig. 39D). Females very similar to those of *I. walekeru* sp. nov. and *I. bariro*, but with more strongly curved epigynal pocket (Fig. 40C) and internal genitalia with pair of distinct tubes (arrows in Fig. 40C; very similar to *I. walekeru* but different from *I. bariro*). Males and females also differ from all known congeners by their small size (carapace width 0.6) and short legs (tibia 1 <0.75).

Etymology

The species name is derived from the type locality; noun in apposition.

Type material

Holotype

COLOMBIA – **Atlántico** • ♂; near Piojo, Reserva Natural Los Charcones; 10.757° N, 75.095° W; 210 m a.s.l.; 23 Sep. 2022; B.A. Huber leg.; MUSENUV-Ar 2739.

Paratypes

COLOMBIA – **Atlántico** • 1 ♀; same collection data as for holotype; MUSENUV-Ar 2740 • 1 ♂, 1 ♀; same collection data as for holotype; ZFMK Ar 24353.

Other material examined

COLOMBIA – **Atlántico** • 1 ♀, 5 juvs, in pure ethanol; same collection data as for holotype; ZFMK Col316.

Description

Male (holotype)

MEASUREMENTS. Total body length 1.7, carapace width 0.58. Distance PME–PME 50 µm; diameter PME 50 µm; distance PME–ALE 25 µm; distance AME–AME 15 µm; diameter AME 30 µm. Leg 1: 2.82 (0.77+0.20+0.68+0.77+0.40), tibia 2: 0.60, tibia 3: 0.57, tibia 4: 0.78; tibia 1 L/d: 8; diameters of leg femora 0.13–0.14, of leg tibiae 0.08–0.09.

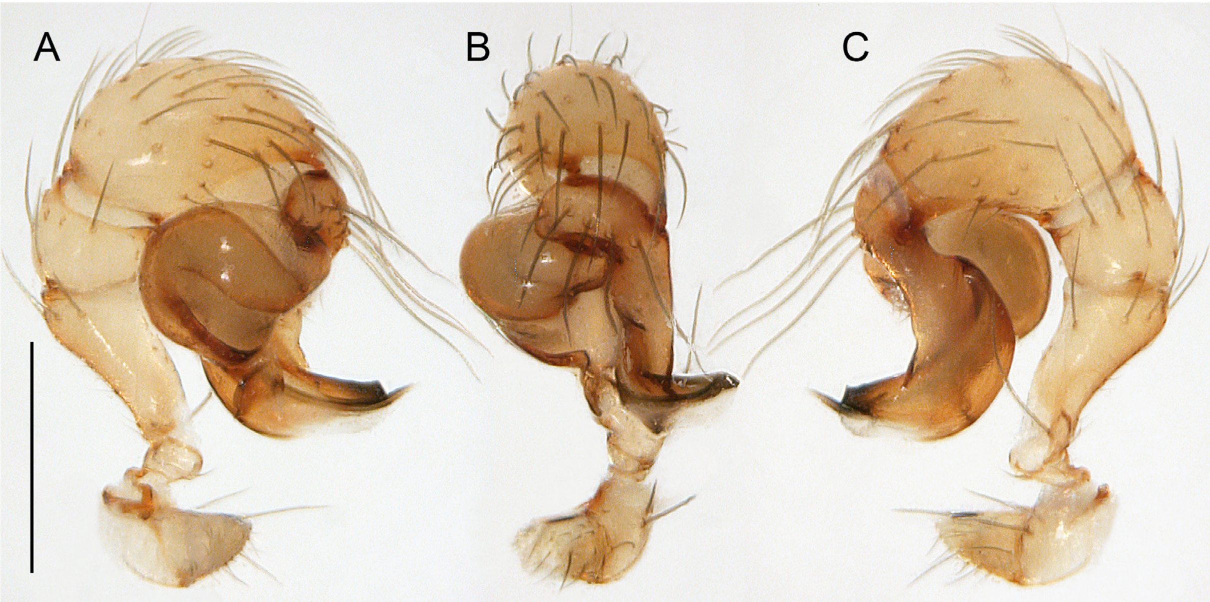

Fig. 38. *Ibotyporanga piojo* Huber sp. nov., male from Colombia, Atlántico, near Piojo, ZFMK Ar 24353. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

Colour (in ethanol). Prosoma and legs light ochre-yellow, carapace medially and ocular area slightly darker ochre; abdomen pale gray with indistinct darker internal marks dorsally and laterally; ventrally with light ochre plates in front of gonopore and in front of spinnerets.

Body. Habitus as in Fig. 25D. Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum slightly wider than long (0.45/0.38), with small but distinct anterior processes near coxae 1 (~30 µm high, 30 µm diameter at basis). Abdomen globular.

Chelicerae. As in Fig. 40A–B; with strong median frontal apophysis; stridulatory files very fine and poorly visible in dissecting microscope.

Palps. As in Fig. 38; coxa and trochanter unmodified; femur proximally with retrolateral process not directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella

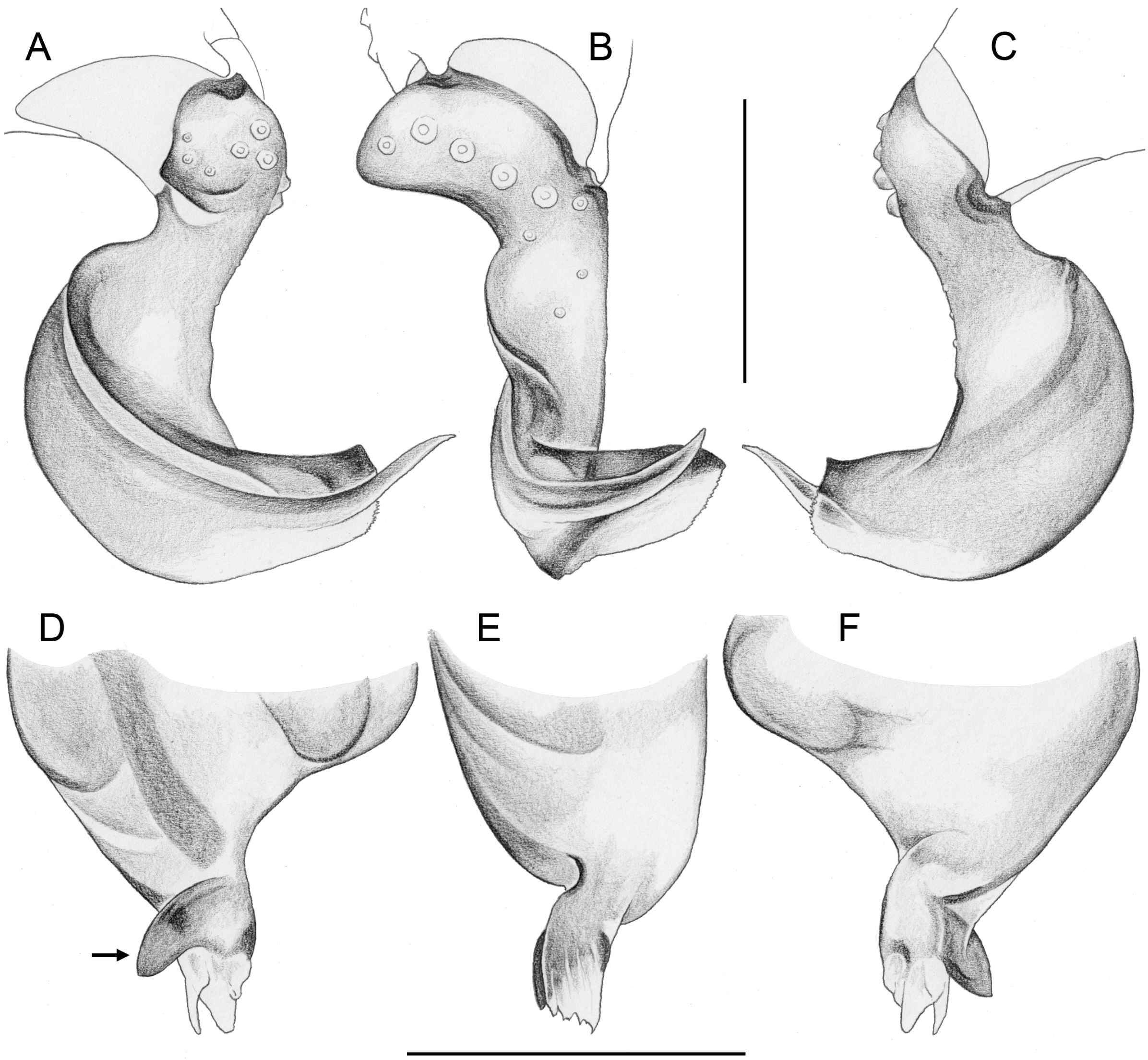

Fig. 39. *Ibotyporanga piojo* Huber sp. nov., male from Colombia, Atlántico, near Piojo, ZFMK Ar 24353. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views. **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views (arrow: distinctive apophysis on embolus). Scale lines: 0.2 mm.

joints not shifted toward one side; patella dorsally as long as medially wide; tibia with two trichobothria in relatively proximal position; tibia-tarsus joints shifted toward retrolateral side; tarsus without dorsal process; procursus (Fig. 39A–C) strongly widened in lateral view, distally bent towards retrolateral, with semitransparent prolateral branch; genital bulb (Fig. 39D–F) with distinct prolateral sclerite on bulbous part, with strong prolateral apophysis on embolus.

Legs. Without spines but with longer and slightly stronger hairs ventrally on femora; without curved hairs; with many short vertical hairs on tibiae 1 and 2; retrolateral trichobothrium of tibia 1 at 54%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~4–5 pseudosegments, distally fairly distinct.

Variation (male)

Other male slightly darker. Tibia 1 in second male 0.70.

Female

In general, similar to male (Fig. 25E) but slightly darker, carapace also laterally with light brown bands, clypeus and legs light brown; clypeus and sternum unmodified; tibiae with few short vertical hairs. Tibia 1 in three females. 0.63, 0.70, 0.70. Epigynum (Fig. 41A) anterior plate oval, wider than long, posterior margin almost straight, with strongly curved anterior pocket; posterior plate wide and short. Internal genitalia (Figs 40C, 41B–C) with pair of oval pore plates, membranous 'valve', and pair of indistinct membranous tubes apparently leading into very thin-walled globular 'receptacles'.

Distribution

Known from type locality only, in Colombia, Atlántico (Fig. 26).

Natural history

The spiders were found in a dry forest where they occupied dry wood that was lying on the floor and that had been heavily mined by termites. Two egg sacs were flattened and contained 7 and 8 eggs, respectively (in one case all eggs in a single layer), with an egg diameter of 0.46–0.48.

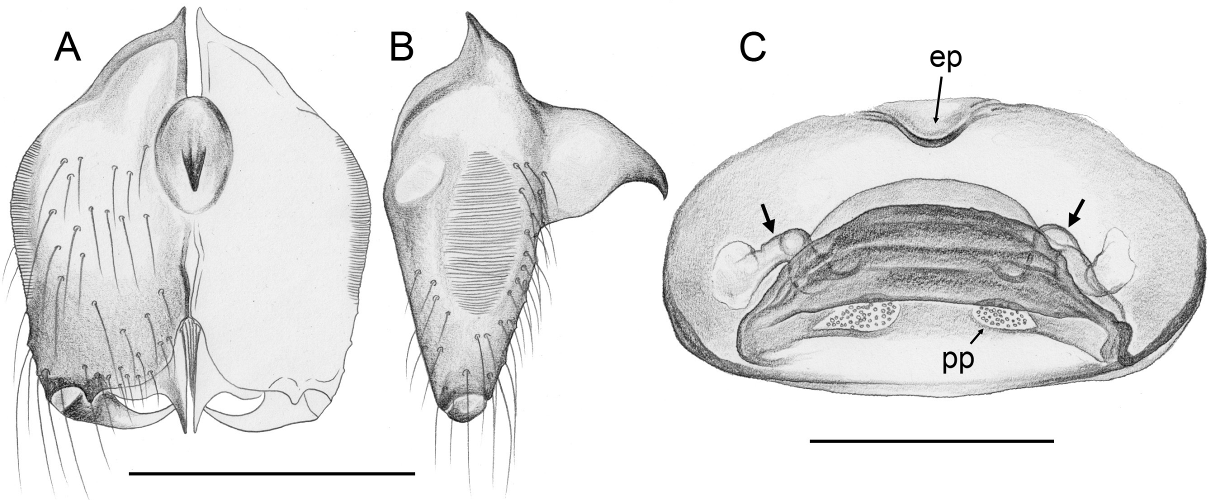

Fig. 40. *Ibotyporanga piojo* Huber sp. nov., male and female from Colombia, Atlántico, near Piojo, ZFMK Ar 24353. **A–B**. Male chelicerae, frontal and lateral views. **C**. Cleared female genitalia, dorsal view (bold arrows: internal tubes). Abbreviations: ep = epigynal pocket; pp = pore plate. Scale lines: 0.2 mm.

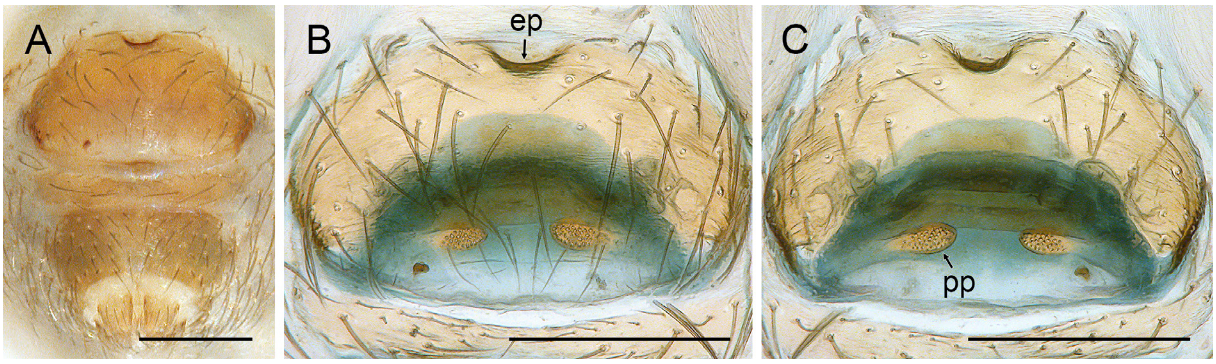

Fig. 41. *Ibotyporanga piojo* Huber sp. nov., female from Colombia, Atlántico, near Piojo, ZFMK Ar 24353. **A**. Abdomen, ventral view. **B–C**. Cleared female genitalia, ventral and dorsal views. Abbreviations: ep = epigynal pocket; pp = pore plate. Scale lines: 0.2 mm.

Ibotyporanga itatim Huber sp. nov.
urn:lsid:zoobank.org:act:849EB775-ABC9-47FB-87B7-C77FFB5B4E1E
Figs 22C, 25F–G, 32E–F, 42–46; SEM Figs 2C, 4C, 7F, 10C, 11B, 13B, 14B, 15E, 16B–C, 17D–E, 18B–C, 19F–G, 21B, D–E

Diagnosis

Males are easily distinguished from most known congeners by shape of procursus (Fig. 44A–C; short and simple, distally widened and membranous); from superficially similar species (*I. bariro*, *I. walekeru* sp. nov.) by strong dorsal process on palpal tarsus (arrow in Fig. 44C) and by longer legs (tibia 1 > 1.5, versus < 1.1). Females are distinguished from known congeners by trapezoidal epigynum with triangular pocket (Fig. 45C; similar in *I. xique* sp. nov. and *I. xakriaba* sp. nov.) and by unique pair of distinct lateral sacs in internal genitalia (Fig. 46C–H).

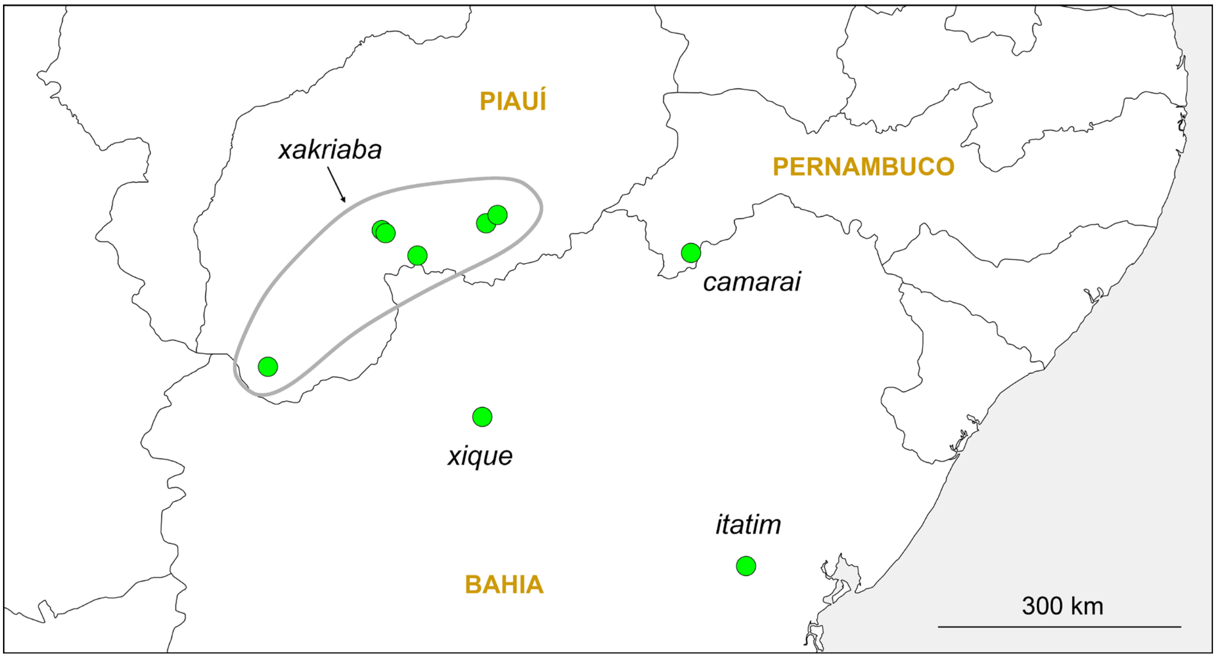

Fig. 42. Known geographic distribution of Brazilian species with plesiomorphic short procursus.

Etymology

The species name is derived from the type locality; noun in apposition.

Type material

Holotype

BRAZIL – **Bahia** • ♂; W of Itatim; 12.7162° S, 39.7626° W; 300 m a.s.l.; 10 Nov. 2022; B.A. Huber and L.S. Carvalho leg.; CHNUFPI 5884.

Paratypes

BRAZIL – **Bahia** • 1 ♂, 4 ♀♀, 3 juvs; same collection data as for holotype; CHNUFPI 5885 • 1 ♂, 1 ♀; same collection data as for holotype; UFMG 31653 • 2 ♂♂, 2 ♀♀; same collection data as for holotype; CHNUFPI 9028 [deposited in ZFMK Ar 24354] • 1 ♂, 1♀; same collection data as for holotype; CHNUFPI 5886.

Other material examined

BRAZIL – **Bahia** • 1 ♂, 7 ♀♀, 1 juv., in pure ethanol; same collection data as for holotype; CHNUFPI 5887 [deposited in ZFMK Br22-148; 1 ♂, 1 ♀ used for SEM].

Description

Male (holotype)

MEASUREMENTS. Total body length 2.0, carapace width 0.83. Distance PME–PME 70 µm; diameter PME 85 µm; distance PME–ALE 25 µm; distance AME–AME 15 µm; diameter AME 60 µm. Leg 1: 5.93 (1.63 + 0.33 + 1.60 + 1.87 + 0.50), tibia 2: 1.33, tibia 3: 1.13, tibia 4: 1.57; tibia 1 L/d: 16; diameters of leg femora 0.19–0.20, of leg tibiae 0.10.

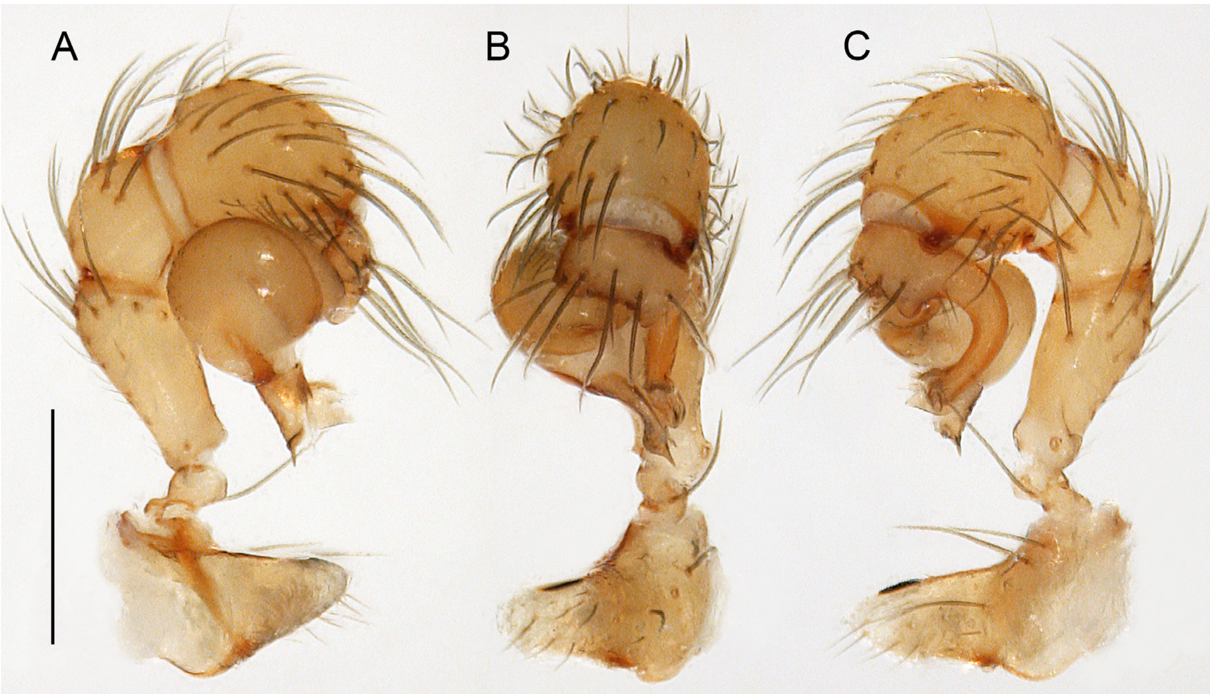

Fig. 43. *Ibotyporanga itatim* Huber sp. nov., male from Brazil, Bahia, W of Itatim, ZFMK Ar 24354. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

Colour (in ethanol). Prosoma and legs ochre-yellow, carapace medially with narrow brown mark including ocular area and clypeus; legs with brown rings on femora (subdistally) and tibiae (proximally and subdistally); abdomen gray with many dark internal marks dorsally and laterally; ventrally with ochre plates in front of gonopore and in front of spinnerets.

Body. Habitus as in Fig. 25F. Ocular area slightly raised (Fig. 2C). Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum slightly wider than long (0.58/0.48), with very low and indistinct anterior processes near coxae 1 (not higher than in female). Abdomen globular; gonopore with four epiandrous spigots (Fig. 4C); spinnerets as in congeners (Fig. 7F).

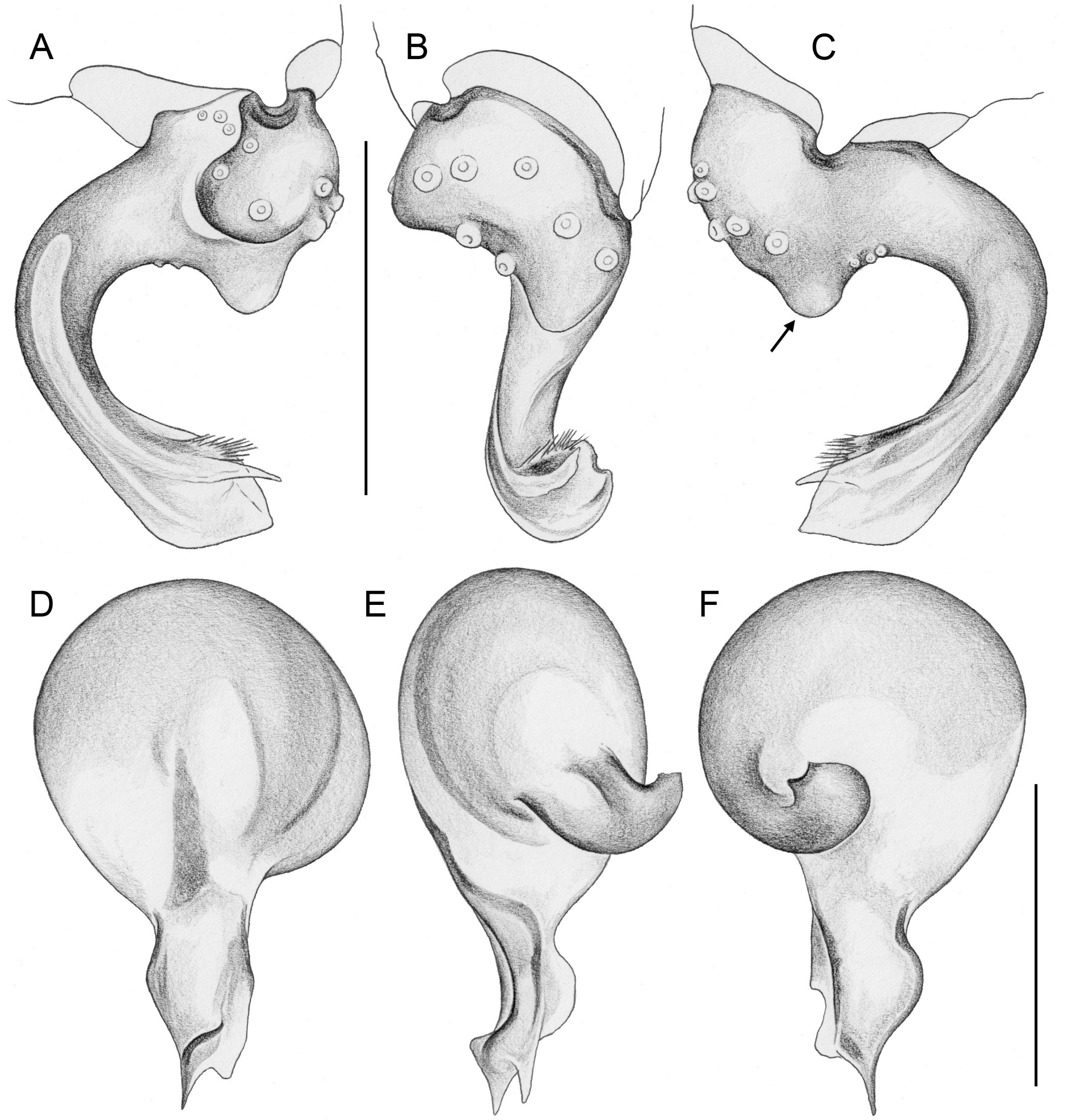

Fig. 44. *Ibotyporanga itatim* Huber sp. nov., male from Brazil, Bahia, W of Itatim, ZFMK Ar 24354. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views (arrow: dorsal process on tarsus). **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views. Scale lines: 0.2 mm.

Chelicerae. As in Fig. 45A–B; width 0.33; with strong median frontal apophysis; stridulatory files (Fig. 10C) very fine and poorly visible in dissecting microscope.

Palps. As in Fig. 43; coxa unmodified; trochanter with short rounded ventral protrusion; femur proximally with short retrolateral process not directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints not shifted toward one side; patella dorsally only slightly longer than medially wide; tibia-tarsus joints shifted toward retrolateral side; tarsus with small capsulate tarsal organ (Fig. 13B) and strong dorsal process; procursus (Fig. 44A–C) evenly curved, with light prolateral band, distally widened and semitransparent, with dorsal brush of pseudotrichia (Figs 11B, 32E–F; barely visible in dissecting microscope); genital bulb (Fig. 44D–F) with short but distinct prolateral sclerite on bulbous part, with simple embolus ending in two semitransparent tips.

Legs. Without spines but with longer hairs ventrally on femora; without curved hairs; with many short vertical hairs on tibia 1 (Fig. 16B–C); retrolateral trichobothrium of tibia 1 at 54%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~3–4 pseudosegments, distally fairly distinct.

Variation (male)
Tibia 1 in seven males (incl. holotype): 1.60–1.83 (mean 1.69).

Female
In general, similar to male (Fig. 25G) but clypeus unmodified and tibiae with few short vertical hairs. Tibia 1 in 13 females: 1.30–1.50 (mean 1.42). Epigynum (Fig. 46A–B) anterior plate trapezoidal, posterior margin straight, with deep triangular anterior pocket; posterior plate wide and short. Internal genitalia (Fig. 46C–H) with pair of elongate pore plates and pair of distinct lateral membranous sacs; median membranes very thin and indistinct.

Distribution

Known from type locality only, in Brazil, Bahia (Fig. 42).

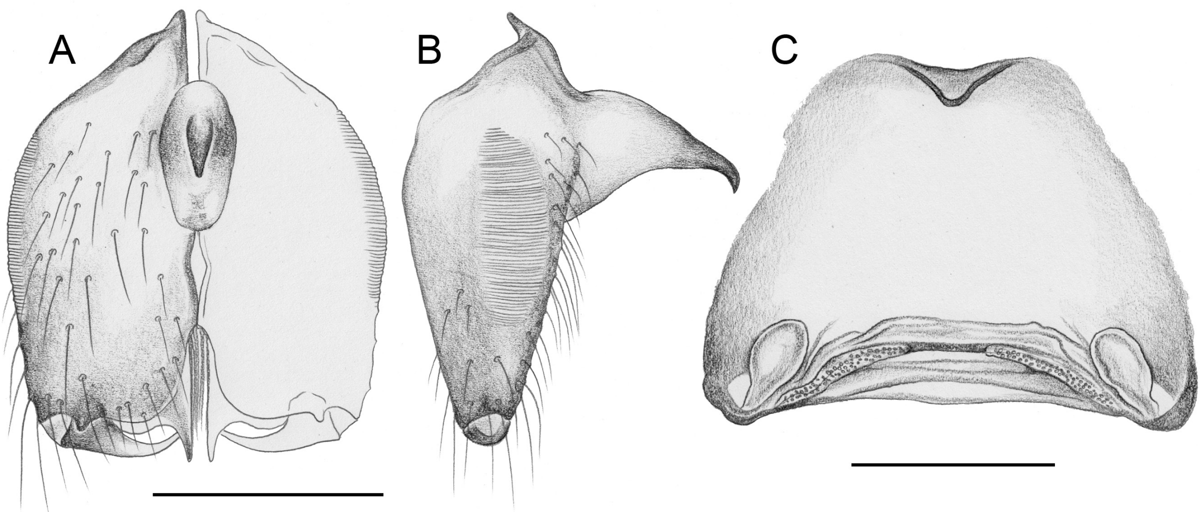

Fig. 45. *Ibotyporanga itatim* Huber sp. nov., male and female from Brazil, Bahia, W of Itatim, ZFMK Ar 24354. **A–B**. Male chelicerae, frontal and lateral views. **C**. Cleared female genitalia, dorsal view. Scale lines: 0.2 mm.

Natural history

The type locality is a granite outcrop with secondary shrubby caatinga (Fig. 22C). Most specimens were found by turning small rocks; a few specimens were collected from roof tiles piled up near a house. Two egg sacs had diameters of 1.8–2.0, were round and slightly flattened, and contained ~12–15 eggs each, with an egg diameter of 0.58–0.60.

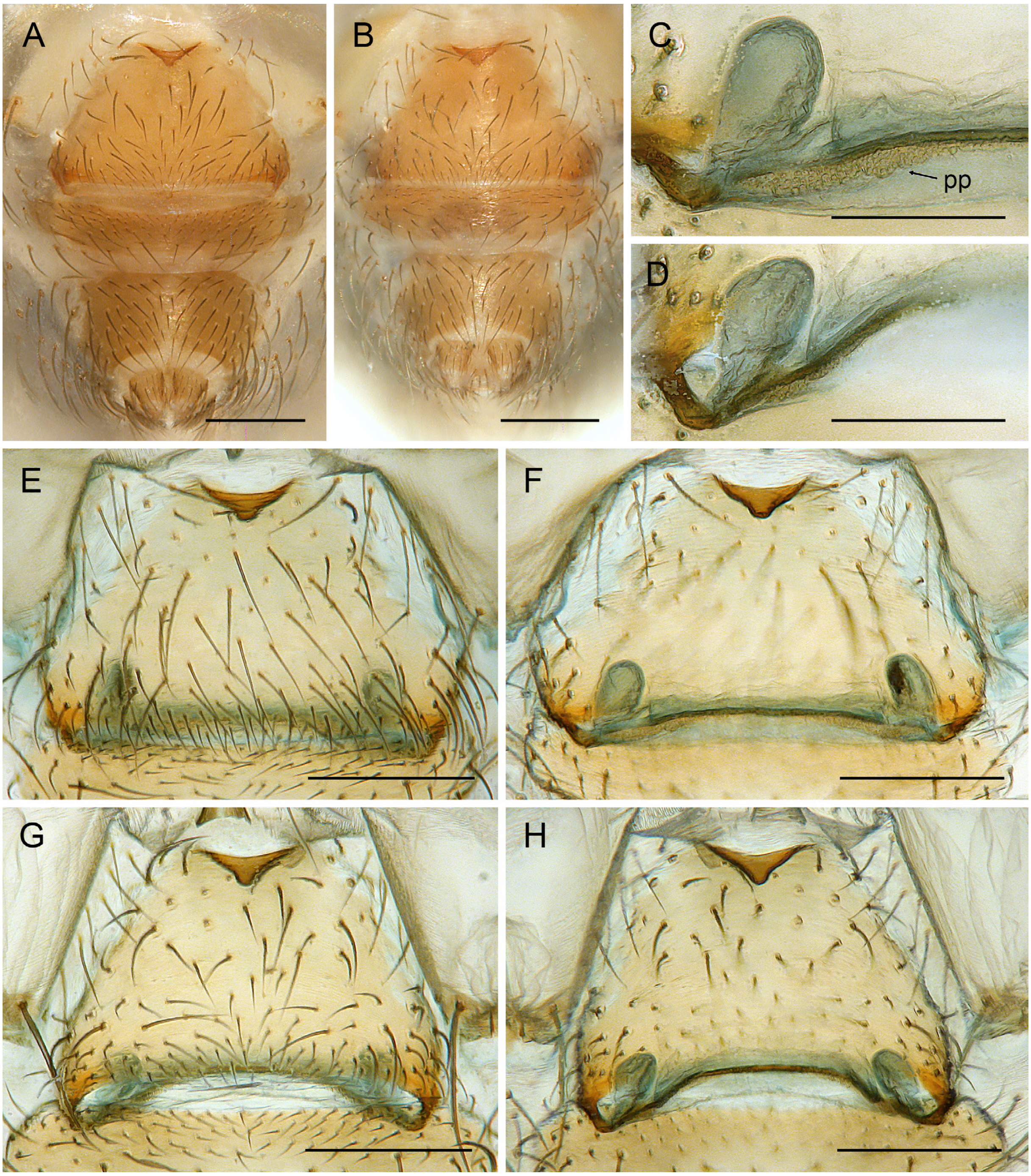

Fig. 46. *Ibotyporanga itatim* Huber sp. nov., females from Brazil, Bahia, W of Itatim, ZFMK Ar 24354. **A–B**. Abdomens, ventral views. **C–D**. Left putative receptacles and pore plates in female internal genitalia, dorsal views. **E–H**. Cleared female genitalia, ventral (E, G) and dorsal (F, H) views. Abbreviation: pp = pore plate. Scale lines: A–B, E–H = 0.2 mm; C–D = 0.1 mm.

Ibotyporanga xakriaba Huber sp. nov.
urn:lsid:zoobank.org:act:EFDAB528-2060-4D13-823D-5F3245131923
Figs 42, 47–50

Diagnosis

Males are easily distinguished from most known congeners (except *I. xique* sp. nov.) by general shape of procursus (Fig. 48A–C; short and wide, distally with semitransparent ventral flap), by very short palpal patella (Fig. 47C; dorsally clearly shorter than medially wide), and by short conical prolateral process on embolus (arrow in Fig. 48D); from similar *I. xique* by unique dorsal process on procursus (arrow in Fig. 48C) and by dorsal protrusion distally on palpal femur (arrow in Fig. 47A); males further distinguished from most known congeners (except *I. xique* and *I. itatim* sp. nov.) by slender legs (tibia 1 L/d > 15). Females are distinguished from most known congeners by trapezoidal epigynum with triangular pocket and posterior lateral parts heavily sclerotized (Fig. 50A; similar in *I. xique* and *I. itatim*); females of *I. xique* are possibly indistinguishable morphologically.

Etymology

The species name honors the Xakriabá, an indigenous people of Brazil who in pre-colonial times lived in the valley of the Tocantins River, in Goiás and along the São Francisco River; noun in apposition.

Type material

Holotype

BRAZIL – **Piauí** • ♂; Guaribas, Parque Nacional da Serra das Confusões; 9.2257° S, 43.4630° W; 720 m a.s.l.; 13 Dec. 2010; L.S. Carvalho *et al.* leg.; CHNUFPI 1121.

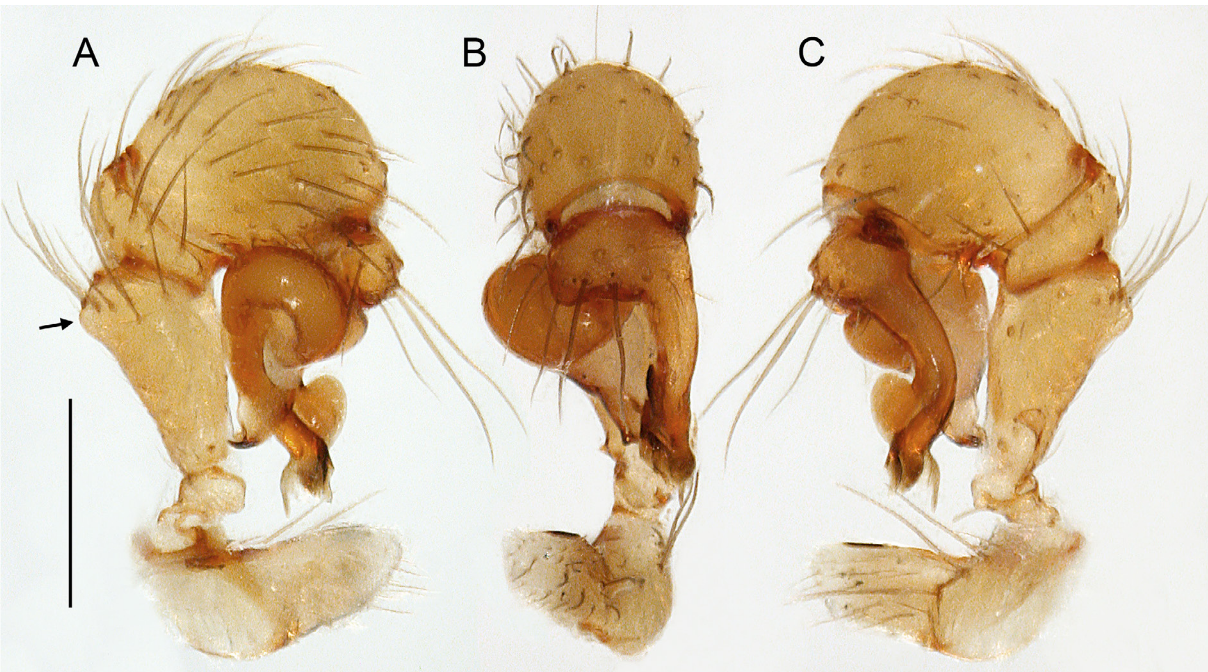

Fig. 47. *Ibotyporanga xakriaba* Huber sp. nov., male from Brazil, Piauí, Parque Nacional da Serra das Confusões, CHNUFPI 1134. Left palp, prolateral, dorsal, and retrolateral views (arrow: distinctive dorsal process on femur). Scale line: 0.3 mm.

Paratypes

BRAZIL – **Piauí** • 2 ♂♂; same collection data as for holotype; CHNUFPI 1132 • 2 ♂♂; same locality as for holotype; 9–15 Dec. 2010; L.S. Carvalho *et al.* leg.; CHNUFPI 1134 • 1 ♂; same collection data as for preceding; CHNUFPI 1447.

Other material examined

BRAZIL – **Piauí** • 1 ♂; Cristino Castro, Parque Nacional da Serra das Confusões; 8.9380° S, 43.8634° W; 335 m a.s.l.; 9 Dec. 2012; L.S. Carvalho *et al.* leg.; CHNUFPI 1168 • 1 ♀; same collection data as for preceding; CHNUFPI 1170 • 1 ♀; same collection data as for preceding; UFMG 15694 • 1 ♂; Guaribas,

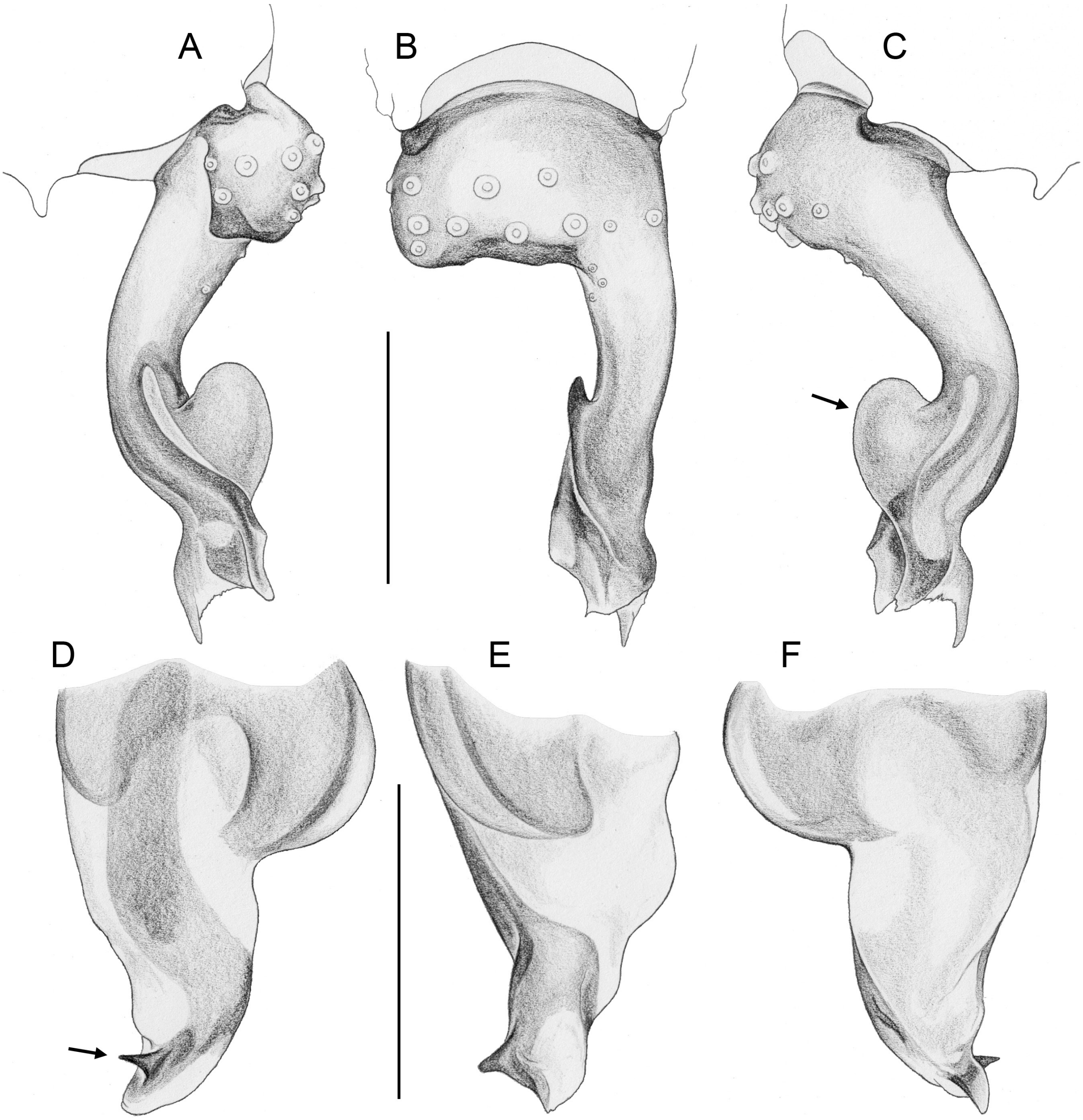

Fig. 48. *Ibotyporanga xakriaba* Huber sp. nov., male from Brazil, Piauí, Parque Nacional da Serra das Confusões, CHNUFPI 1134. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views (arrow: distinctive dorsal process on procursus). **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views (arrow: distinctive process on embolus). Scale lines: 0.2 mm.

Parque Nacional da Serra das Confusões; 8.9756° S, 43.8181° W; 345 m a.s.l.; Dec. 2012; L.S. Carvalho *et al.* leg.; CHNUFPI 3737 • 1 ♀; same collection data as for preceding; CHNUFPI 3745 • 1 ♀; same collection data as for preceding; CHNUFPI 3755 • 1 ♂, 2 ♀♀, 1 juv.; Corrente, near Rio Corrente; 10.4751° S, 45.1433° W; 455 m a.s.l.; 20 Jul. 2023; A. Galleti-Lima *et al.* leg.; CHNUFPI 5025.

Assigned tentatively (no males available)

BRAZIL – **Piauí** • 1 ♀; Coronel José Dias, Parque Nacional Serra da Capivara; 8.7672° S, 42.5600° W; 520 m a.s.l.; Apr. 2012; L.S. Carvalho leg.; CHNUFPI 371 • 1 ♀; same collection data as for preceding; CHNUFPI 396 • 1 ♀; São Raimundo Nonato, Parque Nacional da Serra da Capivara, Baixão das Andorinhas; 8.8625° S, 42.6873° W; 485 m a.s.l.; 15 Jul. 2023; L.S. Carvalho and E.G. Noetzold leg.; CHNUFPI 5012.

Description

Male (holotype)

Measurements. Total body length 2.1, carapace width 0.97. Distance PME–PME 80 µm; diameter PME 85 µm; distance PME–ALE 50 µm; distance AME–AME 20 µm; diameter AME 70 µm. Leg 1: 7.40 (2.10 + 0.37 + 2.00 + 2.43 + 0.50), tibia 2: 1.77, tibia 3: 1.33, tibia 4: 1.92; tibia 1 L/d: 18; diameters of leg femora 0.20–0.21, of leg tibiae 0.11.

Colour (in ethanol). Prosoma ochre-orange, carapace medially slightly darker; legs ochre-yellow with indistinct darker rings distally on femora and tibiae; abdomen greenish-gray, dorsally and laterally with darker internal marks; ventrally with indistinct ochre-yellow plates in front of gonopore and in front of spinnerets.

Body. Habitus as in *I. xique* sp. nov. (cf. Fig. 25H). Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum wider than long (0.66/0.56), with pair of rounded anterior processes near coxae 1, ~30 µm high, ~90 µm diameter at basis. Abdomen globular.

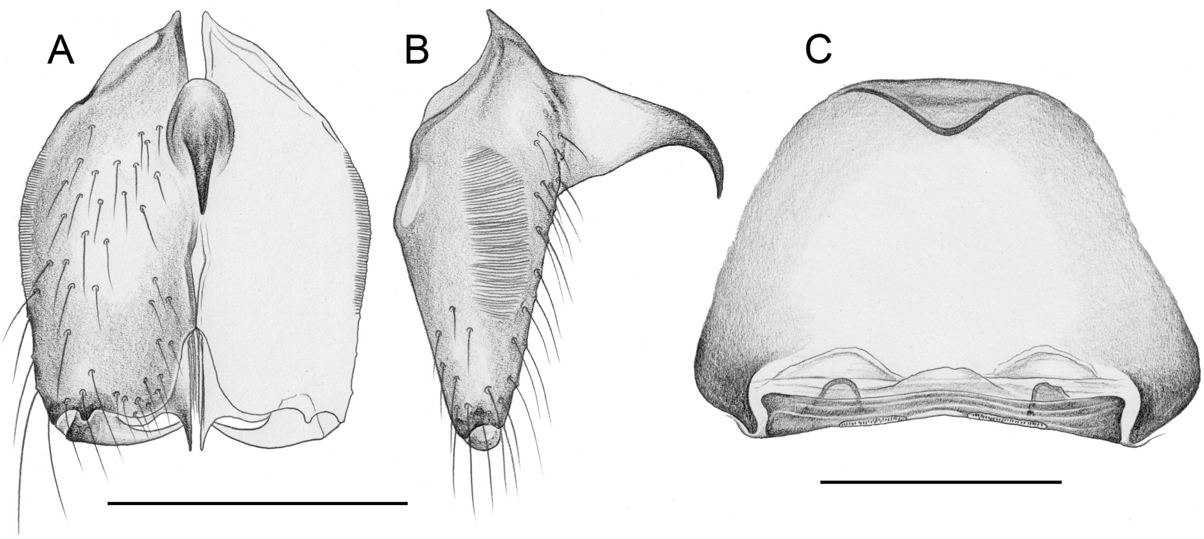

Fig. 49. *Ibotyporanga xakriaba* Huber sp. nov., male and female from Brazil, Piauí, Parque Nacional da Serra das Confusões. **A–B**. Male chelicerae, frontal and lateral views, CHNUFPI 1134. **C**. Cleared female genitalia, dorsal view, CHNUFPI 3745. Scale lines: 0.3 mm.

Chelicerae. As in Fig. 49A–B; with strongly curved median frontal apophysis; stridulatory files fine but well visible in dissecting microscope.

Palps. As in Fig. 47; coxa unmodified; trochanter with short rounded ventral protrusion; femur proximally with distinct retrolateral process directed toward distal, with prolateral stridulatory pick, distally widened with distinctive dorsal protrusion; femur-patella joints not shifted toward one side; patella much shorter than wide, with distal ventral protruding rim; tibia almost globular, with proximal ventral process; tibia-tarsus joints not shifted toward one side; tarsus without dorsal process; procursus (Fig. 48A–C) relatively short, with light prolateral band, distinctive dorsal process, distally with ventral membranous process; genital bulb (Fig. 48D–F) with wide prolateral sclerite on bulbous part, with short conical prolateral process on embolus.

Legs. Without spines but with longer and slightly stronger hairs ventrally on femora; without curved hairs; with several rows of short vertical hairs on tibia 1; retrolateral trichobothrium of tibia 1 at 66%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~4–5 pseudosegments, distally fairly distinct.

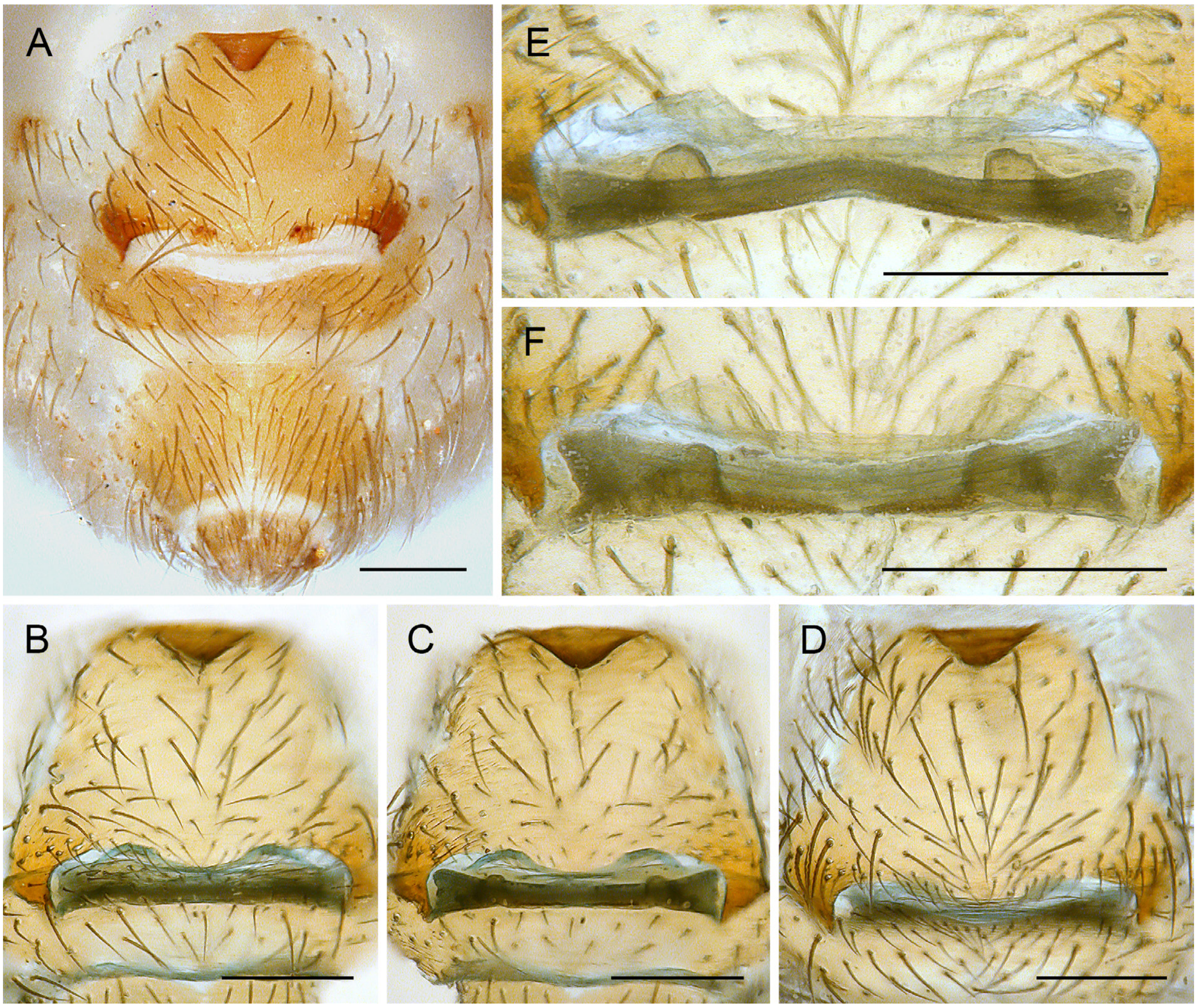

Fig. 50. *Ibotyporanga xakriaba* Huber sp. nov., females from Brazil, Piauí, Parque Nacional da Serra das Confusões. **A**. Abdomen, ventral view, CHNUFPI 3755. **B–C**. Cleared female genitalia, ventral and dorsal views, CHNUFPI 3745. **D**. Cleared female genitalia, ventral view, CHNUFPI 1170. **E–F**. Details of cleared female genitalia, CHNUFPI 3745 (E) and CHNUFPI 1170 (F). Scale lines: 0.2 mm.

Variation (male)

Dark marks on carapace and legs variably distinct, some males also with proximal rings on leg tibiae. Tibia 1 in eight males (incl. holotype): 1.72–2.23 (mean 1.97). Retrolateral trichobothrium of tibia 1 in two other males at 53% and 60%, respectively.

Female

In general, similar to male but clypeus and sternum unmodified; tibia 1 with few short vertical hairs. Tibia 1 length in five females from Parque Nacional da Serra das Confusões and from Corrente: 1.53–1.73 (mean 1.63). Epigynum (Fig. 50A) anterior plate trapezoidal, with deep anterior pocket, posterior lateral parts heavily sclerotized, posterior margin with pair of lateral indentations and with or without darker marks at median side of these indentations; posterior plate short and wide. Internal genitalia (Figs 49C, 50B–F) very short, with pair of very narrow pore plates, with small sclerotized and larger membranous lateral pockets.

The three females from Parque Nacional Serra da Capivara have externally identical epigyna; they are assigned tentatively to this species because no males are available from this locality. Tibia 1 in two females: 1.33, 1.48 (missing in third female).

Distribution

Known from several localities in southern Piauí, Brazil (Fig. 42).

Natural history

The specimens were collected on arenite rock fields, under rocks and dead logs and among small pebbles, in shrubby caatinga vegetation areas.

Ibotyporanga xique Huber sp. nov.

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Figs 22A, 25H–I, 42, 51–54

Diagnosis

Males are easily distinguished from most known congeners (except *I. xakriaba* sp. nov.) by general shape of procursus (Fig. 52A–C; short and wide, distally with semitransparent ventral flap), by very short palpal patella (Fig. 51C; dorsally clearly shorter than medially wide), and by short conical prolateral process on embolus (arrow in Fig. 52D); from similar *I. xakriaba* by absence of dorsal process on procursus (cf. Fig. 48C) and by absence of dorsal protrusion distally on palpal femur (cf. Fig. 47A); males further distinguished from most known congeners (except *I. xakriaba* and *I. itatim* sp. nov.) by slender legs (tibia 1 L/d > 15). Females are distinguished from most known congeners by trapezoidal epigynum with deep pocket and posterior lateral parts heavily sclerotized (Fig. 54A–B; similar in *I. xakriaba* and *I. itatim*); females of *I. xakriaba* sp. nov. are possibly indistinguishable morphologically.

Etymology

The species name is derived from the type locality; noun in apposition.

Type material

Holotype

BRAZIL – **Bahia** • ♂; S of Xique-Xique, ‘loc. 3’; 11.0398° S, 42.7311° W; 430 m a.s.l.; 24 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5888.

Paratypes

BRAZIL – **Bahia** • 1 ♂, 1 ♀; same collection data as for holotype; CHNUFPI 5889 • 1 ♂, 1 ♀; same collection data as for holotype; UFMG 31654 • 1 ♂; same collection data as for holotype; CHNUFPI 9029 [deposited in ZFMK Ar 24355].

Other material examined

BRAZIL – **Bahia** • 1 ♂, 4 ♀♀, in pure ethanol; same collection data as for holotype; CHNUFPI 5890 [deposited in ZFMK Br22-220; one female prosoma used for molecular work; two female abdomens transferred to ZFMK Ar 24355].

Description

Male (holotype)

MEASUREMENTS. Total body length 2.3, carapace width 0.88. Distance PME–PME 85 µm; diameter PME 80 µm; distance PME–ALE 30 µm; distance AME–AME 15 µm; diameter AME 70 µm. Leg 1: 7.28 (2.15 + 0.30 + 2.03 + 2.25 + 0.55), tibia 2: 1.85, tibia 3: 1.40, tibia 4: 1.90; tibia 1 L/d: 20; diameters of leg femora 0.18–0.19, of leg tibiae 0.10.

COLOUR (in ethanol). Prosoma and legs mostly pale ochre, carapace medially and ocular area slightly darker, femora and tibiae with darker subdistal rings; abdomen gray, dorsally and laterally with darker internal marks; ventrally with indistinct plates in front of gonopore and in front of spinnerets.

BODY. Habitus as in Fig. 25H. Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum slightly wider than long (0.62/0.56), with pair of very low and indistinct anterior processes near coxae 1. Abdomen globular.

CHELICERAE. As in Fig. 53A–B; with strongly curved median frontal apophysis; stridulatory files very fine and poorly visible in dissecting microscope.

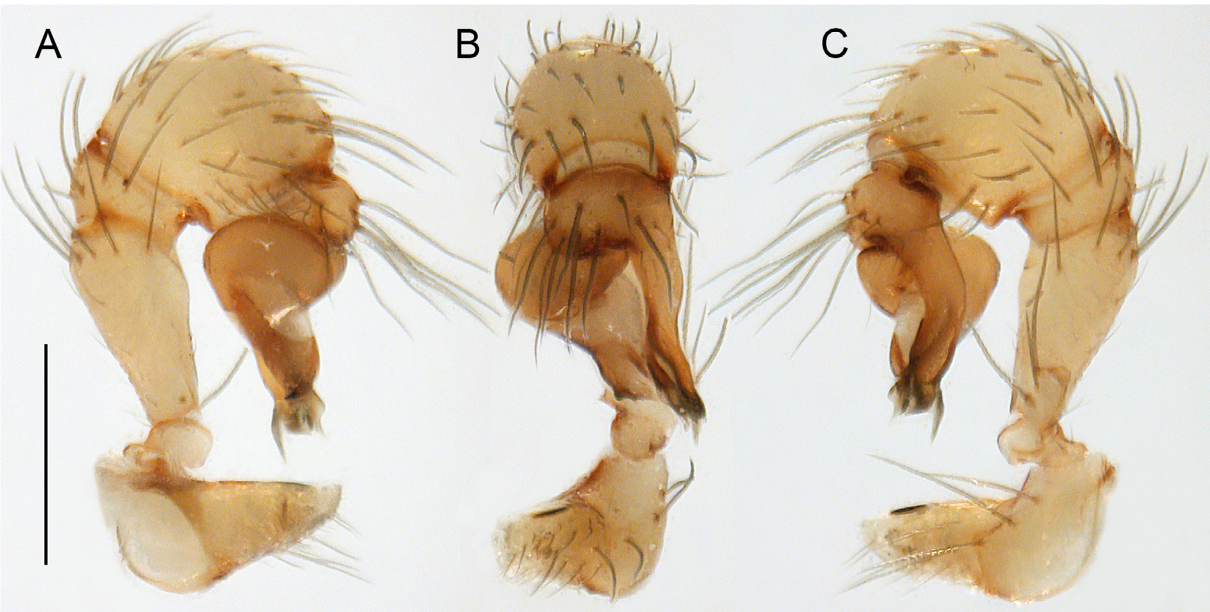

Fig. 51. *Ibotyporanga xique* Huber sp. nov., male from Brazil, Bahia, S of Xique-Xique, 'loc. 3', ZFMK Ar 24355. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

Palps. As in Fig. 51; coxa unmodified; trochanter with short rounded ventral protrusion; femur proximally with distinct retrolateral process directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints not shifted toward one side; patella much shorter than wide; tibia almost globular; tibia-tarsus joints not shifted toward one side; tarsus without dorsal process; procursus (Fig. 52A–C) short, with light prolateral band, distally with membranous ventral process; genital bulb (Fig. 52D–F) with wide prolateral sclerite on bulbous part, with short conical prolateral process on embolus.

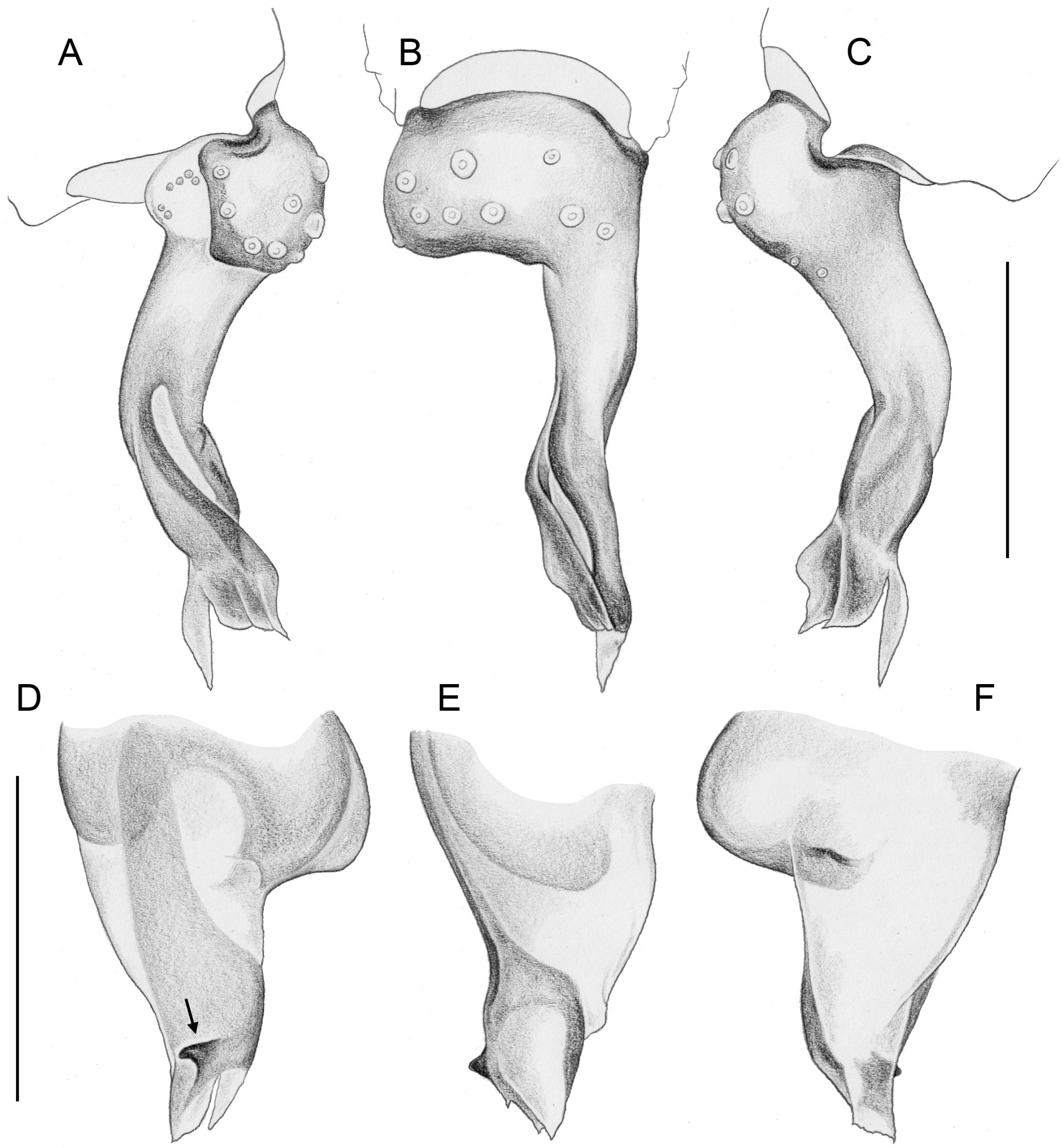

Fig. 52. *Ibotyporanga xique* Huber sp. nov., male from Brazil, Bahia, S of Xique-Xique, 'loc. 3', ZFMK Ar 24355. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views. **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views (arrow: distinctive process on embolus). Scale lines: 0.2 mm.

Legs. Without spines but with longer and slightly stronger hairs ventrally on femora; without curved hairs; with several rows of short vertical hairs on tibia 1; retrolateral trichobothrium of tibia 1 at 57%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~4–5 pseudosegments, distally fairly distinct, proximally apparently irregular.

Variation (male)

Dark marks on carapace and legs in other males barely visible or absent. Tibia 1 in five males (incl. holotype): 1.70–2.05 (mean 1.93).

Female

In general, similar to male (Fig. 25I) but slightly darker ochre, carapace also with indistinct lateral and radial marks; color variable as in male, one female with very distinct dark rings on legs, also proximally on tibiae; clypeus and sternum unmodified; tibia 1 with few short vertical hairs. Tibia 1 length in five females: 1.65–1.95 (mean 1.76). Epigynum (Fig. 54A–B) anterior plate trapezoidal to bell-shaped, posterior lateral parts heavily sclerotized, posterior margin with pair of lateral indentations, with deep anterior pocket; posterior plate short and wide. Internal genitalia (Fig. 54C–G) very short, with pair of very narrow pore plates, complex system of lateral membranous structures (ducts and pouches?).

Distribution

Known from type locality only, in Brazil, Bahia (Fig. 42).

Natural history

The specimens were collected on a rock field with thorny shrubs and scattered trees (Fig. 22A). The spiders were beaten out of dead branches. One egg sac was slightly flattened, had a diameter of 2.0, and an egg diameter of 0.62; the total number of eggs was estimated to be ~25.

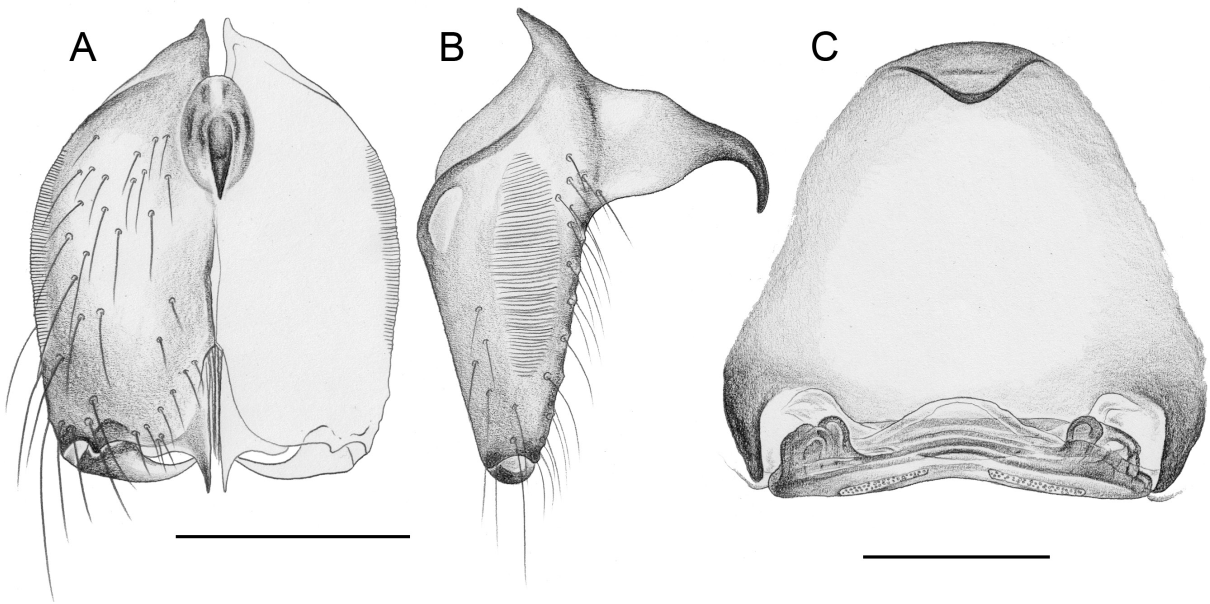

Fig. 53. *Ibotyporanga xique* Huber sp. nov., male and female from Brazil, Bahia, S of Xique-Xique, 'loc. 3', ZFMK Ar 24355. **A–B**. Male chelicerae, frontal and lateral views. **C**. Cleared female genitalia, dorsal view. Scale lines: 0.2 mm.

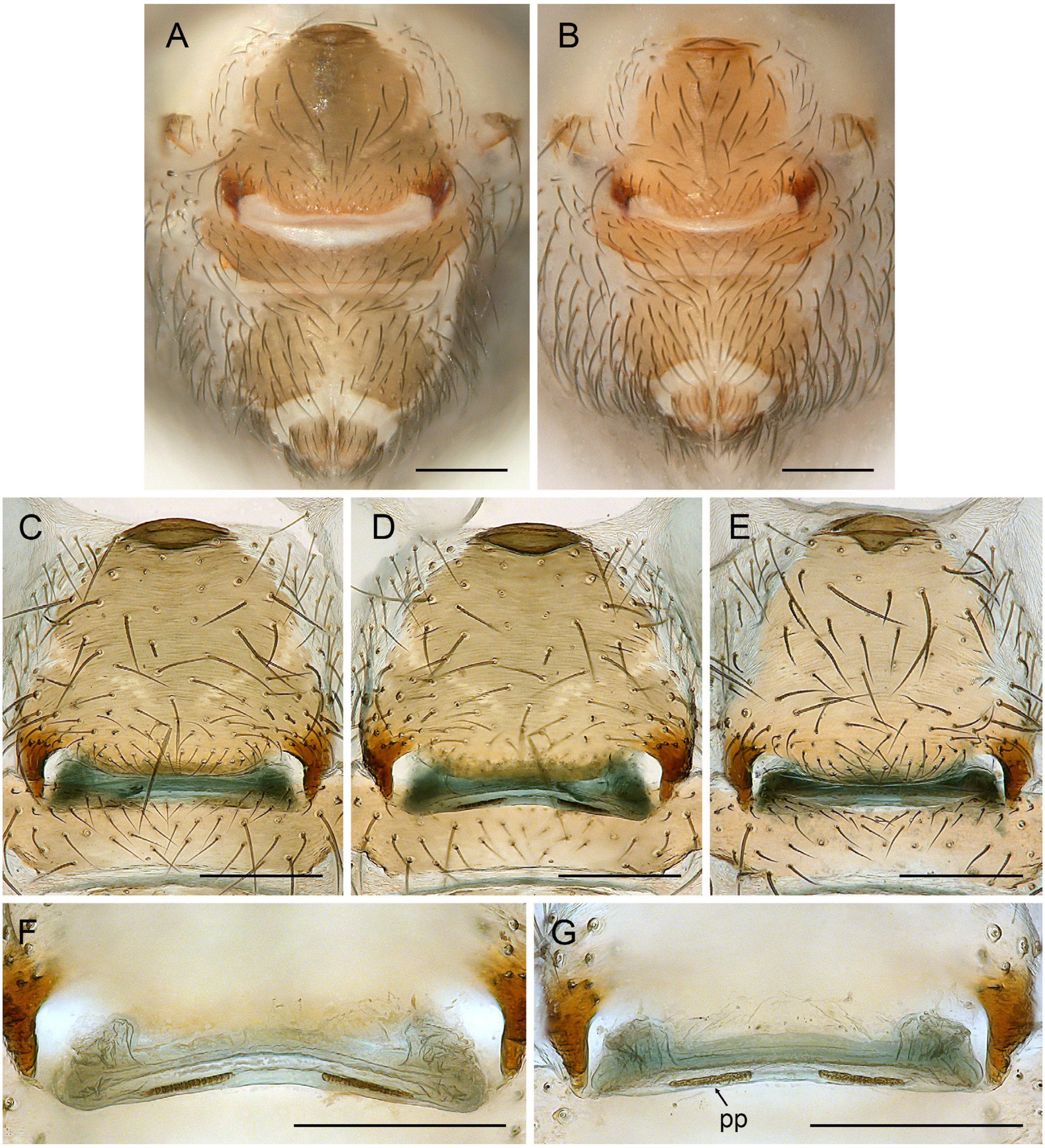

Fig. 54. *Ibotyporanga xique* Huber sp. nov., females from Brazil, Bahia, S of Xique-Xique, 'loc. 3', ZFMK Ar 24355. **A–B**. Abdomens, ventral views. **C–D**. Cleared genitalia of female shown in A, ventral and dorsal views. **E**. Cleared genitalia of female shown in B, ventral view. **F–G**. Detail of cleared female genitalia. Abbreviation: pp = pore plate. Scale lines: 0.2 mm.

Ibotyporanga camarai Huber sp. nov.

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Figs 42, 55A–B, 56–59

Diagnosis

Males are easily distinguished from all known congeners by shape of procursus (Fig. 57A–C; short, proximally strongly curved, distally with slender semitransparent tip curved towards dorsal); also by distinctive prolateral apophysis on embolus (arrows in Fig. 57D–E). Females differ from known congeners by internal genitalia with distinctive transversal membranous structure and large, apparently non-expandable membranous sac (Figs 58C, 59B–C).

Etymology

The species name honors Hélder Câmara (1909–1999), informally called the "bishop of the slums", who served as a Brazilian archbishop from 1964 to 1985, opposing the military dictatorship.

Type material

Holotype

BRAZIL – **Pernambuco** • ♂; NE of Petrolina; 9.1957° S, 40.3832° W; 440 m a.s.l.; 30 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5891.

Paratype

BRAZIL – **Pernambuco** • 1 ♂; same collection data as for holotype; CHNUFPI 5892 [deposited in ZFMK Ar 24356].

Other material examined

BRAZIL – **Pernambuco** • 1 ♂, 1♀, in pure ethanol; same collection data as for holotype; CHNUFPI 5893 [deposited in ZFMK Br22-243; female abdomen cleared and transferred to ZFMK Ar 24256].

Description

Male (holotype)

Measurements. Total body length 2.0, carapace width 0.80. Distance PME–PME 70 µm; diameter PME 85 µm; distance PME–ALE 25 µm; distance AME–AME 15 µm; diameter AME 65 µm. Leg 1: 4.60 (1.27 + 0.30 + 1.13 + 1.43 + 0.47), tibia 2: 0.92, tibia 3: 0.83, tibia 4: 1.20; tibia 1 L/d: 10; diameters of leg femora 0.17–0.18, of leg tibiae 0.11.

Colour (in ethanol). Prosoma and legs mostly ochre-yellow, carapace medially with brown mark including ocular area, legs with indistinct dark rings on femora (subdistally) and tibiae (proximally and subdistally); abdomen pale gray with dark internal marks dorsally and laterally; ventrally with light ochre plates in front of gonopore and in front of spinnerets.

Body. Habitus as in Fig. 55A. Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum wider than long (0.54/0.44), with pair of very low and indistinct anterior processes near coxae 1. Abdomen globular.

Chelicerae. As in Fig. 58A–B; width 0.31; with strong median frontal apophysis; stridulatory files fine but clearly visible in dissecting microscope.

Palps. As in Fig. 56; coxa unmodified; trochanter with rounded prolateral-ventral protrusion; femur proximally with prominent retrolateral process not directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints not shifted toward one side; patella dorsally

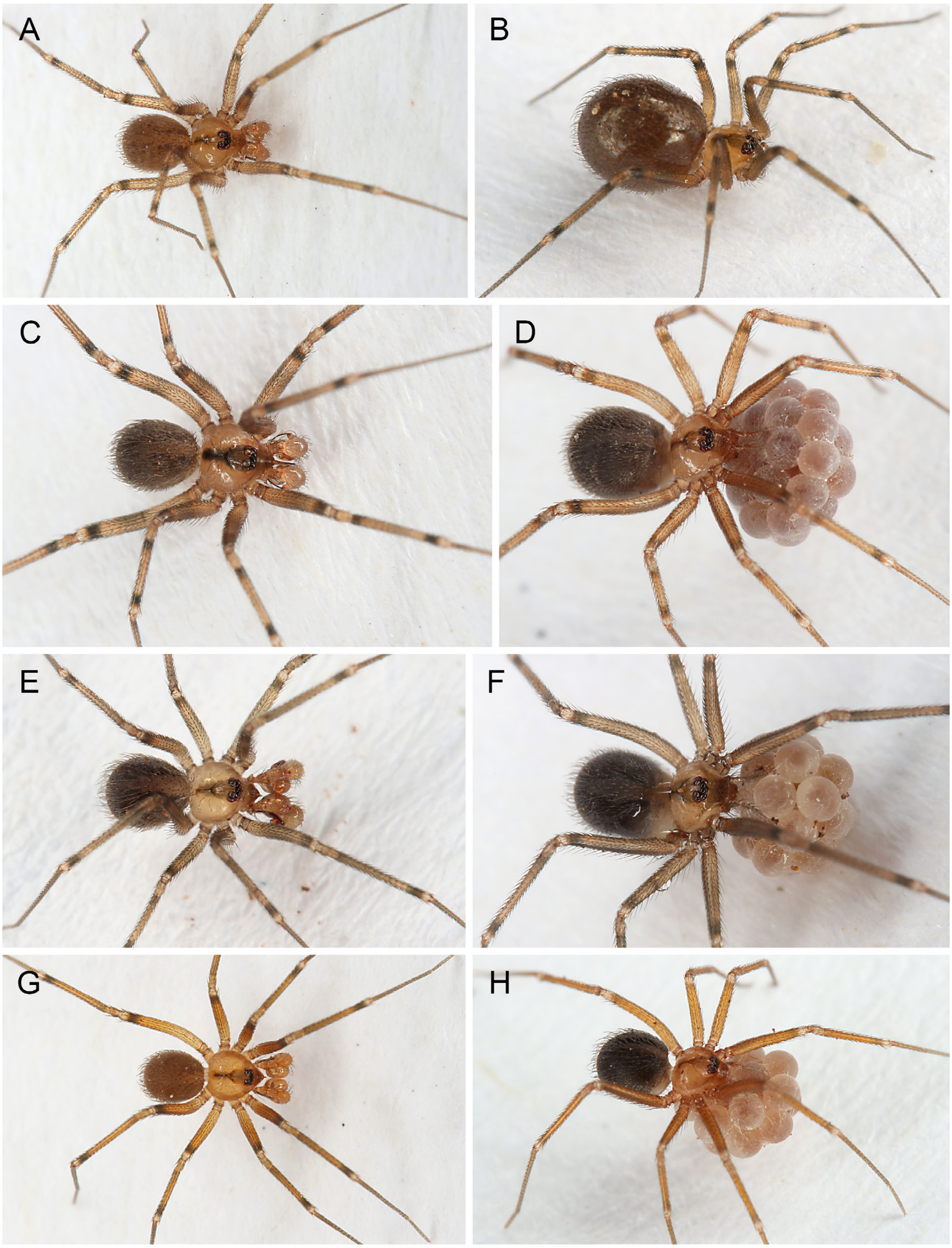

Fig. 55. *Ibotyporanga* spp., live specimens, part two (cf. Figs 25, 73), all from Brazil. **A–B**. *I. camarai* Huber sp. nov., male and female from Pernambuco, NE of Petrolina. **C–D**. *I. naideae* Mello-Leitão, 1944, male and female with egg sac from Bahia, SE of Jacobina. **E–F**. *I. diroa* Huber & Brescovit, 2003, male and female with egg sac from Bahia, near Queimada Nova. **G–H**. *I. imale* Huber sp. nov., male from Bahia, E of São Félix do Coribe, and female with egg sac from Minas Gerais, NW of Itacarambi.

slightly longer than medially wide; tibia-tarsus joints not shifted toward one side; tarsus with low and indistinct dorsal process; procursus (Fig. 57A–C) with light prolateral band, distally with membranous element curved towards dorsal and small subdistal process; genital bulb (Fig. 57D–F) with distinct prolateral sclerite on bulbous part, with distinctive apophysis and membranous structures on embolus.

Legs. Without spines but with longer and slightly stronger hairs ventrally on femora; without curved hairs; with several rows of short vertical hairs on tibia 1; retrolateral trichobothrium of tibia 1 at 58%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~3–4 pseudosegments, distally distinct.

Variation (male)
Dark rings on legs distinct in other males. Tibia 1 in two other males: 1.03, 1.13.

Female
In general, similar to male (Fig. 55B) but slightly darker; clypeus unmodified; tibia 1 with few vertical hairs; tibia 1 length: 1.15. Epigynum (Fig. 59A) anterior plate oval to trapezoidal, posterior margin almost straight, with weakly curved, shallow anterior pocket; posterior plate short and simple. Internal genitalia (Figs 58C, 59B–C) with pair of pore plates, with distinctive transversal membranous structure and large, apparently non-expandable membranous sac.

Distribution

Known from type locality only, in Brazil, Pernambuco (Fig. 42).

Natural history

The spiders were found on the border between a bare rock outcrop and the neighboring thorny woodland. The three males were found under dead bark on the ground; the female was found under a stone.

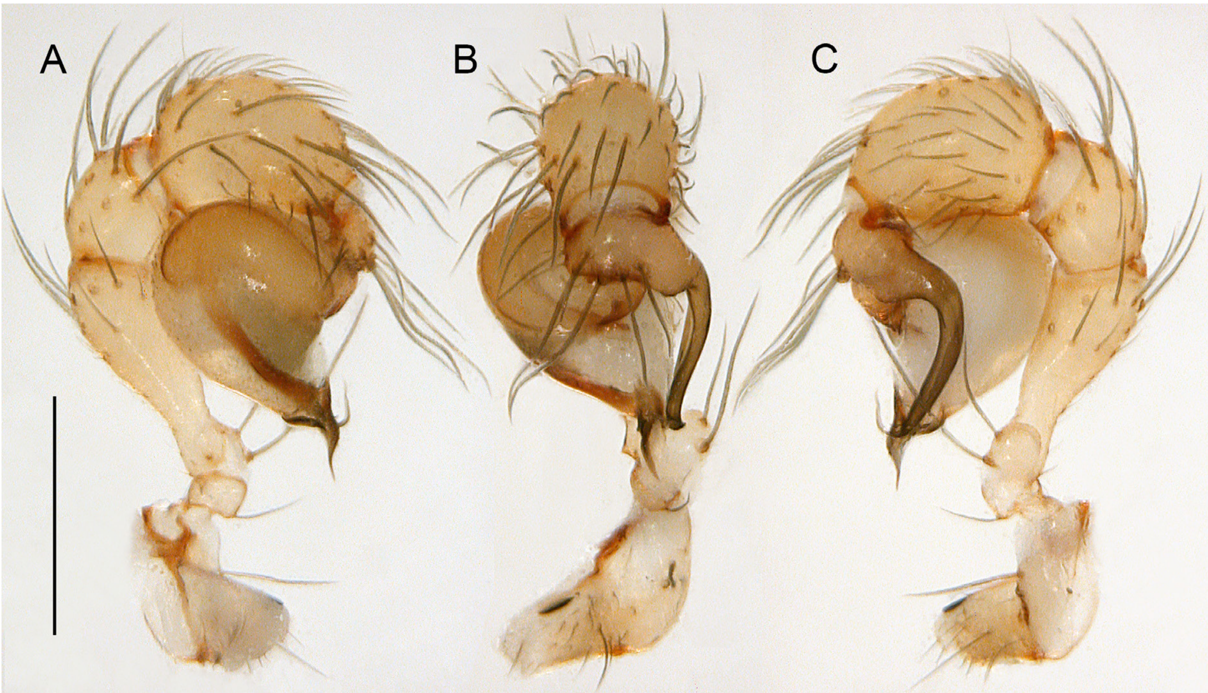

Fig. 56. *Ibotyporanga camarai* Huber sp. nov., male from Brazil, Pernambuco, NE of Petrolina, ZFMK Ar 24356. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

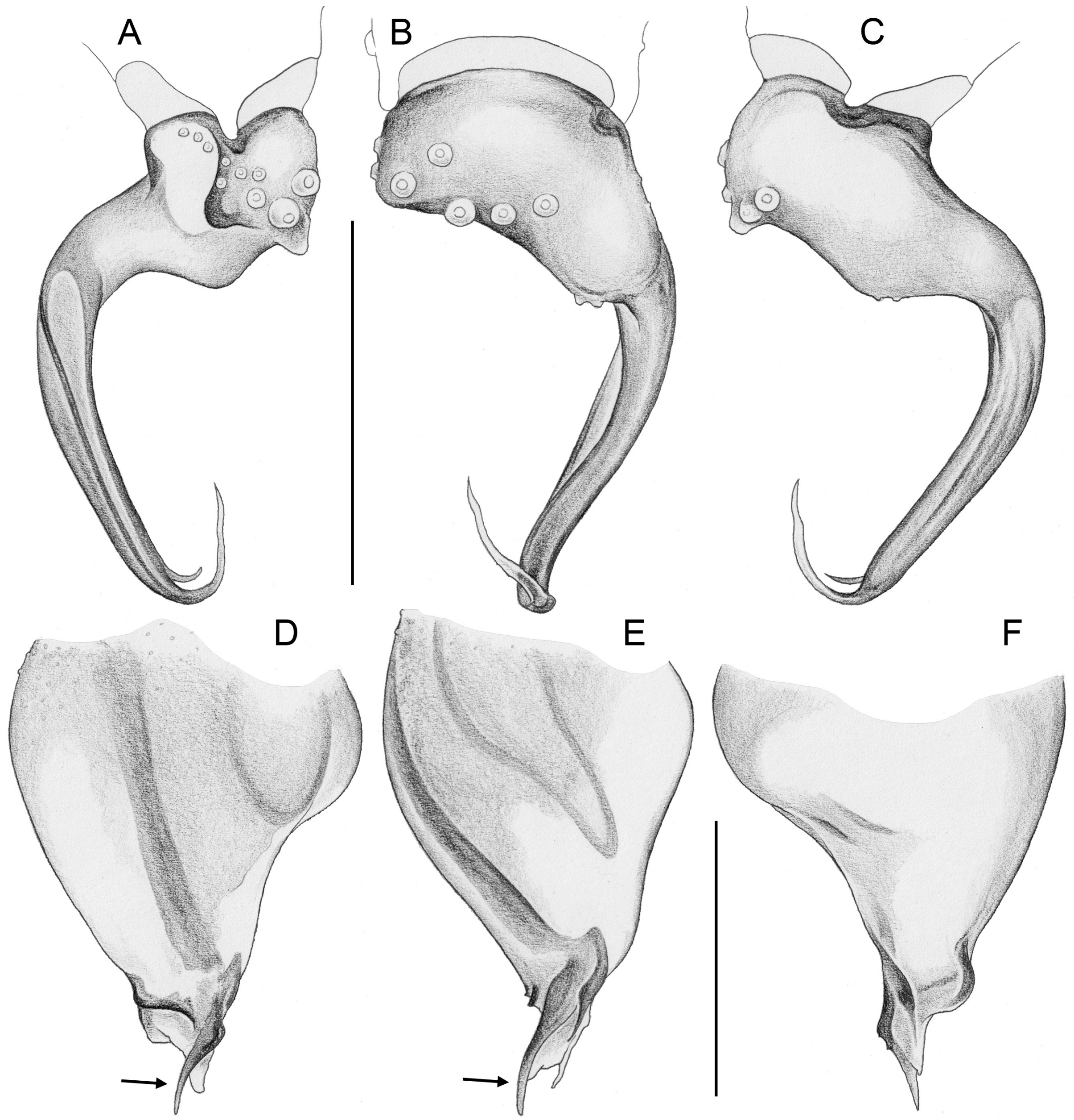

Fig. 57. *Ibotyporanga camarai* Huber sp. nov., male from Brazil, Pernambuco, NE of Petrolina, ZFMK Ar 24356. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views. **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views (arrows: distinctive apophysis on embolus). Scale lines: 0.2 mm.

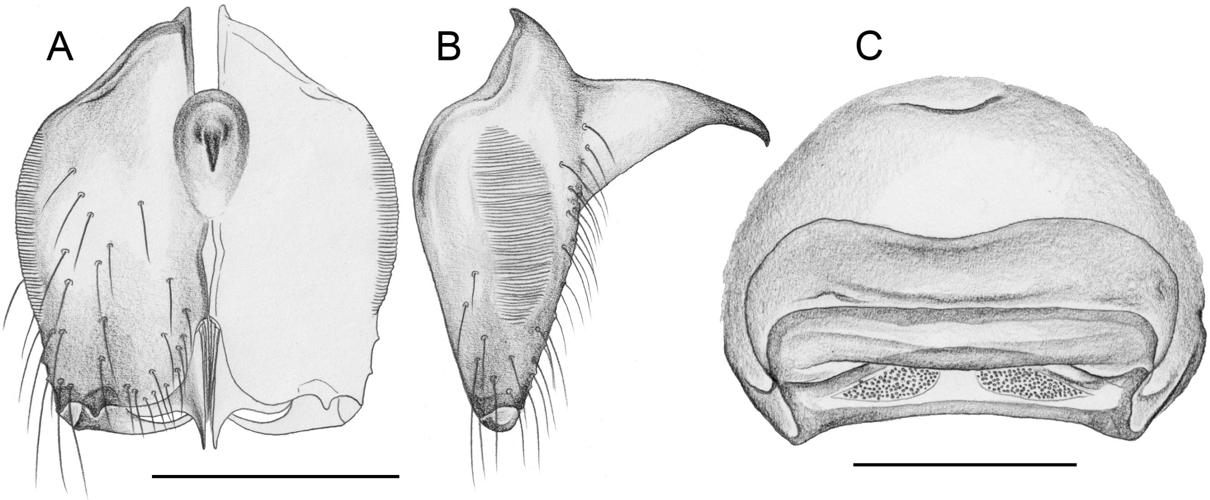

Fig. 58. *Ibotyporanga camarai* Huber sp. nov., male and female from Brazil, Pernambuco, NE of Petrolina, ZFMK Ar 24356. **A–B**. Male chelicerae, frontal and lateral views. **C**. Cleared female genitalia, dorsal view. Scale lines: 0.2 mm.

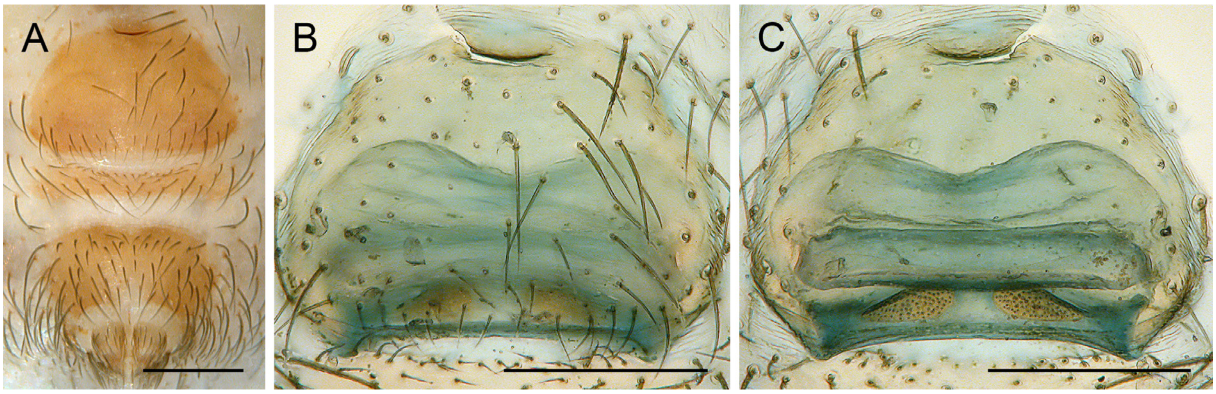

Fig. 59. *Ibotyporanga camarai* Huber sp. nov., female from Brazil, Pernambuco, NE of Petrolina, ZFMK Ar 24356. **A**. Abdomen, ventral view. **B–C**. Cleared female genitalia, ventral and dorsal views. Scale lines: 0.2 mm.

Ibotyporanga naideae Mello-Leitão, 1944
Figs 55C–D, 60–64, 132; SEM Figs 3E–F, 4D, 6C, 7B, 8A–B, 10D, 11E–F, 13C, 14C, 15F, 18F, 19D, H, 20C, F, 21C, F

Ibotyporanga naideae Mello-Leitão 1944: 6 (♀).

Ibotyporanga naideae – Huber 2000: 94, figs 38–39, 60, 78, 104, 109, 128, 174, 357–366 (♂♀). — Carvalho & Avelino 2010: 6. — Astrin *et al.* 2007: table 1 (molecular data).

Diagnosis

Males are easily distinguished from most known congeners (except *I. kanoe* sp. nov. and *I. diroa*) by long and slender procursus without dorsal branch (Fig. 62A–C); from *I. kanoe* and *I. diroa* by long cheliceral apophysis directed upwards (Fig. 63A–D) and by details of genital bulb: strongly developed retrolateral tubercles (Fig. 11E–F) and tip of embolus with small pointed dorsal process (arrow in Fig. 62F); from *I. diroa* also distinguished by presence of prolateral process proximally on procursus (arrow in Fig. 62B) and by very short and indistinct prolateral sclerite on bulbous part of genital bulb (Fig. 62D). Females differ from known congeners by relatively long and narrow epigynum with very indistinct, weakly

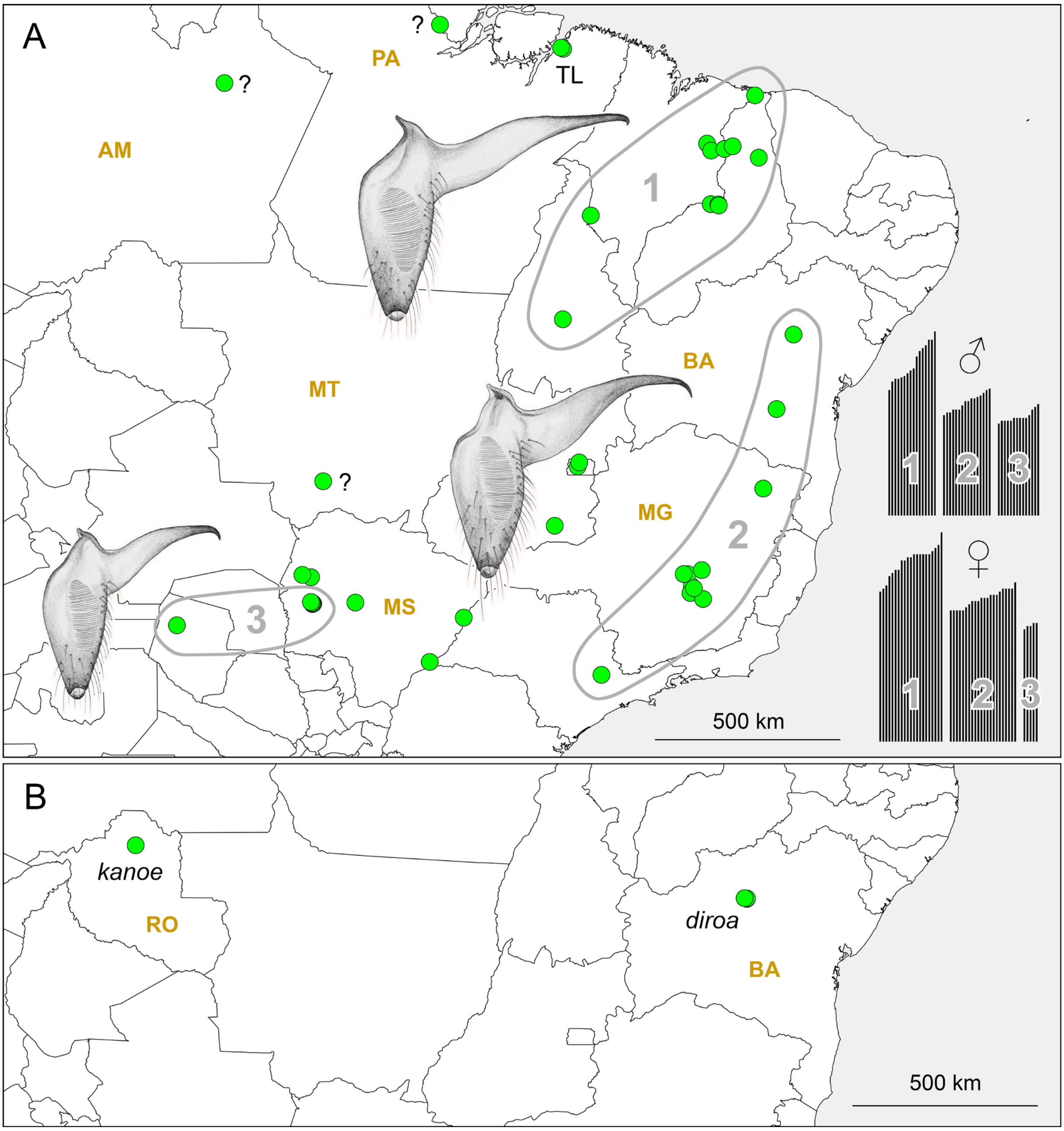

Fig. 60. Known geographic distributions of Brazilian species of *Ibotyporanga* Mello-Leitão, 1944 with a long procursus without a dorsal branch. **A**. *I. naideae* Mello-Leitão, 1944; TL=type locality; "?"=assignment uncertain (see text). The three operational groups of *I. naideae* mentioned in the text are circled and numbered, and representative male chelicerae are shown for each group (all at same scale, cf. Fig. 63). Lower right: tibia 1 lengths in all measured males and females of the three operational species groups (for details see text). **B**. *I. kanoe* and *I. diroa*. Abbreviations: AM=Amazonas; BA=Bahia; MG=Minas Gerais; MS=Mato Grosso do Sul; MT=Mato Grosso; PA=Pará; RO=Rondônia.

curved anterior pocket (Fig. 64A–C); from most congeners (except *I. sertao* sp. nov.) also by pair of long tubes in internal genitalia (Figs 63F–H, 64G–H) (present but much shorter in the similar *I. kanoe*).

Remark

We found considerable variation among specimens from different localities, concerning mainly size (body size, leg length, male palp and female epigynum size) and the length of the male cheliceral apophysis (see Variation below). Some of this variation may indicate species limits. We do not split this species for several reasons. First, in its current circumscription, the species is easily diagnosable by numerous morphological details, especially when males are available. A split into two or more species would currently result in poorly diagnosable species. Second, topotypical males are not available. The males from Maranhão listed below are from localities more than 600 km from the type locality in Pará. Third, while there are quite substantial differences between the extremes, i.e., between the most northern (Maranhão) and most southern (Mato Grosso do Sul) specimens, our limited sample of intermediate localities suggests that this may be a clinal, continuous variation. We thus suggest that this species should not be split until more data become available, in particular: (1) topotypical males; (2) samples from further localities in poorly sampled regions like Mato Grosso and Goiás; (3) molecular sequence data from specimens across the entire geographic range.

Type material

BRAZIL – **Pará** • 4 ♀♀, syntypes; [Belém], Aurá; 1.41° S, 48.39° W; ~20 m a.s.l.; date unknown; Leitão Carvalho leg.; MNRJ 1532 (examined by BAH in 1999; probably lost – see section ‘On lost types’ above).

New material examined

BRAZIL – **Pará** • 1 ♀; Almeirim, Reserva Genética do Pacanari, Monte Dourado; 0.6359° S, 52.5672° W; 25 Oct. 2001; J.A.P. Barreiros leg.; MPEG 1634 • 1 ♀; Belém, Bosque Rodrigues Alves; 1.4303° S, 48.4562° W; 25 Oct. 2001; J.A.P. Barreiros leg.; MPEG 11208 • 1 ♀; same locality and collector as

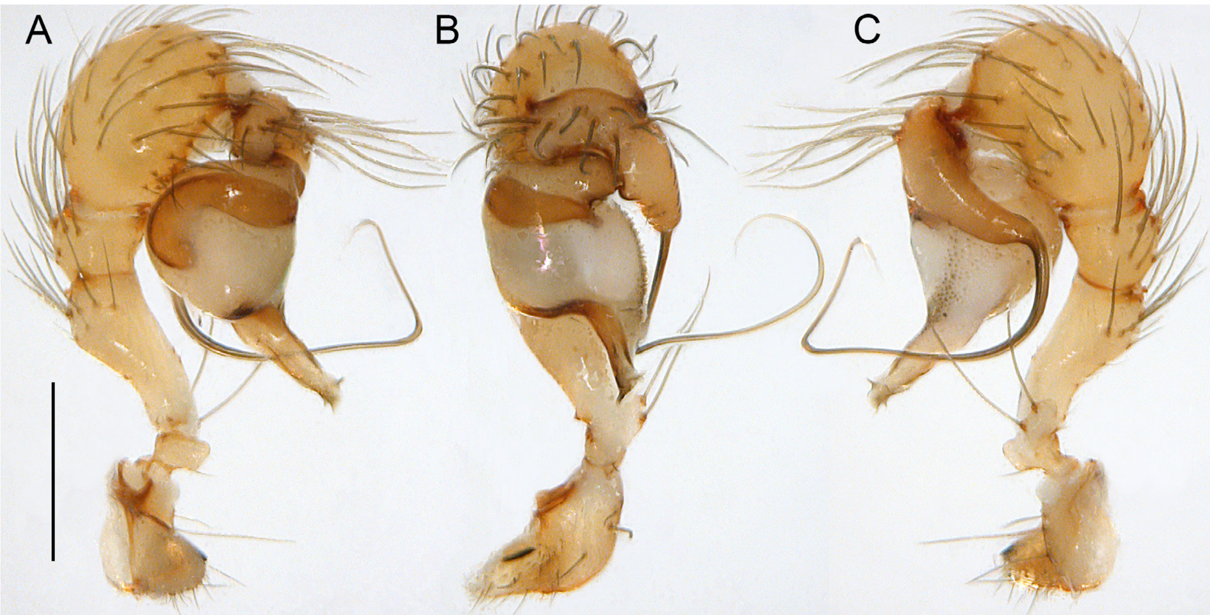

Fig. 61. *Ibotyporanga naideae* Mello-Leitão, 1944, male from Brazil, Bahia, SE of Jacobina, ZFMK Ar 24357. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

for preceding; 22 Feb. 2003; MPEG 11209. – **Maranhão** • 1 ♂, 1 ♀; Carolina, Reserva Particular do Patrimônio Natural Mansinha, near headquarters; 7.1357° S, 47.4351° W; 290 m a.s.l.; 23 Aug. 2022; L.S. Carvalho leg.; CHNUFPI 4205 • 2 ♀♀; same collection data as for preceding; CHNUFPI 4200, 4206 • 1 ♀, 7 juvs; same collection data as for preceding; CHNUFPI 4203 • 1 ♀; Reserva Particular do Patrimônio Natural Mansinha; 7.1262° S, 47.4440° W; 315 m a.s.l.; 22 Aug. 2022; L.S. Carvalho leg.; CHNUFPI 4194 • 1 ♂; Aldeias Altas, Riacho Curva, 2.5 km from bridge over Riacho Limpeza; 4.6618° S, 43.4411° W; 100 m a.s.l.; 11 Dec. 2021; G.S. Lustosa *et al.* leg.; CHNUFPI 4207 • 2 ♂♂, 1 ♀; Caxias, Campus da Universidade Estadual do Maranhão; 4.8658° S, 43.3550° W; ~100 m a.s.l.; 2007; F. Limeira leg.; IBSP 122457 • 2 ♂♂; Caxias, Reserva Ecológica Inhamum; 4.8917° S, 43.4147° W;

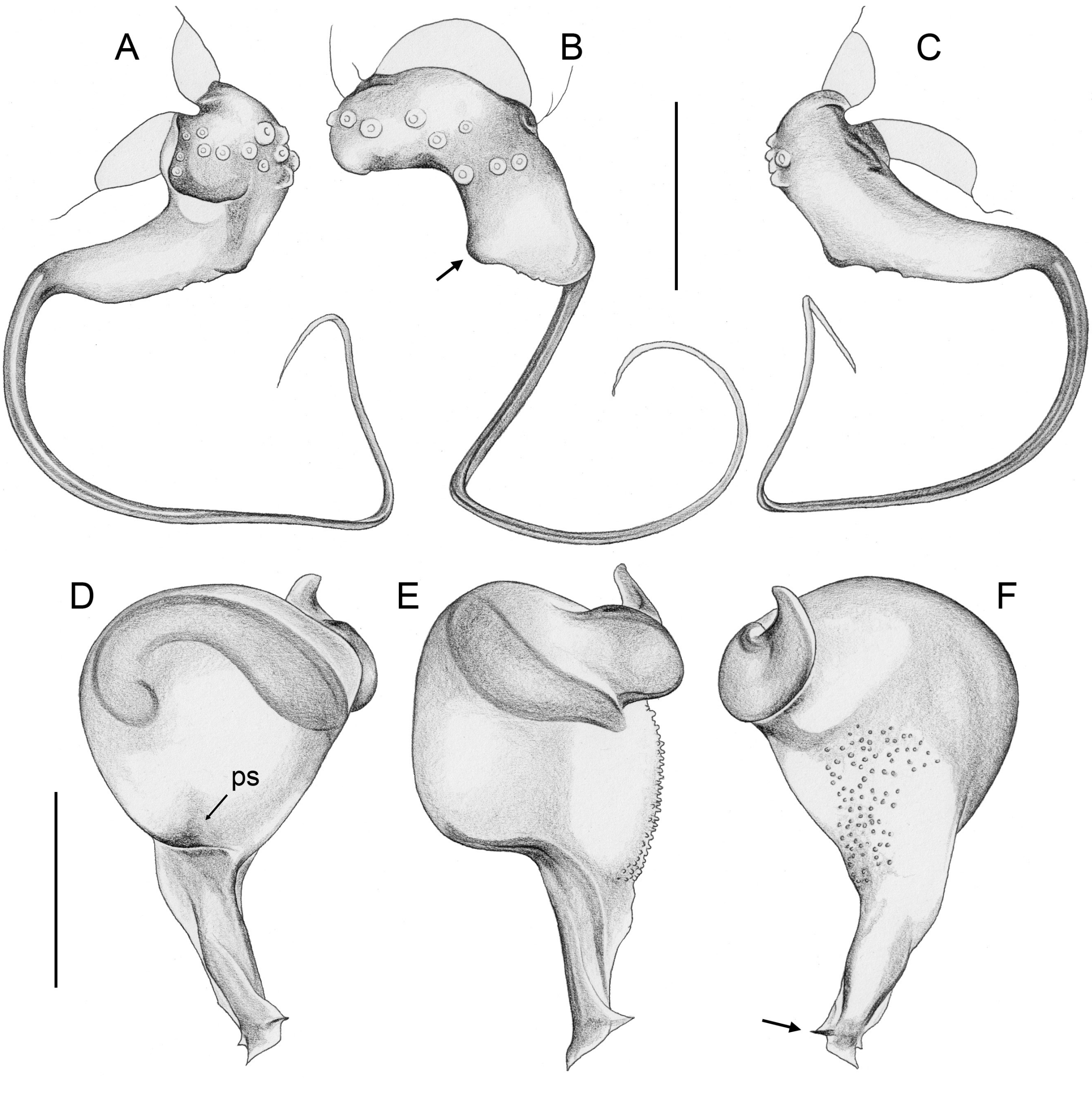

Fig. 62. *Ibotyporanga naideae* Mello-Leitão, 1944, male from Brazil, Bahia, SE of Jacobina, ZFMK Ar 24357. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views (arrow: distinctive prolateral process proximally on procursus). **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views (bold arrow: distinctive apophysis on embolus). Abbreviation: ps = prolateral sclerite. Scale lines: 0.2 mm.

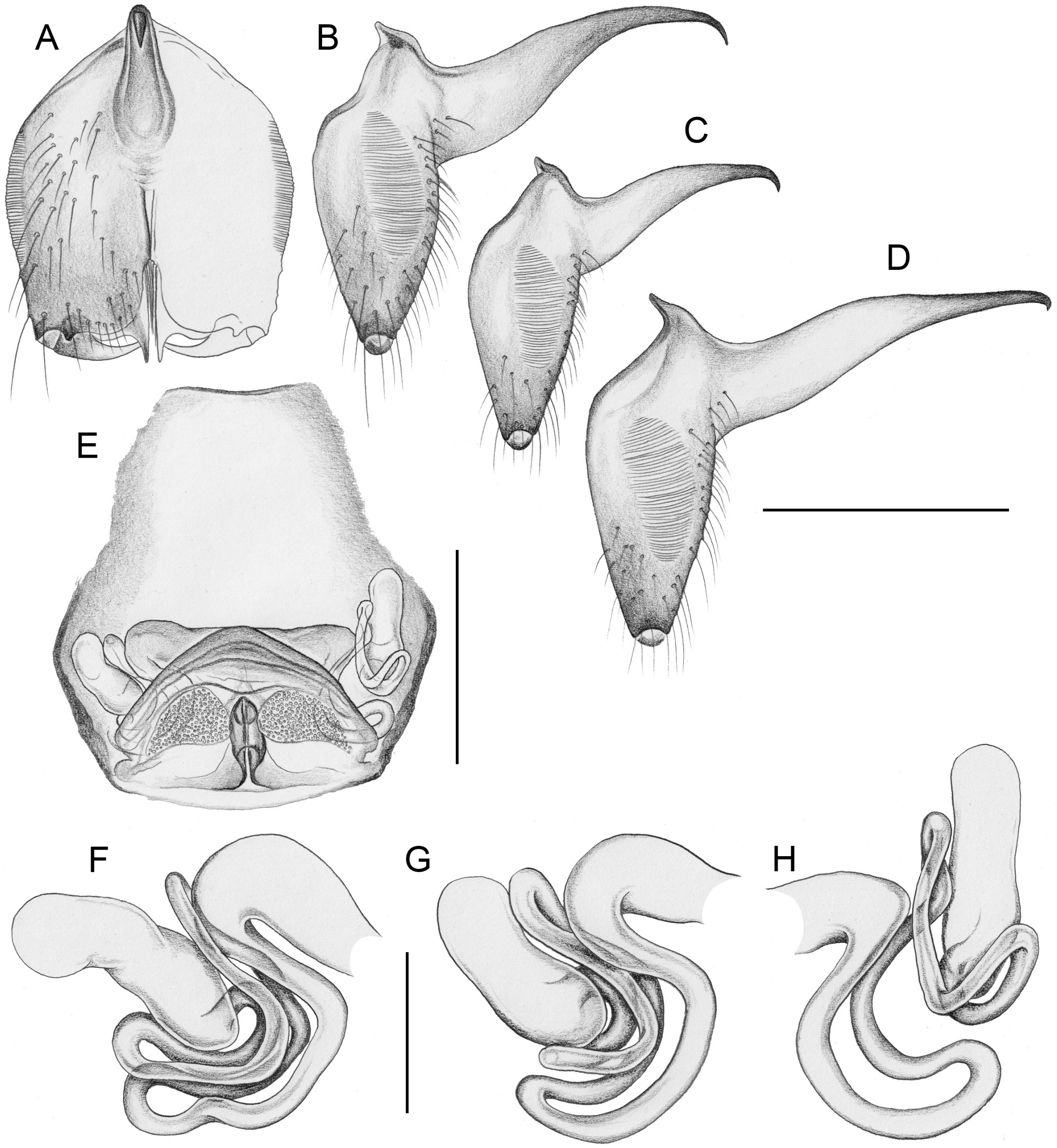

Fig. 63. *Ibotyporanga naideae* Mello-Leitão, 1944. **A–B**. Male chelicerae, frontal and lateral views, male from Brazil, Bahia, SE of Jacobina, ZFMK Ar 24357. **C–D**. Male chelicerae, lateral views, males from Mato Grosso do Sul, Terra Indígena Kadiwéu (C), CHNUFPI 5071, and from Maranhão, Reserva Mansinha (D), CHNUFPI 4205; all chelicerae at same scale. **E**. Cleared female genitalia, dorsal view, female from Maranhão, Reserva Mansinha, CHNUFPI 4206. **F**. Left tube in female internal genitalia, female from Maranhão, Reserva Mansinha, CHNUFPI 4205. **G–H**. Tubes in female internal genitalia, same specimen as in E. Scale lines: A–E = 0.3 mm; F–H = 0.1 mm.

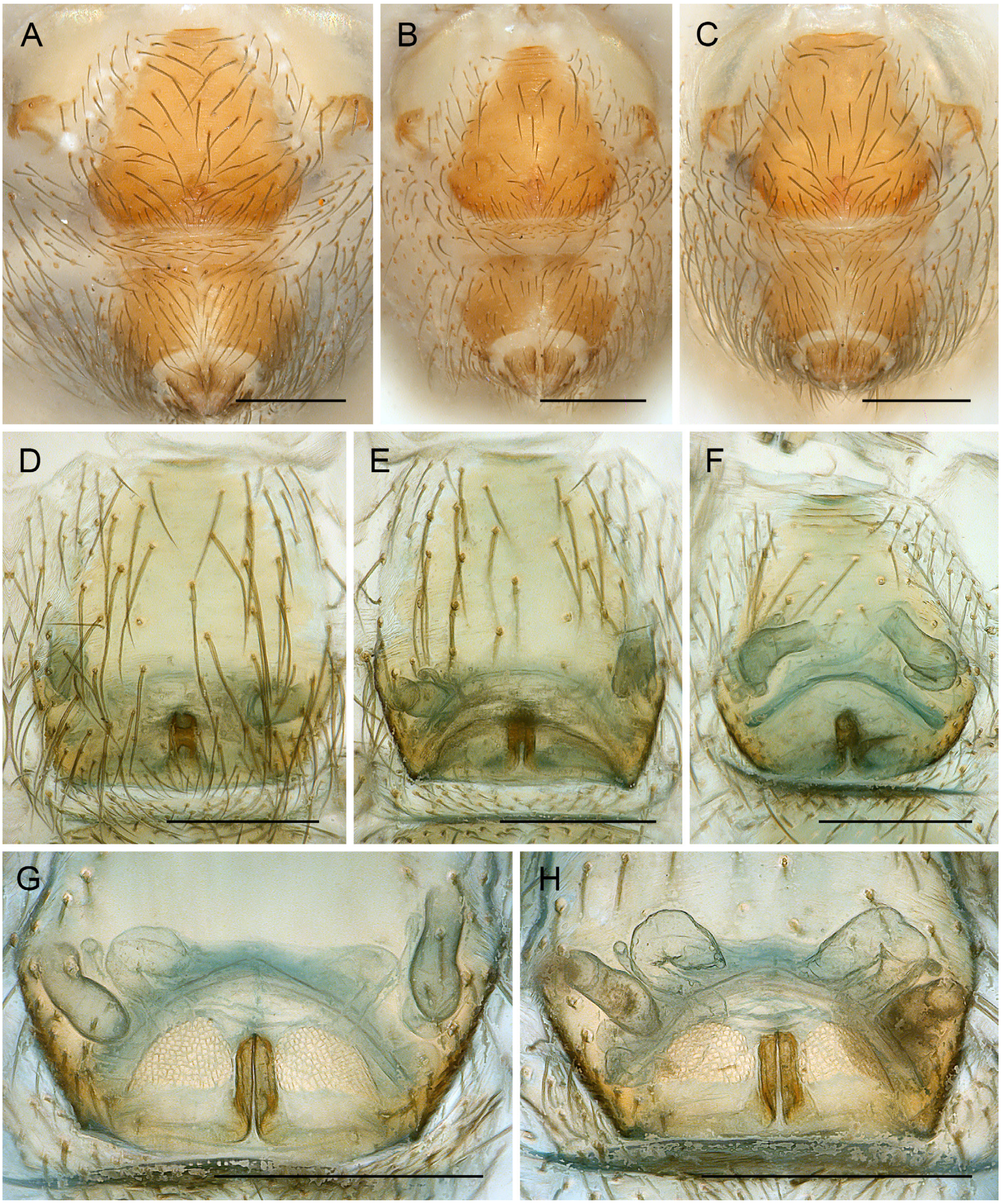

Fig. 64. *Ibotyporanga naideae* Mello-Leitão, 1944. **A–C**. Abdomens, ventral views, females from Brazil, Bahia, SE of Jacobina (A–B at same scale, ZFMK Ar 24357) and from Maranhão, Reserva Mansinha (C), CHNUFPI 4205. **D–E**. Cleared female genitalia, ventral and dorsal views, same specimen as in A. **F**. Cleared female genitalia, dorsal view, same specimen as in B. **G–H**. Posterior part of cleared female genitalia, dorsal views, females from Maranhão, Reserva Mansinha, CHNUFPI 4206 (G) and CHNUFPI 4205 (H). Scale lines: 0.3 mm.

16–20 Sep. 2007; J.F.B. Lima-Lobato *et al.* leg.; IBSP 122455 • 1 ♂; same locality and collector as for preceding; 20–23 Sep. 2007; IBSP 122456 • 2 ♂♂; same locality as for preceding; 2–5 Oct. 2007; J.F.B. Lima-Lobato & F. Limeira de Oliveira leg.; IBSP 129096 • 1 ♂; same locality as for preceding; 2 Oct. 2007; J.F.B. Lima-Lobato leg.; IBSP 130973 • 2 ♂♂; same locality and collector as for preceding; 23–26 Apr. 2007; IBSP 130975 • 1 ♂; same collection data as for preceding; IBSP 130977 • 1 ♂; same locality and collector as for preceding; 2 Oct. 2007; IBSP 131045 • 1 ♂; Caxias, Riacho Favaca, Garrafas village; 4.9044° S, 43.3009° W; 80 m a.s.l.; 27 Dec. 2021; G.S. Lustosa *et al.* leg.; CHNUFPI 4201 • 1 ♂; Barão de Grajaú, road to Povoado Manga, babaçu palm gallery forest; 6.7456° S, 43.3179° W; 160 m a.s.l.; 23 Jul. 2023; L.S. Carvalho *et al.* leg.; CHNUFPI 5062. – **Piauí** • 1 ♂, 1 ♀, 1 juv.; Floriano, Fazenda do Colégio Técnico de Floriano, at Rio Parnaíba; 6.7592° S, 43.0550° W; 110 m a.s.l.; 18 Dec. 2019; L.S. Carvalho *et al.* leg.; CHNUFPI 4042 • 1 ♀; same locality as for preceding; 6.7596° S, 43.0557° W; 105 m a.s.l.; 22 Jul. 2023; CHNUFPI 5048 • 1 ♂; same collection data as for preceding; CHNUFPI 5061 • 1 ♂; Floriano, Bairro Meladão, in house; 6.7831° S, 43.0367° W; 17 Nov. 2013; L.S. Carvalho leg.; CHNUFPI 1169 • 1 ♂; same locality and collector as for preceding; 1 Apr. 2013; CHNUFPI 4187 • 1 ♀; União, near Usina Comvap Ltda; 4.8477° S, 42.8486° W; 85 m a.s.l.; 2007; J. Queiroz *et al.* leg.; CHNUFPI 5055 • 1 ♂; Parnaiba, Distrito de Irrigação de Tabuleiros Litorâneos do Piauí – DITALPI; 3.0123° S, 41.7968° W; 30 m a.s.l.; 5 May 2012; M. Vaz leg.; CHNUFPI 1002. – **Bahia** • 7 ♂♂, 16 ♀♀; SE of Jacobina, 'site 1'; 11.2205° S, 40.4787° W; 520 m a.s.l.; 28 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5894–5895 • 2 ♂♂, 3 ♀♀; same collection data as for preceding; CHNUFPI 9030 [deposited in ZFMK Ar 24357] • 2 ♂♂, 5 ♀♀, in pure ethanol; same collection data as for preceding; CHNUFPI 5896 [deposited in ZFMK Br22-236; 1 ♂, 1 ♀ used for SEM] • 1 juv., in pure ethanol, identity confirmed by CO1 barcode; S of Contendas do Sincorá; 13.7826° S, 41.0507° W; 320 m a.s.l.; hillside with shrubby caatinga woodland on sandy soil; 11 Nov. 2022; B.A. Huber and L.S. Carvalho leg.; CHNUFPI 5897 [deposited in ZFMK Br22-153]. – **Distrito Federal** • 1 ♂; Brasília; 15.7975° S, 47.8919° W; 28 May 2011; P.C. Motta leg.; DZUNB 6652 • 1 ♂, 1 ♀; Sobradinho, near road DF 425, Condomínio Fraternidade; 15.6638° S, 47.8365° W; 18 Mar. 2013; P.C. Motta leg.; DZUNB 6966. – **Goiás** • 5 ♂♂, 9 ♀♀; Caldas Novas, Parque Estadual da Serra de Caldas Novas; 17.8083° S, 48.7000° W; 1 Nov. 2014; P.C. Motta leg.; DZUNB 7522 • 3 ♂♂, 1 ♀; same locality and collector as for preceding; 24 Apr. 2015; DZUNB 7788. – **Minas Gerais** • 2 ♀♀; Itaobim, roadside of BR 111; 16.5061° S, 41.5089° W; 270 m a.s.l.; 9 Apr. 2015; L.S. Carvalho leg.; CHNUFPI 3774, 4199 • 1 ♂; Prudente de Morais, Fazenda do Sapé, road MG-424; 19.500° S, 44.117° W; 850 m a.s.l.; 2 Jun 2001; E.S.S. Álvares leg.; UFMG 6068 • 2 ♂♂, 11 ♀♀; same locality and collector as for preceding; Nov. 2001; IBSP 56007 • 1 ♂, 1 ♀, 1 juv.; Santana do Riacho, Cardeal Mota, Serra do Cipó; 19.3377° S, 43.6385° W; 805 m a.s.l.; 17 Jul. 2012; P.H. Martins *et al.* leg.; UFMG 12586 • 1 ♂; Belo Horizonte, Universidade Federal de Minas Gerais, Laboratório de Aracnologia; 19.8683° S, 43.9658° W; 820 m a.s.l.; 1 Nov. 2015; L.S. Carvalho leg.; CHNUFPI 1679 • 1 ♂; same locality as for preceding; A.J. Santos leg.; UFMG 17235 • 1 ♂; Belo Horizonte, Parque Municipal das Mangabeiras; 19.9541° S, 43.9053° W; 5–12 Dec. 2008; H.H. Santos *et al.* leg.; UFMG 7958 • 1 ♂; Brumadinho, trail to Cachoeira das Ostras; 20.0947° S, 44.0154° W; 985 m a.s.l.; 5 Jul. 2015; P.H. Martins and L.S. Carvalho leg.; CHNUFPI 3971 • 1 ♂, 2 ♀♀; Brumadinho, Monumento Natural Serra da Calçada; 20.0971° S, 44.0279° W; 5 Jul. 2015; P.H. Martins *et. al.* leg.; UFMG 18323 • 1 ♂; Ouro Preto, Floresta Estadual Uaimii; 20.2966° S, 43.5747° W; 1010 m a.s.l.; 8 Jan. 2016; A. Anker and P.H. Martins leg.; CHNUFPI 3960. – **São Paulo** • 3 ♂♂, in pure ethanol; Campinas, in building; 22.9° S, 47.1° W; ~600–700 m a.s.l.; Mar. 2004; A. Santos; ZFMK G117. – **Mato Grosso do Sul** • 2 ♂♂; Corumbá, Morro do Azeite; 19.4833° S, 57.3167° W; Aug. 1998; J. Raizer *et al.* leg.; IBSP 38728 • 2 ♂♂, 7 ♀♀; Corumbá, Hotel Passo do Lontra; 19.5747° S, 57.0378° W; Apr. 1998; J. Razier *et al.* leg.; IBSP 21973 • 1 ♂; Três Lagoas, Horto Barra do Moeda; 20.950° S, 51.783° W; Jan. 2009; M. Uehara-Prado leg.; UFMG 5099 • 1 ♂; same locality and collector as for preceding; Nov. 2008; UFMG 5144 • 4 ♂♂; Porto Murtinho, Terra Indígena Kadiwéu, collecting point "8B"; 20.473° S, 56.998° W; 200 m a.s.l.; 21 Jun.–17 Dec. 2021; B.A. Arrua and V.A. Nacagava leg.; CHNUFPI 5075, 5076, 5077, 5082 • 1 ♀; same collection data as for preceding; CHNUFPI 5079 • 2 ♀♀; Terra Indígena Kadiwéu, collecting point “7B”; 20.465° S, 56.992° W; 175 m a.s.l.; 21 Jun. 2021–15 Feb. 2022; B.A. Arrua and V.A. Nacagava leg.; CHNUFPI 5070, 5078 • 1 ♂; Terra Indígena Kadiwéu, collecting point “6B”; 20.461° S, 56.990° W; 180 m a.s.l.; 21 Jun. 2021; B.A. Arrua and V.A. Nacagava leg.; CHNUFPI 5084 • 3 ♂♂; Terra Indígena Kadiwéu, collecting point “6A”; 20.459° S, 56.983° W; 200 m a.s.l.; 21 Jun. 2021–15 Feb. 2022; B.A. Arrua and V.A. Nacagava leg.; CHNUFPI 5085, 5086, 5087 • 2 ♂♂; Terra Indígena Kadiwéu, collecting point “2”; 20.441° S, 56.996° W; 180 m a.s.l.; 25 Oct. 2021; B.A. Arrua and V.A. Nacagava leg.; CHNUFPI 5069, 5071 • 2 ♂♂; Terra Indígena Kadiwéu, collecting point “3”; 20.438° S, 57.004° W; 170 m a.s.l.; 21 Jun. 2021; B.A. Arrua and V.A. Nacagava leg.; CHNUFPI 5072, 5074 • 2 ♀♀; same locality and collector as for preceding; 17 Dec. 2021–15 Feb. 2022; CHNUFPI 5073, 5080 • 1 ♂; Terra Indígena Kadiwéu, collecting point “4B”; 20.437° S, 57.028° W; 160 m a.s.l.; 17 Dec. 2021; B.A. Arrua and V.A. Nacagava leg.; CHNUFPI 5081 • 1 ♂; Terra Indígena Kadiwéu, collecting point “10”; 20.404° S, 57.060° W; 160 m a.s.l.; 21 Jun. 2021; B.A. Arrua and V.A. Nacagava leg.; CHNUFPI 5083 • 3 ♂♂, 1 ♀; Dois Irmãos do Buriti, Piraputanga, Fazenda Correntes II; 20.45° S, 55.50° W; 16–26 Feb. 2008; R. Bessi leg.; IBSP 128742 • 2 ♂♂, 8 ♀♀; Brasilândia, Usina Hidrelétrica Sérgio Motta; 22.4781° S, 52.9581° W; 11–21 Oct. 2001; IBSP team leg.; IBSP 31603.

PARAGUAY – **Boquerón** • 1 ♂; “Enciso” (Teniente Agripino Enciso National Park), “T89.15.0 r1”; 21.2030° S, 61.6591° W; 255 m a.s.l.; 4 Nov. 2001; M. Leponce leg.; IRSNB.

Redescription

Male (Bahia; ZFMK Ar 24357)

Measurements. Total body length 2.3, carapace width 0.90. Distance PME–PME 75 µm; diameter PME 75 µm; distance PME–ALE 30 µm; distance AME–AME 10 µm; diameter AME 60 µm. Leg 1: 4.99 (1.33 + 0.32 + 1.27 + 1.60 + 0.47), tibia 2: 1.05, tibia 3: 0.95, tibia 4: 1.37; tibia 1 L/d: 11; diameters of leg femora 0.21–0.22, of leg tibiae 0.10–0.11.

Colour (in ethanol). Prosoma and legs mostly ochre-yellow, carapace medially and ocular area slightly darker brown, legs with darker rings on femora (subdistally) and tibiae (proximally and subdistally); abdomen gray with many darker internal marks dorsally and laterally; ventrally with distinct light brown plates in front of gonopore and in front of spinnerets.

Body. Habitus as in Fig. 55C. Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum wider than long (0.62/0.50), with pair of low and indistinct anterior processes near coxae 1. Abdomen globular; gonopore with four epiandrous spigots in two groups (Fig. 4D); spinnerets as in congeners (Figs 6C, 8A).

Chelicerae. As in Fig. 63A–B; width 0.35; with very long median frontal apophysis directed upwards in proximal half; stridulatory files (Fig. 10D) fine but clearly visible in dissecting microscope.

Palps. As in Fig. 61; coxa unmodified; trochanter with distinct ventral protrusion; femur proximally with distinct retrolateral process slightly directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints and tibia-tarsus joints not shifted toward one side; patella dorsally approximately as long as medially wide; tarsus with small capsulate tarsal organ (Fig. 13C), without dorsal process; procursus (Fig. 62A–C) proximally wide and with prolateral process, distal part very long and slender, curved towards dorsal and lateral, with narrow but distinct light prolateral band; genital bulb (Fig. 62D–F) with very short and indistinct prolateral sclerite on bulbous part and strongly developed retrolateral tubercles on bulbous part (Fig. 11E–F); tip of embolus with small pointed dorsal apophysis.

Legs. Without spines but with longer hairs ventrally on femora; without curved hairs; with several rows of short vertical hairs on tibia 1; retrolateral trichobothrium of tibia 1 at 59%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~4–5 pseudosegments, distally fairly distinct.

Variation (male)

Here, we divide the available specimens into three operational groups (Fig. 60A), without implying that these groups are 'natural': a northern group (Maranhão, Piauí, Tocantins) with the largest specimens, an intermediate eastern group (Bahia, Minas Gerais, São Paulo), and a southern group (Mato Grosso do Sul, Paraguay) with the smallest specimens. Tibia 1 in 16 males of northern group: 1.50–2.20 (mean 1.82); in 16 males of eastern group: 1.20–1.52 (mean 1.35); in 13 males of southern group: 1.10–1.30 (mean 1.17). Cheliceral apophysis length in males of northern group: 0.41–0.44; eastern group: 0.32–0.38; southern group: 0.25–0.27. Genital bulb length in northern group: 0.55–0.60; eastern group: 0.46–0.57; southern group: 0.42–0.45. Palpal tibia diameter in northern group: 0.26–0.30; eastern group: 0.24–0.28; southern group: 0.21–0.23.

Apart from size variation, the course of the distal part of the procursus seems to be quite consistent within localities but variable among localities. However, this variation is difficult to assess, mainly because small differences in the angle of view result in very different images of the course. Also, the somewhat angular course in males from Bahia shown in Fig. 62A–C becomes more evenly rounded when the palp is slightly compressed by a cover slide (as was done for fig. 360 in Huber 2000). However, a more evenly curved procursus was also observed among the males newly examined herein (e.g., in males from Floriano, Piauí).

Female

In general, similar to male (Fig. 55D); clypeus unmodified; tibia 1 with few short vertical hairs. Epigynum (Fig. 64A–C) anterior plate trapezoidal, relatively long, posterior margin almost straight, anteriorly with weakly curved, shallow pocket. Internal genitalia (Figs 63E, 64D–F) with heavily sclerotized median structure, with pair of relatively large, weakly sclerotized pore plates, and pair of convoluted ducts (Figs 63F–H, 64G–H) originating laterally from membranous transversal structure and leading into widened terminal sacs. Course of convoluted ducts apparently consistent across localities, but the original course is easily affected by the process of preparation. Median sclerotized structure apparently variable among sites: newly cleared female from near type locality (MPEG 11208) resembles drawing of syntype in Huber (2000: fig. 364; anterior round element, posterior widening), while cleared specimens from Maranhão and Bahia appear slightly different (Fig. 64D–H; anterior round element indistinct or absent; not or barely widening posteriorly).

Size variation similar to that in males: tibia 1 in 18 females of northern group: 1.67–2.23 (mean 1.96); in 22 females of eastern group: 1.40–1.70 (mean 1.52); in five females of southern group: 1.20–1.27 (mean 1.24); in three syntypes from Pará (Huber 2000): 1.61–1.77. Epigynum proportions (length/width) fairly consistent across groups, but narrower anteriorly in eastern group than in other groups. Epigynum width in northern group: 0.52–0.64; eastern group: 0.48–0.60; southern group: 0.40–0.44. Epigynum length in northern group: 0.52–0.62; eastern group: 0.48–0.54; southern group: 0.40–0.48.

Distribution

This species has a wide distribution in the Cerrado and Caatinga biomes of Brazil (Fig. 60A). The records from Amazonas and Mato Grosso in Huber (2000) are based on females only, i.e., on possibly misidentified specimens. This is also true for the single female specimen from Almeirim (Pará) listed above.

Natural history

This species has been collected repeatedly in artificial habitats, suggesting that it has been spreading with humans. In Floriano (Piauí), Belo Horizonte (Minas Gerais), and Campinas (São Paulo), specimens were collected inside buildings. Near Jacobina (Bahia), the species was extremely abundant in a pile of rocks for construction dumped at the roadside; the microhabitat was shared with *Mesabolivar spinulosus* (Mello-Leitão, 1939) and the introduced *Physocyclus globosus*. At Reserva Mansinha (Maranhão), the spiders were collected among tiles and bricks in a Cerrado sensu stricto area, but no specimen was collected in natural environments. At other sites in Maranhão, specimens were collected with beating tray in the understory vegetation of riparian zones in the Cerrado biome, a microhabitat shared with several other Pholcidae species.

Ibotyporanga kanoe Huber sp. nov.

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Figs 22B, 60B, 65–68

Ibotyporanga Br16-149 – Eberle *et al.* 2018: suppl. file, p. 52 (molecular data). — Huber *et al.* 2018: 55.

Diagnosis

Males are easily distinguished from most known congeners (except *I. naideae* and *I. diroa*) by long and slender procursus without dorsal branch (Fig. 66A–C); from *I. naideae* by shorter cheliceral apophysis not directed upwards (Fig. 67A–B) and by details of genital bulb (without strongly developed retrolateral tubercles; tip of embolus without small pointed dorsal apophysis; Fig. 66F); from *I. diroa* also distinguished by presence of prolateral process proximally on procursus (arrow in Fig. 66B) and by very short and indistinct (basically absent) prolateral sclerite on bulbous part of genital bulb (Fig. 66D). Females are externally similar to several congeners with relatively long epigynum (similar to *I. naideae* but relatively shorter) and weakly curved anterior pocket (Fig. 68A–B), but differ by pair of short but distinct tubes in internal genitalia (Figs 67C, 68F–G) (much longer in *I. naideae*).

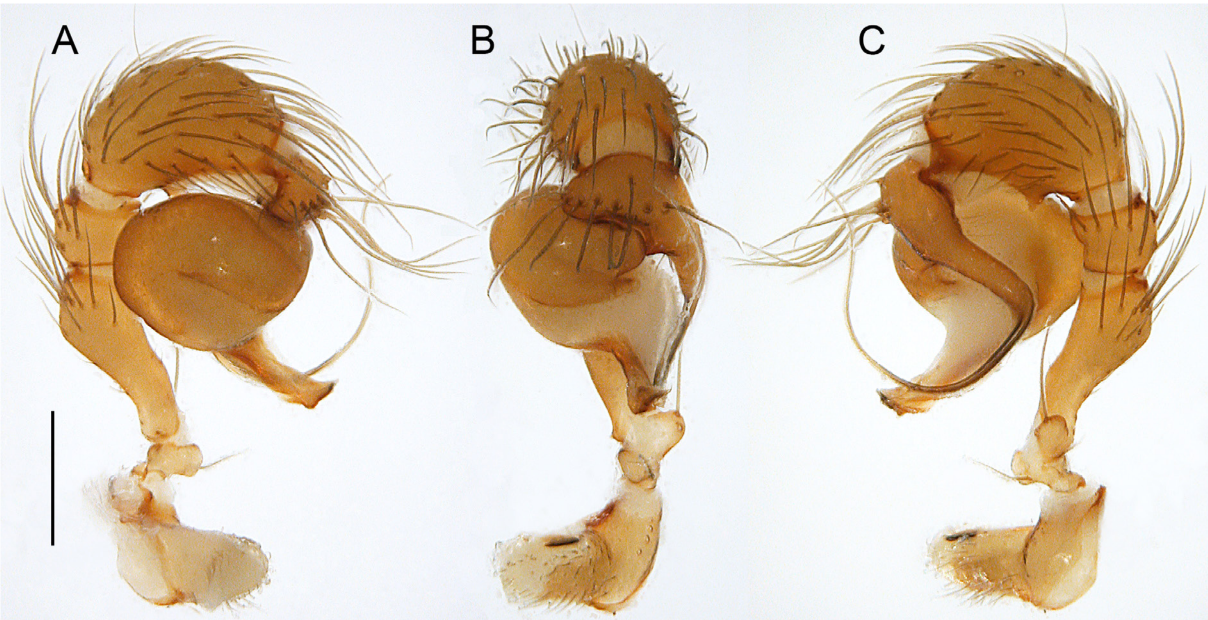

Fig. 65. *Ibotyporanga kanoe* Huber sp. nov., male from Brazil, Rondônia**,** Floresta Nacional do Jamari, ZFMK Ar 24358. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

Etymology

The species name honors the Kanoê, an indigenous people of Brazil that lives in the State of Rondônia; noun in apposition.

Type material

Holotype

BRAZIL – **Rondônia** • ♂; Floresta Nacional do Jamari, Pedra Grande; 9.198° S, 63.081° W; 160 m a.s.l.; 25 Oct. 2016; L.S. Carvalho and B.A. Huber leg.; CHNUFPI 3796.

Paratypes

BRAZIL – **Rondônia** • 1 ♂; same collection data as for holotype; CHNUFPI 3752 • 1 ♀, 4 juvs; same collection data as for holotype; CHNUFPI 3489 • 3 ♀♀; same collection data as for holotype; CHNUFPI 3702, 3731, 3792 • 2 ♂♂, 1 ♀; same collection data as for holotype; CHNUFPI 5898 [deposited in ZFMK Ar 24358].

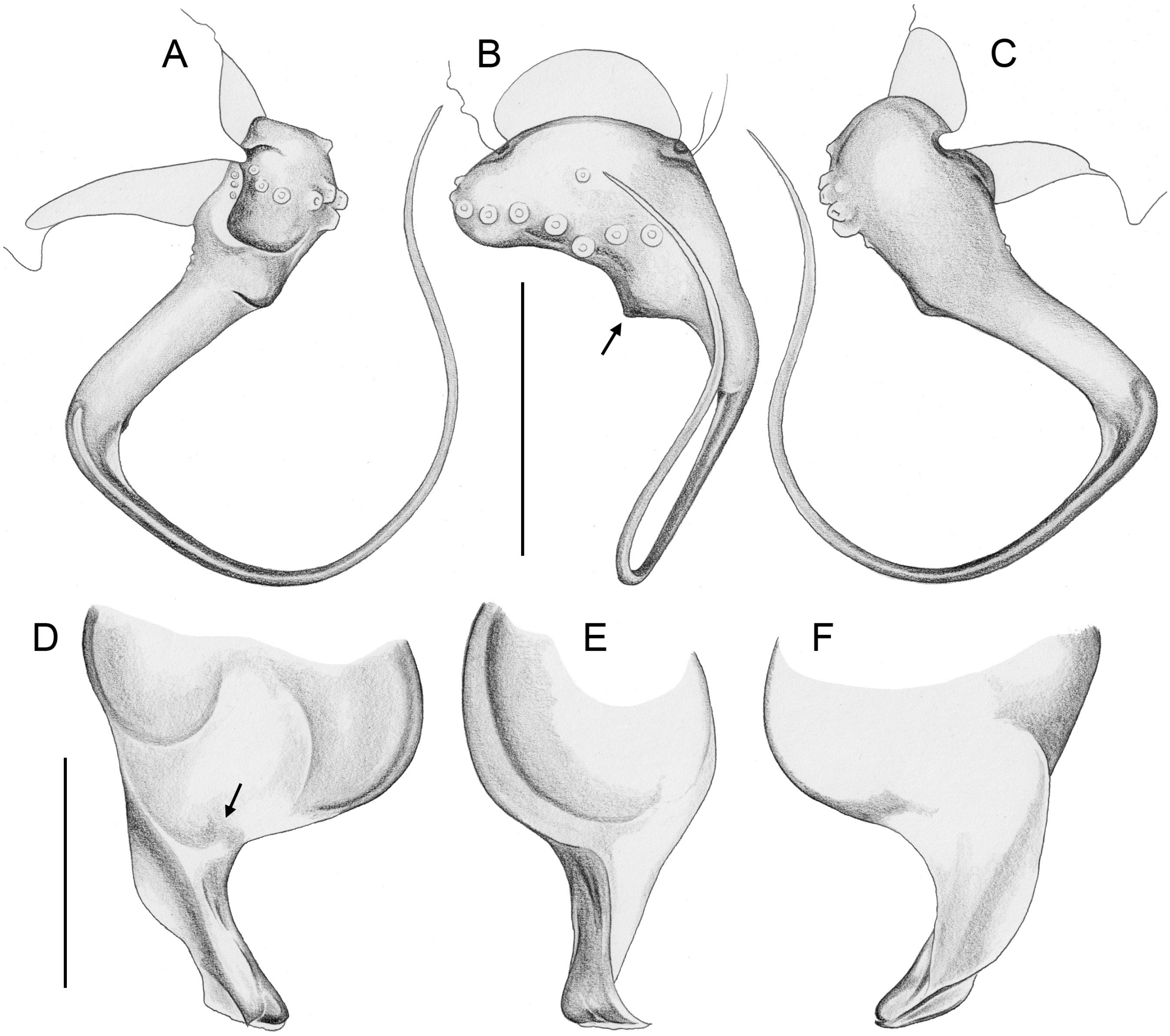

Fig. 66. *Ibotyporanga kanoe* Huber sp. nov., male from Brazil, Rondônia**,** Floresta Nacional do Jamari, ZFMK Ar 24358. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views (arrow: distinctive prolateral process proximally on procursus). **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views (arrow: strongly reduced - essentially absent - prolateral sclerite). Scale lines: 0.3 mm.

Other material examined

BRAZIL – **Rondônia** • 1 ♂, 1 ♀, in pure ethanol; same collection data as for holotype; CHNUFPI 5899 [deposited in ZFMK Br16-303; female prosoma and legs used for molecular work].

Description

Male (holotype)

Measurements. Total body length 2.3, carapace width 0.97. Distance PME–PME 75 µm; diameter PME 85 µm; distance PME–ALE 30 µm; distance AME–AME 20 µm; diameter AME 55 µm. Leg 1: 6.27 (1.67 + 0.35 + 1.62 + 2.03 + 0.60), tibia 2: 1.38, tibia 3: 1.23, tibia 4: 1.73; tibia 1 L/d: 14; diameters of leg femora 0.21–0.22, of leg tibiae 0.12.

Colour (in ethanol). Prosoma and legs mostly light ochre, carapace medially slightly darker brown, including ocular area and clypeus; legs with very indistinct darker rings on femora (subdistally) and tibiae (proximally and subdistally); abdomen gray with many darker internal marks dorsally and laterally; ventrally with distinct light brown plates in front of gonopore and in front of spinnerets.

Body. Habitus similar to *I. naideae* (cf. Fig. 55C). Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum wider than long (0.68/0.52), with pair of distinct anterior processes near coxae 1. Abdomen globular.

Chelicerae. As in Fig. 67A–B; width 0.39; with strong median frontal apophysis; stridulatory files fine but clearly visible in dissecting microscope.

Palps. As in Fig. 65; coxa unmodified; trochanter with distinct ventral protrusion; femur proximally with distinct retrolateral process not directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints and tibia-tarsus joints not shifted toward one side; tibia with distinct ventral process; tarsus without dorsal process; procursus (Fig. 66A–C) proximally wide and with prolateral process, curved towards ventral, distally very long and slender, curved towards dorsal, with narrow but distinct light prolateral band; genital bulb (Fig. 66D–F) with very short and

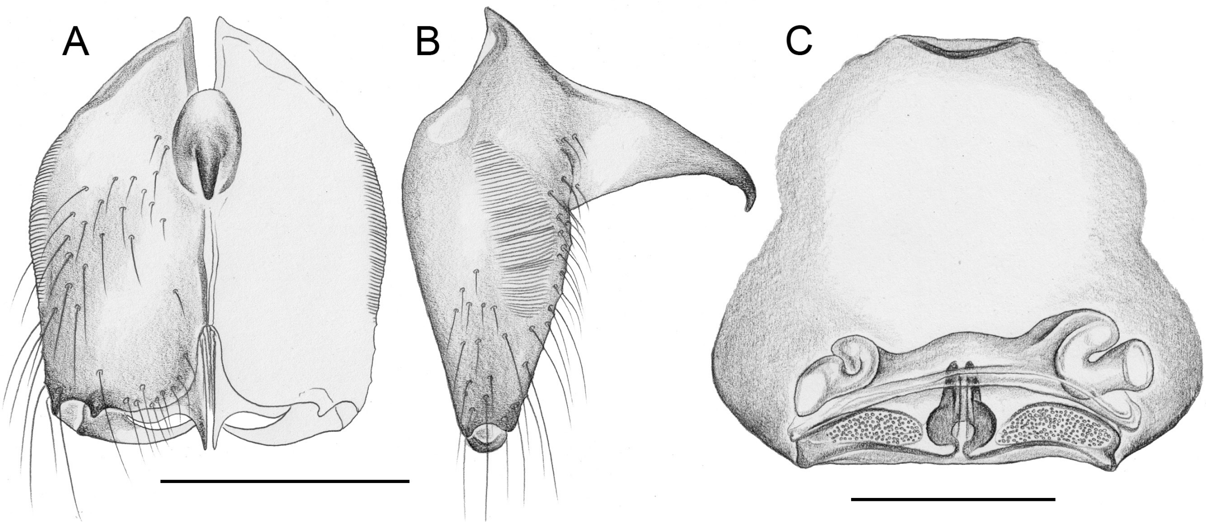

Fig. 67. *Ibotyporanga kanoe* Huber sp. nov., male and female from Brazil, Rondônia, Floresta Nacional do Jamari, ZFMK Ar 24358. **A–B**. Male chelicerae, frontal and lateral views. **C**. Cleared female genitalia, dorsal view. Scale lines: 0.3 mm.

indistinct (practically absent) prolateral sclerite on bulbous part, embolus with distal sclerite directed towards retrolateral.

Legs. Without spines but with longer hairs ventrally on femora; without curved hairs; with several rows of short vertical hairs on tibiae 1 and 2; retrolateral trichobothrium of tibia 1 at 59%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~5 pseudosegments, distally fairly distinct.

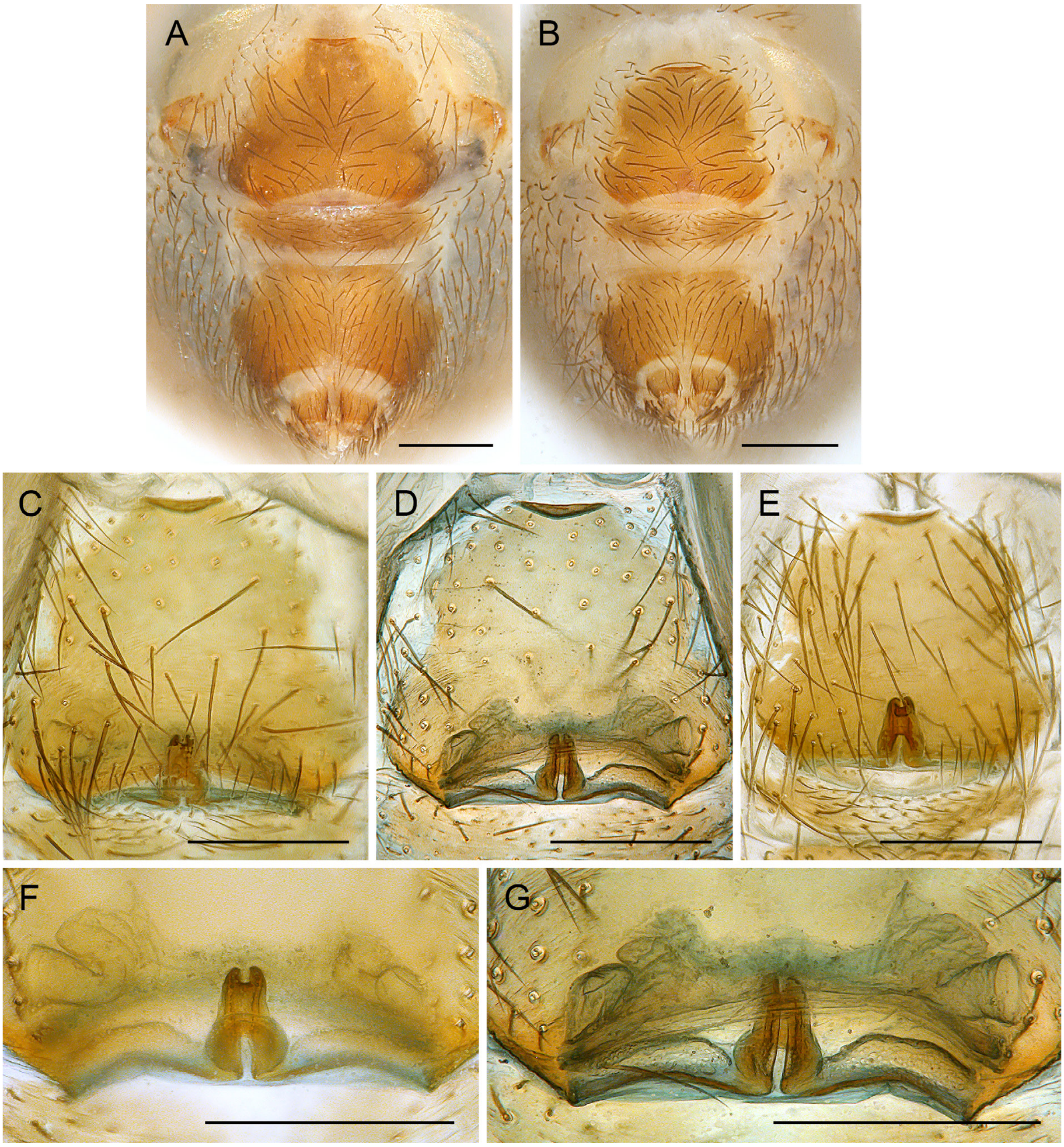

Fig. 68. *Ibotyporanga kanoe* Huber sp. nov., females from Brazil, Rondônia, Floresta Nacional do Jamari. **A–B**. Abdomens, ventral views, large and small females, ZFMK Ar 24358 (A), CHNUFPI 3792 (B). **C–D**. Cleared female genitalia, ventral and dorsal views; same specimen as in A. **E**. Cleared female genitalia, ventral view; same specimen as in B. **F–G**. Posterior part of cleared female genitalia, ventral and dorsal views; same specimen as in A. Scale lines: 0.3 mm.

Variation (male)

Tibia 1 in five males (incl. holotype): 1.60–1.90 (mean 1.76). Largest males also with larger chelicerae and palps, but shapes of genital structures apparently identical. Measurements of largest male: carapace width 1.23; tibia 1 length 1.90; palpal tibia length/diameter: 0.50/0.30 (versus 0.40/0.25 in holotype).

Female

In general, similar to male but clypeus unmodified, tibia 1 with few short vertical hairs. Tibia 1 length in five females: 1.83–2.17 (mean 2.02). Epigynum (Fig. 68A–B) anterior plate trapezoidal, posterior margin slightly and evenly indented, anteriorly with wide and shallow pocket; posterior plate large but simple, rectangular. Internal genitalia (Figs 67C, 68C–G) with heavily sclerotized median structure, with pair of relatively large, weakly sclerotized pore plates, and pair of short ducts originating laterally from membranous anterior structure and leading into widened terminal sacs.

Distribution

Known from type locality only, in Brazil, Rondônia (Fig. 60B).

Natural history

The type locality is located within the Floresta Nacional do Jamari, a sustainable use conservation unit, with about 223 000 hectares of dense Amazon rainforest. About 43% of its area is used for log extraction and cassiterite mining activities (https://www.gov.br/agricultura/pt-br/assuntos/servico-florestal-brasileiro/concessao-florestal/concessoes-florestais-em-andamento-1/floresta-nacional-do-jamari-ro). The sampling in this conservation unit was performed at six sites (Fig. S8A), but *Ibotyporanga* was only found on a granite rock outcrop, which is dominated by exposed rock and scattered low vegetation adapted to drier conditions (Figs 22B and S9A–B). In the surrounding forest, we found several genera of Pholcidae usually encountered in humid Brazilian forests (*Metagonia*, *Mesabolivar*, *Litoporus*), but no Ninetinae. On the outcrop, *Ibotyporanga* was found by turning rocks. Upon turning the rocks, the spiders ran rapidly, making them difficult to catch.

The conservation status of this species should be formally assessed. From satellite images (Fig. S8), we estimate its extent of occurrence (EOO) to be about 0.13 km², i.e., the rock outcrop area. The sampling site is less than 100 meters from a mining site (Taboquinha) inside the conservation unit (Fig. S9B). The mining activities are active and currently under expansion, getting closer to the rock outcrop (Fig. S9). This dynamic potentially decreases habitat quality, threatening *Ibotyporanga kanoe* sp. nov. to extinction.

Ibotyporanga diroa Huber & Brescovit, 2003
Figs 23G, 55E–F, 69–72

Ibotyporanga diroa Huber & Brescovit, 2003: 17, figs 8–9, 14–17 (♂).

Diagnosis

Males are easily distinguished from most known congeners (except *I. naideae* and *I. kanoe* sp. nov.) by long and slender procursus without dorsal branch (Fig. 70A–C); from *I. naideae* and *I. kanoe* by very short cheliceral apophysis (Fig. 71A–B), by absence of prolateral process proximally on procursus (cf. Figs 62B, 66B), by distinct prolateral sclerite on bulbous part of genital bulb (Fig. 70D), and by conical process ventrally on palpal tibia (arrow in Fig. 69C; present but more distal in *I. kanoe*). Females are distinguished from known congeners by medial position of epigynal pocket (Fig. 72A), by strong elements in internal genitalia diverging posteriorly (Fig. 72D), and by almost rectangular sclerotized pore plates (Fig. 72D); from syntopic *I. emekori* also by absence of median sclerite in internal genitalia.

Type material

Holotype

BRAZIL – **Bahia** • ♂; Jussara, Toca da Esperança; 11.033° S, 42.071° W (see Remark below); 23 July 2000; A.D. Brescovit leg.; IBSP 28759; presumably lost – see section 'On lost types' above.

New material examined

BRAZIL – **Bahia** • 2 ♀♀; W of Queimada Nova; 11.0343° S, 42.0682° W; 580 m a.s.l.; 25 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5900 • 1 ♂; same collection data as for preceding; CHNUFPI 9031 [deposited in ZFMK Ar 24359] • 1 ♂, 2 ♀♀, in pure ethanol; same collection data as for preceding; CHNUFPI 5901 [deposited in ZFMK Br22-227; one female abdomen transferred to ZFMK Ar 24359] • 1 ♂; near Toca da Esperança; 11.0314° S, 42.0672° W; 570 m a.s.l.; 26 Aug. 2016; L.S. Carvalho and B.T. Faleiro leg.; CHNUFPI 3784 • 4 ♀♀; same collection data as for preceding; CHNUFPI 3759, 3770, 3772, 3790 • 1 ♂, 1 ♀; near Mundinho, near Toca do Índio; 11.0195° S, 42.1564° W; 550 m a.s.l.; 24 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5902 [deposited in ZFMK Ar 24360] • 4 ♀♀, in pure ethanol; same collection data as for preceding; CHNUFPI 5903 [deposited in ZFMK Br22-225].

Remark

The coordinates of the type locality given in Huber & Brescovit (2003) are wrong. The exact coordinates of the type locality are not known to us, but the type locality is presumably within a few 100 meters from the localities listed above as "W of Queimada Nova" and "near Toca da Esperança".

Redescription of male

Measurements (ZFMK Ar 24360). Total body length 2.0, carapace width 0.90. Distance PME–PME 80 µm; diameter PME 80 µm; distance PME–ALE 30 µm; distance AME–AME 25 µm; diameter AME 60 µm. Leg 1: 5.37 (1.40 + 0.33 + 1.37 + 1.77 + 0.50), tibia 2: 1.07, tibia 3: 0.97, tibia 4: 1.38; tibia 1 L/d: 12; diameters of leg femora 0.19–0.20, of leg tibiae 0.11. Tibia 1 in two other newly examined males: 1.33, 1.40; in holotype: 1.44.

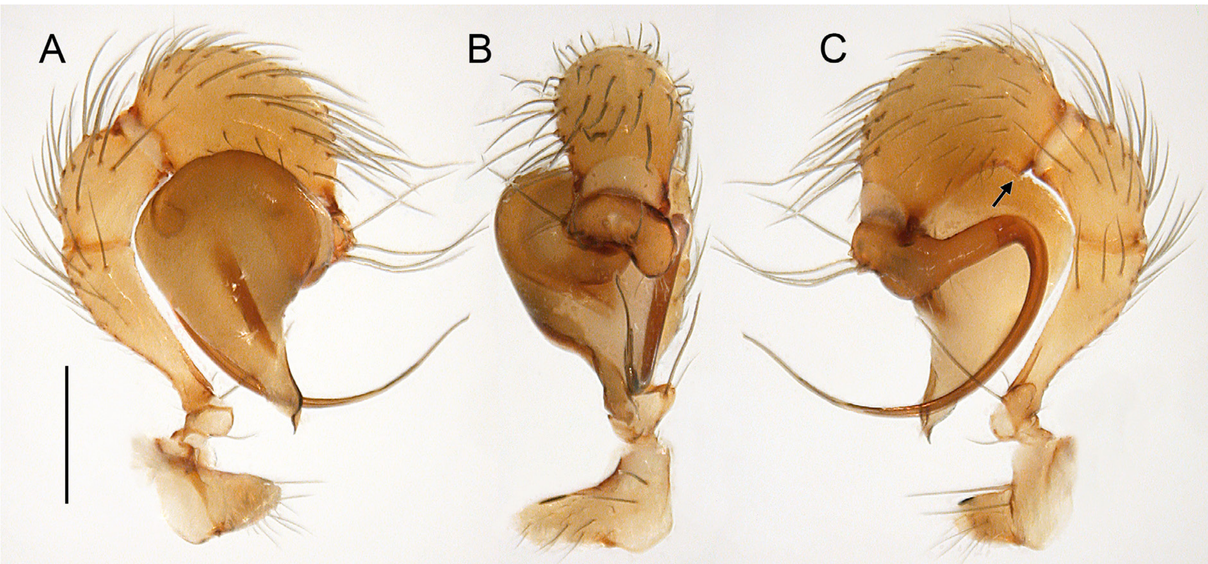

Fig. 69. *Ibotyporanga diroa* Huber & Brescovit, 2003, male from Brazil, Bahia, W of Queimada Nova, ZFMK Ar 24359. Left palp, prolateral, dorsal, and retrolateral views (arrow: conical process on tibia). Scale line: 0.3 mm.

Colour (in ethanol). Prosoma and legs mostly ochre-yellow, carapace medially and ocular area slightly darker, legs with darker rings on femora (subdistally) and tibiae (proximally and subdistally); abdomen pale gray with many darker internal marks dorsally and laterally; ventrally with indistinct light ochre plates in front of gonopore and in front of spinnerets.

Body. Habitus as in Fig. 55E. Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum wider than long (0.58/0.50), with pair of low and indistinct anterior processes near coxae 1. Abdomen globular.

Chelicerae. As in Fig. 71A–B; width 0.33; with short median frontal apophysis; stridulatory files very fine and poorly visible in dissecting microscope.

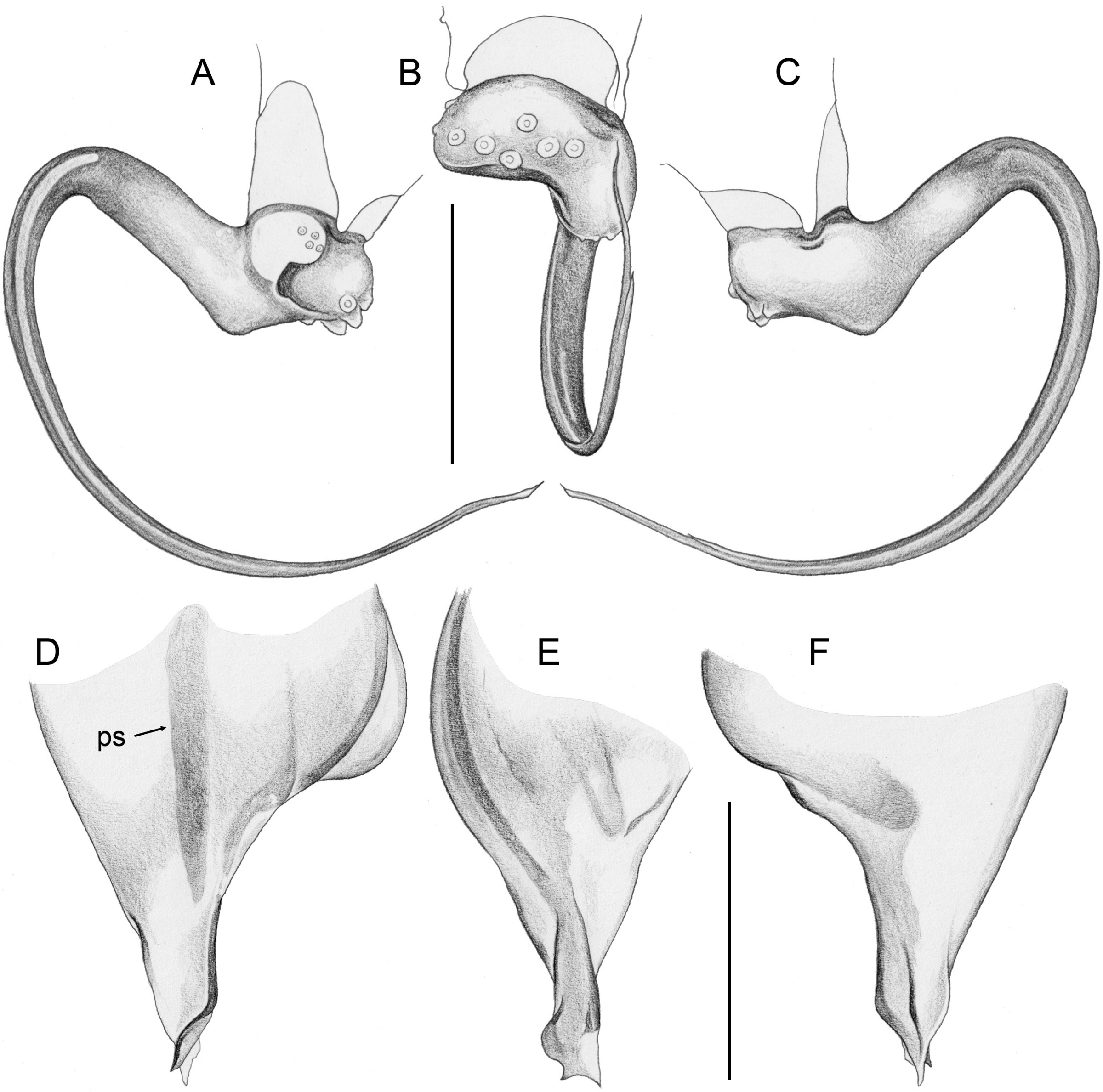

Fig. 70. *Ibotyporanga diroa* Huber & Brescovit, 2003, male from Brazil, Bahia, W of Queimada Nova, ZFMK Ar 24359. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views. **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views. Abbreviation: ps = prolateral sclerite. Scale lines: 0.3 mm.

Palps. As in Fig. 69; coxa unmodified; trochanter with short ventral protrusion; femur very slender, proximally with distinct retrolateral process directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints not shifted toward one side; patella dorsally ~1.7 × as long as medially wide; tibia with two trichobothria in relatively proximal position, with conical process ventrally; tibia-tarsus joints slightly shifted toward retrolateral side; tarsus with indistinct dorsal protrusion; procursus (Fig. 70A–C) very long and slender, with light prolateral band, with tiny subdistal side branch (160 µm from tip); genital bulb (Fig. 70D–F) with distinct prolateral sclerite on bulbous part, embolus with simple distal elements.

Legs. Without spines but with longer hairs ventrally on femora; without curved hairs; with several rows of short vertical hairs on tibia 1; retrolateral trichobothrium of tibia 1 at 58%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~3–4 pseudosegments, distally fairly distinct.

Description of female

In general, similar to male (Fig. 55F) but slightly darker; clypeus and sternum unmodified; tibia 1 with few short vertical hairs; tibia 1 length in ten females: 1.40–1.63 (mean 1.49). Epigynum (Fig. 72A–B) anterior plate trapezoidal to oval, posterior margin almost straight, anteriorly with whitish median area, with wide and shallow pocket medially on epigynal plate, at posterior end of whitish area; posterior plate relatively small. Internal genitalia (Figs 71C, 72C–D) with pair of roughly rectangular, sclerotized pore plates connected to large posterior membranous structures diverging posteriorly; large expandable anterior sac with pair of small lateral pockets (arrows in Fig. 72D).

Distribution

Known from several localities in the Serra do Calcário in Brazil, Bahia (Fig. 60B).

Natural history

The newly collected spiders from W of Queimada Nova and from near Toca do Índio were found under rocks in thorny woodland (Fig. 23G). At both localities, the microhabitat was shared with *Ibotyporanga emekori*. Three egg sacs were round but slightly flattened, had diameters of 1.8–2.1, and egg diameters of 0.60–0.62; the total number of eggs was estimated to be ~15–30.

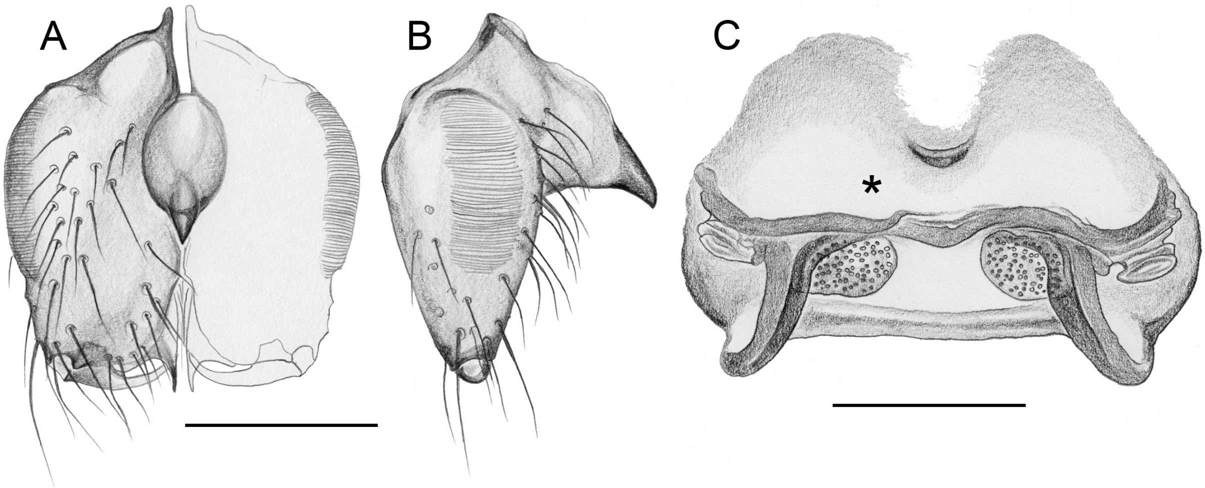

Fig. 71. *Ibotyporanga diroa* Huber & Brescovit, 2003. **A–B**. Male chelicerae, frontal and lateral views, male holotype from Brazil, Bahia, Toca da Esperança (adapted from Huber & Brescovit 2003). **C**. Cleared female genitalia, dorsal view (asterisk: expandable membranous sac not drawn, cf. Fig. 72D), female from Bahia, near Toca do Índio, ZFMK Ar 24360. Scale lines: 0.2 mm.

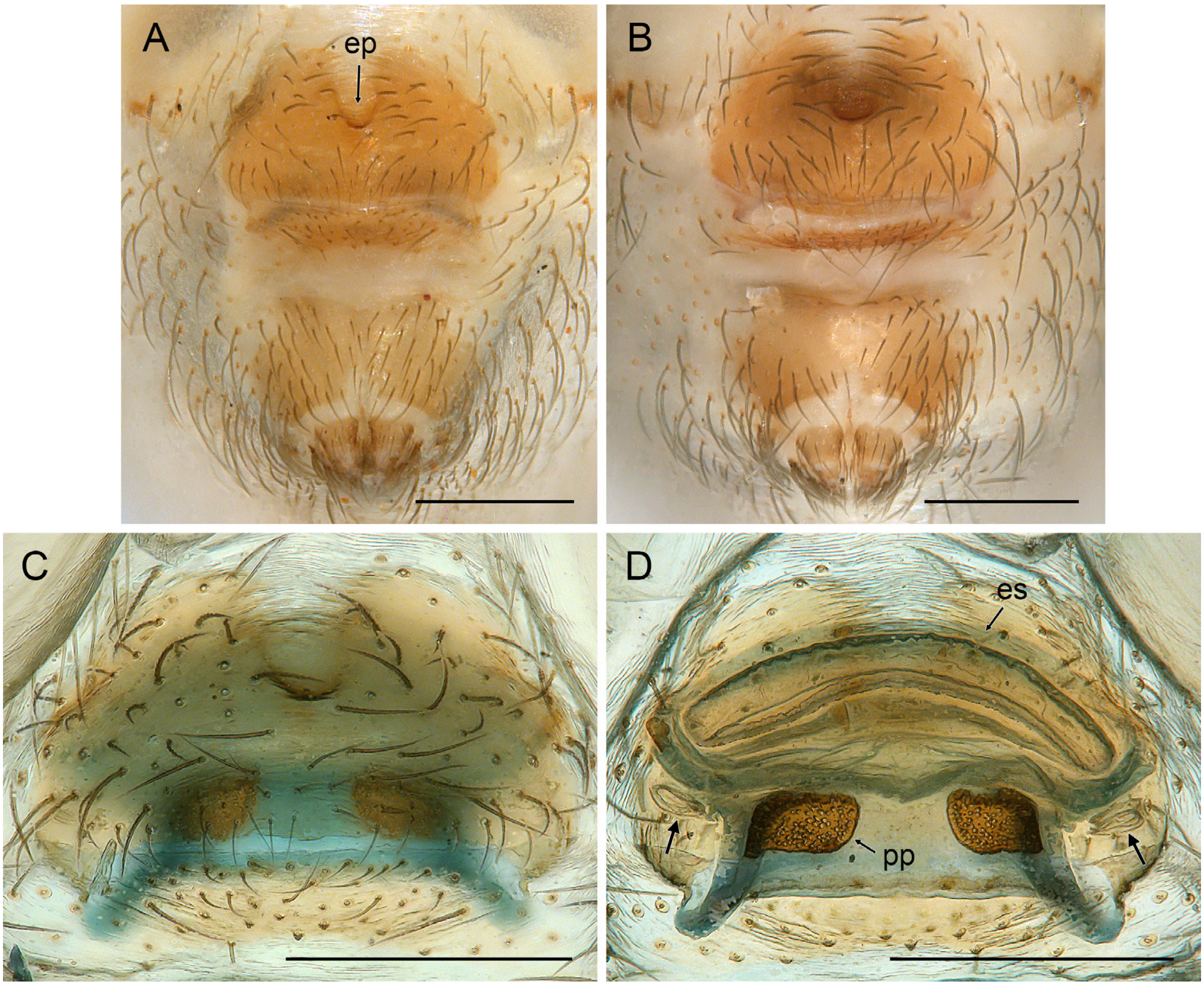

Fig. 72. *Ibotyporanga diroa* Huber & Brescovit, 2003. **A–B**. Abdomens, ventral views, females from Brazil, Bahia, near Toca do Índio (A), ZFMK Ar 24360, and from Bahia, W of Queimada Nova (B), ZFMK Ar 24359. **C–D**. Cleared female genitalia, ventral and dorsal views; same specimen as in A (bold arrows: putative lateral sacs or pockets). Abbreviations: ep = epigynal pocket; es = expandable membranous sac; pp = pore plate. Scale lines: 0.3 mm.

Ibotyporanga imale Huber sp. nov.
urn:lsid:zoobank.org:act:886A7AAB-02D8-4F62-A2BD-5D1ACEE348DD
Figs 23B, 55G–H, 74–78

Diagnosis

Males are distinguished from known congeners by dorsal branch of procursus with distinctive distal bend (arrows in Fig. 76); also by distal course of main procursus branch (Fig. 76; distal membranous part long, directed towards dorsal; similar only in *I. guanambi* sp. nov.). Females are externally possibly indistinguishable from putatively close relatives (species with a split procursus but without median sclerite in female internal genitalia: *I. ramosae*, *I. guanambi*, *I. capivara* sp. nov., *I. sertao* sp. nov.); *I. capivara* seems to have longer legs (tibia 1 > 1.4); *I. sertao* is distinguished by internal genitalia with distinct pair of convoluted tubes and by absence of large median expandable sac. Females of *I. ramosae* and *I. guanambi* may be morphologically indistinguishable from those of *I. imale* sp. nov.

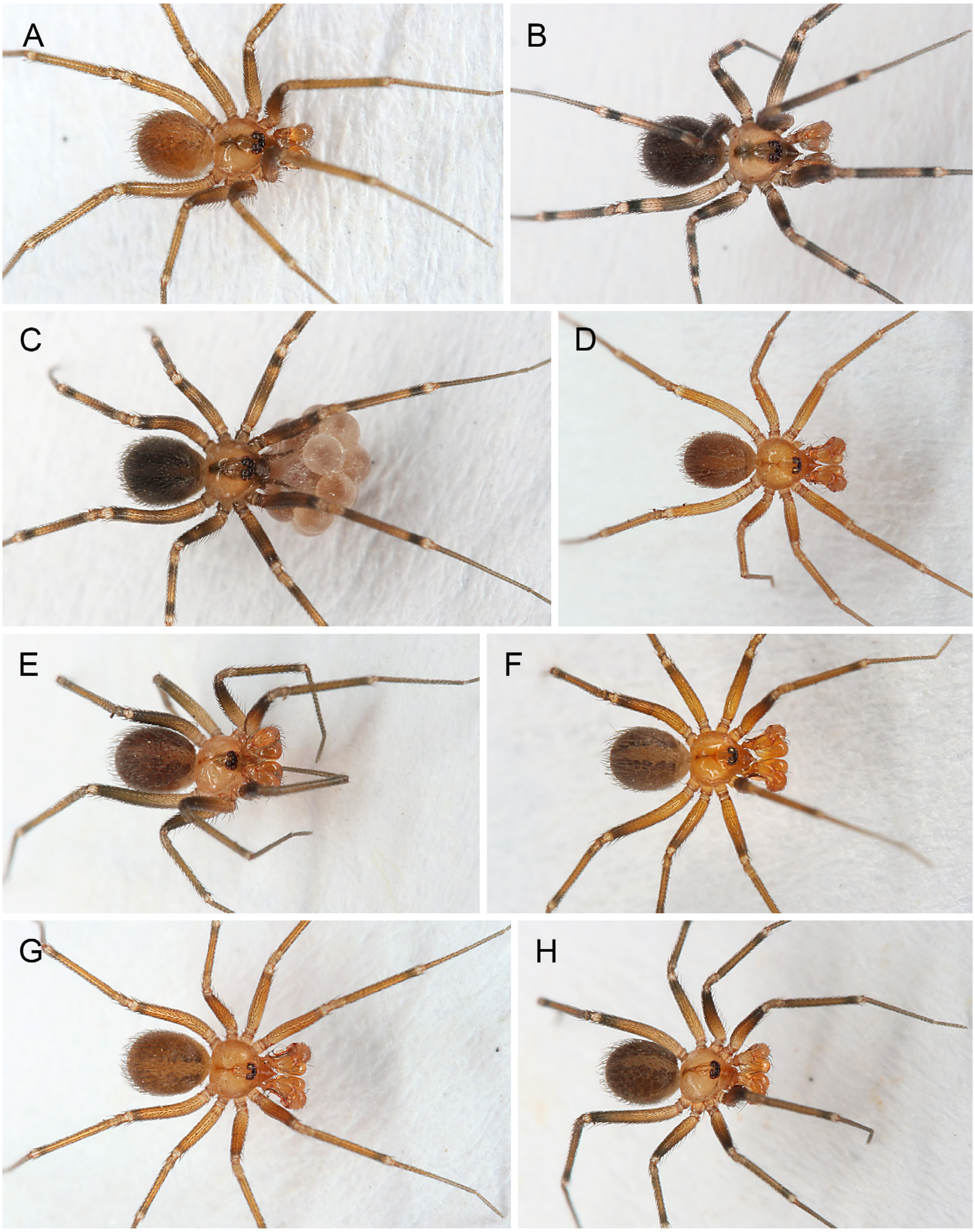

Fig. 73. *Ibotyporanga* spp., live specimens, part three (cf. Figs 25, 55), all from Brazil. **A**. *I. sertao* Huber sp. nov., male from Pernambuco, W of Orocó. **B–C**. *I. guanambi* Huber sp. nov., male and female with egg sac from Bahia, N of Guanambi. **D**. *I. emekori* Huber & Brescovit, 2003, male from Bahia, near Toca do Índio. **E**. *I. tuxa* Huber sp. nov., male from Bahia, W of Barra do Mendes. **F**. *I. kiriri* Huber sp. nov., male from Bahia, SE of Paramirim. **G**. *I. ouro* Huber sp. nov., male from Bahia, E of Gentio do Ouro. **H**. *I. canudos* Huber sp. nov., male from Bahia, SW of Morro do Chapéu.

Etymology

The species name remembers the Malê Revolt of 1835, a term derived from the Yoruba word 'imale'. The slave rebellion was defeated but is considered a turning point in the history of slavery in Brazil; noun in apposition.

Type material

Holotype

BRAZIL – **Bahia** • ♂; E of São Félix do Coribe; 13.404° S, 44.110° W; 470–580 m a.s.l.; 17 Nov. 2022; B.A. Huber and L.S. Carvalho leg.; CHNUFPI 5904.

Paratypes

BRAZIL – **Bahia** • 1 ♂; same collection data as for holotype; CHNUFPI 5905 • 1 ♀; same collection data as for holotype; UFMG 31655 • 1 ♂, 1 ♀; same collection data as for holotype; CHNUFPI 9032 [deposited in ZFMK Ar 24361] • 1 ♀; same collection data as for holotype; CHNUFPI 5906.

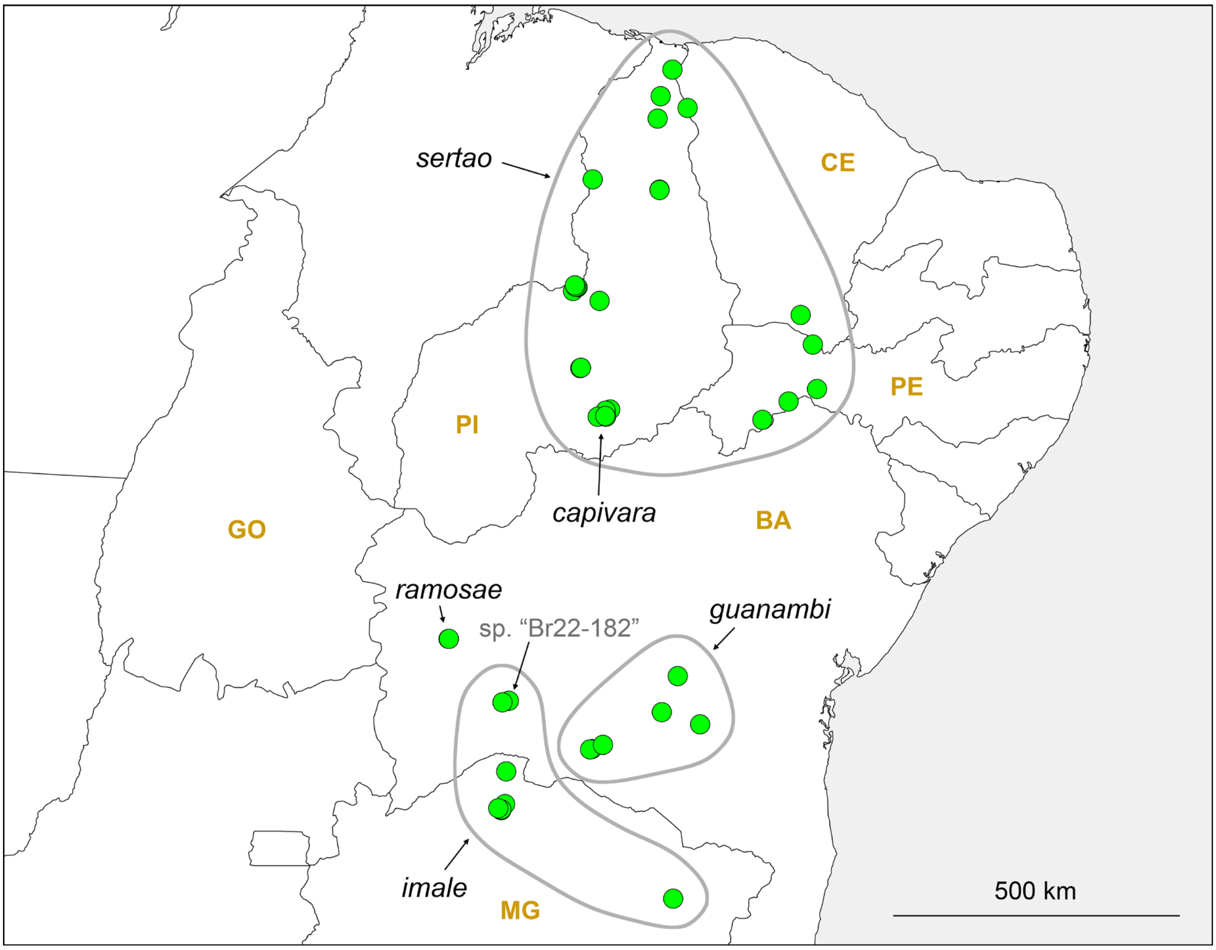

Fig. 74. Known geographic distribution of Brazilian species with long procursus and with dorsal branch on procursus, but without median sclerite in female internal genitalia. Abbreviations: BA = Bahia; CE = Ceará; GO = Goiás; MG = Minas Gerais; PE = Pernambuco; PI = Piauí.

Other material examined

BRAZIL – **Bahia** • 3 ♀♀, in pure ethanol; same collection data as for holotype; CHNUFPI 5907 [deposited in ZFMK Br22-180; one abdomen transferred to ZFMK Ar 24361] • 2 ♀♀; SW of São Félix do Coribe, 'site 1'; 13.4325° S, 44.2168° W; 470 m a.s.l.; arboreous caatinga at base of rocky outcrop; 17 Nov. 2022; B.A. Huber and L.S. Carvalho leg.; CHNUFPI 5908 • 1 ♀; same collection data as for preceding; CHNUFPI 9033 [deposited in ZFMK Ar 24362] • 1 ♀, in pure ethanol; same collection data as for preceding; CHNUFPI 5909 [deposited in ZFMK Br22-177].

Assigned tentatively (see Variation below)

Morph 2

BRAZIL – **Minas Gerais** • 1 ♂; SE of Monte Rei, Fazenda Lapinha; 14.5323° S, 44.1559° W; 490 m a.s.l.; 15 Nov. 2022; B.A. Huber and L.S. Carvalho leg.; CHNUFPI 5910 • 2 ♀♀; same collection data as for preceding; CHNUFPI 5911 • 1 ♀; same collection data as for preceding; CHNUFPI 9034 [deposited in ZFMK Ar 24363] • 1 ♀, 1 juv., in pure ethanol; same collection data as for preceding; CHNUFPI 5912 [deposited in ZFMK Br22-171] • 1 ♂; Itaobim, at margin of BR 367; 16.5689° S, 41.4838° W; 280 m a.s.l.; 10 Apr. 2015; L.S. Carvalho *et al.* leg.; CHNUFPI 3692 • 3 ♀♀; same collection data as for preceding; CHNUFPI 3703, 3735, 3769 • 10 ♀♀, 6 juvs; same locality as for preceding; 27 Nov. 2011; I.L.F. Magalhães *et al*. leg.; UFMG 10151.

Morph 3

BRAZIL – **Minas Gerais** • 2 ♂♂, 6 ♀♀; Parque Nacional Cavernas do Peruaçu, near visitor center; 15.1559° S, 44.2316° W; 530 m a.s.l.; 14 Nov. 2022; B.A. Huber, L.S. Carvalho and R.A. Torres leg.; CHNUFPI 5913 • 1 ♂, 1 ♀; same collection data as for preceding; CHNUFPI 9035 [deposited in ZFMK Ar 24364] • 1 ♂; same collection data as for preceding; CHNUFPI 5914 • 1 ♂, 3 ♀♀, 1 juv., in pure ethanol; same collection data as for preceding; CHNUFPI 5915 [deposited in ZFMK Br22-168].

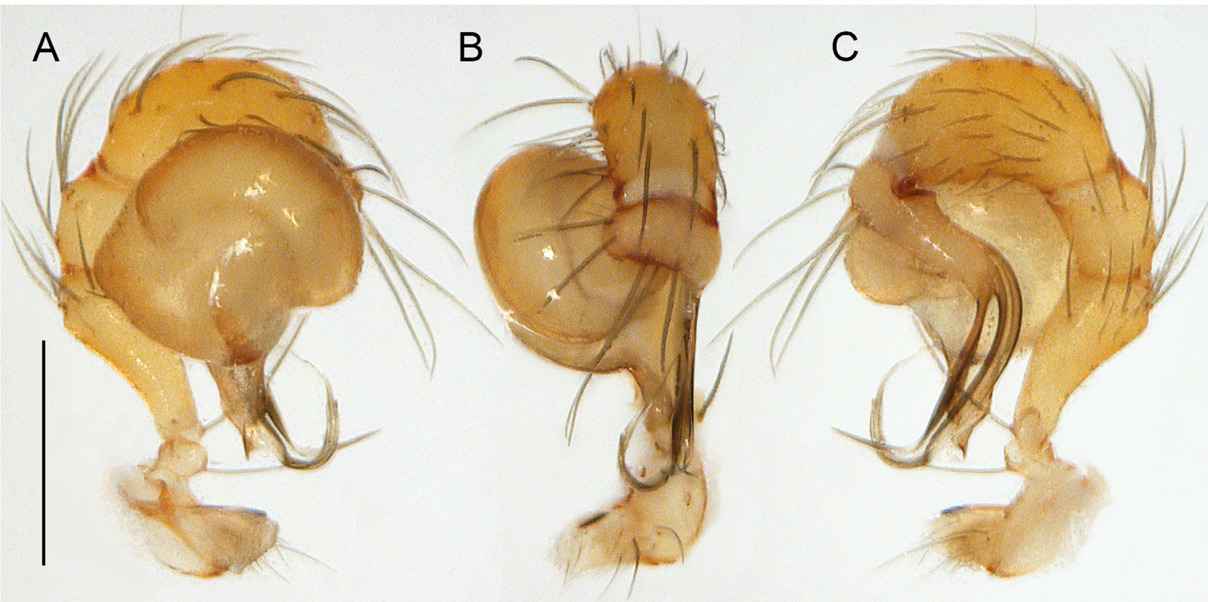

Fig. 75. *Ibotyporanga imale* Huber sp. nov., male from Brazil, Bahia, E of São Félix do Coribe, ZFMK Ar 24361. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

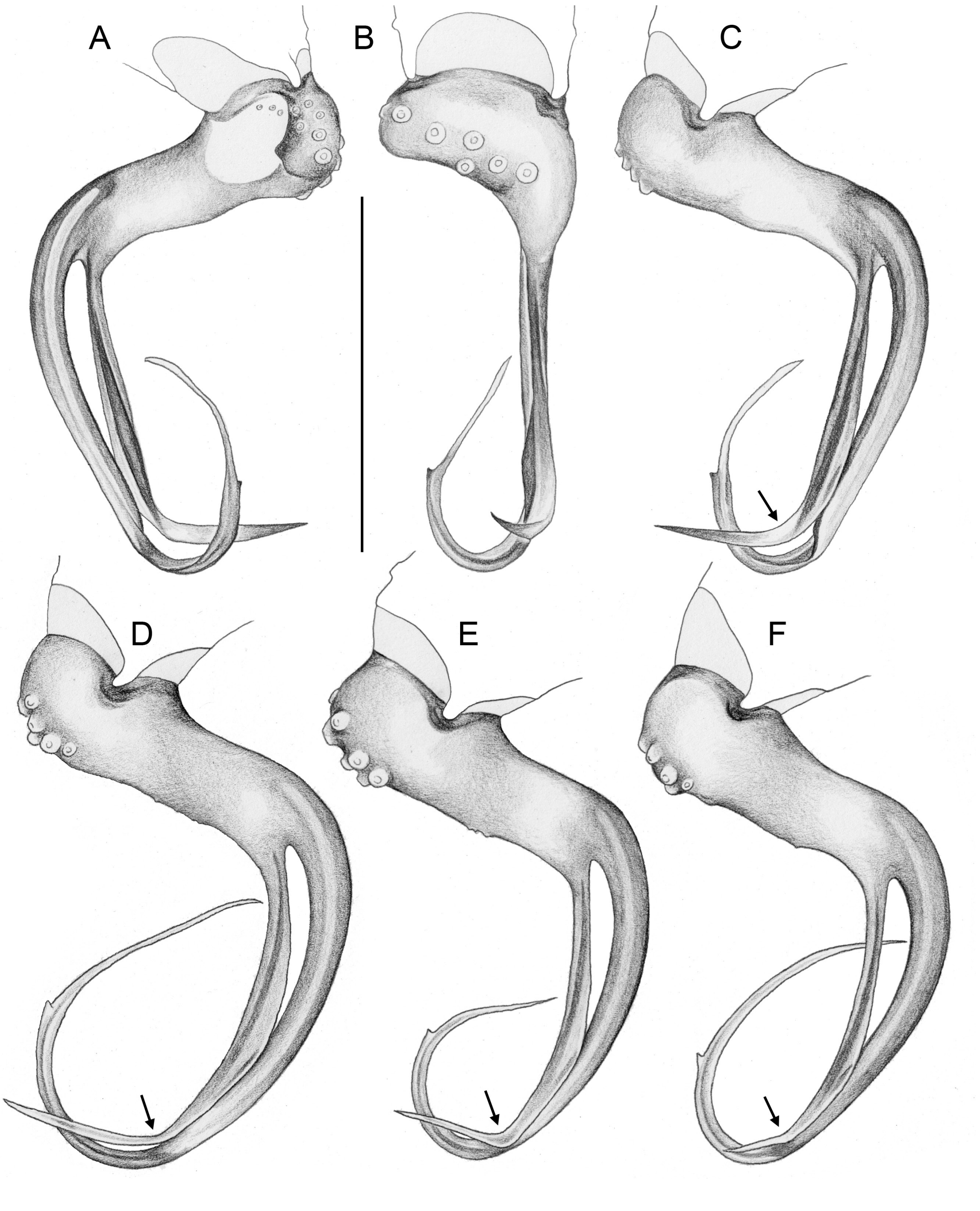

Fig. 76. *Ibotyporanga imale* Huber sp. nov. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views (arrow: distinctive bend of dorsal branch of procursus), male from type locality, Brazil, Bahia, E of São Félix do Coribe, ZFMK Ar 24361. **D–F**. Left tarsi and procursi, retrolateral views (arrows: distinctive bend of dorsal branch of procursus), males from Brazil, Minas Gerais, SE of Monte Rei (D), CHNUFPI 5910; from Minas Gerais, Parque Nacional Cavernas do Peruaçu, near visitor center (E), ZFMK Ar 24364; and from Minas Gerais, Parque Nacional Cavernas do Peruaçu, near guest house (F), ZFMK Ar 24366. Scale line: 0.3 mm (all figures at same scale).

Morph 4

BRAZIL – **Minas Gerais** • 8 ♀♀; NW of Itacarambi, 'site 2'; 15.0555° S, 44.1715° W; 630 m a.s.l.; 13 Nov. 2022; B.A. Huber, L.S. Carvalho and R.A. Torres leg.; CHNUFPI 5916 • 1 ♂, 2 ♀♀; same collection data as for preceding; CHNUFPI 9036 [deposited in ZFMK Ar 24365] • 1 ♀; same collection data as for preceding; CHNUFPI 5917 • 6 ♀♀, 1 juv., in pure ethanol; same collection data as for preceding; CHNUFPI 5918 [deposited in ZFMK Br22-160] • 1 ♂; Parque Nacional Cavernas do Peruaçu, Lapa do Rezar (karst cave), at cave entrance; 15.1433° S, 44.2349° W; 610 m a.s.l.; 14 Nov. 2022; B.A. Huber and R.A. Torres leg.; CHNUFPI 5919 • 2 ♂♂, 3 ♀♀; Parque Nacional Cavernas do Peruaçu, near guest house, 'site 1'; 15.1229° S, 44.2804° W; 770 m a.s.l.; degraded shrubby caatinga; 13 Nov. 2022; B.A. Huber and R.A. Torres leg.; CHNUFPI 5920 • 1 ♂, 1 ♀; same collection data as for preceding; CHNUFPI 9037 [deposited in ZFMK Ar 24366] • 4 ♀♀, 1 juv., in pure ethanol; same collection data as for preceding; CHNUFPI 5921 [deposited in ZFMK Br22-162] • 2 ♀♀; Parque Nacional Cavernas do Peruaçu, near guest house, 'site 2'; 15.1241° S, 44.2813° W; 770 m a.s.l.; degraded shrubby caatinga; 14 Nov. 2022; B.A. Huber and R.A. Torres leg.; CHNUFPI 5922.

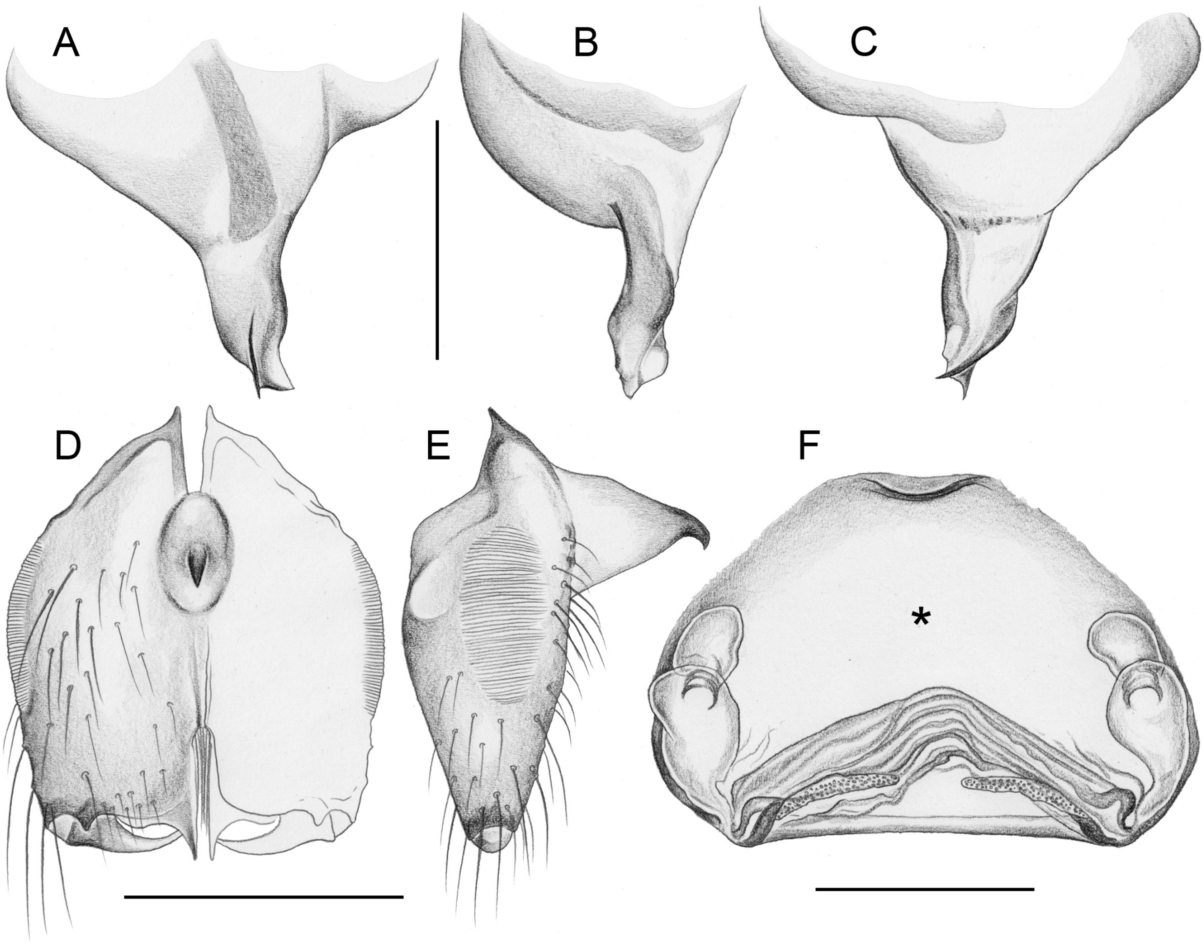

Fig. 77. *Ibotyporanga imale* Huber sp. nov., male and female from Brazil, Bahia, E of São Félix do Coribe, ZFMK Ar 24361. **A–C**. Left genital bulb, prolateral, dorsal, and retrolateral views. **D–E**. Male chelicerae, frontal and lateral views. **F**. Cleared female genitalia, dorsal view (asterisk: expandable membranous sac not drawn, cf. Fig. 78D). Scale lines: 0.2 mm.

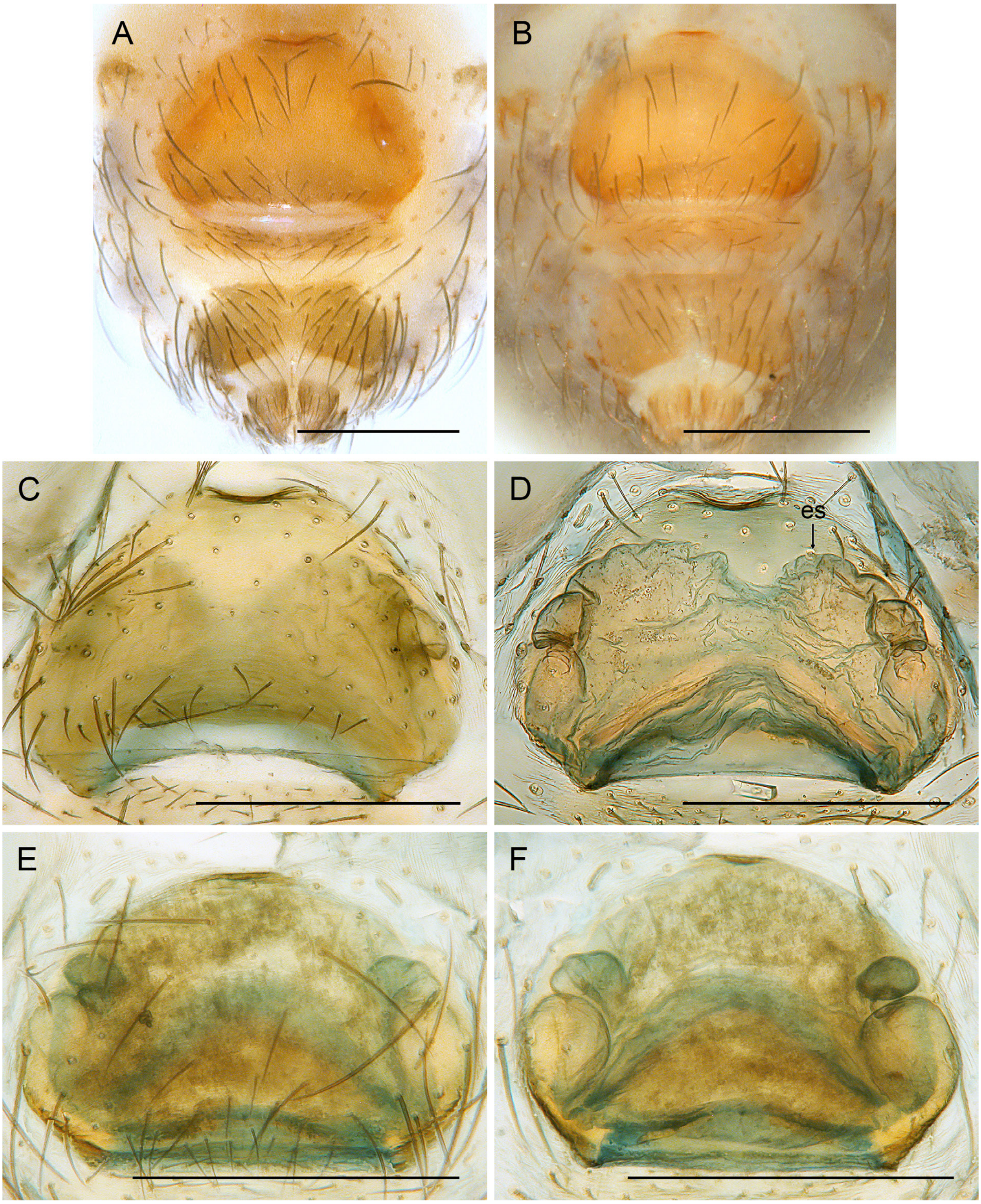

Fig. 78. *Ibotyporanga imale* Huber sp. nov. **A–B**. Abdomens, ventral views, females from Brazil, Bahia, E of São Félix do Coribe (A), ZFMK Ar 24361, and from Bahia, SW of São Félix do Coribe (B), ZFMK Ar 24362. **C–D**. Cleared female genitalia, ventral and dorsal views, same specimen as in A. **E–F**. Cleared female genitalia, ventral and dorsal views, same specimen as in B. Abbreviation: es = expandable membranous sac. Scale lines: 0.3 mm.

Description

Male (holotype)

Measurements. Total body length 1.9, carapace width 0.70. Distance PME–PME 55 µm; diameter PME 75 µm; distance PME–ALE 25 µm; distance AME–AME 25 µm; diameter AME 40 µm. Leg 1: 3.89 (1.00 + 0.23 + 1.00 + 1.23 + 0.43), tibia 2: 0.80, tibia 3: 0.75, tibia 4: 1.10; tibia 1 L/d: 11; diameters of leg femora 0.17, of leg tibiae 0.09.

Colour (in ethanol). Prosoma and legs mostly ochre-yellow, carapace medially and ocular area slightly darker, femora and tibiae with darker subdistal rings; abdomen pale gray with indistinct darker internal marks; ventrally with light ochre plates in front of gonopore and in front of spinnerets.

Body. Habitus as in Fig. 55G. Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum slightly wider than long (0.50/0.46), with pair of very low and indistinct anterior processes near coxae 1. Abdomen globular.

Chelicerae. As in Fig. 77D–E; width 0.27; with short median frontal apophysis, length ~0.10; stridulatory files very fine and poorly visible in dissecting microscope.

Palps. As in Fig. 75; coxa and trochanter unmodified; femur proximally with distinct retrolateral process directed slightly toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints barely shifted toward prolateral side; patella dorsally slightly longer than medially wide; tibia-tarsus joints barely shifted toward retrolateral side; tarsus without dorsal process; procursus (Fig. 76A–C) with long dorsal branch with distinctive subdistal bend; main branch with light prolateral band, length of distal transparent tip 0.14; genital bulb (Fig. 77A–C) with distinct prolateral sclerite on bulbous part; embolus with slender prolateral ridge.

Legs. Without spines but with longer and slightly stronger hairs ventrally on femora; without curved hairs; with several rows of short vertical hairs on tibia 1; retrolateral trichobothrium of tibia 1 at 54%; prolateral trichobothrium absent on tibia 1; tarsus 1 with 3–4 pseudosegments, distally fairly distinct.

Variation (male)

Tibia 1 in 15 males: 0.93–1.17 (mean 1.06). The procursus shows slight variation among (but not within) localities (type morph near São Félix do Coribe and 'morphs 2–4' above in Minas Gerais): the transparent distal tip of the main branch ranges from 110 µm (morph 3) to 210 µm (morphs 2 and 4); type morph is intermediate: 140 µm (Fig. 76). The bent distal element of the dorsal branch ranges from 40–50 µm (morph 4) to 110–120 µm (type morph and morph 2); morph 3 intermediate: 80–95 µm (Fig. 76). No relevant variation seems to exist in the male cheliceral apophysis. Males usually without or with indistinct lateral dark bands on carapace. The species delimitation analysis (Fig. S7) suggests that the individual 'morphs' may in fact represent separate species. The K2P distances between them ranged from 13.1% to 16.8% (Table S1).

Female

In general, similar to male (Fig. 55H) but clypeus and carapace laterally darker ochre; clypeus unmodified; tibia 1 length in 54 females: 0.95–1.33 (mean 1.11). Epigynum (Fig. 78A–B) anterior plate triangular to trapezoidal with rounded edges, posterior margin almost straight, with weakly curved, shallow anterior pocket; posterior plate short and simple. Internal genitalia (Figs 77F, 78C–F) without median sclerotized structure, with pair of narrow and indistinct pore plates posteriorly, with large expandable membranous structure medially from which pair of membranous sacs or pouches originate laterally. Lateral membranous sacs possibly variable but at least part of this apparent variation seems to be due to different degrees of expansion of the large median expandable membranous structure.

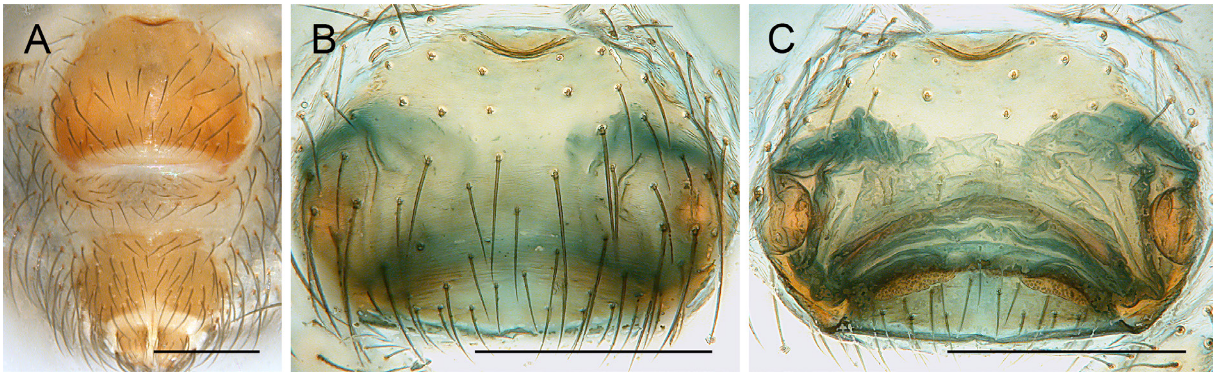

Fig. 79. *Ibotyporanga* sp. “Br22-182”, female from Brazil, Bahia, E of São Félix do Coribe, top of hill; ZFMK Br22-182. **A**. Abdomen, ventral view. **B–C**. Cleared female genitalia, ventral and dorsal views. Scale lines: 0.3 mm.

Distribution

Known from the type locality in southeastern Bahia, Brazil, and from several localities in northern Minas Gerais (Fig. 74); however, the specimens from Minas Gerais are assigned tentatively.

Natural history

The specimens from E of São Félix do Coribe were collected in a secondary arboreous caatinga on a granitic hillside (Fig. 23B). The spiders were found in dry pieces of wood and bark on the ground. Near the top of the same hill, a single female was found that might represent a separate species (*I.* “Br22-182”; cf. Fig. 79). The specimens from SW of São Félix do Coribe and from SE of Monte Rei were collected in degraded woodlands at the bases of karst outcrops, in pieces of wood on the ground and under stones. Near the visitor center of Parque Nacional Cavernas do Peruaçu, the spiders were found in the litter, in dry pieces of wood, and under rocks of a secondary arboreous caatinga. Near the guest house of Parque Nacional Cavernas do Peruaçu, the spiders were found under construction material in a degraded shrubby caatinga. Near Itacarambi, the spiders were found under rocks in an arboreous caatinga at a karst outcrop; males ran rapidly when disturbed and were thus difficult to catch, while females often remained sitting on the rock. Eight egg sacs were round but slightly flattened, had diameters of 1.4–2.0, and egg diameters of 0.46–0.54; the total number of eggs per egg sac was estimated to be ~12–25.

Ibotyporanga ramosae Huber & Brescovit, 2003
Figs 74, 80–83

Ibotyporanga ramosae Huber & Brescovit, 2003: 19, figs 18–21 (♂).

Diagnosis

Males are distinguished from known congeners by strongly curved main branch of procursus (Fig. 81A–C; more than one entire turn; similar only in *I. sertao* sp. nov.); from possibly closest relative (*I. imale* sp. nov.; according to molecular data, Fig. S2) also by shorter dorsal branch of procursus without bend. Females are externally possibly indistinguishable from putatively close relatives (species with a split procursus but without median sclerite in female internal genitalia: *I. imale*, *I. guanambi* sp. nov., *I. capivara* sp. nov., *I. sertao*); *I. capivara* seems to have longer legs (tibia 1 > 1.4); *I. sertao* is distinguished by internal genitalia with distinct pair of convoluted tubes and by absence of large median expandable sac. Females of *I. imale* and *I. guanambi* may be morphologically indistinguishable from those of *I. ramosae*.

Type material

BRAZIL – **Bahia** • ♂ holotype; São Desiderio, Gruta das Pedras Brilhantes; 12.418° S, 45.075° W (see Remark below); 8 Jul. 2000; E.F. Ramos leg.; pitfall, caatinga; IBSP 28758; presumably lost – see section 'On lost types' above.

New material examined

BRAZIL – **Bahia** • 1 ♂, without legs; São Desiderio, near Gruta da Passagem; 12.4177° S, 45.0743° W; 535 m a.s.l.; 28 Aug. 2016; L.S. Carvalho and B.T. Faleiro leg.; CHNUFPI 3730 • 1 ♂, very damaged; same collection data as for preceding; CHNUFPI 3742 • 1 ♀, without legs; same collection data as for preceding; CHNUFPI 3728 • 1 ♀ (epigynum lost after clearing), 3 juvs; same collection data as for preceding; CHNUFPI 3748 • 1 ♀, without legs; same collection data as for preceding; CHNUFPI 3794 • 1 ♀, without legs; same collection data as for preceding; CHNUFPI 4195 • 1 ♀; same collection data as for preceding but inside Gruta da Passagem; "Carv82"; CHNUFPI 3683 • 1 ♀, without legs; same collection data as for preceding; CHNUFPI 3782.

Remark

The coordinates of the type locality given in Huber & Brescovit (2003) are wrong. The exact coordinates are those given above. The specimens newly examined here are from a neighboring cave and its surrounding in the same outcrop, less than 100 m NE of Gruta das Pedras Brilhantes.

Redescription of male (amendments, see Huber & Brescovit 2003)

Measurements of male in CHNUFPI 3730: carapace width 0.72; chelicerae width: 0.30; distance PME–PME 60 µm; diameter PME 70 µm; distance PME–ALE 25 µm; distance AME–AME 15 µm; diameter AME 45 µm; sternum width/ length: 0.47/0.42. Clypeus modified as usual in genus. Sternum with very low humps near coxae 1, not different from those in females. Tibia 1 in male in CHNUFPI 3742: 0.92;

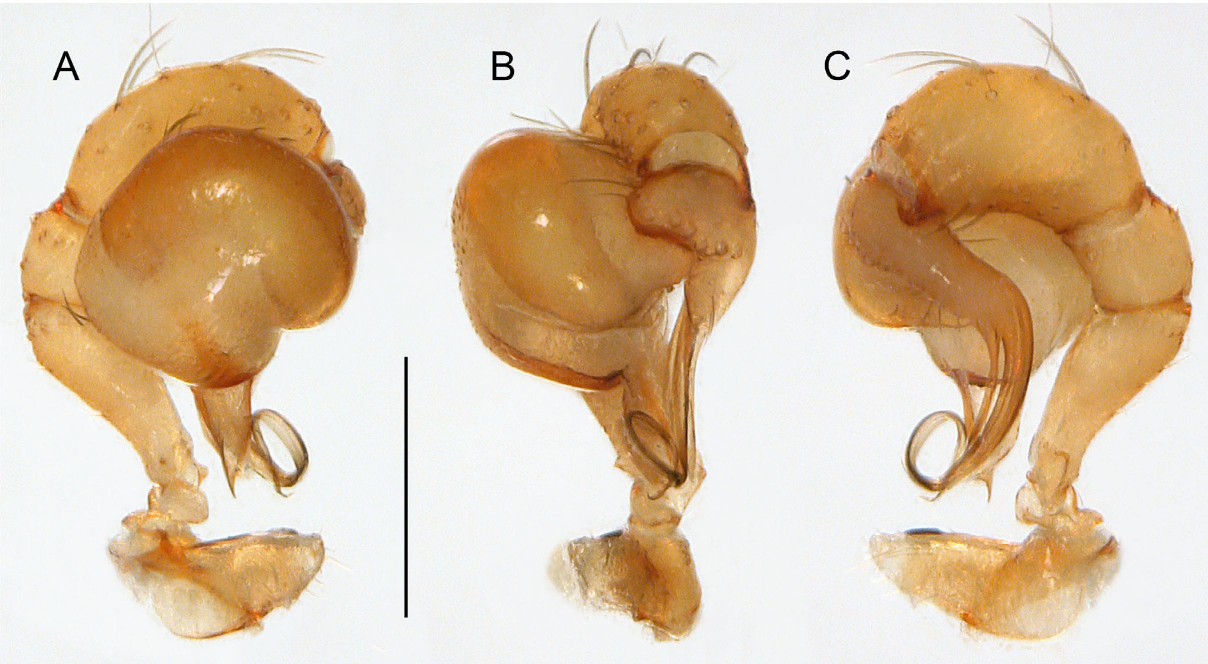

Fig. 80. *Ibotyporanga ramosae* Huber & Brescovit, 2003, male from Brazil, Bahia, São Desiderio, near Gruta da Passagem, CHNUFPI 3730. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

with numerous short vertical hairs on tibia 1. Palp as in Fig. 80; palpal femur retrolateral process distinct, not directed towards distal; femur-patella joints not shifted to one side; patella dorsally barely longer than medially wide; tibia-tarsus joints slightly shifted toward retrolateral side; procursus (Fig. 81A–C) main branch subdistally a wide band, one side sclerotized, other side membranous; dorsal branch of procursus much shorter than main branch, slender and weakly curved; genital bulb (Fig. 81D–F) with distinct prolateral sclerite on bulbous part, embolus with slender prolateral ridge.

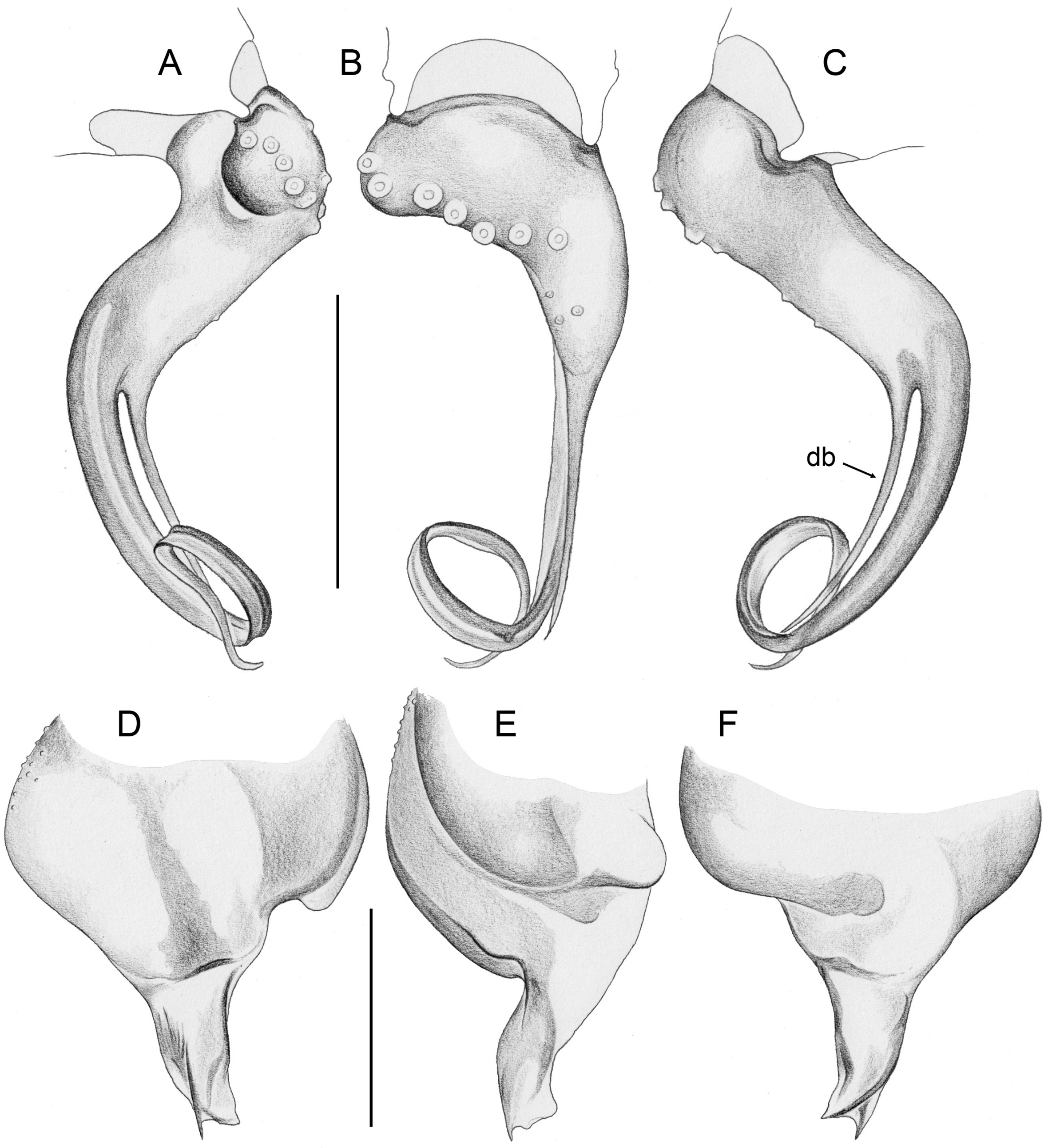

Fig. 81. *Ibotyporanga ramosae* Huber & Brescovit, 2003, male from Brazil, Bahia, São Desiderio, near Gruta da Passagem, CHNUFPI 3730. **A**–**C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views. **D**–**F**. Left genital bulb, prolateral, dorsal, and retrolateral views. Abbreviation: db = dorsal branch of procursus. Scale lines: 0.2 mm.

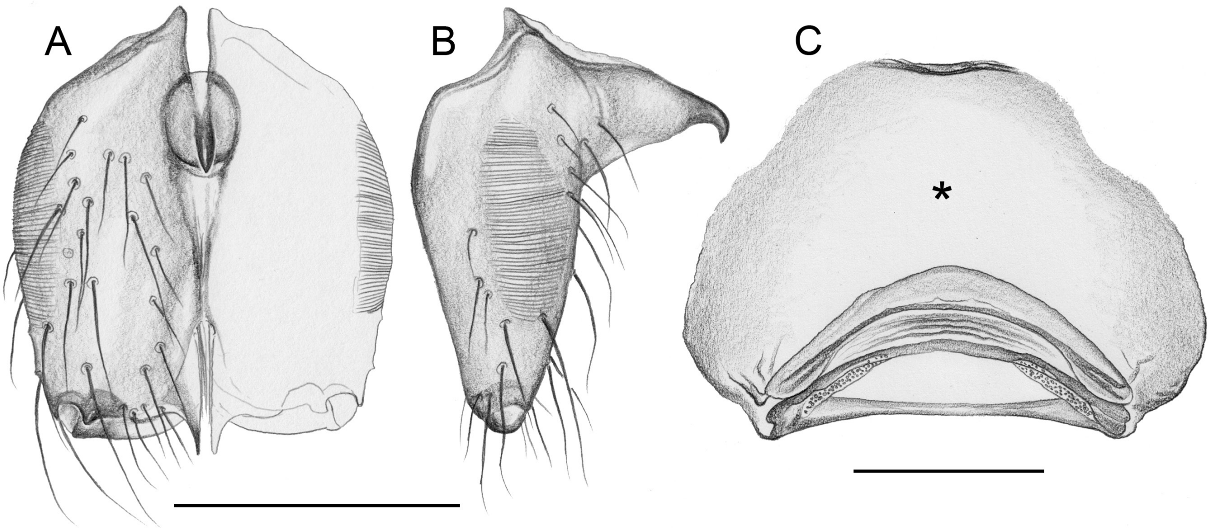

Fig. 82. *Ibotyporanga ramosae* Huber & Brescovit, 2003. **A–B**. Male chelicerae, frontal and lateral views, male holotype from Brazil, Bahia, São Desiderio, Gruta das Pedras Brilhantes (adapted from Huber & Brescovit 2003). **C**. Cleared female genitalia, dorsal view (asterisk: expandable membranous sac not drawn, cf. Fig. 83D), female from Bahia, São Desiderio, near Gruta da Passagem, CHNUFPI 3683. Scale lines: 0.2 mm.

Description of female

In general, similar to male but slightly darker, carapace also laterally sometimes with darker bands; clypeus unmodified; tibia 1 with few short vertical hairs; tibia 1 length in two females: 1.20, 1.23. Epigynum (Fig. 83A–B) anterior plate trapezoidal, posterior margin almost straight, anteriorly with weakly curved, shallow pocket; posterior plate relatively small. Internal genitalia (Fig. 83C–F) with pair of narrow pore plates laterally on curved membranous arc and very transparent and variably large anterior expandable membranous sac, possibly with lateral compartments or pouches.

Distribution

Known from type locality and neighboring area only, in Bahia, Brazil (Fig. 74).

Natural history

The spiders were found under rocks of a secondary arboreous caatinga, inside and outside arenitic caves. The region is altered by cattle and grazing, decreasing habitat quality. One egg sac had a diameter of 2.0, was slightly flattened, and contained about 25 embryos.

Ibotyporanga sertao Huber sp. nov.
urn:lsid:zoobank.org:act:EF744A64-9D71-441D-A1E0-F212ED5D0A03
Figs 22F, 23F, 73A, 74, 84–87; SEM Figs 5A, E, 6E–F, 9E, 10F, 12E, 13F, 14F, 19B, E, 20A

Diagnosis

Males are easily distinguished from known congeners by strongly curved main branch of procursus (Fig. 85A–C; almost two turns; similar only in *I. ramosae*); also by distinctive ventral hump on genital bulb (arrow in Fig. 84A). Females are externally possibly indistinguishable from putatively close

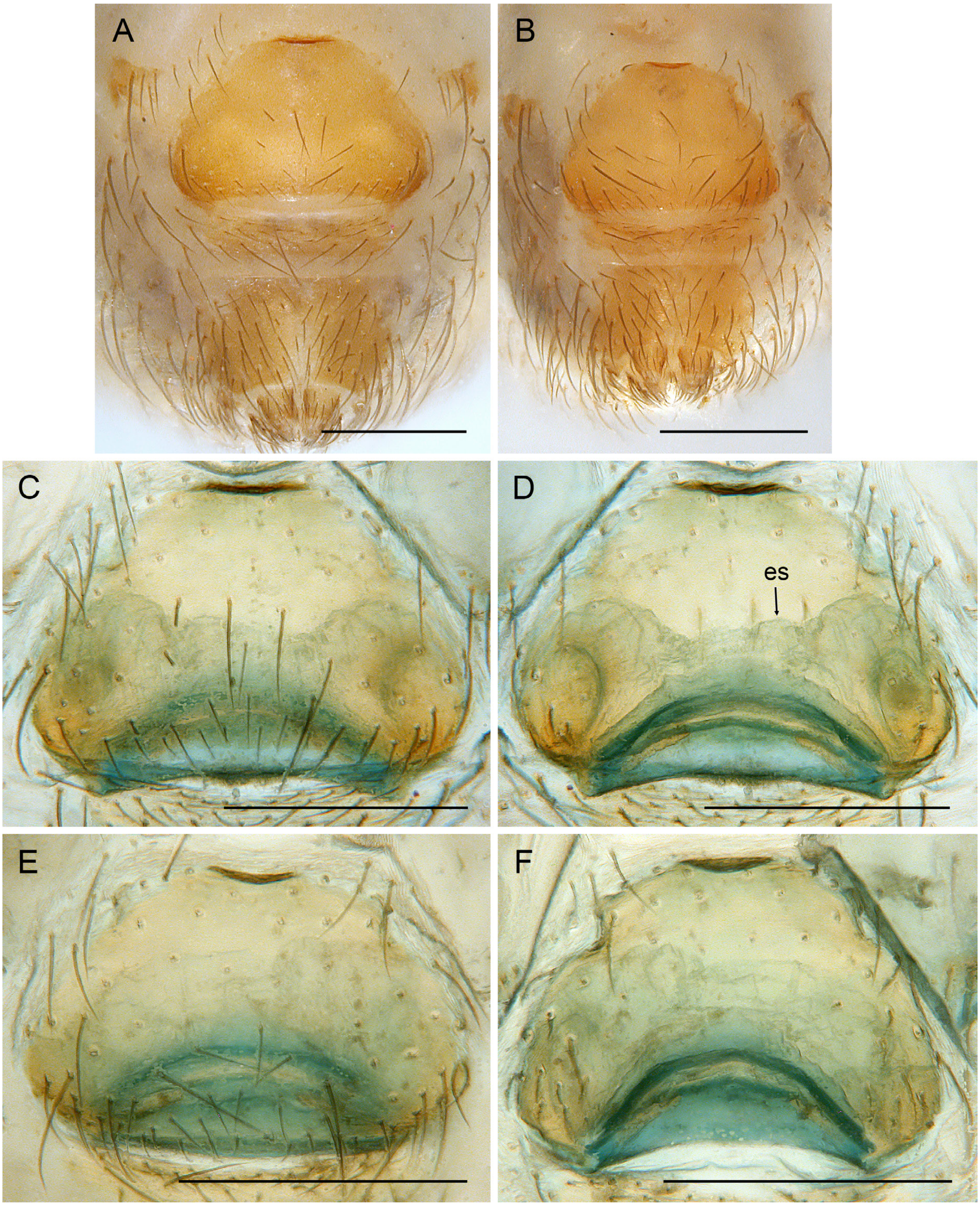

Fig. 83. *Ibotyporanga ramosae* Huber & Brescovit, 2003, females from Brazil, Bahia, São Desiderio, near Gruta da Passagem. **A–B**. Abdomens, ventral views, CHNUFPI 3683 (A), CHNUFPI 3782 (B). **C–D**. Cleared female genitalia, ventral and dorsal views, CHNUFPI 3683. **E–F**. Cleared female genitalia, ventral and dorsal views; CHNUFPI 3782. Abbreviation: es = expandable membranous sac. Scale lines: 0.3 mm.

relatives (species with a split procursus but without median sclerite in female internal genitalia: *I. imale* sp. nov., *I. ramosae*, *I. guanambi* sp. nov., *I. capivara* sp. nov.); internally, females of *I. sertao* sp. nov. are easily distinguished by genitalia with distinct pair of convoluted tubes (Fig. 86C–E; similar only in *I. naideae*); from putatively close relatives also by absence of large median expandable sac.

Etymology

The species name is derived from 'sertão', the 'hinterland' or 'backcountry' of Brazil. Regular droughts make this an economically poor region, but rich in history and folklore, and home to most known species of *Ibotyporanga*; noun in apposition.

Type material

Holotype

BRAZIL – **Pernambuco** • ♂; NE of Lagoa Grande; 8.9117° S, 40.0547° W; 450 m a.s.l.; degraded thorny shrubland; 30 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5923.

Paratypes

BRAZIL – **Pernambuco** • 4 ♂♂, 9 ♀♀; same collection data as for holotype; CHNUFPI 5924–5925 • 1 ♂, 1 ♀; same collection data as for holotype; UFMG 31656 • 2 ♂♂, 2 ♀♀; same collection data as for holotype; CHNUFPI 9038 [deposited in ZFMK Ar 24367].

Other material examined

BRAZIL – **Pernambuco** • 1 ♂, 4 ♀♀, in pure ethanol; same collection data as for holotype; CHNUFPI 5926 [deposited in ZFMK Br22-246; 1 ♂, 1 ♀ used for SEM] • 2 ♂♂, 4 ♀♀; W of Orocó; 8.6157° S, 39.6316° W; 370 m a.s.l.; thorny shrubland; 30 Nov. 2022; B.A. Huber and A.S. Michelotto leg.;

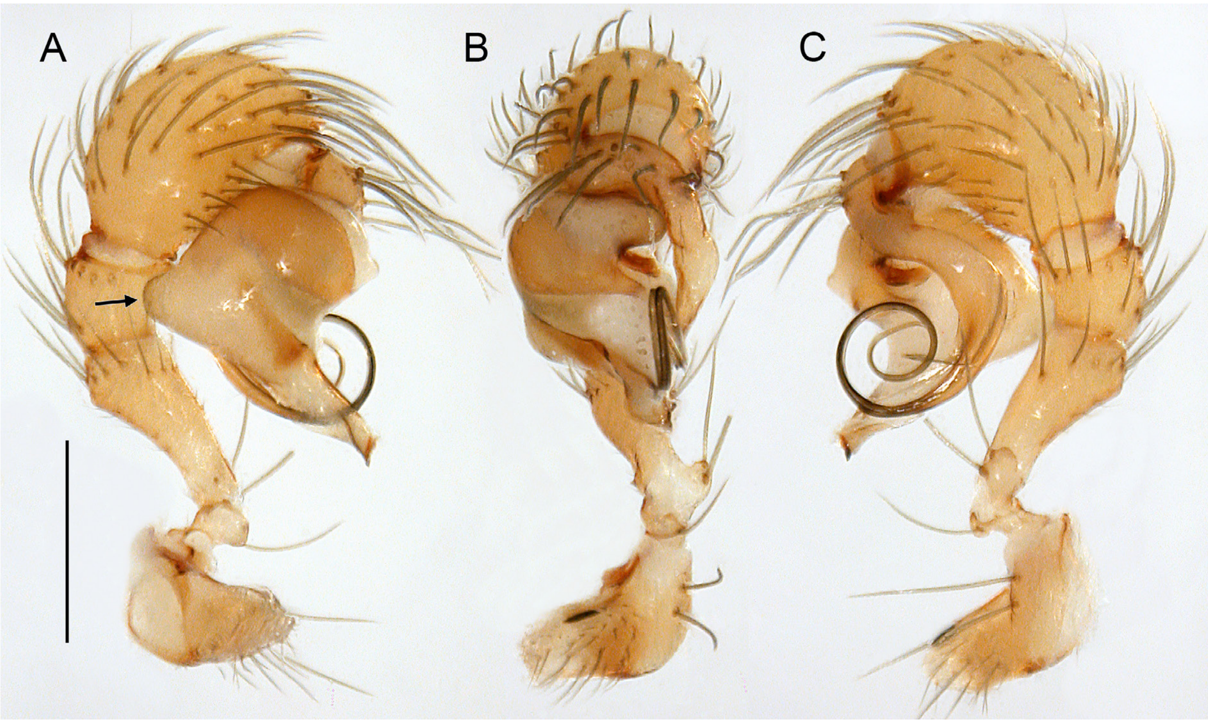

Fig. 84. *Ibotyporanga sertao* Huber sp. nov., male from Brazil, Pernambuco, NE of Lagoa Grande, ZFMK Ar 24367. Left palp, prolateral, dorsal, and retrolateral views (arrow: distinctive ventral process on genital bulb). Scale line: 0.3 mm.

CHNUFPI 5927 • 1 ♂, 1 ♀; same collection data as for preceding; CHNUFPI 9039 [deposited in ZFMK Ar 24368] • 1 ♂, 3 ♀♀, in pure ethanol; same collection data as for preceding; CHNUFPI 5928 [deposited in ZFMK Br22-248] • 1 ♂, 6 ♀♀; NE of Cabrobó; 8.420° S, 39.176° W; 450 m a.s.l.; bare rock fields with scattered shrubs; 2 Dec. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5929 • 1 ♂, 1 ♀; same collection data as for preceding; CHNUFPI 9040 [deposited in ZFMK Ar 24369] • 1 ♂, 3 ♀♀, 2 juvs, in pure ethanol; same collection data as for preceding; CHNUFPI 5930 [deposited in ZFMK Br22-253] • 1 juv., in pure ethanol, assigned tentatively (no adults available from this locality); NW of Cedro; 7.7056° S, 39.2442° W; 600 m a.s.l.; degraded hillside with shrubs and scattered trees; 1 Dec. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5931 [deposited in ZFMK Br22-252]. – **Ceará** • 1 ♂; Crato,

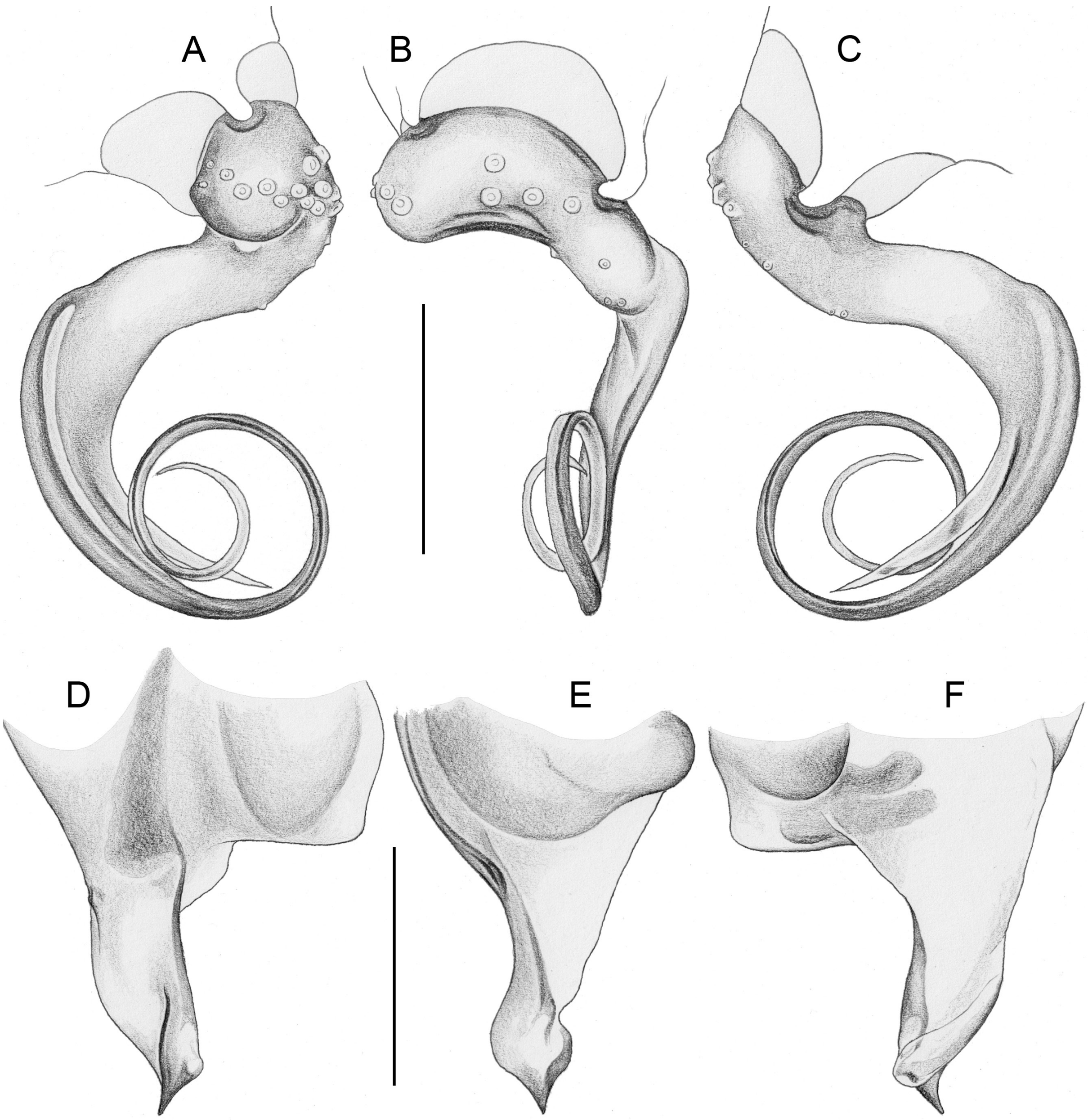

Fig. 85. *Ibotyporanga sertao* Huber sp. nov., male from Brazil, Pernambuco, NE of Lagoa Grande, ZFMK Ar 24367. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views. **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views. Scale lines: 0.2 mm.

Sitio Fundão; 7.2345° S, 39.43845° W; 500 m a.s.l.; 4 Sep. 2016; L.S. Carvalho and R. Azevedo leg.; CHNUFPI 3966 • 1 ♀; same collection data as for preceding; CHNUFPI 3732. – **Piauí** • 2 ♂♂; Coronel José Dias, Parque Nacional da Serra da Capivara, near Boqueirão do Ferreira; 8.7476° S, 42.4870° W; 585 m a.s.l.; 9 Dec. 2019; L.S. Carvalho leg.; "Carv74"; CHNUFPI 4046 • 1 ♀; Coronel José Dias, Parque Nacional da Serra da Capivara; 8.7672° S, 42.5600° W; 520 m a.s.l.; Jun. 2012; L.S. Carvalho leg.; CHNUFPI 372 • 2 ♂♂, 8 ♀♀, 2 juvs; São Raimundo Nonato, Parque Nacional da Serra da Capivara, Baixão das Andorinhas; 8.8614° S, 42.6867° W; 470 m a.s.l.; 9 Dec. 2019; L.S. Carvalho leg.; "Carv72"; CHNUFPI 4045 • 1 ♀; Parque Nacional da Serra da Capivara, Baixão das Andorinhas; 8.8625° S, 42.6873° W; 485 m a.s.l.; 15 Jul. 2023; L.S. Carvalho and E.G. Noetzold leg.; CHNUFPI 5015 • 1 ♂, 1 ♀ (female very large, possibly not conspecific); Parque Nacional da Serra da Capivara, near Baixão das Andorinhas; 8.8605° S, 42.6863° W; 475 m a.s.l.; 8 Dec. 2019; L.S. Carvalho leg.; CHNUFPI 4044 • 3 ♂♂, 9 ♀♀, 9 juvs; Canto do Buriti, Anel Viário de Canto do Buriti, 'ponto 2'; 8.0842° S, 42.9709° W; 295 m a.s.l.; 16 Jul. 2023; L.S. Carvalho and E.G. Noetzold leg.; CHNUFPI 5016 • 1 ♀; same collection data as for preceding; CHNUFPI 5019 • 1 ♂, 1 ♀; same collection data as for preceding; CHNUFPI 5020 • 1 ♂; same collection data as for preceding; CHNUFPI 5024 • 1 ♀, 3 juvs; Canto do Buriti, Anel Viário de Canto do Buriti, 'ponto 1'; 8.0807° S, 42.9576° W; 305 m a.s.l.; 16 Jul. 2023; L.S. Carvalho and E.G. Noetzold leg.; CHNUFPI 5018 • 1 ♂, 1 ♀; Nazaré do Piauí, Fazenda Bela Vista; 7.0100° S, 42.6597° W; 140 m a.s.l.; 16 Oct. 2019; F.K. Ferreira leg.; CHNUFPI 4186 • 2 ♀♀, 1 juv.; Floriano, near Aeroporto de Floriano; 6.8506° S, 43.0823° W; 200 m a.s.l.; 21 Jul. 2023; L.S. Carvalho and A. Galleti-Lima leg.; CHNUFPI 5026 • 1 ♀, 1 juv.; same collection data as for preceding; CHNUFPI 5050 • 1 ♂, 2 ♀♀; Floriano, Bairro Curtume, Residencial Angelim, in house; 6.7922° S, 43.0117° W; 190 m a.s.l.; 18 Dec. 2020; L.S. Carvalho leg.; "Carv60"; CHNUFPI 3508 • 1 ♂; Floriano, Bairro Via Azul, in house; 6.7827° S, 43.0179° W; 170 m a.s.l.; 26 Jun. 2019; L.S. Carvalho leg.; CHNUFPI 2893 • 2 ♀♀; same locality as for preceding; 6 Jun. 2019; E.G. Noetzold leg.; CHNUFPI 2944 • 1 ♂; Floriano, Bairro Meladão, in house; 6.7836° S, 43.0399° W; 120 m a.s.l.; 1 Oct. 2013; L.S. Carvalho leg.; CHNUFPI 3959 • 1 ♂, 1 ♀; Floriano, Fazenda do Colégio Técnico de Floriano, margins of Rio Parnaíba; 6.7596° S, 43.0557° W; 105 m a.s.l.; 22 Jul. 2023; L.S. Carvalho *et al.* leg.; CHNUFPI 5052 • 1 ♂, 4 ♀♀, 7 juvs; same collection data as for preceding; CHNUFPI 5054 • 1 ♂, 1 ♀; Castelo do Piauí, Fazenda Bonito, ECB Rochas Ornamentais do Brasil Ltda; 5.2266° S, 41.6970° W; 230 m a.s.l.; 23 Mar. 2018; L.S. Carvalho and R. Pinto-da-Rocha leg.; CHNUFPI 4041 • 1 ♂; same locality as for preceding; 5.2317° S, 41.7005° W; 220 m a.s.l.; 13 Sep. 2006; F.M. Oliveira-Neto leg.; MPEG 7965 • 1 ♂; same locality as for preceding; 20 Oct. 2005; F.M. Oliveira-Neto leg.; MPEG 11544 • 1 ♂; Teresina, Bairro Morada do Sol, in house; 5.0656° S, 42.7669° W; 115 m a.s.l.; 9 Jan. 2015; L.S. Carvalho leg.; CHNUFPI 1280 • 1 ♂; same locality as for preceding; 25 Oct. 2020; L.S. Carvalho leg.; CHNUFPI 3507 • 2 ♂♂; same locality as for preceding; 24 Nov. 2006; L.S. Carvalho leg.; MPEG 11545 • 1 ♀; Parque Nacional de Sete Cidades; 4.0944° S, 41.7315° W; 160 m a.s.l.; 21 Jun. 2007; M.P. Albuquerque leg.; MPEG 11546 • 1 ♀; same locality as for preceding; 20 Jun. 2007; F.M. Oliveira-Neto leg.; MPEG 11547 • 1 ♀; São João da Fronteira, near Igreja do Padre; 3.9198° S, 41.2502° W; 385 m a.s.l.; 14 Feb. 2023; L.S. Carvalho and E.G. Noetzold leg.; CHNUFPI 5058 • 1 ♂, 1 ♀, 4 juvs; Piracuruca, roadside of BR 343; 3.7359° S, 41.6824° W; 60 m a.s.l.; 20 Feb. 2023; L.S. Carvalho and E.G. Noetzold leg.; CHNUFPI 5056 • 2 ♂♂; Cocal, near Ipuera, roadside of PI-301; 3.3081° S, 41.4944° W; 90 m a.s.l.; 24 Apr. 2022; L.S. Carvalho leg.; CHNUFPI 4181 • 1 ♂; same collection data as for preceding; CHNUFPI 4185 • 1 subadult ♀; same collection data as for preceding; CHNUFPI 4184 • 1 ♂, 2 ♀♀, 1 juv.; same locality as for preceding; 26 Oct. 2021; L.S. Carvalho leg.; CHNUFPI 4198 • 1 ♀; same collection data as for preceding; CHNUFPI 4190.

Description

Male (holotype)

Measurements. Total body length 2.3, carapace width 0.80. Distance PME–PME 80 µm; diameter PME 80 µm; distance PME–ALE 30 µm; distance AME–AME 20 µm; diameter AME 60 µm. Leg 1: 4.66

(1.27 + 0.32 + 1.13 + 1.47 + 0.47), tibia 2: 0.97, tibia 3: 0.85, tibia 4: 1.25; tibia 1 L/d: 11; diameters of leg femora 0.18–0.19, of leg tibiae 0.10–0.11.

Colour (in ethanol). Prosoma ochre-yellow, carapace medially, ocular area and clypeus darker ochre, legs ochre, without darker rings; abdomen gray with dark internal marks dorsally and laterally; ventrally with light ochre plates in front of gonopore and in front of spinnerets.

Body. Habitus as in Fig. 73A. Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum wider than long (0.60/0.50), with distinct anterior processes near coxae 1, ~40 µm high, ~80 µm diameter at basis. Abdomen globular; gonopore with four epiandrous spigots in two groups (Fig. 5A); spinnerets as in congeners (Fig. 6E–F).

Chelicerae. As in Fig. 86A–B; width 0.32; with short median frontal apophysis; stridulatory files (Fig. 10F) distinct.

Palps. As in Fig. 84; coxa unmodified; trochanter with rounded ventral protrusion; femur proximally with distinct retrolateral process not directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints not shifted toward one side; patella dorsally slightly longer than medially wide; tibia-tarsus joints barely shifted toward retrolateral side; tarsus without dorsal process, with small capsulate tarsal organ (Fig. 13F); procursus (Fig. 85A–C) with semitransparent pointed dorsal branch much shorter than main branch; main branch with light prolateral band, distally coiled;

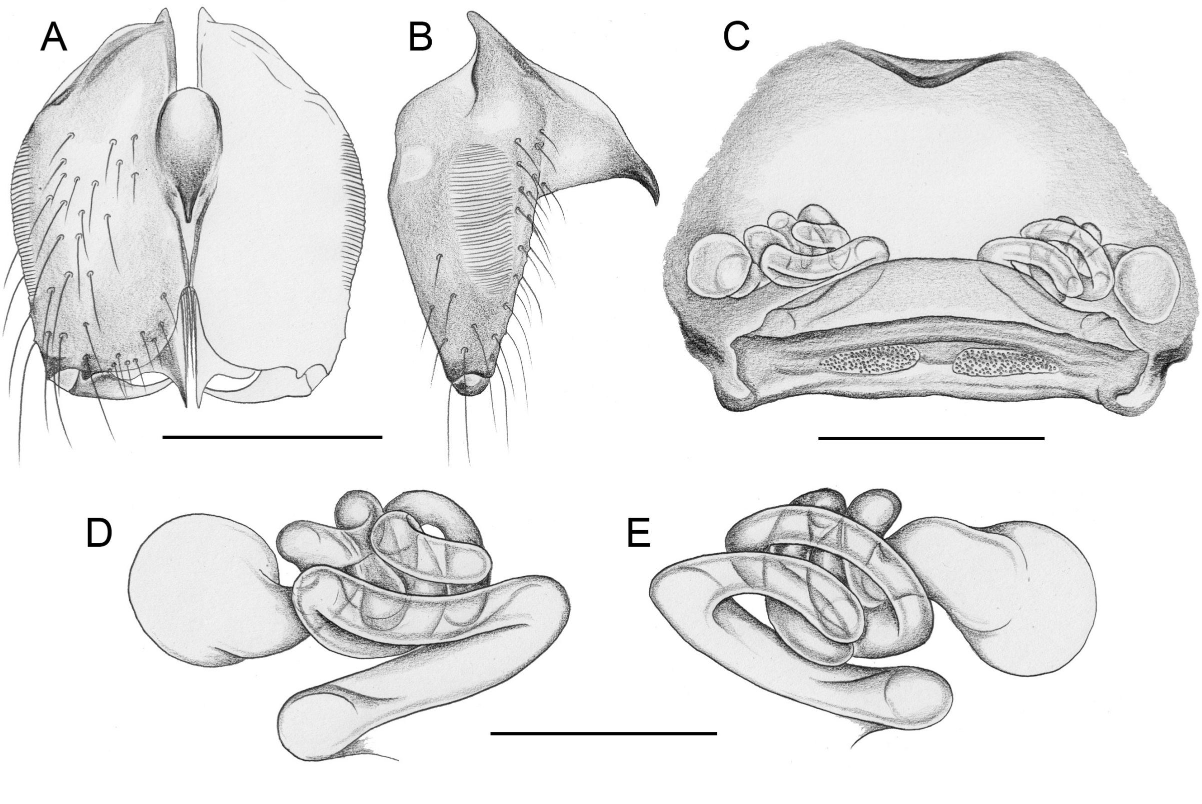

Fig. 86. *Ibotyporanga sertao* Huber sp. nov. **A–B**. Male chelicerae, frontal and lateral views, from Brazil, Pernambuco, NE of Lagoa Grande, ZFMK Ar 24367. **C**. Cleared female genitalia, dorsal view, female from Pernambuco, NE of Cabrobó, ZFMK Ar 24369. **D–E**. Schematic drawings of left side and right side tubes, dorsal views, showing that the convolutions are apparently not regular and symmetric; same specimen as in C. Scale lines: A–C = 0.2 mm; D–E = 0.1 mm.

genital bulb with ventral hump (arrow in Fig. 84A), distinct prolateral sclerite on bulbous part, embolus with slender prolateral ridge (Fig. 85D–F).

Legs. Without spines but with longer and slightly stronger hairs ventrally on femora; without curved hairs; with several rows of short vertical hairs on tibia 1; retrolateral trichobothrium of tibia 1 at 53%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~3–4 pseudosegments, distally distinct.

Variation (male)

Dark marks on prosoma variably distinct, legs ochre-yellow to ochre. Width of distal coil of procursus slightly variable, possibly artificially (compare Figs 84C and 85C, which are from same pedipalp). Ventral hump of bulb with variably distinct tiny tubercles. Tibia 1 in 38 other males: 1.03–1.43 (mean 1.17). One male from Floriano (CHNUFPI 5052) is unusually large (tibia 1 length 1.43, other males 1.03–1.30) but other than that, there is no indication that it might be misplaced in this species. The species delimitation analysis supported the conspecificity of the five sequenced specimens from five localities (Fig. S7). The K2P distances among them ranged from 0.3% to 4.2% (Table S1).

Female

In general, similar to male but slightly darker and dark marks more distinct; clypeus and sternum unmodified; tibia 1 with few vertical hairs; tibia 1 length in 58 females: 1.17–1.53 (mean 1.37); a few females from Serra da Capivara (CHNUFPI 372, 4044, 4045) and from Floriano (CHNUFPI 5054) are unusually large (tibia 1 length 1.54–1.83) but other than that, there is no indication that they might be misplaced in this species. Epigynum (Fig. 87A–B) anterior plate semicircular to trapezoidal, posterior margin almost straight, with distinct anterior pocket (Fig. 5E); posterior plate short and simple. Internal genitalia (Figs 86C–E, 87C–F) with pair of elongated pore plates posteriorly, with pair of convoluted membranous ducts originating from median membranous structure and leading into globular terminal sacs.

Distribution

Widely distributed in Brazil, in the states of Pernambuco, Ceará, and Piauí (Fig. 74). The species does not seem to cross the São Francisco River into Bahia; we found it at several localities just north of the river in Pernambuco, but at none of four localities sampled just south of the river in Bahia.

Natural history

At the type locality, the spiders were found in a highly degraded thorny shrubland along a dirt road (Fig. 23F), where they were abundant under stones, together with another Ninetinae spider, an undescribed species of *Kambiwa*. The second locality listed above, W of Orocó, was a well-preserved caatinga; the same two species of Ninetinae were extremely abundant at this site. The third locality, NE of Cabrobó, was a large granite outcrop with scattered shrubs and stones on bare rock (Fig. 22F); again, both species of Ninetinae shared the same microhabitat. In Floriano and Teresina, this species has also been found in and around houses, usually males wandering at night. Several specimens were found under arenite rocks in shrubby caatinga (São João da Fronteira and Canto do Buriti), arboreal caatinga (Crato) or cerrado sensu stricto vegetation (Castelo do Piauí, Cocal, and Piracuruca), with different levels of preservation. At Parque Nacional da Serra da Capivara, the specimens were found among or under small pebbles in an arenite rock outcrop, at a preserved shrubby caatinga vegetation site. Eight egg sacs were round but slightly flattened, had diameters of 1.7–2.2, and egg diameters of 0.58–0.62; the total number of eggs per egg sac was estimated to be ~15–30.

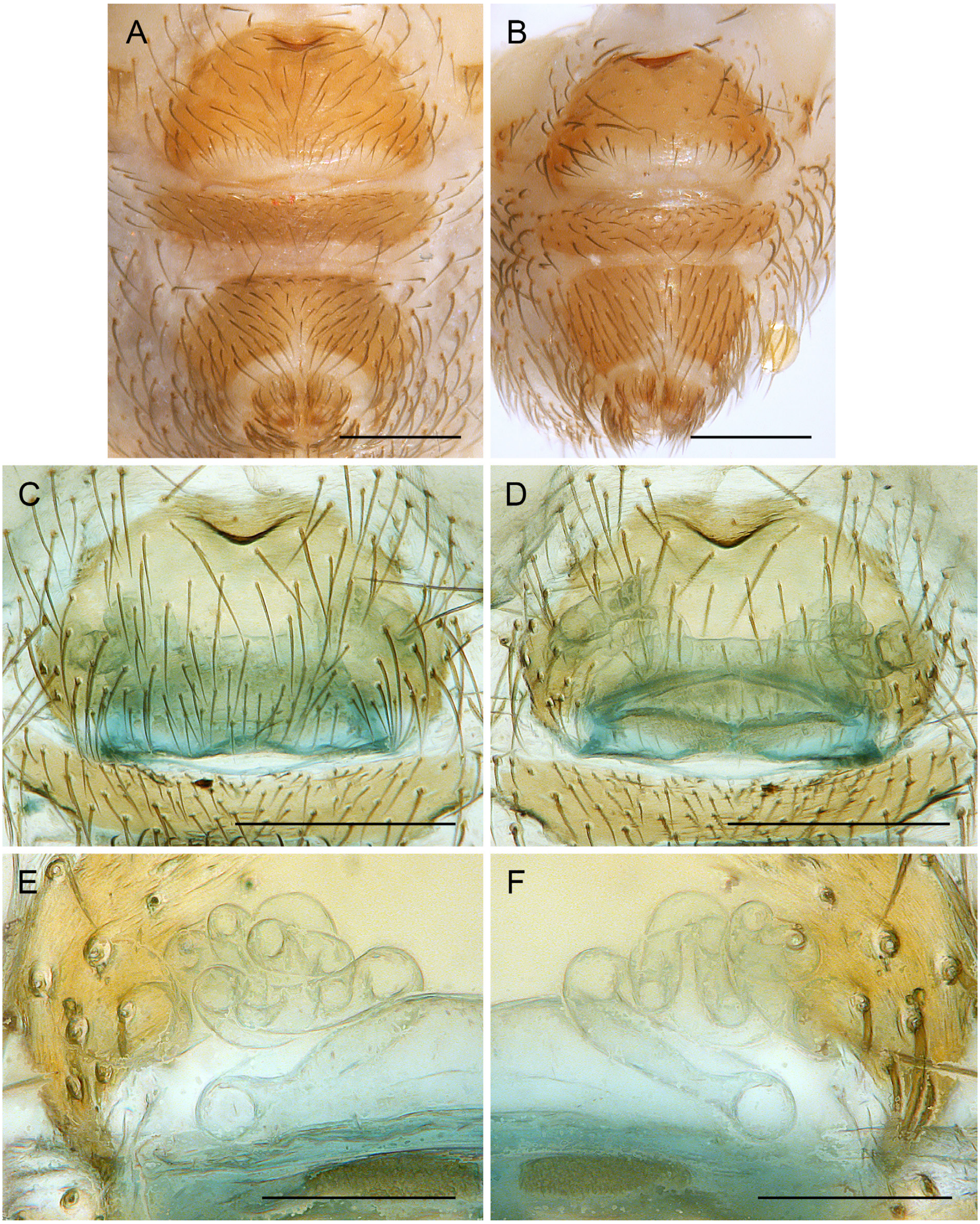

Fig. 87. *Ibotyporanga sertao* Huber sp. nov. **A–B**. Abdomens, ventral views, females from Brazil, Pernambuco, NE of Lagoa Grande (A), ZFMK Ar 24367 and from Pernambuco, NE of Cabrobó (B), ZFMK Ar 24369. **C–D**. Cleared female genitalia, ventral and dorsal views, same specimen as in A. **E–F**. Internal tubes of left side, dorsal and ventral views, same specimen as in B. Scale lines: A–D = 0.3 mm; E–F = 0.1 mm.

Ibotyporanga guanambi Huber sp. nov.
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Figs 22D, 73B–C, 74, 88–91; SEM Figs 2E–F, 4E, 6B, 8C–D, 9F, 10E, 11C–D, 12F, 13D, 14D, 15B, 16D, 18D–E, 19A

Diagnosis

Males are distinguished from most known congeners (except *I. imale* sp. nov.) by distal course of main procursus branch (Fig. 89A–D; distal membranous part long, curved towards dorsal and proximal); from *I. imale* by dorsal process of procursus shorter, without distal bend (Fig. 89C–D). Females are externally possibly indistinguishable from putatively close relatives (species with a split procursus but without median sclerite in female internal genitalia: *I. imale*, *I. ramosae*, *I. capivara* sp. nov., *I. sertao* sp. nov.); *I. sertao* is distinguished by internal genitalia with distinct pair of convoluted tubes and by absence of large median expandable sac. Females of *I. ramosae* and *I. imale* may be morphologically indistinguishable from those of *I. guanambi* sp. nov.

Etymology

The species name is derived from the type locality; noun in apposition.

Type material

Holotype

BRAZIL – **Bahia** • ♂; N of Guanambi; 14.1797° S, 42.7812° W; 560 m a.s.l.; 12 Nov. 2022; B.A. Huber, L.S. Carvalho and R.A. Torres leg.; CHNUFPI 5932.

Paratypes

BRAZIL – **Bahia** • 4 ♂♂, 5 ♀♀, 2 juvs; same collection data as for holotype; CHNUFPI 5933 • 1 ♂, 1 ♀; same collection data as for holotype; UFMG 31657 • 2 ♂♂, 2 ♀♀; same collection data as for holotype; CHNUFPI 9041 [deposited in ZFMK Ar 24370] • 1 ♂, 1 ♀; same collection data as for holotype; CHNUFPI 5934.

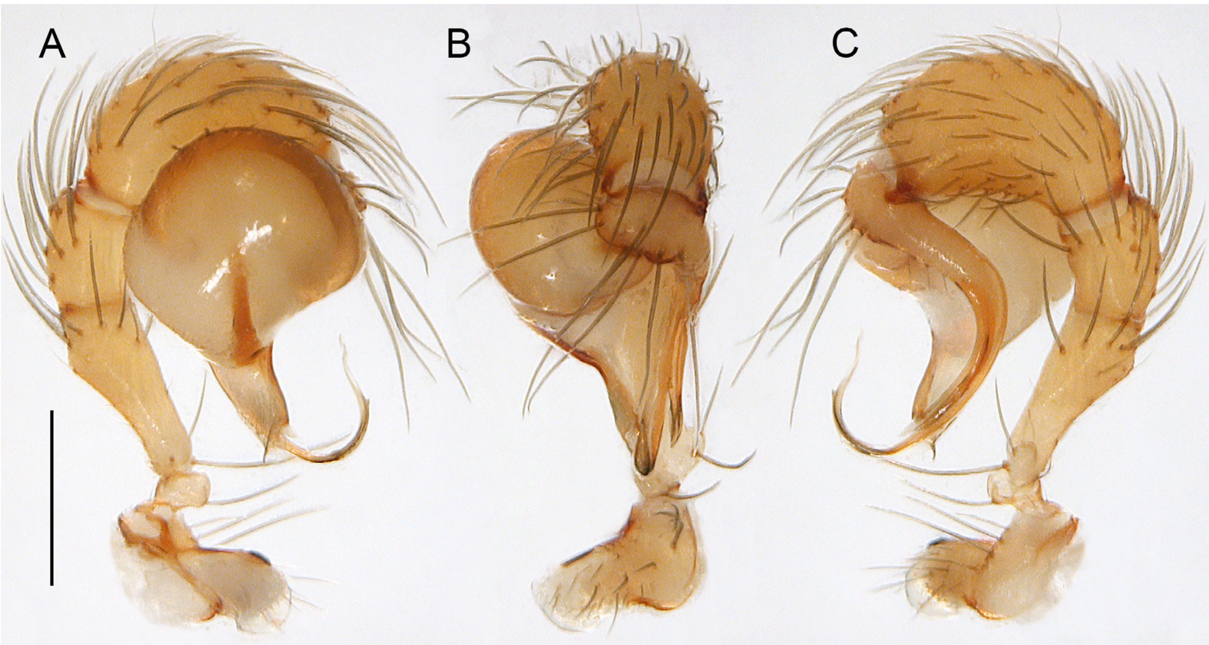

Fig. 88. *Ibotyporanga guanambi* Huber sp. nov., male from Brazil, Bahia, N of Guanambi, ZFMK Ar 24370. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

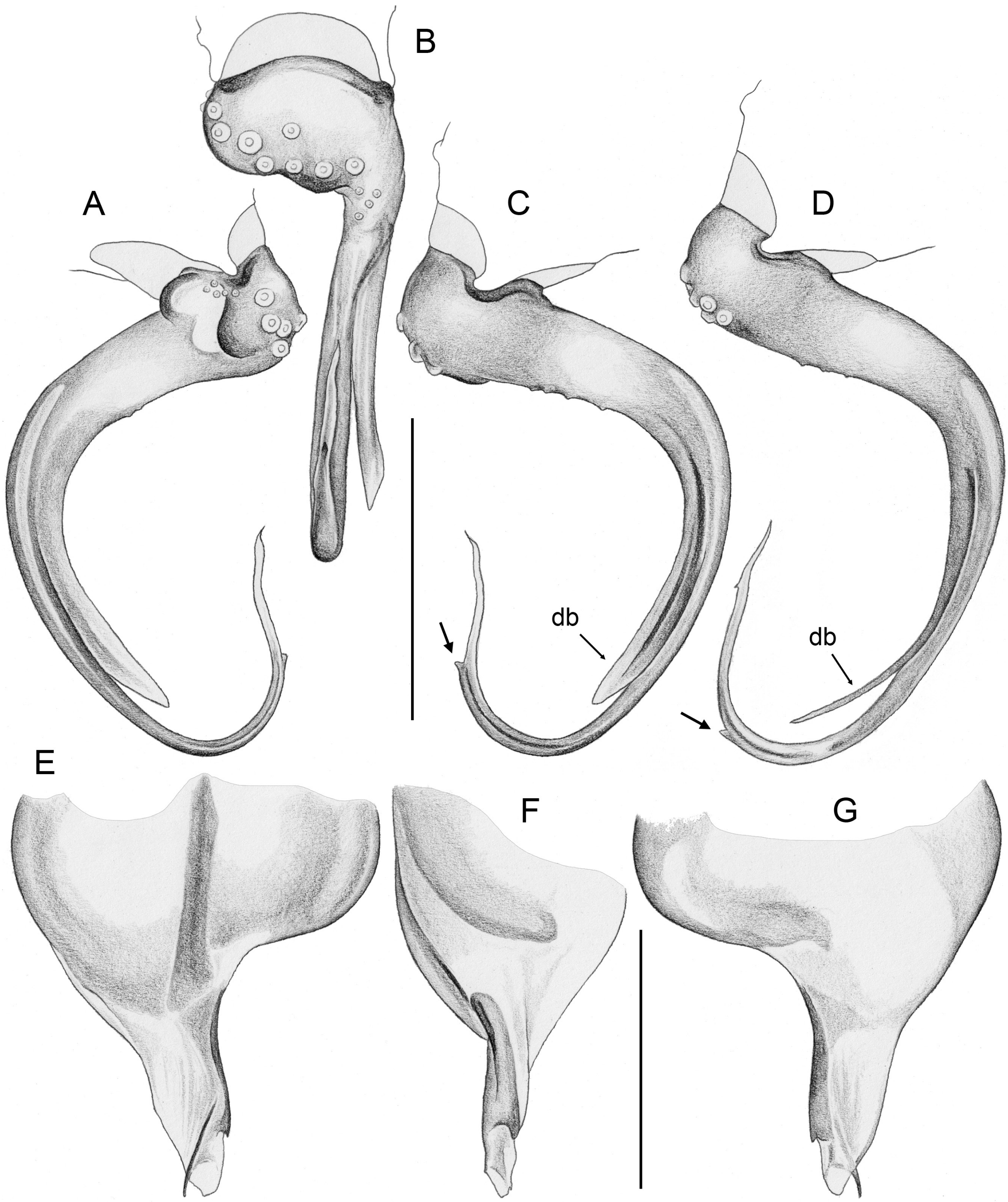

Fig. 89. *Ibotyporanga guanambi* Huber sp. nov. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views (bold arrow: tiny side branch on main branch of procursus), male from Brazil, Bahia, N of Guanambi, ZFMK Ar 24370. **D**. Left tarsus and procursus, retrolateral view (bold arrow: tiny side branch on main branch of procursus), male from Bahia, NE of Marcolino Moura; ZFMK Ar 24371; at same scale as A–C. **E–G**. Left genital bulb, prolateral, dorsal, and retrolateral views; same specimen as in A–C. Abbreviation: db = dorsal branch of procursus. Scale lines: 0.3 mm.

Other material examined

BRAZIL – **Bahia** • 2 ♂♂, 8 ♀♀, 6 juvs, in pure ethanol; same collection data as for holotype; CHNUFPI 5935 [deposited in ZFMK Br22-158; 1 ♂, 1 ♀ used for SEM] • 1 ♂; Guanambi, Fazenda do Seu Washington; 14.1830° S, 42.8128° W; 515 m a.s.l.; 12 Apr. 2015; L.S. Carvalho leg.; CHNUFPI 1496 • 1 ♂; same collection data as for preceding; CHNUFPI 3688 • 4 ♀♀; same collection data as for preceding; CHNUFPI 1543 • 1 ♂ 1 ♀; same data as for preceding; UFMG 17378 • 1 ♀; Caetité, Parque Eólico de Guanambi; 14.1116° S, 42.6077° W; 1000 m a.s.l.; 13 Apr. 2015; L.S. Carvalho leg.; CHNUFPI 3761.

Assigned tentatively (see below)

BRAZIL – **Bahia** • 2 ♂♂, 2 ♀♀; NE of Marcolino Moura; 13.5883° S, 41.6635° W; 630 m a.s.l.; 19 Nov. 2022; B.A. Huber and L.S. Carvalho leg.; CHNUFPI 5936 • 1 ♂, 1 ♀; same collection data as for preceding; CHNUFPI 9042 [deposited in ZFMK Ar 24371] • 3 ♀♀, in pure ethanol; same collection data as for preceding; CHNUFPI 5937 [deposited in ZFMK Br22-198] • 1 ♂; S of Contendas do Sincorá; 13.7826° S, 41.0507° W; 320 m a.s.l.; hillside with shrubby caatinga woodland on sandy soil; 11 Nov. 2022; B.A. Huber and L.S. Carvalho leg.; CHNUFPI 5938 [deposited in ZFMK Ar 24372] • 1 ♀; W of Mucugê, Parque Nacional da Chapada Diamantina; 13.0097° S, 41.4084° W; 1010 m a.s.l.; 19 Nov. 2022; B.A. Huber and L.S. Carvalho leg.; CHNUFPI 5939.

Description

Male (holotype)

MEASUREMENTS. Total body length 2.2, carapace width 0.82. Distance PME–PME 80 µm; diameter PME 75 µm; distance PME–ALE 30 µm; distance AME–AME 10 µm; diameter AME 70 µm. Leg 1: 4.77 (1.27 + 0.30 + 1.20 + 1.50 + 0.50), tibia 2: 0.93, tibia 3: 0.82, tibia 4: 1.23; tibia 1 L/d: 11; diameters of leg femora 0.19–0.20, of leg tibiae 0.11.

COLOUR (in ethanol). Prosoma and legs mostly ochre-yellow, carapace medially with brown mark, legs with distinct dark rings on femora (subdistally) and tibiae (proximally and subdistally); abdomen pale gray with dark internal marks dorsally and laterally; ventrally with light ochre plates in front of gonopore and in front of spinnerets.

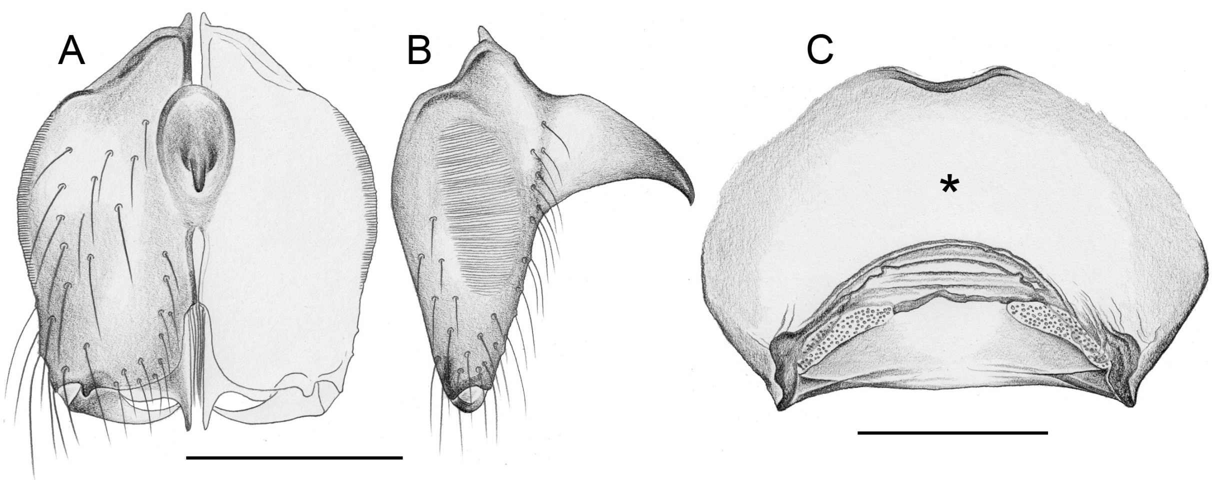

Fig. 90. *Ibotyporanga guanambi* Huber sp. nov., male and female from Brazil, Bahia, N of Guanambi, ZFMK Ar 24370. **A–B**. Male chelicerae, frontal and lateral views. **C**. Cleared female genitalia, dorsal view (asterisk: expandable membranous sac not drawn, cf. Fig. 91D). Scale lines: 0.2 mm.

BODY. Habitus as in Fig. 73B. Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum wider than long (0.56/0.46), with pair of very low and indistinct anterior processes near coxae 1. Abdomen globular; gonopore with four epiandrous spigots in two pairs (Fig. 4E); spinnerets as in congeners (Fig. 8C).

CHELICERAE. As in Fig. 90A–B; width 0.34; with strong median frontal apophysis; stridulatory files (Fig. 10E) very fine and poorly visible in dissecting microscope.

PALPS. As in Fig. 88; coxa unmodified; trochanter with rounded ventral protrusion; femur proximally with distinct retrolateral process directed toward distal, with prolateral stridulatory pick (Fig. 12F), distally widened but unmodified; femur-patella joints not shifted toward one side; patella dorsally slightly longer than medially wide; tibia-tarsus joints barely shifted toward retrolateral side; tarsus with small capsulate tarsal organ (Fig. 13D), without dorsal process; procursus (Fig. 89A–C) with short but wide dorsal branch; main branch with light prolateral band, length of distal transparent element 0.13; genital bulb (Fig. 89E–G) with distinct prolateral sclerite on bulbous part, embolus with slender prolateral ridge.

LEGS. Without spines but with longer and slightly stronger hairs ventrally on femora (Fig. 15B); without curved hairs; with several rows of short vertical hairs on tibia 1 (Fig. 16D); retrolateral trichobothrium of tibia 1 at 51%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~3–4 pseudosegments, distally distinct.

Variation (male)

Dark mark on carapace and dark rings on legs variably distinct, sometimes also ocular area and clypeus dark. Tibia 1 in 12 other males from Guanambi area: 1.20–1.30 (mean 1.24). Males from NE of Marcolino Moura and from S of Contendas do Sincorá have seemingly identical chelicerae but slightly different palps (palpal tibiae slightly thicker: 0.26 vs 0.23; prolateral sclerite on genital bulb proximally narrower, distally wider; dorsal branch of procursus pointed and slightly longer: Fig. 89D; tiny branch subdistally on main branch of procursus slightly more proximal: arrow in Fig. 89D). Tibia 1 in four males from NE of Marcolino Moura and from S of Contendas do Sincorá: 1.23, 1.27, 1.30, 1.33. The species delimitation analysis slightly favors the idea that the sequenced specimen from Guanambi and the specimen from NE of Marcolino Moura are conspecific (Fig. S7). The K2P distance between them was 8.7%.

Female

In general, similar to male (Fig. 73C) but slightly darker and dark marks more distinct; clypeus unmodified, chelicerae without stridulatory files (Fig. 9F); tibia 1 with few vertical hairs; tibia 1 length in 22 females from Guanambi area: 1.13–1.63 (mean 1.40). Epigynum (Fig. 91A) anterior plate oval to trapezoidal, posterior margin almost straight, with wide and shallow anterior pocket; posterior plate short and simple. Internal genitalia (Figs 90C, 91C–D) with pair of narrow and indistinct pore plates posteriorly, with complex system of membranous structures anteriorly.

The females from NE of Marcolino Moura and from near Mucugê may be indistinguishable from those from the Guanambi area (Fig. 91B, E–F). The internal genitalia appear identical except that the distance between pocket and internal folds appears larger (especially in the cleared female from NE of Marcolino Moura); however, this may in part be an artifact of preparation, in part due to slight variation in the shape of the anterior epigynal plate even within localities. Tibia 1 in seven females from NE of Marcolino Moura and from near Mucugê: 1.33–1.57 (mean 1.48).

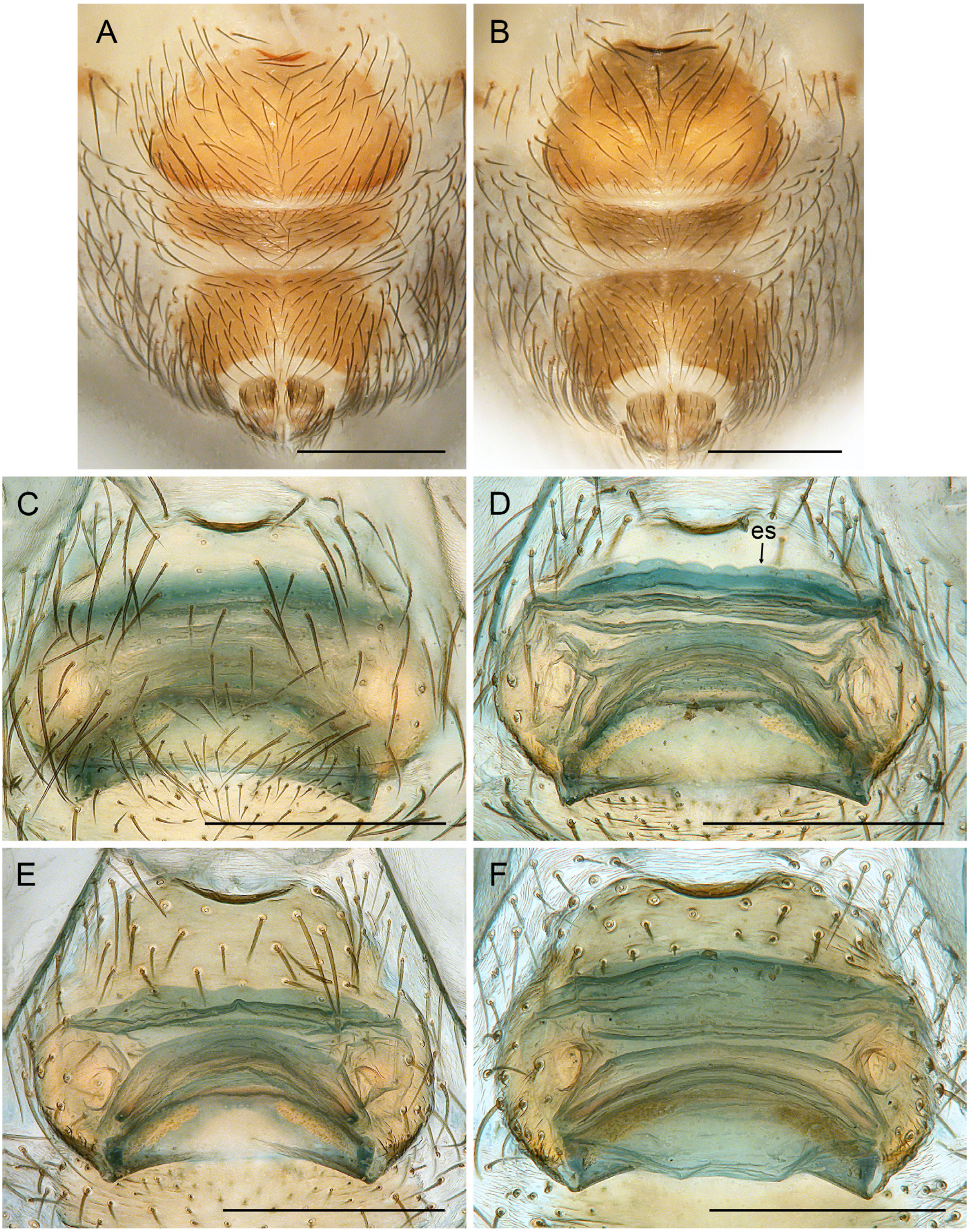

Fig. 91. *Ibotyporanga guanambi* Huber sp. nov. **A–B**. Abdomens, ventral views, females from Brazil, Bahia, N of Guanambi (A), ZFMK Ar 24370, and from Bahia, NE of Marcolino Moura (B), ZFMK Ar 24371. **C–D**. Cleared female genitalia, ventral and dorsal views; same specimen as in A. **E–F**. Cleared female genitalia, dorsal views, females from Bahia, NE of Marcolino Moura (E), ZFMK Ar 24371 and from Bahia, W of Mucugê (F), CHNUFPI 5939. Abbreviation: es = expandable membranous sac. Scale lines: 0.3 mm.

Distribution

Known from three localities in the Guanambi area in Brazil, Bahia, and from three localities 130–200 km NE of Guanambi (Fig. 74); however, all specimens other than those from the Guanambi area are assigned tentatively.

Natural history

The specimens from N of Guanambi were collected on a bare granite outcrop (Fig. 22D) and in the neighboring woodland on clayish soil. Most specimens were found under stones lying on the bare granite outcrop. The specimens from NE of Marcolino Moura were collected on a bare hillside with rocks and thorny shrubs (caatinga) on clayish soil. The female from near Mucugê was found in shrubland at the base of a large granite outcrop. Seven egg sacs were round but slightly flattened, had diameters of 1.5–2.4, and egg diameters of 0.52–0.54; the total number of eggs per egg sac was estimated to be ~10–30.

Ibotyporanga capivara Huber sp. nov.

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Figs 74, 92–95

Diagnosis

Males are easily distinguished from known congeners by very distal origin of dorsal branch of procursus (arrow in Fig. 93C). Females are externally possibly indistinguishable from putatively close relatives (species with split procursus but without median sclerite in female internal genitalia: *I. imale* sp. nov., *I. ramosae*, *I. guanambi* sp. nov., *I. sertao* sp. nov.); *I. ramosae* and *I. imale* seem to have shorter legs (tibia 1 < 1.4); *I. sertao* is distinguished by internal genitalia with distinct pair of convoluted tubes and by absence of large median expandable sac. Distinguished from *I. ramosae*, *I. imale*, and *I. guanambi* by larger pore plates not clearly integrated in internal genital arc (Figs 94C, 95D).

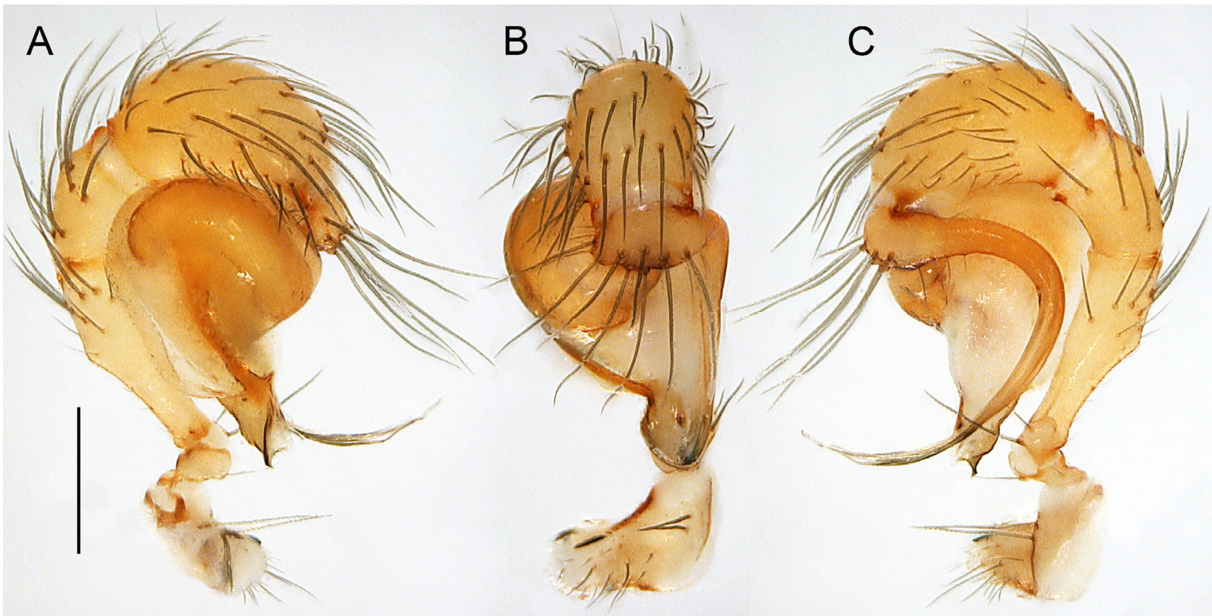

Fig. 92. *Ibotyporanga capivara* Huber sp. nov., male holotype from Brazil, Piauí, Parque Nacional da Serra da Capivara, CHNUFPI 5021. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

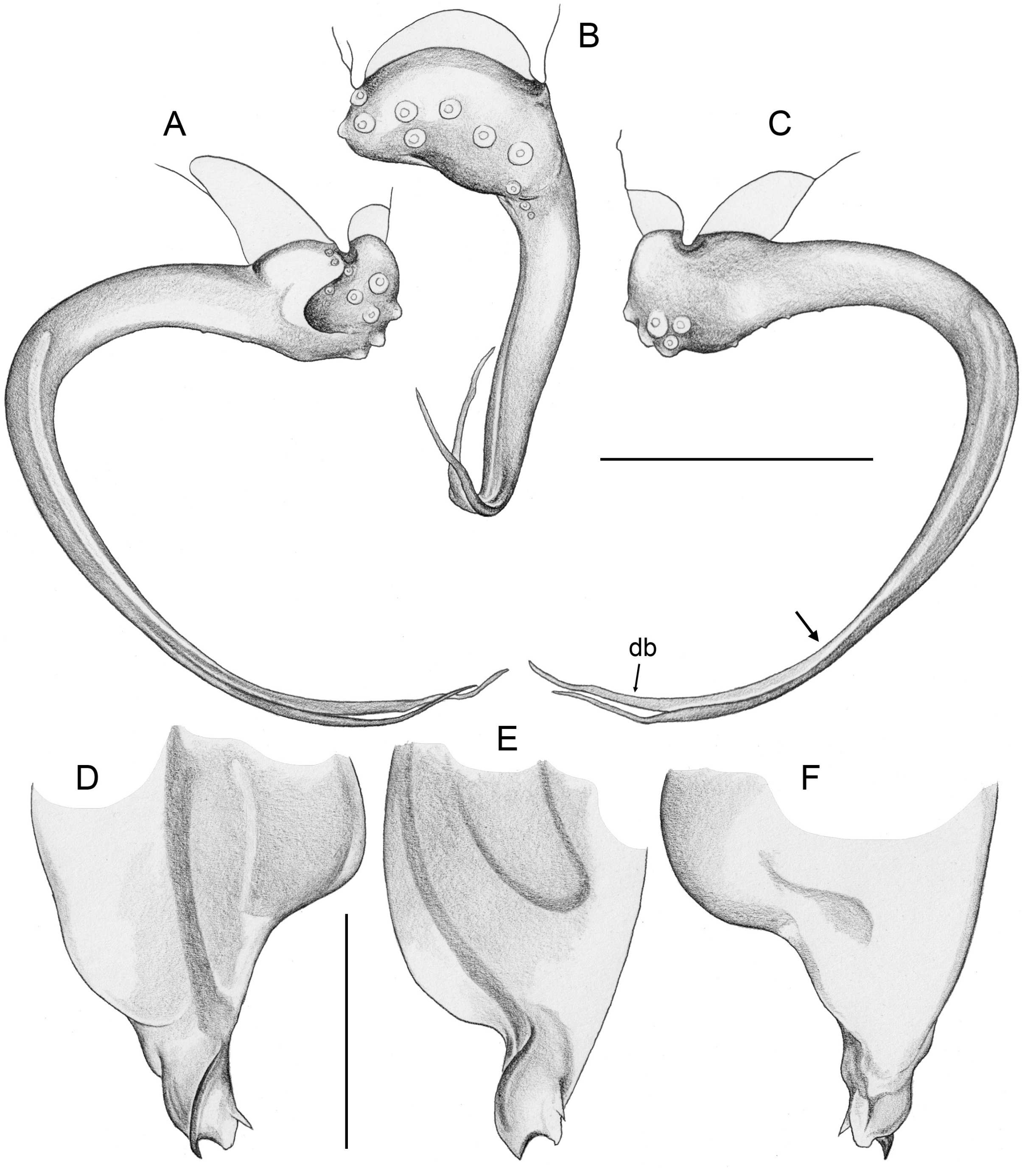

Fig. 93. *Ibotyporanga capivara* Huber sp. nov., male holotype from Brazil, Piauí, Parque Nacional da Serra da Capivara, CHNUFPI 5021. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views (bold arrow: approximate position of origin of dorsal branch). **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views. Abbreviation: db = dorsal branch of procursus. Scale lines: 0.3 mm.

Etymology

The species name is derived from the type locality; noun in apposition.

Type material

Holotype

BRAZIL – **Piauí** • ♂; Coronel José Dias, Parque Nacional da Serra da Capivara, near Toca de Cima dos Pilões; 8.8635° S, 42.5571° W; 415 m a.s.l.; 15 Jul. 2023; L.S. Carvalho and E.G. Noetzold leg.; CHNUFPI 5021.

Paratypes

BRAZIL – **Piauí** • 1 ♀; together with holotype; CHNUFPI 5021 • 1 ♀; same collection data as for holotype; CHNUFPI 5011.

Other material examined

BRAZIL – **Piauí** • 1 ♀, 1 juv.; Coronel José Dias, Parque Nacional da Serra da Capivara, Trilha Interpretativa Hombu, mountain top; 8.8494° S, 42.5661° W; 550 m a.s.l.; 15 Jul. 2023; L.S. Carvalho and E.G. Noetzold leg.; CHNUFPI 5023.

Description

Male (holotype)

Measurements. Total body length 2.7, carapace width 0.95. Distance PME–PME 80 µm; diameter PME 100 µm; distance PME–ALE 30 µm; distance AME–AME 20 µm; diameter AME 80 µm. Leg 1: 6.22 (1.67 + 0.37 + 1.58 + 2.03 + 0.57), tibia 2: 1.30, tibia 3: 1.17, tibia 4: 1.67; tibia 1 L/d: 13; diameters of leg femora 0.21–0.22, of leg tibiae 0.12.

Colour (in ethanol). Prosoma pale ochre-yellow, carapace medially and clypeus darker, ocular area with dark median band; legs ochre-yellow with darker rings on femora (subdistally) and tibiae (proximally and subdistally); abdomen gray, dorsally and laterally with many dark internal marks; ventrally with ochre-yellow plates in front of gonopore and in front of spinnerets.

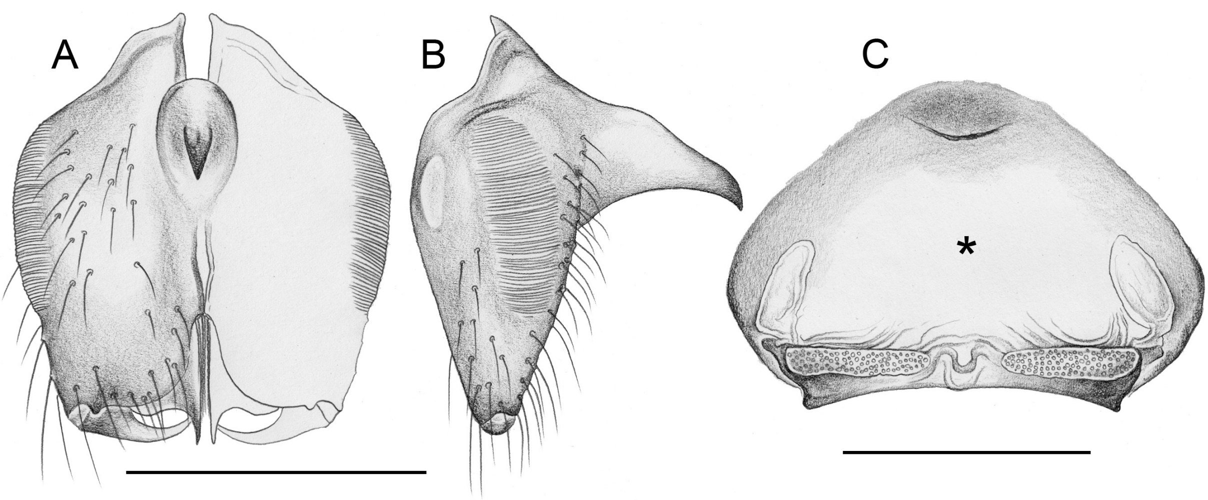

Fig. 94. *Ibotyporanga capivara* Huber sp. nov., male holotype and female paratype from Brazil, Piauí, Parque Nacional da Serra da Capivara. **A–B**. Male chelicerae, frontal and lateral views, CHNUFPI 5021. **C**. Cleared female genitalia, dorsal view (asterisk: expandable membranous sac not drawn, cf. Fig. 95C), CHNUFPI 5011. Scale lines: 0.3 mm.

Body. Habitus as in *I. sertao* sp. nov. (cf. Fig. 73A). Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum wider than long (0.64/0.54), with very low humps near coxae 1 not higher than in female. Abdomen globular.

Chelicerae. As in Fig. 94A–B; with strong median frontal apophysis; stridulatory files large, ridges fine and poorly visible in dissecting microscope.

Palps. As in Fig. 92; coxa unmodified; trochanter with short rounded ventral protrusion; femur proximally with distinct retrolateral process directed toward distal, with prolateral stridulatory pick, distally widened with low dorsal hump; femur-patella joints not shifted toward one side; patella dorsally ~1.6 × as long as medially wide; tibia-tarsus joints slightly shifted toward retrolateral side; tarsus without dorsal process; procursus (Fig. 93A–C) long and widely curved, with light prolateral band, distally split; genital bulb (Fig. 93D–F) with distinct prolateral sclerite on bulbous part, embolus with slender prolateral ridge.

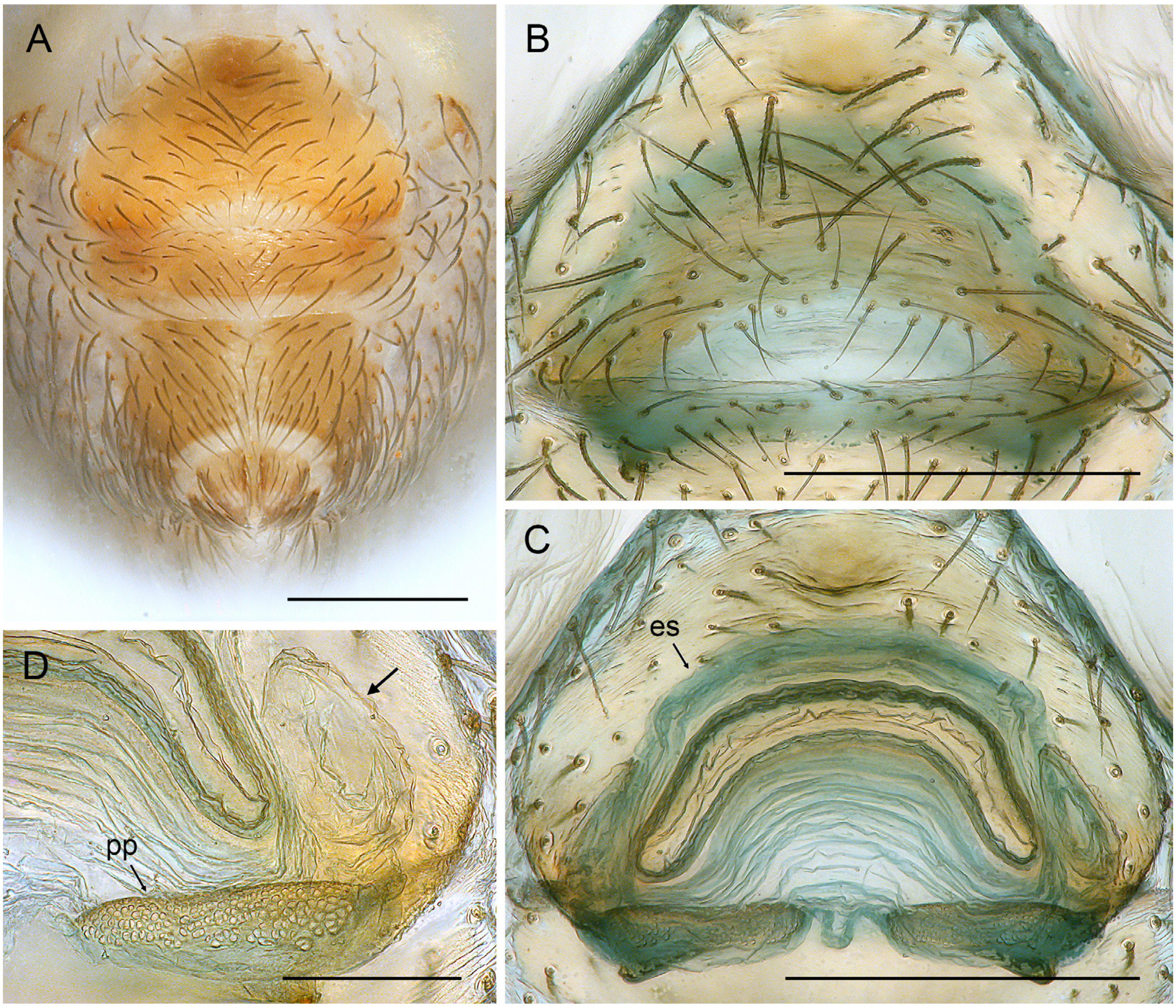

Fig. 95. *Ibotyporanga capivara* Huber sp. nov., female paratype from Brazil, Piauí, Parque Nacional da Serra da Capivara, CHNUFPI 5011. **A**. Abdomen, ventral view. **B**–**C**. Cleared female genitalia, ventral and dorsal views. **D**. Detail of cleared female genitalia, right side, dorsal view (bold arrow: lateral putative sac or pouch). Abbreviations: es = expandable membranous sac; pp = pore plate. Scale lines: 0.3 mm (A–C), 0.1 mm (D).

Legs. Without spines but with longer and slightly stronger hairs ventrally on femora; without curved hairs; with several rows of short vertical hairs on tibia 1; retrolateral trichobothrium of tibia 1 at 57%; prolateral trichobothrium absent on tibia 1; tarsus 1 with 3–4 pseudosegments.

Female

In general, similar to male but clypeus unmodified; tibia 1 with few short vertical hairs. Tibia 1 length in three females: 1.43, 1.50, 1.50. Epigynum (Fig. 95A) anterior plate semi-circular, with indistinct and shallow anterior pocket, posterior margin indented; posterior plate large but simple. Internal genitalia (Figs 94C, 95B–D) with large membranous expandable sac, pair of large pore plates posteriorly, and apparently with pair of lateral membranous sacs or pouches (bold arrow in Fig. 95D).

Distribution

Known from two neighboring localities in the Serra da Capivara, southern Piauí, Brazil (Fig. 74).

Natural history

The spiders were found under arenite rocks in primary arboreal caatinga vegetation, within a national park.

Ibotyporanga emekori Huber & Brescovit, 2003
Figs 23D, G, 73D, 96–100

Ibotyporanga emekori Huber & Brescovit, 2003: 17, figs 1–7, 10–13 (♂♀).

Diagnosis

Distinguished from similar congeners (with split procursus with long dorsal branch; long male palpal patella, i.e., dorsally > 1.8 × as long as medially wide; and median sclerite in female internal genitalia) by combination of: procursus main branch and dorsal branch proximally overlapping, i.e., without space between them in lateral view (Fig. 98C); male palpal tarsus without dorsal hump or process; epigynum not particularly wide (width/length < 1.9); and median sclerite in female internal genitalia with posterior narrowing ('neck') (Fig. 99C). From the very similar *I. payaya* sp. nov. by shorter cheliceral apophysis (compare Figs 99B and 103B), thicker main branch of procursus proximally (compare Figs 98A and 102A), and thinner prolateral sclerite on bulbous part of genital bulb (compare Figs 98D and 102D); females of these two species may be indistinguishable morphologically.

Type material

BRAZIL – **Bahia** • ♂, holotype; Central, [near] Toca do Índio; 11.0183° S, 42.1558° W; 12–18 Jul. 2000; E.F. Ramos and A.D. Brescovit leg.; pitfall, caatinga; IBSP 28760; presumably lost – see section 'On lost types' above.

New material examined

BRAZIL – **Bahia** • 1 ♂; near Mundinho, near Toca do Índio; 11.0195° S, 42.1564° W; 550 m a.s.l.; 24 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5940 • 1 ♂, 1 ♀; same collection data as for preceding; CHNUFPI 9044 [deposited in ZFMK Ar 24373] • 1 ♂, 1 ♀, in pure ethanol; same collection data as for preceding; CHNUFPI 5941 [deposited in ZFMK Br22-224] • 1 ♀; Serra do Pau D'Arco, near Toca do Índio; 11.0534° S, 42.1252° W; 605 m a.s.l.; 26 Aug. 2016; L.S. Carvalho and B.T. Faleiro leg.; CHNUFPI 3697 • 1 ♀; same collection data as for preceding; CHNUFPI 3800 • 1 ♂; Toca de Pilões; 11.0578° S, 42.1044° W; 6 Mar. 2002; E. Folly and S.F. Paula leg.; IBSP 55241 • 1 ♂; same collection data as for preceding; IBSP 55250 • 1 ♂; W of Queimada Nova; 11.0343° S, 42.0682° W; 580 m a.s.l.; 25 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5942 [deposited in ZFMK Ar 24374] • 1 ♂, 1 ♀, in pure ethanol; same collection data as for preceding; CHNUFPI 5943 [deposited

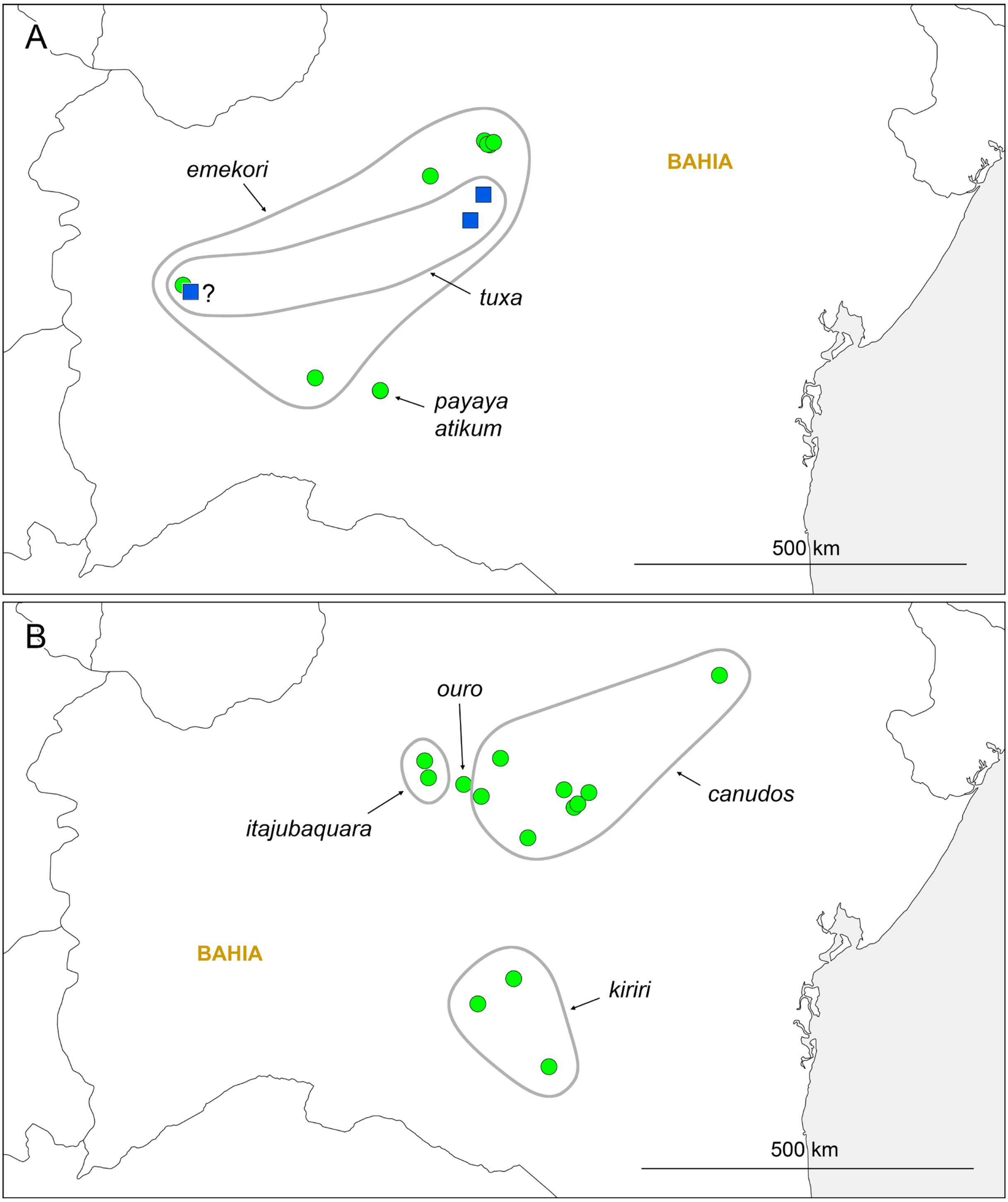

Fig. 96. Known geographic distribution of Brazilian species with long procursus, with dorsal branch on procursus, and with median sclerite in female internal genitalia. The figure is split in order to avoid too much overlap. The question mark denotes a possibly mislabeled female specimen of *I. tuxa* sp. nov.

in ZFMK Br22-226; female abdomen transferred to ZFMK Ar 24374] • 1 ♂; N of Itajubaquara; 11.3607° S, 42.6810° W; 840 m a.s.l.; 23 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5944 [deposited in ZFMK Ar 24375] • 1 ♂, 3 ♀♀; W of Bom Jesus da Lapa, Fazenda Pedra Branca; 13.315° S, 43.795° W; 470 m a.s.l.; 17 Nov. 2022; B.A. Huber and L.S. Carvalho leg.; CHNUFPI 5945 • 1 ♂, 4 ♀♀, 4 juvs; same collection data as for preceding; CHNUFPI 5946 • 1 ♂, 1 ♀; same collection data as for preceding; CHNUFPI 9045 [deposited in ZFMK Ar 24376] • 2 ♂♂; same collection data as for preceding; CHNUFPI 5947 • 2 ♀♀, 2 juvs, in pure ethanol; same collection data as for preceding; CHNUFPI 5948 [deposited in ZFMK Br22-183] • 1 ♀, in pure ethanol; same collection data as for preceding; CHNUFPI 5949 [deposited in ZFMK Br22-183a] • 3 ♀♀, 1 juv., in pure ethanol; same collection data as for preceding; CHNUFPI 5950 [deposited in ZFMK Br22-185].

Assigned tentatively (no male available)

BRAZIL – **Bahia** • 2 ♀♀; São Desiderio, inside Gruta dos Noivos; 12.4166° S, 45.0749° W; 555 m a.s.l.; 28 Aug. 2016; L.S. Carvalho and B.T. Faleiro leg.; CHNUFPI 3706, 3712.

Remark

The coordinates of the type locality given above (copied from Huber & Brescovit 2003) are apparently not correct. We visited this exact spot in 2022 but found no cave or shelter in this place. We were not able to identify the exact location of Toca do Índio.

Redescription

Male (ZFMK Ar 24374)

Measurements. Total body length 1.7, carapace width 0.72. Distance PME–PME 55 µm; diameter PME 55 µm; distance PME–ALE 20 µm; distance AME–AME 15 µm; diameter AME 40 µm. Leg 1: 4.03 (1.10 + 0.30 + 1.00 + 1.20 + 0.43), tibia 2: 0.87, tibia 3: 0.63, tibia 4: 1.23; tibia 1 L/d: 11; diameters of leg femora 0.18, of leg tibiae 0.09–0.10.

Colour (in ethanol). Prosoma and legs mostly ochre-yellow, carapace posteriorly medially slightly darker, femora and tibiae with indistinct darker subdistal rings on femora and tibiae; abdomen pale gray

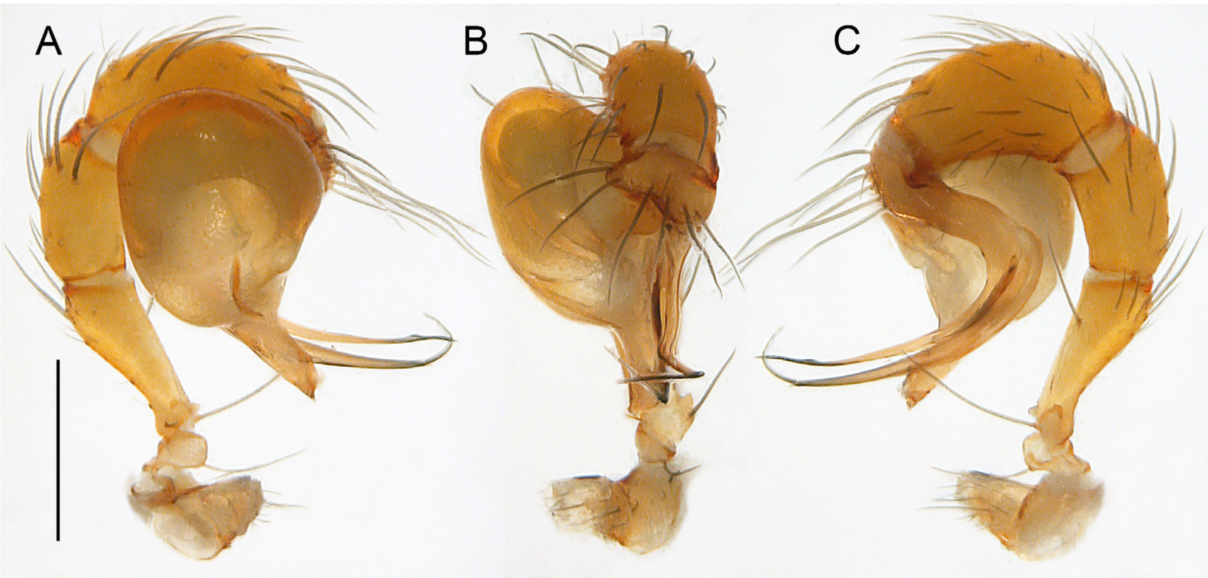

Fig. 97. *Ibotyporanga emekori* Huber & Brescovit, 2003, male from Brazil, Bahia, W of Queimada Nova, ZFMK Ar24374. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

with many darker internal marks dorsally and laterally; ventrally with indistinct light ochre plates in front of gonopore and in front of spinnerets.

Body. Habitus as in Fig. 73D. Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum slightly wider than long (0.48/0.45), with pair of very low and indistinct humps near coxae 1 not different from those of female. Abdomen globular.

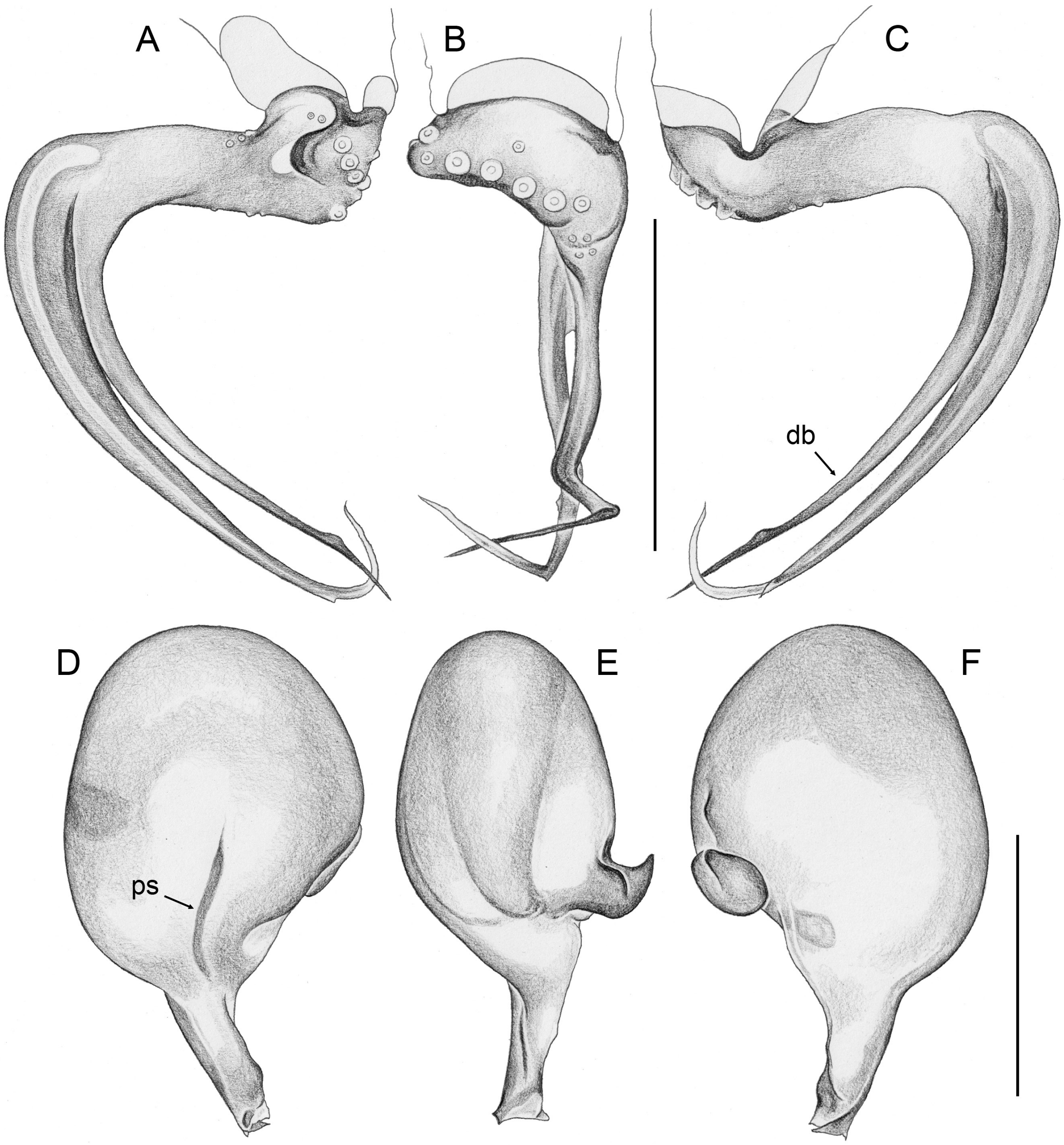

Fig. 98. *Ibotyporanga emekori* Huber & Brescovit, 2003, male from Brazil, Bahia, W of Queimada Nova, ZFMK Ar24374. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views. **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views. Abbreviations: db = dorsal branch of procursus; ps = prolateral sclerite. Scale lines: 0.3 mm.

Chelicerae. As in Fig. 99A–B; width 0.29; with short median frontal apophysis; stridulatory files very fine and poorly visible in dissecting microscope.

Palps. As in Fig. 97; coxa unmodified; trochanter with short ventral protrusion; femur proximally with distinct retrolateral process directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints not shifted toward one side; patella dorsally ~1.9 × as long as medially wide; tibia with two trichobothria in very proximal position; tibia-tarsus joints slightly shifted toward retrolateral side; tarsus without dorsal process; procursus (Fig. 98A–C) long and slender, with long dorsal branch proximally very close to main branch, distally in dorsal view S-shaped; main branch with light prolateral band, with tiny subdistal side branch (130 µm from tip), distal tip membranous, strongly curved towards dorsal and prolateral; genital bulb (Fig. 98D–F) with narrow but distinct prolateral sclerite on bulbous part, embolus very simple, with indistinct processes.

Legs. Without spines but with longer hairs ventrally on femora; without curved hairs; with several rows of short vertical hairs on tibiae 1 and 2; retrolateral trichobothrium of tibia 1 at 59%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~4–5 pseudosegments, distally fairly distinct.

Variation (male)

Tibia 1 in nine newly examined males: 0.90–1.02 (mean 0.96); in holotype: 0.84; in six other males examined previously (Huber & Brescovit 2003): 0.88–0.96. Dark rings on legs sometimes barely visible or absent. The species delimitation analysis (Fig. S7) suggested a possible split between the sequenced specimens from near Toca do Índio and those from Fazenda Pedra Branca. The K2P distance between them was 14.1%. However, no morphological differences were found between males from these two localities.

Female

In general, similar to male but with slightly darker legs, ocular area, and clypeus; clypeus unmodified; leg tibiae with few short vertical hairs; tibia 1 length in 17 newly examined females: 0.88–1.17 (mean 1.00); in three other females examined previously (Huber & Brescovit 2003): 0.88–0.96. Epigynum (Fig. 100A–C) anterior plate trapezoidal to oval, posterior margin almost straight, with weakly curved

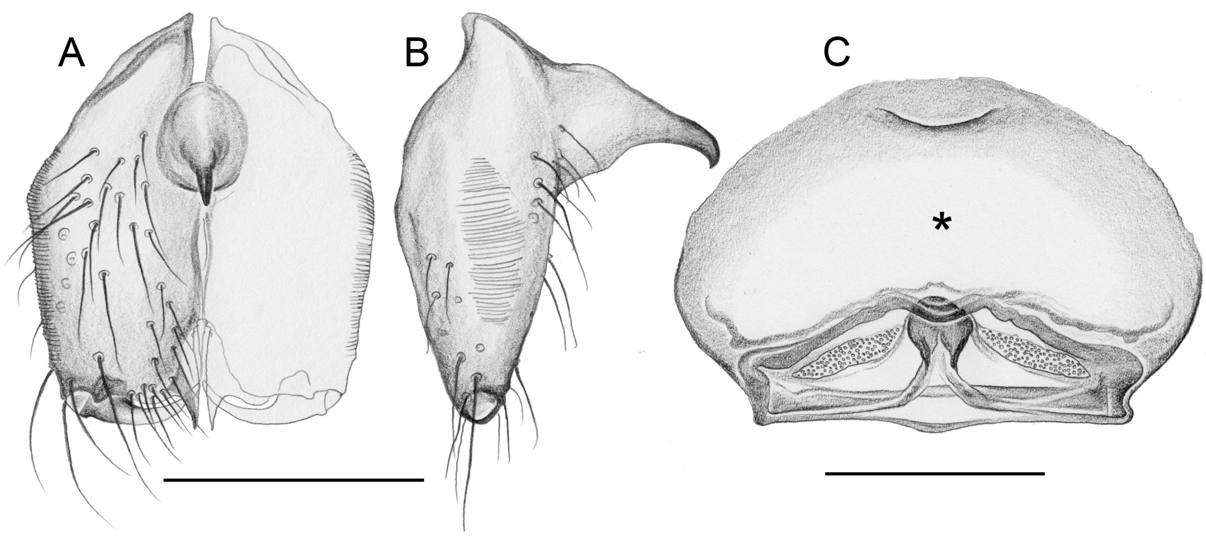

Fig. 99. *Ibotyporanga emekori* Huber & Brescovit, 2003. **A–B**. Male chelicerae, frontal and lateral views, male from Brazil, Bahia, Toca do Índio (adapted from Huber & Brescovit 2003). **C**. Cleared female genitalia, dorsal view (asterisk: expandable membranous sac not drawn, cf. Fig. 100E), female from Bahia, near Toca do Índio, ZFMK Ar 24373. Scale lines: 0.2 mm.

and shallow pocket near anterior margin; posterior plate wide but short. Internal genitalia (Figs 99C, 100D–E) with median sclerotized structure, distinct pair of pore plates, and large expandable anterior sac.

The females from São Desiderio are assigned tentatively because no males are available from this locality. One female was cleared, and the internal genitalia (not figured) appear essentially identical to those of two cleared females from Serra do Calcário. In a cleared female from Fazenda Pedra Branca, the median internal genital sclerite appears slightly longer than in females from Serra do Calcário.

Distribution

Known from several localities in Brazil, Bahia (Fig. 96A); females from São Desiderio are assigned tentatively, see above.

Natural history

The newly collected spiders from near Toca do Índio and from W of Queimada Nova were found under rocks in thorny woodland (Fig. 23G). At both localities, the microhabitat was shared with *Ibotyporanga diroa*. At Fazenda Pedra Branca (Fig. 23D), the spiders were found in the leaf litter of a thorny shrubland

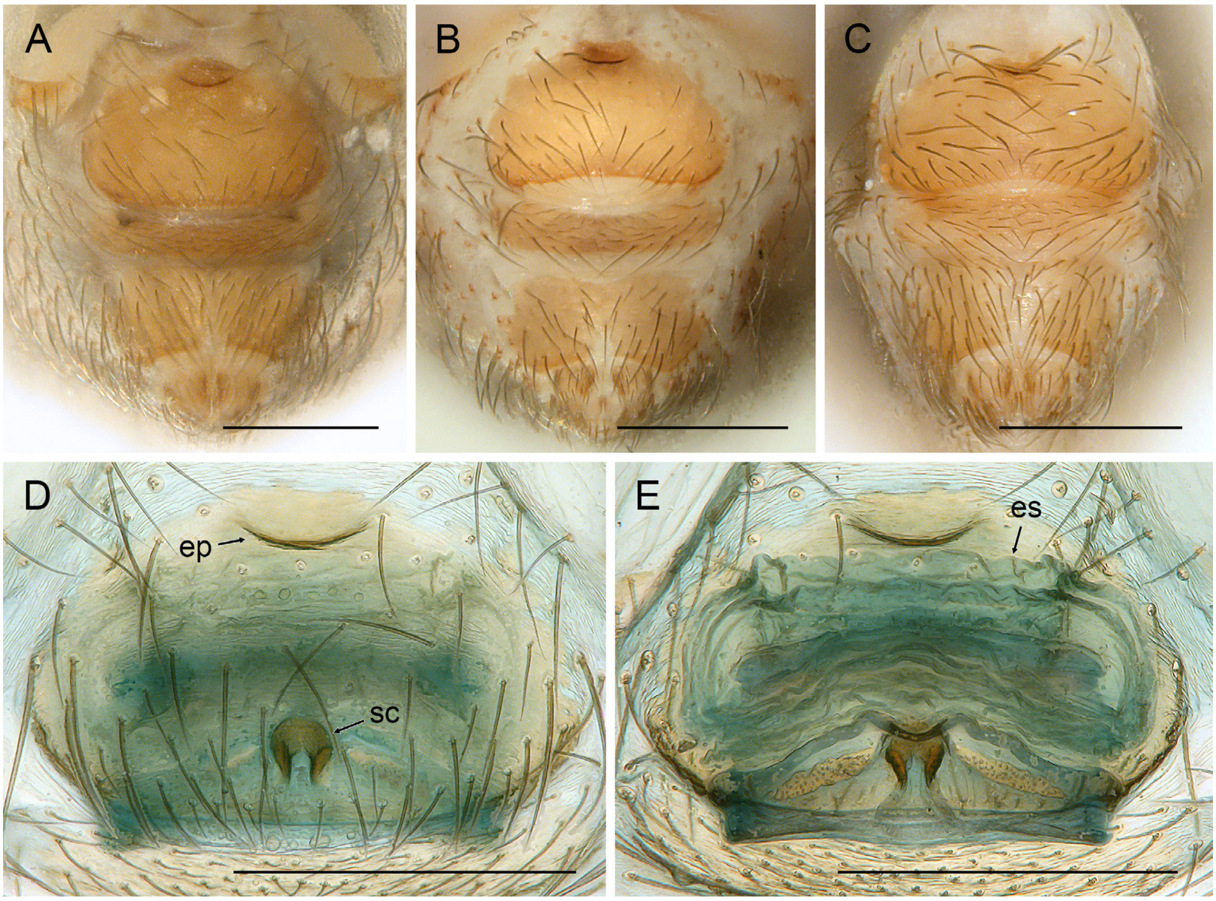

Fig. 100. *Ibotyporanga emekori* Huber & Brescovit, 2003. **A–C**. Abdomens, ventral views, females from Brazil, Bahia, near Toca do Índio (A), ZFMK Ar 24373, from Bahia, W of Queimada Nova (B), ZFMK Ar 24374, and from Bahia, Fazenda Pedra Branca (C), ZFMK Ar 24376. **D–E**. Cleared female genitalia, ventral and dorsal views; same specimen as in A. Abbreviations: ep = epigynal pocket; es = expandable membranous sac; sc = internal sclerite. Scale lines: 0.3 mm.

(caatinga) on sandy soil. Here, the microhabitat was shared with another Ninetinae spider, an undescribed representative of *Kambiwa*. North of Itajubaquara, the single male was found under a stone, in degraded shrubland with scattered trees; the habitat was shared with *I. itajubaquara* sp. nov. Three egg sacs were round but slightly flattened, had diameters of ~1.6, and egg diameters of ~0.54–0.58; the total number of eggs per egg sac was ~15–20.

Ibotyporanga payaya Huber sp. nov.

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Figs 96, 101–104; SEM Figs 2G, 3A–B, 4F, 5D, 6D, 8E–F, 12A–B, 13E, 14E, 16E, 18G

Diagnosis

Distinguished from similar congeners (with split procursus with long dorsal branch; long male palpal patella, i.e., dorsally > 1.8 × as long as medially wide; and sclerite in female internal genitalia) by combination of: procursus main branch and dorsal branch proximally overlapping, i.e., without space between them in lateral view (Fig. 102C); male palpal tarsus without dorsal hump or process; epigynum not particularly wide (width/length < 1.9); and median sclerite in female internal genitalia with posterior narrowing ('neck') (Fig. 103C). Distinguished from very similar *I. emekori* by longer cheliceral apophysis (compare Figs 99B and 103B), thinner main branch of procursus proximally (compare Figs 98A and 102A), and wider prolateral sclerite on bulbous part of genital bulb (compare Figs 98D and 102D); females of these two species may be indistinguishable morphologically. Distinguished from the very similar *I. atikum* sp. nov. also by main procursus branch in dorsal view wider (compare Figs 102B and 110B) and epigynal pocket straighter and indistinct (compare Figs 103C and 111C).

Etymology

The species name honors the Payayá, an indigenous people of Brazil that lives in Bahia; noun in apposition.

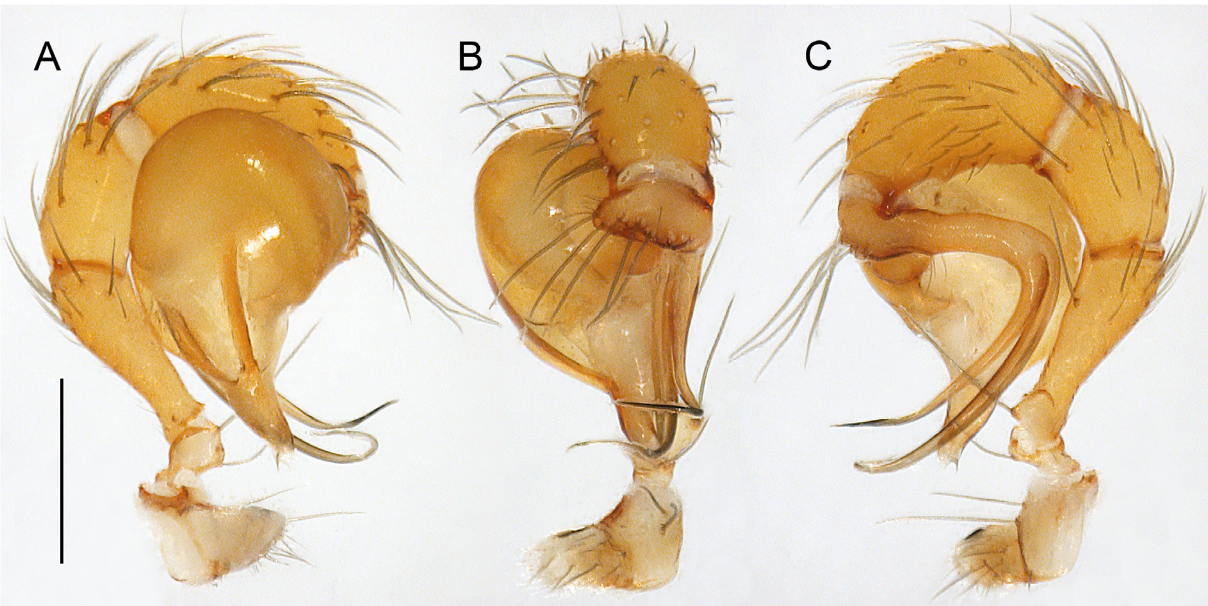

Fig. 101. *Ibotyporanga payaya* Huber sp. nov., male from Brazil, Bahia, SE of Bom Jesus da Lapa, 'site 1', ZFMK Ar 24377. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

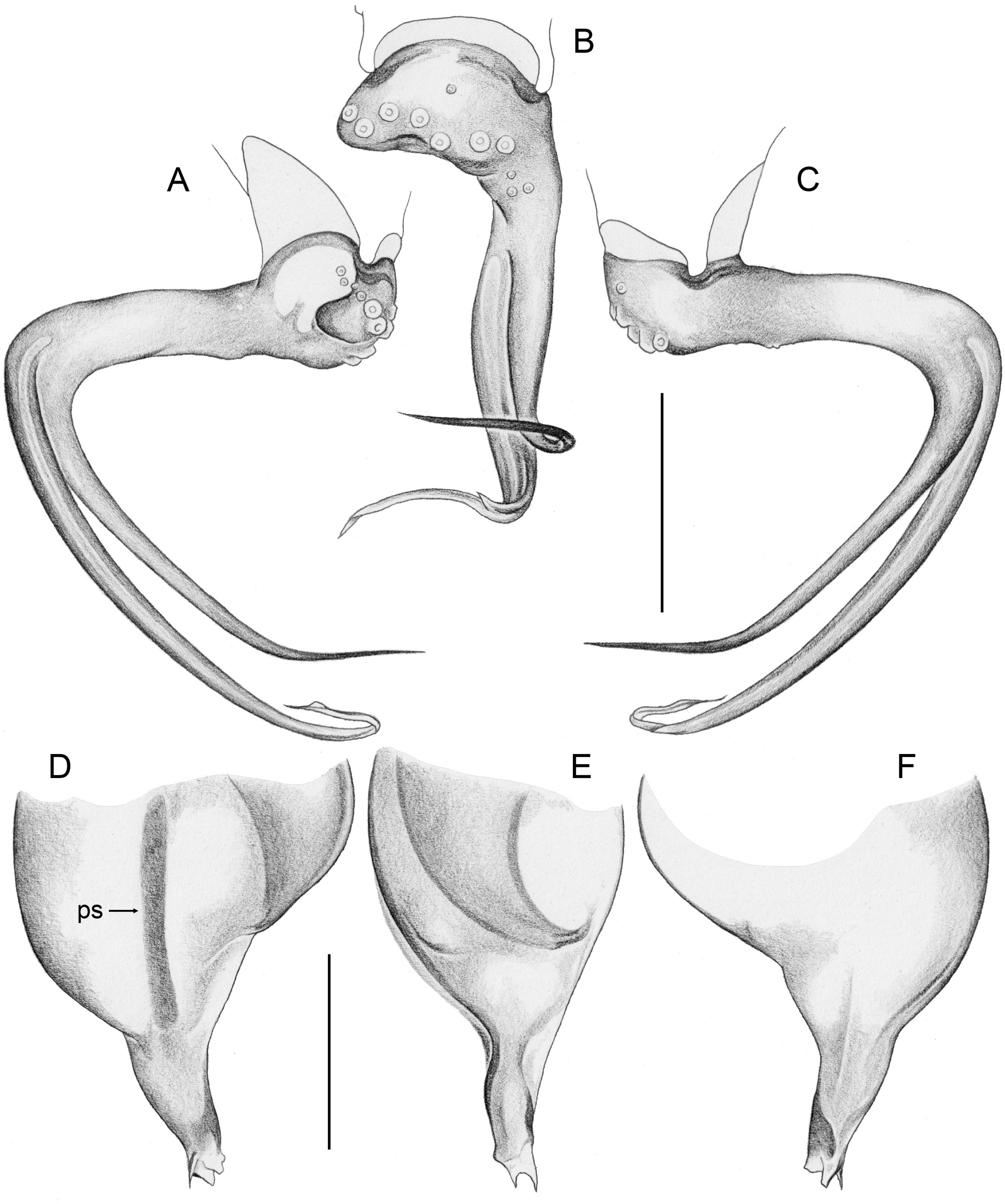

Fig. 102. *Ibotyporanga payaya* Huber sp. nov., male from Brazil, Bahia, SE of Bom Jesus da Lapa, 'site 1', ZFMK Ar 24377. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views. **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views. Abbreviation: ps = prolateral sclerite. Scale lines: 0.2 mm.

Type material

Holotype

BRAZIL – **Bahia** • ♂; SE of Bom Jesus da Lapa, ‘site 1’; 13.4398° S, 43.1643° W; 520 m a.s.l.; 18 Nov. 2022; B.A. Huber and L.S. Carvalho leg.; CHNUFPI 5951.

Paratypes

BRAZIL – **Bahia** • 4 ♂♂; same collection data as for holotype; CHNUFPI 5952 • 1 ♂, 1 ♀; same collection data as for holotype; UFMG 31658 • 1 ♂, 1 ♀; same collection data as for holotype; CHNUFPI 9046 [deposited in ZFMK Ar 24377] • 1 ♂, 1 ♀; same collection data as for holotype; CHNUFPI 5953.

Other material examined

BRAZIL – **Bahia** • 2 ♂♂, 3 ♀♀, in pure ethanol; same collection data as for holotype; CHNUFPI 5954 [deposited in ZFMK Br22-192; one female abdomen transferred to ZFMK Ar 24377; 1 ♂, 1 ♀ used for SEM] • 1 ♀, in pure ethanol; same collection data as for holotype but ‘site 2’, 13.4383° S, 43.1645° W; 480 m a.s.l.; CHNUFPI 5955 [deposited in ZFMK Br22-193].

Description

Male (holotype)

Measurements. Total body length 2.0, carapace width 0.75. Distance PME–PME 55 µm; diameter PME 70 µm; distance PME–ALE 20 µm; distance AME–AME 15 µm; diameter AME 45 µm. Leg 1: 4.25 (1.13 + 0.27 + 1.10 + 1.30 + 0.45), tibia 2: 0.90, tibia 3: 0.85, tibia 4: 1.28; tibia 1 L/d: 11; diameters of leg femora 0.17–0.18; of leg tibiae 0.10.

Colour (in ethanol). Prosoma and legs ochre-yellow, carapace medially with darker band; legs without darker rings; abdomen gray with many darker internal marks; ventrally with light ochre plates in front of gonopore and in front of spinnerets.

Body. Habitus as in *I. emekori* (cf. Fig. 73D). Ocular area slightly raised. Carapace with distinct but shallow thoracic groove (Fig. 3A). Clypeus with sclerotized rim with median notch. Sternum wider than long (0.52/0.44), with very low and indistinct anterior processes near coxae 1 not different from those in

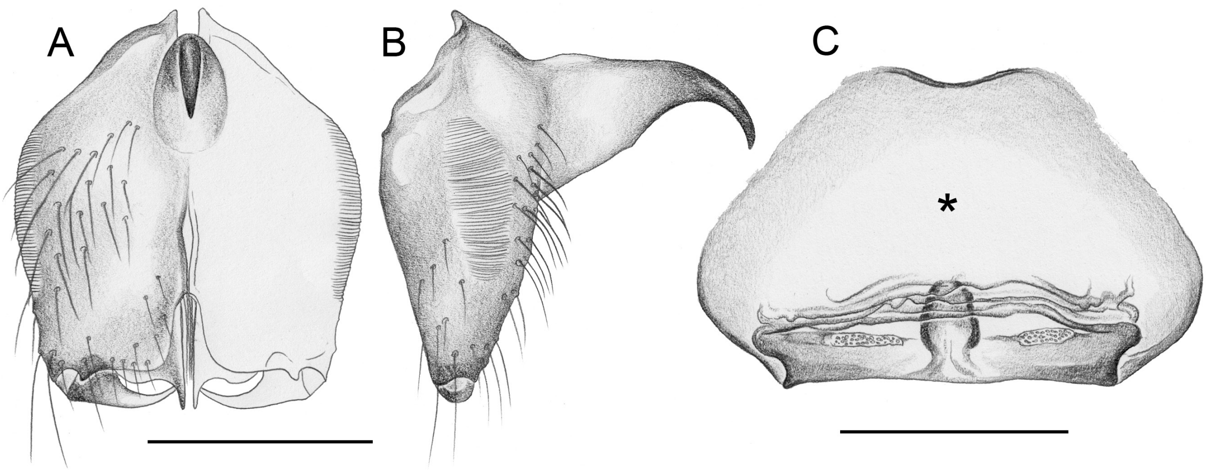

Fig. 103. *Ibotyporanga payaya* Huber sp. nov., male and female from Brazil, Bahia, SE of Bom Jesus da Lapa, ‘site 1’, ZFMK Ar 24377. **A–B**. Male chelicerae, frontal and lateral views. **C**. Cleared female genitalia, dorsal view (asterisk: expandable membranous sac not drawn, cf. Fig. 104C). Scale lines: 0.2 mm.

female. Abdomen globular; gonopore with four epiandrous spigots in two groups (Fig. 4F); spinnerets as in congeners (Figs 6D, 8E).

Chelicerae. As in Fig. 103A–B; width 0.30; with long median frontal apophysis; stridulatory files very fine and poorly visible in dissecting microscope.

Palps. As in Fig. 101; coxa unmodified; trochanter with short ventral process; femur proximally with distinct retrolateral process slightly directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints not shifted toward one side; patella dorsally ~2.0× as long as medially wide; tibia with two trichobothria in relatively proximal position; tibia-tarsus joints slightly shifted toward retrolateral side; tarsus with small capsulate tarsal organ (Fig. 13E), without dorsal process; procursus (Fig. 102A–C) with long dorsal branch distally curved towards prolateral, main branch with light prolateral band, with short subdistal side-branch (Fig. 12A–B), distally transparent and curved towards prolateral; genital bulb (Fig. 102D–F) with distinct prolateral sclerite on bulbous part, embolus very simple, with indistinct processes.

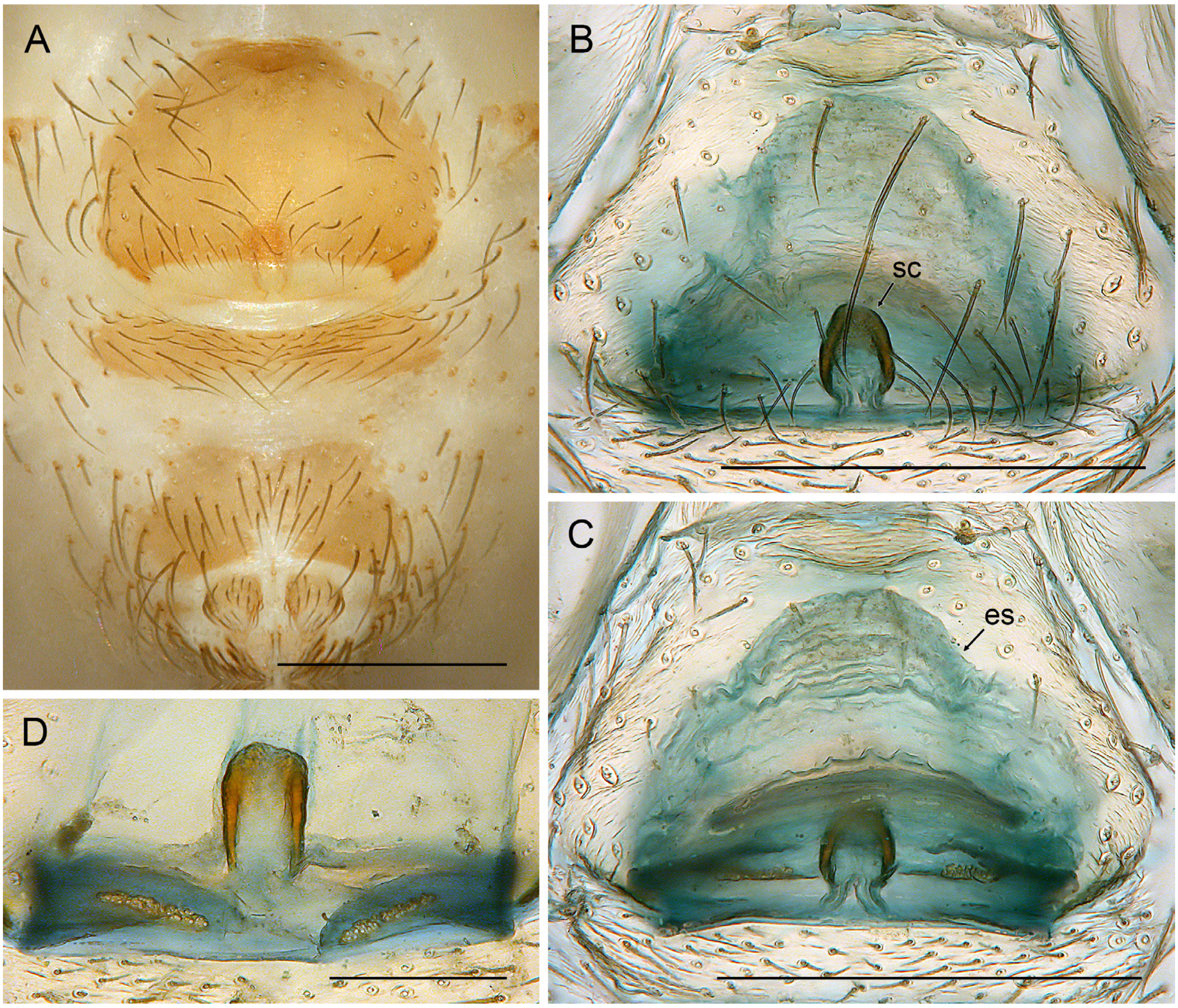

Fig. 104. *Ibotyporanga payaya* Huber sp. nov., female from Brazil, Bahia, SE of Bom Jesus da Lapa, 'site 1', ZFMK Ar 24377. **A**. Abdomen, ventral view. **B–C**. Cleared female genitalia, ventral and dorsal views. **D**. Detail of cleared female genitalia, dorsal view. Abbreviations: es = expandable membranous sac; sc = internal sclerite. Scale lines: A–C = 0.3 mm; D = 0.1 mm.

LEGS. Without spines but with longer hairs ventrally on femora; without curved hairs; with short vertical hairs on tibiae 1 and 2 (Fig. 16E); retrolateral trichobothrium of tibia 1 at 60%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~3–4 pseudosegments, only distally distinct.

Variation (male)
Tibia 1 in ten males (incl. holotype): 1.00–1.17 (mean 1.10).

Female
In general, similar to male but clypeus unmodified, leg tibiae with few vertical hairs. Tibia 1 in seven females: 1.03–1.20 (mean 1.07). Epigynum (Fig. 104A) anterior plate trapezoidal to semicircular, posterior margin straight to weakly indented, with indistinct and shallow anterior pocket (Fig. 5D); posterior plate large but simple. Internal genitalia (Figs 103C, 104B–D) with pair of elongated pore plates posteriorly, median sclerite with posterior constriction, and very thin-walled large anterior expandable membranous sac.

Distribution

Known from type locality only, in Brazil, Bahia (Fig. 96A).

Natural history

Most specimens were found under rocks and in dead pieces of wood in an arboreous caatinga neighboring a large granite outcrop. The granite outcrop itself was occupied by two other species of Ninetinae tentatively placed in *Kambiwa*. One single female was found at the neighboring roadside, in the leaf litter among low shrubs and grasses. This site was mainly occupied by a different species of *Ibotyporanga*, *I. atikum* sp. nov., and we cannot confidently dismiss the possibility that this single female got mislabeled and also originated from the first site.

Ibotyporanga tuxa Huber sp. nov.

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Figs 73E, 96, 105–108

Diagnosis

Males are easily distinguished from known congeners by long process on palpal tarsus (arrow in Fig. 106C) and by wide distance between main and dorsal branches of procursus (Fig. 106C); also by widened tip of dorsal branch of procursus (Fig. 106A–C). Females differ from known congeners by shape of epigynum (Fig. 108A–C; triangular rather than trapezoidal or oval, with distinct posterior indentation) and by internal sclerite with long stalk (Figs 107D, 108D–G).

Etymology

The species name honors the Tuxá, an indigenous people of Brazil that lives in Bahia; noun in apposition.

Type material

Holotype
BRAZIL – **Bahia** • ♂; W of Barra do Mendes, Ipupiara, at BA-046; 11.794° S, 42.288° W; 810 m a.s.l.; bare rock field with scattered shrubs; 21 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5956.

Paratypes
BRAZIL – **Bahia** • 1 ♂, 7 ♀♀; same collection data as for holotype; CHNUFPI 5957 • 1 ♂, 1 ♀; same collection data as for holotype; UFMG 31659 • 1 ♂, 1 ♀; same collection data as for holotype;

CHNUFPI 9047 [deposited in ZFMK Ar 24378] • 2 ♂♂; same locality as for holotype but 250 m NW; 11.7930° S, 42.2901° W; 765 m a.s.l.; 25 Aug. 2016; L.S. Carvalho and B.T. Faleiro leg.; CHNUFPI 3669, 3776 • 5 ♀♀; same collection data as for preceding; CHNUFPI 3696, 3716, 3717, 3738, 3756 • 3 ♀♀; same collection data as for preceding; CHNUFPI 3795.

Other material examined

BRAZIL – **Bahia** • 1 ♂ 10 ♀♀, in pure ethanol; same collection data as for holotype; CHNUFPI 5958 [deposited in ZFMK Br22-204; two female abdomens transferred to ZFMK Ar 24378].

Assigned tentatively (no males available)

BRAZIL – **Bahia** • 1 ♀; NW of Ibipeba; 11.540° S, 42.170° W; 590–640 m a.s.l.; hillside with scattered trees and thorny shrubs; 22 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5959 • 1 ♀, without legs, possibly mislabeled; São Desiderio, inside Gruta dos Noivos; 12.4166° S, 45.0749° W; 555 m a.s.l.; 28 Aug. 2016; L.S. Carvalho and B.T. Faleiro leg.; CHNUFPI 3659.

Description

Male (holotype)

MEASUREMENTS. Total body length 2.3, carapace width 0.85. Distance PME–PME 60 µm; diameter PME 75 µm; distance PME–ALE 20 µm; distance AME–AME 25 µm; diameter AME 45 µm. Leg 1: 4.65 (1.20 + 0.30 + 1.25 + 1.45 + 0.45), tibia 2: 1.05, tibia 3: 1.00, tibia 4: 1.45; tibia 1 L/d: 11; diameters of leg femora 0.21–0.22, of leg tibiae 0.10–0.11.

COLOUR (in ethanol). Prosoma and legs light ochre, leg femora and tibiae distally slightly darkened; abdomen pale gray with indistinct darker internal marks; ventrally with light ochre plates in front of gonopore and in front of spinnerets.

BODY. Habitus as in Fig. 73E. Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with thick sclerotized rim with median notch (Fig. 107A). Sternum slightly wider than long (0.56/0.52), with pair of very low and indistinct anterior humps near coxae 1. Abdomen globular.

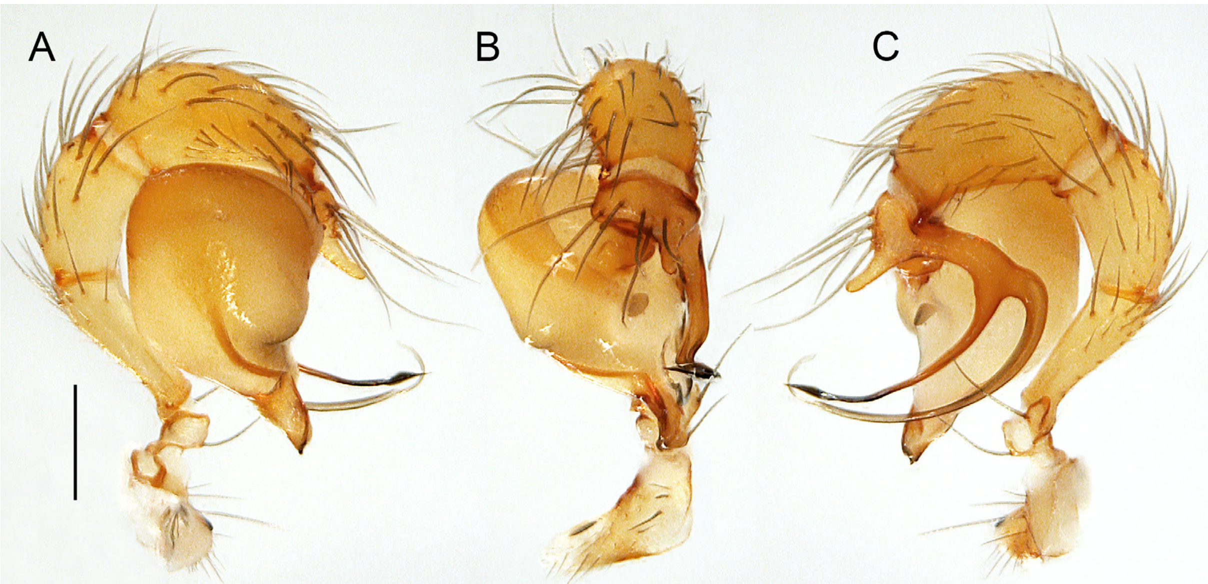

Fig. 105. *Ibotyporanga tuxa* Huber sp. nov., male from Brazil, Bahia, W of Barra do Mendes, ZFMK Ar 24378. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

CHELICERAE. As in Fig. 107B–C; with long median frontal apophysis; stridulatory files very fine and poorly visible in dissecting microscope.

PALPS. As in Fig. 105; coxa unmodified; trochanter with short ventral process; femur proximally with distinct retrolateral process directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints not shifted toward one side; patella dorsally ~1.9 × as long as medially wide; tibia with two trichobothria in relatively proximal position; tibia-tarsus joints barely shifted toward retrolateral side; tarsus with distinct finger-shaped dorsal process; procursus (Fig. 106A–C) with long dorsal branch widely separated in lateral view from main branch; dorsal branch slightly flattened (wider in dorsal view than in lateral view) and distally S-shaped, with widened and sclerotized tip; main

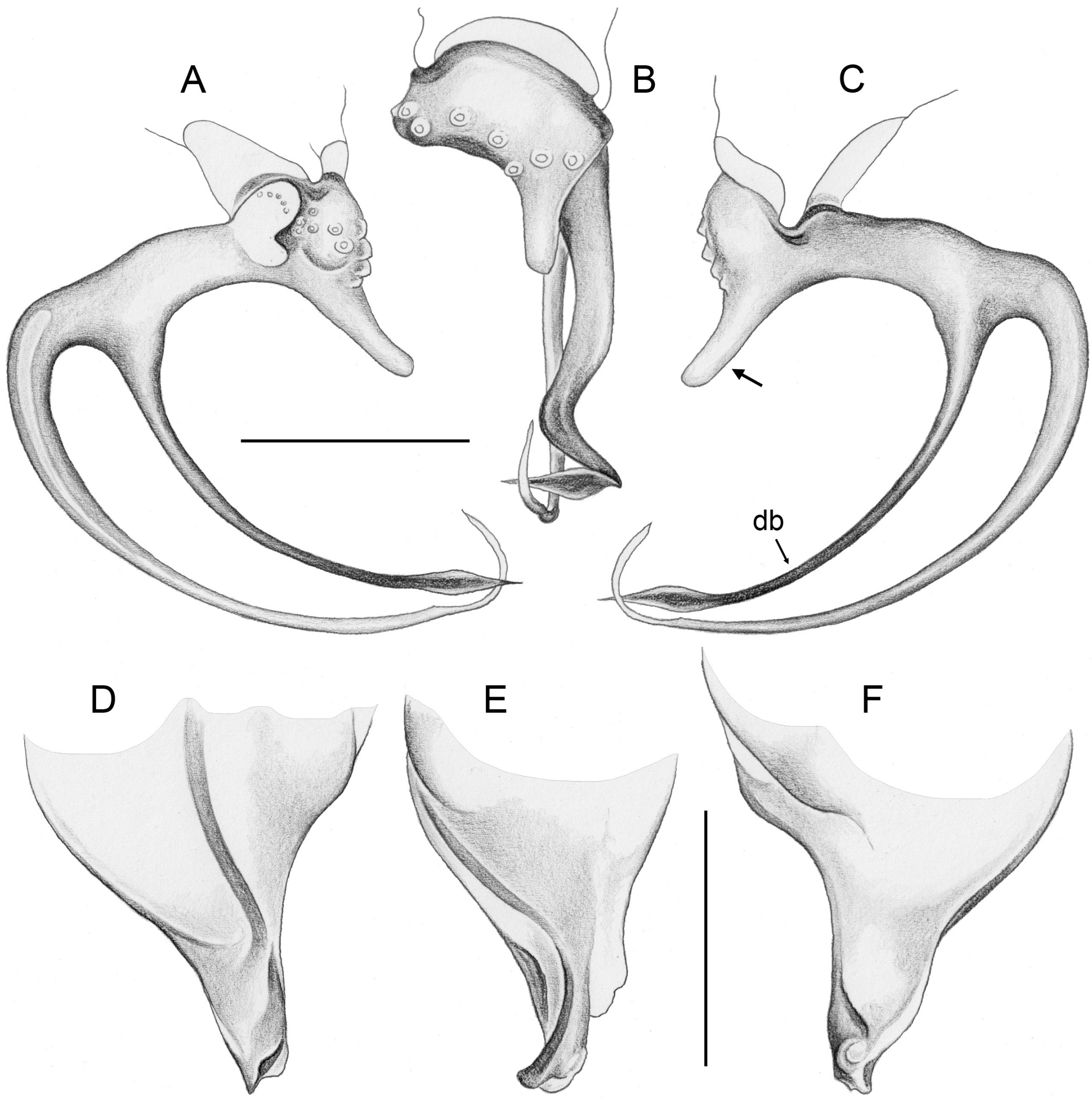

Fig. 106. *Ibotyporanga tuxa* Huber sp. nov., male from Brazil, Bahia, W of Barra do Mendes, ZFMK Ar 24378. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views (bold arrow: distinctive dorsal process on tarsus). **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views. Abbreviation: db = dorsal branch of procursus. Scale lines: 0.3 mm.

procursus branch with light prolateral band, distally slender and transparent; genital bulb (Fig. 106D–F) with prolateral sclerite on bulbous part, embolus with dorsal ridge curved towards prolateral.

Legs. Without spines but with longer and slightly stronger hairs ventrally on femora; without curved hairs; apparently without short vertical hairs; retrolateral trichobothrium of tibia 1 at 60%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~4–5 indistinct pseudosegments.

Variation (male)

Tibia 1 in six males (incl. holotype): 1.10–1.30 (mean 1.20).

Female

In general, similar to male but slightly darker (prosoma and legs mostly light brown rather than light ochre), carapace medially darker, ocular area and clypeus darker, leg femora and tibiae distally not darkened; slightly larger than males (total body length ~2.5) and with slightly longer legs: tibia 1 in 21 females: 1.25–1.55 (mean 1.42); sternum unmodified. Epigynum (Fig. 108A–B) anterior plate roughly triangular with rounded edges, posterior margin indented, with wide and shallow anterior pocket; posterior plate large but simple. Internal genitalia (Figs 107D, 108D–E) with pair of narrow pore plates posteriorly, median sclerite with long posterior stalk, and very thin-walled large membranous expandable sac.

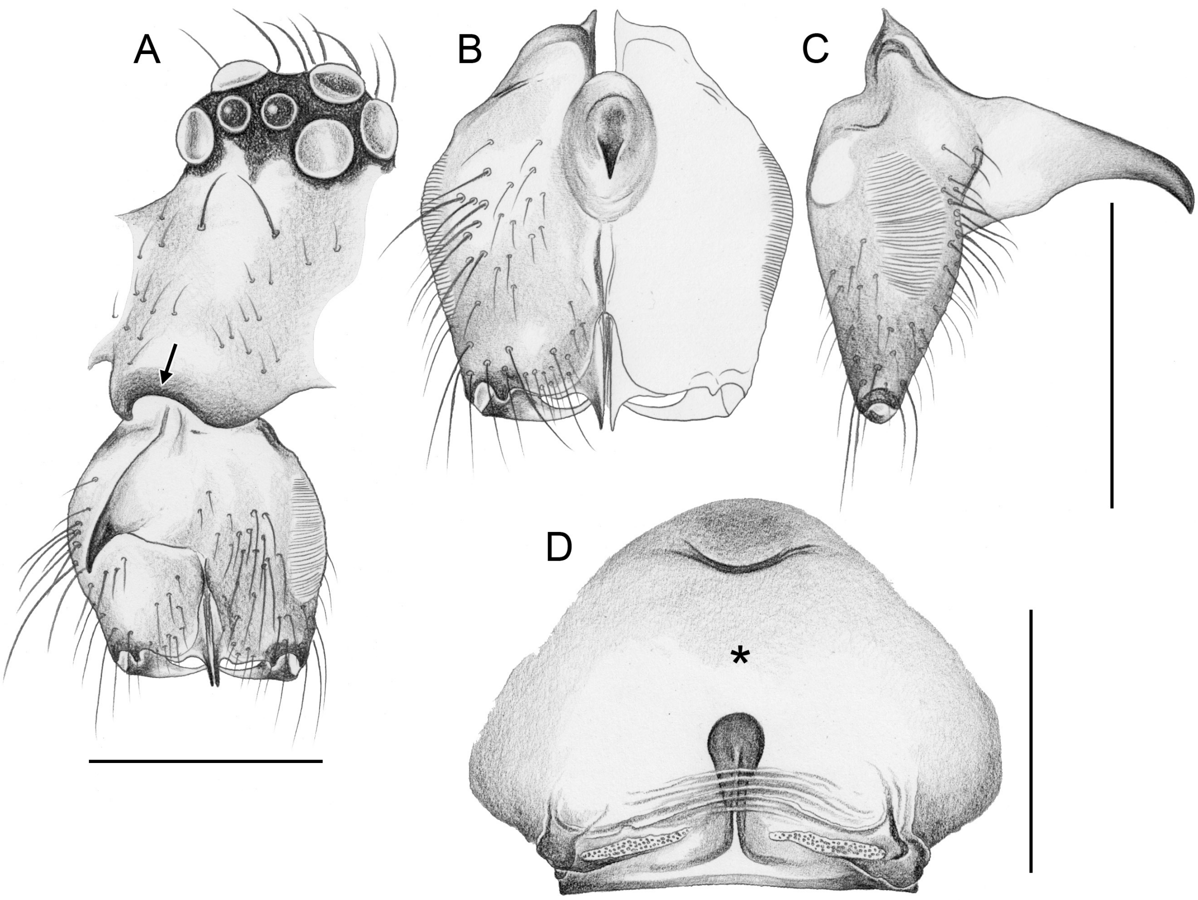

Fig. 107. *Ibotyporanga tuxa* Huber sp. nov., male and female from Brazil, Bahia, W of Barra do Mendes, ZFMK Ar 24378. **A**. Male ocular area, clypeus, and chelicerae, oblique frontal view (arrow: clypeus notch). **B–C**. Male chelicerae, frontal and lateral views. **D**. Cleared female genitalia, dorsal view (asterisk: expandable membranous sac not drawn, cf. Fig. 108E). Scale lines: 0.3 mm.

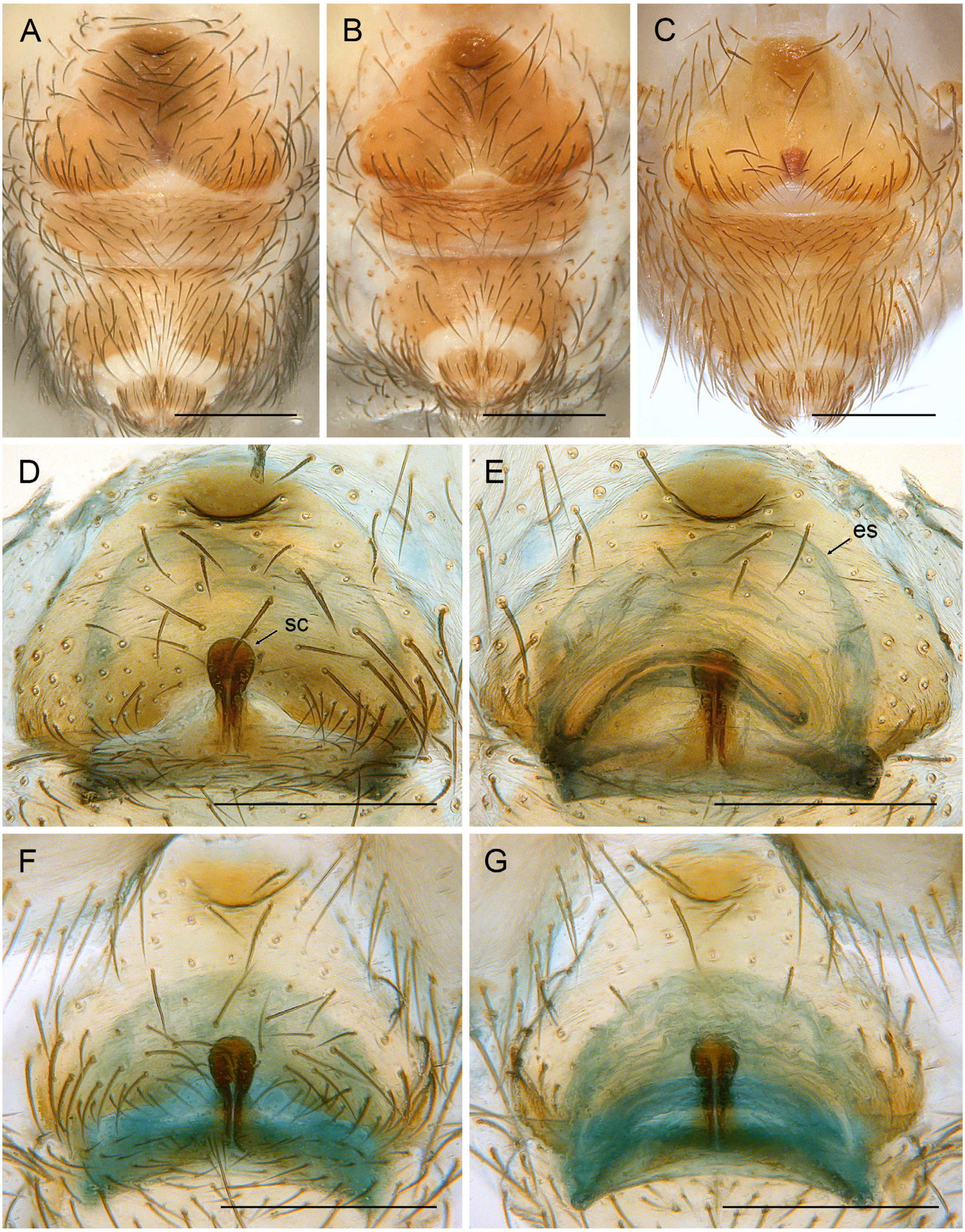

Fig. 108. *Ibotyporanga tuxa* Huber sp. nov. **A–C**. Female abdomens, ventral views, females from Brazil, Bahia, W of Barra do Mendes (A–B), ZFMK Ar 24378, and from Bahia, São Desiderio (C), CHNUFPI 3659. **D–E**. Cleared female genitalia, ventral and dorsal views, same specimen as in B. **F–G**. Cleared female genitalia, ventral and dorsal views, same specimen as in C. Abbreviations: es = expandable membranous sac; sc = internal sclerite. Scale lines: 0.3 mm.

The females from NW of Ibipeba and from São Desiderio are assigned tentatively because no males are available from these localities; the female from NW of Ibipeba has slightly shorter legs (tibia 1: 1.15); all legs are missing in the female from São Desiderio. The epigyna of both females appear indistinguishable from those of topotypical females (Fig. 108C); the same is true for the cleared genitalia of the female from São Desiderio (Fig. 108F–G; the female from NW of Ibipeba was not cleared).

Distribution

Known from type locality in Brazil, Bahia, and from two further localities ~30 km NNE and 310 km E, respectively, of the type locality (Fig. 96A); however, the specimens (only females) from the latter two localities are assigned tentatively. The female from São Desiderio is possibly mislabeled.

Natural history

At the type locality, the spiders were found under stones lying on a large rock plateau with very sparse vegetation. Females were very abundant and did either not move upon turning the stone or ran a short distance and quickly stopped when reaching a small depression on the stone. Males appeared less abundant and were much quicker at escaping. Many females were carrying an egg sac. Nine egg sacs from the type locality were round but slightly flattened, had diameters of 1.8–2.6, and egg diameters of 0.54–0.60; the total number of eggs per egg sac was ~30–40.

Ibotyporanga atikum Huber sp. nov.

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Figs 23C, 96, 109–112

Diagnosis

Distinguished from similar congeners (with split procursus with long dorsal branch; long male palpal patella, i.e., dorsally >1.8 × as long as medially wide; and sclerite in female internal genitalia) by combination of: procursus main branch and dorsal branch proximally overlapping, i.e., without space between them in lateral view (Fig. 110C); male palpal tarsus with very low dorsal hump (arrow in Fig. 110C); embolus with distinctive dorsal apophysis (arrow in Fig. 110E); and median sclerite in female internal genitalia very simple, almost rectangular (Fig. 112C–D). Distinguished from the very similar *I. payaya* sp. nov. also by main procursus branch in dorsal view narrower (compare Figs 102B and 110B), shorter cheliceral apophysis (compare Figs 103B and 111B), and epigynal pocket more curved and distinct (compare Figs 103C and 111C).

Etymology

The species name honors the Atikum, an indigenous people of Brazil that lives in Bahia and Pernambuco; noun in apposition.

Type material

Holotype

BRAZIL – **Bahia** • ♂; SE of Bom Jesus da Lapa, 'site 2'; 13.4383° S, 43.1645° W; 480 m a.s.l.; 18 Nov. 2022; B.A. Huber and L.S. Carvalho leg.; CHNUFPI 5960.

Paratypes

BRAZIL – **Bahia** • 1 ♀; same collection data as for holotype; CHNUFPI 5961 • 1 ♂, 1 ♀; same collection data as for holotype; CHNUFPI 9048 [deposited in ZFMK Ar 24379] • 1 ♀; same collection data as for holotype; CHNUFPI 5962.

Description

Male (holotype)

Measurements. Total body length 1.7, carapace width 0.73. Distance PME–PME 45 µm; diameter PME 70 µm; distance PME–ALE 25 µm; distance AME–AME 20 µm; diameter AME 35 µm. Leg 1: 4.03 (1.07 + 0.27 + 1.03 + 1.23 + 0.43), tibia 2: 0.83, tibia 3: 0.77, tibia 4: 1.20; tibia 1 L/d: 11; diameters of leg femora 0.17; of leg tibiae 0.09–0.10.

Colour (in ethanol). Prosoma and legs ochre-yellow, carapace medially with darker Y-mark and posterior narrow band, leg femora and tibiae subdistally slightly darkened; abdomen gray with many darker internal marks; ventrally with light ochre plates in front of gonopore and in front of spinnerets.

Body. Habitus as in *I. ouro* sp. nov. (cf. Fig. 73G). Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum wider than long (0.52/0.42), with very low and indistinct anterior processes near coxae 1 not different from those in female. Abdomen globular.

Chelicerae. As in Fig. 111A–B; width 0.29; with relatively short median frontal apophysis; stridulatory files very fine and poorly visible in dissecting microscope.

Palps. As in Fig. 109; coxa unmodified; trochanter with short ventral process; femur proximally with distinct retrolateral process directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints not shifted toward one side; patella dorsally ~2.0 × as long as medially wide; tibia with two trichobothria in relatively proximal position; tibia-tarsus joints barely shifted toward retrolateral side; tarsus with very low dorsal hump (arrow in Fig. 110C); procursus (Fig. 110A–C) with long dorsal branch distally curved towards prolateral, main branch with light prolateral band, subdistal short side-branch, distally slender and transparent; genital bulb (Fig. 110D–F) with narrow prolateral sclerite on bulbous part, embolus with distinctive dorsal sclerite.

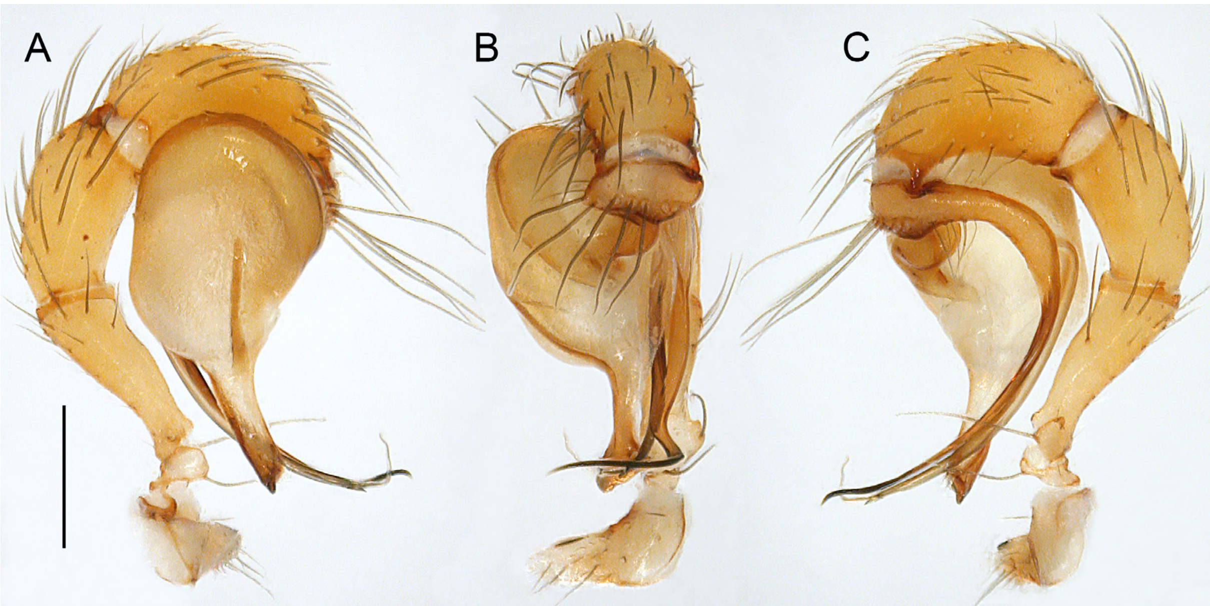

Fig. 109. *Ibotyporanga atikum* Huber sp. nov., male from Brazil, Bahia, SE of Bom Jesus da Lapa, 'site 2', ZFMK Ar 24379. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

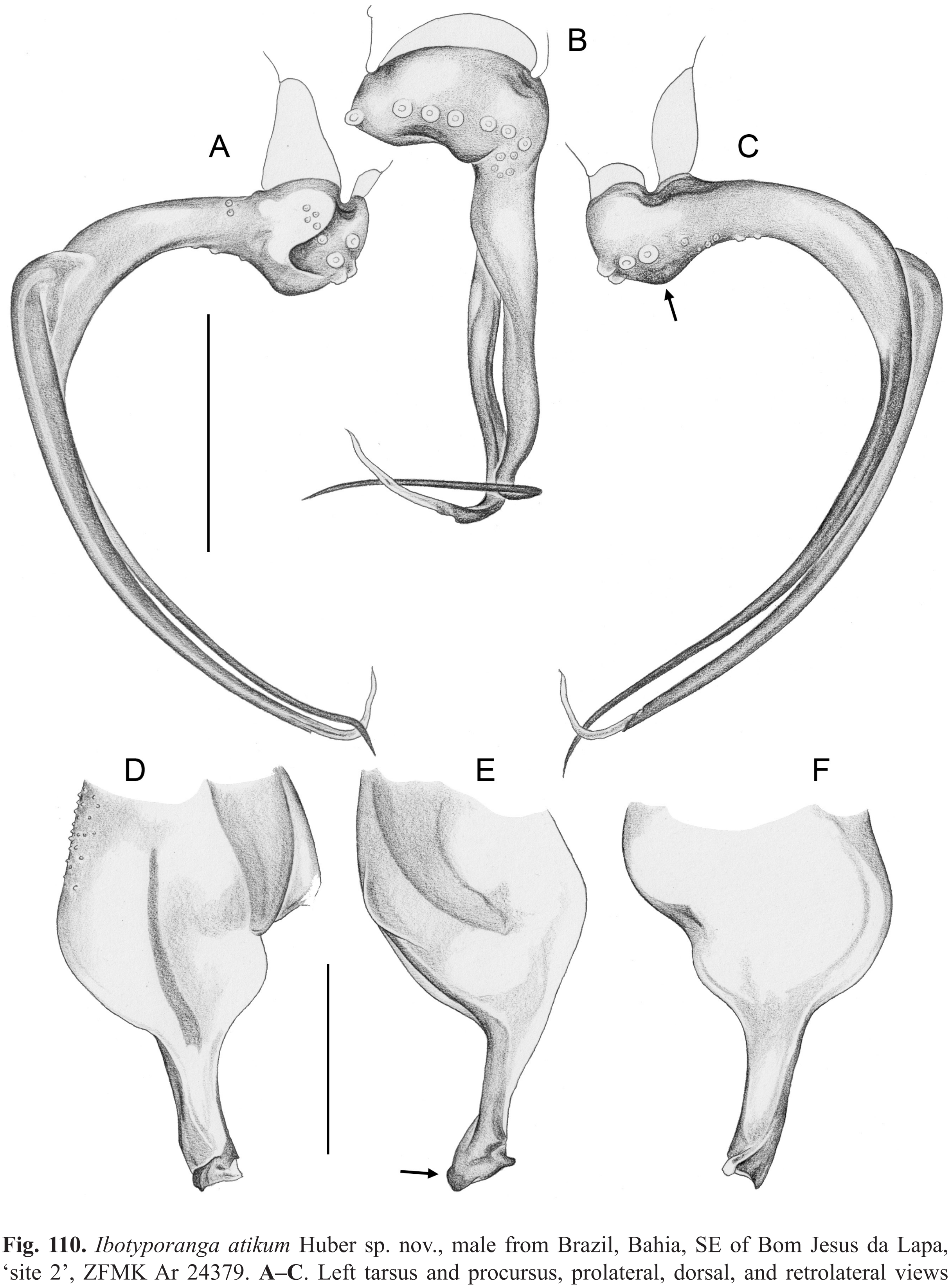

Fig. 110. *Ibotyporanga atikum* Huber sp. nov., male from Brazil, Bahia, SE of Bom Jesus da Lapa, ‘site 2’, ZFMK Ar 24379. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views (arrow: indistinct dorsal hump on tarsus). **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views (arrow: distinctive apophysis on embolus). Scale lines: 0.3 mm.

Legs. Without spines but with longer hairs ventrally on femora; without curved hairs; with short vertical hairs on tibia 1; retrolateral trichobothrium of tibia 1 at 60%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~3–4 pseudosegments, only distally distinct.

Variation (male)
Tibia 1 in second male: 1.18; dark rings on legs slightly more distinct in second male.

Female
In general, similar to male but clypeus unmodified, tibia 1 with few vertical hairs. Tibia 1 in three females: 1.07, 1.17, 1.23. Epigynum (Fig. 112A) anterior plate roughly semi-circular, posterior margin weakly indented, with distinct and strongly curved anterior pocket; posterior plate large but simple. Internal genitalia (Figs 111C, 112B–D) with pair of oval pore plates posteriorly, strongly sclerotized median structure, and very thin-walled large anterior expandable membranous sac.

Distribution

Known from type locality only, in Brazil, Bahia (Fig. 96A).

Natural history

The spiders were collected in the leaf litter of degraded roadside vegetation, among low shrubs and grasses. On the neighboring granite outcrop, we found a different species of *Ibotyporanga*, *I. payaya* sp. nov.

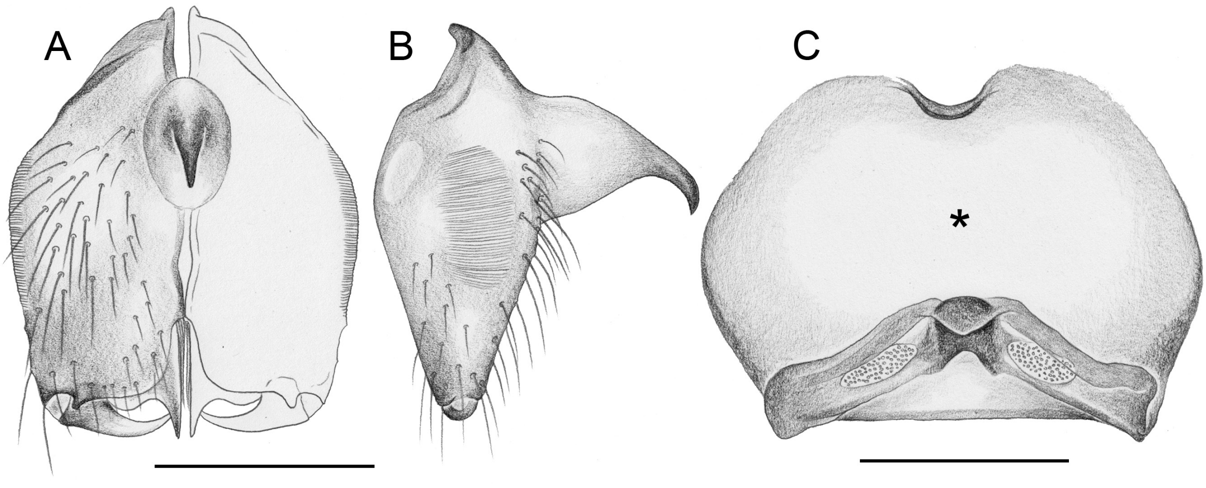

Fig. 111. *Ibotyporanga atikum* Huber sp. nov., male and female from Brazil, Bahia, SE of Bom Jesus da Lapa, 'site 2', ZFMK Ar 24379. **A–B**. Male chelicerae, frontal and lateral views. **C**. Cleared female genitalia, dorsal view (asterisk: expandable membranous sac not drawn, cf. Fig. 112C). Scale lines: 0.2 mm.

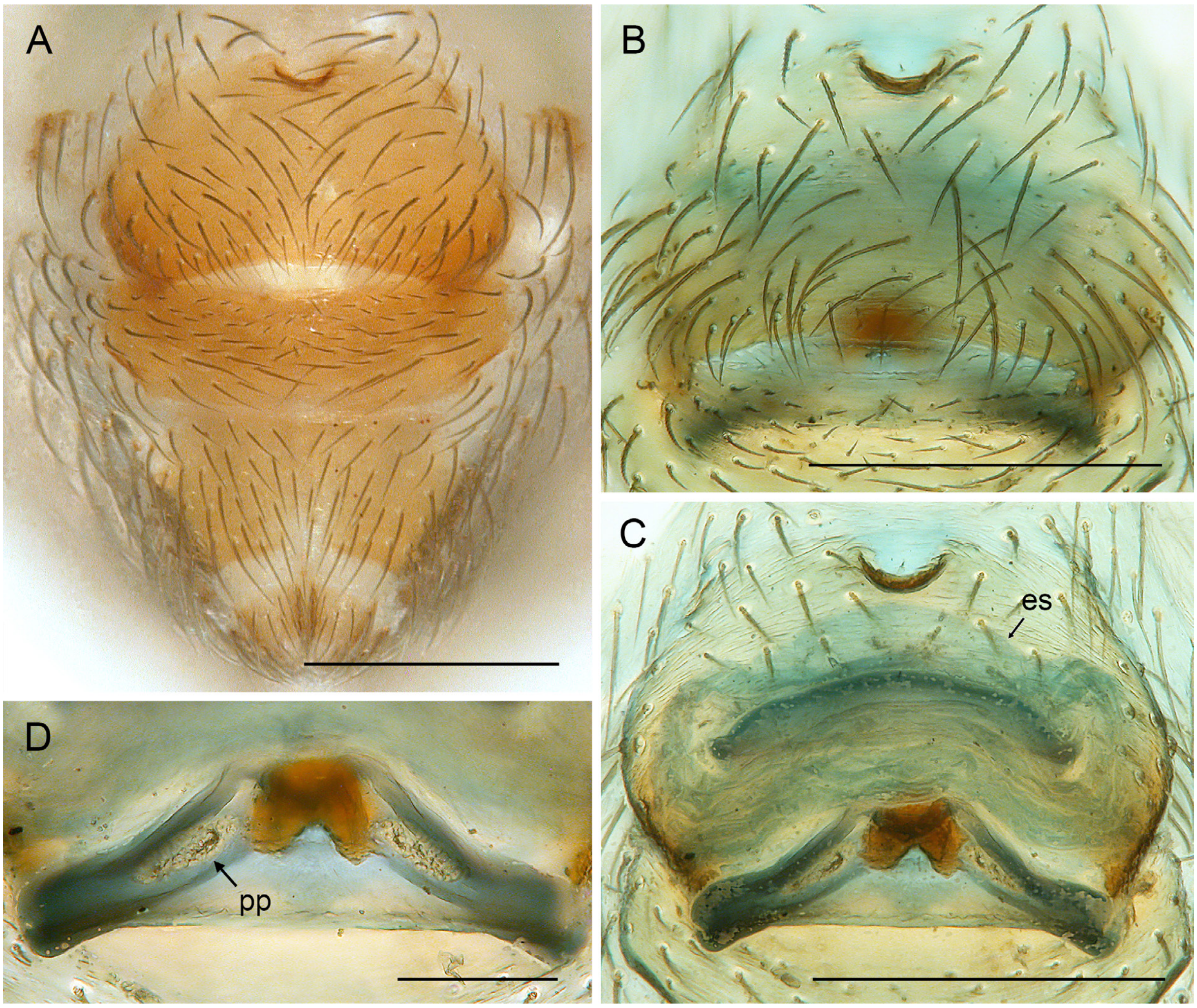

Fig. 112. *Ibotyporanga atikum* Huber sp. nov., female from Brazil, Bahia, SE of Bom Jesus da Lapa, 'site 2', ZFMK Ar 24379. **A**. Abdomen, ventral view. **B–C**. Cleared female genitalia, ventral and dorsal views. **D**. Detail of cleared female genitalia, dorsal view. Abbreviations: es = expandable membranous sac; pp = pore plate. Scale lines: A–C = 0.3 mm; D = 0.1 mm.

Ibotyporanga kiriri Huber sp. nov.
urn:lsid:zoobank.org:act:7CCAD29A-4A21-46C0-9312-F6324D66B228
Figs 23E, 73F, 96, 113–116

Diagnosis

Distinguished from similar congeners (with split procursus with long dorsal branch; long male palpal patella, i.e., dorsally > 1.8 × as long as medially wide; wide epigynum, i.e., > 1.9 × as wide as long; distinct epigynal pocket, i.e., narrow and relatively deep; and sclerite in female internal genitalia) by combination of: procursus main and dorsal branches proximally not overlapping, i.e., with space between them in lateral view (Fig. 114C); male palpal tarsus with small dorsal hump (arrow in Fig. 114C); and median sclerite in female internal genitalia without posterior constriction (Figs 115C, 116B–C); from *I. itajubaquara* sp. nov. also by cheliceral apophysis (Fig. 115B; more pointing downwards and with stronger tip); from *I. ouro* sp. nov. also by smaller distance between dorsal and main branches of procursus (compare Figs 114C and 118C); from *I. canudos* sp. nov. also by simple evenly curved tip of dorsal branch of procursus (compare Figs 114C and 126C). Females of *I. kiriri* sp. nov. may be indistinguishable morphologically from females of *I. itajubaquara*, *I. ouro*, and *I. canudos* sp. nov.

Etymology

The species name honors the Kiriri, an indigenous people of Eastern Brazil; noun in apposition.

Type material

Holotype

BRAZIL – **Bahia** • ♂; SE of Paramirim; 13.550° S, 42.202° W; 590–640 m a.s.l.; 18 Nov. 2022; B.A. Huber and L.S. Carvalho leg.; CHNUFPI 5963.

Paratypes

BRAZIL – **Bahia** • 5 ♀♀; same collection data as for holotype; CHNUFPI 5964 • 1 ♂, 1 ♀; same collection data as for holotype; UFMG 31660 • 1 ♂, 1 ♀; same collection data as for holotype; CHNUFPI 9049 [deposited in ZFMK Ar 24380] • 1 ♂; same collection data as for holotype; CHNUFPI 5965.

Other material examined

BRAZIL – **Bahia** • 4 ♀♀, 1 juv., in pure ethanol; same collection data as for holotype; CHNUFPI 5966 [deposited in ZFMK Br22-195] • 6 ♀♀; NE of Brumado; 14.1601° S, 41.5154° W; 470 m a.s.l.; 11 Nov. 2022; B.A. Huber and L.S. Carvalho leg.; CHNUFPI 5967 • 1 ♂, 1 ♀; same collection data as for preceding; CHNUFPI 9050 [deposited in ZFMK Ar 24381] • 4 ♀♀, in pure ethanol; same collection data as for preceding; CHNUFPI 5968 [deposited in ZFMK Br22-154].

Assigned tentatively (see Variation below)

BRAZIL – **Bahia** • 1 ♂; Abaira, Cachoeira da Samambaia, Rio Catolés; 13.3060° S, 41.8544° W; 1160 m a.s.l.; 4 Nov. 2013; L.S. Carvalho and M.B. da Silva leg.; CHNUFPI 3965.

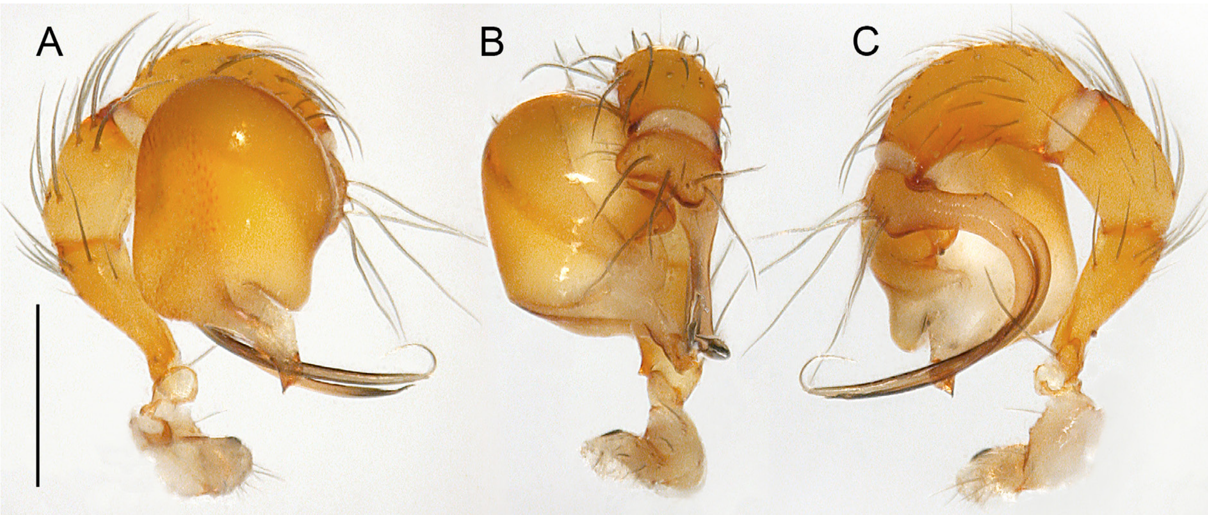

Fig. 113. *Ibotyporanga kiriri* Huber sp. nov., male from Brazil, Bahia, SE of Paramirim, ZFMK Ar 24380. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

Description

Male (holotype)

MEASUREMENTS. Total body length 1.9, carapace width 0.77. Distance PME–PME 50 µm; diameter PME 70 µm; distance PME–ALE 25 µm; distance AME–AME 15 µm; diameter AME 45 µm. Leg 1: 4.19 (1.13 + 0.25 + 1.07 + 1.27 + 0.47), tibia 2: 0.88, tibia 3: 0.83, tibia 4: 1.27; tibia 1 L/d: 10; diameters of leg femora 0.18–0.19; of leg tibiae 0.10–0.11.

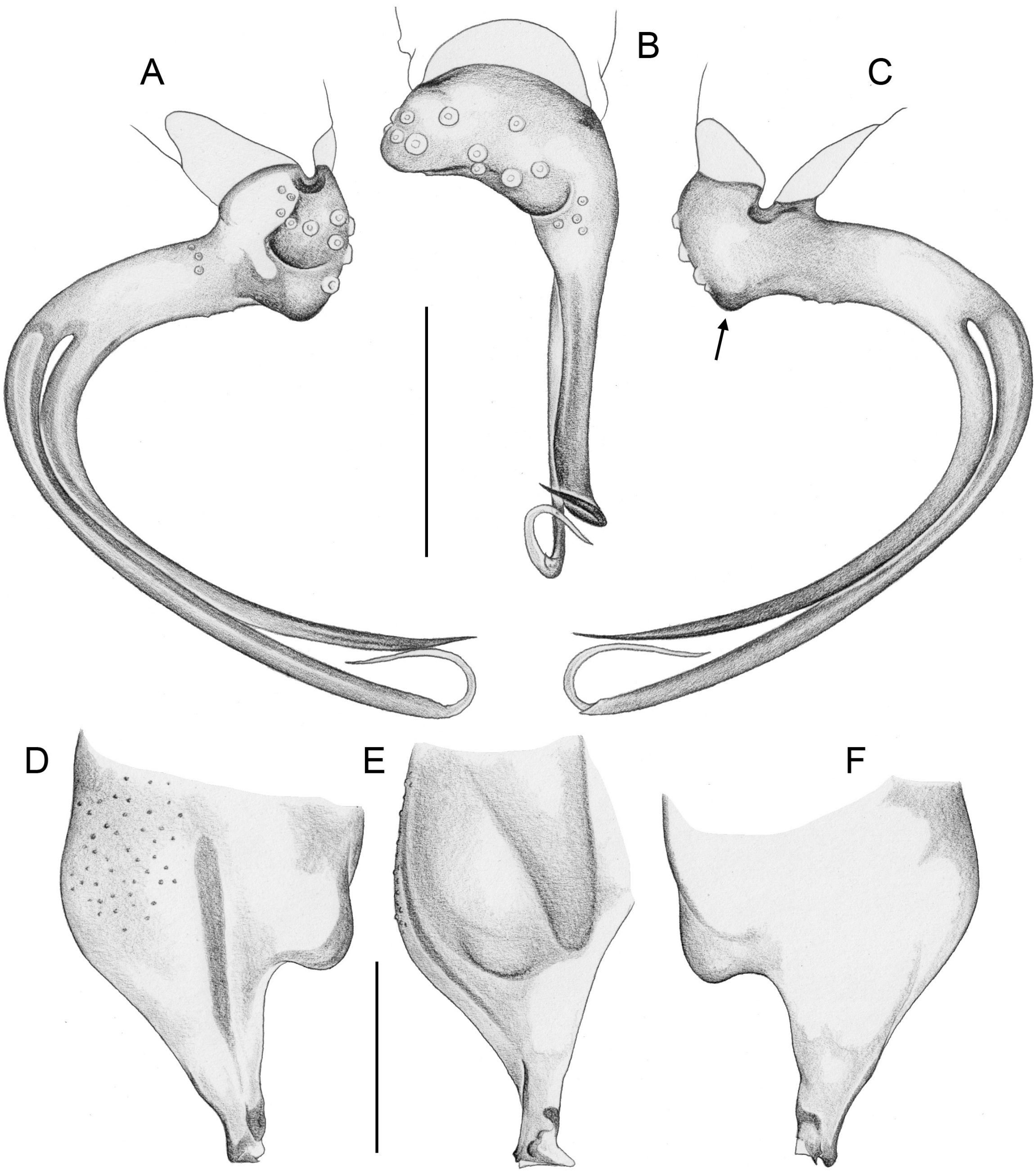

Fig. 114. *Ibotyporanga kiriri* Huber sp. nov., male from Brazil, Bahia, SE of Paramirim, ZFMK Ar 24380. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views (arrow: dorsal hump on tarsus). **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views. Scale lines: 0.2 mm.

Colour (in ethanol). Prosoma and legs ochre-yellow, carapace medially with Y-shaped line but without darker band; legs with darker rings subdistally on femora and tibiae; abdomen gray with many darker internal marks; ventrally with light ochre plates in front of gonopore and in front of spinnerets.

Body. Habitus as in Fig. 73F. Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum wider than long (0.56/0.46), with very low and indistinct anterior processes near coxae 1 not different from those in female. Abdomen globular.

Chelicerae. As in Fig. 115A–B; width 0.29; with short median frontal apophysis; stridulatory files very fine and poorly visible in dissecting microscope.

Palps. As in Fig. 113; coxa unmodified; trochanter with short rounded ventral process; femur proximally with distinct retrolateral process directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints not shifted toward one side; patella dorsally ~1.85 × as long as medially wide; tibia with two trichobothria in relatively proximal position; tibia-tarsus joints slightly shifted toward retrolateral side; tarsus with small dorsal hump; procursus (Fig. 114A–C) split into long dorsal and main (ventral) branches; dorsal branch narrow in lateral view, wider in dorsal view, distally only slightly curved towards prolateral; main branch with light prolateral band, wider in lateral view than in dorsal view, with small subdistal side-branch, distally transparent and curved backwards; genital bulb (Fig. 114D–F) with prolateral sclerite on bulbous part, embolus tip simple, without distinctive sclerotized elements.

Legs. Without spines but with longer hairs ventrally on femora; without curved hairs; with short vertical hairs on tibiae 1 and 2; retrolateral trichobothrium of tibia 1 at 60%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~3–4 pseudosegments, only distally distinct.

Variation (male)

Tibia 1 in five males (incl. holotype): 1.00–1.07 (mean 1.04). The single male from near Catolés has essentially identical palps (both shape and size) but the cheliceral apophysis is slenderer in lateral view (maximum height ~80 µm versus > 100 µm in other males). It is therefore assigned tentatively; the first legs of this male are missing.

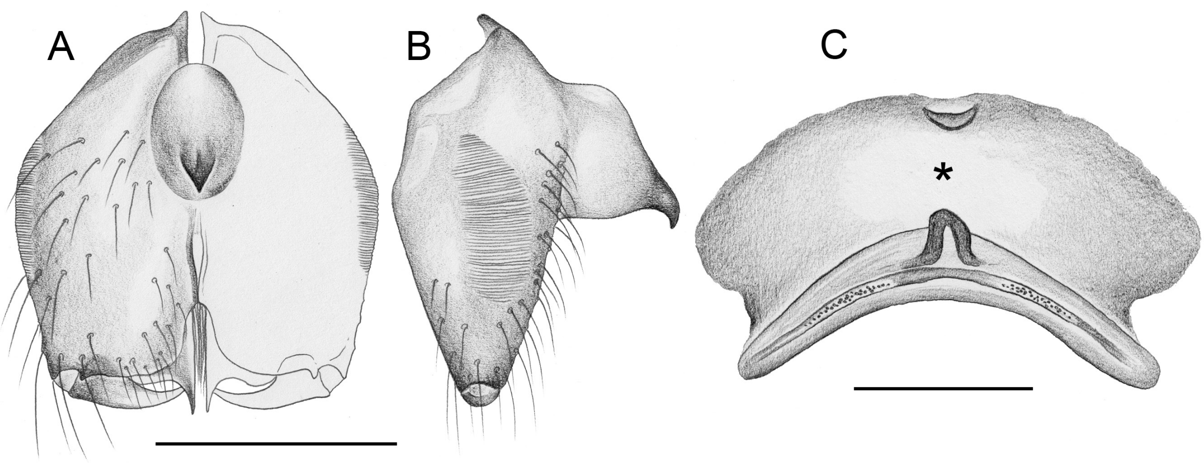

Fig. 115. *Ibotyporanga kiriri* Huber sp. nov., male and female from Brazil, Bahia, SE of Paramirim, ZFMK Ar 24380. **A–B**. Male chelicerae, frontal and lateral views. **C**. Cleared female genitalia, dorsal view (asterisk: expandable membranous sac not drawn, cf. Fig. 116C). Scale lines: 0.2 mm.

Female

In general, similar to male but ocular area and clypeus slightly darker, legs without or with indistinct dark rings, clypeus unmodified, leg tibiae with few vertical hairs. Tibia 1 in 21 females: 1.00–1.30 (mean 1.14); females from NE of Brumado tend to have shorter legs than topotypical females: ten females from NE of Brumado: 1.00–1.13 (mean 1.08); eleven females from SE of Paramirim: 1.07–1.30 (mean 1.20). Epigynum (Fig. 116A) anterior plate short and wide, posterior margin weakly indented, with distinct anterior pocket; posterior plate large but simple. Internal genitalia (Figs 115C, 116B–D) with strongly sclerotized median structure and very thin-walled large anterior membranous expandable sac; pore plates elongated, integrated into posterior arc. Internal genitalia in one cleared female from NE of Brumado as in cleared topotypical female.

Distribution

Known from three localities in southern central Bahia, Brazil (Fig. 96B).

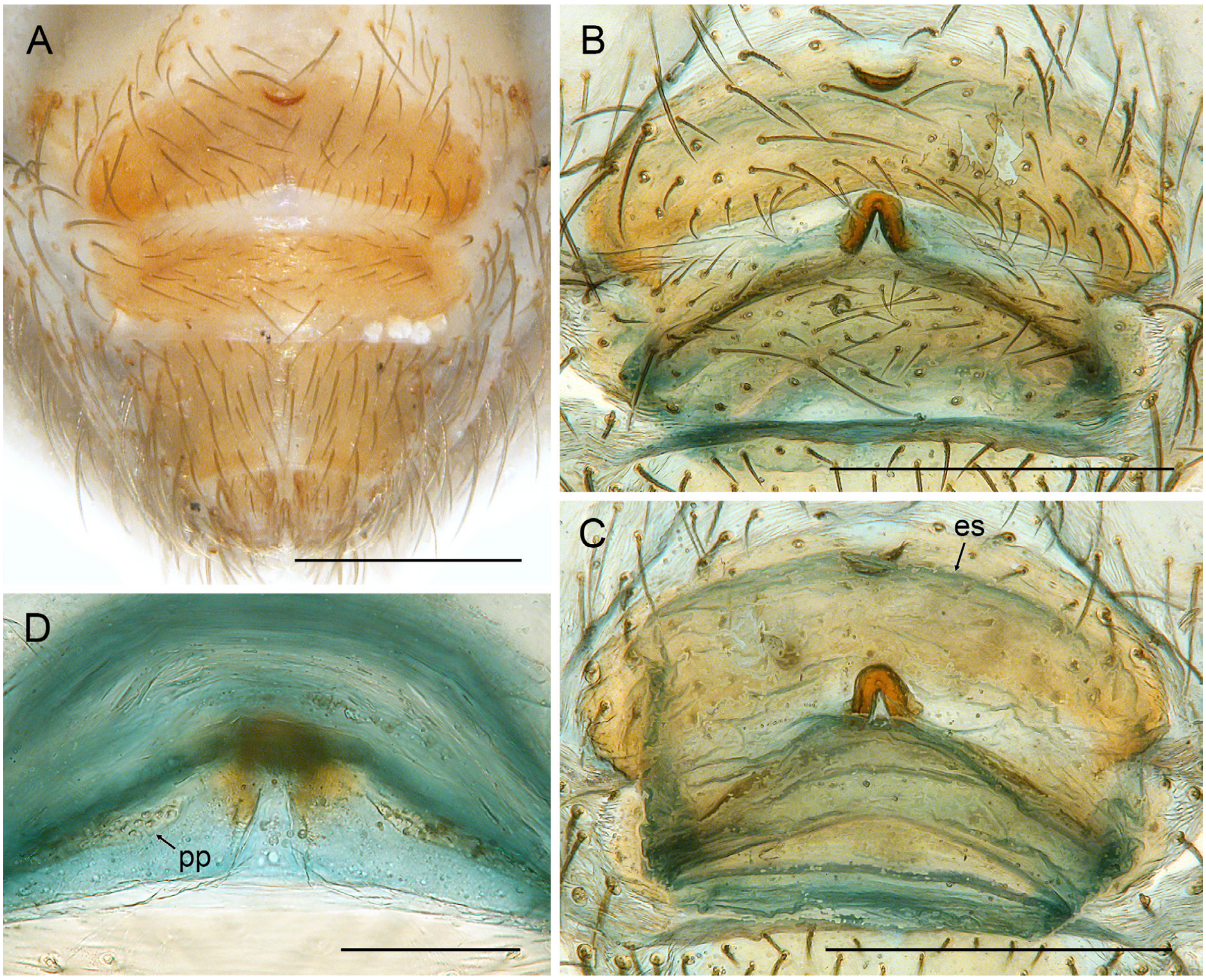

Fig. 116. *Ibotyporanga kiriri* Huber sp. nov., females from Brazil, Bahia, SE of Paramirim, ZFMK Ar 24380 (A–C) and from Bahia, NE of Brumado, ZFMK Ar 24381 (D). **A**. Abdomen, ventral view. **B–C**. Cleared female genitalia, ventral and dorsal views. **D**. Detail of cleared female genitalia, dorsal view. Abbreviations: es = expandable membranous sac; pp = pore plate. Scale lines: A–C = 0.3 mm; D = 0.1 mm.

Natural history

At the type locality, the spiders were collected on a hillside with bare granite outcrops and in the neighboring thorny shrubland on clayish soil (Fig. 23E). They were found both under rocks in areas fully exposed to the sun and in dead pieces of wood and cacti in the shrubland. The second locality (NE of Brumado) was a marble outcrop surrounded by arboreous caatinga on clayish soil; most specimens were found by turning rocks in the shrubland. At both localities, the microhabitat was shared with another species of Ninetinae tentatively placed in *Kambiwa*. Three egg sacs had diameters of ~1.8 and contained ~15–18 eggs each, with egg diameters of 0.55–0.57.

Ibotyporanga ouro Huber sp. nov.

urn:lsid:zoobank.org:act:F163AD8E-9921-4EC6-9032-E1F39ED7F1F5

Figs 73G, 96, 117–120

Diagnosis

Distinguished from similar congeners (with split procursus with long dorsal branch; long male palpal patella, i.e., dorsally >1.8 × as long as medially wide; wide epigynum, i.e., >1.9 × as wide as long; distinct epigynal pocket, i.e., narrow and relatively deep; and sclerite in female internal genitalia) by combination of: procursus main and dorsal branches proximally with relatively wide space between them in lateral view (Fig. 118C); male palpal tarsus with large dorsal hump (arrow in Fig. 118C); and median sclerite in female internal genitalia without posterior constriction (Figs 119C, 120B–C); from *I. itajubaquara* sp. nov. and *I. kiriri* sp. nov. also by tip of dorsal branch of procursus with distinct 'buckle', i.e., not evenly curved (Fig. 118C). Females of *I. ouro* sp. nov. may be indistinguishable morphologically from females of *I. itajubaquara*, *I. kiriri*, and *I. canudos* sp. nov.

Etymology

The species name is derived from the type locality; noun in apposition.

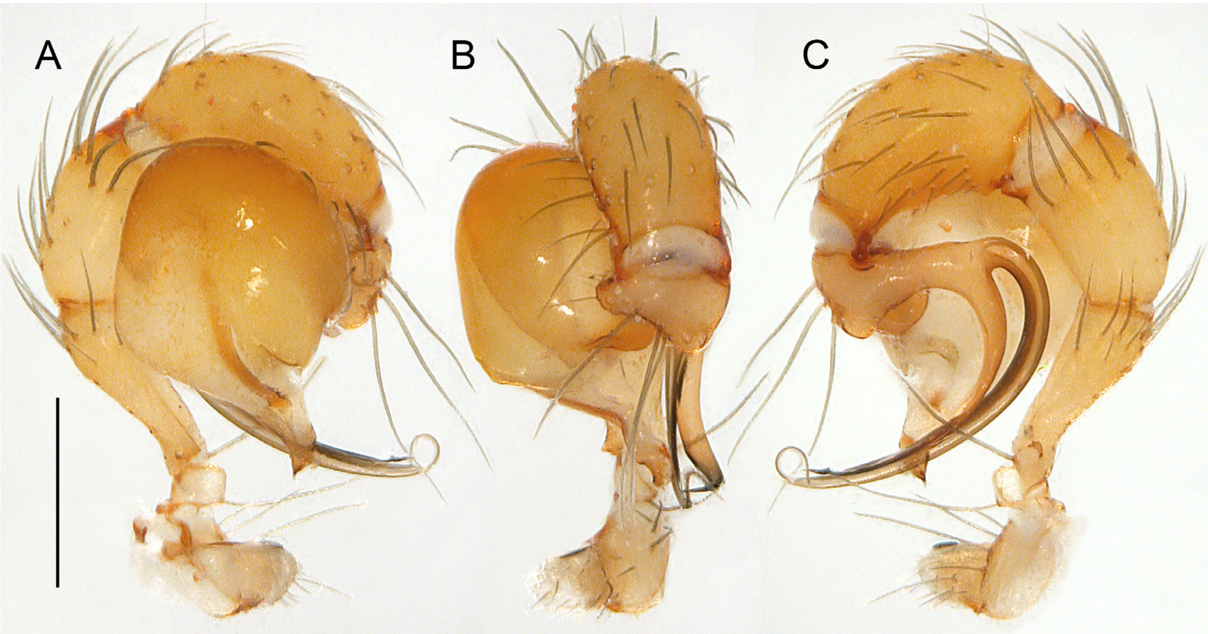

Fig. 117. *Ibotyporanga ouro* Huber sp. nov., male from Brazil, Bahia, E of Gentio do Ouro, ZFMK Ar 24382. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

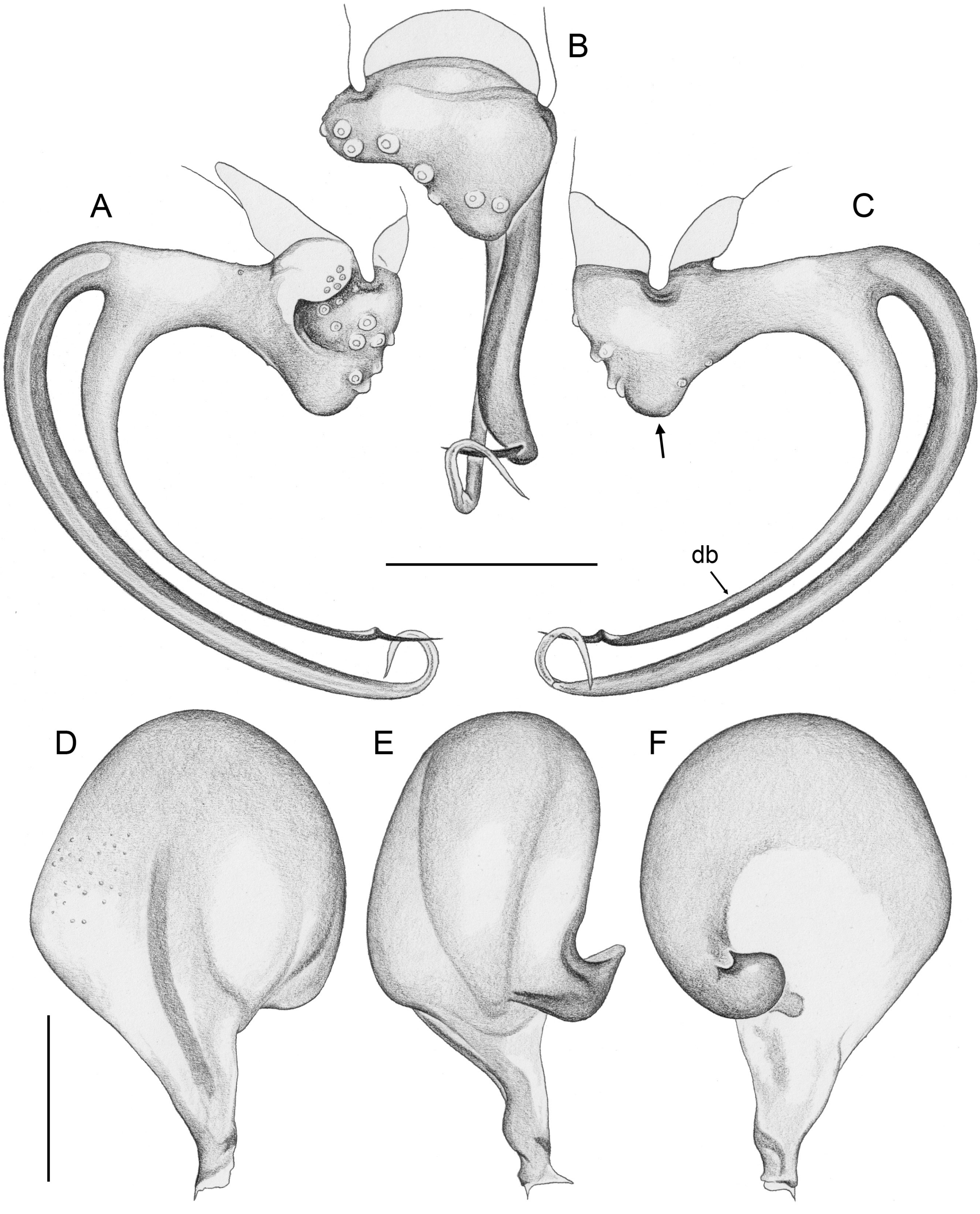

Fig. 118. *Ibotyporanga ouro* Huber sp. nov., male from Brazil, Bahia, E of Gentio do Ouro, ZFMK Ar 24382. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views (bold arrow: dorsal hump on tarsus). **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views. Abbreviation: db = dorsal branch of procursus. Scale lines: 0.2 mm.

Type material

Holotype

BRAZIL – **Bahia** • ♂; E of Gentio do Ouro; 11.4242° S, 42.3394° W; 550 m a.s.l.; 22 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5969.

Paratypes

BRAZIL – **Bahia** • 1 ♂, 5 ♀♀; same collection data as for holotype; CHNUFPI 5970 • 1 ♀; same collection data as for holotype; UFMG 31661 • 1 ♂, 1 ♀; same collection data as for holotype; CHNUFPI 9051 [deposited in ZFMK Ar 24382].

Other material examined

BRAZIL – **Bahia** • 1 ♂, 7 ♀♀, in pure ethanol; same collection data as for holotype; CHNUFPI 5971 [deposited in ZFMK Br22-209].

Description

Male (holotype)

MEASUREMENTS. Total body length 1.9, carapace width 0.78. Distance PME–PME 60 µm; diameter PME 70 µm; distance PME–ALE 25 µm; distance AME–AME 15 µm; diameter AME 45 µm. Leg 1: 4.40 (1.17 + 0.27 + 1.12 + 1.37 + 0.47), tibia 2: 0.93, tibia 3: 0.87, tibia 4: 1.30; tibia 1 L/d: 11; diameters of leg femora 0.18–0.19; of leg tibiae 0.10.

COLOUR (in ethanol). Prosoma ochre-yellow, carapace medially with narrow darker Y-mark, ocular area and clypeus not darkened; legs ochre, with indistinct darker rings subdistally on femora and tibiae; abdomen gray with indistinct darker internal marks; ventrally with barely visible light ochre plates in front of gonopore and in front of spinnerets.

BODY. Habitus as in Fig. 73G. Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum wider than long (0.56/0.46), with very low and indistinct anterior processes near coxae 1 only slightly higher than in female. Abdomen globular.

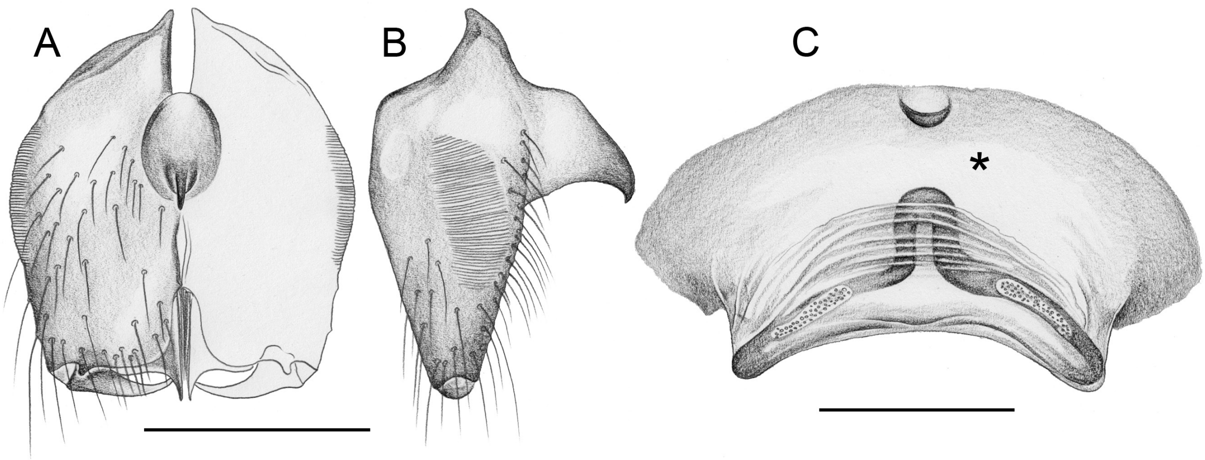

Fig. 119. *Ibotyporanga ouro* Huber sp. nov., male and female from Brazil, Bahia, E of Gentio do Ouro, ZFMK Ar 24382. **A–B**. Male chelicerae, frontal and lateral views. **C**. Cleared female genitalia, dorsal view (asterisk: expandable membranous sac not drawn, cf. Fig. 120C). Scale lines: 0.2 mm.

Chelicerae. As in Fig. 119A–B; width 0.305; with short median frontal apophysis; stridulatory files very fine and poorly visible in dissecting microscope.

Palps. As in Fig. 117; coxa unmodified; trochanter with short ventral process; femur proximally with distinct retrolateral process slightly directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints not shifted toward one side; patella dorsally ~1.9 × as long as medially wide; tibia with two trichobothria in relatively proximal position; tibia-tarsus joints slightly shifted toward retrolateral side; tarsus with strong dorsal hump (arrow in Fig. 118C); procursus (Fig. 118A–C) split into long dorsal and main (ventral) branches; dorsal branch narrow in lateral view, slightly wider in dorsal view, distally with distinctive 'buckle' and slightly curved towards prolateral; main branch with light prolateral band, wider in lateral view than in dorsal view, with tiny subdistal side-branch, distally transparent and curved backwards; genital bulb (Fig. 118D–F) with prolateral sclerite on bulbous part, embolus tip simple, without distinctive sclerotized elements.

Legs. Without spines but with longer hairs ventrally on femora; without curved hairs; with short vertical hairs on tibiae 1 and 2; retrolateral trichobothrium of left tibia 1 at 63%, of right tibia 1 at 59%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~3–4 pseudosegments, only distally distinct.

Variation (male)

Tibia 1 in three other males: 1.07, 1.10, 1.20. Dark rings on legs variably distinct.

Female

In general, similar to male but clypeus unmodified, leg tibiae with few vertical hairs. Tibia 1 in 13 females: 1.03–1.35 (mean 1.20). Epigynum (Fig. 120A) anterior plate wide and short, posterior margin barely indented, with distinct anterior pocket; posterior plate large but simple. Internal genitalia (Figs 119C, 120B–C) with strongly sclerotized median structure and very thin-walled large anterior membranous expandable sac; pore plates narrow, at posterior margin of internal arc.

Distribution

Known from the type locality only, in Bahia, Brazil (Fig. 96B).

Natural history

The type locality is a hill at the roadside with thorny shrubs, with the soil covered by a thin layer of small stones. The spiders were found under these stones. Two egg sacs had diameters of 1.7 and 2.0 and contained ~20 and 30 eggs each, with egg diameters of 0.54–0.56.

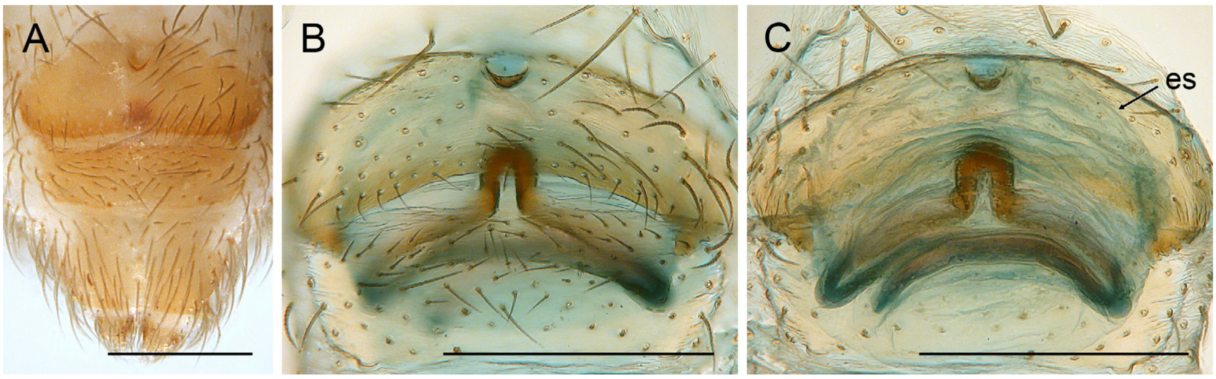

Fig. 120. *Ibotyporanga ouro* Huber sp. nov., female from Brazil, Bahia, E of Gentio do Ouro, ZFMK Ar 24382. **A**. Abdomen, ventral view. **B**–**C**. Cleared female genitalia, ventral and dorsal views. Abbreviation: es = expandable membranous sac. Scale lines: 0.3 mm.

Ibotyporanga itajubaquara Huber sp. nov.

urn:lsid:zoobank.org:act:7D8BA391-1F21-45B4-B226-1E033A14EEA1

Figs 96, 121–124

Diagnosis

Distinguished from similar congeners (with split procursus with long dorsal branch; long male palpal patella, i.e., dorsally > 1.8 × as long as medially wide; wide epigynum, i.e., > 1.9 × as wide as long; distinct epigynal pocket, i.e., narrow and relatively deep; and sclerite in female internal genitalia) by combination of: procursus main and dorsal branches proximally not overlapping, i.e., with space between them in lateral view (Fig. 122C); male palpal tarsus with large dorsal hump (bold arrow in Fig. 122C); and median sclerite in female internal genitalia without posterior constriction (Figs 123C, 124D–G); from *I. kiriri* sp. nov. also by cheliceral apophysis (Fig. 123B; directed more forwards and with more slender tip); from *I. canudos* sp. nov. and *I. ouro* sp. nov. also by simple evenly curved tip of dorsal branch of procursus, i.e., without 'buckle' (Fig. 122C). Females of *I. itajubaquara* sp. nov. may be indistinguishable morphologically from females of *I. kiriri*, *I. ouro*, and *I. canudos*.

Etymology

The species name is derived from the type locality; noun in apposition.

Type material

Holotype

BRAZIL – **Bahia** • ♂; N of Itajubaquara; 11.3607° S, 42.6810° W; 840 m a.s.l.; 23 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5972.

Paratypes

BRAZIL – **Bahia** • 1 ♀; same collection data as for holotype; CHNUFPI 5973 • 1 ♂; same collection data as for holotype; CHNUFPI 9052 [deposited in ZFMK Ar 24383].

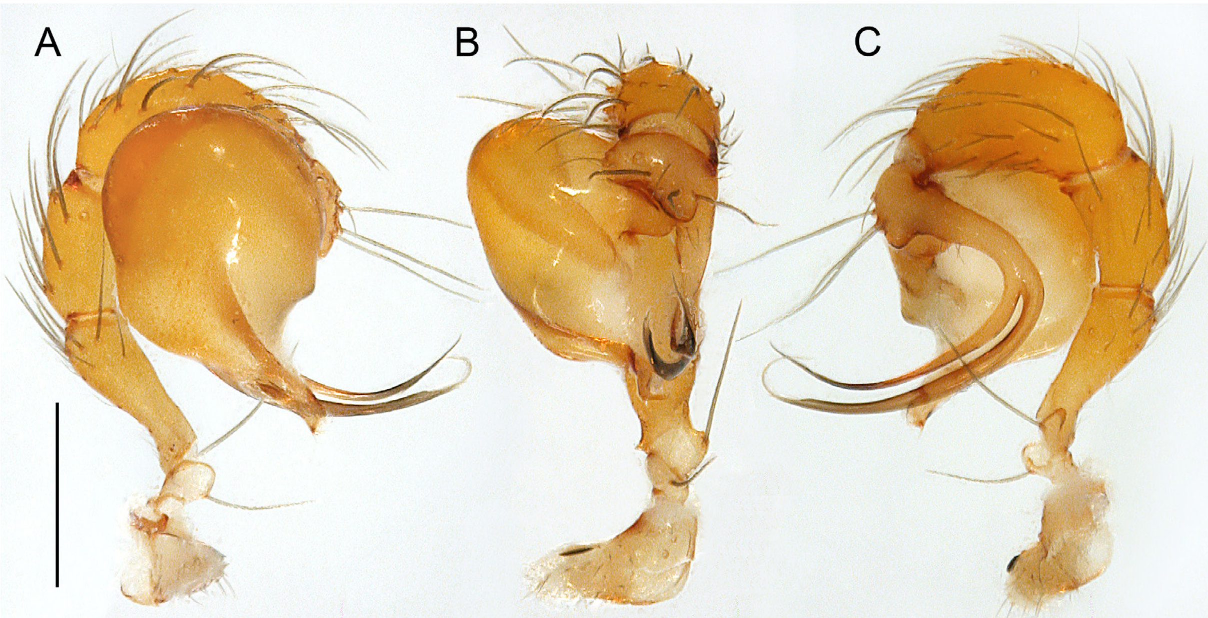

Fig. 121. *Ibotyporanga itajubaquara* Huber sp. nov., male from Brazil, Bahia, N of Itajubaquara, ZFMK Ar 24383. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

Other material examined

BRAZIL – **Bahia** • 1 ♀, 1 juv., in pure ethanol; same collection data as for holotype; CHNUFPI 5974 [deposited in ZFMK Br22-212; female abdomen transferred to ZFMK Ar 24383] • 1 ♂; NW of Gameleira do Assuruá; 11.1942° S, 42.7165° W; 640 m a.s.l.; 23 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5975 • 1 ♂, 1 ♀; same collection data as for preceding; CHNUFPI 9053 [deposited in ZFMK Ar 24384] • 2 juvs, in pure ethanol; same collection data as for preceding; CHNUFPI 5976 [deposited in ZFMK Br22-216].

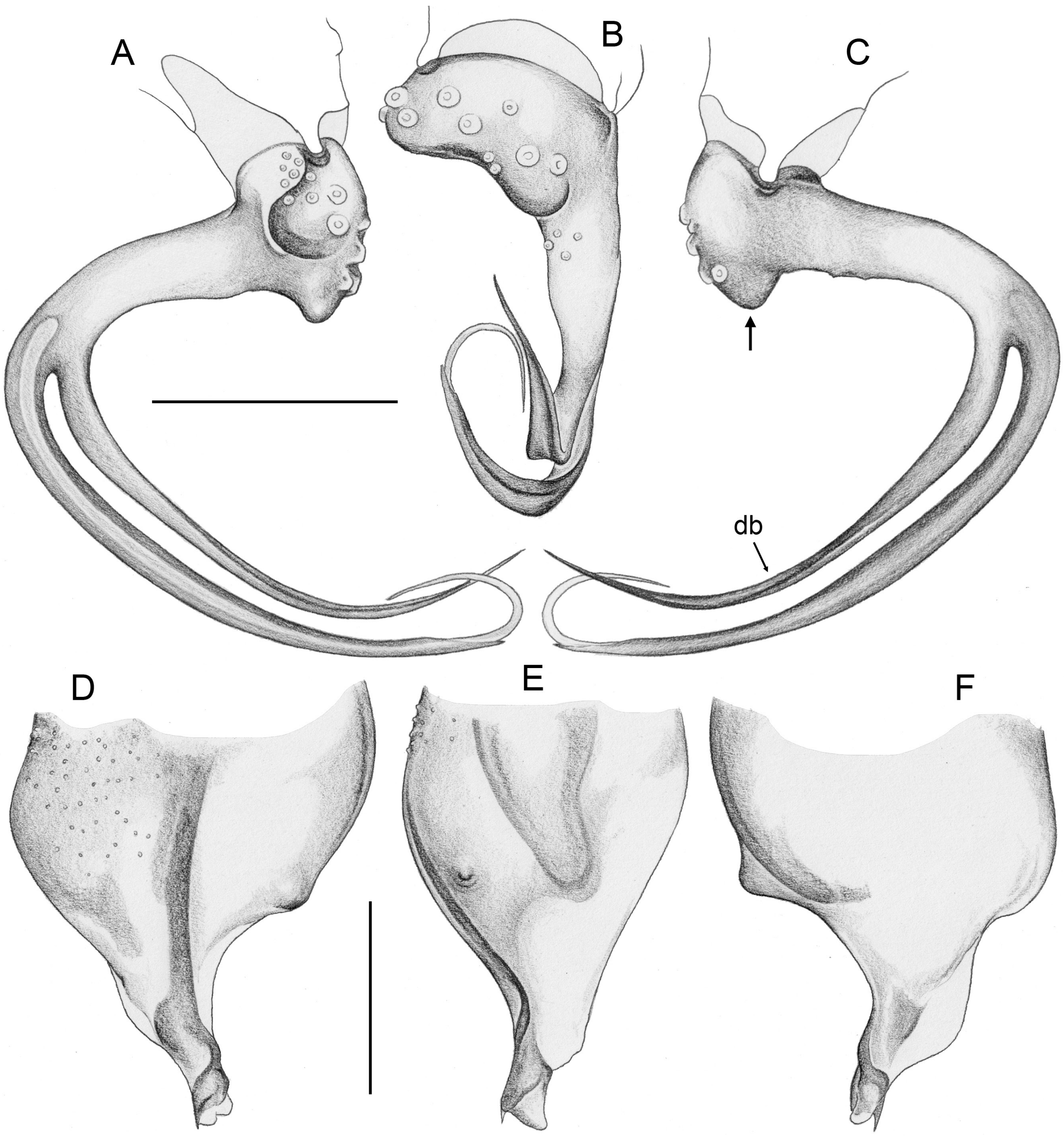

Fig. 122. *Ibotyporanga itajubaquara* Huber sp. nov., male from Brazil, Bahia, N of Itajubaquara, ZFMK Ar 24383. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views (bold arrow: dorsal hump on tarsus). **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views. Abbreviation: db = dorsal branch of procursus. Scale lines: 0.2 mm.

Description

Male (holotype)

Measurements. Total body length 1.9, carapace width 0.73. Distance PME–PME 65 µm; diameter PME 70 µm; distance PME–ALE 25 µm; distance AME–AME 20 µm; diameter AME 45 µm. Leg 1: 4.17 (1.13 + 0.30 + 1.03 + 1.28 + 0.43), tibia 2: 0.87, tibia 3: 0.80, tibia 4: 1.20; tibia 1 L/d: 10; diameters of leg femora 0.18–0.20; of leg tibiae 0.10–0.11.

Colour (in ethanol). Prosoma and legs ochre-yellow, carapace medially with darker Y-mark, legs without darker rings; abdomen pale gray with many darker internal marks; ventrally with light ochre plates in front of gonopore and in front of spinnerets.

Body. Habitus as in *I. ouro* sp. nov. (cf. Fig. 73G). Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum wider than long (0.54/0.47), with very low and indistinct anterior processes near coxae 1 not different from those of female. Abdomen globular.

Chelicerae. As in Fig. 123A–B; width 0.32; with strong median frontal apophysis; stridulatory files very fine and poorly visible in dissecting microscope.

Palps. As in Fig. 121; coxa unmodified; trochanter with short ventral process; femur proximally with distinct retrolateral process directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints not shifted toward one side; patella dorsally ~1.9 × as long as medially wide; tibia with two trichobothria in relatively proximal position; tibia-tarsus joints slightly shifted toward retrolateral side; tarsus with strong dorsal hump (bold arrow in Fig. 122C); procursus (Fig. 122A–C) with long dorsal branch distally flattened (wider in dorsal than in lateral view), main branch with light prolateral band, tiny subdistal side-branch, distally transparent and curved backwards; genital bulb (Fig. 122D–F) with prolateral sclerite on bulbous part, embolus tip simple, without distinctive sclerotized elements.

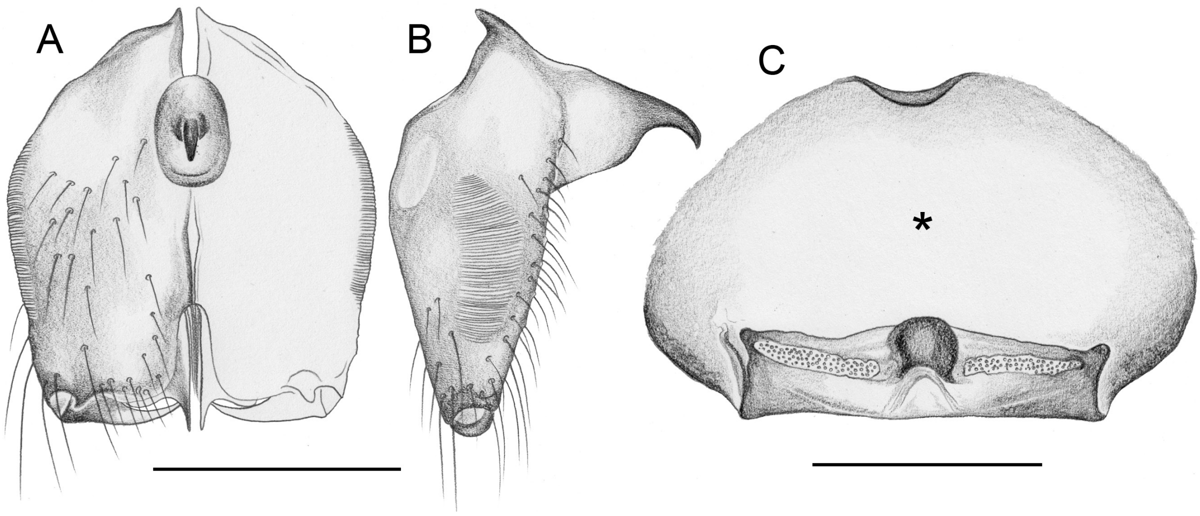

Fig. 123. *Ibotyporanga itajubaquara* Huber sp. nov., male and female from Brazil, Bahia, N of Itajubaquara, ZFMK Ar 24383. **A–B**. Male chelicerae, frontal and lateral views. **C**. Cleared female genitalia, dorsal view (asterisk: expandable membranous sac not drawn, cf. Fig. 124D). Scale lines: 0.2 mm.

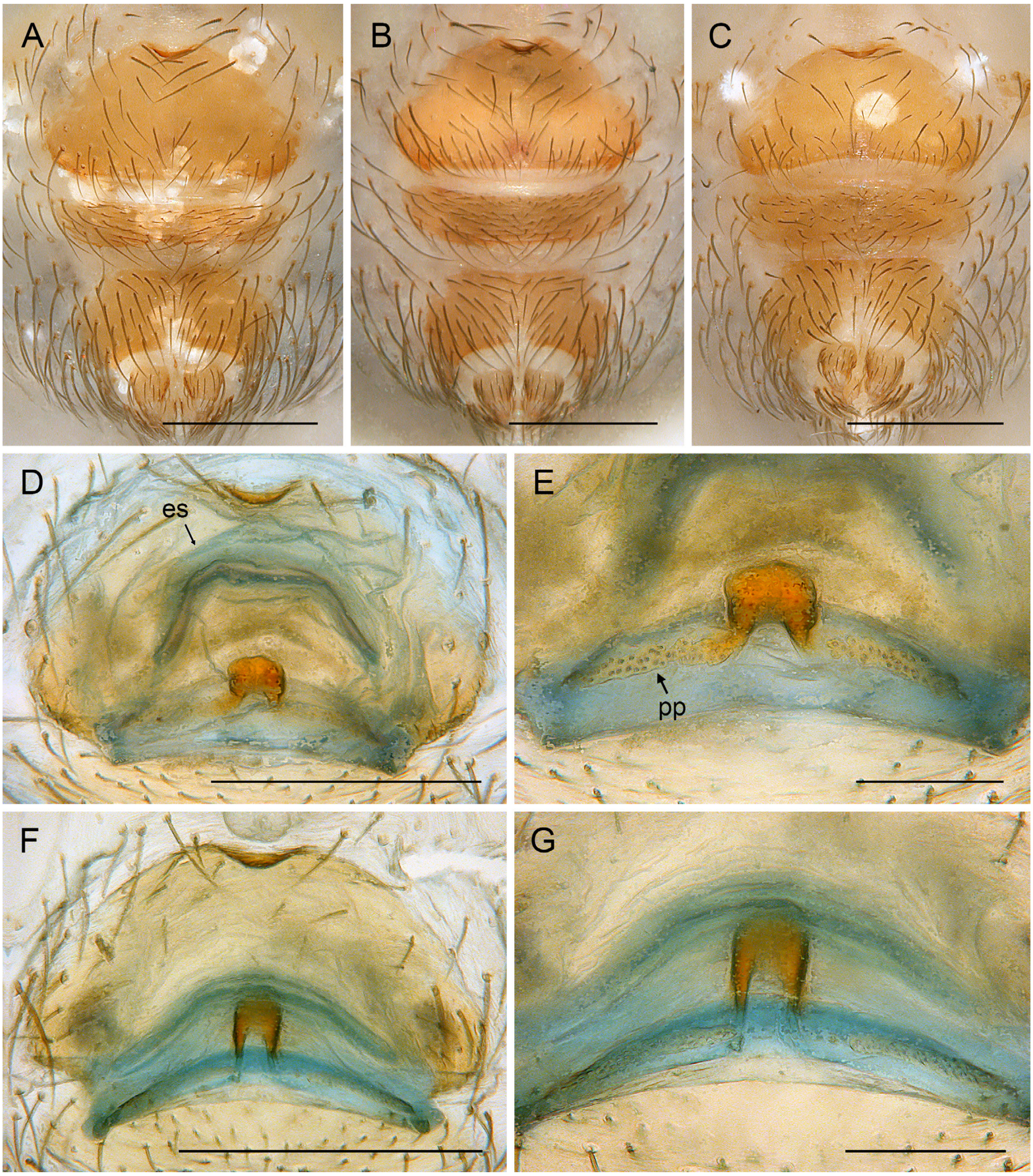

Fig. 124. *Ibotyporanga itajubaquara* Huber sp. nov. **A–C**. Abdomens, ventral views, females from Brazil, Bahia, N of Itajubaquara (A–B), CHNUFPI 5973 and ZFMK Ar 24383, and from Bahia, NW of Gameleira do Assuruá (C), ZFMK Ar 24384. **D–E**. Cleared female genitalia, dorsal view, and detail of same figure, same specimen as in B. **F–G**. Cleared female genitalia, dorsal view, and detail of same figure, same specimen as in C. Abbreviations: es = expandable membranous sac; pp = pore plate. Scale lines: A–D, F = 0.3 mm; E, G = 0.1 mm.

Legs. Without spines but with longer hairs ventrally on femora; without curved hairs; with short vertical hairs on tibiae 1 and 2; retrolateral trichobothrium of tibia 1 at 60%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~3–4 pseudosegments, only distally distinct.

Variation (male)

Tibia 1 in three other males: 0.97, 1.07, 1.07. The species delimitation analysis (Fig. S7) suggested a possible split between the sequenced specimen from N of Itajubaquara and the specimen from NW of Gameleira do Assuruá. The K2P distance between them was 10.2%. However, no morphological differences could be found in males.

Female

In general, similar to male but clypeus unmodified, tibia 1 with few vertical hairs. Tibia 1 in three females: 1.07, 1.13, 1.17. Epigynum (Fig. 124A–C) anterior plate trapezoidal, posterior margin almost straight, with distinct anterior pocket; posterior plate large but simple. Internal genitalia (Figs 123C, 124D–E) with pair of elongated pore plates posteriorly, strongly sclerotized median structure, and very thin-walled large anterior membranous expandable sac. In the cleared female from NW of Gameleira do Assuruá, the internal sclerotized median structure is longer than in the cleared female from the type locality (Fig. 124F–G). Since males from the two localities appear indistinguishable, this is here interpreted to represent intraspecific variation.

Distribution

Known from two neighboring localities (distance 19 km) in Brazil, Bahia (Fig. 96B).

Natural history

At the type locality, the spiders were found under rocks fully exposed to the sun in a degraded shrubland with scattered trees. Upon turning the rocks, the spiders ran extremely fast and were thus difficult to catch. At the second locality, a rocky outcrop with thorny shrubs and trees, the spiders were mostly found under rocks, one female under the bark of a dead branch lying on the ground.

Ibotyporanga canudos Huber sp. nov.

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Figs 22E, 23H, 73H, 96, 125–128; SEM Figs 3C–D, 5B, F, 9C–D, 12C–D, 16F, 17F, 18H, 20B

Diagnosis

Distinguished from similar congeners (with split procursus with long dorsal branch; long male palpal patella, i.e., dorsally >1.8 × as long as medially wide; wide epigynum, i.e., >1.9 × as wide as long; distinct epigynal pocket, i.e., narrow and relatively deep; and sclerite in female internal genitalia) by combination of: procursus main and dorsal branches proximally not overlapping, i.e., with space between them in lateral view (Fig. 126C); male palpal tarsus with large dorsal hump (arrow in Fig. 126C); and median sclerite in female internal genitalia without posterior constriction (Figs 127C, 128D–G); from *I. itajubaquara* sp. nov. and *I. kiriri* sp. nov. also by tip of dorsal branch of procursus with distinct 'buckle', i.e., not evenly curved (Fig. 126C); from *I. ouro* sp. nov. also by smaller distance between dorsal and main branches of procursus (compare Figs 118C and 126C). Females of *I. canudos* sp. nov. may be indistinguishable morphologically from females of *I. itajubaquara*, *I. ouro*, and *I. kiriri*.

Etymology

The species name remembers the autonomous movement at Canudos (now flooded by the Cocorobó Dam), which was the scene of violent clashes between peasants and police in the 1890s. Eventually, the Brazilian army killed the survivors and destroyed the village; noun in apposition.

Type material

Holotype

BRAZIL – **Bahia** • ♂; 25 km WNW of Morro do Chapéu; 11.475° S, 41.369° W; 760 m a.s.l.; 26 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5977.

Paratypes

BRAZIL – **Bahia** • 5 ♂♂, 3 ♀♀; same collection data as for holotype; CHNUFPI 5978 • 1 ♂, 1 ♀; same collection data as for holotype; UFMG 31662 • 1 ♂, 1 ♀; same collection data as for holotype; CHNUFPI 9054 [deposited in ZFMK Ar 24385].

Other material examined

BRAZIL – **Bahia** • 1 ♂, 7 ♀♀, in pure ethanol; same collection data as for holotype; CHNUFPI 5979 [deposited in ZFMK Br22-230] • 1 ♂, 1 ♀; 16 km SW of Morro do Chapéu, at Buraco do Possidônio; 11.6467° S, 41.2713° W; 970 m a.s.l.; 27 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5980 • 1 ♂, 1 ♀, in pure ethanol; same collection data as for preceding; CHNUFPI 5981 [deposited in ZFMK Br22-233] • 1 ♂, 1 ♀; 16 km SW of Morro do Chapéu, near Buraco do Possidônio; 11.6473° S, 41.2694° W; 980 m a.s.l.; 3 Sep. 2015; L.S. Carvalho and G. Santana leg.; CHNUFPI 3700 • 2 ♀♀; same collection data as for preceding but 5 Sep. 2015; CHNUFPI 3961, 3963 • 2 ♂♂; same collection data as for preceding; CHNUFPI 3962, 4204 • 2 ♂♂, 7 ♀♀; 10 km SW of Morro do Chapéu; 11.6130° S, 41.2339° W; 1010 m a.s.l.; 27 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5982 • 2 ♂♂, 5 ♀♀, 1 juv., in pure ethanol; same collection data as for preceding; CHNUFPI 5983 [deposited in ZFMK Br22-234; 1 ♂, 1 ♀ used for SEM] • 5 ♂♂, 3 ♀♀; 5 km NE of Morro do Chapéu; 11.5034° S, 41.1281° W; 980 m a.s.l.; 27 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5984 • 2 ♂♂,

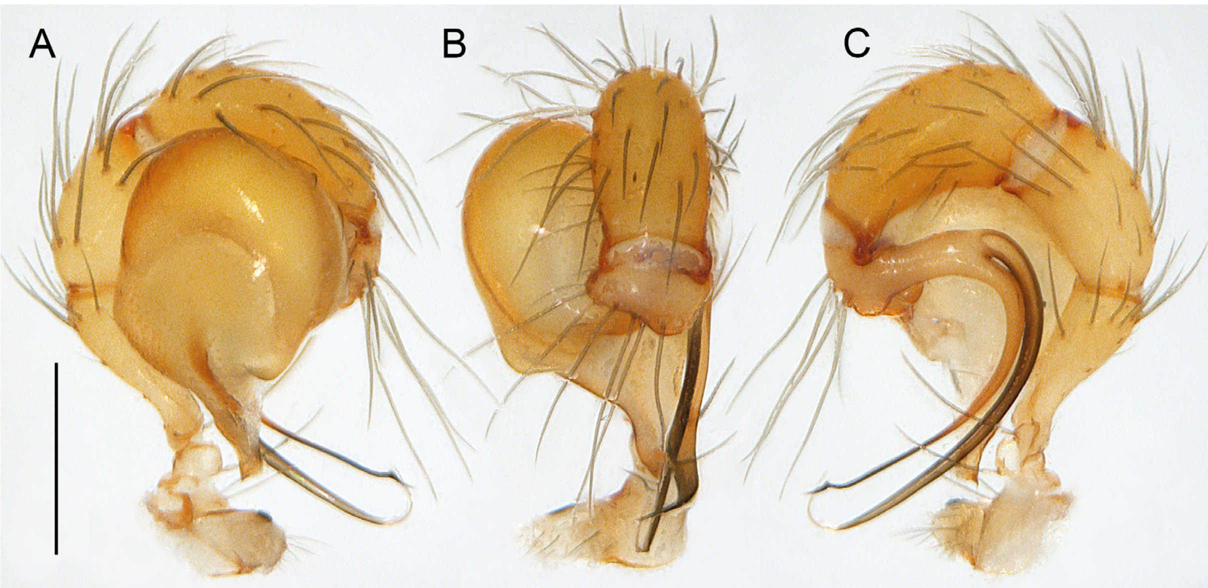

Fig. 125. *Ibotyporanga canudos* Huber sp. nov., male from Brazil, Bahia, 25 km WNW of Morro do Chapéu, ZFMK Ar 24385. Left palp, prolateral, dorsal, and retrolateral views. Scale line: 0.3 mm.

2 ♀♀; same collection data as for preceding; CHNUFPI 9064 [deposited in ZFMK Ar 24386] • 1 ♂, 5 ♀♀, in pure ethanol; same collection data as for preceding; CHNUFPI 5985 [deposited in ZFMK Br22-235] • 1 ♂, 7 ♀♀; SE of Lagoa do Boi; 11.942° S, 41.717° W; 840 m a.s.l.; 21 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5986 • 2 ♂♂, 2 ♀♀; same collection data as for preceding;

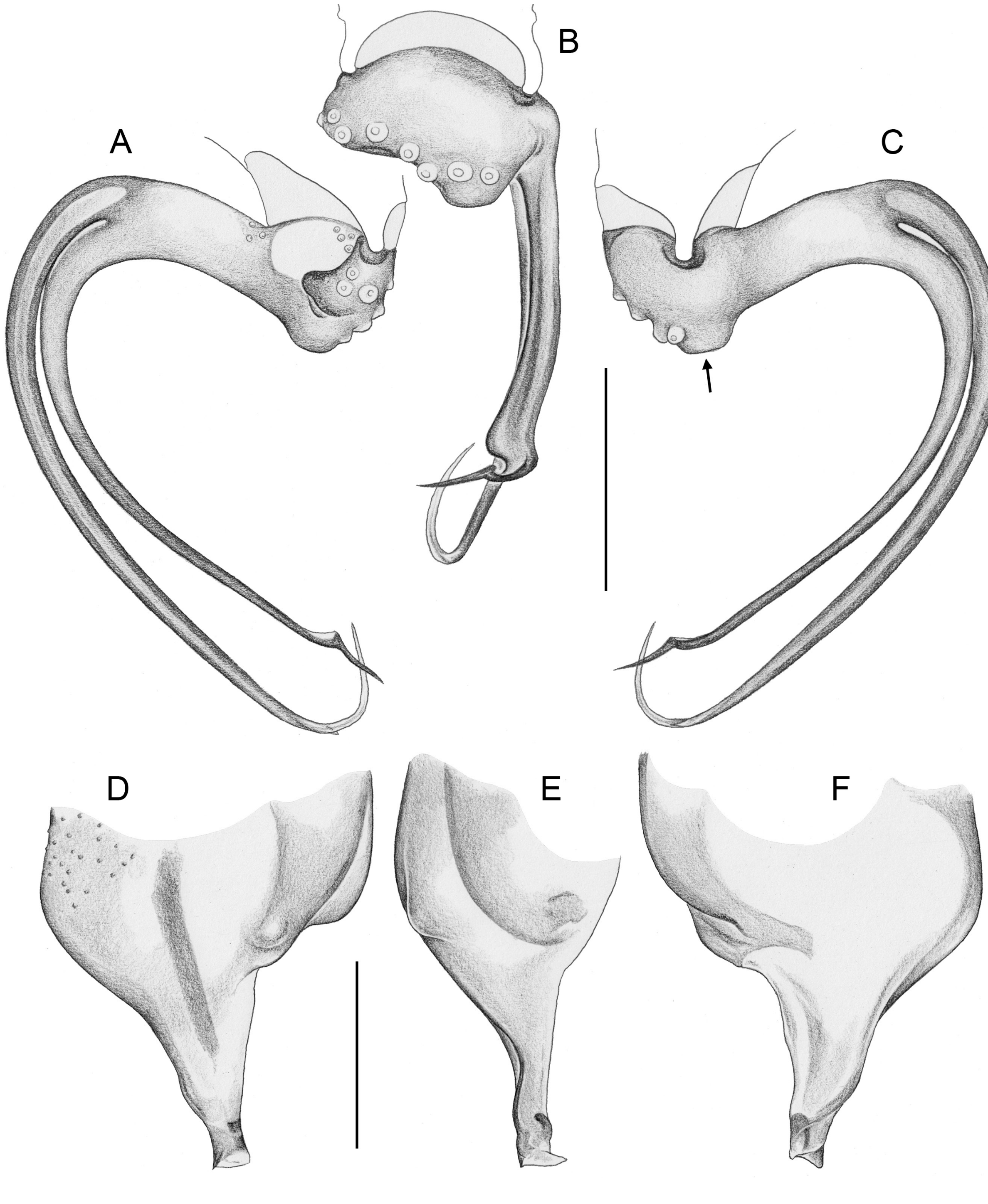

Fig. 126. *Ibotyporanga canudos* Huber sp. nov., male from Brazil, Bahia, 25 km WNW of Morro do Chapéu, ZFMK Ar 24385. **A–C**. Left tarsus and procursus, prolateral, dorsal, and retrolateral views (arrow: dorsal hump on tarsus). **D–F**. Left genital bulb, prolateral, dorsal, and retrolateral views. Scale lines: 0.2 mm.

CHNUFPI 9065 [deposited in ZFMK Ar 24387] • 2 ♂♂, 3 ♀♀, 3 juvs, in pure ethanol; same collection data as for preceding; CHNUFPI 5987 [deposited in ZFMK Br22-203] • 4 ♀♀; NW of Ibipeba; 11.540° S, 42.170° W; 590–640 m a.s.l.; 22 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5988 • 4 ♀♀, in pure ethanol; same collection data as for preceding; CHNUFPI 5989 [deposited in ZFMK Br22-208] • 3 ♂♂, 1 ♀; 4 km SW of Andorinha; 10.3668° S, 39.8636° W; 470 m a.s.l.; 28–29 Nov. 2022; B.A. Huber and A.S. Michelotto leg.; CHNUFPI 5990 • 2 ♂♂, 2 ♀♀; same collection data as for preceding; CHNUFPI 5992 [deposited in ZFMK Ar 24388] • 1 ♂, 3 ♀♀, 1 juv., in pure ethanol; same collection data as for preceding; CHNUFPI 5991 [deposited in ZFMK Br22-239].

Assigned tentatively (no males available)

BRAZIL – **Bahia** • 2 ♀♀; 14 km ESE of Central, rural area near BA-052; 11.1703° S, 41.9827° W; 770 m a.s.l.; 25 Aug. 2016; L.S. Carvalho and B.T. Faleiro leg.; CHNUFPI 3715, 3766.

Description

Male (holotype)

Measurements. Total body length 1.7, carapace width 0.77. Distance PME–PME 55 µm; diameter PME 70 µm; distance PME–ALE 30 µm; distance AME–AME 20 µm; diameter AME 40 µm. Leg 1: 4.14 (1.13 + 0.30 + 1.03 + 1.25 + 0.43), tibia 2: 0.90, tibia 3: 0.83, tibia 4: 1.28; tibia 1 L/d: 10; diameters of leg femora 0.18–0.19; of leg tibiae 0.10.

Colour (in ethanol). Prosoma ochre-yellow, carapace medially with narrow darker band, ocular area and clypeus not darkened; legs ochre, with darker rings subdistally on femora and tibiae (darkening gradually towards distal rather than distinct rings); abdomen gray with many darker internal marks; ventrally with light ochre plates in front of gonopore and in front of spinnerets.

Body. Habitus as in Fig. 73H. Ocular area slightly raised. Carapace with distinct but shallow thoracic groove. Clypeus with sclerotized rim with median notch. Sternum wider than long (0.52/0.46), with very low and indistinct anterior processes near coxae 1 not different from those in female. Abdomen globular.

Chelicerae. As in Fig. 127A–B; width 0.28; with strong but short median frontal apophysis; stridulatory files very fine and poorly visible in dissecting microscope.

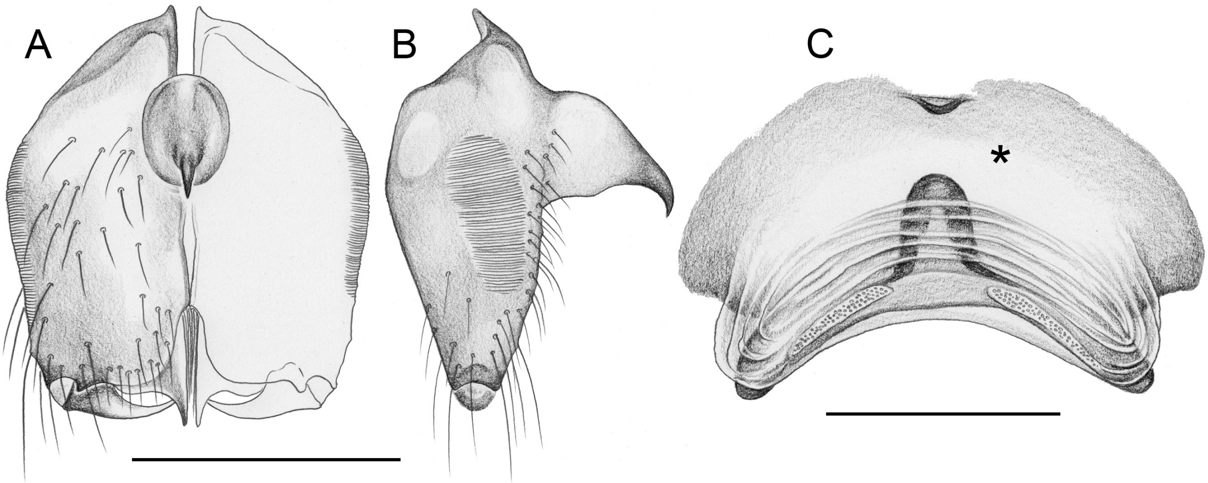

Fig. 127. *Ibotyporanga canudos* Huber sp. nov. **A–B**. Male chelicerae, frontal and lateral views, from Brazil, Bahia, 25 km WNW of Morro do Chapéu, ZFMK Ar 24385. **C**. Cleared female genitalia, dorsal view (asterisk: expandable membranous sac not drawn, cf. Fig. 128E), female from Bahia, SE of Lagoa do Boi, ZFMK Ar 24387. Scale lines: 0.2 mm.

Palps. As in Fig. 125; coxa unmodified; trochanter with short rounded ventral process; femur proximally with distinct retrolateral process slightly directed toward distal, with prolateral stridulatory pick, distally widened but unmodified; femur-patella joints not shifted toward one side; patella dorsally ~1.9× as long as medially wide; tibia with two trichobothria in relatively proximal position; tibia-tarsus joints slightly shifted toward retrolateral side; tarsus with large dorsal hump (arrow in Fig. 126C); procursus

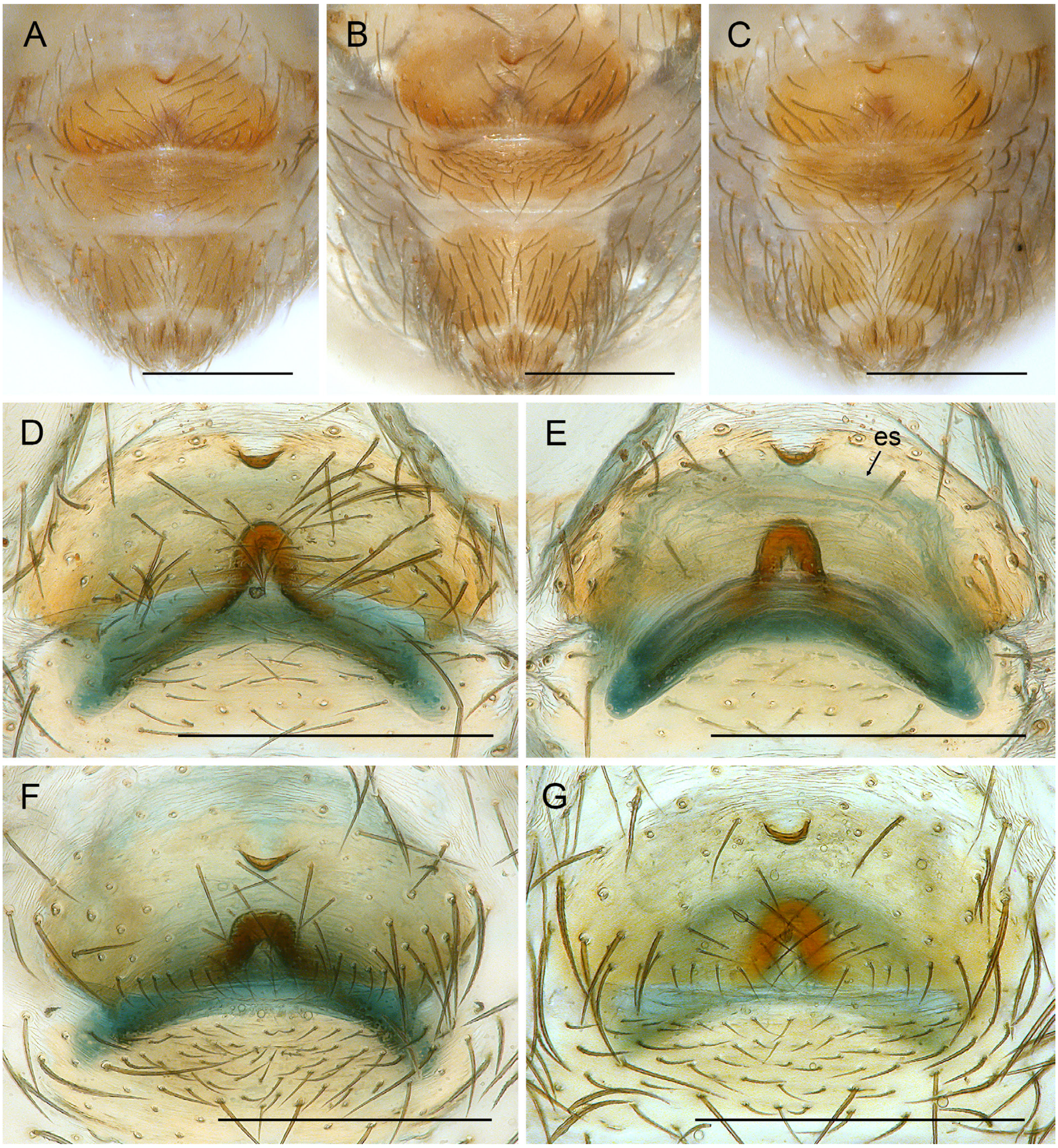

Fig. 128. *Ibotyporanga canudos* Huber sp. nov. **A–C**. Female abdomens, ventral views, females from Brazil, Bahia, SE of Lagoa do Boi (A), ZFMK Ar 24387, Bahia, 25 km WNW of Morro do Chapéu (B), ZFMK Ar 24385, and from Bahia, 4 km SW of Andorinha (C), ZFMK Ar 24388. **D–E**. Cleared female genitalia, ventral and dorsal views, same specimen as in A. **F**. Cleared female genitalia, ventral view, same specimen as in B. **G**. Cleared female genitalia, ventral view, same specimen as in C. Abbreviation: es = expandable membranous sac. Scale lines: 0.3 mm.

(Fig. 126A–C) split into long dorsal and main (ventral) branches; dorsal branch narrow in lateral view, wide in dorsal view, distally with distinctive 'buckle' and slightly curved towards prolateral; main branch with light prolateral band, slightly wider in lateral view than in dorsal view, with tiny subdistal side-branch, distally transparent and curved backwards; genital bulb (Fig. 126D–F) with prolateral sclerite on bulbous part, embolus tip simple, without distinctive sclerotized elements.

Legs. Without spines but with longer hairs ventrally on femora; without curved hairs; with short vertical hairs on tibiae 1 and 2; retrolateral trichobothrium of tibia 1 at 59%; prolateral trichobothrium absent on tibia 1; tarsus 1 with ~3–4 pseudosegments, only distally distinct.

Variation (male)

Tibia 1 in 36 males (incl. holotype): 0.90–1.17 (mean 1.01). The species delimitation analysis (Fig. S7) suggested a possible split between the sequenced specimen from SW of Andorinha and the other three sequenced specimens; the respective K2P distances ranged from 10.1 to 12.1%. However, no morphological differences could be found, neither in males nor in females.

Female

In general, similar to male but ocular area and clypeus slightly darker, legs darker ochre but without or with less distinct dark rings, clypeus unmodified, leg tibiae with few vertical hairs. Tibia 1 in 63 females: 0.98–1.30 (mean 1.11). Epigynum (Fig. 128A–C) anterior plate much wider than long, posterior margin weakly indented, with distinct narrow anterior pocket; posterior plate large but simple. Internal genitalia (Figs 127C, 128D–G) with strongly sclerotized median structure and very thin-walled large anterior expandable membranous sac; pore plates elongate, integrated into posterior arc.

Distribution

Known from several localities in northeastern central Bahia, Brazil (Fig. 96B).

Natural history

At the type locality, a hillside with rocky fields, the spiders were found under rocks on soil; in a neighboring area with stones on a flat rock outcrop they were not found. At Buraco do Possidônio, the spiders were beaten out of a dead bromeliad and from dead wood lying on the ground in savanna with shrubs and scattered trees. NE of Morro do Chapéu, most specimens were beaten out of large tree trunks lying on bare rock (Fig. 22E). SE of Lagoa do Boi, they were also beaten out of dead wood in a highly degraded savanna with scattered trees and shrubs. SW of Morro do Chapéu, the spiders were abundant under rocks from road construction in the roadside shrubland (Fig. 23H). NW of Ibipeba, they were found under rocks on a hillside with scattered trees and thorny shrubs. SW of Andorinha, they were found in dead wood on a hillside with thorny shrubs and scattered trees. When beaten out of their shelters, the spiders either feigned death or they ran rapidly until touching a piece of 'dirt' where they stopped abruptly. None of the habitats was shared with another species of Ninetinae. Eleven egg sacs had diameters of 1.6–2.0 and contained ~12–25 eggs each (mean ~20), with egg diameters of 0.56–0.58.

Sampling biases

On average, points of occurrences of *Ibotyporanga* representatives are located at 0.51 (± 0.94) km from access routes (Fig. 129). This distance is significantly smaller (d.f. = 1, F = 23.14, $p < 0.000$) than distances to random points selected at a 20 km radius buffer around the points of occurrences (1.40 ± 1.87 km). Localities more than 1.89 km from access routes were less sampled than expected by chance (Fig. 129). The extent of occurrence (EOO) of *Ibotyporanga* species varied from 0.13 to 4 955 630 km² (median = 10 449 km²; see Table S2). When *I. naideae* was excluded from the analysis, the proximity of access routes did not significantly explain the EOO (d.f. = 1, F = 0.086, p = 0.776; Fig. S10).

Ibotyporanga naideae had a much larger EOO and mean distance of records from access routes (n = 57; 5.8 ± 28.7 km; see Table S2), compared to the other species. Including this synanthropic and widespread species in the analysis resulted in a significant relation between EOO and distance from access routes (d.f. = 1, F = 56.721, p < 0.000).

The environmental niche occupied by *Ibotyporanga* species from Brazil shows a low overlap with records of species from Colombia and Venezuela, suggesting that these taxa occupy slightly different environments (Fig. 130). The first principal component (PC) explained 38.0% of the variance (Table S3), being positively related to the mean temperature of the coldest quarter, the mean temperature of the driest quarter and the annual mean temperature (Table S4). The second PC explained 22.5% of the variation (Table S3), being positively associated with the precipitation of the driest quarter, the precipitation of the driest month and the aridity index (Table S4).

The species distribution modeling (SDM) was based on four principal components that encompassed 86.0% of the predictor layers' variation (see Tables S5–S7). Three areas with higher relative occurrence rate were identified: (1) the Caatinga and Cerrado provinces in northeastern Brazil; (2) the Western Ecuador and Ecuadorian provinces; and (3) the Venezuelan province (Fig. 131). Not included in these areas are the type-locality of *I. kanoe* sp. nov. in the state of Rondônia and several localities with records of *I. naideae*, even in natural environments (Fig. 131). Although the ordination showed a low overlap between Brazilian and non-Brazilian species and the SDM did not support a high relative occurrence rate for the Colombian and Venezuelan points of occurrences, the environmental niche of *Ibotyporanga* evolved following the expectations of a Brownian motion in all analyzed scenarios (see Tables S8–S10).

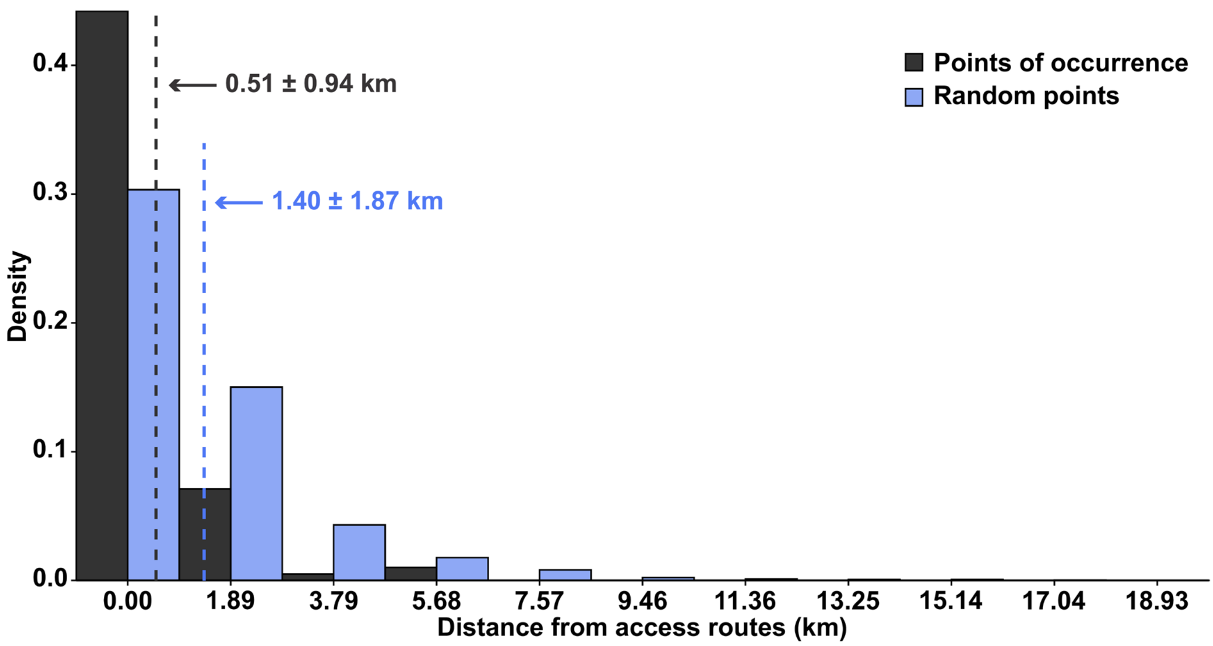

Fig. 129. Density plot of the distance from access routes (in km) of the points of occurrence (black bars) of species of *Ibotyporanga* Mello-Leitão, 1944, compared to the expected distance (blue bars) based on 200 random points sorted at a 20 km radius. Dashed lines represent the mean values (shown with the standard deviation beside them) for each class. Records of *I. naideae* Mello-Leitão, 1944 were excluded from this analysis.

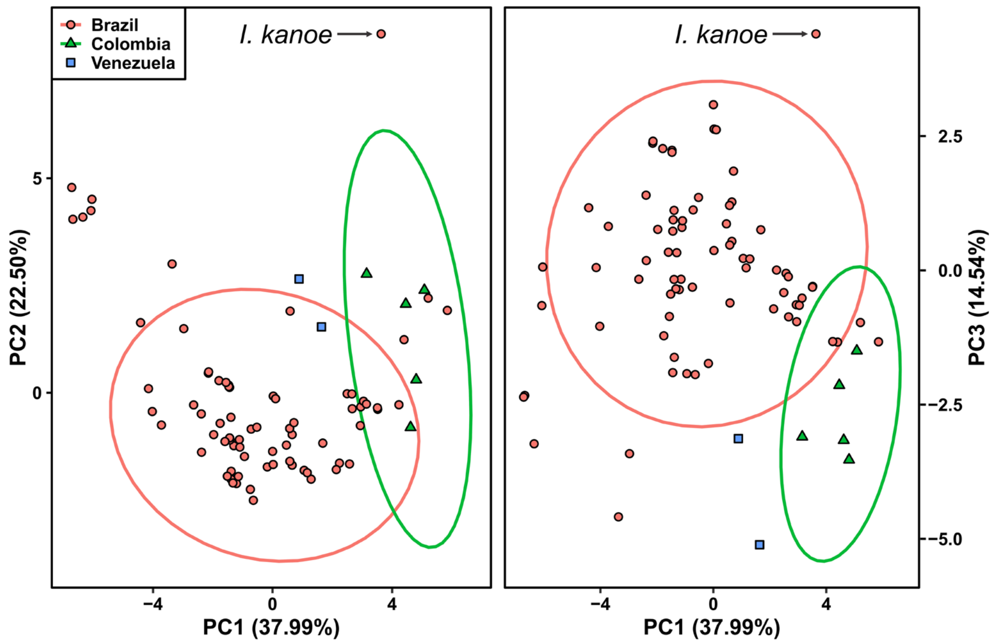

Fig. 130. Principal component analysis of the environmental conditions for species of *Ibotyporanga* Mello-Leitão, 1944 from Brazil (red circles), Colombia (green triangles) and Venezuela (blue squares). The ellipses encompass the values within a 95% confidence interval of a multivariate t-distribution (absent for Venezuela owing to the small number of records). Records of *I. naideae* Mello-Leitão, 1944 were excluded from this analysis.

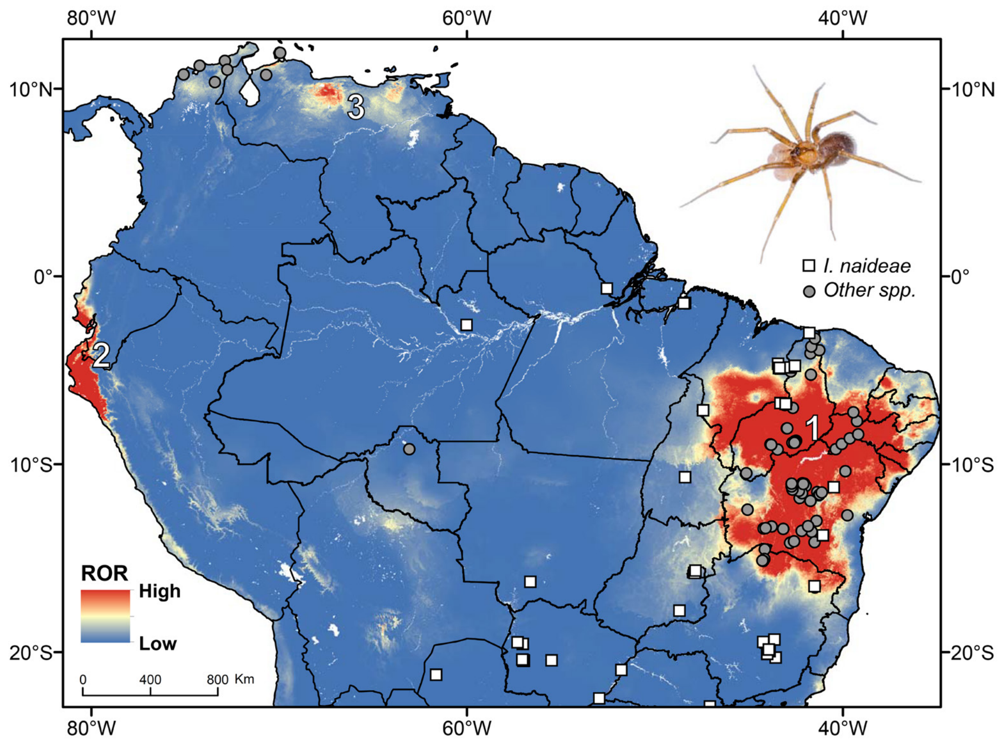

Fig. 131. Relative occurrence rate (ROR) of species of *Ibotyporanga* Mello-Leitão, 1944, and the points of occurrences of *Ibotyporanga* (grey circles). Records of *I. naideae* Mello-Leitão, 1944 were excluded from the distribution modeling, but are plotted in the map. Numbered sites represent areas with higher ROR, namely: (1) Caatinga province; (2) Western Ecuador and Ecuadorian provinces; and (3) Venezuelan province. Live spider: *I. sertao* Huber sp. nov., female with eggsac from Brazil, Cocal.

Karyology

The testes of the analyzed males contained both spermatogonial mitoses and meiotic cells. Both species analyzed had the same diploid number (30) (Fig. 132B, H) and sex chromosome system $X_1X_2X_3Y$ (Fig. 132G–H). Metaphases of spermatogonial mitosis were composed of 30 chromosomes including the Y chromosome (Fig. 132A–B). The two studied species differed in the size of this element. While it was a small chromosome in both species, it was much bigger in *I. naideae* (2.8 ± 0.61 µm, $n=4$; Fig. 132A) than in *Ibotyporanga* sp. (0.98 ± 0.12 µm, $n=7$; Fig. 132B). The Y chromosome of *I. naideae* was metacentric and slightly positively heteropycnotic (i.e., stained more intensively than the other chromosomes) in some mitotic plates (Fig. 132A). The morphology of this element was not resolved in *Ibotyporanga* sp. In the interphase nucleus before meiosis, sex chromosomes formed a positively heteropycnotic, highly condensed mass at the periphery of the nucleus. In addition to this mass, some nuclei included a rod-shaped element exhibiting a slight positive heteropycnosis (Fig. 132C). The early prophase of the first meiotic division (leptotene-pachytene) was followed by a stage characterized by a considerable decondensation of chromosome pairs (so-called diffuse stage). On the contrary, the sex chromosomes were positively heteropycnotic and highly condensed, forming a cluster or body at the periphery of the nucleus. One bivalent often showed positive heteropycnosis (Fig. 132D–E). Late prophase I and metaphase I contained 13 bivalents, each with one chiasma. Although the sex chromosomes were considerably decondensed at these stages (Fig. 132F), the mode of their pairing was evident in some plates. Each X chromosome formed a loop, which paired by its ends with a Y chromosome (Fig. 132G). In late prophase I, a large bivalent exhibited positive heteropycnosis except for the chiasma region (Fig. 132F). Two types of metaphases II were found, one with 14 chromosomes including the Y chromosome, the other with 16 chromosomes including the three X chromosomes (Fig. 132H). The morphology of the chromosomes in metaphase II shows that most if not all chromosomes are biarmed. The X chromosomes did not differ in condensation intensity from the other chromosomes at this stage (Fig. 132H). In contrast to this, the Y chromosome was positively heteropycnotic in some metaphases II of *I. naideae* (Fig. 132I).

Discussion

On species limits

Several specimens in this study are 'assigned tentatively' to the respective species. In some cases, this is for the trivial reason that no males are available from the respective localities, and females of some species appear very similar or indistinguishable morphologically. In other cases, this highlights the fact that we found morphological or genetic variation that is difficult to interpret. We treat these cases conservatively, following the premise that the null hypothesis in taxonomy is that all specimens are the same species. Here, we briefly summarize the cases that most obviously need further study.

Ibotyporanga naideae. We found substantial morphological variation across the large geographic range of this species, while within-population variation was at a usual level. However, the variation seemed to be continuous, along a north-south cline (Fig. 60A). The three CO1 barcodes we generated (Table 1) are from specimens originating from a limited geographic area. The high support in the ASAP species delimitation analysis (Fig. S7) is thus misleading.

Ibotyporanga imale sp. nov. Two details of the male palp, both concerning the tips of the two procursus branches, were variable among localities (Fig. 76). Almost every sampled locality had its own morph, but we found no congruent differences in other details that usually differ among species (genital bulb, male chelicerae, epigynum, and female internal genitalia). The large K2P distances among the four barcoded specimens (13.1% to 16.8%; Table S1) and the ASAP species delimitation analysis (Fig. S7) support the existence of several species.

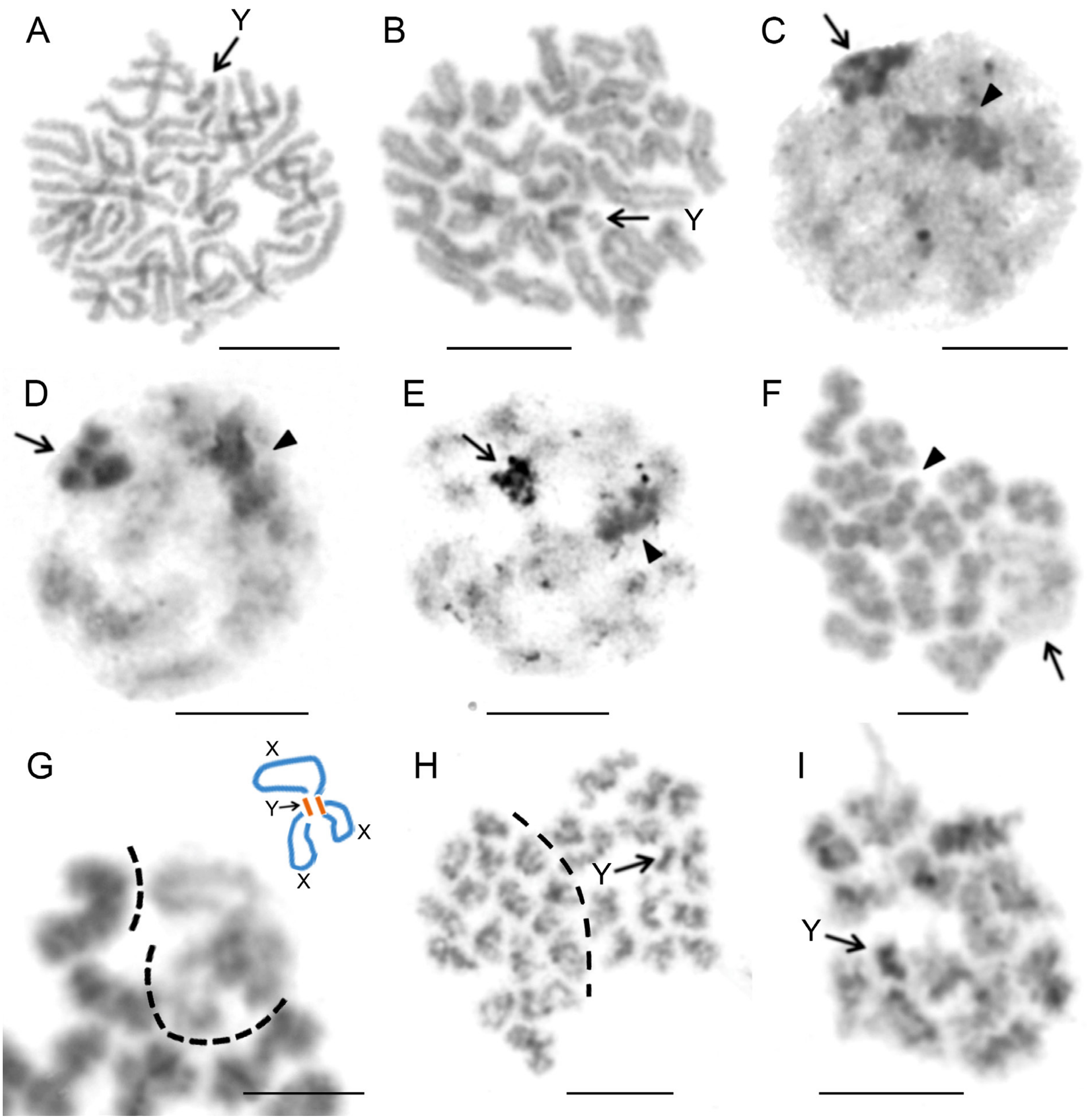

Fig. 132. *Ibotyporanga* Mello-Leitão, 1944, male chromosome plates of *I. naideae* Mello-Leitão (A, C–I) and *Ibotyporanga* sp. (B). **A**. Spermatogonial metaphase, including Y chromosome; note metacentric morphology and slight positive heteropycnosis of this element. **B**. Spermatogonial metaphase (2n = 30), including Y microchromosome. **C**. Premeiotic interphase; note a heteropycnotic body formed by sex chromosomes and rod-shaped element exhibiting weak heteropycnosis. **D–E**. Diffuse stage; note cluster comprising four heteropycnotic sex chromosomes (D) or sex chromosome body (E) and a heteropycnotic bivalent. **F**. Late prophase I consisting of 13 bivalents and sex chromosomes, which show considerable decondensation. One bivalent is positively heteropycnotic except for chiasma region. **G**. Sex chromosome tetravalent from metaphase I (separated by dashed line from bivalents); note scheme of sex chromosome pairing (blue – X chromosomes, orange – Y chromosome). **H**. Two sister metaphases II separated by dashed line. Left plate contains 16 chromosomes, right plate 14 chromosomes including small Y chromosome. Note predominance of biarmed chromosomes. **I**. Metaphase II containing 14 chromosomes; note small heteropycnotic Y chromosome. Arrows without letters point at sex chromosome body/cluster; arrowheads point at heteropycnotic bivalent/element. Abbreviations: X = X chromosome; Y = Y chromosome. Scale lines: A–F, H–I = 10 µm; G = 5 µm.

Ibotyporanga walekeru sp. nov. The species is described from three localities; from two of them, males are available, and they only differ in the number of pseudotrichia at the tip of the procursus (approximately six versus ten). Females from the three localities were morphologically very similar (or identical) to each other. However, K2P distances among specimens from the three localities were relatively high (11.0% to 13.9%; Table S1), and the species delimitation analysis suggested that specimens from the three localities may in fact represent three distinct species (Fig. S7).

Ibotyporanga guanambi sp. nov. We found several minor differences among specimens from different localities, but some of them may represent continuous variation, others may result from artifacts of preparation. The K2P distance between the sequenced specimens from two localities was 8.7%, which is, in Pholcidae, within a typically problematic range (cf. Astrin *et al.* 2006; Huber *et al.* 2023e). The species delimitation analysis slightly favored the idea that the two sequenced specimens are conspecific (Fig. S7).

Ibotyporanga emekori. Two specimens from two localities were barcoded, and their K2P distance was 14.1%, suggesting two separate species. This interpretation was also favored by the species delimitation analysis (Fig. S7). However, we found no differences between males from the two localities, and only one small difference in the female internal genitalia of the two cleared specimens.

Ibotyporanga kiriri sp. nov. This species is described from three localities, one of which is represented by a single male specimen. This male differs in one detail (male chelicerae). No CO1 barcode is available from this specimen.

Ibotyporanga canudos sp. nov. The K2P distances among the four sequenced specimens from four different localities ranged from 10.1 to 12.1% (Table S1). The species delimitation analysis suggested a possible split into two (or even three) species (Fig. S7). However, we found no morphological differences that support such a split.

On relationships

The monophyly of *Ibotyporanga* was strongly supported by the cladistic analysis of morphological characters. It could be argued that three of the five synapomorphies are functionally related and thus not independent characters: the unique fused median cheliceral apophysis (char. 3), the clypeus notch (char. 1) that accommodates the cheliceral apophysis, and the epigynal pocket (char. 18) into which the cheliceral apophysis is very probably lodged during copulation. The fourth synapomorphy, the reduction of ALS spigots to only two per spinneret (char. 2) has occurred numerous times independently in Pholcidae, possibly a dozen times (B.A. Huber, unpubl. data). However, *Ibotyporanga* is the only known genus among Ninetinae in which this reduction has happened. A second character that is unique among Pholcidae (in addition to the fused median cheliceral apophysis) is the light band on the procursus (char. 10). Its function is unknown; the slit visible on the procursus in SEM images (arrows in Figs 11D, 12E) suggests that it might be a longitudinal invagination. The prolateral sclerite on the bulbous part of the genital bulb (char. 13) is probably a further synapomorphy. It is not resolved as such in the cladistic analysis because it was conservatively coded as “distinct, long” versus “indistinct, very short” rather than as “present” versus “absent” (an indistinct and very short sclerite might also occur in other Ninetinae). In sum, we consider the monophyly of *Ibotyporanga* well supported by morphological data regardless of the exact number of synapomorphies. This is also corroborated by molecular (UCE) data on four species of *Ibotyporanga* and numerous species representing most other Ninetinae genera (G. Meng, L. Podsiadlowski, B.A. Huber, unpubl. data).

Further conclusions from the morphological tree are problematic because they are mostly supported by a very limited number of characters (often one) and they receive no additional support from the CO1 data (Fig. S2), and not even from the combined analysis of morphological and CO1 data (Fig. S3). Without further evidence, a preference of one of the alternative trees seems arbitrary, but we tend to favor the idea of Maddison (2018) that "morphology alone is more reliable than CO1, as its basis is distributed throughout the genome". With this reserve in mind, we highlight two interesting conclusions from the morphological tree. First, a large clade within *Ibotyporanga* is supported by an exceptional elongation of the male genitalia, in particular the procursus (char. 6). In species with a long procursus, the female internal genitalia are either provided with a pair of long membranous tubes (char. 22) or with a large expandable median sac (char. 24). We thus hypothesize that these male and female structures are functionally related. Similar cases of coevolved genital elongation have been reported in other Pholcidae (e.g., Huber 2006) and in other spiders (e.g., Jäger 2005). Second, the cladistic analysis suggests two remarkable convergences in the internal female genitalia: the surprisingly similar long tubes of *I. naideae* and *I. sertao* sp. nov. have apparently evolved independently; and the median internal sclerites have evolved twice independently. Long membranous tubes (but median instead of paired) have also evolved in other Ninetinae (e.g., *Gertschiola*, *Pholcophora*; Huber 2000; Huber *et al.* 2023b; Izquierdo *et al.* 2023). The similarity between the internal sclerites of the two putative clades that have such a structure may be superficial. Its structure in one of the two clades (*I. naideae*+*I. kanoe*) appears more complex but is poorly understood. We hypothesize that it serves a different function than the simple sclerite in the other clade.

Sampling biases

Records of *Ibotyporanga* have a strong sampling bias towards the proximity of access routes. This bias is shared with other invertebrates, vertebrates, and plants in Brazil, for which the highest peaks in diversity are located less than 1 km from access routes (Oliveira *et al.* 2016). Localities more distant from access routes have also been identified as those with the poorest biological knowledge, presenting a distinct species composition (Oliveira *et al.* 2016). Since Brazil is home to most known *Ibotyporanga* species and also has the most extensive areas with suitable environmental conditions (Fig. 131), we predict that a high number of undescribed species remains to be discovered in Brazil. The environmental niche occupied by *Ibotyporanga* representatives from Brazil, Colombia, and Venezuela, albeit being slightly different (Fig. 130), is phylogenetically conserved (see Table S10), as already described for other Ninetinae (Huber *et al.* 2023a, 2023b, 2024b).

The regions with a high environmental suitability for *Ibotyporanga* but without any known records (Western Ecuador, Ecuadorian and Venezuelan provinces, see Fig. 131) contain some humid environments but are mainly composed of seasonally dry tropical forests, xerophytic scrublands, and savannas (Morrone 2017). These drier environments are generally characterized by a strong sampling bias, with few records of Pholcidae (see Huber *et al.* 2024b: figs 34–35) and should be prioritized for sampling to test the modeling predictions. The species distribution modeling failed to recover the type-locality of *I. kanoe* sp. nov. (Rondônia), the only known species from the Brazilian Amazon forest (excluding records of the synanthropic species *I. naideae*). *Ibotyporanga kanoe* is known from a single small granite outcrop with a distinct semi-arid environment (see Fig. 130), suggesting that it represents a relict from the past wider distribution of *Ibotyporanga*. Amazonian granite rocky outcrops and mountains have been shown to harbor a unique and endemic flora (Silva *et al.* 2020), and the surprising record of *I. kanoe* in Rondônia suggests that a focus on similar Amazonian environments will be rewarding.

Karyology

The diploid number of *Ibotyporanga* (2n♂ = 30) is among the highest known in Pholcidae. The karyotypes of the two analyzed species include 13 chromosome pairs, which is possibly the ancestral state of Ninetinae. The available data allow a reconstruction of the evolution of the number of chromosome pairs (further NCP) in Ninetinae. Molecular data have suggested a division of Ninetinae into two major clades, a Northern clade (including *Ibotyporanga*) and a Southern clade (Eberle *et al.* 2018). This split is also supported by UCE data (G. Meng, L. Podsiadlowski, B.A. Huber, unpubl. data). *Ibotyporanga* shares the NCP with two other genera of the Northern clade, *Pholcophora* (Ávila Herrera *et al.* 2021) and *Papiamenta* (Huber *et al.* 2024a). Similar to many other spiders (e.g., Suzuki 1954; Kořínková & Král 2013) including pholcids (Ávila Herrera *et al.* 2021), the NCP has been reduced in some clades of ninetines. Published data (Ávila Herrera *et al.* 2021; Huber *et al.* 2023a) indicate that the NCP was reduced to 12 in an ancestor of the Southern Ninetinae clade. This number is retained in the genera *Gertschiola* (Huber *et al.* 2023a) and *Kambiwa* (Ávila Herrera *et al.* 2021). The Ninetinae genera *Tolteca* Huber, 2000 (Huber *et al.* 2023b) and *Guaranita* Huber, 2000 (Huber *et al.* 2023c) show a further considerable reduction of the NCP. The NCPs of these genera are among the lowest known in araneomorph spiders with a standard chromosome structure. The sex chromosome number was also reduced in *Guaranita* (Huber *et al.* 2023c).

The prophase of the first meiotic division of *Ibotyporanga* males includes a specific stage, which is remarkable for a considerable decondensation of almost all chromosome pairs. In contrast to this, the sex chromosomes and a peculiar heteropycnotic pair are highly condensed. A period with a considerable decondensation of chromosomes has also been found in female and/or male meiosis of some other animals; it is called the diffuse stage (Benavente & Wettstein 1980; Král *et al.* 2006). The male diffuse stage is probably a synapomorphy of Haplogynae, i.e., a clade formed by Synspermiata spiders and the families Filistatidae and Hypochilidae (Král *et al.* 2006; Kořínková & Král 2013). Similar to most other pholcids (Ávila Herrera *et al.* 2021), the bivalents of *Ibotyporanga* exhibit a very low frequency of chiasmata.

Ibotyporanga has an $X_1X_2X_3Y$ sex chromosome system, which has also been found in other ninetines of both the Northern and Southern clades, i.e., in *Papiamenta* (Huber *et al.* 2024a), *Gertschiola*, and *Nerudia* (Huber *et al.* 2023a). Chromosomes of the $X_1X_2X_3Y$ system pair without chiasmata during male meiosis. The $X_1X_2X_3X_4Y$ system, which is probably derived from the $X_1X_2X_3Y$ system (Huber *et al.* 2023a), was found in the Ninetinae genus *Kambiwa* (Ávila Herrera *et al.* 2021). The $X_1X_2X_3Y$ system has probably evolved from an X_1X_2Y system (Huber *et al.* 2023a), which is the ancestral sex chromosome system of araneomorph spiders including Haplogynae (Paula-Neto *et al.* 2017; Ávila Herrera *et al.* 2021). The ancestral X_1X_2Y system presumably consisted of two large metacentric X chromosomes and a metacentric Y microchromosome, which paired without chiasmata by the ends of their arms (so-called end-to-end pairing; Král *et al.* 2006; Ávila Herrera *et al.* 2021). End-to-end pairing of X chromosomes is retained in some ninetines with an $X_1X_2X_3Y$ system, namely in *Gertschiola* (Huber *et al.* 2023a) and *Ibotyporanga* (this study). The mode of X chromosome pairing in *Nerudia* (Huber *et al.* 2023a) and *Papiamenta* (Huber *et al.* 2024a) is unresolved. End-to-end pairing of the Y chromosome is retained in *Papiamenta* (Huber *et al.* 2024a). The mode of Y chromosome pairing in other ninetines with an $X_1X_2X_3Y$ system is unresolved. In some ninetines with an $X_1X_2X_3Y$ system, the tiny size of the Y chromosome is also retained. This concerns *Gertschiola* and *Ibotyporanga* sp. (Huber *et al.* 2023a; this study). The size of the Y chromosome seems to have increased considerably at least three times convergently in ninetines, namely in *Nerudia* (Huber *et al.* 2023a), *Papiamenta* (Huber *et al.* 2024a), and *I. naideae* (this study). The size of the Y chromosome has also expanded in some other Haplogynae spiders with an achiasmatic sex chromosome system, namely in pacullids and some pholcids with an X_1X_2Y system (Král *et al.* 2006, 2019, 2022; Ávila Herrera *et al.* 2021) as well as in pholcids and diguetids with an XY system, which is derived from an X_1X_2Y system (Král *et al.* 2006; Ávila Herrera *et al.* 2021). A size increase of the Y chromosome could be a consequence of accumulation of repetitive DNA and/or addition of autosome block(s) (Sember *et al.* 2020; Ávila Herrera *et al.* 2021). Addition of autosome material to the sex chromosomes is often involved in the formation of reproductive barriers and speciation (e.g., Kitano *et al.* 2009).

In spiders, an achiasmatic $X_1X_2X_3Y$ system has been found in some Ninetinae only (Huber *et al.* 2023a, 2024a, this study). The occurrence of this rare system in representatives of both the Northern and Southern clades of ninetines indicates that the $X_1X_2X_3Y$ system could be ancestral for the whole subfamily. If so, the X_1X_2Y system of *Pholcophora* may have arisen secondarily by fusion of two X chromosomes in an $X_1X_2X_3Y$ system. This hypothesis is supported by the evolution of sex chromosomes in *Guaranita* (Huber *et al.* 2023c). Although *Guaranita* spiders exhibit an X0 system, it belongs to a Ninetinae clade for which the $X_1X_2X_3Y$ system is very probably ancestral (Huber *et al.* 2024a). The transformation of the $X_1X_2X_3Y$ system to X0 probably first involved the transformation of the $X_1X_2X_3Y$ system to X_1X_2Y. Alternatively, *Pholcophora*, which is characterized by the X_1X_2Y system (ancestral to the pholcids), could be sister to all other ninetines, for which the $X_1X_2X_3Y$ system would be ancestral. This scenario is not currently supported by molecular data (Eberle *et al.* 2018; G. Meng, L. Podsiadlowski, B.A. Huber, unpubl. data).

Similar to other spiders (e.g., Suzuki 1954; Král *et al.* 2011; Araujo *et al.* 2012; Kořínková & Král 2013), the sex chromosomes of *Ibotyporanga* exhibit a specific behavior in the male germline (i.e., spermatogonia and meiotic cells). While the Y microchromosome of *Ibotyporanga* sp. does not show heteropycnosis during spermatogonial metaphase, the enlarged Y chromosome of *I. naideae* is positively heteropycnotic during this period. We suppose that heteropycnosis of this element could be a consequence of integration of autosome genes into the Y chromosome during its enlargement. It is possible that these genes cannot be transcribed in spermatogonia. Consequently, the Y chromosome is heteropycnotic and inactivated in these cells. In Pholcidae, heteropycnosis of sex chromosomes in spermatogonial cells has also been observed in some Modisiminae and Pholcinae (Ávila Herrera *et al.* 2021). Another unusual aspect of the *Ibotyporanga* sex chromosomes is their considerable decondensation in late prophase I and metaphase I. In Pholcidae, a similar pattern was found in the Ninetinae genus *Pholcophora* and in some Pholcinae (Ávila Herrera *et al.* 2021). However, in these taxa, the sex chromosomes re-condense already in late prophase I and the Y chromosome does not usually exhibit such a low condensation.

Some germline cells (premeiotic interphases, diffuse stages, late prophases I) of *Ibotyporanga* males contain an unusual heteropycnotic chromosome pair. This pair could be related to sex chromosomes; it resembles them in behavior. Besides differentiated sex chromosomes, the karyotype of araneomorph spiders probably contains a pair of undifferentiated sex chromosomes XY, the so-called sex chromosome pair (Král 2007; Král *et al.* 2011) or cryptic sex chromosome pair (CSCP; Král 2007; Král *et al.* 2011; Sember *et al.* 2020). These chromosomes exhibit a specific behavior in the male germline of several Haplogynae spiders (Král *et al.* 2006; Ávila Herrera *et al.* 2021) and many mygalomorph spiders (Král *et al.* 2013). In Haplogynae with a specific behavior of the CSCP, the chromosomes of the CSCP pair already during the premeiotic interphase, being positively heteropycnotic. Their heteropycnosis continues during meiosis (Král *et al.* 2006). The unusual chromosome pair of *Ibotyporanga* exhibits the same behavior, so it is probably also a CSCP. In Pholcidae, a specific behavior of the presumed CSCPs was otherwise detected in *Pholcophora* (Ninetinae) and *Pehrforsskalia* Deeleman-Reinhold & van Harten (Pholcinae) only. *Ibotyporanga* and *Pholcophora* belong to the same Ninetinae lineage, the Northern clade. Remarkably, the CSCPs of both genera have a similar morphology (they are large pairs) and behavior in the male germline (Ávila Herrera *et al.* 2021; this study). Both genera also exhibit a considerable decondensation of sex chromosomes during late prophase I. A solid interpretation of intriguing similarities such as these will require a denser sampling of karyotypes in Pholcidae in general and in Ninetinae in particular.

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Author contributions

BAH: initiation of project, collecting, taxonomy, writing

GM: curation and analysis of molecular data, species delimitation analysis, writing

IMAH: preparation of chromosome slides, evaluation of karyological data, writing

JK: preparation of chromosome slides, evaluation of karyological data, writing

LSC: permits, collecting, biogeography, taxonomy, writing

References

Aharon S., Huber B.A. & Gavish-Regev E. 2017. Daddy-long-leg giants: revision of the spider genus *Artema* Walckenaer, 1837 (Araneae, Pholcidae). *European Journal of Taxonomy* 376: 1–57. https://doi.org/10.5852/ejt.2017.376

Araujo D., Schneider M.C., Paula-Neto E. & Cella D.M. 2012. Sex chromosomes and meiosis in spiders: A review. *In*: Swan E. (ed.) *Meiosis - Molecular Mechanisms and Cytogenetic Diversity*: 87–108. InTech, Rijeka.

Astrin J.J., Huber B.A., Misof B. & Kluetsch C.F.C. 2006. Molecular taxonomy in pholcid spiders (Pholcidae, Araneae): evaluation of species identification methods using CO1 and 16S rRNA. *Zoologica Scripta* 35: 441–457. https://doi.org/10.1111/j.1463-6409.2006.00239.x

Astrin J.J., Misof B. & Huber B.A. 2007. The pitfalls of exaggeration: molecular and morphological evidence suggests *Kaliana* is a synonym of *Mesabolivar* (Araneae: Pholcidae). *Zootaxa* 1646 (1): 17–30. https://doi.org/10.11646/zootaxa.1646.1.2

Astrin J.J., Höfer H., Spelda J., Holstein J., Bayer S., Hendrich L., Huber B.A., Kielhorn K.-H., Krammer H.-J., Lemke M., Monje J.C., Morinière J., Rulik B., Petersen M., Janssen H. & Muster C. 2016. Towards a DNA barcode reference database for spiders and harvestmen of Germany. *PLoS One* 11 (9): e0162624. https://doi.org/10.1371/journal.pone.0162624

Ávila Herrera I.M., Král J., Pastuchová M., Forman M., Musilová J., Kořínková T., Šťáhlavský F., Zrzavá M., Nguyen P., Just P., Haddad C.R., Hiřman M., Koubová M., Sadílek D. & Huber B.A. 2021. Evolutionary pattern of karyotypes and meiosis in pholcid spiders (Araneae: Pholcidae): implications for reconstructing chromosome evolution of araneomorph spiders. *BMC Ecology and Evolution* 21: e75. https://doi.org/10.1186/s12862-021-01750-8

Benavente R. & Wettstein R. 1980. Ultrastructural characterization of the sex chromosomes during spermatogenesis of spiders having holocentric chromosomes and a long diffuse stage. *Chromosoma* 77: 69–81. https://doi.org/10.1007/bf00292042

Brown B.V. 1993. A further chemical alternative to critical-point-drying for preparing small (or large) flies. *Fly Times* 11: 10.

Carvalho L.S. & Avelino M.T.L. 2010. Composição e diversidade da fauna de aranhas (Arachnida, Araneae) da Fazenda Nazareth, Município de José de Freitas, Piauí, Brasil. *Biota Neotropica* 10: 1–11. https://doi.org/10.1590/S1676-06032010000300001

Cock P.J., Antao T., Chang J.T., Chapman B.A., Cox C.J., Dalke A., Friedberg I., Hamelryck T., Kauff F., Wilczynski B. & de Hoon M.J. 2009. Biopython: freely available Python tools for computational molecular biology and bioinformatics. *Bioinformatics* 25: 1422–1423. https://doi.org/10.1093/bioinformatics/btp163

Crowther T.W., Glick H.B., Covey K.R., Bettigole C., Maynard D.S., Thomas S.M., Smith J.R., Hintler G., Duguid M.C., Amatulli G., Tuanmu M.-N., Jetz W., Salas C., Stam C., Piotto D., Tavani R., Green S., Bruce G., Williams S.J., Wiser S.K., Huber M.O., Hengeveld G.M., Nabuurs G.-J., Tikhonova E., Borchardt P., Li C.-F., Powrie L.W., Fischer M., Hemp A., Homeier J., Cho P., Vibrans A.C., Umunay P.M., Piao S.L., Rowe C.W., Ashton M.S., Crane P.R. & Bradford M.A. 2015. Mapping tree density at a global scale. *Nature* 525: 201–205. https://doi.org/10.1038/nature14967

Diniz-Filho J.A.F., Santos T., Rangel T.F. & Bini L.M. 2012. A comparison of metrics for estimating phylogenetic signal under alternative evolutionary models. *Genetics and Molecular Biology* 35: 673–679. https://doi.org/10.1590/S1415-47572012005000053

Dolejš P., Kořínková T., Musilová J., Opatová V., Kubcová L., Buchar J. & Král J. 2011. Karyotypes of central European spiders of the genera *Arctosa*, *Tricca*, and *Xerolycosa* (Araneae: Lycosidae). *European Journal of Entomology* 108: 1–16. https://doi.org/10.14411/eje.2011.001

Eberle J., Dimitrov D., Valdez-Mondragón A. & Huber B.A. 2018. Microhabitat change drives diversification in pholcid spiders. *BMC Evolutionary Biology* 18: e141. https://doi.org/10.1186/s12862-018-1244-8

Felsenstein J. 1985. Confidence limits on phylogenies: An approach using the bootstrap. *Evolution* 39: 783–791. https://doi.org/10.2307/2408678

Fick S.E. & Hijmans R.J. 2017. WorldClim 2: new 1-km spatial resolution climate surfaces for global land areas. *International Journal of Climatology* 37: 4302–4315. https://doi.org/10.1002/joc.5086

Gertsch W.J. 1982. The spider genera *Pholcophora* and *Anopsicus* (Araneae, Pholcidae) in North America, Central America and the West Indies. *Texas Memorial Museum, Bulletin* 28: 95–144.

Goloboff P.A. 1993. NONA (NO NAME) ver. 2. Published by the author, Tucumán, Argentina. Available from http://www.lillo.org.ar/phylogeny/ [accessed 28 Aug. 2024].

Goloboff P.A., Farris J.S. & Nixon K. 2004. TNT, tree analysis using new technology, version 1.1, sponsored by the Willi Hennig Society. Available from http://www.lillo.org.ar/phylogeny/ [accessed 28 Aug. 2024].

Goloboff P.A., Farris J.S. & Nixon K. 2008. TNT, a free program for phylogenetic analysis. *Cladistics* 24: 774–786. https://doi.org/10.1111/j.1096-0031.2008.00217.x

Guindon S., Dufayard J.-F., Lefort V., Anisimova M., Hordijk W. & Gascuel O. 2010. New algorithms and methods to estimate maximum-likelihood phylogenies: assessing the performance of PhyML 3.0. *Systematic Biology* 59: 307–321. https://doi.org/10.1093/sysbio/syq010

Hoang D.T., Chernomor O., von Haeseler A., Minh B.Q. & Vinh L.S. 2017. UFBoot2: Improving the ultrafast bootstrap approximation. *Molecular Biology and Evolution* 35: 518–522. https://doi.org/10.1093/molbev/msx281

Huber B.A. 2000. New World pholcid spiders (Araneae: Pholcidae): a revision at generic level. *Bulletin of the American Museum of Natural History* 254: 1–348. https://doi.org/brh26h

Huber B.A. 2006. Cryptic female exaggeration: the asymmetric female internal genitalia of *Kaliana yuruani* (Araneae: Pholcidae). *Journal of Morphology* 276: 705–712. https://doi.org/10.1002/jmor.10431

Huber B.A. 2011. Phylogeny and classification of Pholcidae (Araneae): an update. *Journal of Arachnology* 39: 211–222. https://doi.org/10.1636/CA10-57.1

Huber B.A. 2018. The South American spider genera *Mesabolivar* and *Carapoia* (Araneae, Pholcidae): new species and a framework for redrawing generic limits. *Zootaxa* 4395 (1): 1–178. https://doi.org/10.11646/zootaxa.4395.1.1

Huber B.A. 2022. Revisions of *Holocnemus* and *Crossopriza*: the spotted-leg clade of Smeringopinae (Araneae, Pholcidae). *European Journal of Taxonomy* 795: 1–241. https://doi.org/10.5852/ejt.2022.795.1663

Huber B.A. & Brescovit A.D. 2003. *Ibotyporanga* Mello-Leitão: tropical spiders in Brazilian semi-arid habitats (Araneae: Pholcidae). *Insect Systematics and Evolution* 34: 15–20. https://doi.org/10.1163/187631203788964926

Huber B.A. & Carvalho L.S. 2019. Filling the gaps: descriptions of unnamed species included in the latest molecular phylogeny of Pholcidae (Araneae). *Zootaxa* 4546 (1): 1–96. https://doi.org/10.11646/zootaxa.4546.1.1

Huber B.A. & Dimitrov D. 2014. Slow genital and genetic but rapid non-genital and ecological differentiation in a pair of spider species (Araneae, Pholcidae). *Zoologischer Anzeiger* 253: 394–403. https://doi.org/10.1016/j.jcz.2014.04.001

Huber B.A. & Villarreal O. 2020. On Venezuelan pholcid spiders (Araneae, Pholcidae). *European Journal of Taxonomy* 718: 1–317. https://doi.org/10.5852/ejt.2020.718.1101

Huber B.A., Eberle J. & Dimitrov D. 2018. The phylogeny of pholcid spiders: a critical evaluation of relationships suggested by molecular data (Araneae, Pholcidae). *ZooKeys* 789: 51–101. https://doi.org/10.3897/zookeys.789.22781

Huber B.A., Caspar K. & Eberle J. 2019. New species reveal unexpected interspecific microhabitat diversity in the genus *Uthina* Simon, 1893 (Araneae: Pholcidae). *Invertebrate Systematics* 33: 181–207. https://doi.org/10.1071/IS18002

Huber B.A., Meng G., Acurio A.E., Astrin J.J., Inclán D.J., Izquierdo M. & Valdez-Mondragón A. 2022. *Metagonia* spiders of Galápagos: blind cave-dwellers and their epigean relatives (Araneae, Pholcidae). *Invertebrate Systematics* 36: 647–678. https://doi.org/10.1071/IS21082

Huber B.A., Meng G., Král J., Ávila Herrera I.M., Izquierdo M.A. & Carvalho L.S. 2023a. High and dry: integrative taxonomy of the Andean spider genus *Nerudia* (Araneae: Pholcidae). *Zoological Journal of the Linnean Society* 198: 534–591. https://doi.org/10.1093/zoolinnean/zlac100

Huber B.A., Meng G., Váldez-Mondragón A., Král J., Ávila Herrera I.M. & Carvalho L.S. 2023b. Short-legged daddy-long-leg spiders in North America: the genera *Pholcophora* and *Tolteca* (Araneae, Pholcidae). *European Journal of Taxonomy* 880: 1–89. https://doi.org/10.5852/ejt.2023.880.2173

Huber B.A., Meng G., Král J., Ávila Herrera I.M. & Izquierdo M.A. 2023c. Revision of the South American Ninetinae genus *Guaranita* (Araneae, Pholcidae). *European Journal of Taxonomy* 900: 32–80. https://doi.org/10.5852/ejt.2023.900.2301

Huber B.A., Meng G., Dupérré N., Herrera M., Inclán D. & Wipfler B. 2023d. Humpback spiders from Ecuador: relationships, prosoma 'inflation', and genital asymmetry (Araneae: Pholcidae: *Mecolaesthus*). *Invertebrate Systematics* 37: 117–151. https://doi.org/10.1071/IS22052

Huber B.A., Meng G., Dupérré N., Astrin J. & Herrera M. 2023e. Andean giants: *Priscula* spiders from Ecuador, with notes on species groups and egg-sac troglomorphism (Araneae: Pholcidae). *European Journal of Taxonomy* 909: 1–63. https://doi.org/10.5852/ejt.2023.909.2351

Huber B.A., Meng G., Dederichs T.M., Michalik P., Forman M. & Král J. 2024a. Castaways: the Leeward Antilles endemic spider genus *Papiamenta* (Araneae: Pholcidae). *Invertebrate Systematics* 38 (2): IS23052. https://doi.org/10.1071/IS23052

Huber B.A., Meng G., Cabra García J. & Carvalho L.S. 2024b. Thriving in dry conditions: on the Neotropical spider genus *Galapa* (Araneae: Pholcidae). *Zootaxa* 5419 (3): 301–347. https://doi.org/10.11646/zootaxa.5419.3.1

Huber B.A., Meng G. & Valdez-Mondragón A. 2024c. Notes on *Chisosa* (Araneae, Pholcidae), with the description of a new species from Mexico. *Zootaxa* 5419 (2): 217–244. https://doi.org/10.11646/zootaxa.5419.2.3

Izquierdo M.A., Dederichs T.M., Cargnelutti F. & Michalik P. 2023. Copulatory behaviour and genital mechanics suggest sperm allocation by a non-intromittent sclerite in a pholcid spider. *Royal Society Open Science* 10 (5): e230263. https://doi.org/10.1098/rsos.230263

Jäger P. 2005. Lengthening of embolus and copulatory duct: a review of an evolutionary trend in the spider family Sparassidae (Araneae). *Acta Zoologica Bulgarica* Suppl. 1: 49–62.

Kalyaanamoorthy S., Minh B.Q., Wong T.K.F., von Haeseler A. & Jermiin L.S. 2017. ModelFinder: fast model selection for accurate phylogenetic estimates. *Nature Methods* 14: 587–589. https://doi.org/10.1038/nmeth.4285

Kassambara A. 2014. easyGgplot2: Perform and customize easily a plot with ggplot2. R package version 1.0.0.9000. Available from http://www.sthda.com [accessed 28 Aug. 2024].

Katoh K. & Standley D.M. 2013. MAFFT multiple sequence alignment software version 7: improvements in performance and usability. *Molecular Biology and Evolution* 30: 772–780. https://doi.org/10.1093/molbev/mst010

Kimura M. 1980. A simple method for estimating evolutionary rates of base substitutions through comparative studies of nucleotide sequences. *Journal of Molecular Evolution* 16: 111–120. https://doi.org/10.1007/BF01731581

Kitano J., Ross J.A., Mori S., Kume M., Jones F.C., Chan Y.F., Absher D.M., Grimwood J., Schmutz J., Myers R.M., Kingsley D.M. & Peichel C.L. 2009. A role for a neo-sex chromosome in stickleback speciation. *Nature* 461 (7267): 1079–1083. https://doi.org/10.1038/nature08441

Kořínková T. & Král J. 2013. Karyotypes, sex chromosomes, and meiotic division in spiders. *In*: Nentwig W. (ed.) *Spider Ecophysiology*: 159–171. Springer, Berlin. https://doi.org/10.1007/978-3-642-33989-9_12

Král J. 2007. Evolution of multiple sex chromosomes in the spider genus *Malthonica* (Araneae: Agelenidae) indicates unique structure of the spider sex chromosome systems. *Chromosome Research* 15: 863–879. https://doi.org/10.1007/s10577-007-1169-3

Král J., Musilová J., Šťáhlavský F., Řezáč M., Akan Z., Edwards R.L., Coyle F.A. & Ribera Almerje C. 2006. Evolution of the karyotype and sex chromosome systems in basal clades of araneomorph spiders (Araneae: Araneomorphae). *Chromosome Research* 14: 859–880. https://doi.org/10.1007/s10577-006-1095-9

Král J., Kořínková T., Forman M. & Krkavcová L. 2011. Insights into the meiotic behavior and evolution of multiple sex chromosome systems in spiders. *Cytogenetic and Genome Research* 133 (1): 43–66. https://doi.org/10.1159/000323497

Král J., Kořínková T., Krkavcová L., Musilová J., Forman M., Ávila Herrera I.M., Haddad C.R., Vítková M., Henriques S., Palacios Vargas J.G. & Hedin M. 2013. Evolution of karyotype, sex chromosomes, and meiosis in mygalomorph spiders (Araneae: Mygalomorphae). *Biological Journal of the Linnean Society* 109: 377–408. https://doi.org/10.1111/bij.12056

Král J., Forman M., Kořínková T., Reyes Lerma A.C., Haddad C.R., Musilová J., Řezáč M., Ávila Herrera I.M., Thakur S., Dippenaar-Schoeman A.S., Marec F., Horová L. & Bureš P. 2019. Insights into the karyotype and genome evolution of haplogyne spiders indicate a polyploid origin of lineage with holokinetic chromosomes. *Scientific Reports* 9: e3001. https://doi.org/10.1038/s41598-019-39034-3

Král J., Ávila Herrera I.M., Šťáhlavský F., Sadílek D., Pavelka J., Chatzaki M. & Huber B.A. 2022. Karyotype differentiation and male meiosis in European clades of the spider genus *Pholcus* (Araneae, Pholcidae). *Comparative Cytogenetics* 16 (4): 185–209. https://doi.org/10.3897/compcytogen.v16i4.85059

Letunic I. & Bork P. 2021. Interactive Tree Of Life (iTOL) v5: an online tool for phylogenetic tree display and annotation. *Nucleic Acids Research* 49: W293–W296. https://doi.org/10.1093/nar/gkab301

Levan A.K., Fredga K. & Sandberg A.A. 1964. Nomenclature for centromeric position on chromosomes. *Hereditas* 52: 201–220. https://doi.org/10.1111/j.1601-5223.1964.tb01953.x

Maddison W. 2018. Please, don't use CO1 barcodes alone for spider phylogeny. *In*: *Wayne Maddison's Blog: Discovering Spiders, Evolutionary History, and the World*. Available from https://waynemaddison.wordpress.com/2018/11/22/please-dont-use-co1-barcodes-alone-for-spider-phylogeny/ [accessed 28 Aug. 2024].

Magalhães I., Fernandes L., Ramírez M. & Bonaldo A. 2016. Phylogenetic position and taxonomic review of the *Ianduba* spiders (Araneae: Corinnidae) endemic to the Brazilian Atlantic rainforest. *Arthropod Systematics & Phylogeny* 74: 127–159. https://doi.org/10.3897/asp.74.e31843

Mello-Leitão C.F. de 1944. Algumas aranhas da região amazônica. *Boletim do Museu Nacional do Rio de Janeiro (Nova Serie, Zoologia)* 25: 1–12.

Minh B.Q., Schmidt H.A., Chernomor O., Schrempf D., Woodhams M.D., von Haeseler A. & Lanfear R. 2020. IQ-TREE 2: New models and efficient methods for phylogenetic inference in the genomic era. *Molecular Biology and Evolution* 37: 1530–1534. https://doi.org/10.1093/molbev/msaa015

Morrone J.J. 2017. *Neotropical Biogeography: Regionalization and Evolution*. CRC Press, Boca Raton. Available from https://www.taylorfrancis.com/books/9781315390659 [accessed 28 Aug. 2024].

Nixon K.C. 2002. Winclada, version 1.00.08. Program and documentation. Available from http://www.diversityoflife.org/winclada/ [accessed 28 Aug. 2024].

Oliveira U., Paglia A.P., Brescovit A.D., de Carvalho C.J.B., Silva D.P., Rezende D.T., Leite F.S.F., Batista J.A.N., Barbosa J.P.P.P., Stehmann J.R., Ascher J.S., de Vasconcelos M.F., De Marco P., Löwenberg-Neto P., Dias P.G., Ferro V.G. & Santos A.J. 2016. The strong influence of collection bias on biodiversity knowledge shortfalls of Brazilian terrestrial biodiversity. *Diversity and Distributions* 22: 1232–1244. https://doi.org/10.1111/ddi.12489

Pagel M. 1999. Inferring the historical patterns of biological evolution. *Nature* 401: 877–884. https://doi.org/10.1038/44766

Paula-Neto E., Cella D.M., Araujo D., Brescovit A.D. & Schneider M.C. 2017. Comparative cytogenetic analysis among filistatid spiders (Araneomorphae: Haplogynae). *Journal of Arachnology* 45: 123–128. https://doi.org/10.1636/M14-69.1

Puillandre N., Brouillet S. & Achaz G. 2021. ASAP: assemble species by automatic partitioning. *Molecular Ecology Resources* 21: 609–620. https://doi.org/10.1111/1755-0998.13281

Ratnasingham S. & Hebert P.D.N. 2007. bold: The Barcode of Life Data System (http://www.barcodinglife.org). *Molecular Ecology Notes* 7: 355–364. https://doi.org/10.1111/j.1471-8286.2007.01678.x

Revell L.J. 2012. phytools: an R package for phylogenetic comparative biology (and other things). *Methods in Ecology and Evolution* 3: 217–223. https://doi.org/10.1111/j.2041-210X.2011.00169.x

Saitou N. & Nei M. 1987. The neighbor-joining method: A new method for reconstructing phylogenetic trees. *Molecular Biology and Evolution* 4: 406–425. https://doi.org/10.1093/oxfordjournals.molbev.a040454

Sember A., Pappová M., Forman M., Nguyen P., Marec F., Dalíková M., Divišová K., Doležálková-Kaštánková M., Zrzavá M., Sadílek D., Hrubá B. & Král J. 2020. Patterns of sex chromosome differentiation in spiders: Insights from comparative genomic hybridisation. *Genes (Basel)* 11: e849. https://doi.org/10.3390/genes11080849

Silva D.R. da, Soares-Lopes C.R.A., Gressler E. & Eisenlohr P.V. 2020. Woody vegetation associated with rocky outcrops in Southern Amazonia: a starting point to unveil a unique flora. *Biota Neotropica* 20: 1–16. https://doi.org/10.1590/1676-0611-bn-2019-0874

Simard M., Pinto N., Fisher J.B. & Baccini A. 2011. Mapping forest canopy height globally with spaceborne lidar. *Journal of Geophysical Research* 116: G04021. https://doi.org/10.1029/2011JG001708

Suyama M., Torrents D. & Bork P. 2006. PAL2NAL: robust conversion of protein sequence alignments into the corresponding codon alignments. *Nucleic Acids Research* 34: W609–W612. https://doi.org/10.1093/nar/gkl315

Suzuki S. 1954. Cytological studies in spiders. III. Studies on the chromosomes of fifty-seven species of spiders belonging to seventeen families, with general considerations on chromosomal evolution. *Journal of Science of Hiroshima University* Series B 2: 23–136.

Tamura K., Stecher G. & Kumar S. 2021. MEGA11: Molecular Evolutionary Genetics Analysis Version 11. *Molecular Biology and Evolution* 38: 3022–3027. https://doi.org/10.1093/molbev/msab120

Wickham H. 2011. ggplot2. *Wiley Interdisciplinary Reviews: Computational Statistics* 3: 180–185. https://doi.org/10.1002/wics.147

Yang C., Zheng Y., Tan S., Meng G., Rao W., Yang C., Bourne D.G., O'Brien P.A., Xu J., Liao S., Chen A., Chen X., Jia X., Zhang A. & Liu S. 2020. Efficient COI barcoding using high throughput single-end 400 bp sequencing. *BMC Genomics* 21: e862. https://doi.org/10.1186/s12864-020-07255-w

Zomer R.J., Xu J. & Trabucco A. 2022. Version 3 of the Global Aridity Index and Potential Evapotranspiration Database. *Scientific Data* 9: e409. https://doi.org/10.1038/s41597-022-01493-1

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Fig. S1. ML tree of morphological data.
Fig. S2. ML tree of CO1 data.
Fig. S3. ML tree of combined morphological + molecular data.
Fig. S4. Tibia 1 length sexual dimorphism.
Fig. S5. Body size and egg size.
Fig. S6. NJ tree of CO1 data.
Fig. S7. ASAP species delimitation analysis.
Fig. S8. Type locality of *Ibotyporanga kanoe* at Floresta Nacional do Jamari.
Fig. S9. Vegetation and mining activities at type locality of *Ibotyporanga kanoe*.
Fig. S10. Relation between extent of occurrence and mean distance from access routes.
Table S1. CO1 K2P distances.
Table S2. Distance from access routes, extent of occurrence, and number of points of occurrence.
Table S3. Summary of principal components analysis for comparing the environmental niche.
Table S4. Covariance between principal components and environmental layers.
Table S5. Summary of principal components analysis for species distribution modeling.
Table S6. Correlation coefficients between principal components and environmental layers.
Table S7. Contribution of principal components to species distribution modeling.
Table S8. Summary of principal components analysis for computing the phylogenetic signal for environmental niche.
Table S9. Covariance of principal components and environmental layers used to compute phylogenetic signal.
Table S10. Summary of phylogenetic signal (Pagel's λ) analyses.

Appendix 1

Data matrix for cladistic analysis. Taxa are arranged as in the cladogram in Fig. 1. Terminals and characters are detailed in Appendices 2 and 3; “-” = non-applicable. This matrix is available online at www.pholcidae.de/matrices.html

	....0....1....1....2....2
	....5....0....5....0....5
Artema doriae	00010000-000-01100-00000-
Pholcophora a.	00000000-000-50010-00000-
I. ziruma	11100000-100010001000000-
I. walekeru	11100000-100000001001000-
I. bariro	11100000-100000001001000-
I. piojo	11100000-100030001001000-
I. itatim	11101000-100001101110000-
I. xakriaba	11110000-110021101110000-
I. xique	11110000-110021101110000-
I. camarai	11100000-101000001000000-
I. naideae	11100110-1011000010001101
I. kanoe	11100110-1011000010001101
I. diroa	11100100-101000001000001-
I. ramosae	111001010101040001000001-
I. imale	111001011101040001000001-
I. sertao	111001010101040001000100-
I. guanambi	111001010101040001000001-
I. capivara	111001010101040001000001-
I. emekori	1112010111010000010000111
I. payaya	1112010111010000010000111
I. tuxa	1112110111010000010000111
I. atikum	1112110111010000010000110
I. kiriri	1112110111010000110000110
I. ouro	1112110111010000110000110
I. itajubaquara	1112110111010000110000110
I. canudos	1112110111010000110000110

Appendix 2

Terminal taxa scored for the cladistic analysis, with origin (for further details and depository information see individual species descriptions). Taxa are arranged as in the cladogram in Fig. 1.

Artema doriae: scored following redescription in Aharon *et al.* 2017.
Pholcophora americana: scored following redescription in Huber *et al.* 2023b.
I. itatim: Brazil, Bahia, W of Itatim
I. xique: Brazil, Bahia, S of Xique-Xique, 'loc. 3'
I. xakriaba: Brazil, Piauí, Guaribas, Parque Nacional da Serra das Confusões
I. ziruma: Colombia, Magdalena, Santa Marta, at Cerro Ziruma
I. walekeru: Colombia, Cesar, 18 km ESE of Pueblo Bello
I. bariro: Venezuela, Falcón, SE of Bariro
I. piojo: Colombia, Atlántico, near Piojo, Reserva Natural Los Charcones
I. camarai: Brazil, Pernambuco, NE of Petrolina
I. naideae: Brazil, Bahia, SE of Jacobina
I. kanoe: Brazil, Rondônia, Floresta Nacional do Jamari, Pedra Grande
I. diroa: Brazil, Bahia, W of Queimada Nova
I. imale: Brazil, Bahia, E of São Felix do Coribe
I. ramosae: Brazil, Bahia, São Desiderio, near Gruta da Passagem
I. guanambi: Brazil, Bahia, N of Guanambi
I. capivara: Brazil, Piauí, Parque Nacional da Serra da Capivara, near Toca de Cima dos Pilões
I. sertao: Brazil, Pernambuco, NE of Lagoa Grande
I. emekori: Brazil, Bahia, near Mundinho, near Toca do Índio
I. payaya: Brazil, Bahia, SE of Bom Jesus da Lapa, 'site 1'
I. tuxa: Brazil, Bahia, W of Barra do Mendes, Ipupiara, at BA-046
I. atikum: Brazil, Bahia, SE of Bom Jesus da Lapa, 'site 2'
I. kiriri: Brazil, Bahia, SE of Paramirim
I. ouro: Brazil, Bahia, E of Gentio do Ouro
I. itajubaquara: Brazil, Bahia, N of Itajubaquara
I. canudos: Brazil, Bahia, 25 km WNW of Morro do Chapéu

Appendix 3

Characters scored for cladistic analysis.

1. Male clypeus notch: (0) absent; (1) present (arrow in Fig. 107A). All known species of *Ibotyporanga* share this notch, which seems to allow the male cheliceral apophysis to be in a very proximal position. The notch is also present in *I. ziruma* sp. nov., a species with a distal cheliceral apophysis but with a proximal rounded process. No similar structure is known in other Ninetinae.
2. ALS spigots: (0) more than two; (1) two. *Ibotyporanga* seems to be the only genus among Ninetinae with a reduced set of ALS spigots (Figs 7–8). Only eight species were studied in an SEM, but the number of spigots was verified in all species (using cleared female abdomens under a compound microscope).
3. Male cheliceral apophyses: (0) separate, paired; (1) fused, median. *Ibotyporanga* is the only genus among Pholcidae with a fused median cheliceral apophysis.
4. Male palpal patella length: (0) regular length (length/diameter 0.9–1.8); (1) very short (<0.7; Figs 47, 51); (2) very long (>1.8; e.g., Figs 97, 109).
5. Male palpal tarsus, dorsal hump: (0) absent; (1) present (arrows in, e.g., Figs 114C, 118C, 122C).
6. Procursus shape: (0) short (length/width ≤10; e.g., Figs 27, 31, 38); (1) long (length/width >20; Figs 61, 69, 84). The plesiomorphic condition in *Ibotyporanga* seems to be a procursus with a length as commonly found in Pholcidae, i.e. ~3–6 times as long as wide in its mid section in lateral view. *Ibotyporanga camarai* sp. nov. has a short but slender procursus (length/width ~10). All other species have a strongly elongated procursus.
7. Prolateral process proximally on procursus: (0) absent; (1) present (arrows in Figs 62B, 66B).
8. Procursus dorsal branch: (0) absent; (1) present (e.g., Figs 81, 89, 98).
9. Length of dorsal branch on procursus: (0) short, i.e., much shorter than main branch (e.g., Figs 81, 85); (1) long, i.e., of almost same length as main branch (e.g., Figs 98, 102, 106).
10. Light band on procursus: (0) absent; (1) present (e.g., Figs 28A, 33A, 37A). This band is usually also visible in retrolateral view, but more distinct in prolateral view. The slit visible on the procursus in SEM images (arrows in Figs 11D, 12E) suggests that it might represent a longitudinal invagination.
11. Membranous flap distally ventrally on procursus: (0) absent; (1) present (Figs 48C, 52C).
12. Slender semitransparent tip of procursus: (0) absent; (1) present (e.g., Figs 57, 76, 89).
13. Prolateral sclerite on bulbous part of genital bulb: (0) distinct, long (e.g., Figs 28D, 33D, 37D); (1) indistinct, very short (Figs 62D, 66D). Most species of *Ibotyporanga* share a distinct sclerite on the prolateral side of the genital bulb. Only *I. naideae* Mello-Leitão and *I. kanoe* sp. nov. have very short or basically no sclerites; the cladistic analysis interprets this as a secondary loss. The presence of such a sclerite is possibly a synapomorphy of *Ibotyporanga*, but not resolved as such because the outgroup taxa are coded as "-" = non-applicable.
14. Prolateral apophysis on embolus: (0) absent or indistinct; (1) long, slender, pointed (Fig. 28D, E); (2) short and conical (Figs 48D, 52D); (3) large thick process (Fig. 39D); (4) slender ridge (e.g., Figs 77A, 81D, 85D); (5) small and finger-shaped, rather dorsal (only *Pholcophora americana* Banks 1896, cf. fig. 5g in Huber *et al.* 2023b). The coding of this character is problematic. Some structures on the embolus appear somewhat intermediate, others might require an additional character state.
15. Leg length: (0) short (male tibia 1 L/d <15); (1) long (male tibia 1 L/d >15).

16. Relationship between male tibia 4 and tibia 1 lengths: (0) tibia 4 longer than tibia 1; (1) tibia 4 shorter than tibia 1.
17. Epigynum shape: (0) regular (width/length <1.9); (1) much wider than long (width/length ≥ 1.9).
18. Epigynal pocket: (0) absent; (1) present. Epigynal pockets are common in Pholcidae but very rare in Ninetinae (only known presence other than *Ibotyporanga*: *Ninetis* Simon, 1890). All representatives of *Ibotyporanga* have a median epigynal pocket (e.g., Figs 30, 35, 41).
19. Shape of epigynal pocket: (0) straight or evenly curved, shallow (e.g., Figs 30, 35, 41); (1) strongly curved, almost triangular (Figs 45, 49, 53).
20. Epigynum, heavy sclerotization of lateral posterior parts of main (anterior) plate: (0) absent; (1) present (Figs 46, 50, 54).
21. Female internal genitalia, membranous dome-shaped median element from which pair of tubes originate: (0) absent; (1) present (Figs 36, 41). Paired tubes (or sacs, or pouches) also occur in other taxa (cf. char. 22) but not in combination with a dome-shaped median element.
22. Female internal genitalia, elongated lateral tubes: (0) absent; (1) present. The cladistic analysis suggests that the very similar long tubes of *I. naideae* (Fig. 63) and *I. sertao* sp. nov. (Fig. 86) have evolved independently.
23. Female internal genitalia, median sclerite: (0) absent; (1) present (e.g., Figs 64, 68, 100, 104). The cladistic analysis suggests that the apparently complex median sclerotized elements of *I. naideae* and *I. kanoe* sp. nov. evolved independently from the simpler median sclerites in other species.
24. Female internal genitalia, large expandable sac: (0) absent; (1) present (e.g., Figs 72, 78, 91, 95). A large Brazilian clade of *Ibotyporanga* is characterized by a large expandable sac in the female internal genitalia. This sac barely expanded when females stored in 80% EtOH were cleared, but it expanded strongly when specimens stored in pure ethanol were cleared.
25. Female internal genitalia, posterior narrowing ('neck') of median sclerite: (0) absent (e.g., Figs 119C, 127C); (1) present (e.g., Figs 99C, 107D).