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Pachomius areteguazu sp. nov. (Araneae: Salticidae: Freyina), and the first description of the epigynum of a member of the *nigrus* group

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Abstract. Our latest collections in northeastern Argentina include new species of jumping spiders (Salticidae) that indicate that the diversity of this group in Argentina is indeed underestimated. This paper describes and illustrates a new species, *Pachomius areteguazu* sp. nov., an inhabitant of the grasslands of northeastern Argentina. Within the genus *Pachomius*, this new species is placed in the *nigrus* group (Edwards 2015) because it has a sclerotized lateral subterminal apophysis (LSA) next to the embolus, spine-shaped, possibly derived by loss of the membranous part of the LSA. Previously no females in the *nigrus* group were known, so we also present the first description of an epigynum for this group and discuss its relationship to the LSA with respect to copulation.

Keywords. Aelurillini, Argentina, Misiones, taxonomy

Introduction

Pachomius Peckham & Peckham, 1896 is a genus of medium-sized jumping spiders, represented by 21 species that share a general setal patterns on the carapace to include lateral light bands and a median thoracic stripe (Edwards 2015; WSC 2021). The abdomen also has a variable pattern of spots. A distinctive femoral organ on distal prolateral femur of the male pedipalp is another diagnostic character for this genus (Edwards 2015).

Species of the genus *Pachomius* inhabit Neotropical areas, and most of them seem to have a preference for grassland environments, disturbed low vegetation, secondary growth forests and forest edges, although they have also been collected in primary forest (Galiano 1995; Rubio 2014; Edwards 2015).

In Argentina and neighboring countries, our knowledge of *Pachomius* was mostly contributed by M. E. Galiano (Galiano 1994, 1995). Previously two species have been described in Argentina, *P. misionensis* (Galiano, 1995) and *P. ministerialis* (C. L. Koch, 1846), formerly under the genus *Uspachus* Galiano, 1995. We also found one of these species in the grasslands of Paraguay. In our most recent field studies we discovered a third species of *Pachomius* in Argentina, and we describe that species here. Based on its morphology we place this species in the *nigrus* group defined by Edwards (2015). Also, we describe the female reproductive structures, previously unknown in this group.

Material and methods

Morphological terms, abbreviations, definitions, and some measurements follow recent studies on freyine salticids (Edwards 2015; Rubio et al. 2019). Female genitalia was dissected as described by Levi (1965), examined after digestion in a hot ~15% NaOH solution, and cleared in clove oil to examine their internal structure. Temporary preparations were observed and photographed using a Leica DM500 compound microscope and a Leica M60 stereomicroscope. Structures were sketched from incident light photograph models using a computer system for drawing and image processing (Wacom digitizer tablet with GIMP, free software). Measurements were taken directly from a microscope ocular lens with an ocular micrometer and are expressed in millimeters. Photographs of live spiders were taken using a Nikon D3400 digital camera with a Raynox 250 or a Micro-Nikkor 85 mm lenses.

Acronyms. **ALE**, anterior lateral eyes; **AT**, atrium; **CD**, copulatory duct; **CO**, copulatory opening; **E**, embolus; **FD**, fertilization duct; **LSA**, lateral subterminal apophysis; **PME**, posterior medial eyes; **PLE**, posterior lateral eyes; **pPL**, proximal prolateral lobe of TDD; **pRL**, proximal retrolateral lobe of TDD; **RTA**, retrolateral tibial apophysis; **S**, spermophore; **TBD**, tegulum basal division; **TDD**, tegulum distal division. The arachnological collections were abbreviated as follows (curator in parenthesis): **CNNE**, Colección de Artrópodos de la Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, Argentina (G. Avalos); **IBSI-Ara**, Instituto de Biología Subtropical, Universidad Nacional de Misiones, Argentina (G. Rubio).

Results/Systematics

Family SALTICIDAE Blackwall, 1841
Subfamily SALTICINAE Blackwall, 1841
Tribe AELURILLINI Simon, 1901
Subtribe FREYINA Edwards, 2015
Genus *Pachomius* Peckham & Peckham, 1896

Pachomius areteguazu sp. nov.

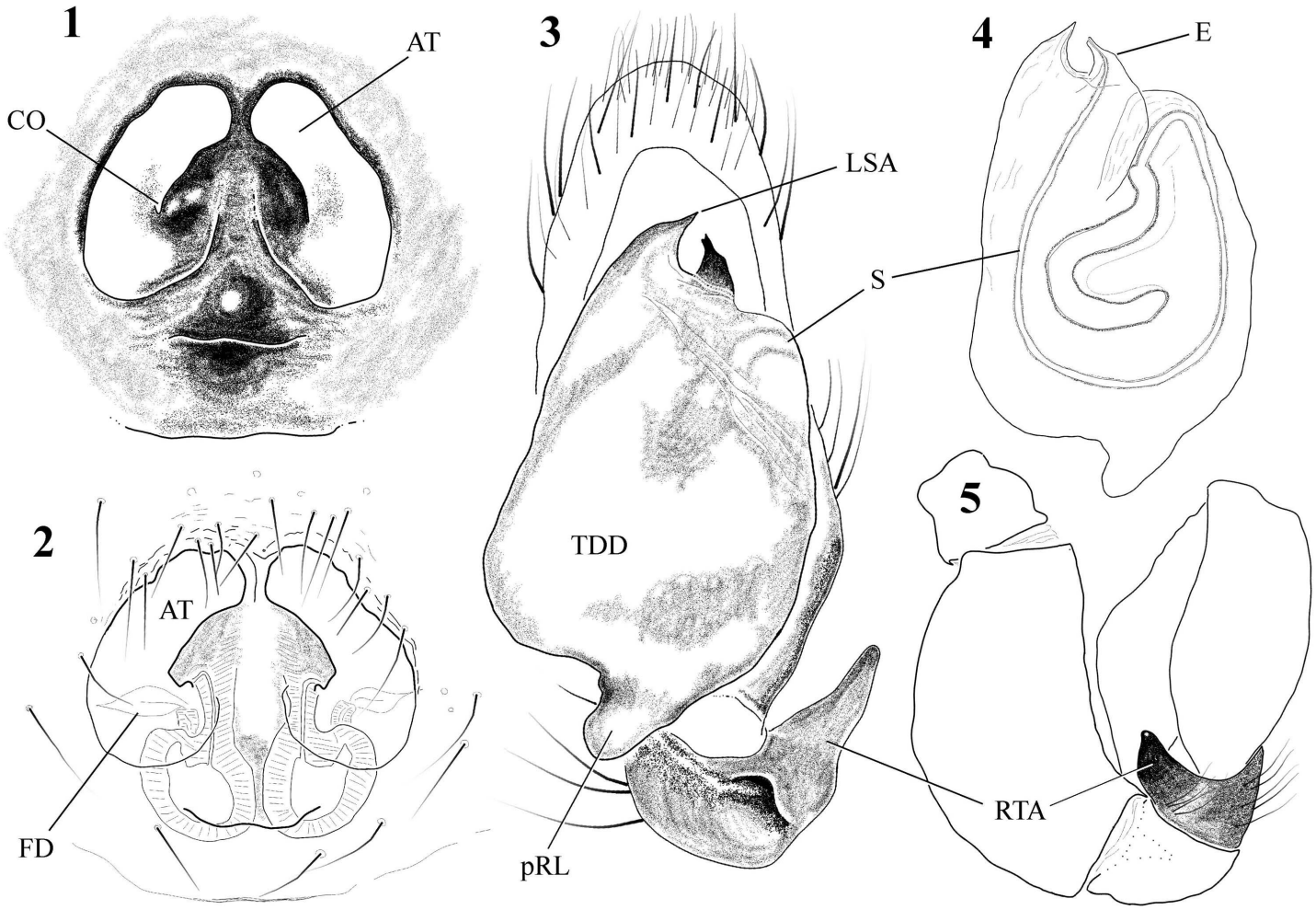
Figures 1-22

Type material. Male holotype (IBSI-Ara 1453) from Argentina, Misiones, Candelaria, Santa Cecilia Ranch (27.45046°S, 55.716375°W), 6 February 2019, J. E. M. Baigorria coll.; female allotype (IBSI-Ara 1248), same place and collector, 13 January 2019. Paratypes: 1 female (IBSI-Ara 1479), San Pedro, Cruce Caballero, Forestal Belga Ranch (26.572361°S, 53.801667°W), 22 October 2019, G. D. Rubio, A. A. Toro and C. E. Stolar coll.; 1 male (IBSI-Ara 1535), same place and collector as holotype, September 2020.

Etymology. The specific epithet, "areteguazu," refers to one of the most important and traditional celebrations of the year for the Guaraní indigenous community, whose meaning is "big party" or "important party." In this event, Guaraní people use masks that resemble the pattern observed on the carapace of this species.

Diagnosis. The male *P. areteguazu* sp. nov. resembles *P. nigrus* (Caporiacco, 1947) and *P. lehmanni* (Strand, 1908) by the presence of a sclerotized, spine-shaped (possibly derived by the loss of the membraneous part of the LSA) LSA on the tegulum, next to the embolus, and for this reason we place it in the *nigrus* group (Edwards 2015). It can be distinguished from the other two species by the wider and shorter LSA (Figures 3, 4, 11), the shorter embolus with the tip directed prolaterally (retrolateral in *P. nigrus*), and by

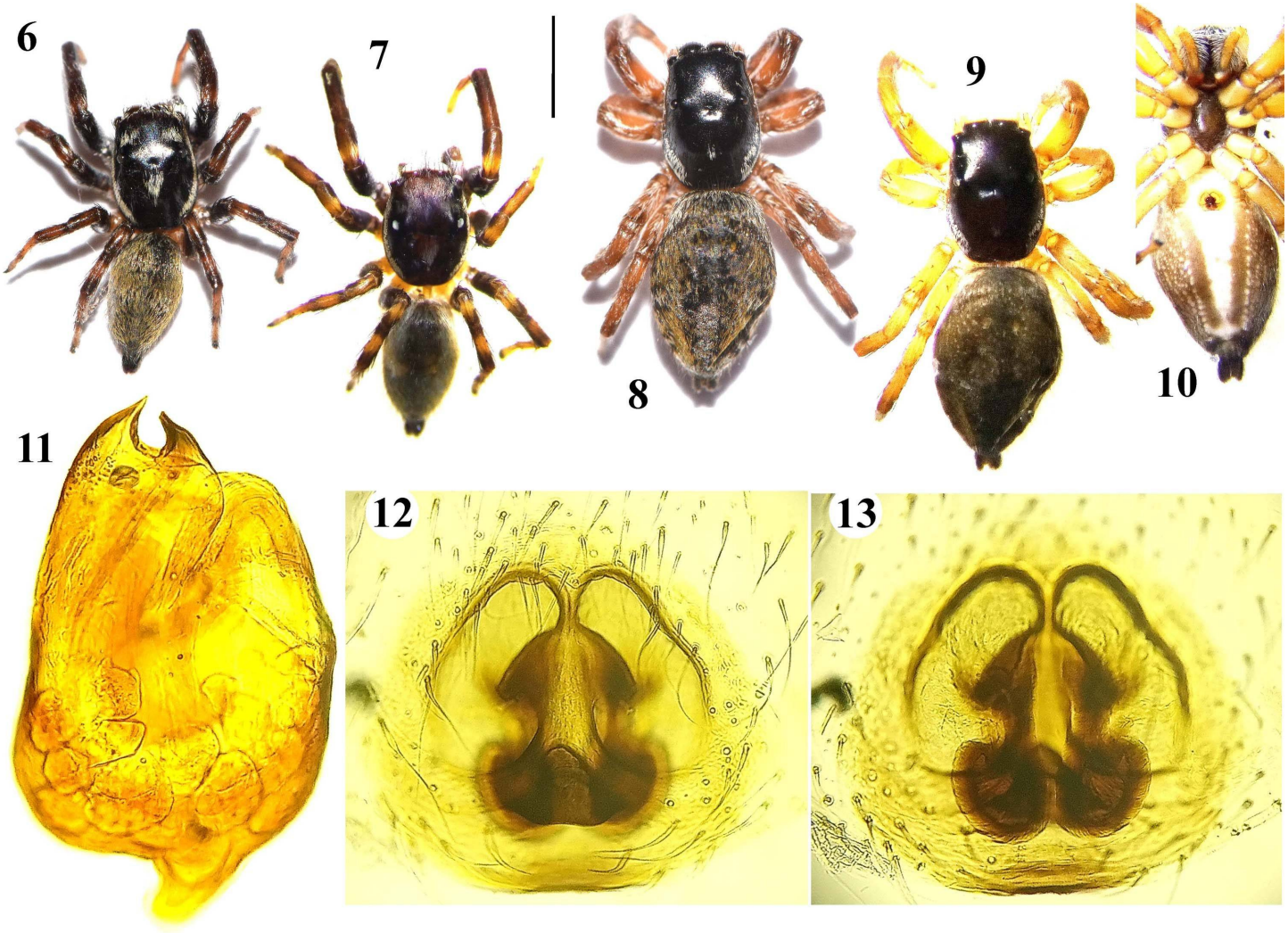
the absence of a pPL on the TDD (present in those two species of the group) (Figures 3, 11). The nigrus group is completed with *P. lehmanni* and *P. nigrus*, and several undescribed species (Edwards 2015; Galvis 2018). The female *P. areteguazu* sp. nov. differs from those of other congeners by the structure of the epigynal plate, with a CO at the center of each of two conspicuous, non-circular atria (Figures 1, 2, 12, 13). No female in the *nigrus* group has been described previously, therefore the first description of the epigynum for this group is presented here.



Figures 1-5. Sexual structures of *Pachomius areteguazu* sp. nov. **1-2,** Paratype ♀. **3-5,** Holotype ♂. **1,** Epigynum, ventral view. **2,** Same, cleared. **3,** Left palp, ventral view. **4,** Copulatory bulb, cleared, ventral view. **5,** Left palp, retrolateral view. **AT,** atrium; **CO**, copulatory opening; **E**, embolus; **FD**, fertilization duct; **LSA**, lateral subterminal apophysis; **pRL**, proximal retrolateral lobe of TDD; **RTA**, retrolateral tibial apophysis; **S**, spermophore; **TDD**, tegulum distal division.

Description. The *male* (holotype) is shown in Figures 3-7 and 11. Medium-sized salticid, total length 5.10. Carapace longer than wide, length 2.45, width: 1.70. Carapace dark brown, cephalic region blackish with three conspicuous spots of white setae, two between PME and PLE, and one between PLE. Wide white marginal bands continued from below ALE. Clypeus with a row of 14 to 16 long, inconspicuous hairs. Chelicerae dark mahogany brown, paturon with some scaly, translucent white hairs, with two promarginal teeth and one retromarginal tooth. Sternum blackish, with some scattered white translucent hairs; labium blackish and endites dark brown. Legs equal, hairy, brown color, ringed dark brown, femurs blackish; coxae I dark brown, coxae II-IV pale yellow. Abdomen length: 2.40, width: 1.50, color in ethanol greenish-gray (Figure 7), pale orange-brown in life (Figures 18, 22); with an abdominal basal band of lighter hairs on the anterior edge of the abdomen. Dorsal scutum absent. Palp: femur strong, slightly

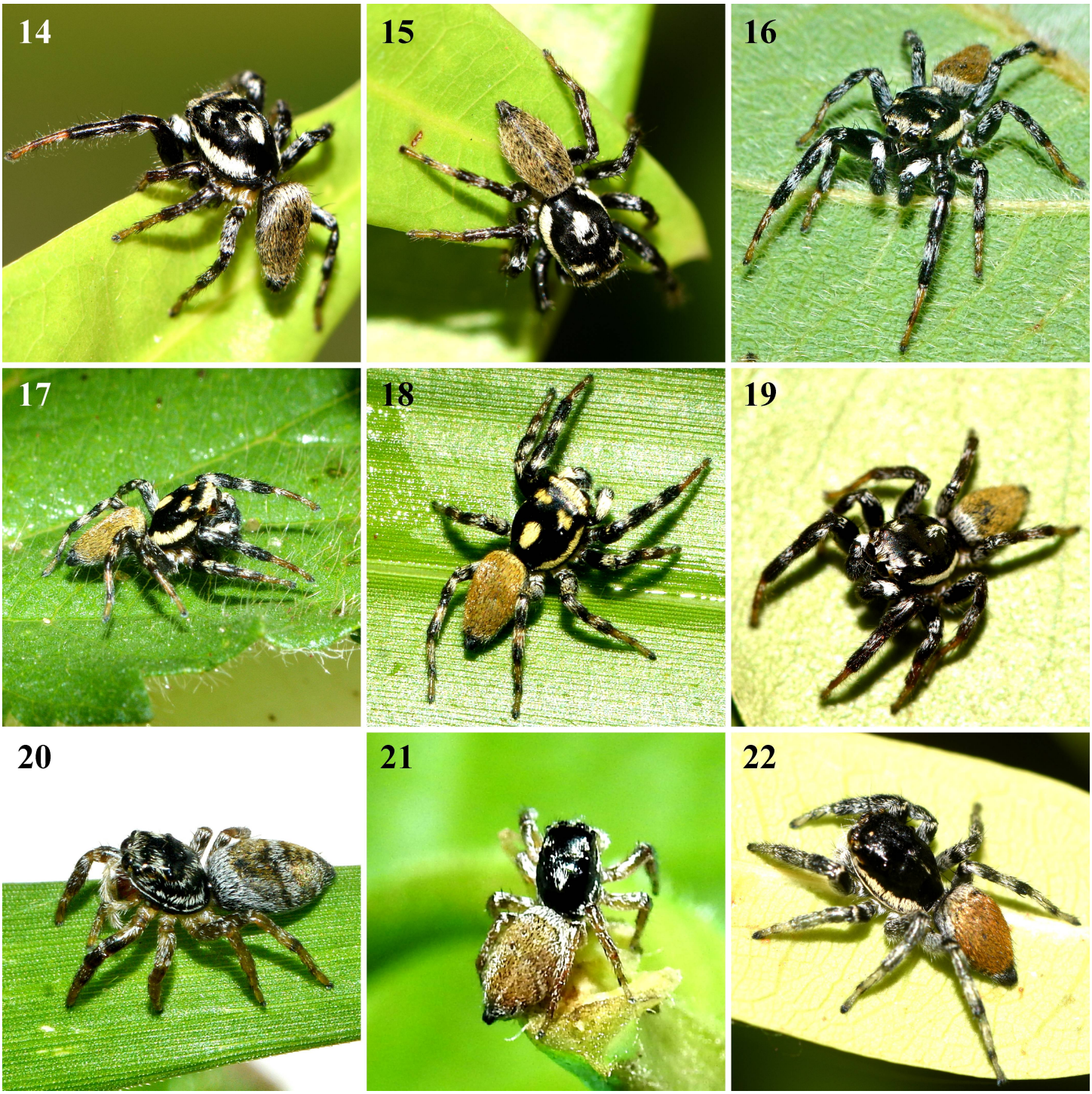
curved (Figure 5), with femoral organ on the distal prolateral side, tibia with a conspicuous RTA with a wide base, narrower towards the apex, tip somewhat triangular, directed ventrally (Figure 5). Division of the tegulum inconspicuous, with the border between TBD and TDD oblique in ventral view. TDD with pRL narrow, rounded edges and a lobed tip (Figure 3). Embolus short, thick, sclerotized with conspicuous base and prolaterally directed tip (Figures 3-4, 11). Lateral subterminal apophysis (LSA) sclerotized, prolateral to the embolus and shaped like a short and thick spine, retrolaterally directed tip. TBD with a short, curved, and small visible stretch of the spermophore (Figures 3-4).



Figures 6-13. Preserved specimens of *Pachomius areteguazu* sp. nov. 6-7, 11, Holotype ♂. **8-10,** Allotype ♀. **12-13,** Paratype ♀. **6,** Dorsal view of male, dry. **7,** Same, submerged in ethanol. **8,** Dorsal view of female, dry. **9,** Same, submerged in ethanol. **10,** Same, ventral view. **11**, Copulatory bulb, cleared, ventral view. **12,** epigynum, cleared, ventral view. **13,** Same, different focus. Scale bar 2 mm, specimens in figures 6-10 shown at the same scale.

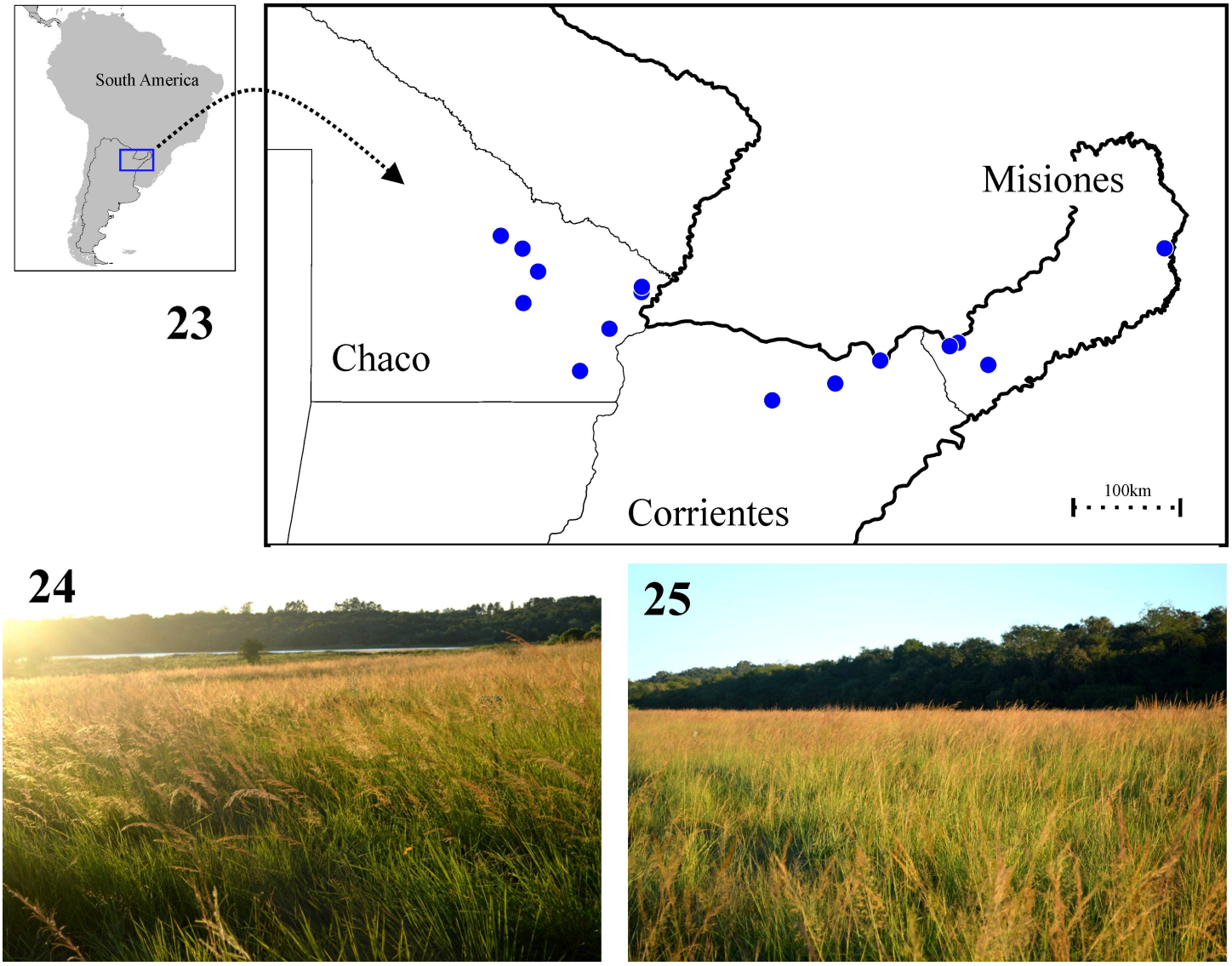
Female (paratype IBSI-Ara 1479) illustrated in Figures 1-2, 12-13. Total length: 6.50. Carapace longer than wide, length: 2.70, width: 1.80. Carapace dark brown to blackish, cephalic region darker with some scattered black hairs, most conspicuous on the edge of the first row of eyes. Wide whitish marginal bands continued from the clypeus. Clypeus covered with long white hairs. Chelicerae dark mahogany brown, with two promarginal teeth and one retromarginal tooth. Sternum, labium and endites as in male (Figure 10). Legs equal, brown with paler coxae, as in the male but somewhat paler (Figures 8-10). Abdomen length: 3.55, width: 2.25, hairy, color in ethanol greenish-gray, with a lighter abdominal basal band on the anterior edge of the abdomen, a similar transverse band in the middle, and a small chevron-shaped band

at the rear, all bordered in black (Figure 20). Epigynum: medium epigynal plate, as long as wide (length: 0.47, width: 0.47), forming two broad atria with two small COs, one at the center of each atrium (Figures 1-2, 12-13); CD short, oriented in an anteroposterior direction, connecting anteriorly to a somewhat spherical spermatheca, FD anterior and dorsal to spermatheca (Figure 2).



Figures 14-22. Photographs from nature of *Pachomius areteguazu* sp. nov. from Urutaú Nature Reserve (14-15, 22) and Santa Cecilia Ranch (16-21) in Candelaria, Misiones. **14-19, 22,** Males. **20, 21,** Females.

Variation. Males (n = 9): Total length 4.50–5.55. Carapace length 2.30–3.00, width 1.65–2.20. Abdomen length 2.10–2.80, width 1.50–1.60. Some males have coxae I darker or all legs darker; also, some males have the spots and thoracic stripe on the carapace yellowish instead of white (Figures 17-18). Females (n = 13): Total length 5.30–7.00. Carapace length 2.40–2.90, width 1.80–2.00. Abdomen length 3.10–4.10, width 2.15–2.95. The color pattern of the legs varies, being paler in some females. Some specimens do not have white spots or thoracic stripe on the carapace (Figure 22).



Figures 23-25. Map with specimen records for *Pachomius areteguazu* sp. nov. shown as blue dots (23), and grasslands where this species lives at the type locality, Santa Cecilia Ranch, Candelaria (24-25).

Natural history. Appearance in life as in Figures 14-22. *Pachomius areteguazu* n. sp. inhabits dense grasslands at the ecoregion known as "Southern Cone Mesopotamian Savanna." We have collected these spiders mostly at Candelaria, southern Misiones province, in northeastern Argentina. This species is usually found near the ground on the leaves of tall grass species like *Andropogon lateralis* or *Sorghastrum setosum* (Figures 24-25). It seems to be relatively common and is probably one of the most numerous salticid species within this environment. Adults are found throughout the year, but especially from October to April.

Distribution (map, Figure 23). This species is known from northeastern Argentina: Chaco, Misiones, and north of Corrientes.

The LSA and its relationship to the epigynum described here. The presence of an atrium can be explained by its role in mating. Galiano (1995) wrote that a group of *Pachomius*, the one previously represented under *Uspachus*, differs by having an epigynum with circular atria, and the bulb of the male palp with an LSA (she called it "lamella") accompanying the embolus. When the embolus enters the CO, a structure must necessarily exist to accommodate the LSA, since the LSA moves together with the embolus. It seems highly probable that the LSA lodges in the side pocket of the atrium contributing to fixation (Galiano 1995). Since the LSA of the *nigrus* group is spine-shaped, possibly derived by loss of the membranous part of the LSA (Edwards 2015; Galvis 2018), that can explain the epigynum described here for this group, with two non-circular atria with conspicuous edges (Figures 1-2).

Other material examined. Misiones province, Leandro N. Alem, Estación Experimental Agropecuaria Cerro Azul (27.654757°S, 55.435562°W), 1 ♀ (IBSI-Ara 1112), beating on pastures, 28 August 2018, C. E. Stolar and G. D. Rubio coll.; same place and coll., 1 ♂ (IBSI-Ara 1128), beating on foliage, 30 August 2018; same place, 1 ♂ (IBSI-Ara 1144), 10 September 2018, C. E. Stolar coll.; Candelaria, Santa Cecilia Ranch (27.45046°S, 55.716375°W), 1 ♂ (IBSI-Ara 1514), 1 ♀ (IBSI-Ara 1515), 2 ♀ (IBSI-Ara 1530) and 1 ♂ (IBSI-Ara 1545), September 2020, J. E. M. Baigorria coll.; same place and coll., 1 ♀ (IBSI-Ara 1542) and 2 ♀ (IBSI-Ara 1544), October 2020; Candelaria, Urutaú Nature Reserve (27.48024°S, 55.792547°W), 2 ♀ (IBSI-Ara 1548), grasslands, 5 February 2021, G. D. Rubio, J. E. M. Baigorria and C. E. Stolar coll.; Corrientes province, Iberá Wetlands, Cambyretá (27.82679°S, 56.855668°W), 1 ♂ (IBSI-Ara 0646) and 1 ♂ (IBSI-Ara 0647), g-vac on grassland, 7 November 2013, G. Avalos coll.; Iberá Wetlands, San Nicolás (27.98185°S, 57.438223°W), 1 ♀ (IBSI-Ara 0658), g-vac on grassland, 20 November 2012, same coll.; Iberá Wetlands, Puerto Valle (27,613429°S, 56.438505°W), 1 ♂ (IBSI-Ara 0662) and 1 ♀ (CNNE), g-vac on grassland, 23-24 March 2015, same coll.; Chaco province, Sargento Cabral (26.5756°S, 59.7567°W), 1 ♀ (IBSI-Ara), 1 ♀ (CNNE 9208) and 1 ♀ (CNNE), grassland, 5 December 2017, G. D. Rubio and M. F. Nadal coll.; 1 ♂ (CNNE 8755) and 1 ♂ (IBSI-Ara), same place, 9 March 2017, G. Avalos and M. F. Nadal coll.; Presidencia de la Plaza, Est. Los Alisos (27.0794°S, 59.7486°W), 1 ♀ (CNNE) and 1 ♀ (CNNE 9213), trawl net on grassland, 7 October 2006, G. Avalos coll.; Bermejo, Est. San Carlos, La Leonesa (26.9781°S, 58,6508°W), 1 ♀ (IBSI-Ara), g-vac on grassland, 8 December 2015, G. Avalos coll.; 1 ♀ (CNNE), same place and coll., 15 December 2015; General Vedia (26.9306°S, 58.6478°W), 1 ♀ (CNNE 9033), 10 December 2014, G. Avalos coll.; Primero de Mayo, RNE Colonia Benitez (27.3178°S, 58.9500°W), 1 ♀ (CNNE), g-vac on grassland, 20 December 2011, M. J. Escobar coll.; 2 ♀ (CNNE 9210), same data; 1 male (CNNE 9209), beating on forest foliage, 25 October 2011, same coll.; Veinticinco de Mayo (26.4569°S, 59.9578°W), 1 male (CNNE 8753), g-vac on grassland, 8 March 2017, G. Avalos and M. F. Nadal coll.; 1 ♂ (CNNE 8879), same place and coll., 30 May 2018; San Fernando, Est. La Querencia (27.7106°S, 59.2231°W), 1 ♂ (CNNE), grassland, 16 November 2015, G. Avalos coll.; 1 ♂ (CNNE 8754), same data; Chaco National Park (26.7889°S, 59.6122°W), 1 ♂ (CNNE), g-vac on grassland, 7 November 2016, G. Avalos and M. F. Nadal coll.

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