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Revisiting the tarantula genus *Neischnocolus* Petrunkevitch, 1925 (Araneae, Theraphosidae): new insights on male palpal bulb morphology and description of three new species

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Abstract. We reassess the palpal bulb morphology and taxonomy of *Neischnocolus* Petrunkevitch, 1925 based on the examination of several types of previously described species and the description of three new species (*N. moraspungo* Cisneros-Heredia, Peñaherrera-R., Guerrero-Campoverde, León-E., Gabriel & Sherwood sp. nov., *N. samonellaacademy* Peñaherrera-R., León-E., Guerrero-Campoverde, Gabriel, Sherwood & Cisneros-Heredia sp. nov., and *N. tiputini* Guerrero-Campoverde, Peñaherrera-R., León-E., Gabriel, Sherwood & Cisneros-Heredia sp. nov.) from Ecuador. A new keel structure is named and herein considered as a valid diagnostic feature for the genus, previously identified as a prolateral inferior keel. The rest of the keel identification of *Neischnocolus* is also relabelled in concordance with Bertani's (2000) keel homology hypothesis. Amended diagnoses of almost all the species are provided, leaving only *Neischnocolus obscurus* (Ausserer, 1875) since the type material has not been located.

Keywords. Theraphosinae, Ecuador, Andes, Mygalomorphae, morphology.

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Introduction

The taxonomy of the genus *Neischnocolus* Petrunkevitch, 1925 has undergone significant changes since its description based on a single female specimen from Panama (type species: *Neischnocolus panamanus* Petrunkevitch, 1925) and inclusion in the subfamily Ischnocolinae Simon, 1892. Taxonomic revisions synonymised *Neischnocolus* first under *Crypsidromus* Ausserer, 1871 and later under *Lasiodora* C.L. Koch, 1850 (Raven 1985; Pérez-Miles *et al.* 1996). Nonetheless, Gabriel (2016) revalidated *Neischnocolus* based on the unique spermathecal morphology, with *Barropelma* Chamberlin, 1940 as its junior synonym. In 2008, the genus *Ami* Pérez-Miles, 2008 was established based on the presence of highly modified urticating setae Type I, one or two subconical processes on the retrolateral face of male palpal tibiae, and paired ventral receptacles attached to a sclerotised semicircular back-plate (Pérez-Miles *et al.* 2008). However, strong morphological similarities were found between females of *Ami* and the rediscovered female holotype of *N. panamanus* and *Ami* was placed in the synonymy of *Neischnocolus* (Pérez-Miles *et al.* 2019).

Currently, *Neischnocolus* is diagnosed from all other theraphosine genera by the presence of Type Id urticating setae; males with one or two retrolateral processes on the palpal tibia and a bent and slightly twisted at the apex embolus, with the palpal bulb also displaying prolateral superior and prolateral inferior keels; and females with ventral translucent paired spermathecal receptacles emerging from a semicircular or heart-shaped back-plate, sclerotised with a corrugated texture (Pérez-Miles *et al.* 2008, 2019; Kaderka 2014, 2020; Lapinski *et al.* 2018; Almeida *et al*. 2019; Peñaherrera-R. *et al.* 2023). *Neischnocolus* mainly occurs in South America and includes thirteen species: *N. amazonica* (Jimenez & Bertani, 2008), *N. armihuariensis* (Kaderka, 2014), *N. caxiuana* (Pérez-Miles, Miglio & Bonaldo, 2008), *N. cisnerosi* Peñaherrera-R., Guerrero-Campoverde, León-E., Pinos-Sánchez & Falcón-Reibán, 2023, *N. iquitos* Kaderka, 2020, *N. mecana* Echeverri, Gómez Torres, Pinel & Perafán, 2023, *N. obscurus* (Ausserer, 1875), *N. panamanus* (Petrunkevitch, 1925), *N. pijaos* (Jimenez & Bertani, 2008), *N. tsere* Peñaherrera-R., Guerrero-Campoverde, León-E., Pinos-Sánchez & Falcón-Reibán, 2023, *N. valentinae* (Almeida, Salvatierra & de Morais, 2019), *N. weinmanni* (Pérez-Miles, 2008), and *N. yupanquii* (Pérez-Miles, Gabriel & Gallon, 2008) (World Spider Catalog 2025).

The remarkable diversity and morphological complexity of this group have led to contrasting interpretations in the literature, as each researcher has approached the species of *Neischnocolus* with differing perspectives on their morphology. For these reasons, and to coalesce the taxonomic information of this genus to provide valid and accessible information for future researchers, we present here a taxonomic revision of *Neischnocolus* with an emphasis on the female and male genital morphology, characters that are of great importance in the taxonomy of Theraphosinae Thorell, 1869. In addition, three new species from Ecuador are also described in this work.

Material and methods

Morphological descriptions and measurements follow standards proposed by Gabriel & Sherwood (2020) and Sherwood *et al*. (2021). Spination description follows Petrunkevitch (1925) with modifications proposed by Bertani (2001). Palpal bulb terminology follows Bertani (2000), Ortiz & Francke (2015), Gabriel (2016), Gabriel & Sherwood (2020), Sherwood *et al*. (2021), Peñaherrera-R. *et al*. (2023, 2024a), and Ferretti *et al*. (2023). Classification, subtypes, and morphology of urticating setae follow Kaderka *et al*. (2019). The term slightly scopulate refers to tarsal scopulae that are primarily composed of large and short ascopulate setae, with only a few true scopulate setae present. Colouration descriptions are based on photographs of live specimens and notes taken in the field. Illustrations of *N. amazonica* are based on a direct examination of the type material and photographs taken with a Samsung Galaxy A71. Illustrations were made by Janella Calderón-C. (Universidad San Francisco de Quito USFQ). Measurements, in millimetres, were recorded with the micro-imaging software for Olympus cellSens

Dimension (ver. 1.16, Evident™). Compound images were obtained by stacking a series of photographs taken at different depths and processed with Helicon Focus.

New species distributions over biogeographical classification follows the framework by Morrone (2014), with specifications for the Western Ecuador biogeographic province provided by Cisneros-Heredia (2006, 2007, 2019) and Cisneros-Heredia & Yánez-Muñoz (2007). Ecosystems classification for Ecuador follows MAE (2013).

Abbreviations

Somatic characters

ALE = anterior lateral eyes
AME = anterior median eyes
PLE = posterior lateral eyes
PME = posterior median eyes

Male genitalia

A = apical keel
D = ventral median depression (sensu Sherwood *et al*. 2021)
ER = embolic ridge
IM = intermediate keel
MDGA = median dorsal granular area
PACK = prolateral accessory central keel
PAIK = prolateral accessory inferior keel
PASK = prolateral accessory superior keel
PC = prolateral crease
PI = prolateral inferior keel
PS = prolateral superior keel
RI = retrolateral inferior keel
RS = retrolateral superior keel
SP = spermatic pore (when multiple spermatic pores are present, they are numbered and labeled with the abbreviation)
TH = tegular heel

Urticating setae

C1 = posterior central section of urticating setae with well-developed reversed barbs
C2 = anterior central section of urticating setae without barbs or with small denticles

Repositories and examined material

Type material of the new Ecuadorian species is deposited in the Museo de Zoología, Universidad San Francisco de Quito, Quito, Ecuador (ZSFQ), preserved in 75% ethanol. Specimens were examined and measured under an Olympus SZX16 stereo microscope with an Olympus DP73 digital camera, Olympus CX22 microscope with an OMAX A35180U3 digital camera, Leica M125C auto-montage system, and Leica M205A auto-montage system.

Repositories of examined material include

AMNH = American Museum of Natural History, New York, United States
BMNH = Natural History Museum, London, United Kingdom
FCE-MY = Facultad de Ciencias (Arachnological collection), Montevideo, Uruguay

ICN-Ar	=	Instituto de Ciencias Naturales (Arachnological collection), Universidad Nacional de Colombia, Bogotá, Colombia
INPA	=	Instituto Nacional de Pesquisas da Amazonia, Manaus, Brazil
MCZ IZ	=	Museum of Comparative Zoology (Invertebrate Zoology collection), Harvard University, Cambridge, USA
MECN-AR	=	Instituto Nacional de Biodiversidad (Arachnological collection), Quito, Ecuador
MIUP	=	Museo de Invertebrados G.B. Fairchild, Universidad de Panama, Panama City, Panama
MPEG (ARA)	=	Museu Paraense Emílio Goeldi (Arachnological collection), Belém, Pará, Brazil
OUMNH	=	Oxford University Museum of Natural History, Oxford, United Kingdom
PMY	=	Peabody Museum of Natural History, Yale University, New Haven, USA
ZSFQ-i	=	Museo de Zoología (Invertebrate collection), Universidad San Francisco de Quito, Quito, Ecuador

Total list of examined material used for this article is available as Supp. file 1.

During this research, we were unable to examine material corresponding of the following species: *Neischnocolus armihuariensis*, *N. iquitos*, *N. mecana*, and *N. valentinae*. However, revised diagnoses of these species were reinterpreted based on the original descriptions and figures provided in Kaderka (2014, 2020), Almeida *et al.* (2019), and Echeverri *et al.* (2023), which include detailed information on each species.

Results

Morphology

During the recent re-examination of the male type specimens of *N. caxiuana*, *N. cisnerosi*, *N. panamanus* (holotype of *Ami bladesi* Pérez-Miles, Gabriel & Gallon, 2008 from a formal revision of the material by these authors), *N. tsere*, *N. weinmanni*, and *N. yupanquii*, it became evident that the keel descriptions proposed in previous works did not agree with the framework of homologous keels for Theraphosinae by Bertani (2000), specifically on prolateral and retrolateral keels. Therefore, a new clarification of the keels of *Neischnocolus* is provided and to correct keel identification of previous works. The new changes should be reinterpreted into the following statements:

Prolateral superior keel sensu Kaderka (2014) is now identified as the **prolateral inferior keel**, complying with the definition of Bertani (2000) by being the closest parallel keel to the newly clarified prolateral superior keel (see point #2) and converging with each other in the distal region (see Discussion for further explanation).

Retrolateral keel sensu Kaderka (2020) is now identified as the **prolateral superior keel**. Although this keel is slightly projected to the dorsal area of embolus, this keel still being parallel to the newly clarified prolateral inferior keel and distally converges with this keel. The slight retrolateral projection observed in *Neischnocolus* could be caused by the strong distal torsion of the embolus of some species.

Prolateral accessory keel sensu Peñaherrera-R. *et al.* (2023) is now identified as the **prolateral accessory central keel**, complying with the modified classification of Ferretti *et al.* (2023)'s prolateral accessory keels by Peñaherrera-R. *et al.* (2024a).

The prolateral inferior keel sensu Pérez-Miles *et al.* (2008) is an extremely elongated and crested keel that does not resemble any previously described keel for any mygalomorph. At first glance, this unnamed keel seems to originate from a small apical keel (if present), leading to the initial suggestion that it might be a subapical keel. However, after detailed examination under high magnification, this keel emerges

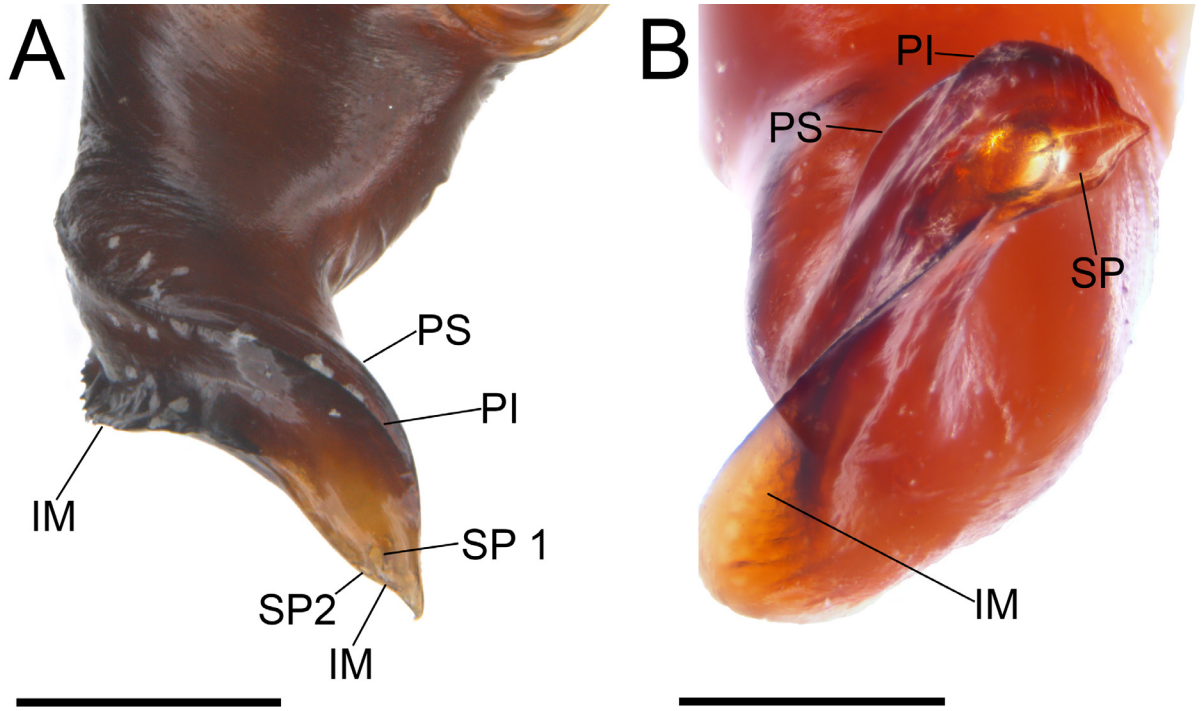

Fig. 1. Intermediate keel in species of *Neischnocolus* Petrunkevitch, 1925. **A**. Emerging between spermatic pore in *N. yupanquii* (Pérez-Miles, Gabriel & Gallon, 2008). **B**. Emerging below spermatic pore in *N. cisnerosi* Peñaherrera-R., Guerrero-Campoverde, León-E., Pinos-Sánchez & Falcón-Reibán, 2023. Abbreviations: see Material and methods. Scale bars = 0.5 mm.

between (i.e., *N. yunpanquii* and *N. tsere*) or below but very close to the weakly developed spermatic pore keels (sensu Ortiz & Francke 2015) covering the sperm pore (Fig. 1). Based on this new finding, and the fact that it is conserved in the specimens studied (suggesting a possible homologous character for *Neischnocolous*), we herein name this newly identified keel as the **intermediate keel**, referring to its position between the spermatic pore keels.

Taxonomy

Class Arachnida Cuvier, 1812
Orden Araneae Clerk, 1757
Family Theraphosidae Thorell, 1869
Subfamily Theraphosinae Thorell, 1869
Tribe Theraphosini Thorell, 1869

Genus ***Neischnocolus*** Petrunkevitch, 1925

Neischnocolus Petrunkevitch, 1935: 85.
Barropelma Chamberlin, 1940: 39 (synonymised by Pérez-Miles *et al.* 2019: 151).
Ami Pérez-Miles in Pérez-Miles *et al*., 2008: 55 (synonymised by Pérez-Miles *et al.* 2019: 151).

Crypsidromus – Raven 1985: 156 (in part, considered junior synonym).
Lasiodora – Pérez-Miles *et al.* 1996: 52 (in part, considered junior synonym of *Crypsidromus*).
Ami – Kaderka 2014: 208. — Almeida *et al.* 2019: 642.

Neischnocolus – Gabriel 2016: 85. — Pérez-Miles *et al.* 2019: 151. — Kaderka 2020: 442. — Peñaherrera-R. *et al.* 2023: 484.

Type species

Neischnocolus panamanus Petrunkevitch, 1925 by monotypy.

Amended diagnosis

Urticating setae morphology of the males and females of *Neischnocolus* resemble those found in *Citharacanthus* Pocock, 1901 by having urticating setae Subtype Id. Nevertheless, *Neischnocolus* can be distinguished from *Citharacanthus* and all other known genera of Theraphosinae by having a noticeable enlarged C2 region, being ~4–5 times as long as C1 region (Pérez-Miles *et al*. 2019: fig. 1). Males of *Neischnocolus* differ from all known Theraphosini genera by the distinct medial to distal dorso-retrolateral torsion of the embolus, creating a mucronate shape in conjunction with the embolus tip and the presence of an enlarged and crested intermediate keel, and pronounced and wide tegular apophysis. Females of *Neischnocolus* differ from all known Theraphosini genera by having wide and fused spermathecae with a pair of receptacles originating from ventro-medial surface of spermathecae (except *N. parvior* and *N. weinmanni*) and horizontal striae.

Male palpal bulb morphology of *Neischnocolus* slightly resembles that of *Jambu* Miglio, Perafán & Pérez-Miles, 2024 by the presence of a pronounced and wide tegular apophysis with a medial extension over the prolateral surface of the bulb and the absence of a prolateral crease by the prolateral extension of the non-sclerotized median haematodocha. Nevertheless, males of *Neischnocolus* differ from those of *Jambu* by having urticating setae Type I (Id), a comparatively wide, short, and non-filiform embolus with a distal dorso-retrolateral torsion, the apical section of the embolus with a mucronate shape, prolateral superior and inferior keels comparatively more conspicuous, the presence of an enlarged and crested intermediate keel, two or one (in *N. armihuarensis*; Kaderka 2014: figs 4–5) developed retrolateral palpal tibial apophysis, the prolateral extension of the median haematodocha comparatively elongate

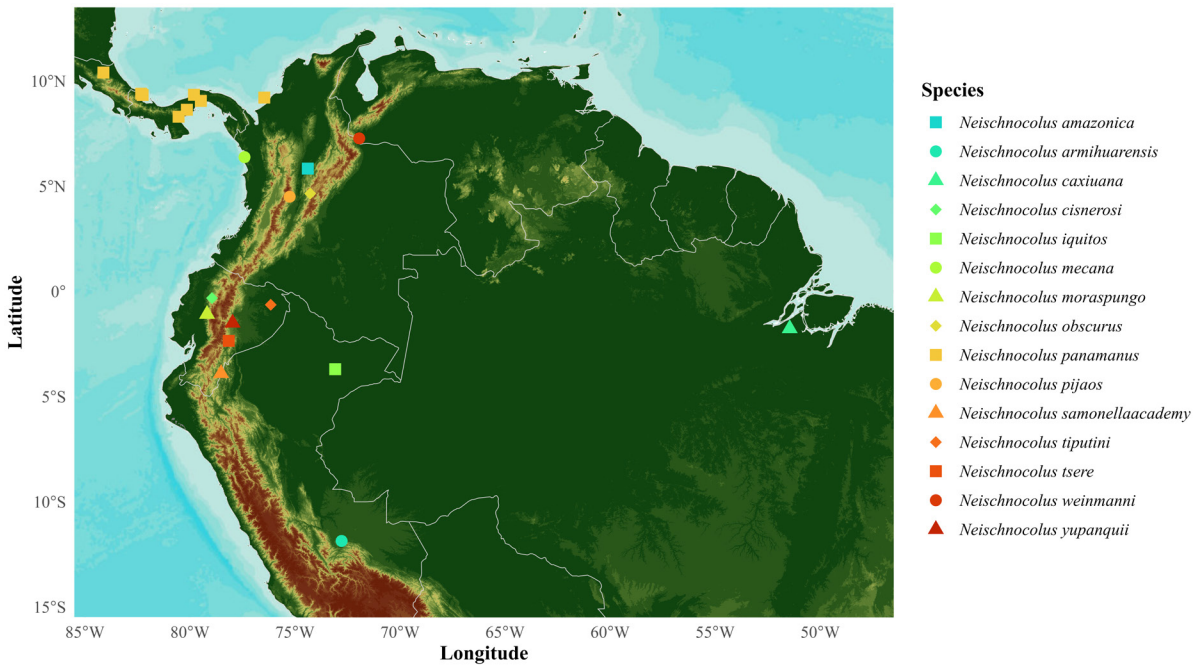

Fig. 2. General distribution of *Neischnocolus* Petrunkevitch, 1925.

and extending to the prolateral surface of the tegulum, and the absence of a paraembolic apophysis (urticating setae Type IV, comparatively thinner, elongated, and filiform embolus with a medial to distal slight ventral curvature, apical section of embolus without a mucronate shape, inconspicuous prolateral superior (if present) and inferior keels, only one weakly developed domed retrolateral palpal tibial apophysis (in *J. paru*; Miglio *et al.* 2024: fig. 1e), prolateral extension of median haematodocha comparatively shorter and restricted to tegulum and subtegulum indentation, and absence of an enlarged and crested intermediate keel in *Jambu*).

General spermathecae morphology of *Neischnocolus* resembles that of *Aguapanela* Perafán & Cifuentes, 2015 by having wide and fused spermathecae with a pair of ventral receptacles. Nevertheless, females of *Neischnocolus* differ from those of *Aguapanela* by having urticating setae Type I (Id), non-hypersclerotised receptacles emerging from the medial surface of the spermathecae, and the absence of stridulatory setae (urticating setae Types III and IV and hypersclerotised receptacles emerging from the distal surface of the spermathecae, plumose stridulatory setae over coxae, trochanters, and femur I–II, palpal coxa and trochanter in *Aguapanela*; Perafán *et al.* 2015: figs 7–12, 16).

Description

See Pérez-Miles *et al*. (2019).

Distribution

Colombia, Costa Rica, Brazil, Ecuador, Panama, Peru, and Venezuela (Fig. 2).

Species included

Neischnocolus amazonica (Jimenez & Bertani, 2008), *N. armihuariensis* (Kaderka, 2014), *N. caxiuana* (Pérez-Miles, Miglio & Bonaldo, 2008), *N. cisnerosi* (Peñaherrera-R., Guerrero-Campoverde, León-E., Pinos-Sánchez & Falcón-Reibán, 2023), *N. samonellaacademy* Peñaherrera-R., León-E., Guerrero-Campoverde, Gabriel, Sherwood & Cisneros-Heredia sp. nov., *N. iquitos* (Kaderka, 2020), *N. mecana* (Echeverri, Gómez Torres, Pinel & Perafán, 2023), *N. moraspungo* Cisneros-Heredia, Peñaherrera-R., Guerrero-Campoverde, León-E., Gabriel & Sherwood sp. nov., *N. obscurus* (Ausserer, 1875), *N. panamanus* (Petrunkevitch, 1925; type species), *N. parvior* (Chamberlin & Ivie, 1936) stat. rev. et comb. nov., *N. tiputini* Guerrero-Campoverde, Peñaherrera-R., León-E., Gabriel, Sherwood & Cisneros-Heredia sp. nov., *N. tsere* (Peñaherrera-R., Guerrero-Campoverde, León-E., Pinos-Sánchez & Falcón-Reibán, 2023), *N. valentinae* (Almeida, Salvatierra & de Morais, 2019), *N. weinmanni* (Pérez-Miles, 2008), *N. yupanquii* (Pérez-Miles, Gabriel & Gallon, 2008).

Remarks

Male and female of *Neischnocolus pijaos* are included within another work (Peñaherrera-R. & Guayasamin in prep.). The placement of each specimen is dubious and required further examination and comparison with an upcoming new genus.

Neischnocolus amazonica (Jimenez & Bertani, 2008)
Figs 2–3

Ami amazonica Jimenez & Bertani in Pérez-Miles *et al.*, 2008: 63, figs 30–31, 41.

Neischnocolus amazonica – Pérez-Miles *et al.* 2019: 153.

Amended diagnosis

Females of *Neischnocolus amazonica* resemble those of *N. panamanus* by having spermathecal striae converging in an incomplete arc and an inverted L-shaped guard plate. Nonetheless, they differ by

having a triangular central area of spermathecae and comparatively more inconspicuous and short spermathecal striae and ventral receptacles (trapezoid central area of spermathecae and conspicuous and large spermathecal striae and ventral receptacles in *N. panamanus*; Lapinski *et al*. 2018: figs 10–14; Pérez-Miles *et al*. 2019: fig. 5).

Type material

Holotype

COLOMBIA – **Amazonas** • ♀; Leticia [Departamento de Amazonas, alrededores IMANI, Leticia]; 4.16972° S, 69.94694° W; elev. 100 m; 4 Nov. 2005 [Nov. 2001]; E. Flórez leg.; ICN-Ar, ICN-Ar-1149.

Remarks

Pérez-Miles *et al.* (2008) described *N. amazonica* based on a female collected at Leticia (4.16972° S, 69.94694° W) in November 2005. These coordinates place the type locality between the towns of San Sebastián and Camilo Torres, departamento de Amazonas, Colombia. Upon examination of the holotype's label, no such coordinates were found. Still, there was other important information about the specimen, the female holotype was collected in 2001 in the surroundings of Instituto Amazónico de Investigaciones (IMANI) (georeferenced using the following coordinates: 4.19360° S, 69.94050° W) (label information available through https://doi.org/10.6084/m9.figshare.28447211).

Neischnocolus armihuarensis (Kaderka, 2014)

Fig. 2

Ami armihuarensis Kaderka, 2014: 208, figs 1–11.

Neischnocolus armihuarensis – Pérez-Miles *et al.* 2019: 154.

Amended diagnosis

Males of *Neischnocolus armihuarensis* differ from all other male congeners by having only one developed retrolateral palpal tibial apophysis (Kaderka 2014: figs 4–5). Males of *N. armihuarensis* slightly resemble those of *N. cisnerosi* and *N. caxiuana* by having an embolus straight perpendicular (dorsal curvature) to palpal organ axis and presence of a median dorsal granular area. Nevertheless,

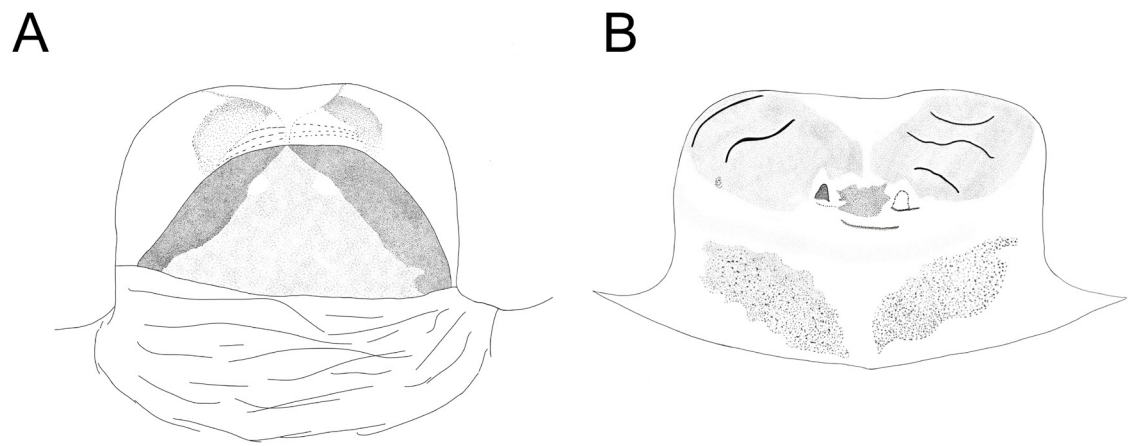

Fig. 3. Schematic illustration of *Neischnocolus amazonica* (Jimenez & Bertani, 2008), holotype, ♀ (ICN-Ar-1149), spermatheca. **A**. Dorsal view. **B**. Ventral view. Not to scale.

N. armihuarensis differ from *N. cisnerosi* and *C. caxiuana* by having one developed retrolateral palpal tibial apophysis, median dorsal granular area composed of spiky spicules extending over prolatero-dorsal and retrolateral surfaces of bulb, PS and PI keels weakly developed and comparatively shorter, distal portion of embolus not dilated, and prolateral accessory inferior keel absent (two developed retrolateral palpal tibial apophyses, median dorsal granular area composed of rounded spicules extending only over dorsal surface of bulb, PS and PI keels well developed and comparatively longer, distal portion of embolus dilated, and prolateral accessory inferior keel extremely weakly developed in *N. cisnerosi*; two developed retrolateral palpal tibial apophyses, median dorsal granular area composed of spiky spicules extending over dorso-retrolateral surfaces of bulb, PS and PI keels developed and comparatively longer, distal portion of embolus dilated, and prolateral accessory inferior keel absent in *N. caxiuana*) (Fig. 4; Kaderka 2014: figs 4–5, 7–10).

Type material

Holotype (not examined)

PERU – **Departamento de Cuzco** • ♂; Río Camiseta, Armihuari; 11.86425° S, 72.77933° W; elev. 577 m; May–Jun. 1997; S. Cordova leg.; MUSM-ENT, MUSM-ENT-0506547.

Neischnocolus caxiuana (Pérez-Miles, Miglio & Bonaldo, 2008)
Figs 2, 4–5

Ami caxiuana Pérez-Miles, Miglio & Bonaldo in Pérez-Miles *et al.*, 2008: 57, figs 4–10.

Neischnocolus caxiuana – Pérez-Miles *et al.* 2019: 154

Amended diagnosis

Males of *N. caxiuana* slightly resemble those males of *N. armihuarensis* and *N. cisnerosi* by having an embolus straight perpendicular (dorsal curvature) to palpal organ axis and presence of a median dorsal granular area. Nevertheless, they differ by having an median dorsal granular area composed of spiky spicules extending over dorso-retrolateral surfaces of bulb, PS and PI keels developed and comparatively longer, distal portion of embolus dilated, and prolateral accessory inferior keel absent (median dorsal granular area composed of spiky spicules extending over prolatero-dorsal and retrolateral surfaces of bulb, PS and PI keels weakly developed and comparatively shorter, distal portion of embolus not dilated, and prolateral accessory inferior keel absent in *N. armihuarensis*; median dorsal granular area composed of rounded spicules extending only over dorsal surface of bulb, PS and PI keels well-developed and comparatively longer, distal portion of embolus dilated, and prolateral accessory inferior keel extremely weakly developed in *N. cisnerosi*). Additionally, *N. caxiuana* can easily be differentiated from *N. armihuarensis* by the presence of two developed retrolateral palpal tibial apophyses, while the latter only presents one developed retrolateral palpal tibial apophysis. Females of *N. caxiuana* differ from those of other known species by having semi-circular spermathecae, spermathecal striae converging in a complete arc, extremely elongated ventral receptacles extending over the length of the spermathecae, weakly developed guard plates.

Type material

Holotype

BRAZIL – **Estado do Pará** • ♂; FLONA, Estação Científica Ferreira Penna; A.P. Barreiros and L.T. Miglio leg.; MPEG(ARA), MPEG(ARA)000994.

Paratype

BRAZIL • 1 ♀; same data as for holotype; 26 May 2003; J.A.P. Barreiros and C.O. Araújo leg.; MPEG(ARA), MPEG(ARA)000989.

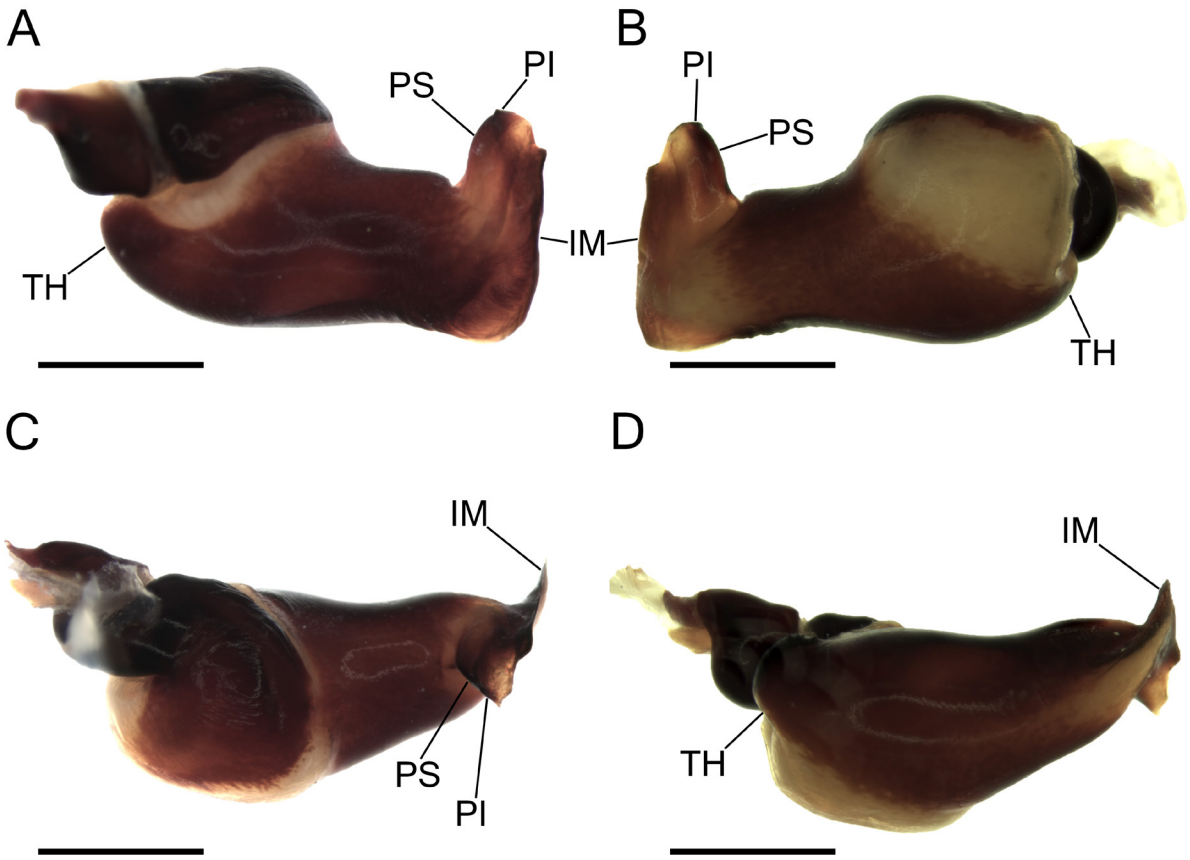

Fig. 4. *Neischnocolus caxiuana* (Pérez-Miles, Miglio & Bonaldo, 2008), holotype, ♂ (MPEG(ARA)000994), palpal bulb (left hand side). **A**. Prolateral view. **B**. Retrolateral view. **C**. Dorsal view. **D**. Ventral view. Abbreviations: see Material and methods. Scale bars = 1 mm.

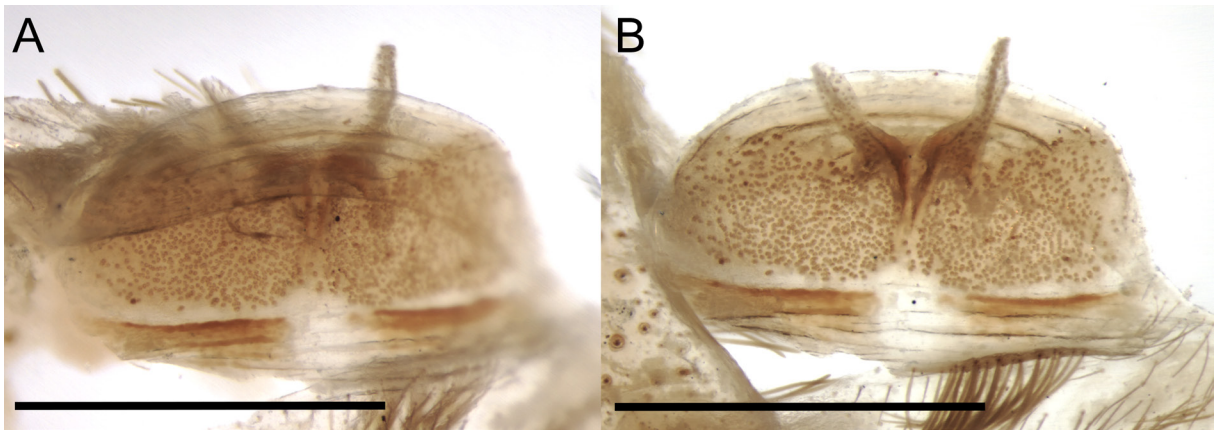

Fig. 5. *Neischnocolus caxiuana* (Pérez-Miles, Miglio & Bonaldo, 2008), paratype, ♀ (MPEG(ARA)000989), spermatheca. **A**. Dorsal view. **B**. Ventral view. Scale bars = 0.1 mm.

Neischnocolus cisnerosi Peñaherrera-R., Guerrero-Campoverde, León-E., Pinos-Sánchez & Falcón-Reibán, 2023
Fig. 1B

Neischnocolus cisnerosi Peñaherrera-R., Guerrero-Campoverde, León-E., Pinos-Sánchez & Falcón-Reibán, 2023: 487, figs 2c–d, 3b, 4c–d, 5a–d, 6.

Amended diagnosis

Males of *Neischnocolus cisnerosi* resemble those of *N. armihuarensis* and *N. caxiuana* by having an embolus straight perpendicular (dorsal curvature) to palpal organ axis and presence of a median dorsal granular area. Nevertheless, males of *N. cisnerosi* differ from those of *N. armihuarensis* by having two developed retrolateral palpal tibial apophyses, median dorsal granular area composed of rounded spicules extending only over dorsal surface of bulb, PS and PI keels developed and comparatively longer, distal portion of embolus dilated, and a prolateral accessory inferior keel extremely weakly developed (one developed retrolateral palpal tibial apophysis, median dorsal granular area composed of spiky spicules extending over prolatero-dorsal and retrolateral surfaces of bulb, PS and PI keels weakly developed and comparatively shorter, distal portion of embolus not dilated, and prolateral accessory inferior keel absent in *N. armihuarensis*; Kaderka 2014: figs 4–5, 7–10); from *N. caxiuana* by having median dorsal granular area composed of rounded spicules extending only over dorsal surface of bulb, PS and PI keels well developed and comparatively longer, distal portion of embolus dilated, and prolateral accessory inferior keel extremely weakly developed (median dorsal granular area composed of spiky spicules extending over dorso-retrolateral surfaces of bulb, PS and PI keels developed and comparatively longer, distal portion of embolus dilated, and prolateral accessory inferior keel absent in *N. caxiuana*; Fig. 4).

Type material

Holotype
REPUBLIC OF ECUADOR – **Provincia de Santo Domingo de Los Tsáchilas** • ♂; Parroquia de Santo Domingo, Reserva Otongachi—Fundación Otonga; 0.32000° S, 78.95000° W; elev. 947 m; 6 Oct. 2017; F. Velasques leg.; wet forest; ZSFQ-i, ZSFQ-i11100.

Neischnocolus iquitos Kaderka, 2020
Fig. 2

Neischnocolus iquitos Kaderka, 2020: 443, figs 1, 2a–g, 3, 4a–d, 5–6, 7a–f, 8a–f.

Amended diagnosis

Males of *Neischnocolus iquitos* resemble those of *N. mecana* by having an embolus with an acute angulation to palpal organ axis, intermediate keel without undulation, and absence of a median dorsal granular area. Nonetheless, males of *N. iquitos* differ from those of *N. mecana* by having well-developed prolateral superior and inferior keels, prolateral inferior keel being continuous, and coxae without ventral colour pattern (prolateral superior keel weakly developed, prolateral inferior keel disjunct and weakly developed, and coxae with ventral colour pattern in *N. mecana*). For diagnosis of female *N. iquitos* see Kaderka (2020).

Type material

Holotype (not examined)
PERU – **Departamento de Loreto** • 1 ♂; Iquitos, Umaral; 3.70126° S, 73.09816° W; elev. 101 m; 20 Oct. 2017; N. Ahuanari leg.; MUSM-ENT, MUSM-ENT 0511874.

Paratype (not examined)
PERU • 1 ♀; same data as for holotype; MUSM-ENT, MUSM-ENT 0511873.

Neischnocolus mecana Echeverri, Gómez Torres, Pinel & Perafán, 2023
Fig. 2

Neischnocolus mecana Echeverri, Gómez Torres, Pinel & Perafán, 2023: 79, figs 23a–b, 24a–e, 25a–f, 26a–f.

Amended diagnosis

Males of *N. mecana* resemble those of *N. iquitos* by having an embolus with an acute angulation to palpal organ axis, intermediate keel without undulation, and absence of a median dorsal granular area. Nonetheless, males of *N. mecana* differ from those of *N. iquitos* by having a weakly developed prolateral superior keel, prolateral inferior keel disjunct and weakly developed, and coxae with ventral colour pattern (prolateral superior and inferior keel well-developed, prolateral inferior keel being continuous, and coxae without ventral colour pattern in *N. iquitos*). For diagnosis of female *N. mecana* see Echeverri *et al*. (2023).

Type material

Holotype (not examined)
COLOMBIA – **Departamento de Chocó** • ♂; Jardín Botánico del Pacífico; 6.38000° N, 77.40000° W; elev. 28 m; 10–25 Feb. 2022; M. Echeverri, S. Gómez Torres and C. Perafán leg.; ICN [ICN-Ar?], ICN 12365.

Paratype (not examined)
COLOMBIA • 1 ♀; same data as for holotype; ICN [ICN-Ar?], ICN 12366.

Remarks

Echeverri *et al.* (2023) mention the presence of an apical keel; however, as we have not been able to examine this material, we are not yet sure if it is an apical keel or if it is the lower prolateral edge as Peñaherrera-R. *et al*. (2023) had confused in *N. cisnerosi* and *N. tsere*. Because of this, we did not include this character in the diagnosis of the species.

***Neischnocolus parvior* (**Chamberlin & Ivie, 1936) stat. rev. et comb. nov.

Eurypelma parvior Chamberlin & Ivie, 1936: 7.

Barropelma parvior – Chamberlin 1940: 39.
Neischnocolus panamanus – Pérez-Miles *et al.* 2019: 152, fig. 7.

Diagnosis

Females of *N. parvior* stat. rev. et comb. nov. resemble those of *N. weinmanni* by having spermathecal striae converging in a complete arc and absence of ventral receptacles. Nevertheless, *N. parvior* differs from *N. weinmanni* by having irregular pentagon-shaped spermathecae, I-shaped guard plate, and spermathecal striae comparatively more ordered into a horizontal orientation (rectangular spermathecae, rectangular guard plate, and spermathecal striae unordered in *N. weinmanni*). Additionally, females of *N. parvior* stat. rev. et comb. nov. slightly resemble those of *N. caxiuana* by having spermathecal striae converging in a complete arc. Nonetheless, *N. parvior* easily differs from *N. caxiuana* by the absence of ventral receptacles (Fig. 4; Pérez-Miles *et al.* 2019: fig. 7).

Type material

Holotype
PANAMA – **Provincia de Colón** • ♂; Barro Colorado Island; Aug. 1928; A.M. Chickering leg.; AMNH.

Remarks

Pérez-Miles *et al.* (2019) considered *N. parvior* stat. rev. et comb. nov. as a junior synonym of *N. panamanus* due to spermathecae morphologic resemblance. However, the indicated morphological variation on *N. panamanus* strongly indicates the conserved presence of ventral receptacles and spermathecal striae converging into an incomplete arc (Lapinski *et al.* 2018: figs 10–14; Pérez-Miles *et al.* 2019: fig. 5), while the holotype female of *N. parvior* presents striking and informative characters that support the separation of this species (i.e., loss of ventral receptacles and spermathecal striae converging in a complete arc and ordered into a horizontal orientation; Pérez-Miles *et al.* 2019: fig. 7). Pérez-Miles *et al.* (2019) indicated that the spermatheca of *N. parvior* was damaged by a previous worker. However, this damage is located at the dorsal surface of the spermatheca (missing; Pérez-Miles *et al.* 2019: cf. fig. 7), which is mainly formed by a membrane. That membrane so far does not seem to have informative characters. This would further support the previously mentioned characters for this species.

Neischnocolus obscurus (Ausserer, 1875) nomen dubium
Fig. 2

Ischnocolus obscurus Ausserer, 1875: 171.

Eurypelma obscurum – Roewer 1942: 240.
Ami obscura – Pérez-Miles *et al.* 2008: 65.
Neischnocolus obscurus – Pérez-Miles *et al.* 2019: 154.

Remarks

The type material of *N. obscurus* is lost, searches by RG and DS on a number of occasions in both the Natural History Museum, London, and Naturhistorisches Museum Wien, Vienna [the two museums which hold what survives of the Ausserer collection] have failed to turn up the specimens. Therefore, it is impossible to clarify the taxonomy of this species until topotypic material can be collected and a neotype designated for stability. We propose *N. obscurus* be regarded as nomen dubium.

Neischnocolus tsere Peñaherrera-R., Guerrero-Campoverde, León-E., Pinos-Sánchez & Falcón-Reibán, 2023
Fig. 2

Neischnocolus tsere Peñaherrera-R., Guerrero-Campoverde, León-E., Pinos-Sánchez & Falcón-Reibán 2023: 484, figs 1a–d, 2a–b, 3a, 4a–b.

Emended diagnosis

Males of *N. tsere* resemble those of *N. samonellaacademy* sp. nov. by having an embolus with an acute angulation to palpal organ axis, intermediate keel without undulation, presence of a median dorsal granular area, and absence of an apical keel. Nonetheless, *N. tsere* differ from *N. samonellaacademy* by having a comparatively more elongated distal to medial extension of the embolus, prolateral superior keel well developed, prolateral inferior keel developed, elongated, and slightly serrated apically, intermediate keel slightly serrated apically and disjunct, intermediate keel emerging between spermatic pore keels, and median dorsal granular area composed of spiky spicules extending only over prolatero-dorsal surface of bulb (distal to medial extension of the embolus comparatively shorter, prolateral superior keel developed, prolateral inferior keel well developed, short, and smooth, intermediate keel smooth and continuous, intermediate keel emerging below spermatic pore keels, and median dorsal granular area composed of rounded spicules extending only over dorsal surface of bulb in *N. samonellaacademy*).

Type material

Holotype

REPUBLIC OF ECUADOR – **Provincia de Morona Santiago** • ♂; Parroquia de Morona, Río Blanco; 2.35463° S, 78.15171° W; elev. 922 m; 4 Jul. 2019; J. Falcón-Reibán and A. Recalde leg.; MECN-AR, MECN-AR-450.

Remarks

Peñaherrera-R. *et al.* (2023) identified the presence of an apical keel on *N. tsere* as the inferior border of the apical section of the prolateral embolus surface. Nonetheless, after a second examination, we can confirm the absence of this keel.

Neischnocolus valentinae (Almeida, Salvatierra & de Morais, 2019)

Ami valentinae Almeida, Salvatierra & de Morais, 2019: 642, figs 1–2.

Amended diagnosis

Males of *N. valentinae* easily differ from those of all known congeners by having an undulated intermediate keel. Males of *N. valentinae* slightly resemble those of *N. samonellaacademy* sp. nov. and *N. tsere* by having an embolus with an acute angulation to palpal organ axis, presence of a median dorsal granular area, and absence of an apical keel. Nonetheless, *N. valentinae* differs from *N. samonellaacademy* by having prolateral superior keel weakly developed, prolateral inferior keel developed and elongated, median dorsal granular area composed of spiky spicules extending only over the dorsal surface of the bulb, and comparatively having a more elongated distal to medial extension of the embolus (developed prolateral superior keel, prolateral inferior keel well developed and short, median dorsal granular area composed of rounded spicules extending only over the dorsal surface of the bulb, and distal to medial extension of the embolus comparatively shorter in *N. samonellaacademy*); from *N. tsere* by having prolateral inferior and intermediate keels smooth, intermediate keel continuous and emerging below spermatic pore keels, and median dorsal granular area composed of spiky spicules extending only over the dorsal surface of the bulb (prolateral inferior and intermediate keels slightly apically serrated, intermediate keel disjunct and emerging between spermatic pore keels, and median dorsal granular area composed of spiky spicules extending only over the prolatero-dorsal surface of the bulb in *N. tsere*).

Type material

Holotype (not examined)

BRAZIL – **Estado do Amazonas** • ♂; Manaus, Fazenda Experimental da UFAM; 2.63000° S, 60.05000° W; elev. 68 m; 1 Jul. 2018; M.Q. Almeida leg.; INPA, INPA (9074).

Paratypes (not examined)

BRAZIL • 2 ♂♂; same data as for holotype; INPA, INPA (9075).

Neischnocolus weinmanni (Pérez-Miles 2008)

Figs 2, 6–7

Ami weinmanni Pérez-Miles in Pérez-Miles *et al.*, 2008: 64, figs 32–38, 43–45.

Neischnocolus weinmanni – Pérez-Miles *et al.* 2019: 154.

Amended diagnosis

Males of *N. weinmanni* resemble those of *N. yupanquii* by having an embolus with an acute angulation to palpal organ axis, developed prolateral superior keel, and intermediate keel denticulate and continuous.

Nonetheless, *N. weinmanni* differs from *N. yupanquii* by having a comparatively well developed and elongated prolateral inferior keel, intermediate keel emerging below spermatic pore keels, intermediate keel basally denticulate, and absence of an apical keel and median dorsal granular area (comparatively developed and shorter prolateral inferior keel, intermediate keel emerging between spermatic pore keels, intermediate keel overall denticulate, median dorsal granular area extending over dorsal surface, and developed and denticulate apical keel in *N. yupanquii*). Females of *N. weinmanni* resemble those of *N. parvior* stat. rev. et comb. nov. by having spermathecal striae converging in a complete arc and absence of ventral receptacles. Nevertheless, *N. weinmanni* differs from *N. parvior* by having rectangular spermathecae, rectangular guard plate, and spermathecal striae unordered (irregular pentagon-shaped spermathecae, I-shaped guard plate, and spermathecal striae comparatively more ordered into a horizontal orientation in *N. parvior*).

Type material

Holotype

VENEZUELA – **Estado de Mérida** • ♂; La Azulital; 7.27160° N, 71.94020° W; elev. 261 m; 26 Sep. 2002; D. Weinmann leg.; FC-MY.

Paratype

VENEZUELA • 1 ♀; same data as for holotype; FC-MY.

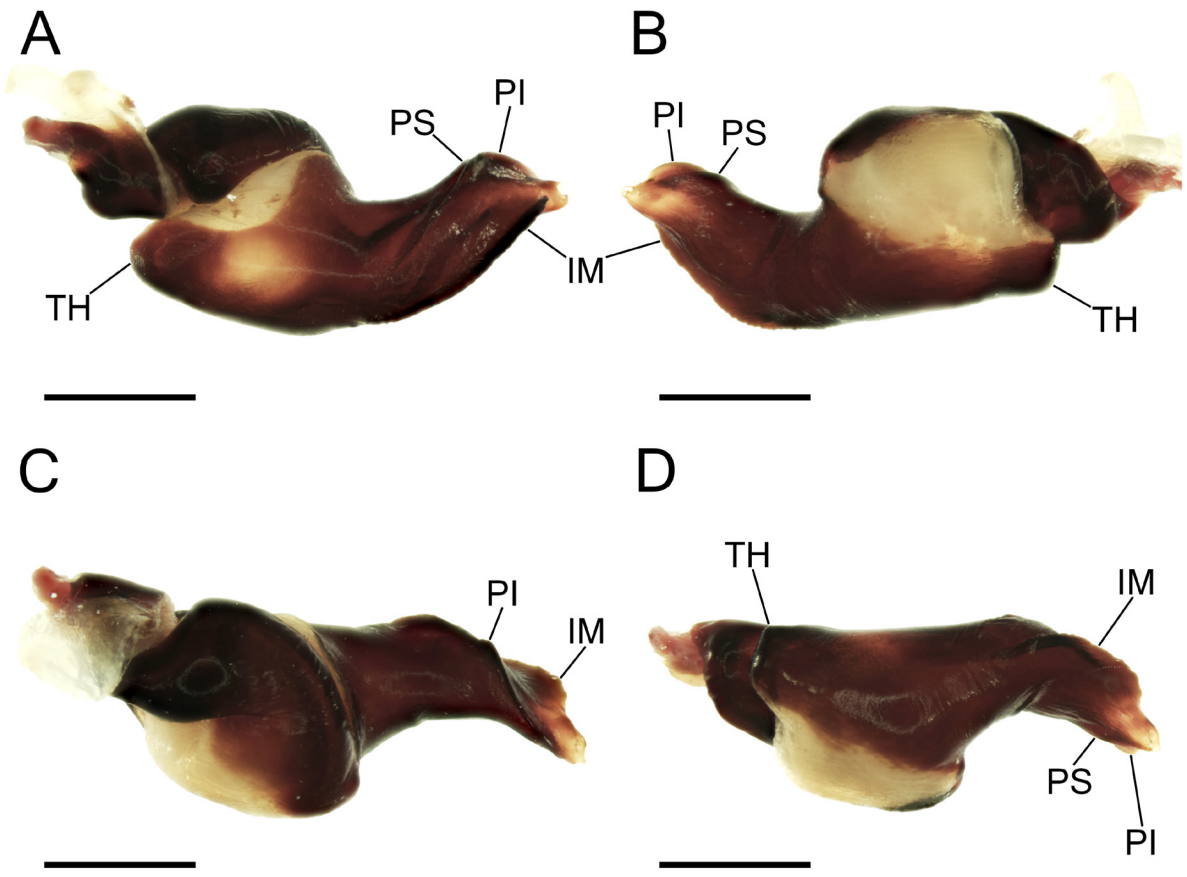

Fig. 6. *Neischnocolus weinmanni* (Pérez-Miles, 2008), holotype, ♂ (FC-MY), palpal bulb (left hand side). **A**. Prolateral view. **B**. Retrolateral view. **C**. Dorsal view. **D**. Ventral view. Abbreviations: see Material and methods. Scale bars = 1 mm.

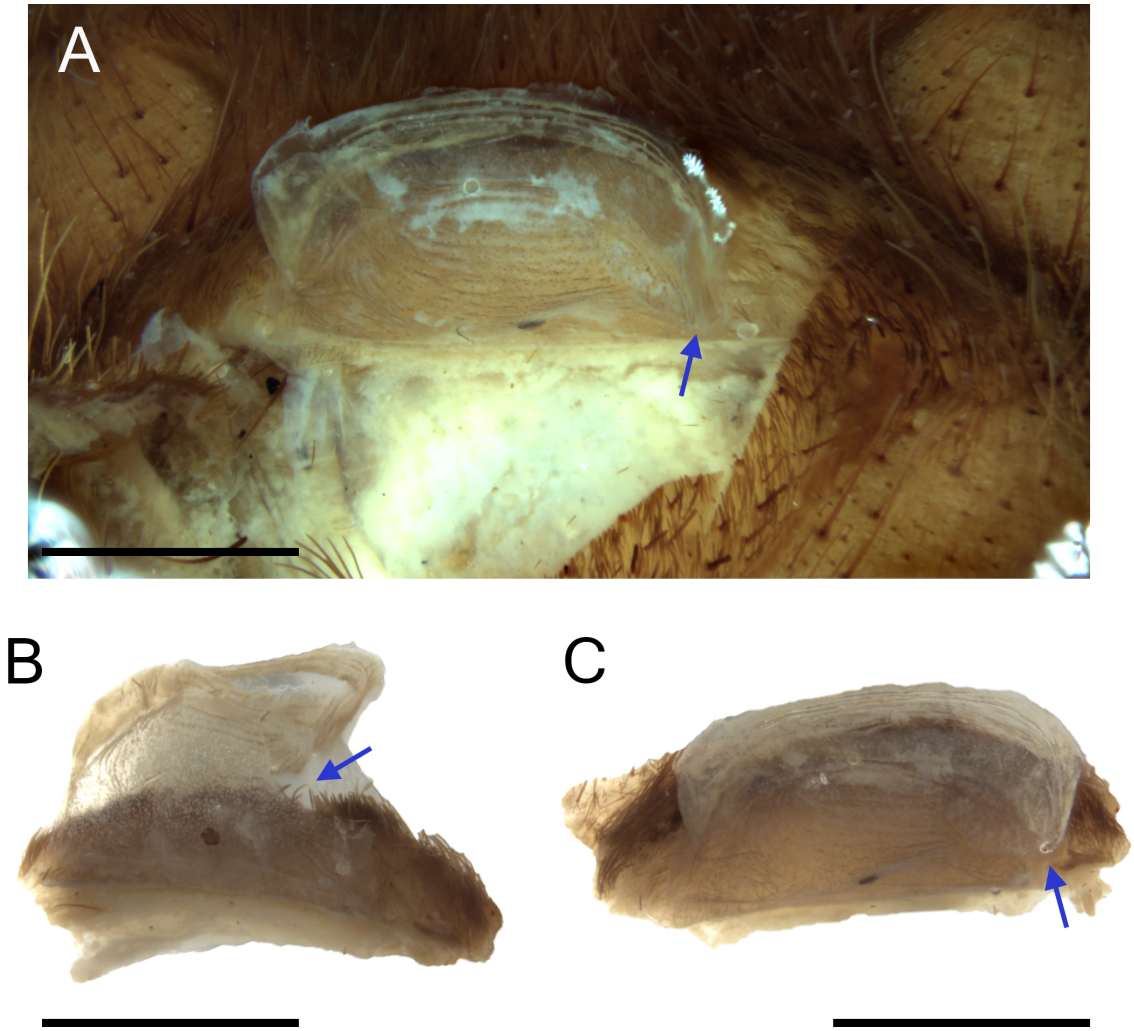

Fig. 7. *Neischnocolus weinmanni* (Pérez-Miles, 2008), paratype female (FC-MY), spermatheca. **A**. Dorsal view, as dissected by previous examiners. **B**. Dorsal view. **C**. Dorso-apical view. Blue arrows show broken section. Scale bars = 2 mm.

Remarks

During the examination of the paratype female of *N. weinmanni*, we noted that the spermatheca was damaged by a previous examinator.

Neischnocolus yupanquii (Pérez-Miles, Gabriel & Gallon, 2008)
Figs 1A, 2, 8–9

Ami yupanquii Pérez-Miles, Gabriel & Gallon in Pérez-Miles *et al.*, 2008: 58, figs 3, 11–15, 39.

Neischnocolus yupanquii – Pérez-Miles *et al.* 2019: 154.

non *Ami yupanquii* – Kaderka 2014: 211, figs 12–13.
non *Neischnocolus yupanquii* – Kaderka 2020: 448, fig. 9.

Emended diagnosis

Males of *N. yupanquii* resemble those of *N. weinmanni* by having an embolus with an acute angulation to palpal organ axis, developed prolateral superior keel, intermediate keel denticulate and continuous, and presence of a median dorsal granular area. Nonetheless, *N. yupanquii* differs from *N. weinmanni* by comparatively developed and shorter prolateral inferior keel, intermediate keel emerging between

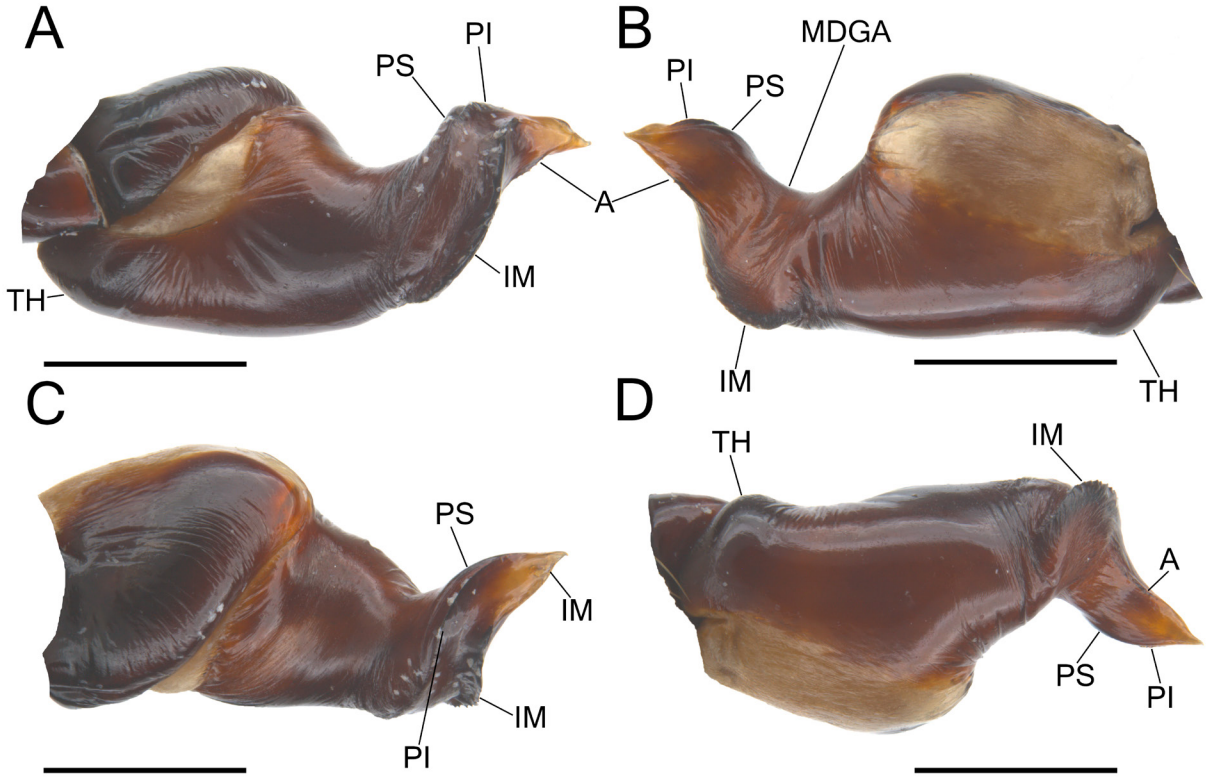

Fig. 8. *Neischnocolus yupanquii* (Pérez-Miles, Gabriel & Gallon, 2008), holotype, ♂ (OUMNH-2010-033), palpal bulb (left hand side). **A**. Prolateral view. **B**. Retrolateral view. **C**. Dorsal view. **D**. Ventral view. Abbreviations: see Material and methods. Scale bars = 1 mm.

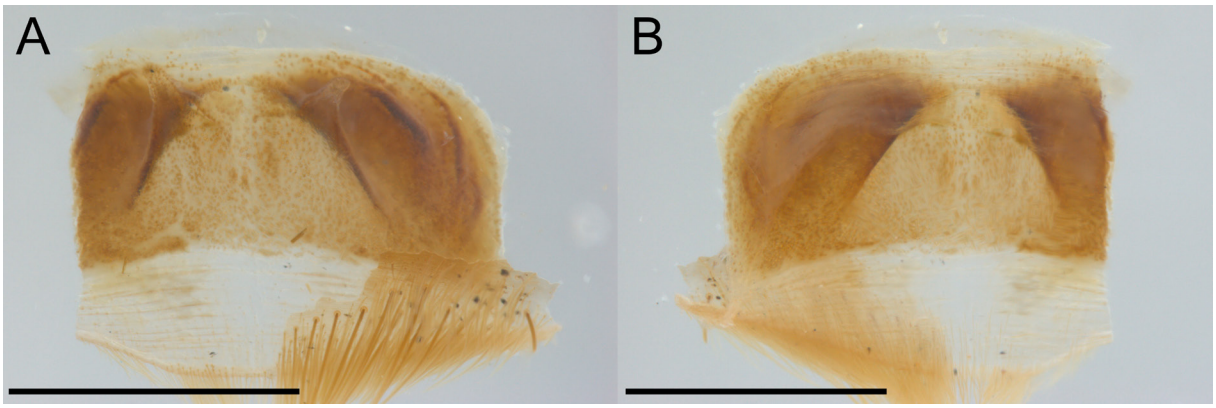

Fig. 9. *Neischnocolus yupanquii* (Pérez-Miles, Gabriel & Gallon, 2008), paratype, ♀ (OUMNH-2010-033), spermatheca. **A**. Dorsal view. **B**. Ventral view. Scale bars = 1 mm.

spermatic pore keels, intermediate keel overall denticulate, median dorsal granular area extending over dorsal surface, developed and denticulate apical keel (comparatively having a well-developed and elongated prolateral inferior keel, intermediate keel emerging below spermatic pore keels, intermediate keel basally denticulate, and absence of an apical keel and median dorsal granular area in *N. weinmanni*).

Type material

Holotype

REPUBLIC OF ECUADOR – **Provincia de Pastaza** • ♂; near Puyo; 1.50000° S, 77.96000° W; elev. 934 m; 2001; P. Stevens leg.; OUMNH, OUMNH-2010-033.

Paratype

REPUBLIC OF ECUADOR • 1 ♀; same data as for holotype; OUMNH, OUMNH-2010-033.

Remarks

During the examination of the paratype female of *N. yupanquii*, we noted that the spermatheca was damaged by a previous examinator.

Neischnocolus tiputini Guerrero-Campoverde, Peñaherrera-R., León-E., Gabriel, Sherwood & Cisneros-Heredia sp. nov.

urn:lsid:zoobank.org:act:08868B4E-C407-4792-8D52-2A1ADAC123A6

Figs 2, 10–11

Diagnosis

Females of *N. tiputini* sp. nov. resemble those of *N. moraspungo* sp. nov. by having rectangular spermathecae and spermathecal striae converging in a complete arc and collapsing between digitiform ventral receptacles. Nonetheless, *N. tiputini* differs from *N. moraspungo* by having comparatively shorter spermathecae, weakly developed inverted L-shaped guard plates, spermathecal striae conspicuous, as well as longer and wider ventral receptacles extending over the length of the spermathecae (comparatively more elongated spermathecae, developed inverted L-shaped guard plates, spermathecal striae inconspicuous, and short and narrower ventral receptacles in *N. moraspungo*).

Fig. 10. *Neischnocolus tiputini* Guerrero-Campoverde, Peñaherrera-R., León-E., Gabriel, Sherwood & Cisneros-Heredia sp. nov., holotype, ♀ (ZSFQ-i20415), spermatheca. **A**. Dorsal view. **B**. Ventral view. Scale bars = 0.5 mm.

Etymology

The specific epithet *tiputini* is a noun in apposition and refers to the type locality of the species. The Tiputini Biodiversity Station (TBS) is a research station on the northern bank of the Tiputini River, within the Yasuní Biosphere Reserve, Ecuador. This station, managed by the Universidad San Francisco de Quito USFQ, is one of the most important research sites in the upper Amazon basin and one of the most biodiverse regions in the world.

Type material

Holotype

REPUBLIC OF ECUADOR – **Provincia de Orellana** • ♀; Parroquia Tiputini, Tiputini Biodiversity Station; 0.63593° S, 76.15811° W; elev. 220 m; 23 Jul. 2023; A. Guerrero-Campoverde leg.; ZSFQ-i, ZSFQ-20415.

Description (holotype, ♀, ZSFQ-i20415)

Total length: 24.37. Carapace length 11.03, width 10.08. Abdomen length 13.34, width 11.34. Eyes: anterior eye rows slightly recurved; AME: 0.36, ALE: 0.18, PME: 0.22, PLE: 0.15, AME–AME: 0.37, AME–ALE: 0.16, PME–PME: 0.92, PME–PLE: 0.08, AlE–PLE: 0.23, OQ length: 0.89, width: 1.83, clypeus: 0.25. Fovea slightly deep straight. Chelicerae: 13 promarginal teeth and 12 denticles. Labium: length 1.18, width 1.52, with 16 cuspules. Maxillae: 41–21 cuspules on inner third. Sternum: length: 4.77, width: 4.03. Legs: formula 4123, total length: I 22.91, II 20.50, III 19.20, IV 25.94; leg (femur/patella/tibia/metatarsus/tarsus) and pedipalp (femur/patella/tibia/cymbium) article lengths: I 7.62/2.78/5.97/3.53/3.01, II 7.06/2.31/5.29/3.24/2.60, III 5.86/1.47/5.10/3.69/3.08, IV 8.01/2.34/6.01/6.17/3.41 palp 5.76/2.07/4.53/3.80. Scopula: tarsi I–III scopulated and tarsi IV slightly scopulated, metatarsi I–II scopulated, metatarsi III distal half slightly scopulated, metatarsi IV

Fig. 11. *Neischnocolus tiputini* Guerrero-Campoverde, Peñaherrera-R., León-E., Gabriel, Sherwood & Cisneros-Heredia sp. nov., holotype, ♀ (ZSFQ-i20415), live habitus. **A**. Dorsal view. **B**. Frontal view.

not scopulated. Metatarsi I–II distally divided by rhomboidal group of setae; tarsi III almost divided by thicker setae than tarsi I–II; tarsi IV fully divided by a line of longer and thicker setae than tarsi III. Metatarsus: I 60%, II 50%, III 25%, IV 0%, absent. Legs and pedipalp spination: femora and patellae I–IV and palp 0. Tibiae I 2V, II 2V, 1P, 1D; III 3V, 2P, 1D; IV 3V, 1R, 1P, 2D; palp 4V. Metatarsi; I, 2V; II, 4V; III, 4V, 1P, 2R, 4D; IV, 10V, 1R, 3D. Tarsi I–IV and palp, 0. Spermathecae (Fig. 10): rectangular spermatheca with two short ventral receptacles not extending over the length of this structure. At least ten spermathecal striae are present and conspicuous; all of them converge in a complete arc and collapsing between the ventral receptacles. weakly developed inverted L-shaped guard plates present. Live colouration (Fig. 11): carapace, abdomen and legs overall dark orange, covered by long orange setae; abdomen with dorsal anterior brown dot; tibia, metatarsus, and tarsus progressively becoming darker.

Distribution and natural history

Currently known only from its type locality, Tiputini Biodiversity Station, in the Amazonian lowlands of Ecuador, at 220 m, province of Orellana, Ecuador. The holotype was collected in Lowland Evergreen Forest in the Napo biogeographic province (Morrone 2014).

Remarks

Regarding the most morphologically similar species, *N. moraspungo* sp. nov., in comparison with *N. tiputini* sp. nov., we can consider several biogeographic factors that further support the recognition of both as distinct species and reject the possibility that they represent a single species. The type localities of the two species are separated by approximately 340 km. Between these localities lie several significant large-scale geographical barriers, including the Cordillera Occidental and Cordillera Oriental of the Andes of Ecuador, the Inter-Andean Depression, and the Napo Uplift. Each of these large-scale barriers provides numerous valleys originating across different altitudinal gradients and volcanic complexes, which promotes short-ranged endemism through isolation and diversification of niche, microclimate, and microecosystem structures (see Polato *et al.* 2018; Rahbek *et al*. 2019). These short- and large-ranged barriers promote speciation. Furthermore, members of the genus *Neischnocolus*, as well as other genera within the tribe Theraphosini, are known to exhibit restricted geographic distributions. This pattern of limited dispersal further supports the interpretation that *N. moraspungo* and *N. tiputini* represent separate lineages.

Neischnocolus moraspungo Cisneros-Heredia, Peñaherrera-R., Guerrero-Campoverde, León-E., Gabriel & Sherwood sp. nov.
urn:lsid:zoobank.org:act:97A1A140-87F1-4A98-B157-D54600AACDE3
Figs 2, 12–13

Diagnosis

Females of *N. moraspungo* sp. nov. resemble those of *N. tiputini* sp. nov. by having rectangular spermathecae and spermathecal striae converging in a complete arc and collapsing between digitiform ventral receptacles. Nonetheless, *N. moraspungo* differs from *N. tiputini* by having comparatively more elongated spermathecae, developed inverted L-shaped guard plates, spermathecal striae inconspicuous, and short and thinner ventral receptacles (comparatively shorter spermathecae, weakly developed inverted L-shaped guard plates, spermathecal striae conspicuous, as well as longer and wider ventral receptacles extending over the length of the spermathecae in *N. tiputini*).

Etymology

The specific epithet *moraspungo* is a noun in apposition derived from the name of the parish Moraspungo where the type locality is placed – a region within canton Pangua, Ecuador. The name also pays homage to the dedicated efforts of the *Frente de Defensa del Agua, la Vida y la Naturaleza del Cantón Pangua*,

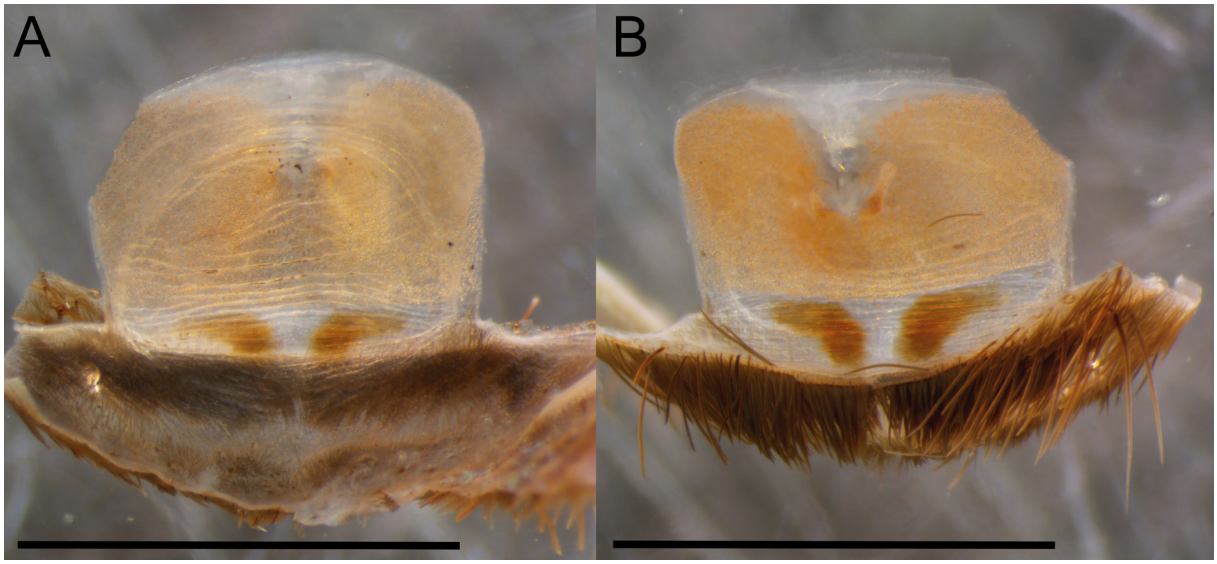

Fig. 12. *Neischnocolus moraspungo* Cisneros-Heredia, Peñaherrera-R., Guerrero-Campoverde, León-E., Gabriel & Sherwood sp. nov., holotype, ♀ (ZSFQ-i21330), spermatheca. **A**. Dorsal view. **B**. Ventral view. Scale bars = 0.5 mm.

Fig. 13. *Neischnocolus moraspungo* Cisneros-Heredia, Peñaherrera-R., Guerrero-Campoverde, León-E., Gabriel & Sherwood sp. nov., holotype, ♀ (ZSFQ-i21330), live habitus, dorsal view.

a grassroot organization actively opposing mining activities in the area. This community-driven group, formed by local farmers and rural residents, exemplifies unity and commitment to defending their land, water, and ecosystems, often through peaceful protests and collective action.

Type material

Holotype

REPUBLIC OF ECUADOR – **Provincia de Cotopaxi** • ♀; Cantón Pangua, Hacienda La Mariela; 1.08560° S, 79.18410° W; elev. 760 m; 27 Feb. 2023; M. López-García, J. Montalvo, D. Brito-Zapata and C. Reyes-Puig leg.; ZSFQ-i, ZSFQ-i21330.

Description (holotype, ♀, ZSFQ-i21330)

Total length: 24.14. Carapace length 11.50, width 11.50. Abdomen length 14.05, width 11.50. Eyes: anterior slightly recurved; AME: 0.29, ALE: 0.16, PME: 0.20, PLE: 0.09, AME–AME: 0.43, AME–ALE: 0.21, PME–PME: 0.93, PME–PLE: 0.14, AlE–PLE: 0.20, OQ length: 1.79, width: 0.82, clypeus: 0.28. Fovea deep, recurved. Chelicerae: 11 promarginal teeth and 9 denticles. Labium: length 1.40, width 1.87, with 14 cuspules. Maxillae: 45–48 cuspules on inner third. Sternum: length: 4.85, width: 4.35. Legs: formula 4123, total length: I, II, III, IV; leg (femur/patella/tibia/metatarsus/tarsus) and pedipalp (femur/patella/tibia/cymbium) article lengths: I 7.65/5.60/6.10/4.50/4.05, II 7.25/5.05/4.90/3.85/3.90, III 6.20/4.50/4.90/5.20/3.70, IV 7.70/5.30/6.50/7.95/4.00 palp 5.55/4.65/4.85/5.10. Scopula: tarsi I–II densely scopulated, tarsi III–IV slightly scopulated. Tarsi and metatarsi I–II not divided by a rhomboidal group of setae; tarsi III partially divided by rhomboidal setae; tarsi IV completely divided. Metatarsi III and IV absent thicker setae. Metatarsus: I 100%, II 50%, III 40%, IV 0%, absent. Legs and pedipalp spination: femora and patellae I–IV and palp 0. Tibiae I 2V; II 2V; III 2V, 2P; IV 2V, 1R, 3P; palp 2V–2P. Metatarsi I 2V; II 2V-2R; III 4V, 2P, 2R, 2D; IV 8V, 2P, 5R, 2D. Tarsi I–IV and palp, 0. Spermathecae (Fig. 12): rectangular spermatheca with two extremely short ventral receptacles not extending over the length of this structure. Spermathecal striae are present but inconspicuous; all of them converge in a complete arc and collapsing between the ventral receptacles. Developed inverted L-shaped guard plates present. Live colouration (Fig. 13): carapace, abdomen and legs overall black, covered by long reddish setae and short coppery setae; abdomen with dorsal anterior black dot.

Distribution

Currently known only from its type locality, Hacienda La Mariela, on the western foothills of the Cordillera Occidental of the Andes, at 760 m, province of Cotopaxi, Ecuador. The examined specimen was collected in Foothill Evergreen Forest of the Cordillera Occidental of the Andes in the Western Ecuador biogeographic province (Morrone 2014).

Neischnocolus samonellaacademy Peñaherrera-R., León-E., Guerrero-Campoverde, Gabriel, Sherwood & Cisneros-Heredia sp. nov.
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Figs 2, 14–16

Diagnosis

Males of *N. samonellaacademy* sp. nov. resemble those of *N. tsere* by having an embolus with an acute angulation to palpal organ axis, intermediate keel without undulation, presence of a median dorsal granular area, and absence of an apical keel. Nonetheless, *N. samonellaacademy* differ from *N. tsere* by comparatively having shorter distal to medial extension of the embolus, prolateral superior keel developed, prolateral inferior keel well developed, short, and smooth, retrolateral superior keel developed, intermediate keel smooth and continuous, intermediate keel emerging below spermatic pore keels, and median dorsal granular area composed of rounded spicules extending only over dorsal surface

of bulb (comparatively having more elongated distal to medial extension of the embolus, prolateral superior keel well developed, prolateral inferior keel developed, elongated, and slightly serrated apically, intermediate keel slightly serrated apically and disjunct, intermediate keel emerging between spermatic pore keels, and median dorsal granular area composed of spiky spicules extending only over prolatero-dorsal surface of bulb, retrolateral superior keel absent in *N. tsere*).

Etymology

The species epithet *samonellaacademy* pays homage to Samuel Andrew Miller, as an apposition, creator of the popular and humorous educational YouTube channel Sam O'Nella Academy. Sam often uses crudely drawn animations and stick figures to deliver unconventional knowledge on various intriguing topics. The species name is a response to his request in timestamp 5:24 of "Where Animals' Scientific Names Come From", where he states [referring to having a species named in his honour]: "If that gives any of you epic biologists out there any ideas, you know, I wouldn't be opposed", and "Please, I would do anything, for the love of God, I will even take a lichen". This tribute immortalises his unique contribution to science communication and humour, capturing the spirit of curiosity and creativity that inspires audiences worldwide.

Type material

Holotype

REPUBLIC OF ECUADOR – **Provincia de Zamora Chinchipe** • ♂; Cantón Paquisha, Río Blanco; 3.90075° S, 78.51787° W; elev. 1700 m; 10 Aug. 2023; A. Hurtado and P. Peñaherrera-R. leg.; ZSFQ-i, ZSFQ-i21619.

Fig. 14. *Neischnocolus samonellaacademy* Peñaherrera-R., León-E., Guerrero-Campoverde, Gabriel, Sherwood & Cisneros-Heredia sp. nov., holotype, ♂ (ZSFQ-i21619), tibial apophysis. **A**. Ventral view. **B**. Proventral view. Scale bars = 0.5 mm.

Description (holotype, ♂, ZSFQ-i21619)

Total length: 15.91. Carapace length 7.55, width 6.80. Abdomen length 8.30, width 4.52. Eyes: anterior and posterior eye rows slightly recurved; AME: 0.17, ALE: 0.39, PME: 0.15, PLE: 0.17, AME–AME: 0.23, AME–ALE: 0.09, PME–PME: 0.53, PME–PLE: 0.13. AlE–PLE: 0.22, OQ length: 0.70, width: 1.50, clypeus: 0.27. Fovea deep, slightly procurved. Chelicerae: 9 promarginal teeth and 17 denticles. Labium: length 0.55, width 1.17, with 6 cuspules. Maxillae: 20–21 cuspules on inner third. Sternum: length: 3.77, width: 3.02. Legs: formula 4123, total length: I, II, III, IV; leg (femur/patella/tibia/metatarsus/tarsus) and pedipalp (femur/patella/tibia/cymbium) article lengths: I 6.85/3.45/7.51/4.85/3.81, II 7.20/2.88/6.07/4.76/3.77, III 6.34/1.76/5.44/5.63/3.53, IV 8.35/2.02/7.14/9.07/4.28 palp 4.82/2.15/4.29/1.63. Tibia I with paired distal proventral tibial apophyses with one short and wide spine

Fig. 15. *Neischnocolus samonellaacademy* Peñaherrera-R., León-E., Guerrero-Campoverde, Gabriel, Sherwood & Cisneros-Heredia sp. nov., holotype, ♂ (ZSFQ-i21619), palpal tibia. **A**. Dorsal view. **B**. Retrolateral view. Scale bars = 2.0 mm.

on inner side of each branch (Fig. 14). Palpal tibia with two small distal conical processes, both processes point towards each other (Fig. 15). Scopula: tarsi I–IV slightly scopulated, tarsi I–II distally divided by rhomboidal group of setae; tarsi III almost divided by thicker setae than tarsi I–II; tarsi IV fully divided by a line of longer, thicker setae than tarsi III. Metatarsus: I 30%, II 25%, III 25%, IV 0%, absent. Legs and pedipalp spination: femora and patellae I–IV and palp 0. Tibiae I 1V; II 2V; III 3V, 1P, 1R; IV 3V, 1R, 1P; palp 0. Metatarsi; I 2V; II, 4V; III, 6V, 2P, 1R, 2D; IV, 9V, 2P, 2R, 2D. Tarsi I–IV and palp, 0. Palpal bulb (Figs 2, 16) with a strong retrolateral distal curvature. MDGA composed of rounded spicules extending only over dorsal surface of bulb. Developed rounded TH; IM, PS, and PI keels well-developed, RS keel developed, RI and SA keel absent.

Distribution

Currently known only from its type locality, Río Blanco, in the Cóndor sub-Andean Cordillera, at 1700 m, province of Zamora Chinchipe, Ecuador. The examined specimen was collected in Low Montane Evergreen Forest of the Cordillera del Cóndor-Kutukú, Northern Andes biogeographic province (Morrone 2014).

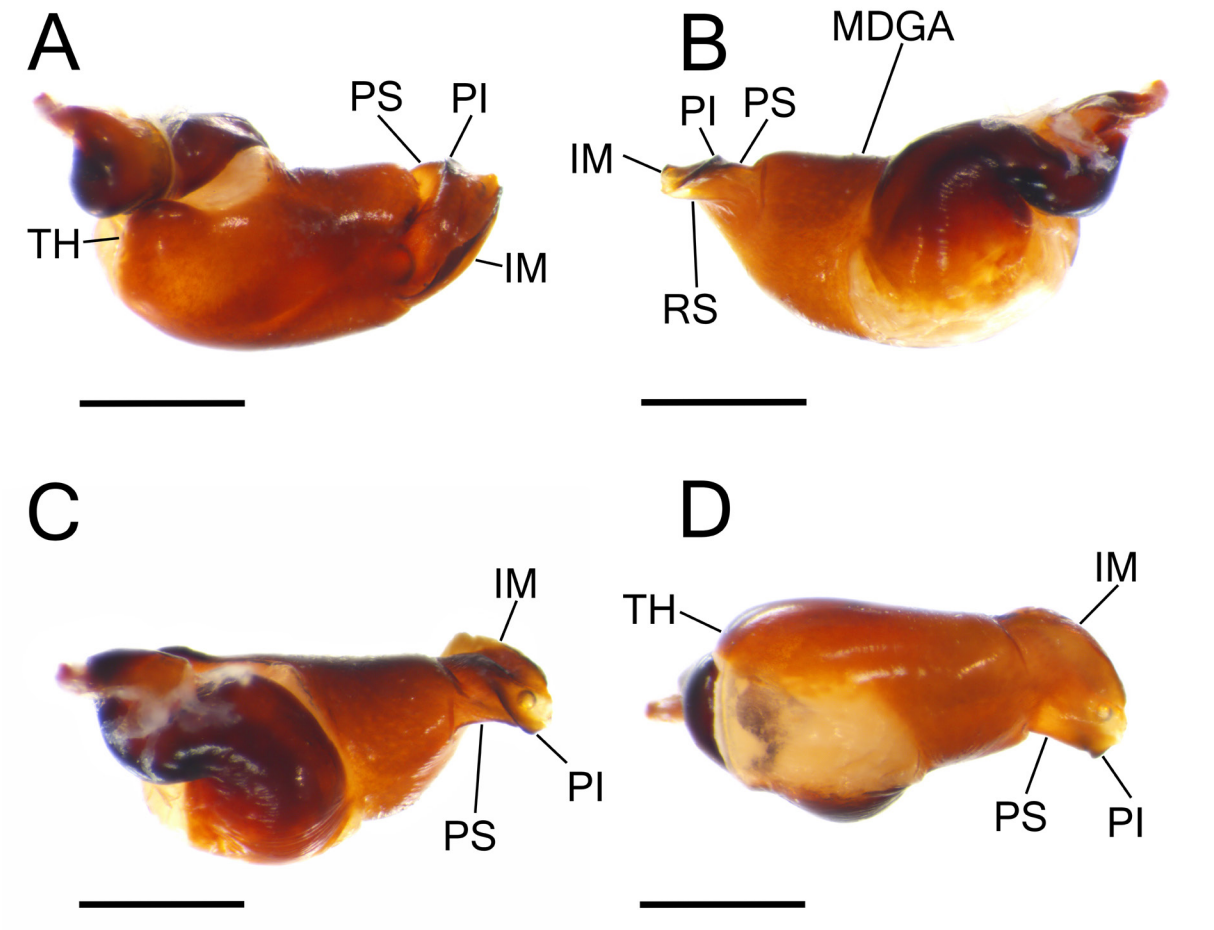

Fig. 16. *Neischnocolus samonellaacademy* Peñaherrera-R., León-E., Guerrero-Campoverde, Gabriel, Sherwood & Cisneros-Heredia sp. nov., holotype male (ZSFQ-i21619), palpal bulb (left hand side). **A**. Prolateral view. **B**. Retrolateral view. **C**. Dorsal view. **D**. Ventral view. Abbreviations: see Material and methods. Scale bars = 0.25 mm.

Discussion

Publications in Theraphosidae with the absence of detailed illustrations can lead to interpretative challenges and taxonomic ambiguity. For example, some diagnostic features, particularly male palpal bulb and female spermathecae, were not fully illustrated or described in Pérez-Miles *et al*. (2008), which has led to subsequent uncertainty in species- and genus-level diagnoses. In several instances, discrepancies between published illustrations by Pérez-Miles *et al.* (2008) and our observations, documented here through photographic evidence and detailed morphological descriptions (see Results), highlight the need for re-examination and reinterpretation of palpal bulb and spermathecal key characters. Without the comprehensive revision undertaken in this study, important morphological information could have remained undocumented or unclear, potentially hindering accurate identification of these species and complicating their comparison with undescribed taxa for future researchers to study.

Interpretative inconsistencies in the morphological data of Pérez-Miles *et al.* (2008) (i.e., Fig. 3; Pérez-Miles *et al*. 2008: cf. fig. 31) illustrate broader difficulties in reliably charaterising palpal bulb and spermathecae morphology across Theraphosinae. These issues underscore the importance of detailed standardised documentation to reduce ambiguity in species, as seen in subsequent studies (i.e., Almeida *et al.* 2019; Kaderka 2020; Peñaherrera-R. *et al*. 2023). Notably, illustrations of female *Neischnocolus* specimens in Pérez-Miles *et al.* (2008) appear to differ in spermathecal structures when comparing with the present evidence, these include ventral receptacles, spermathecal striae, and overall shape. These differences demonstrate that the illustrated material does not fully reflect the morphological interpretations observed in *Neischnocolus* by Pérez-Miles *et al.* (2008) and should therefore be interpreted with caution in future studies (e.g., the term 'back-plate', which lacks a formal definition and remains unclear in its morphological reference).

Keel identification rationale and male palpal bulb morphology observations

In Theraphosinae taxonomy, male palpal bulb morphology, particularly the arrangement and identity of keels, is a fundamental source of diagnostic characters at both generic and species levels and serves as a basis for inferring phylogenetic relationships. However, consistent interpretation of these keels across studies remains problematic. Despite the homologous keel hypothesis proposed by Bertani (2000), variability in how researchers assign and interpret these structures across different theraphosid groups has led to inconsistent usage. This lack of standardisation complicates comparative morphological analyses and undermines the replicability of taxonomic and systematic frameworks in Theraphosinae.

The confusion is most evident in the identification of the prolateral superior, prolateral inferior, apical, subapical, and, in some cases, the retrolateral superior keels. Several recent works have proposed emendations or alternative identifications (e.g., Sherwood *et al.* 2021, 2025; Kaderka 2024; Peñaherrera-R. *et al*. 2024a), which further reflects the ongoing uncertainty. While in some taxa this ambiguity can be attributed to the presence of multiple accessory keels (Ferretti *et al*. 2023), in many cases, misidentifications persist even when only the primary keels are expressed. Frequently observed issues include: the misassignment of apical or subapical keels as the prolateral inferior keel, identification of the prolateral inferior keel as an accessory central keel, and the misinterpretation of the prolateral superior keel as a retrolateral keel – as previously seen in species of *Neischnocolus* (see Results).

As outlined in the results, these earlier identifications conflict with the positional and structural framework established by Bertani (2000). To address these inconsistencies and support this revised identification of keels in *Neischnocolus*, which aligns with Bertani's (2000) original homology criteria, we provide the following detailed explanation of these keels. These clarifications are not intended as a reassessment of keel homology systems for Theraphosinae, but the expanded definitions aim to provide greater clarity in establishing more accurate descriptions and identifications of these structures in

Theraphosinae, until more comprehensive studies testing their homology through integrative approaches are conducted (Peñaherrera-R. & Pérez-Miles in prep.).

As previously mentioned, these specific keels (PS, PI, A, and SA) are regularly confused with each other due to the parallel development that all have in common following the embolus torsion, if present. However, the way in which each keel develops indicates the first differentiators between each structure. For example, the apical keel represents a structure located at the apex of the embolus in the ventral or prolatero-ventral region (at least in Theraphosinae). In addition, the apical keel is comparatively transparent comopared with the others, except for the spermatic pore keels (Bertani 2000; Sherwood *et al.* 2025). On the other hand, the subapical keel lies above the apical keel, which means that this is a suprajacent structure to the apical keel and therefore if the apical keel is absent, the possibility of the existence of a subapical keel can be ruled out (this further justifies the establishment of the intermediate keel in *Neischnocolus*). Further, the subapical keel is more sclerotised and regularly projects in the opposite direction to that in which the apical keel projects. To the naked eye, this overlapping is not clearly discernible, but bulbs with similar considerably developed keels make visual observation possible; also, high amplifications like scanning electron microscope allow clear observations of both structures (e.g., Candia-Ramírez & Francke 2017: fig. 9f). Now, an additional thing is that this set of keels is located below the spermatic pore and independent of its corresponding spermatic pore keels.

Moving on to the prolateral superior and inferior keels, these structures can present major steps in the recognition of nested characters and their respective states that could increase the degree of identification complexity of the prolateral superior and inferior keels. For example, variable presence of denticles, length extension over tegulum and embolus, and variable positional placement of the prolateral superior keel over prolateral (e.g., *Cymbiapophysa* Gabriel & Sherwood, 2020 and *Spinosatibiapalpus* Gabriel & Sherwood, 2020), prolatero-dorsal (e.g., *Notahapalopus* Sherwood, Gabriel, Osorio, Benavides, Peñaherrera-R., Hörweg, Brescovit & Lucas, 2024), dorsal (e.g., *Lasiocyano* Galleti-Lima, Hamilton, Borges & Guadanucci, 2023 and *Neischnocolus*), and even dorso-retrolateral (e.g., *Hapalopus* Ausserer, 1875 and *Acanthoscurria* Ausserer, 1871 [s. str. and *theraphosoides* species group]) areas of the embolus. The latter two are important for generic delimitation due to their conserved nature. Additionally, the broad concept of two parallel keels proposed by Bertani (2000) for the identification of both prolateral superior and inferior keels does not adequately explain how their homology and identification can be supported. In fact, almost all known keels reported for Theraphosinae are parallel to one another at some extension of tegulum and embolus.

Thus, to properly identify both structures, attention should be focused on the distal region of the prolateral and dorsal surfaces of the embolus. In this context, the prolateral surface refers specifically to the section above the spermatic pore and respective spermatic pore keel. With these surfaces in mind, the prolateral superior and inferior keels can only be identified by their distal or apical convergence, even when their extensions at tegular region or medial sections of the embolus are far apart and separated by a prolateral accessory central keel (e.g., *Acanthoscurria* s. str.; Gabriel 2020: figs 3–5, 51–53). As previously mentioned, the prolateral superior keel exhibits positional variation – ranging from prolateral, prolatero-dorsal, dorsal, and even dorso-retrolateral surface of embolus. Nonetheless, the distal or apical convergence between the prolateral superior and inferior keels remains consistently conserved (e.g., Gabriel 2020: figs 3–5; Mendoza & Francke 2020: figs 10d, 39e; Galletti-Lima *et al.* 2023: figs 4b–c, 5c–f; Sherwood *et al.* 2023: figs 109–113, 143–147, 2024: fig. 10a–e, 2025: fig. 3a–e; Peñaherrera-R. *et al.* 2024b: figs 3, 5).

Herein, we describe a newly accessorial structure of the male palpal bulb, the intermediate keel, which uniquely forms between the spermatic keels. This structure is conserved across all known species of *Neischnocolus* and serves as a robust diagnostic character for the genus, with different states like keel

dentation and extension over or below spermatic keels aiding species delimitation. On the other hand, the extension of the median haematodocha on the prolateral side of the tegulum, observed only in *Neischnocolus* and *Jambu*, remains unreported in other Theraphosidae or Avicularioidea Simon, 1874. While its evolutionary significance – whether a regression or convergent acquisition – remains unclear, further studies should analyse its reproductive function and occurrence in other groups of Avicularioidea. Until more data on Theraphosinae provide alternative insights, we hypothesise that the intermediate keel and the prolateral extension of median haematodocha developed over the prolateral surface of tegulum are two of the strongest diagnostic characters for *Neischnocolus*.

Alongside the new species delineation presented here and preliminary work on two Ecuadorian species (Peñaherrera-R. *et al.* 2023), we propose that the shape and extension of the spicules in the median dorsal granular area serve as an informative character for grouping species. These spicules can be as spikes (*N. caxiuana*, *N. armihuariensis*, *N. tsere*, *N. valentinae*) (Kaderka 2014) or rounded dots (*N. cisnerosi* and *N. yupanquii*) and could additionally extend to the prolateral (e.g., *N. tsere*) or prolateral and retrolateral surfaces (e.g., *N. armihuariensis*) of the basal to medial regions of the embolus. While spicule density (e.g., densely grouped in *N. tsere*) may also be informative, further validation requires additional specimens for comparative study.

The absence of the apical keel in *Neischnocolus* is interesting. Only *N. iquitos* and *N. yupanquii* show this keel, as do most other genera of Theraphosinae. Its absence in most *Neischnocolus* could represent a secondary loss, suggesting a reduced morphofunctional significance when not associated with a subapical keel, which is regularly more developed and arranged on different projections, extensions, and ornamentations (e.g., keelar apophysis sensu Sherwood *et al.* 2024 and denticulation or serration). Two phylogenetic scenarios may explain their presence in *N. iquitos* and *N. yupanquii*: (1) the presence of the apical keel would represent a basal placement within the genus, or (2) a character reversal without implying a basal placement, considering that it would be the same homologous apical keel. Further phylogenetic studies using total evidence analyses are needed to test these hypotheses. Given this suggestion, it is worth noting that the cladistic analysis provided by Pérez-Miles *et al.* (2008) and each respective topology of the inferred cladograms must be considered erroneous due to the misinterpretations regarding the morphology of the palpal bulbs and spermathecae of the studied species.

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Supplementary file

Supp. file 1. List of examined material. https://doi.org/10.5852/ejt.2025.1021.3079.13729