

Three new species of the spider genus *Nopsma* (Araneae, Caponiidae, Nopinae) from Colombia

Alexander Sánchez-Ruiz¹, Leonel Martínez², Alexandre B. Bonaldo¹

1 *Museu Paraense Emílio Goeldi, Coordenação de Zoologia, Laboratório de Aracnologia. Av. Perimetral, 1901, Terra Firme, CEP 66077–830, Belém, Pará, Brazil*

2 *Grupo de Investigación Biodiversidad del Caribe Colombiano, Semillero de Investigación Sistemática de Artrópodos Neotropicales, Departamento de Biología, Universidad del Atlántico, Barranquilla, Colombia*

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Corresponding author: Alexander Sánchez-Ruiz (alex.sanchezruiz@hotmail.com)

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Abstract

Three new Colombian species of the spider genus *Nopsma* Sánchez-Ruiz, Brescovit & Bonaldo, 2020 are described and illustrated: *Nopsma leticia* **sp. nov.** (male) from Amazonas department, *Nopsma macagual* **sp. nov.** (male) from Caquetá department and *Nopsma paya* **sp. nov.** (male and female) from Putumayo department. The collection data of the holotype of *Nopsma florencía* Sánchez-Ruiz, Brescovit & Bonaldo are corrected. Additionally, an updated identification key for all species of the genus and a distribution map for the Colombian species are included.

Key Words

Arachnida, neotropical region, synspermiata, taxonomy

Introduction

The two-eyed spider genus *Nopsma* was recently proposed by Sánchez-Ruiz et al. (2020) for four species occurring in Colombia, Ecuador, Peru and Nicaragua. The Ecuadorian species *Nopsma juchuy* (Dupérré, 2014) was transferred from *Nyetnops* Platnick & Lise, 2007 and was elected as the type species. Members of this genus can be distinguished from other two-eyed Nopinae (except *Nyetnops*), by lacking a crista and an arolium on anterior metatarsi, and from *Nyetnops* by the presence of a gladius. Additionally, *Nopsma* species are characterized by having an elongated, prolaterally protruded embolus, unique among nopines, and by the shape of endites, without projected outer sides on anterior margin (Sánchez-Ruiz et al. 2020).

Members of *Nopsma* are poorly known in Colombia, being represented by only one species, *N. florencía* Sánchez-Ruiz, Brescovit & Bonaldo, 2020. The species was described from male specimens revised and photo-

graphed prior to the publication by the second author of this paper (L.M.), who unfortunately confused the type's data label with those of other Colombian *Nopsma* specimens from Macagual in Caquetá department, while the actual locality of *N. florencía* is in Chocó department. The collection data of this Colombian species is corrected below. On the bright side, this mislabeling event led to the discovery of a new *Nopsma* species, since the specimens from Macagual belong to an undescribed species. This finding also triggered the opportunity to review caponiids from three Colombian collections, leading to the discovery of two additional undescribed *Nopsma* species. These three species are herein described, along with the correction of the type locality of *N. florencía*. Photos of the habitus, male palpal morphology and female genital organs, line drawings of the male copulatory bulbs and schematic drawings of the female internal genitalia are provided. Additionally, a distribution map for all Colombian species and an updated identification key for all species of the genus are presented.

Materials and methods

The specimens examined in this study were supplied by the following collections (acronym and curator in parentheses): Instituto Alexander Von Humboldt, Bogotá, Colombia (IAvH-I, J.C. Neita) Instituto de Ciencias Naturales of the Universidad Nacional, Bogotá, Colombia (ICN-Ar, E. Flórez) and Pontificia Universidad Javeriana, Bogotá (MPUJ-ENT, D. Forero).

Morphological observations and illustrations were made using a Leica MC125 stereomicroscope with a camera lucida. Multifocal images were taken with the Leica MC-190 HD and Leica MC-170 HD digital cameras attached to Leica S8AP0 and Leica MC125 stereomicroscopes respectively with extended focal range. All multifocal images were assembled using Helicon Focus Pro ver. 5.3.14. The measurements are in millimeters (mm) and were made using an ocular micrometer. Descriptions and measurements follow Sánchez-Ruiz and Brescovit (2018). Coloration patterns were described based on specimens preserved in 70–80% ethanol. The internal female genitalia was dissected with fine forceps and their soft tissues were digested for 24 hours with Ultrazyme enzymatic eye lens cleaner, diluted with distilled water

at the proportion of 1 tablet/5 ml. After cleaning, samples were immersed in clove oil for visualization of internal structures. The terminology for copulatory structures follows Sánchez-Ruiz et al. (2015). All digital photos were edited using Adobe Photoshop CS ver. 12.0 and the distribution map was prepared in QGIS (QGIS 2021). Plates were edited with Corel Draw X7 ver. 17.1. Geographic coordinates were extracted from original labels. Locality elevations refer to meters above sea level.

The following abbreviations are used in the text and figures: ap = anterior plate, as = anterior tracheal spiracles, dmr = distal margin of receptaculum, e = embolus, ess = external sclerotization around spiracles, go = genital opening (gonopore), mk = membranous keel on embolus, re = receptaculum, pmr = proximal margin of receptaculum, pp = posterior plate, ps = posterior tracheal spiracles, t = tegulum.

Taxonomy

Caponiidae Simon, 1890

Genus *Nopsma* Sánchez-Ruiz, Brescovit & Bonaldo, 2020

Updated key to the species of *Nopsma* (males only)

- 1 Large tegulum, reaching or exceeding the palpal tibia length (Sánchez-Ruiz et al. 2020: figs 11B, 17B)..... 2
- Small tegulum, not reaching the palpal tibia length (Sánchez-Ruiz et al. 2020: figs 15B, 18B)..... 3
- 2 Elongated palpal tibia, two times the patella length (Sánchez-Ruiz et al. 2020: fig. 11B), embolus projecting from the prolateral distal surface of the tegulum with a keel bordering the tip (Sánchez-Ruiz et al. 2020: figs 11B, C, 14A, D–F)..... *N. enriquei*
- Short palpal tibia, just a little longer than patella length (Sánchez-Ruiz et al. 2020: fig. 17B), embolus projecting from the prolateral median surface of the tegulum with three very thin, long projections on the tip (Sánchez-Ruiz et al. 2020: fig. 17B, C, F)..... *N. armandoi*
- 3 Embolus posteriorly directed (Figs 1C, D, 2C, D, 4E, H)..... 4
- Embolus anteriorly directed (Fig. 3C, D) *N. macagal* sp. nov.
- 4 Tegulum one-third of the cymbium length (Figs 2C, D, 3C, D, 4E, F)..... 5
- Tegulum conspicuously small, only one-fifth the cymbium length (Fig. 1C, D)..... *N. florencia*
- 5 Embolus with a membranous keel at the opening, extended proximally towards the embolus shaft (Fig. 6E, F) 6
- Embolus with membranous keel restricted to the opening of embolus tip (Fig. 6G, H)..... *N. paya* sp. nov.
- 6 Membranous keel long, reaching more than one-third of the embolus shaft (Fig. 6F)..... *N. leticia* sp. nov.
- Membranous keel short, reaching only one-fourth or less of the embolus shaft (Sánchez-Ruiz et al. 2020: fig. 16B–E) ...
..... *N. juchuy*

Nopsma florencia Sánchez-Ruiz, Brescovit & Bonaldo, 2020

Figures 1A–D, 5A, B, 6A, B, 8

Nopsma florencia Sánchez-Ruiz, Brescovit & Bonaldo, 2020: 483, fig. 18A–F.

Type material. Holotype ♂, COLOMBIA: Chocó department, Jardín Botánico El Darién, Capurgana, Acaandí, Camino a los Ríos; 8°37'53.95"N, 77°21'23.43"W; 260 m; 14 April 2008; C. Peña leg; pitfall trap; MPUJ-ENT 61986; examined, type locality corrected.

Remark. The type locality of this species is here corrected. The data labels of the holotype and paratype reported in the original description are actually those belonging to *Nopsma macagal* sp. nov.

Diagnosis. Males of *Nopsma florencia* resemble those of *Nopsma leticia* sp. nov. by the similarly shaped membranous keel on embolus tip (Fig. 6A, B, E, F), but can be distinguished by the conspicuous small oval tegulum, with only one-fifth the cymbium length (Fig. 1C, D), (one-third in *N. leticia* sp. nov., Fig. 2C, D) and by the enlarged embolus (Fig. 1C, D) (shorter in *N. leticia* sp. nov., Fig. 2C, D).

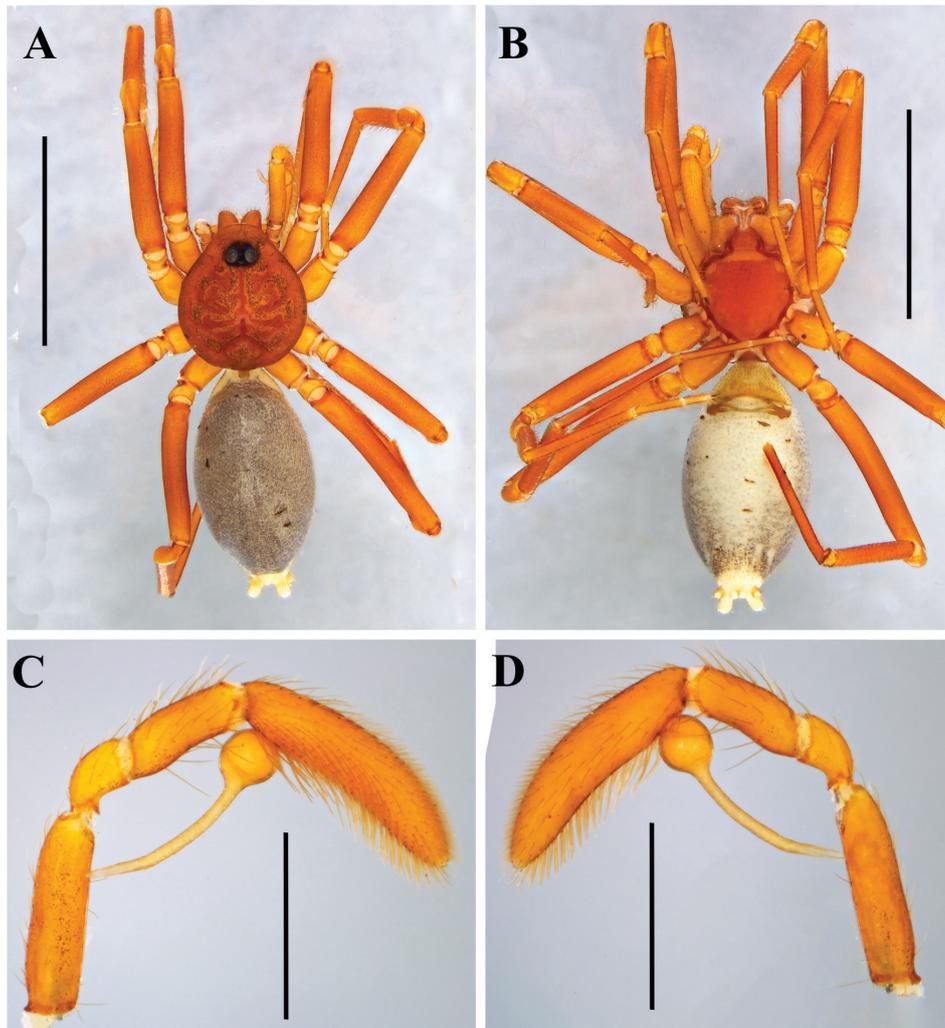


Figure 1. *Nopsma florencia* Sánchez-Ruiz, Brescovit & Bonaldo, male (holotype). **A.** Habitus, dorsal view. **B.** Habitus, ventral view. **C.** Left palp, retrolateral view. **D.** Left palp, prolateral view. Scale bars: **A, B:** 1.5 mm, **C, D:** 0.7 mm.

Description. Male described by Sánchez-Ruiz et al. (2020). Female unknown.

Distribution. Known only from the type locality in Chocó, Colombia (Fig. 8).

Preservation status. Preserved in 70% ethanol. Male holotype in good condition, left palp dissected in a separate microvial.

***Nopsma leticia* sp. nov.**

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 Figures 2A–D, 5E, F, 6E, F, 8

Type material. Holotype ♂, COLOMBIA: Amazonas department, Leticia, Comunidad Indígena Monifue Amena, km 9,8 Vía Leticia-Tarapacá; 4°8'30"S, 69°55'23.72"W; 70 m; 12 Oct. 2003; Ospina leg; MPUJ-ENT 70460. Paratypes: 2 ♂; same collection data as for holotype; 13 Oct. 2003; MPUJ-ENT 70411.

Additional material examined. COLOMBIA • 1 ♂; Amazonas department, Leticia, Reserva Forestal del Río Calderón, Estación Biológica El Zafire; 4°00'21"S,

69°53'55"W; 150 m; 2–13 Dec. 2007; L. Franco & S. Flórez leg; IAVH-I 3784 • 1 ♂; same data as for preceding; IAVH-I 3785.

Diagnosis. Males of *Nopsma leticia* sp. nov. resemble those of *Nopsma florencia* by having a similarly shaped membranous keel on embolus tip (Fig. 6A, B, E, F), but can be distinguished by having a larger tegulum, one-third of the cymbium length (Fig. 2C, D), and by the thicker embolus and membranous keel (Fig. 6E, F).

Description. Male (holotype): Total length 3.92. Carapace 1.67 long, 1.42 wide. Sternum 1.02 long, 0.92 wide. Leg measurements: I: 4.37; II: 4.54; III: 4.31; IV: 5.52. Carapace orange-brown with remarkable dorsal pattern of dark brown stains (Fig. 2A). Chelicerae, palps, sternum, endites, labium and legs orangish brown (Fig. 2B). Abdomen dorsally gray with tenuous light stripes (Fig. 2A), ventrally yellowish (Fig. 2B). Anal tubercle and spinnerets pale yellowish. Palp with rounded tegulum and a posteriorly directed embolus (Fig. 2C, D), with a long membranous keel, reaching more than one-third of the embolus tip (Fig. 6F). **Female:** unknown.

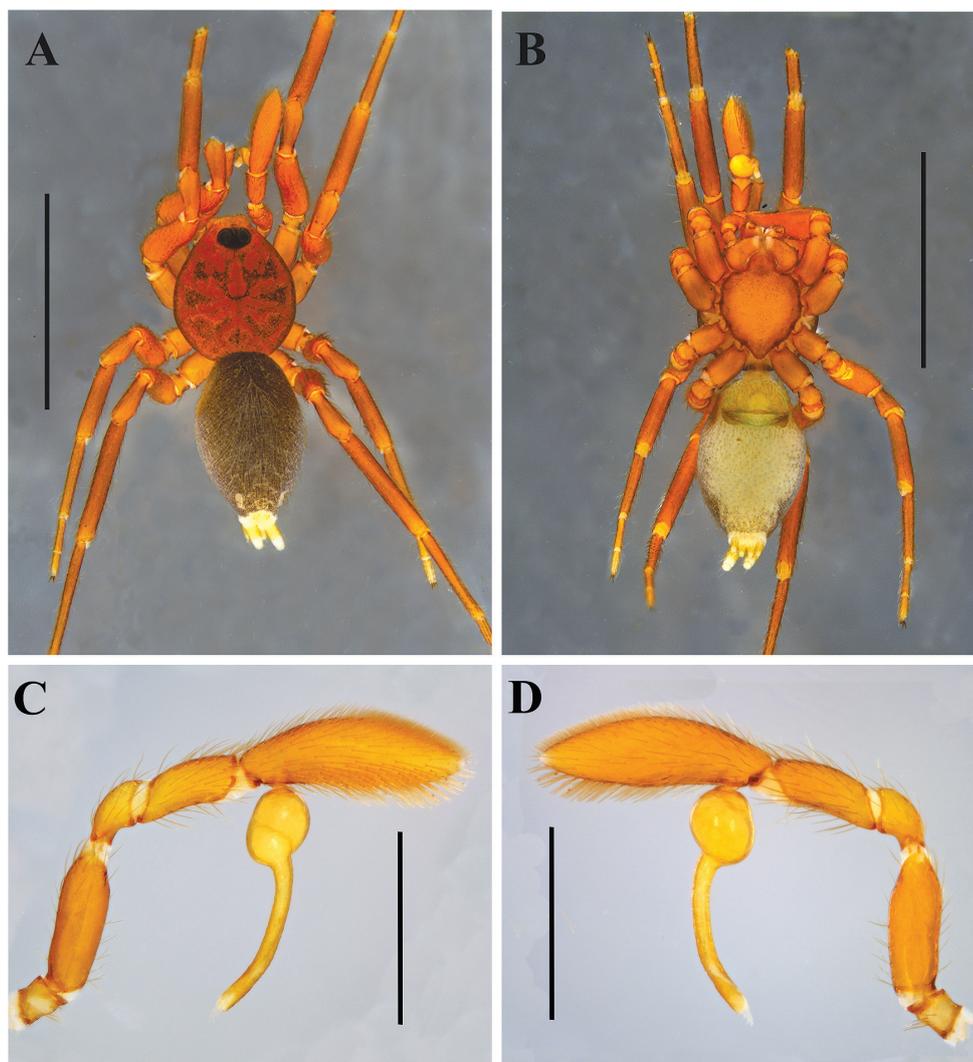


Figure 2. *Nopsma leticia* sp. nov., male (MPUJ-ENT 0070411). **A.** Habitus, dorsal view. **B.** Habitus, ventral view. **C.** Left palp, retrolateral view. **D.** Left palp, prolateral view. Scale bars: **A, B:** 1.5 mm, **C, D:** 0.7 mm.

Etymology. The specific name is a noun in apposition taken from the type locality.

Variation. Males (n=5): total length: 2.68–3.99; carapace length: 1.54–1.71.

Distribution. Known from two localities in Amazonas department (Fig. 8).

Preservation status. Preserved in 70% ethanol. Male holotype in good condition, left palp dissected in a separate microvial.

***Nopsma macagual* sp. nov.**

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Figures 3A, D, 5C, D, 6C, D, 8

Type material. Holotype ♂, COLOMBIA: Caquetá department, Florencia, Centro de Investigaciones de la Universidad de la Amazonia Macagual; 1°30'5.364"N, 75°39'46.26"W; 250 m; 29 Mar.–04 Apr. 2017, E. Flórez leg; ICN-Ar 10354.

Diagnosis. *Nopsma macagual* sp. nov. can be distinguished from all other members of *Nopsma* by having the embolus anteriorly directed (Figs 3C, D, 6C, D).

Description. Male (holotype): Total length 2.67. Carapace 1.51 long, 1.25 wide. Sternum 1.05 long, 0.86 wide. Leg measurements: I: 4.83; II: 4.44; III: 4.42; IV: 5.67. Carapace orange-brown with remarkable dorsal pattern of dark brown stains (Fig. 3A). Chelicerae, palps, and sternum orange-brown. Labium, endites and legs light orange, excepting coxae and tarsi pale orange (Fig. 3A, B). Abdomen dorsally dark gray, without stripes (Fig. 3A), ventrally light gray (Fig. 3B). Anal tubercle and spinnerets pale light brown. Palp with large, pear-shaped tegulum, one-third of the cymbium length (Fig. 3C, D, with retrolateral torsion (Fig. 6C, D), embolus long, anteriorly directed (Fig. 3C, D), with a membranous keel at the opening and surrounding the embolus tip (Fig. 6C, D). **Female:** unknown.

Etymology. The specific name is a noun in apposition taken from the type locality.

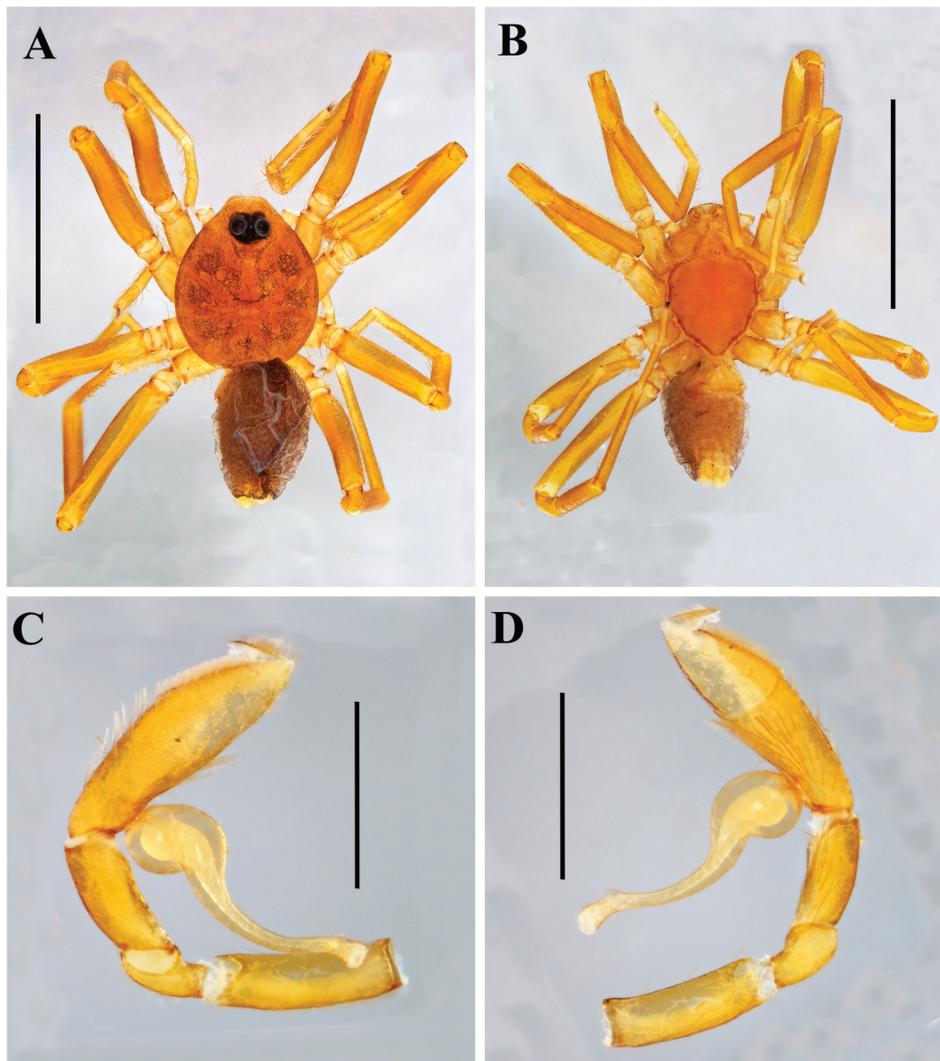


Figure 3. *Nopsma macagual* sp. nov., male (holotype). **A.** Habitus, dorsal view. **B.** Habitus, ventral view. **C.** Left palp, retrolateral view. **D.** Left palp, prolateral view. Scale bars: **A, B:** 1.5 mm, **C, D:** 0.7 mm.

Distribution. Known only from the type locality (Fig. 8).

Preservation status. Preserved in 80% ethanol. Male holotype in good condition, but abdomen is dry and shriveled (Fig 3A). Both palps of holotype dissected in a separate microvial with partial damage on left cymbium tip (Fig 3D).

***Nopsma paya* sp. nov.**

<http://zoobank.org/41F19726-8256-446E-98DF-43404AB773D9>

Figures 4A–G, 5G, H, 6G, H, 7B, 8

Type material. Holotype ♂, COLOMBIA: Putumayo, Parque Natural Nacional La Paya, Cabaña Viviano Cocha; 0°7'S, 74°56'W; 320 m; 15–20 Jul. 2003; R. Cobete leg; IAvH-I 3786. Paratypes: 1♀; same data as for holotype; IAvH-I 3796 • 1♀; same data as for holotype; IAvH-I 3806.

Diagnosis. Males of *N. paya* sp. nov. resemble those of *N. leticia* sp. nov. by having an oval tegulum reach-

ing one-third of the cymbium length (Figs 2C, D, 4E, F), but can be distinguished by having a straighter embolus with membranous keel restricted to the opening tip (Fig. 6G, H) (curved, with membranous keel surrounding the embolus in *N. leticia*; Fig. 6E, F). Females differ from those of *N. juchuy*, the only other *Nopsma* species known by females, by the external genitalia strongly sclerotized around spiracles, with V-shaped margin on posterior plate (Fig. 4G) (concave margin on posterior plate, weak sclerotization around spiracles in *N. juchuy*; Sánchez-Ruiz et al. 2020: fig. 15I); internally with median concavity on distal margin of receptaculum (Figs 4H, 7B) (straight distal margin in *N. juchuy*; Fig. 7A, Sánchez-Ruiz et al. 2020: fig. 16G–J).

Description. Male (holotype): Total length (approximately) 3.04. Carapace 1.60 long, 1.29 wide. Sternum 0.94 long, 0.81 wide. Leg measurements: I: 5.09; II: 4.84; III: 4.58; IV: 6.14. Carapace orange-brown with disperse dorsal pattern of dark brown stains (Fig. 4A). Chelicerae, palps, sternum, labium, endites and legs

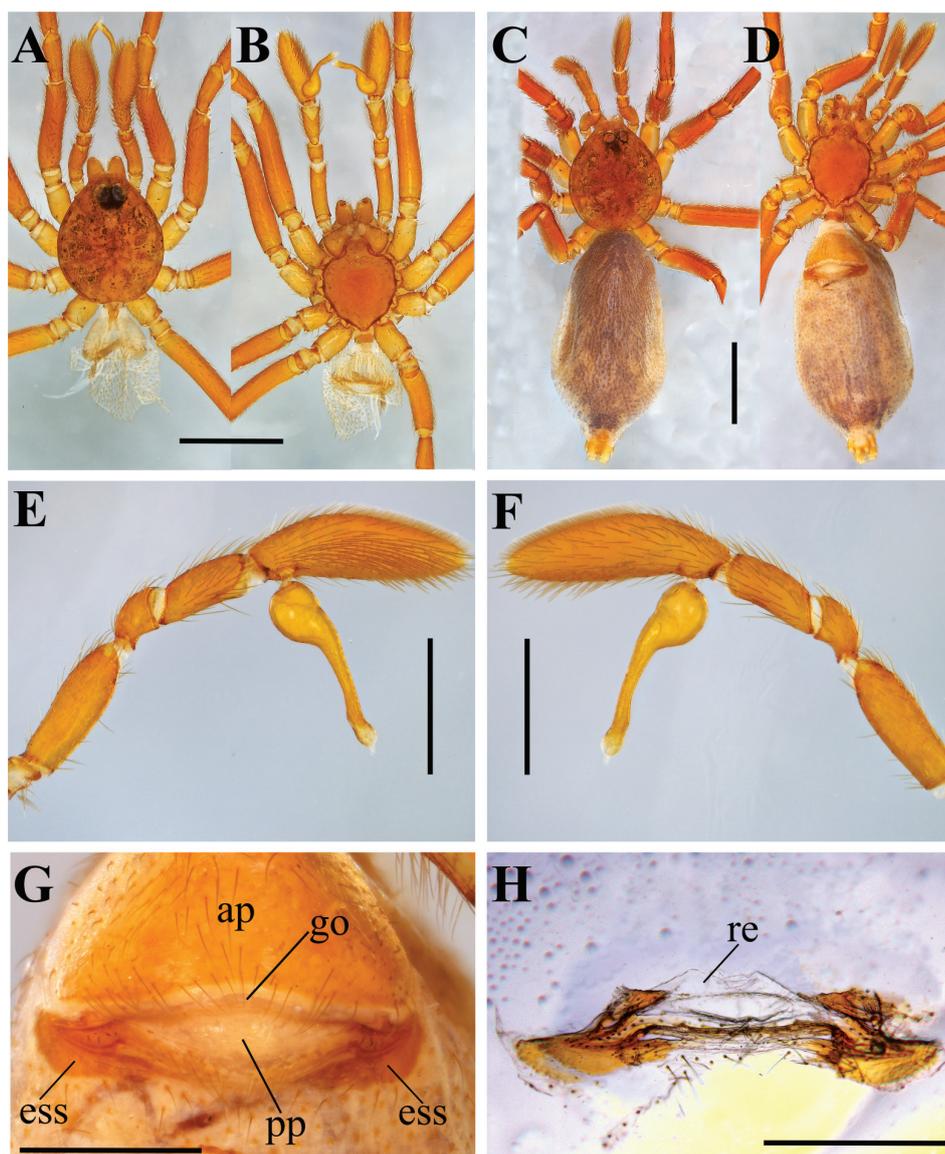


Figure 4. *Nopsma paya* sp. nov.; **A, B, E, F.** male holotype; **C, D, G.** female paratype (IAvH-I 3796). **A.** Habitus, dorsal view. **B** Habitus, ventral view. **C.** Habitus, dorsal view. **D.** Habitus, ventral view. **E.** Left palp, retrolateral view. **F.** Left palp, prolateral view. **G.** External genitalia, ventral view. **H.** Internal genitalia, dorsal view. Scale bars: **A–D:** 1.5 mm, **E, F:** 0.7 mm, **G, H:** 0.5 mm. Abbreviations: ap = anterior plate, ess = external sclerotization around spiracles, go = genital opening, pp = posterior plate, re = receptaculum.

light orange-brown, except coxae and tarsi pale orange (Fig. 4A, B). Abdomen dorsally dark gray with dark patches, but not forming a pattern, ventrally light gray. Anal tubercle and spinnerets pale light brown. Palp with oval, pear-shaped tegulum with retrolateral torsion (Fig. 6G, H) and a straight embolus with membranous keel only at the opening tip (Fig. 6G, H). **Female** (paratype, IAvH-I 3796): Total length 5.24. Carapace 1.80 long, 1.55 wide. Sternum 1.07 long, 0.99 wide. Leg measurements: I: 5.21; II: 5.01; III: 4.58; IV: 6.37. Coloration as in male. External genitalia strongly sclerotized around spiracles and in the anterior plate, with V-shaped margin on posterior plate (Fig. 4G); internal genitalia with median concavity or invagination on distal margin of receptaculum, slightly sloping on sides (Figs 4H, 7B).

Etymology. The specific name is a noun in apposition taken from the type locality.

Variation. Females (n=2): total length: 4.97–5.24; carapace length: 1.64–1.80.

Distribution. Known only from the type locality (Fig. 8).

Preservation status. Preserved in 80% ethanol. Male holotype with only a half of the abdomen, left palp dissected in a separate microvial. Female paratype IAvH-I 3796 in good condition, genitalia dissected in a separate microvial.

Discussion

The three new Colombian species of *Nopsma* described here increase to seven the number of known species of this genus. These new species are probably endemic, being currently known from only one or two localities

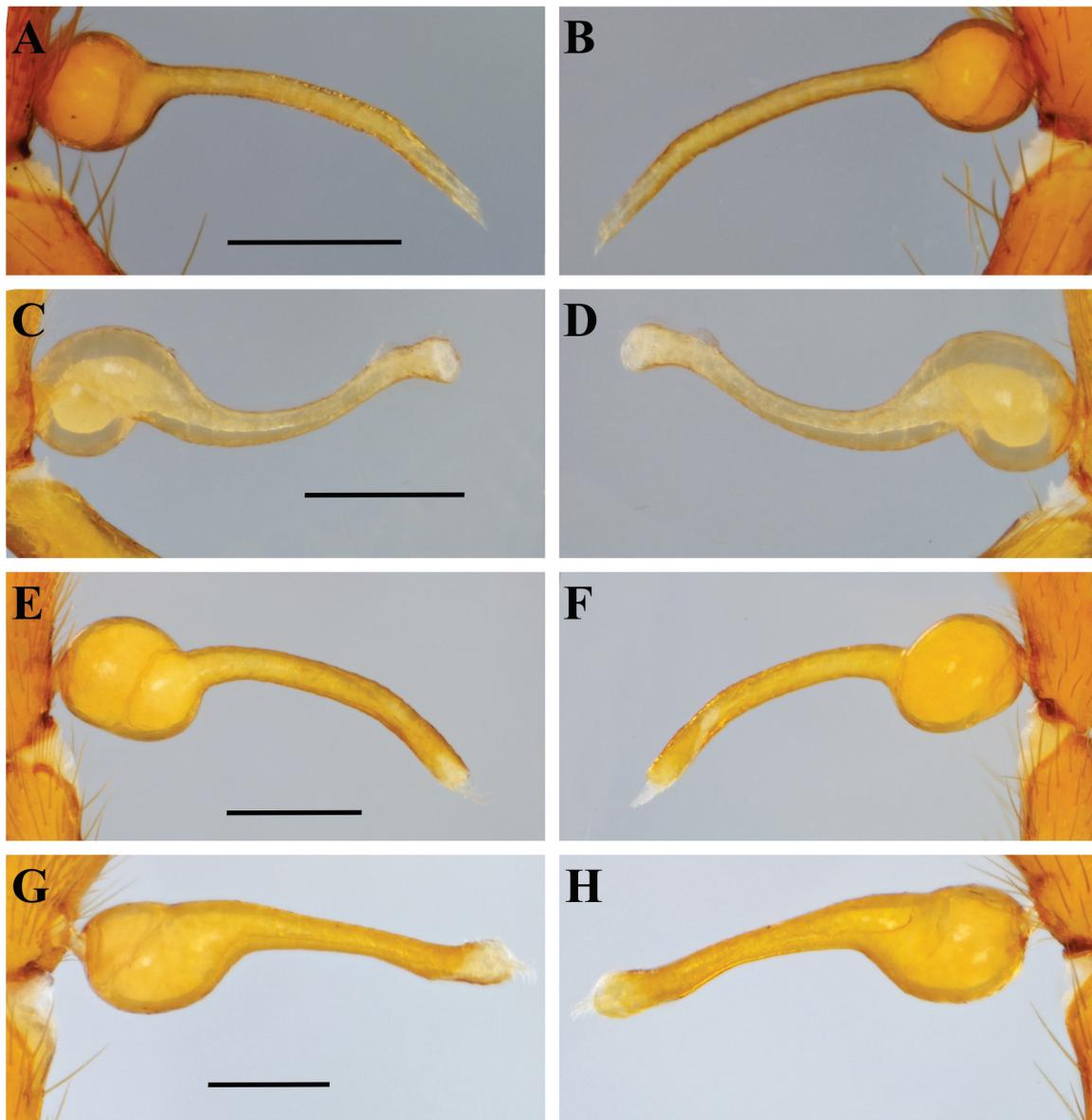


Figure 5. Male copulatory bulbs of Colombian *Nopsma* species. **A, B.** *Nopsma florencia* Sánchez-Ruiz, Brescovit & Bonaldo. **C, D.** *Nopsma macagual* sp. nov. **E, F** *Nopsma leticia* sp. nov. **G, H.** *Nopsma paya* sp. nov. **A, C, E, G.** Retrolateral view. **B, D, F, H.** Prolateral view. Scale bars: 0.7 mm.

within the country. Until now, only the males of *Nopsma* are well known since the few known female specimens belong to the type species, *N. juchuy* (Dupérré), which was internally studied by (Sánchez-Ruiz et al. 2020). In this paper we present the internal genitalia of *Nopsma paya* sp. nov., the second species represented by females within the genus. The internal genitalia of the Nopininae females are weakly sclerotized (Sánchez-Ruiz and Brescovit 2018) and sometimes it is necessary to dissect several females in order to resolve the internal morphology. Generally, internal female genitalia of Nopininae genera tend to be very similar among its species and only differences in the morphology of the receptaculum were observed in previous studies on these genera (see Platnick 1995; Sánchez-Ruiz et al. 2010, 2020; Sánchez-Ruiz and Brescovit 2017, 2018). The genus *Nopsma* seems to be no exception, since the female genitalia of *N. juchuy* and *N.*

paya are very similar internally, with only few differences in the distal margin of the receptaculum (Fig. 7A, B). The straight distal margin of the receptaculum in *N. juchuy* (Fig. 7A, Sánchez-Ruiz et al. 2020: fig. 16G–J) appears to be diagnostic, while *N. paya* sp. nov. shows an invagination on distal margin of receptaculum with both sides slightly sloping (Fig. 7B). Furthermore, comparing the external genital area of both species we found also some discrete differences that are diagnostic for each of these species (see diagnosis of *N. paya* sp. nov.).

Members of *Nopsma* lack *crista* and *arolium* but retain the gladius on the anterior legs. Sánchez-Ruiz et al. (2020) suggested that this genus could be phylogenetically related to *Nyetnops* Platnick & Lise and *Cubanops* Sánchez-Ruiz, Platnick & Dupérré, since these three genera have several common characteristics in the shape and stain patterns of the cephalothorax, sharing a

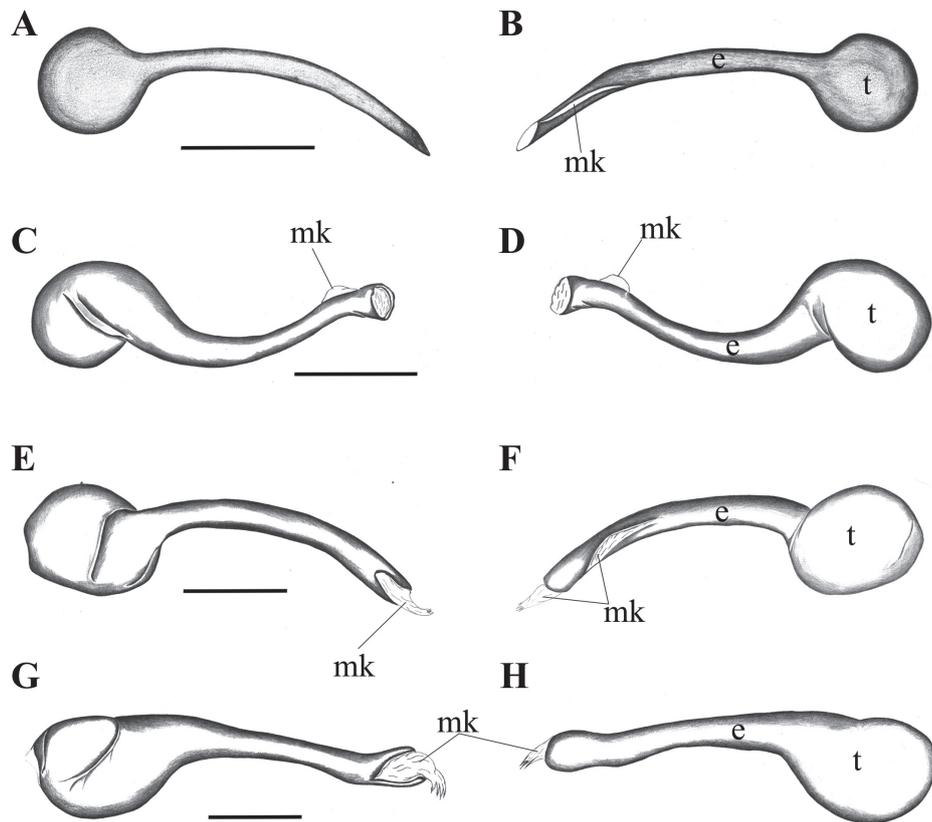


Figure 6. Drawings of male copulatory bulbs of Colombian *Nopsma* species. **A, B.** *Nopsma florencia* Sánchez-Ruiz, Brescovit & Bonaldo. **C, D.** *Nopsma macagual* sp. nov. **E, F.** *Nopsma leticia* sp. nov. **G, H.** *Nopsma paya* sp. nov. **A, C, E, G.** Retrolateral view. **B, D, F, H.** Proteral view. Scale bars: 0.7 mm. Abbreviations: e = embolus, mk = membranous keel, t = tegulum.

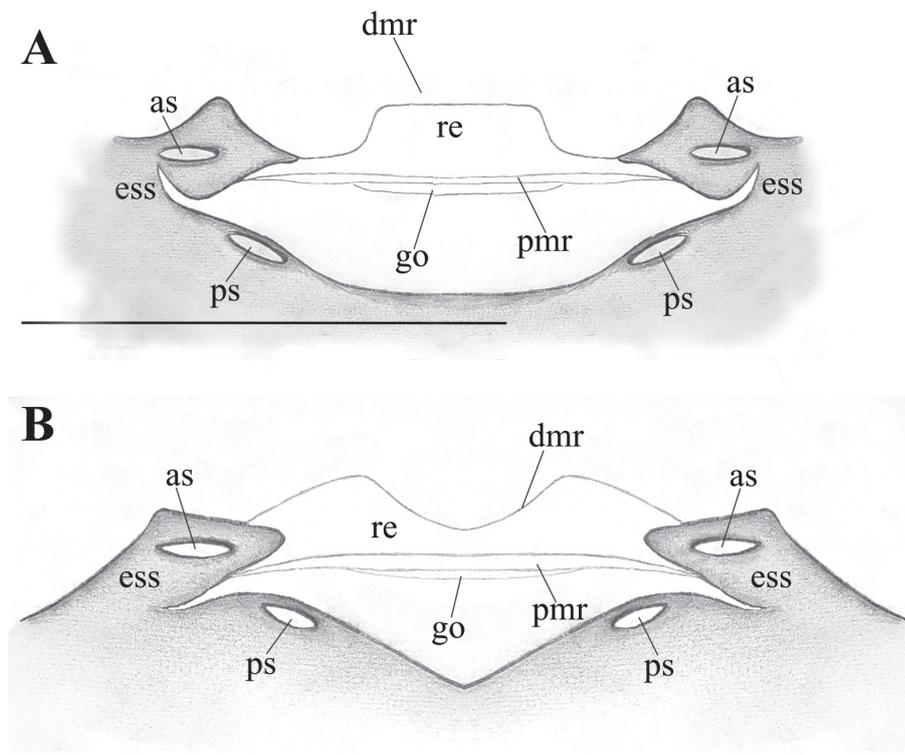


Figure 7. Schematic drawing of internal female genitalia in two *Nopsma* species. **A.** *Nopsma juchuy* (Dupérré). **B.** *Nopsma paya* sp. nov. Scale bars: **A, B:** 0.5mm. Abbreviations: as = anterior tracheal spiracles, dmr = distal margin of receptaculum, ess = external sclerotization around spiracles, go = genital opening, pmr = proximal margin of receptaculum, pp = posterior plate, ps = posterior tracheal spiracles, re = receptaculum.

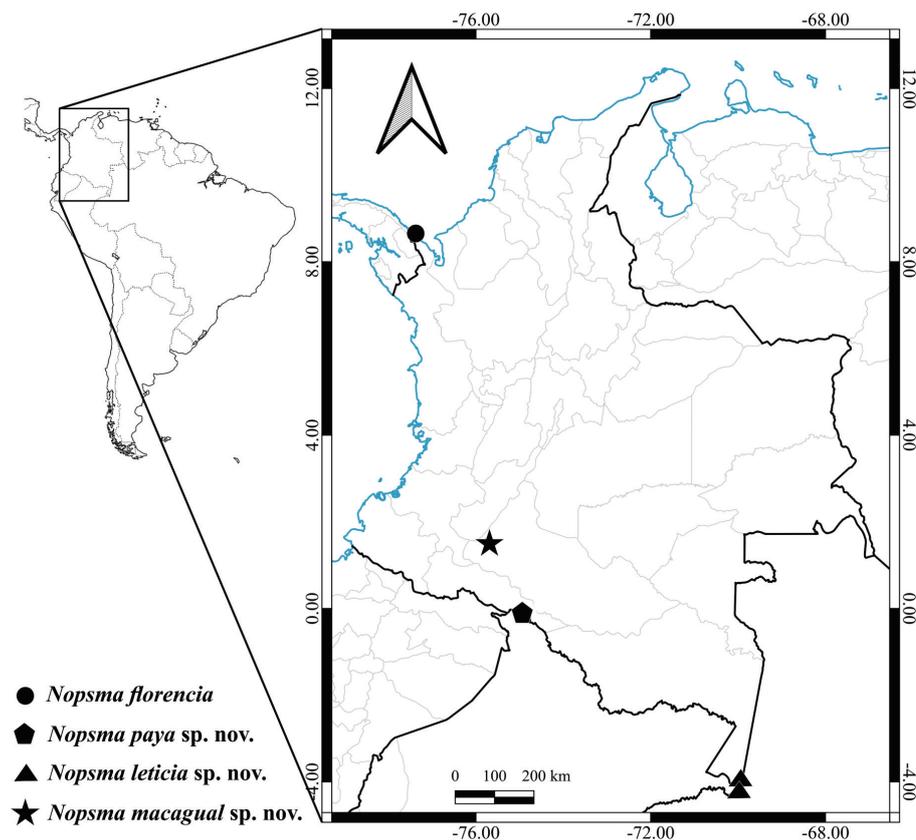


Figure 8. Distribution map of Colombian *Nopsma* species. *Nopsma florencia* Sánchez-Ruiz, Brescovit & Bonaldo (circle), *Nopsma leticia* sp. nov. (triangles), *Nopsma macagual* sp. nov. (star) and *Nopsma paya* sp. nov. (polygon).

distinct sub-circular, broad carapace shape, with narrow pars cephalica on dorsal view. Besides, the pars thoracica is elevated near the middle and slopes abruptly posteriorly on lateral view. The only known species of *Nopsma* that diverges from those patterns is *Nopsma armandoi* Sánchez-Ruiz, Brescovit & Bonaldo (see Sánchez-Ruiz et al. 2020: fig. 17A). This species, however, exhibits the *Nopsma* diagnostic characteristics mentioned by Sánchez-Ruiz et al. (2020). Thus, although lacking an *arolium* on the pretarsi, *N. armandoi* has the cephalothorax similar to that presented by genera of the clade with *arolium* (*Nops* MacLeay, *Medionops* Sánchez-Ruiz & Brescovit and *Nopsides* Chamberlin). The absence of a membranous keel on the embolus tip is another important characteristic that set apart *N. armandoi* from other members of *Nopsma*. All presently known *Nopsma* species have this membranous keel, however *N. armandoi* has three, very thin, long projections at the embolus tip (see Sánchez-Ruiz et al. 2020: fig. 17B, C, F). These projections at the embolus tip again relate this species to those representatives from the *arolium* clade. Therefore, this species must be better studied, preferably with additional specimens, including the females which are currently unknown. An updated phylogeny of Nopinæ that includes *Nopsma*, must address the hypothesis that this species would not belong to the genus, but instead to a hitherto undescribed lineage of Nopinæ in which the loss of *arolium* has occurred independently.

Acknowledgements

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