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Research article

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Cave-dwelling species of *Brasineura* Silva-Neto & García Aldrete, 2015 (Psocodea: Ptiloneuridae) from southwestern Brazil: new species, wing variation, and new geographic and troglophile status records

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Abstract. Three new troglophilic species of *Brasineura* Silva-Neto & García Aldrete, 2015 are described and illustrated herein: *Brasineura hpba* Reategui, Pereira, Rafael & Silva-Netosp. nov., *B. renaissance* Reategui, Pereira, Rafael & Silva-Neto sp. nov., and *B. vicentoi* Reategui, Pereira, Rafael & Silva-Neto sp. nov. Intraspecific variation in wing venation is documented for the newly described taxa. Additionally, we report for the first time the occurrence of *B. serranortensis* Silva-Neto, García Aldrete & Rafael, 2016 and *B.spinosa* Silva-Neto, García Aldrete & Rafael, 2018 within cave environments. An updated distribution map of the species of *Brasineura* in Brazil is provided, along with an identification key based on male morphological characters. With the inclusion of these new records, the number of the species of *Brasineura* known from Brazil rises to ten. This study significantly advances the understanding of the diversity and distribution of free-living lice associated with Brazilian cave ecosystems.

Keywords. Troglophilic, free-living lice, Neotropical, Psocomorpha.

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Introduction

Psocodea Novack, 1890, a group of small insects ranging from 1 to 10 mm in length, is the currently accepted name following the reclassification that unified the former orders Psocoptera Shipley, 1904 (free-living lice) and Phthiraptera Haeckel, 1896 (parasitic lice) (Silva-Neto *et al.* 2024). Members of this group are found in a variety of habitats throughout Brazil, including cave environments, where they play important ecological roles in organic matter decomposition and as components of the trophic web (Silva-Neto *et al.* 2024).

To date, 33 species of Psocoptera have been recorded in Brazilian caves, representing five families: Amphientomidae Enderlein, 1903 (1 species), Pachytroctidae Enderlein, 1904 (1 species), Psyllipsocidae Lienhard & Smithers, 2002 (19 species), Prionoglarididae Azar, Huang & Nel, 2017 (4 species), and Ptiloneuridae Roesler, 1940 (8 species) (Zampaulo & Prous 2022).

Brasineura Silva-Neto & García Aldrete, 2015 is one of 12 recently established genera within the psocopteran family Ptiloneuridae. The genus currently comprises seven described species: *B. calori* Lima, Silva-Neto, García Aldrete & Bravo, 2020, *B. diamantina* Silva-Neto & García Aldrete, 2015, *B. jiboia* Silva-Neto, García Aldrete & Rafael, 2018, *B. morrense* Lima, Silva-Neto, García Aldrete & Bravo, 2020, *B. serranortensis* Silva-Neto, García Aldrete & Rafael, 2016, *B. spinosa* Silva-Neto, García Aldrete & Rafael, 2018, and *B. troglophilica* Silva-Neto & García Aldrete, 2015. Among them, only *B. troglophilica* has previously been recorded from a cave environment.

Recently, two of the authors (NSR and AMSN) examined material collected from Brazilian caves and identified specimens of *B. serranortensis* and *B. spinosa*, representing the first records of these species from subterranean habitats. Additionally, three distinct morphotypes were found that do not correspond to any known species of *Brasineura*, indicating the presence of undescribed taxa and they are being described and illustrated bellow. Additionally, we document previously unreported intraspecific variation in the wing venation, we confirm the occurrence of *B. serranortensis* and *B. spinosa* in cave environments, and we provide an updated identification key to the males of *Brasineura*, based on the key originally published by Lima *et al.* (2020).

Material and methods

A total of 22 specimens collected from caves in the Brazilian states of Bahia, Espírito Santo, Minas Gerais, and Pará were examined. Specimens were dissected in 80% ethanol and mounted on slides using Canada balsam. After dissection and slide preparation, the remaining body parts of each specimen were preserved in 80% ethanol and labeled with the same collection data as the corresponding slides.

Standard morphological measurements were taken using a filar micrometer and are expressed in micrometers (μm).

Abbreviations for measurements and morphological terms

D and d = antero-posterior and transverse diameter, respectively, of right compound eye, in dorsal view of head
FW = right forewing
HW = right hindwings
IO = minimum distance between compound eyes in dorsal view of head
Lp = pterostigma
MX2 = second segment of right maxillary palpus
MX4 = fourth segment of right maxillary palpus
PO = d/D

T = tibia
t1 and t2 = tarsomeres 1 and 2

Photographs of mounted parts were taken using a Leica DFC500 digital camera attached to a Leica M205C stereo microscope, connected to a computer with Leica Application Suite (LAS) ver. 3.6, which includes an Auto-Montage module (Syncroscopy software).

The specimens studied were stored in CD boxes, following the methodology outlined by Silva-Neto *et al.* (2016c). The terminology of phallosome sclerites terminology follows Silva-Neto *et al.* (2024). A map of the species locality was created with QGIS software ver. 3.30.0.

Type specimens were deposited in the Collection of Subterranean Invertebrates of the Universidade Federal de Lavras, Minas Gerais, Brazil (ISLA/UFLA).

Results

Key to males of Brasineura Silva-Neto & García Aldrete, 2015, modified from Lima et al. (2020)

1. Phallosoma side struts not fused proximally (Fig. 3J; Lima *et al.* 2020: figs 7–21) 2
– Phallosoma side struts fused proximally (Fig. 1L; Silva-Neto *et al.* 2018: figs 28–32) 5

2. Hypandrium with a projection in the middle (Lima *et al.* 2020: fig. 20) .... ***B. morrense*** Lima, Silva-Neto, García Aldrete & Bravo, 2020 (Bahia / Brazil)
– Hypandrium without a projection in the middle (Figs 3–6; Lima *et al.* 2020: fig 6) 3

3. Phallosome with three pairs of endophallic sclerite, with antero-lateral sclerite pair fused to the antero-mesal, external parameres distinctly forked distally (Fig. 6J) ....***B.vicentei*** sp. nov (Minas Gerais / Brazil)
– Phallosome with two pairs of endophallic sclerites, external parameres distally not forked (Fig. 3J) 4

4. External parameres distally not forked, phallobase with numerous small spines gently sclerotized concentrated in the medial region of the membranous matrix (Fig. 3J) ....***B. renaissance*** sp. nov (Minas Gerais / Brazil)
– External parameres slightly forked distally; phallobase without spines (Lima *et al.* 2020: fig. 7) .... ***B. caroli*** Lima, Silva-Neto, García Aldrete & Bravo, 2020 (Bahia / Brazil)

5. Hypandrium with a projection in the middle; paraprocts elongate, distally outwards curved (Silva-Neto *et al.* 2016a: figs 5–6) .... ***B. serranortensis*** Silva-Neto, García Aldrete & Rafael, 2016 (Pará / Brazil)
– Hypandrium without a projection in the middle; paraprocts not elongate, distally not outwards curved (Fig. 1I; Lima *et al.* 2020: figs 6–8) 6

6. Phallobase without spine-like structures (Silva-Neto & Garcia Aldrete 2015: fig. 7) 7
– Phallobase with spine-like structures (Fig. 1L; Silva-Neto *et al.* 2018: fig. 21) 9

7. External parameres forked distally; side struts V-shaped basally (Silva-Neto & García Aldrete 2015: fig. 14) ..... ***B. troglophilica*** Silva-Neto & García Aldrete, 2015 (Pará / Brazil)
– External parameres not forked distally; side struts U-shaped basally (Silva-Neto & García Aldrete 2015: fig. 7) 8

8. Antero-mesal pair of endophallic sclerites sinuous, with a row of tiny spines in the middle, acuminate distally; external parameres distally with a small area more sclerotized, almost triangular (Silva-Neto & García Aldrete 2015: fig. 7) .... ***B. diamantina*** Silva-Neto & García Aldrete, 2015 (Bahia / Brazil)
– Antero-mesal pair of endophallic sclerites bow-shaped, without spines and distally not acuminate; external parameres distally with an acuminate projection, outwards curved (Silva-Neto *et al.* 2018: fig. 6) ..... ***B. jiboia*** Silva-Neto, García Aldrete & Rafael, 2018 (Bahia / Brazil)

9. External parameres forked distally; phallosome with three pairs of endophallic sclerites; phallobase with prominent tripartite structures, similar to spines (in Silva-Neto *et al.* 2018: fig. 21) ..... ***B. spinosa*** Silva-Neto, García Aldrete & Rafael, 2018 (Espírito Santo / Minas Gerais / Brazil)
– External parameres not forked distally; phallosome with two pairs of endophallic sclerites, phallobase with numerous small spines heavily sclerotized forming a concave band in a membranous matrix (Fig. 1L) ..... ***B. hpba*** sp. nov. (Minas Gerais / Brazil)

Taxonomy

Class Insecta Linnaeus, 1758
Order Psocodea Henning, 1966
Suborder Psocomorpha Badonnel, 1951
Family Ptiloneuridae Roesler, 1940
Genus *Brasineura* Silva-Neto & Garcia Aldrete, 2015

Brasineura hpba Reategui, Pereira, Rafael & Silva-Neto sp. nov.
urn:lsid:zoobank.org:act:91149DE4-9BB4-4E72-8FD2-E7C7B09B4DEC
Figs 1–2, 7

Diagnosis

This species is similar to *B. spinosa* and *B. renaissance* Reategui, Pereira, Rafael & Silva-Neto sp. nov. in the general structure of the phallobase. It is close to *B. renaissance* in the external parameres that are not forked distally but differs from it at the phallobase which bears numerous small spines, which are heavily sclerotized and arranged in a concave band embedded within a membranous matrix. Three pairs of endophallic sclerites are present: antero-lateral pair long and slender; antero-mesal pair is M-shaped, with stout anterior arms that contact medially, forming inwardly curved projections, and a posterior portion that is sinuous and gently inward curved; posterior pair stout, distally curved outwards, blunt ended, close to the external parameres.

Etymology

The specific epithet is treated as a noun in apposition and refers to an invariable letter combination corresponding to the acronym of the Hospital Português da Bahia (HPBA), an emblematic healthcare institution in the state of Bahia, Brazil. The name honors the essential medical care provided to AMSN and his family members.

Type material

Holotype

BRAZIL – **Minas Gerais** • ♂; Barão de Cocais, Ravena, Sabará, cave AVG 43 seca [dry]; 19°49′20.69″ S, 43°41′45.38″ W; 18 May 2013; Ativo ambiental leg.; ISLA/UFLA, ISLA 126106.

Paratypes

BRAZIL – **Minas Gerais** • 1 ♂; same data as for holotype; Barão de Cocais, cave CBT 02/6P4; 19°52′24.0″ S, 43°23′30.0″ W; 22 Jan. 2015; ISLA/UFLA, ISLA 126108 • 2 ♂♂; same data as for

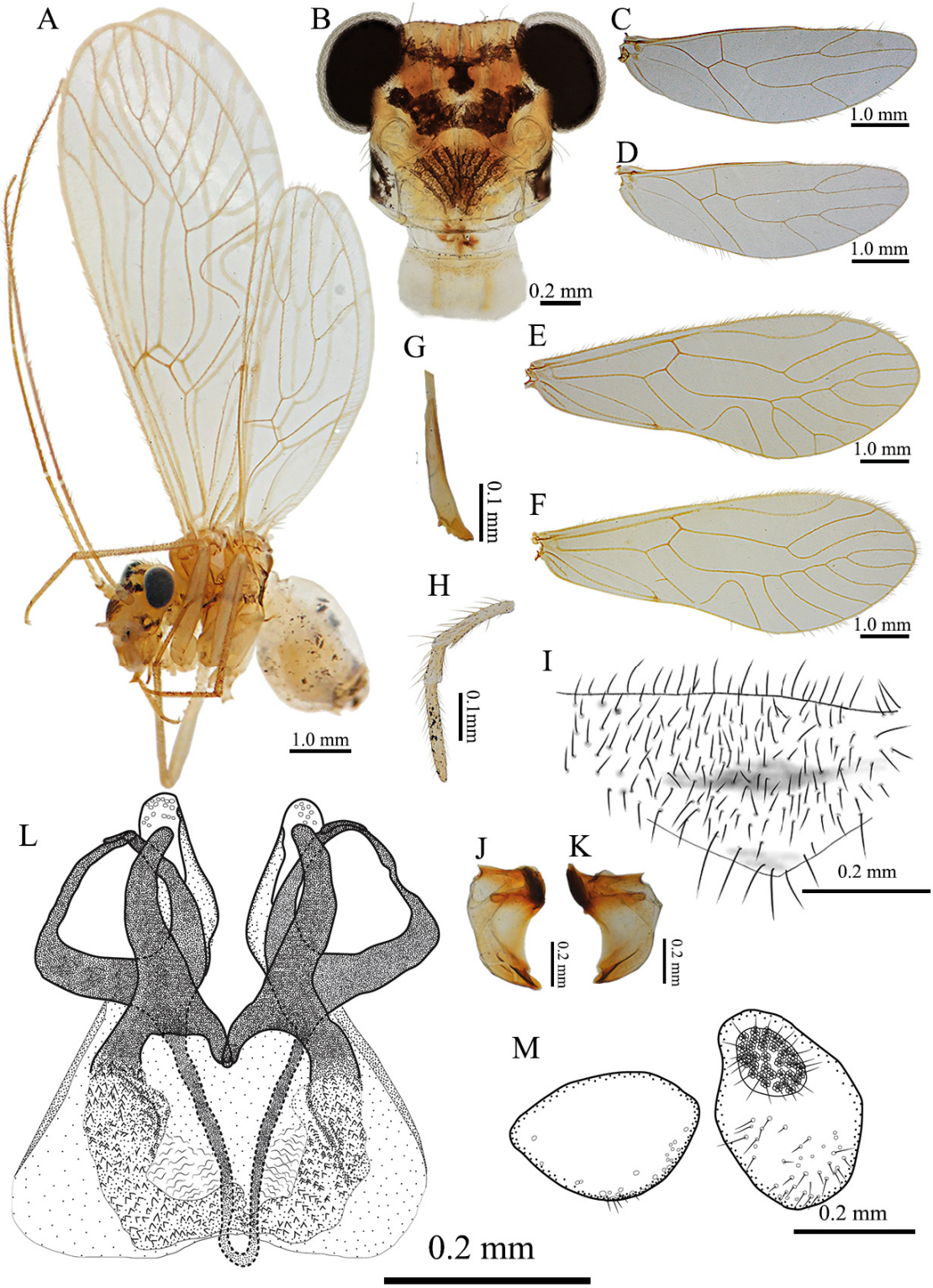

Fig. 1. *Brasineura hpba* Reategui, Pereira, Rafael & Silva-Neto sp. nov., holotype, ♂ (ISLA 126106). **A**. Lateral view. **B**. Head in frontal view. **C**. Right hindwing. **D**. Left hindwing. **E**. Right forewing. **F**. Left forewing. **G**. Lacinia. **H**. Maxillary palp. **I**. Hypandrium. **J**. Right mandible. **K**. Left mandible. **L**. Phallosome. **M**. Paraproct and epiproct.

holotype; cave AVG-08 seca [dry]; 19°49′24.56″ S, 43°42′21.30″ W; 19 May 2013; ISLA/UFLA, ISLA 126112 • 3 ♂♂; same data as for holotype; cave AVG-30 seca [dry]; 19°49′21.77″ S, 43°41′50.08″ W; ISLA/UFLA, ISLA 126114 • 4 ♂♂; same data as for holotype; cave AVG-38 úmida [humid]; 19°49′22.37″ S, 43°41′44.06″ W; 17 May 2013; ISLA/UFLA, ISLA 126116.

Description

Male

Coloration. Body pale yellow with brown and pale brown areas as indicated below. Compound eyes black, ocelli hyaline, with ochre centripetal crescents (Fig. 1A–B); head pattern (Fig. 1B). Legs with coxae, trochanters and femora creamy white, tibiae and tarsomeres pale yellow. Fore-hindwings hyaline (Fig. 1C–F).

Morphology. Compound eyes without interommatidial setae (Fig. 1B). Outer cusp of lacinial tip broad, with six denticles and markedly sclerotized (Fig. 1G); labial palps almost triangular (Fig. 1H); mandibles asymmetrical, elongate and with outer margin angled (Fig. 1J–K). Forewing pterostigma elongate, constricted proximally, widest in middle. Areola postica tall, broadly triangular, with apex rounded. Rs almost straight, R_{2+3} and R_{4+5} slightly sinuous. M stem slightly concave proximally, then almost straight. Right forewing M of five branches, with M5 three branched, resulting in M_{5a1}, M_{5a2} and M_{5b} (Fig. 1E). Left forewing M of six branches (Figs 1F, 2A–E; see also variation of paratype below). Right hindwing Rs-M joined, M of two branches (Fig. 1C). Left hindwing M of three branches (Fig. 1D). Paraprocts (Fig. 1M) stout, broad, elongate, distally curved outward, sensory fields with 33 thichobothria on basal rosettes, setae as illustrated (Fig. 1M). Epiproct (Fig. 1M) anteriorly convex, sides converging to round

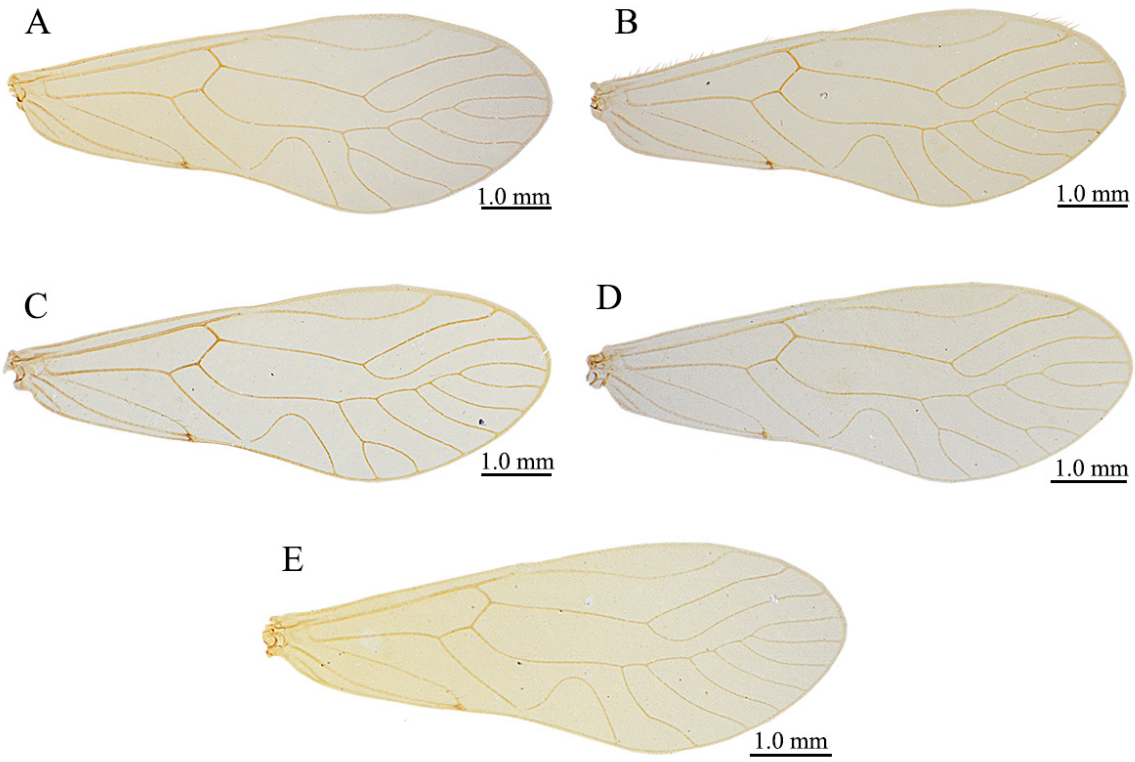

Fig. 2. Variation of forewing venation of paratypes of *Brasineura hpba* Reategui, Pereira, Rafael & Silva-Neto sp. nov., ♂♂. **A–B**. Paratype, (ISLA 126108). **A**. Right forewing. **B**. Left forewing. **C–D**. Paratype, (ISLA 126112). **C**. Right forewing. **D**. Left forewing. **E**. Paratype (ISLA 126114), right forewing.

posterior border. Hypandrium with posterior projection with slightly accentuated apex, straight median anterior region, gently dark spot in center of structure (Fig. 1I). Phallosome (Fig. 1L) with side struts proximally fused, external parameres distally not forked, with sharp, heavily sclerotized projection on inner side. Phallobase with numerous small spines heavily sclerotized forming concave band in membranous matrix; three pairs of endophallic sclerites are present: antero-lateral long pair slender; antero-mesal pair M-shaped, with stout anterior arms that contact medially, forming inwardly curved projections, and posterior portion sinuous and gently inward curved; posterior pair stout, distally curved outwards, blunt ended, close to external parameres.

Measurements (in mm). FW: 5.802; HW: 3.990; F: 1.156; T: 1.473; t1: 0.712; t2: 0.097; t3: 0.155; MX4: 0.5255; IO: 0. 71723; D: 0.769664; d: 0.439632; IO/d: 1.631; PO: 0.571.

Variations in the forewing veins

The following text describes the five distinct variations of forewing veins identified in male specimens of *B. hpba* Reategui, Pereira, Rafael & Silva-Neto sp. nov.

Type 1. Forewing M with five branches, M_5 branched resulting in M_{5a} and M_{5b} (Fig. 2A).
Type 2. Forewing M with six primary branches and without secondary branches (Fig. 2B)
Type 3. Forewing M with six branches, M_6 branched resulting in M_{6a} and M_{6b} (Fig. 2C).
Type 4. Forewing M with five branches, M_4 and M_5 branched resulting in M_{4a} and M_{4b}, and M_{5a} and M_{5b}, respectively (Fig. 2D).
Type 5. Forewing M with seven primary branches and without secondary branches (Fig. 2E).

Brasineura renaissance Reategui, Pereira, Rafael & Silva-Neto sp. nov.
urn:lsid:zoobank.org:act:77E4DEAA-D365-45CD-825C-520419FD279D
Figs 3–5, 7

Diagnosis

This species is similar to *B. spinosa* and *B. hpba* Reategui, Pereira, Rafael & Silva-Neto sp. nov. in possessing spines on the phallobase. It is closer to *B. hpba* in the external parameres that are not forked distally, but differs from it at the phallobase which bears numerous small, lightly sclerotized spines concentrated medially within the membranous matrix. Three pairs of endophallic sclerites are present: the antero-lateral pair short, slender and sinuous; antero-mesal pair is M-shaped, with stout anterior arms that meet medially, forming fin-shaped, inwardly curved projections, posteriorly, sclerites are slender, gently curved outward, and distally pointed; posterior pair stout, distally curved outwards, blunt ended, close to the external parameres (Fig. 3J).

Etymology

The specific epithet is treated as a noun in apposition and refers to ‘Renaissance’, the title of a studio album by the pop singer Beyoncé.

Type material

Holotype

BRAZIL – **Minas Gerais** • ♂; Dores de Guanhães, cave G.E. – S1_NOVA_009; 18°58′51.6″ S, 42°55′55.6″ W; 1–2 Mar. 2016; Spelayon *et al.* leg; ISLA/UFLA, ISLA 126158.

Paratypes

BRAZIL – **Minas Gerais** • 1 ♂; same data as for holotype; ISLA/UFLA, ISLA 126075 • 2 ♂♂; same data as for holotype; cave G. de Energia – SPT 002; 19°00′48.2″ S, 42°55′37.2″ W; 17–20 Jul. 2015; ISLA/

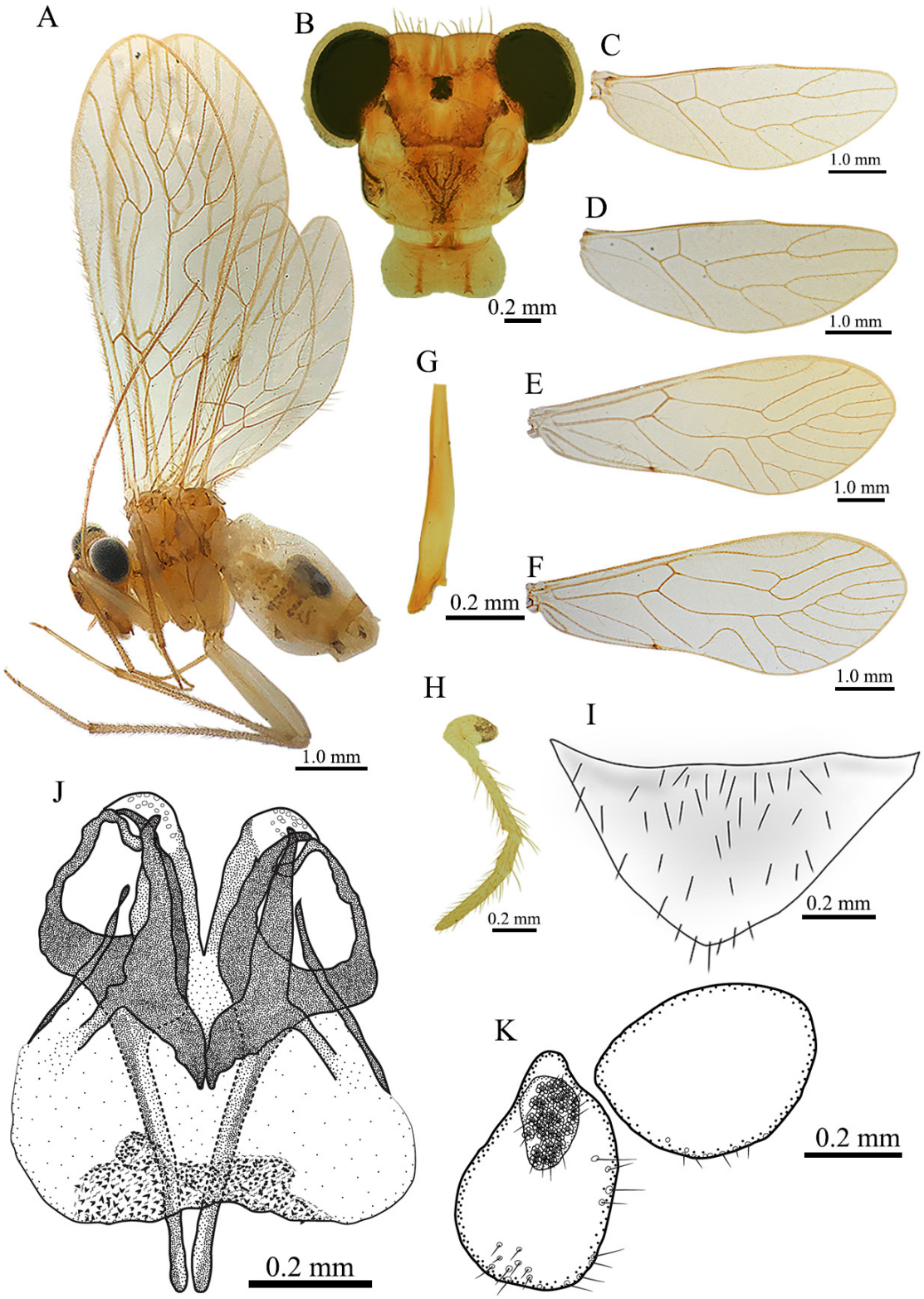

Fig. 3. *Brasineura renaissance* Reategui, Pereira, Rafael & Silva-Neto sp. nov., holotype, ♂ (ISLA 126158). **A**. Lateral view. **B**. Head in frontal view. **C**. Right hindwing. **D**. Left hindwing. **E**. Right forewing. **F**. Left forewing. **G**. Lacinia. **H**. Maxillary palp. **I**. Hypandrium. **J**. Phallosome. **K**. Paraproct and epiproct.

UFLA, ISLA 126047 • 3 ♂♂; Dores de Guanhães, cave G.de energia – SE_NOVA_002; 18°59′52.8″ S, 42°59′29.0″ W; 17 Jul. 2015; ISLA/UFLA, ISLA 126080 • 7 ♂♂; same data as for preceding; cave G. de energia – S1_JAC 005; 18°59′26.2″ S, 42°57′03.6″ W; ISLA/UFLA, ISLA 126102 • 8 ♂♂; same data as for preceding; cave G. de energia – S1_JAC 003; 18° 57′42.1″ S, 42°55′27.8″ W; ISLA/UFLA, ISLA 126104 • 9 ♂♂; same data as for preceding; cave G. de energia – S1_JAC 006; 18°59′26.2″ S, 42°57′03.2″ W; ISLA/UFLA, ISLA 126105 • 4 ♂♂; same data as for holotype; cave G. de energia – S1_NOVA_004; 18°58′58.1″ S, 42°57’25.9″ W; 5–7 Jul. 2016; ISLA/UFLA, ISLA 126090 • 5 ♂♂; same data as for holotype; cave G. de energia – S1_NOVA_001; 19°00′45.7″ S, 43°01′41.9″ W; ISLA/UFLA, ISLA 126094 • 6 ♂♂; same data as for holotype; cave G. de energia – S1_NOVA_003; 18° 58′54.5″ S, 42°57′25.6″ W; ISLA/UFLA, ISLA 126100.

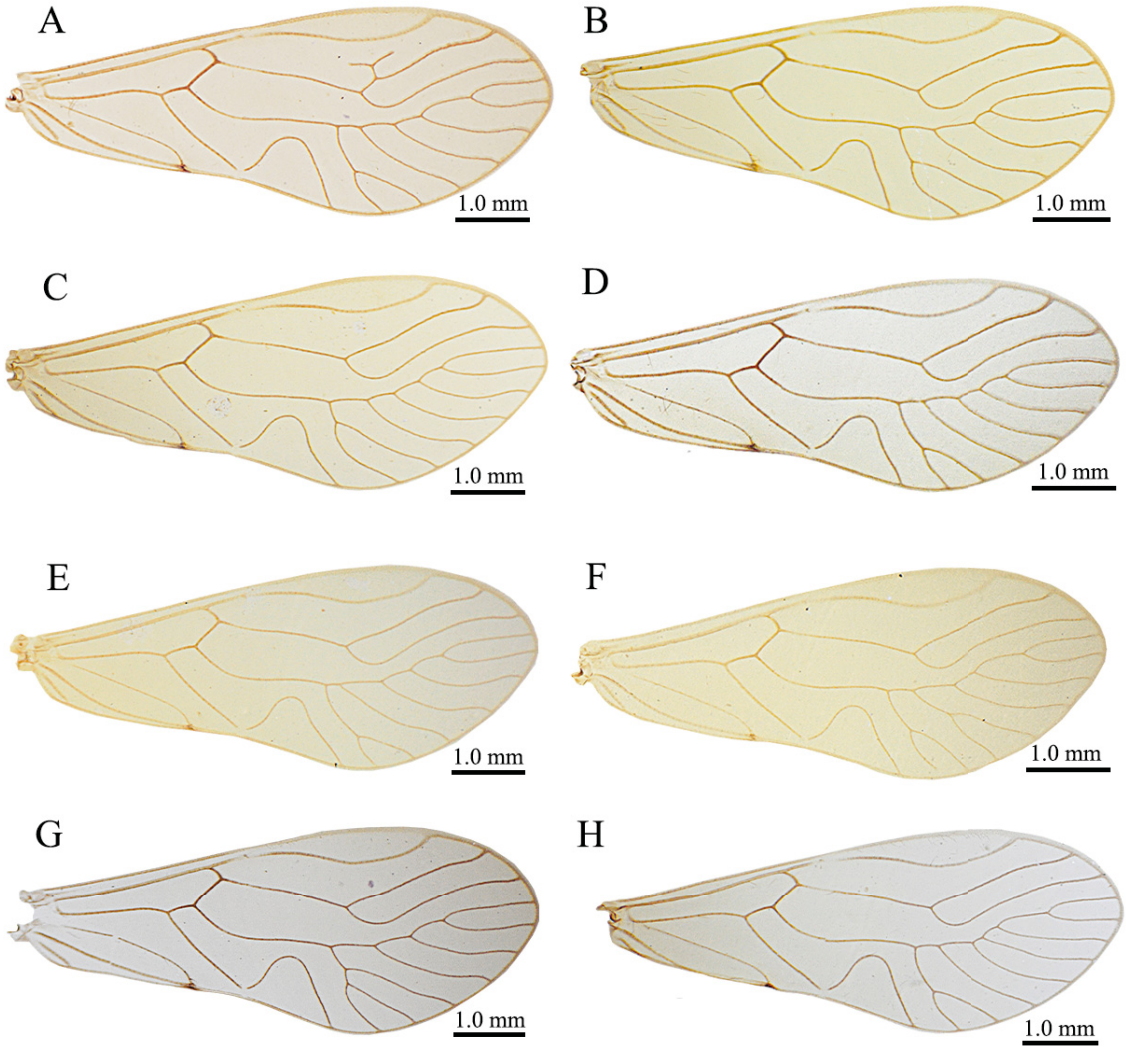

Fig. 4. Variation of forewing venation of paratypes of *Brasineura renaissance* Reategui, Pereira, Rafael & Silva-Neto sp. nov., ♂♂. **A–B**. Paratype (ISLA 126047). **A**. Right forewing. **B**. Left forewing. **C–D**. Paratype, (ISLA 126075). **C**. Right forewing. **D**. Left forewing. **E–F**. Paratype, (ISLA 126080). **E**. Right forewing. **F**. Left forewing. **G–H**. Paratype (ISLA 126090). **G**. Right forewing. **H**. Left forewing.

Description

Male

Coloration. Body pale yellow with brown and pale brown areas as indicated below (Fig. 3A). Compound eyes black, ocelli hyaline, with ochre centripetal crescents; head pattern (Fig. 3B). Legs with coxae, trochanters and femora creamy white, tibiae and tarsomeres pale yellow. Fore-hindwings hyaline (Fig. 3C–F).

Morphology. Compound eyes without interommatidial setae (Fig. 3B). Outer cusp of lacinial tip broad, with five denticles and markedly sclerotized (Fig. 3G); labial palps almost triangular (Fig. 3H). Forewing pterostigma elongate, constricted proximally, widest in middle. Areola postica tall, broadly triangular, with apex rounded. Rs almost straight, R_{2+3} and R_{4+5} gently sinuous. M stem slightly concave proximally, then sinuous. Right forewing M of six branches, with M_6 three branched, resulting in M_{6a1}, M_{6a2} and M_{6b} (Fig. 3E). Left forewing M of six branches, with M_6 forked, resulting in M_{6a} and M_{6b} (Figs 3F, 4A–H; see also variation of paratype below). Right hindwing Rs-M joined, M of three branches (Fig. 3C). Left hindwing M of three branches (Figs 3D, 5A–B; see also variation of paratype below). Paraprocts (Fig. 3K) almost oval, sensory fields with 34 thichobothria on basal rosetters, setae as illustrated (Fig. 3K). Epiproct almost redounded, setae as illustrated (Fig. 3K). Hypandrium almost triangular, setae as illustrated (Fig. 3I). Phallosome (Fig. 3J) with side struts proximally not fused, external parameres distally forked, with heavily sclerotized projection on inner side. Phallobase with numerous small spines gently sclerotized concentrated in medial region of membranous matrix. Three pairs of endophallic sclerites present: antero-lateral pair short and slender; antero-mesal pair M-shaped, with slender anterior arms that meet medially, forming fin-shaped, inwardly curved projections, posteriorly, these sclerites slender, gently curved outward, and distally pointed; posterior pair stout, distally curved outwards, close to external parameres (Fig. 3J).

Measurements (in mm). FW: 5.301; HW: 3.529; F: 1.301; T: 2.359; t1: 0.986; t2: 0.081; t3: 0.150; MX4: 0.430867; IO: 0.675249; D: 0.892636; d: 0.579787; IO/d: 1.164; PO: 0.649.

Variations and anomalies in the fore- and hindwing veins

The following text describes the ten distinct variations of fore- and hindwing veins identified in male specimens of *B. renaissance* Reategui, Pereira, Rafael & Silva-Neto sp. nov.

Type 1. Forewing with spurious R_{2+3} bifurcated, not touching the pterostigma, M with six primary branches, M_6 branched resulting in M_{6a} and M_{6b} (Fig. 4A).

Type 2. Forewing M with five branches, M_5 branched resulting in M_{5a} and M_{5b} (Fig. 4B).

Type 3. Forewing M with six branches, M_6 branched at the base of the vein resulting in M_{6a} and M_{6b} (Fig. 4C).

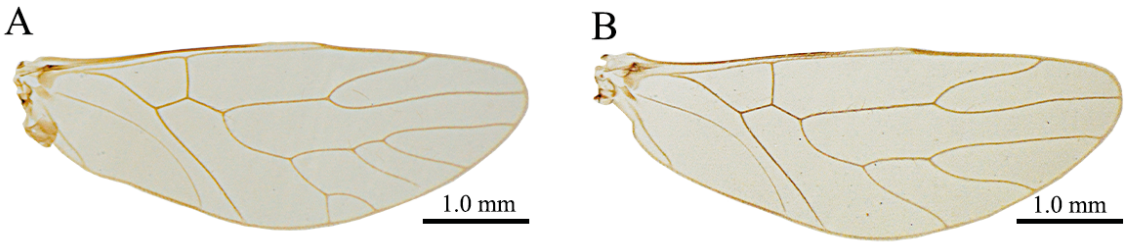

Fig. 5. Variation of hindwing venation of paratypes of *Brasineura renaissance* Reategui, Pereira, Rafael & Silva-Neto sp. nov., ♂♂. **A**. Paratype (ISLA 126075), right hindwing. **B**. Paratype (ISLA 126090), left hindwing.

Type 4. Forewing M with six branches, M_6 branched in the middle of the vein resulting in M_{6a} and M_{6b} (Fig. 4D).
Type 5. Forewing M with six branches, M_6 branched at the apex of the vein resulting in M_{6a} and M_{6b} (Fig. 4E).
Type 6. Forewing M with six branches, M_5 branched resulting in M_{5a} and M_{5b}, M_6 branched resulting in M_{6a} and M_{6b} (Fig. 4F).
Type 7. Forewing M with five branches, with M_5 three branched, resulting in M_{5b}, M_{5a1} and M_{5a2} (Fig. 4G).
Type 8. Forewing M with seven branches, with M_7 branched, resulting in M_{7a1} and M_{7a2} (Fig. 4H).
Type 9. Hindwing M with four primary branches, M3 with spurious vein, M_4 branched resulting in M_{4a} and M_{4b} (Fig. 5A).
Type 10. Hindwing M with three primary branches and without secondary branches (Fig. 5B).

Brasineura vicentei Reategui, Pereira, Rafael & Silva-Neto sp. nov.
urn:lsid:zoobank.org:act:710D68B0-8D51-4271-9008-1024E60A8AA2
Figs 6–7

Diagnosis

This species is similar to *B. troglophilica* in the general structure of the external parameres but differs in several key features. Phallosome (Fig. 6J) with side struts not fused; phallobase with membranous matrix gently sclerotized. Two pairs of endophallic sclerites; antero-lateral pair anteriorly sinuous, fused posteriorly with to the antero-mesal pair; these elongate, each sclerite independent, slender, dilated distally (Fig. 6J).

Etymology

The specific epithet is dedicated to Dr Vicente de Araújo dos Santos, Superintendent of the Hospital Português da Bahia, in recognition of the care and dedication provided in saving the life of AMSN's father.

Type material

Holotype

BRAZIL – **Minas Gerais** • ♂; Minas Gerais, Belo Horizonte, Taquaril, cave TAQ-02 RU; 19°56′47″ S, 43°52′56″ W; 8 Jan. 2014; Bioespeleo Cons leg; ISLA/UFLA, ISLA 126120.

Paratype

BRAZIL – **Minas Gerais** • 1 ♂; same data as for holotype; cave Taq-1.ES; 19°56′30″ S, 43°52′20″ W; 21 May 2014; ISLA/UFLA, ISLA 126121.

Description

Male

Coloration. Body pale yellow with brown and pale brown areas as indicated below. Compound eyes black, ocelli hyaline, with ochre centripetal crescents; head pattern (Fig. 6A–B). Legs with coxae, trochanters and femora creamy white, tibiae and tarsomeres pale yellow. Fore hindwings hyaline (Fig. 6C–F).

Morphology. Compound eyes without interommatidial setae (Fig. 6B). Outer cusp of lacinial tip broad, with five denticles and markedly sclerotized (Fig. 6G); labial palps almost triangular (Fig. 6H). Forewing pterostigma elongate, constricted proximally, widest in middle; areola postica tall, broadly triangular, with apex rounded. Rs almost straight, R_{2+3} e R_{4+5} gently sinuous. M stem slightly concave proximally,

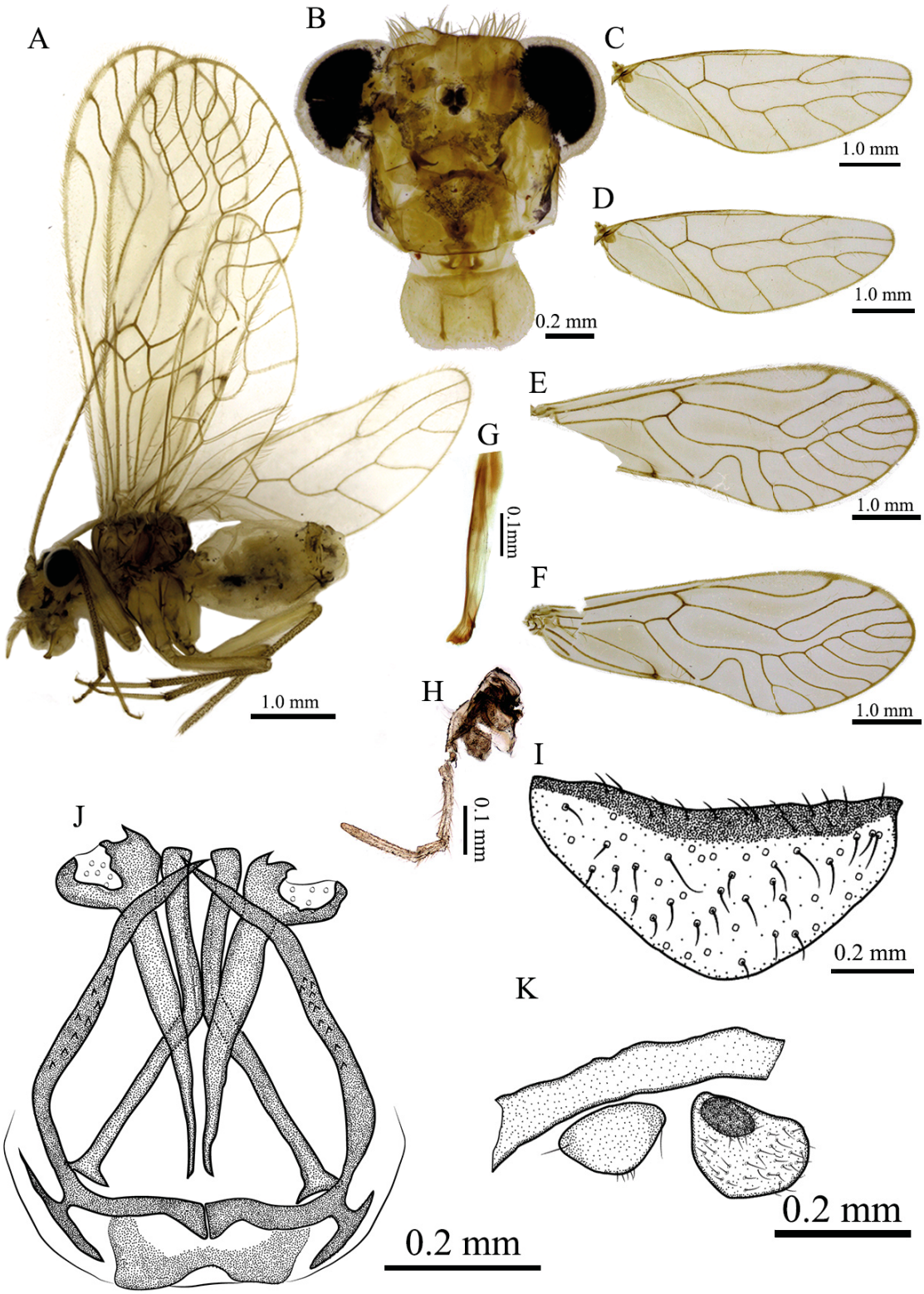

Fig. 6. *Brasineura vicentei* Reategui, Pereira, Rafael & Silva-Neto sp. nov., holotype, ♂ (ISLA 126120). **A**. Lateral view. **B**. Head in frontal view. **C**. Right hindwing. **D**. Left hindwing. **E**. Right forewing. **F**. Left forewing. **G**. Lacinia. **H**. Maxillary palp. **I**. Hypandrium. **J**. Phallosome. **K**. Paraproct and epiproct.

then sinuous. Right forewing M of seven branches, with M_7 forked, resulting in M_{7a} and M_{7b} (Fig. 6E). Left forewing M of seven branches, with M_7 forked, resulting in M_{7a} and M_{7b} (Fig. 6F). Right hindwing Rs-M joined, M of four branches (Fig. 6C). Left hindwing M of four branches (Fig. 6D). Paraprocts (Fig. 6K) almost oval, sensory fields with 29–35 thichobothria on basal rosetters, setae as illustrated (Fig. 6K). Epiproct almost elliptic, setae as illustrated (Fig. 6K). Hypandrium of single sclerite, anteriorly concave, with a highly sclerotized anterior edge and triangular distally (Fig. 6I). Phallosome (Fig. 6J) with side struts not fused; external parameres distally forked, with heavily sclerotized projection on inner side, this sclerotized fork forming almost closed ring, enclosing membrane with numerous pores. Phallobase with membranous matrix gently sclerotized. Two pairs of endophallic sclerites; antero-lateral pair, anteriorly sinuous, pointed end inward directed, posteriorly fused with lateral extensions of phallobase; antero-mesal pair elongate, each sclerite independent, slender, X-shaped structure, dilated distally and proximally fused to antero-lateral sclerite.

MEASUREMENTS (in mm). FW: 5.456; HW: 3.868; F: 1.367; T: 2.392; t1: 0.989; t2: 0.068; t3: 0.149; MX4: 0.335; IO: 0.634; D: 0.512; d: 0.330; IO/d: 1.921; PO: 0.64.

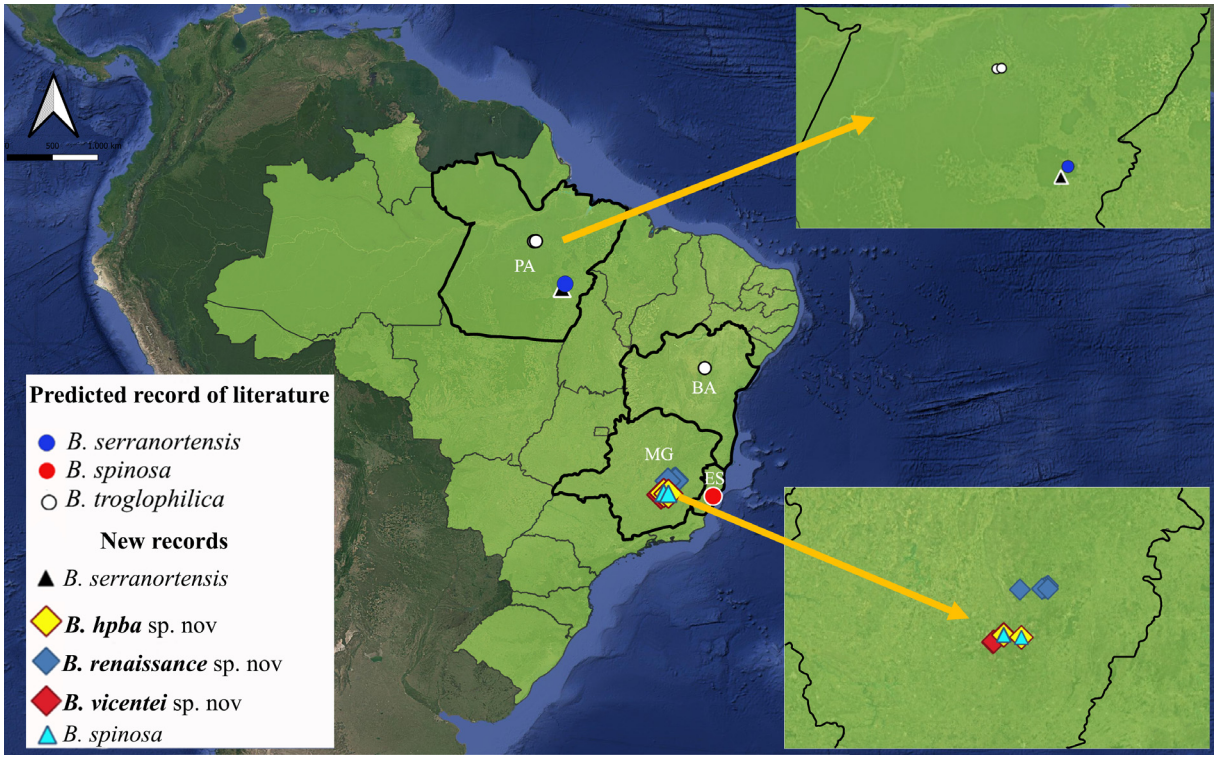

Fig. 7. Geographic distribution of *Brasineura* Silva-Neto & García Aldrete, 2015. Abbreviations: BA = Bahia; ES = Espírito Santo; MG = Minas Gerais; PA = Pará.

New records of other species of Ptiloneuridae Roesler, 1940 from Canaã dos Carajás (Pará), Santa Tereza (Espírito Santo) and Novo Oriente de Minas (Minas Gerais)

Brasineura serranortensis Silva-Neto, Garcia Aldrete & Rafael, 2016
Fig. 7

Brasineura serranortensis – Silva-Neto, Garcia Aldrete & Rafael, 2016a: 84 (phylogeny).

Brasineura serranortensis – Silva-Neto, García Aldrete & Rafael 2018: 556, fig. 30 (taxonomy). — Lima *et al.* 2018: e20185843 (taxonomy); 384 (taxonomy).

Material examined

BRAZIL – **Pará** • 1 ♂; Pará, Canaã dos Carajás, S11C-0128 ES; 6°22′58″ S, 50°23′19″ W; 17 May 2013; ISLA/UFLA • 2 ♂♂ same datas as for preceding; 6°24′06″ S, 50°22′50″ W; ISLA/UFLA.

Distribution

Brazil state: Pará (Canaã dos Carajás (new record), Marabá**)**.

Brasineura spinosa Silva-Neto, Garcia Aldrete & Rafael, 2018
Fig. 7

Brasineura spinosa –Silva-Neto, Garcia Aldrete & Rafael, 2018: 556 (taxonomy).

Brasineura spinosa – Lima *et al.* 2020: 384 (taxonomy).

Material examined

BRAZIL – **Espírito Santo** • 1 ♂; Espírito Santo, Santa Tereza, Gruta André Huski, 19°56′15.0″ S, 40°33′45.0″ W; 10 Jan. 2015; Ativo ambiental leg.; ISLA/UFLA • 2 ♂♂; Minas Gerais, Novo Oriente de Minas, Loca da Serra Jardim; 17°24′24″ S, 41°12′22″ W; 15 Jul. 2015; Ativo ambiental leg.; ISLA/UFLA.

Distribution

Brazil states: Espírito Santo (Fazenda Monte Sião, Santa Tereza (new record)), Minas Gerais (Novo Oriente de Minas (new record)).

Discussion

Brasineura serranortensis and *B. spinosa* were originally collected using light and Malaise traps in Serra Norte (Pará) and the Fundão region (Espírito Santo), respectively. These collections were made in pseudokarstic landscapes, where caves are associated with iron-ore and quartzite formations. Until now, however, neither species had been recorded from subterranean environments.

In this study, we report for the first time the occurrence of *B. serranortensis* and *B. spinosa* in caves, including the iron-ore caves S11C-0128 and S11C-0090, located in the municipality of Canaã dos Carajás, Pará, and the granite cave André Huski in Santa Teresa, Espírito Santo. The presence of both species in epigean and hypogean habitats suggests a potential troglophilic status. Moreover, the collection of both adults and nymphs within the caves reinforces this hypothesis, indicating that these species can complete their life cycle in subterranean environments as well as in surface habitats.

The new species described in this study were collected from caves in the Brazilian states of Minas Gerais and Pará, which currently hold the highest number of registered caves in the country (Brazil 2022). All specimens were obtained exclusively from subterranean environments, supporting their preliminary classification as troglophiles. However, we recommend that future research on these species includes systematic sampling in both epigean and hypogean habitats within the same geographic areas. Such an approach is essential to determine whether the observed association with caves is permanent (confirming a truly troglophilic status) or merely occasional. This strategy would enable a more accurate assessment of the species' degree of dependence on subterranean environments (Reategui *et al.* 2024).

Additionally, our study documents intraspecific variation in the forewing and hindwing venation patterns of the newly described species. Similar variation has been reported in other genera of Ptiloneuridae, such as *Loneura* (Cutrim *et al.* 2022) and *Brasineura* (Lima *et al.* 2018, 2020, present paper). The new distribution records (Fig. 7), along with the descriptions of the species provided here, contribute to the growing knowledge of subterranean diversity among free-living lice. These findings also highlight the ecological importance of Psocodea in organic matter decomposition and their role in the trophic dynamics of cave ecosystems.

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