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Research article

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Neurostigma Enderlein, 1900 (Psocodea: 'Psocoptera': Epipsocidae) from Brazilian Amazon Rainforest: new species and variations in forewings

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Abstract. Five new species of *Neurostigma* collected in the Brazilian Amazon Rainforest are described and illustrated: *Neurostigma alfonsoi* sp. nov., *N. patriciae* sp. nov., *N. angelicum* sp. nov., *N. spinosum* sp. nov. and *N. willkeniae* sp. nov. The first record of *Neurostigma* for the Brazilian state of Rondônia is included, along with an unpdated distribution map of male specimens of *Neurostigma*. An updated identification key of males of the genus is provided. Now, the number of species of *Neurostigma* recorded for Brazil has increased to 12, with two of them also occurring in Colombia. With this study, we significantly contributed to the knowledge of the diversity of the genus, which increased to 19 species.

Keywords. Biodiversity, Non-parasitic lice, Epipsocetae, Neotropical, taxonomy.

Introduction

The non-parasitic members of the order Psocodea Novack, 1890, previously known as Psocoptera Shipley, 1904 and popularly called booklice, barklice, or psocids in other countries, do not yet have a consolidated popular name in Brazil (Silva-Neto *et al*. 2024). Currently, there is an attempt to popularize the term 'non-parasitic lice' to designate this group. This initiative is justified by the recent taxonomic

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reclassification that united Psocoptera and Phthiraptera Haeckel, 1896 (lice) into a single order, Psocodea (Lyal 1985; Grimaldi & Engel 2005; Yoshizawa & Johnson 2010).

Traditionally, 'Psocoptera' is grouped in the suborders Trogiomorpha Roesler, 1940, Troctomorpha Roesler, 1940 and Psocomorpha Weber, 1936 (Yoshizawa & Johnson 2003). Psocomorpha is further divided into six infraorders: Homilopsocidea Pearman, 1936, Archipsocetae Yoshizawa, 2002, Philotarsetae Yoshizawa & Johnson, 2014, Caeciliusetae Pearman, 1936, Psocetae Pearman, 1936, and Epipsocetae Pearman, 1936 (Yoshizawa 2002; Yoshizawa *et al.* 2006). The infraorder Epipsocetae comprises five families. One of these families, Epipsocidae Pearman, 1936, is known from the Neotropical region and currently includes more than 200 species distributed in 31 genera.

One of this genera, *Neurostigma* Enderlein, 1900, was described based on a single male specimen (*N. chaetocephalum* Enderlein, 1900) from Callanga, Peru. *Neurostigma* presently includes 14 described species. Nine are known only from male specimens, one from a female specimen, and four have both sexes described (Silva-Neto & García Aldrete 2020; González-Obando *et al.* 2021; Reategui *et al.* 2022b). The genus is restricted to the Neotropical region. In South America, Colombia, and Brazil are the richest countries in terms of *Neurostigma* diversity. Eight species have been recorded in Colombia (*N. furcivenula* Badonnel, 1986, *N. lienhardi* González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021, *N. mockfordi* González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021, *N. newi* González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021, *N. roesleri* New, 1980, *N. thorntoni* González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021, *N. valderramae* González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021 and *N. xanthopterum* New, 1980). In Brazil, seven species are known (*N. atlanticum* Reategui, Rafael & Silva-Neto, 2022, *N. dispositum* Roesler, 1940, *N. enderleini* New, 1980, *N. paucivenosum* New, 1980, *N. radiatum* Mockford, 1991, *N. roesleri* and *N. xanthopterum*).

Out of the seven Brazilian species of *Neurostigma*, five were described from the Amazon, and the other two were recorded from the Atlantic Forest. The Amazonian species were described from the states of Amazonas (New 1980) and Roraima (Mockford 1991) with no new species being described from this biome for over 30 years. The species from the Atlantic Forest were described from the state of Santa Catarina (Roesler 1940) and recently from the state of Minas Gerais (Reategui *et al.* 2022b).

Upon examining specimens of 'non-parasitic lice' collected in the Brazilian Amazon Rainforest, we identified five new species of *Neurostigma* that were not assignable to any known species. The purpose of this paper is to describe and illustrate these species, present the variation in the forewing venation, and provide an identification key for males of the genus. Additionally, a checklist and distribution map of all known species of *Neurostigma* is presented.

Material and methods

We examined the type material of *Neurostigma radiatum* and *N. paucivenosum*, deposited in the Invertebrate Collection of the National Institute for Amazonian Research (INPA). We obtained photos of the forewing and the phallosome of the respective species to be used in the dichotomous key.

To describe the new species, eleven male specimens were used. Their pieces were separated after they were dissected in 70% ethanol. Because of the quantity of fat and membranes, the phallosome was treated in hot (100ºC) lactic acid for 20 minutes. Following maceration, the components were placed in butyl acetate and were mounted on slides in Canada balsam.

Standard measurements (in μm) were taken with a filar micrometer.

Abbreviations of parts measured are as follows:

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

The specimens studied were stored in CD boxes, as described by (Silva-Neto *et al*. 2016). The phallosome sclerites terminology follows (García Aldrete & Mockford 2012). Map of the species locality was made with QGIS software ver. 3.28.2.

The new species of *Neurostigma* were deposited in the Invertebrate Collection of the Instituto Nacional de Pesquisas da Amazônia, Manaus, Amazonas, Brazil – INPA.

Results

Taxonomy

Class Insecta Linnaeus, 1758
Order Psocodea Henning, 1966
Suborder Psocomorpha Badonnel, 1951
Family Epipsocidae Pearman, 1936
Genus *Neurostigma* Enderlein, 1900

Neurostigma alfonsoi sp. nov.
urn:lsid:zoobank.org:act:C60BE836-ED83-4339-8F04-08FA8BBCD6D5
Figs 1–5, 22

Diagnosis

The new species belongs in species group II, of Mendivil-Nieto *et al.* (2020). It is similar to *Neurostigma radiatum* in wing venation. I differs from the latter by having a distinctly irregular spot on forewing in medial region between M and CuA veins, and Cua_1 touching wing margin at a parallel point between first and second bifurcation of M vein (Figs 3A–B, 5); the phallosome somewhat wide basally and gently curved outwards, with a V-shaped posterior process of the aedeagal arch, with a small subtriangular projection in the middle of its inner margin; and the endophallus with numerous V-shaped small spines, the radula with two sclerites, these almost together in middle of endophallus, basally almost triangular and weakly sclerotized, and posteriorly strongly sclerotized, with numerous acuminate projections, with two medially detached projections (Fig. 4C).

Etymology

This species is dedicated to the memory of Dr Alfonso Neri García Aldrete (1942–2022), in recognition of his extensive and excellent contributions to the taxonomy of South American psocids.

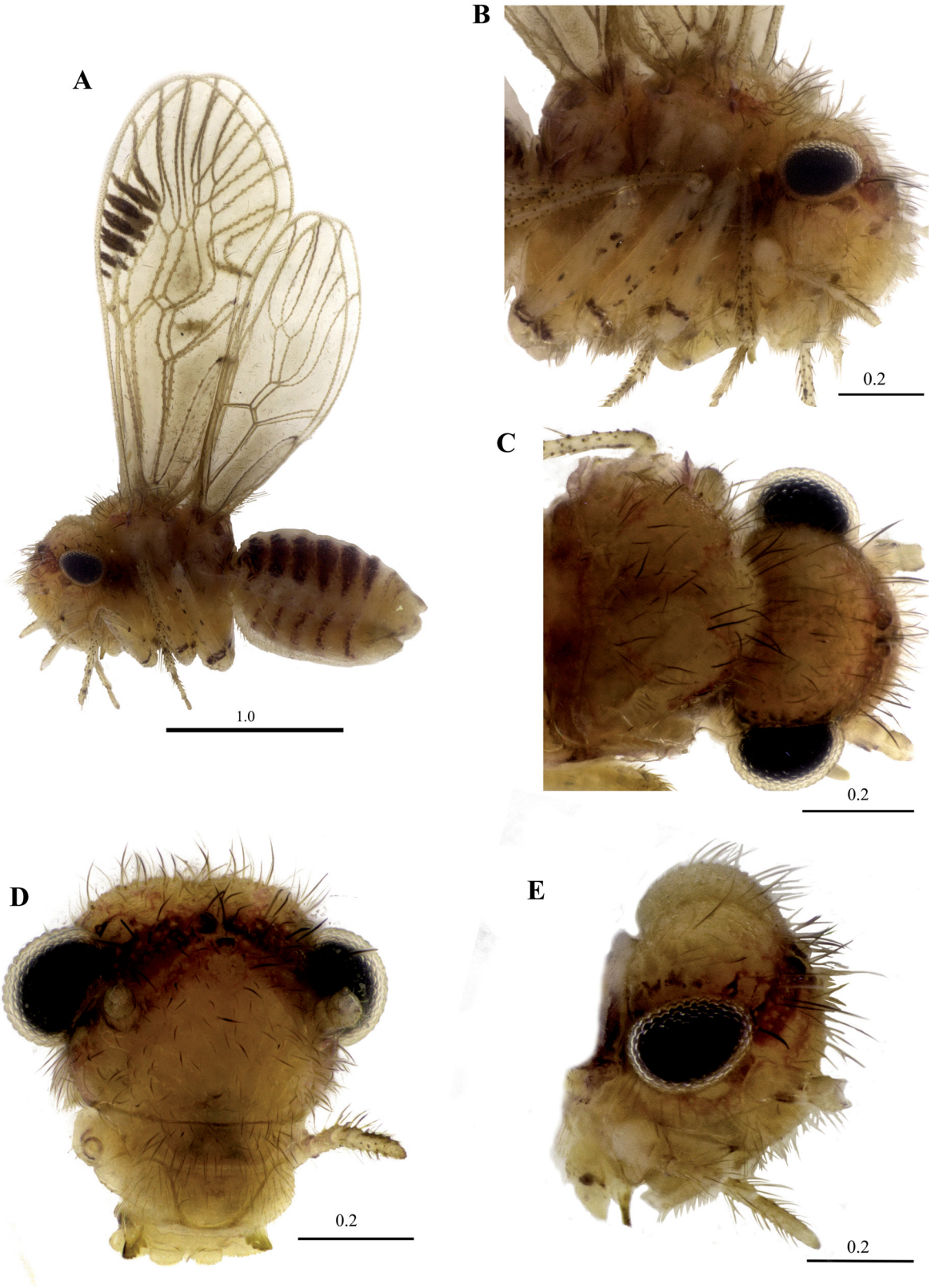

Fig. 1. *Neurostigma alfonsoi* sp. nov., holotype, ♂ (INPA-PSO 000030). **A**. Lateral view. **B**. Thorax and head in lateral view. **C**. Thorax and head in dorsal view. **D**. Front view of head. **E**. Lateral view of head. Scale bars in mm.

Type material

Holotype

BRAZIL • ♂; Rondônia, Itapuã do Oeste, Flona Jamari; 9°56′36″ S, 62°54′45″ W; 2 May 2016; Z.F.M. da Silva and J.A. Rafael leg.; Malaise trap; Rede de Biodiversidade de Insecta na Amazônia (REDE BIA); INPA, INPA-PSO 000030.

Paratypes

BRAZIL • 4 ♂♂; same data as for holotype; INPA, INPA-PSO 000031 to 000034.

Description

Male

Coloration. Frons of head with two dark brown spots between eyes and ocelli, first spot wider, second spot thinner, together forming convex shape (Fig. 1D); lateral areas of head entirely light brown (Fig. 1). Compound eyes black, ocelli hyaline with ochre centripetal crescents (Fig. 1). Scape, pedicel and flagellomeres hyaline. Clypeus light brown (Fig. 1D); labrum light brown, with dark brown labral sclerites (Fig. 2A), labium with light brown prementum, with dark brown round spot on sides, with palpi, paraglossas and glossa light brown (Fig. 2B); brown maxillary palpi without blackish contour (Fig. 2C), mandibles hyaline with yellowish and brownish ends (Fig. 2D–E); hyaline lacinia with yellowish distal region (Fig. 2F–G). Tergal lobes of meso and metathorax light brown (Fig. 1A); thoracic pleura light brown (Fig. 1A–B). Forewings with distinctly irregular spot in medial region between veins M and CuA (Fig. 3A–B), brownish spots that run through all crossveins of pterostigma of right forewing, except vein R1 (Fig. 3A), on left forewing, the spot runs through R1 (Fig. 3B). Hindwings hyaline, veins brown

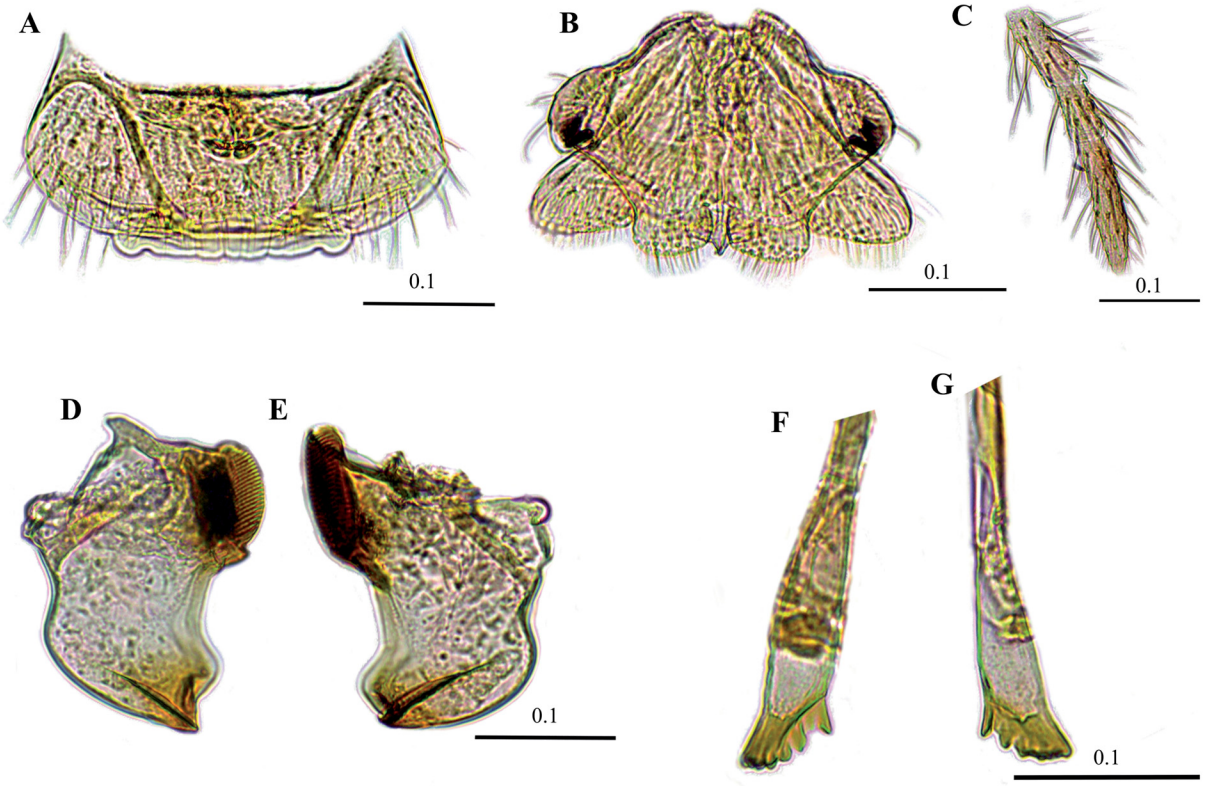

Fig. 2. *Neurostigma alfonsoi* sp. nov., holotype, ♂ (INPA-PSO 000030). **A**. Labrum. **B**. Labium. **C**. Right maxillary palp. **D**. Right mandible. **E**. Left mandible. **F**. Right lacinia. **G**. Left lacinia. Scale bars in mm.

(Fig. 3C–D). Legs with coxae yellowish with blackened ends, trochanters light brown, femora basally with blackish spots, with several rounded black spots towards their ends (Fig. 3E–G), tibiae with two rounded black spots distally, tarsomeres 1 light brown, tarsomeres 2 dark brown (Fig. 3E–G). Abdomen light brown with dark abdominal segments (Fig. 1A).

Morphology. Head with abundant macrosetae, more concentrated on vertex (Fig. 1C–D), compound eyes large, widely separated (Fig. 1C–D) and laterally elliptical (Fig. 1E); vertex convex, clearly above upper border of compound eyes, with each lobe twice as wide as it is long (Fig. 1D). Labium with prementum narrow, labial palpi with round shape, paraglossas with round shape, slender glossa (Fig. 2B). Mandibles asymmetrical, elongate and with outer margin angled (Fig. 2D–E), outer cusp of lacinial tip broad, with six or eight denticles (Fig. 2F–G). Lobes tergal with many setae. Forewings with broad pterostigma (Fig. 3A–B), right forewing pterostigma with six crossveins, sixth crossvein forked (Fig. 3A); left forewing pterostigma with six crossveins, with second crossvein fused medially to third crossvein

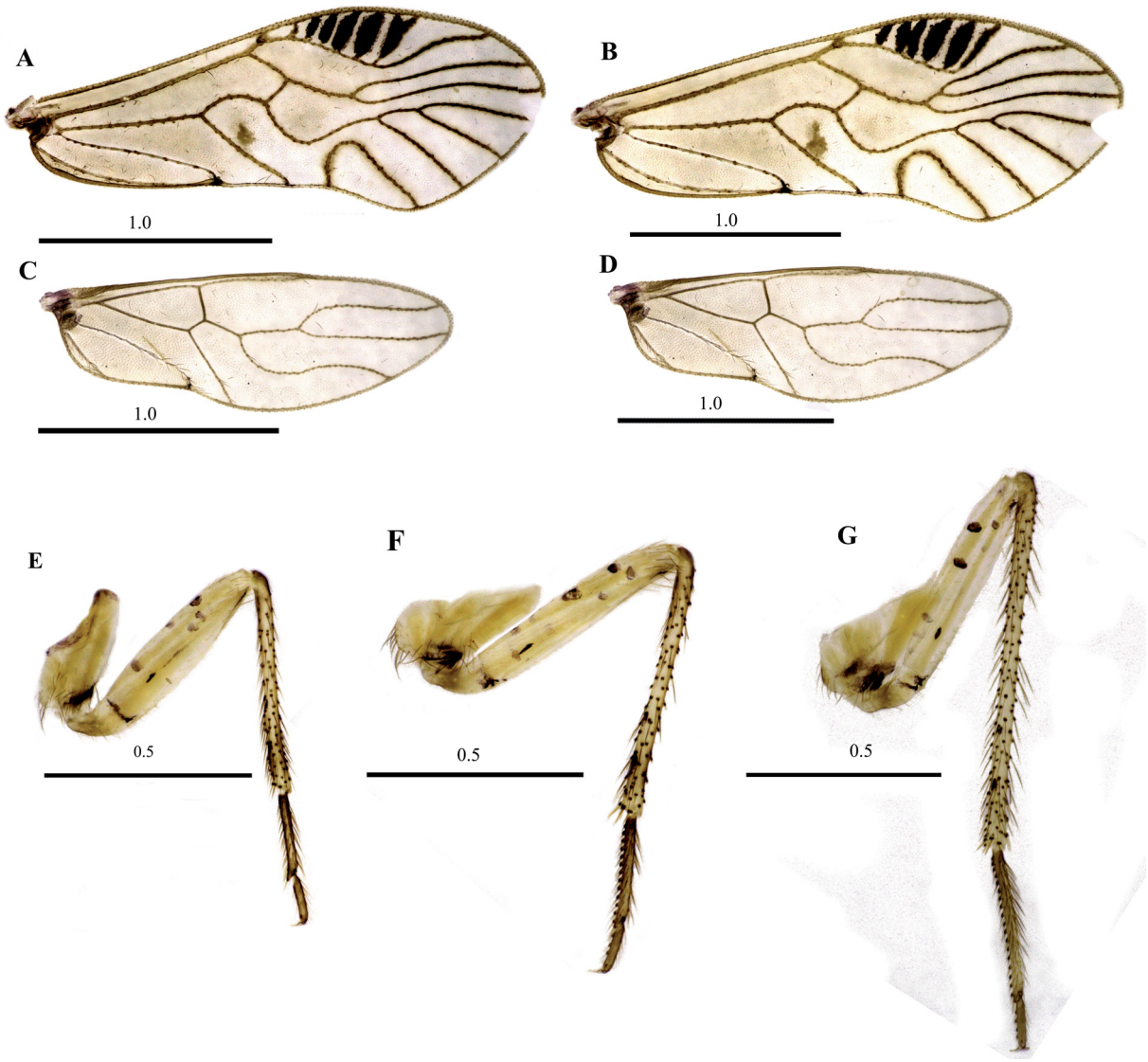

Fig. 3. *Neurostigma alfonsoi* sp. nov., holotype, ♂ (INPA-PSO 000030). **A**. Right forewing. **B**. Left forewing. **C**. Right hindwing. **D**. Left hindwing. **E**. Right front leg. **F**. Right medial leg. **G**. Right hind leg. Scale bars in mm.

(Fig. 3B) (see also the variations present in the paratypes (Fig. 5); R_{2+3} veins unbranched (Fig. 3A) or branched (Fig. 3B of the holotype and Fig. 5 of the paratypes); M vein before its first bifurcation gently concave, U-shaped, then almost straight, areola postica wide basally, slightly slanted posteriorly, apically rounded, with Cua_1 touching the wing margin at a parallel point between first and second bifurcation of M vein (Figs 3A–B, 5). Hindwing R_{2+3} sinuous, R_{4+5} almost straight, M sinuous (Fig. 3C–D). Hypandrium with abundant setae, distally rounded, with a sclerotized line on each postero-lateral side (Fig. 4A). Phallosome open basally; side struts straight, somewhat wide basally and gently curved outwards; aedeagal arch robust, posterior process of edeagal arch V-shaped, with small subtriangular projection in the middle of its inner margin; endophallus with numerous small spines V-shaped, radula with two sclerites, these almost together in the middle of endophallus, basally almost triangular and weakly sclerotized, and posteriorly strongly sclerotized, with numerous acuminate projections, with two medially detached projections (Fig. 4C). Epiproct broad basally, with one triangular area on each antero-lateral corner and small concavity in the middle of its anterior margin, sides converging to rounded posterior border, setae as illustrated (Fig. 4B). Paraproct extremely elongated, distally almost triangular,

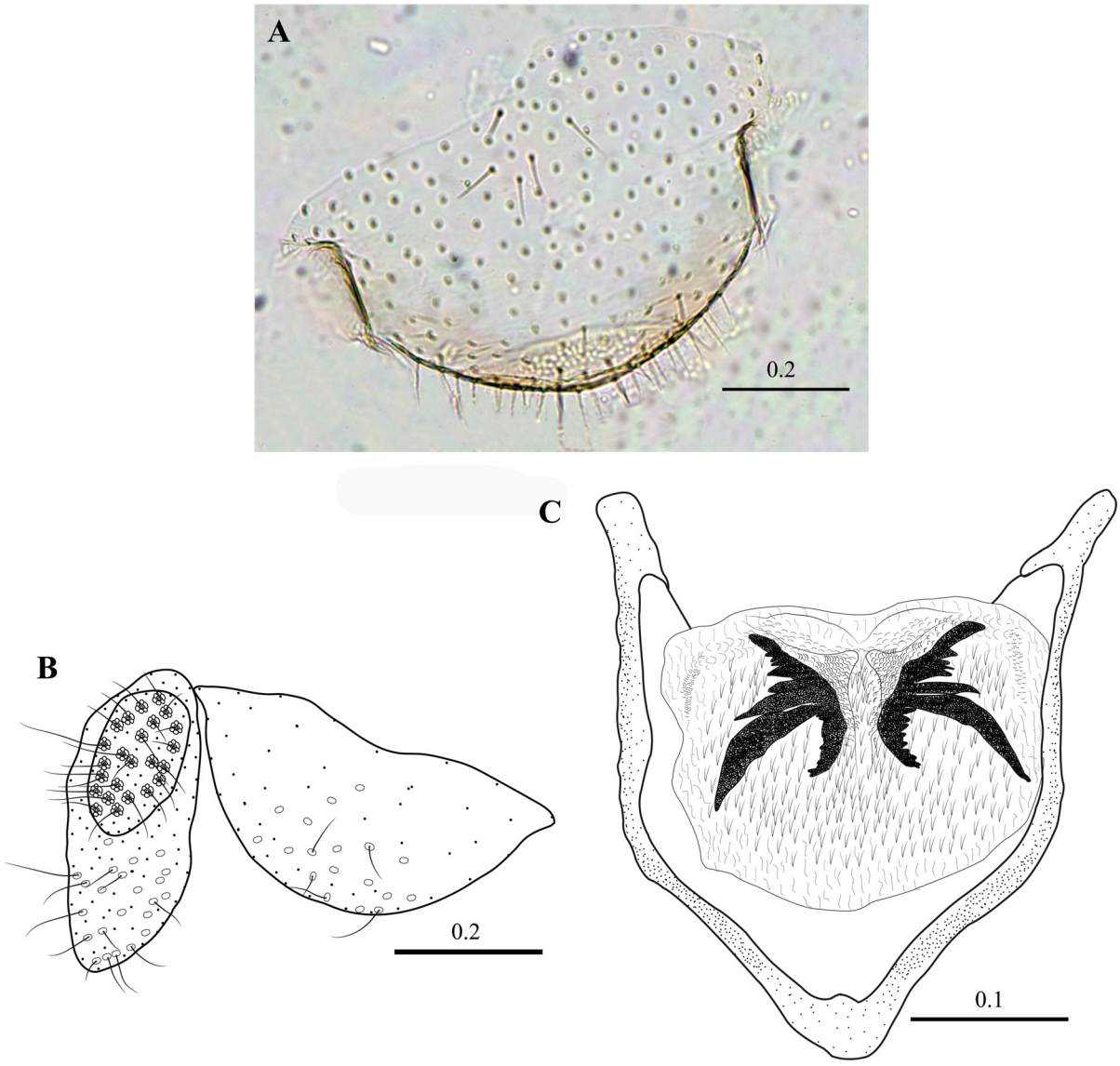

Fig. 4. *Neurostigma alfonsoi* sp. nov., holotype, ♂ (INPA-PSO 000030). **A**. Hypandrium. **B**. Right paraproct and epiproct. **C**. Phallosome. Scale bars in mm.

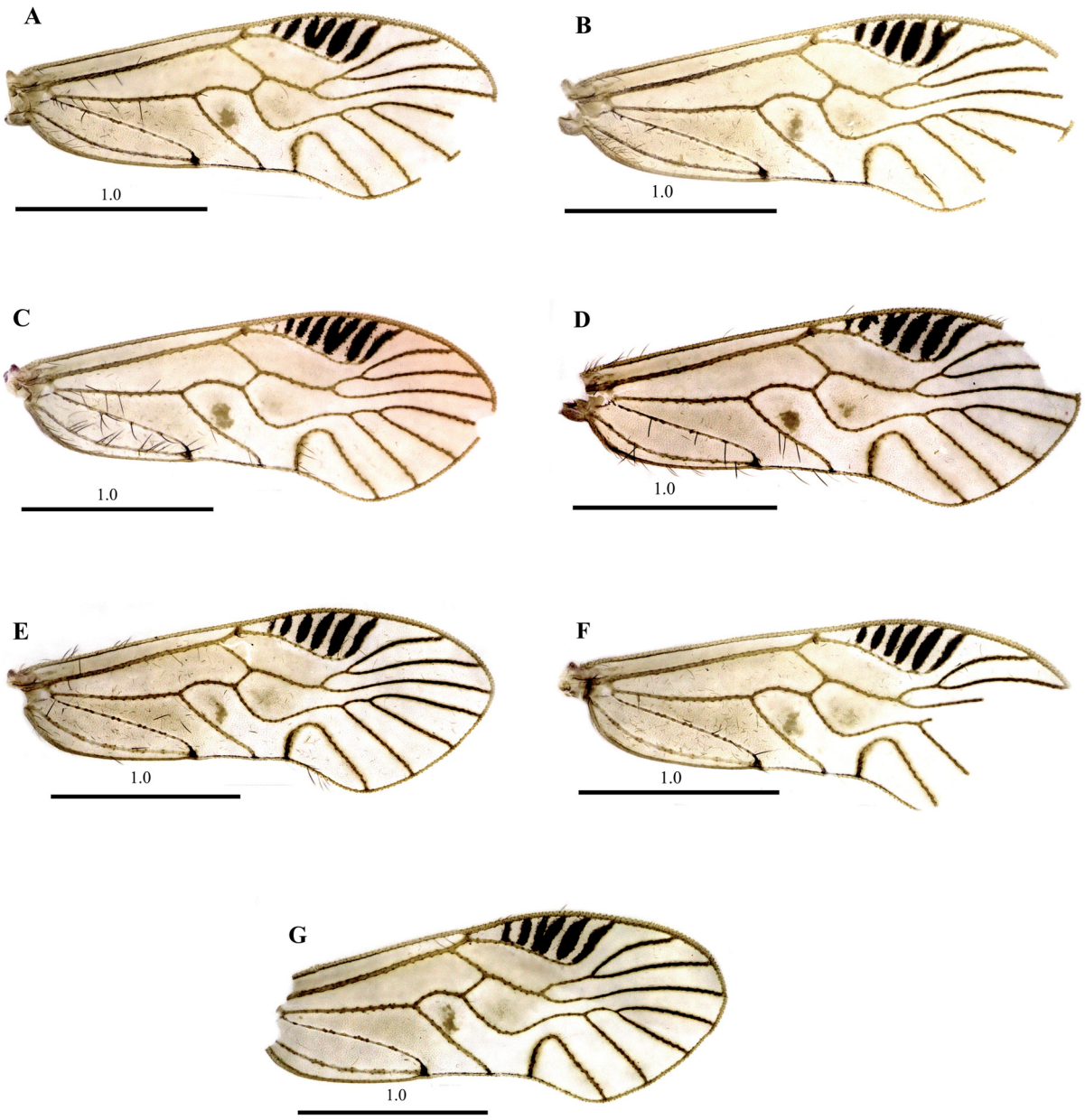

Fig. 5. Variation of forewing venation of paratypes of *Neurostigma alfonsoi* sp. nov., ♂. **A–B**. Paratype I (INPA-PSO 000031). **A**. Right forewing. **B**. Left forewing. **C–D**. Paratype II (INPA-PSO 000032). **C**. Right forewing. **D**. Left forewing. **E–F**. Paratype III (INPA-PSO 000033). **E**. Right forewing. **F**. Left forewing. **G**. Right forewing of paratype IV (INPA-PSO 000034). Scale bars in mm.

with field of microsetae in distal region, sensory fields large, with 24–28 trichobothria on basal rosettes (Fig. 4B).

Measurements (in µm). FW: 2335, HW: 1735, F: 527, T: 839, t1: 317, t2: 99, MX2: 88, MX4: 145, IO: 398, D: 139, d: 184, PO: 1.323.

Neurostigma angelicum sp. nov.
urn:lsid:zoobank.org:act:01FF68C2-EA58-4CFA-9FC2-51AC38E37C60
Figs 6–9, 22

Diagnosis

The new species belongs in species group II, of Mendivil-Nieto *et al.* (2020). It is similar to *Neurostigma patriciae* sp. nov. in wing venation. It differs from the latter by having a phalossome somewhat narrow basaly and anteriorly curved outwards, with a long and wide posterior process of the aedeagal arch, with a slight indentation of the external and internal margins; the anterior margin of the endophallus with a U-shaped indentation, originating two areas similar to 'angels' wings, extremely membranous, ending posteriorly with six strongly sclerotized and acuminate projections (Fig. 9C) and by having hypandrium almost square in shape, basally wide and distally straight, with slightly sclerotized sides (Fig. 9A).

Etymology

The specific name is an adjective in Latin, '*angelicus*' = 'angelic', derived from 'angel' in reference to the shape of the endophallus of the phallosoma resembling an angel's wing.

Type material

Holotype

BRAZIL • ♂; Amazonas, Coari, Rio Urucu, Igarapé Marta 3; 04°48′30″ S, 64°50′26″ W; 18–19 Aug. 1993; P.F Buhrnhein *et al.* leg.; Pennsylvania trap; INPA, INPA-PSO 000035.

Description

Male

Coloration. Head vertex with dark brown dotted spots (Fig. 6C), lateral areas of head entirely light brown (Fig. 6E). Compound eyes black, ocelli hyaline with ochre centripetal crescents. Scapes and pedicels brownish; flagellomeres hyaline. Clypeus with diffuse brownish spots (Fig. 6D); labrum light brown, with light brown labral sclerites (Fig. 7A); labium with prementum, palpi, paraglossa and glossa brown (Fig. 7B), mandibles hyaline with yellowish and brownish ends (Fig. 7C–D), laciniae hyaline with yellowish distal region (Fig. 7E–F). Tergal lobes of meso and metathorax light brown (Fig. 6C), thoracic pleura light brown (Fig. 6B). Forewings with dark brown spot all over anal cell, and almost homogeneous in CuP and M+CuA cells (Fig. 8A–B). Hindwings with homogeneous light brown spots on anal and CuP cells, M+CuA cell filled almost homogeneously by brown spot, with brown veins (Fig. 8C–D). Abdomen light brown (Fig. 6A).

Morphology. Head with macrosetae, more concentrated on vertex (Fig. 6D–E); compound eyes large, widely separated, laterally rounded in shape (Fig. 6E); vertex not bilobed, approximately at the same level as upper edge of compound eyes (Fig. 6D). Labium with prementum narrow, labial palpi with round shape, paraglossa with round shape, slender glossa (Fig. 7B). Mandibles asymmetrical, elongate and with outer margin angled (Fig. 7C–D), outer cusp of lacinial tip broad, with six to eight denticles (Fig. 7E–F). Tergal lobes with setae (Fig. 6C). Forewings with many setae, especially on margins; right forewing pterostigma with four crossveins (Fig. 8A); left forewing pterostigma with four crossveinns (Fig. 8B); R1 sinuous (Fig. 8B), M vein before its first bifurcation gently concave, U-shaped (Fig. 8A–B). Hindwing with R_{2+3} and R_{4+5} almost straight, M sinuous (Fig. 8C–D). Hypandrium with a subquarate shape, with sides slightly sclerotized with abundant setae (Fig. 9A). Process posterior of aedeagal arch long and narrow, with slightly indented external and internal margins; anterior margin of endophallus with U-shaped indentation, originating two areas similar to 'angels' wings, extremely membranous, ending posteriorly with six strongly sclerotized and acuminate projections (Fig. 9C). Epiproct with straight posterior margin, with a field of microsetae in medial and distal region (Fig. 9B). Paraproct with broad base, narrowing distally, with a field of microsetae towards outer margin, sensory fields with 25–29 trichobothria on basal rosettes (Fig. 9B).

Measurements (in μm). FW: 2818, HW: 2091, IO: 438, D: 266, d: 223, PO: 0.838.

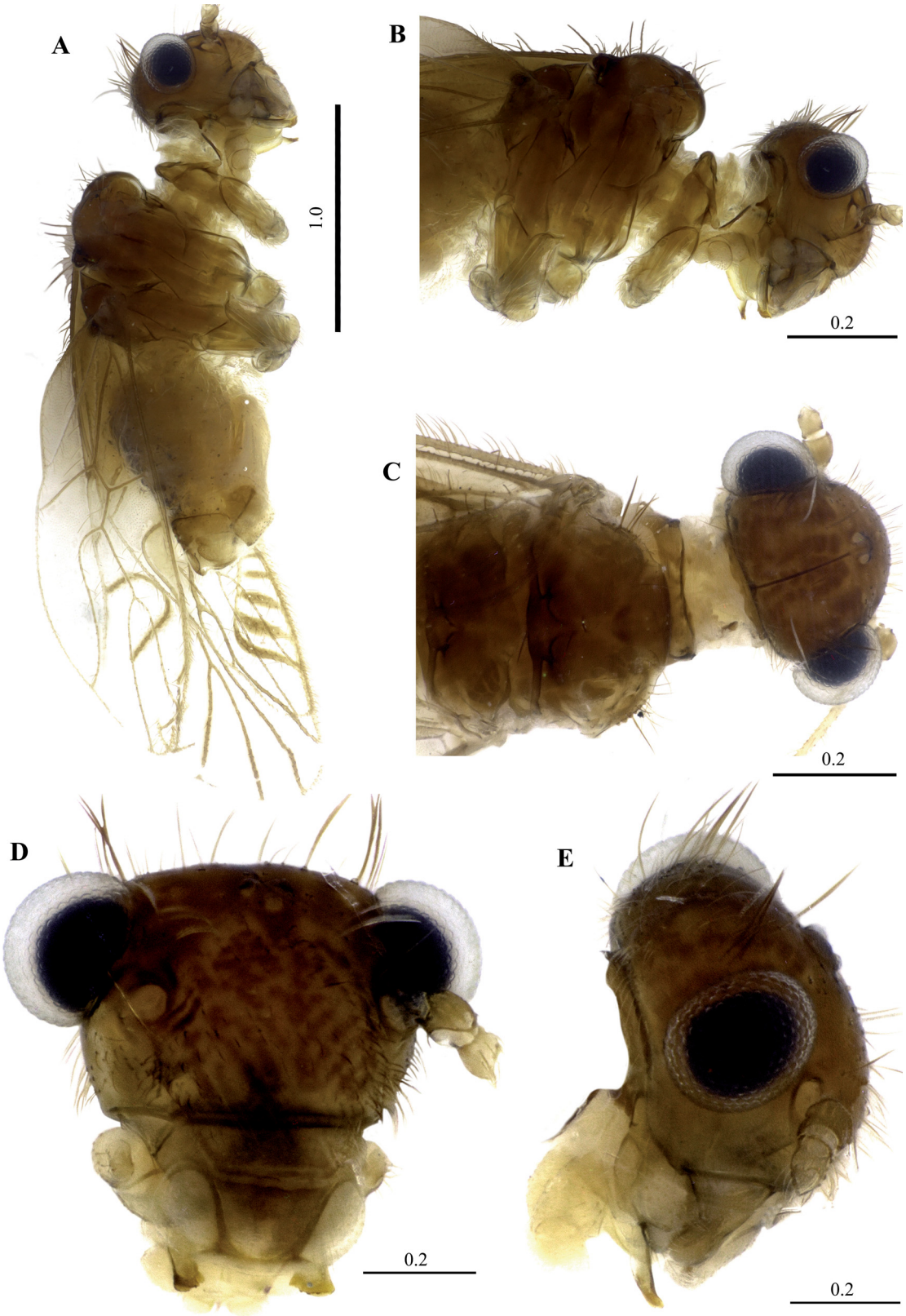

Fig. 6. *Neurostigma angelicum* sp. nov., holotype, ♂ (INPA-PSO 000035). **A**. Lateral view. **B**. Thorax and head in lateral view. **C**. Thorax and head in dorsal view. **D**. Front view of head. **E**. Lateral view of head. Scale bars in mm.

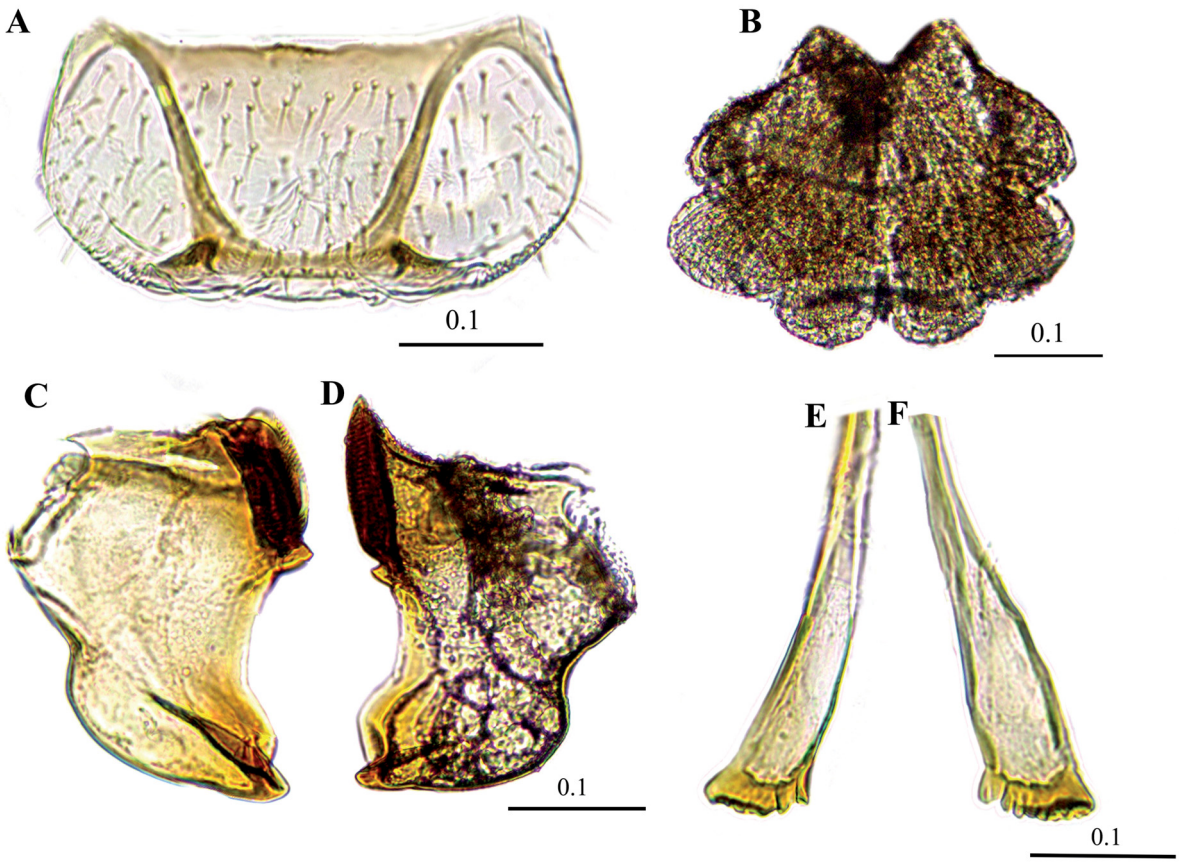

Fig. 7. Mouthparts of *Neurostigma angelicum* sp. nov., holotype, ♂ (INPA-PSO 000035). **A**. Labrum. **B**. Labium. **C**. Right mandible. **D**. Left mandible. **E**. Right lacinia. **F**. Left lacinia. Scale bars in mm.

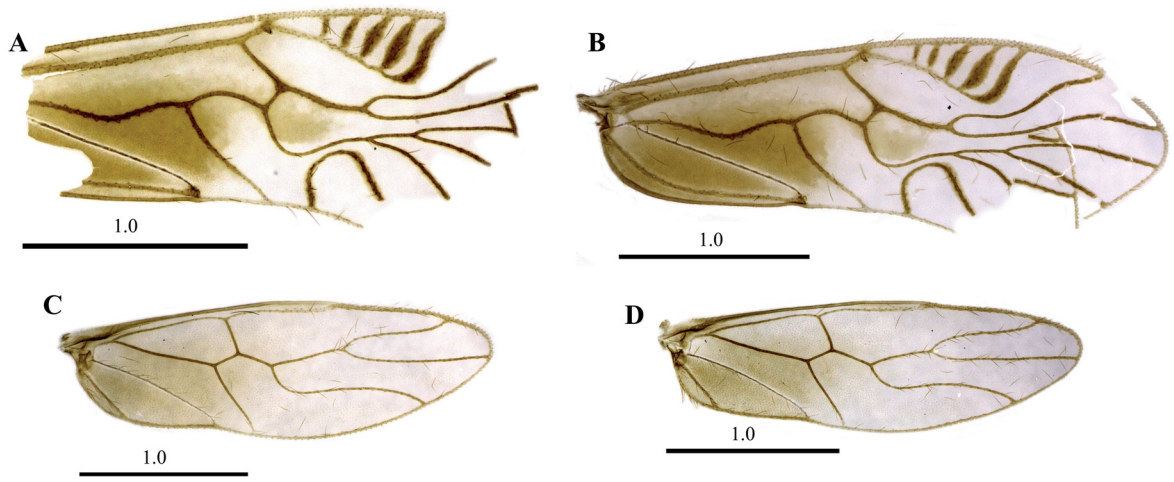

Fig. 8. *Neurostigma angelicum* sp. nov., holotype, ♂ (INPA-PSO 000035). **A**. Right forewing. **B**. Left forewing. **C**. Right hindwing. **D**. Left hindwing. Scale bars in mm.

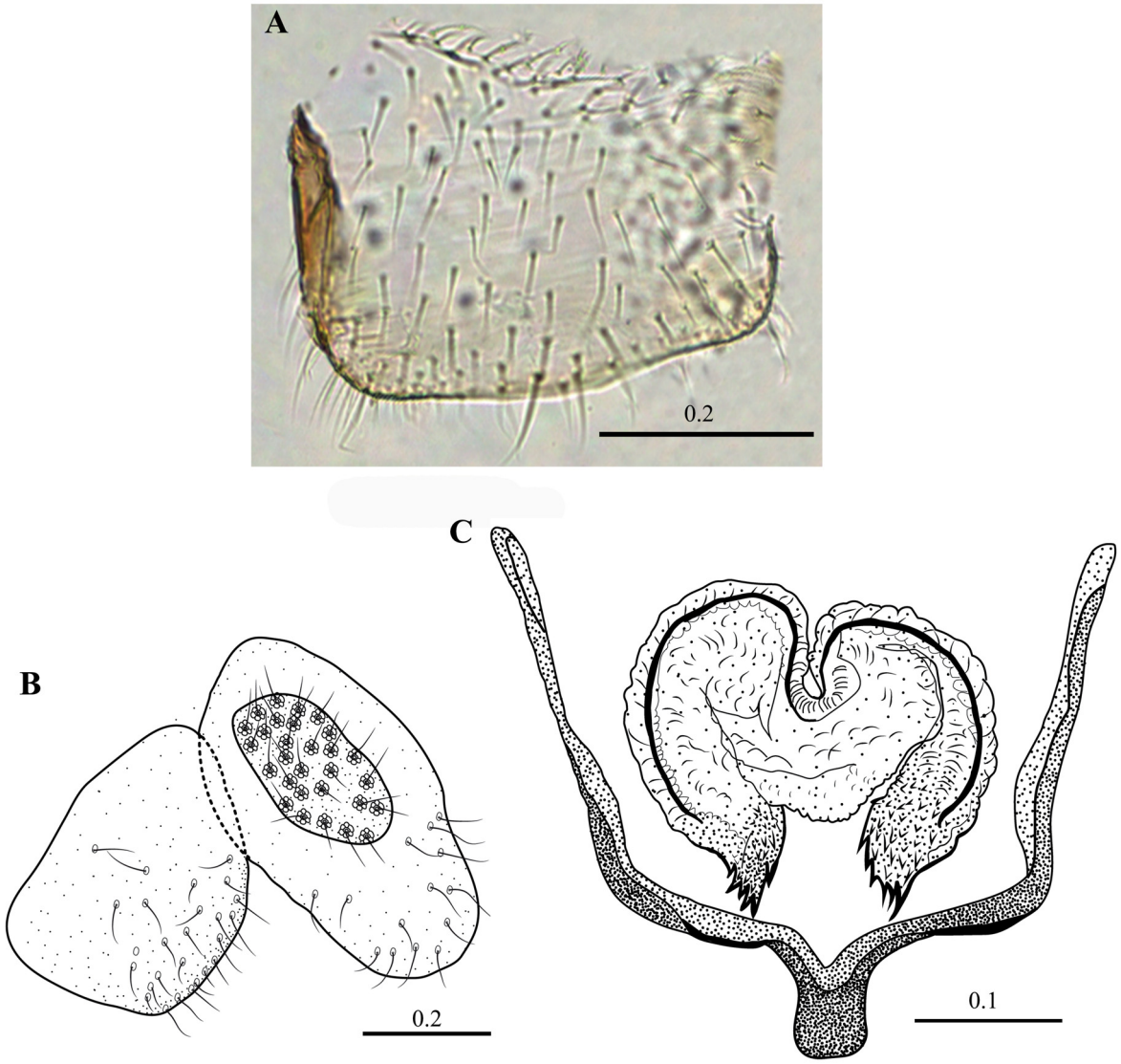

Fig. 9. *Neurostigma angelicum* sp. nov., holotype, ♂ (INPA-PSO 000035). **A**. Hypandrium. **B**. Right paraproct and epiproct. **C**. Phallosome. Scale bars in mm.

Neurostigma patriciae sp. nov.
urn:lsid:zoobank.org:act:B4EB71C0-C42A-46D0-B361-FF16AF09A333
Figs 10–13, 22

Diagnosis

The new species belongs in species group II, of Mendivil-Nieto *et al.* (2020). It is similar to *Neurostigma angelicum* sp. nov. in wing venation. It differs from the latter by having the phallosoma somewhat narrow basaly and curved inwards anteriorly, posteriorly with a slight concavity, the posterior process of the aedeagal arch long, wide, with the distal margin concave, the external margin with an abruptly long indentation, and the internal margin with a slight indentation; the endophallus with two distinctly sclerotized areas, with separate endophallic sclerites touching anteriorly, posteriorly separated by a

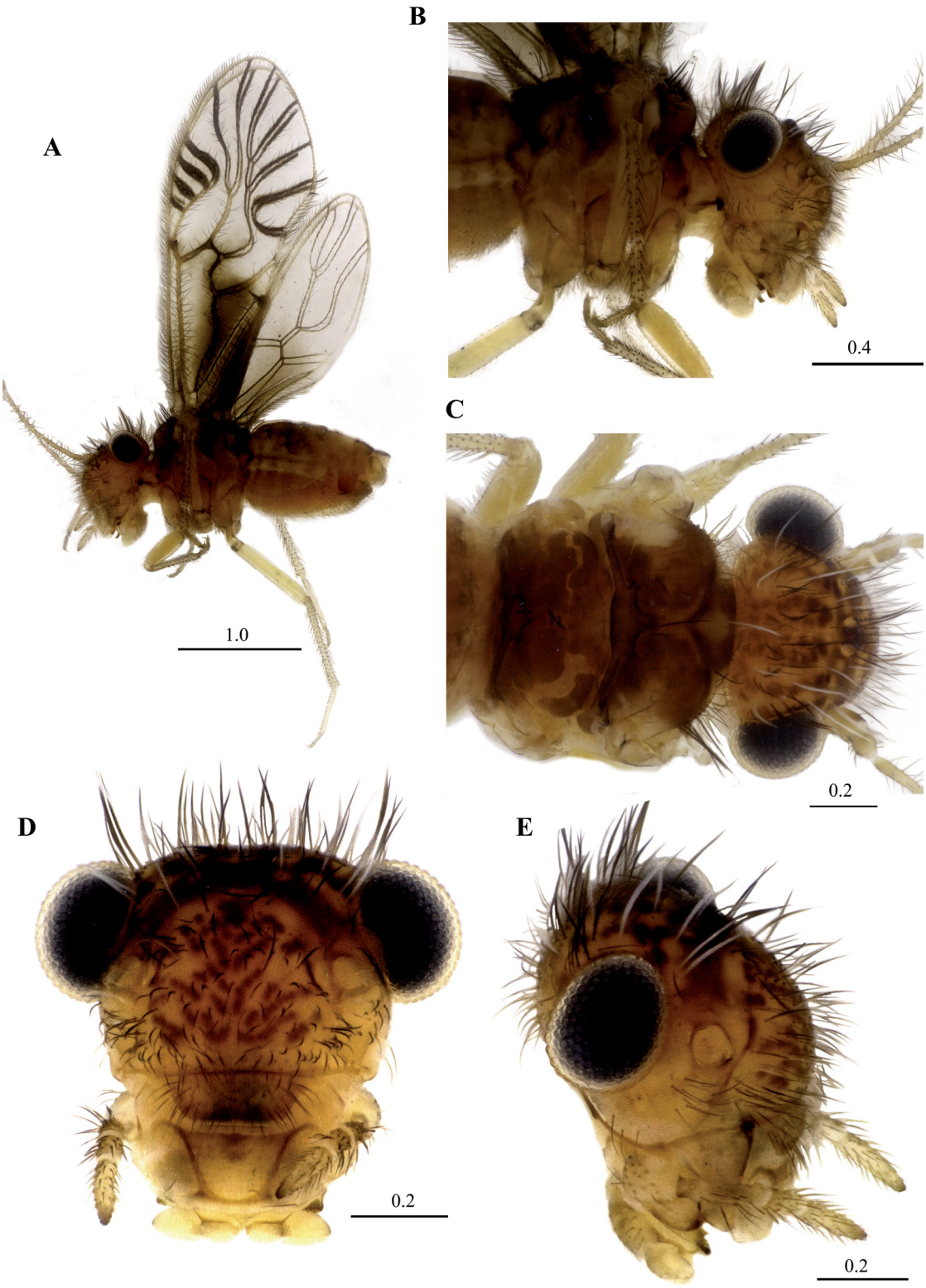

Fig. 10. *Neurostigma patriciae* sp. nov., holotype, ♂ (INPA-PSO 000036). **A**. Lateral view. **B**. Thorax and head in lateral view. **C**. Thorax and head in dorsal view. **D**. Front view of head. **E**. Lateral view of head. Scale bars in mm.

membranous area, each of these endophallic sclerites with denticulated posterior margin with numerous small acuminate and anteriorly coiled projections giving rise to a spiral area (Fig. 13C).

Etymology

This species is dedicated to Dr Patrícia do Rosário Reis, from the University of the State of Amazonas (UEA), in recognition of her great contribution to the teaching of science in more remote areas of Amazonas, and for her friendship and affection.

Type material

Holotype

BRAZIL • ♂; Amazonas, Manaus, Estação Experimental de Silvicultura Tropical (EEST-ZF-2); 02°35′21″ S, 60°06′55″ W; 9–24 Jan. 2018; J.A. Rafael leg.; Malaise trap; Rede de Biodiversidade de Insecta na Amazônia (REDE BIA); INPA, INPA-PSO 000036.

Description

Male

Coloration. Head vertex with dark brown dotted spots (Fig. 10), a dark brown horizontal spot between eyes and ocelli (Fig. 10D), lateral areas of head entirely light brown (Fig. 10E). Compound eyes black,

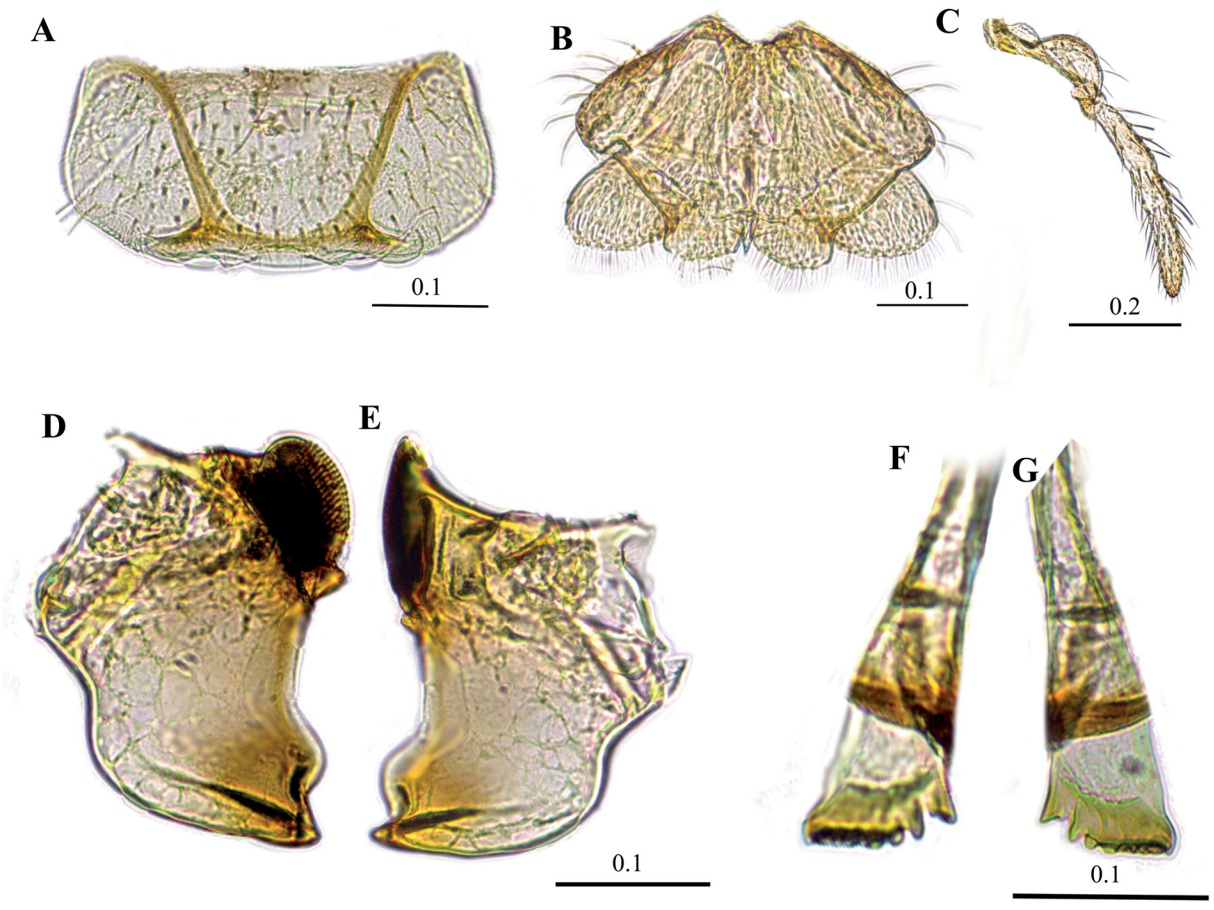

Fig. 11. Mouthparts of *Neurostigma patriciae* sp. nov., holotype, ♂ (INPA-PSO 000036). **A**. Labrum. **B**. Labium. **C**. Right maxillary palp. **D**. Right mandible. **E**. Left mandible. **F**. Right lacinia. **G**. Left mandible. Scale bars in mm.

ocelli hyaline with ochre centripetal crescents (Fig. 10A). Scape and pedicels light brown, flagellomeres hyaline. Clypeus with diffuse brown spots (Fig. 10D), labrum light brown, with dark brown labral sclerites (Fig. 11A), labium with brown prementum, with palpi, paraglossas and glossa light brown (Fig. 11B), light brown maxillary palpi without blackish contour (Fig. 11C), mandibles hyaline with yellowish and brownish ends (Fig. 11D–E), hyaline lacinia with a yellowish distal region (Fig. 11F–G). Tergal lobes of meso and metathorax dark brown, thoracic pleura light brown (Fig. 10B). Forewings with dark brown stain all over anal cell, and almost homogeneously in CuP and M+CuA cells (Fig. 12A–B). Hindwings with light brown spots homogeneously in anal and CuP cells, with markedly brownish veins (Fig. 12C–D). Legs with coxae, trochanters and femurs brownish, basally with blackish spots, no rounded spots medially and distally (Fig. 12E–G), tibiae brownish without rounded spots distally, tarsomeres 1 light brown, tarsomeres 2 dark brown (Fig. 12E–G). Abdomen light brown (Fig. 10A).

Morphology. Head with abundant macrosetae, more concentrated on vertex (Fig. 10D–E) compound eyes large, widely separated (Fig. 10D–E) and laterally rounded in shape; vertex not bilobed, approximately at same level as upper edge of compound eyes (Fig. 10D). Labium with prementum narrow, labial palpi with round shape, paraglossas with round shape, slender glossa (Fig. 11B). Mandibles asymmetrical,

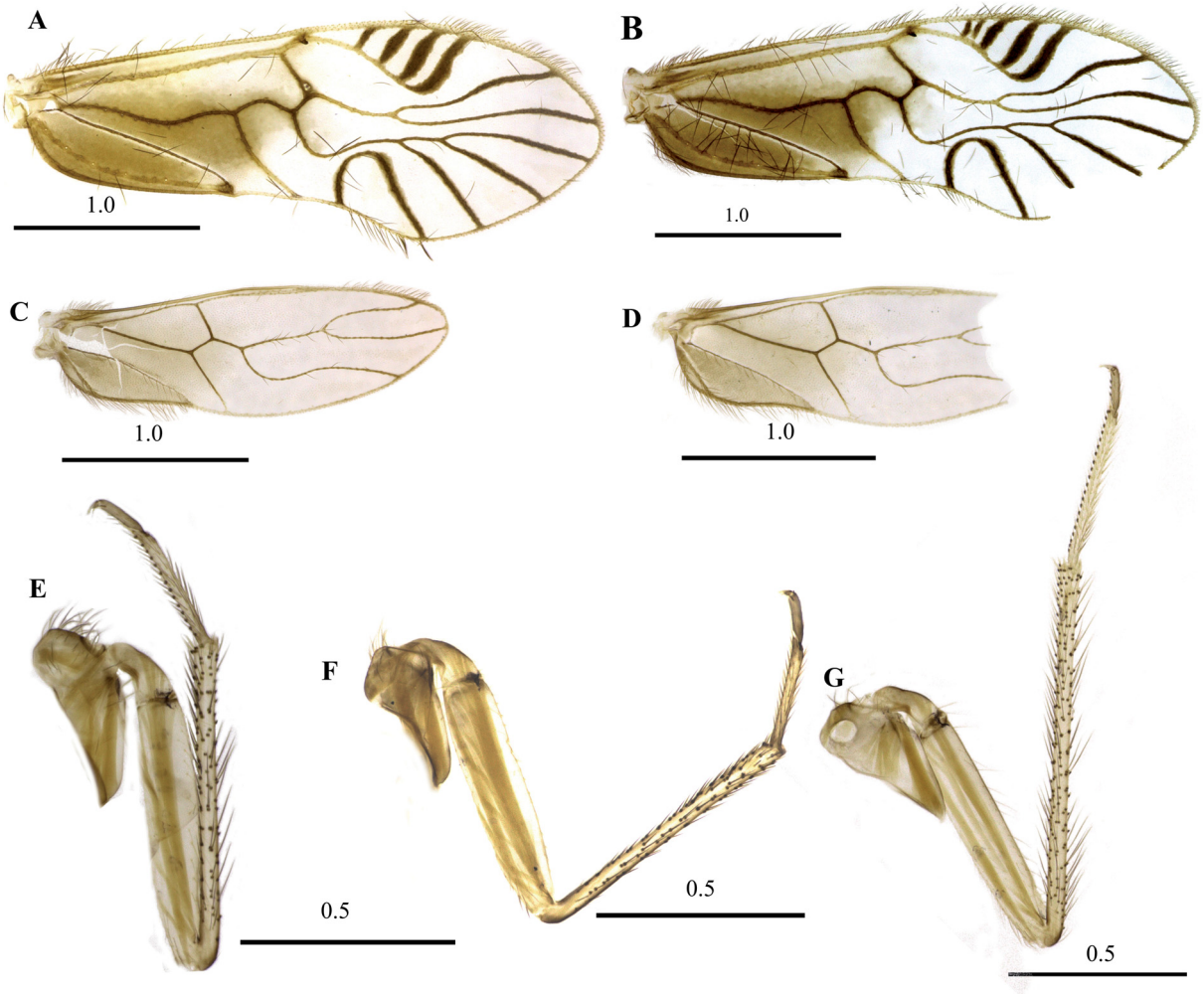

Fig. 12. *Neurostigma patriciae* sp. nov., holotype, ♂ (INPA-PSO 000036). **A**. Right forewing. **B**. Left forewing. **C**. Right hindwing. **D**. Left hindwing. **E**. Right front leg. **F**. Right medial leg. **G**. Right hind leg. Scale bars in mm.

elongate and with outer margin angled (Fig. 11D–E), outer cusp of lacinial tip broad, with eight to nine denticles (Fig. 11F–G). Forewings with many setae, especially on margins, right forewing pterostigma with three crossveins (Fig. 12A); left forewing pterostigma with four crossveinss (Fig. 12B). M vein before its first bifurcation, gently concave, U-shape, areola postica wide basally, slightly slanted posteriorly, apically rounded, with Cua_1 touching wing margin at a parallel point between first and second bifurcation of the vein M (Fig. 12A–B). Hindwing R_{2+3} nearly straight, M sinuous (Fig. 12C–D). Hypandrium completely sclerotized with abundant setae, distally concave (Fig. 13A). Posterior process of edeagal arch long, wide, with distal margin concave, external margin with abruptly long indentation, and internal margin with slight indentation; endophallus with two distinctly sclerotized areas, with separate endophallic sclerites touching anteriorly, posteriorly separated by membranous area, each of these endophallic sclerites with denticulated posterior margin with numerous small acuminate and anteriorly coiled projections giving rise to a spiral area (Fig. 13C). Epiproct basally wide, distally concave, with field of microsetae (Fig. 13B). Paraproct subtriangular in shape, with narrow base, extending distally,

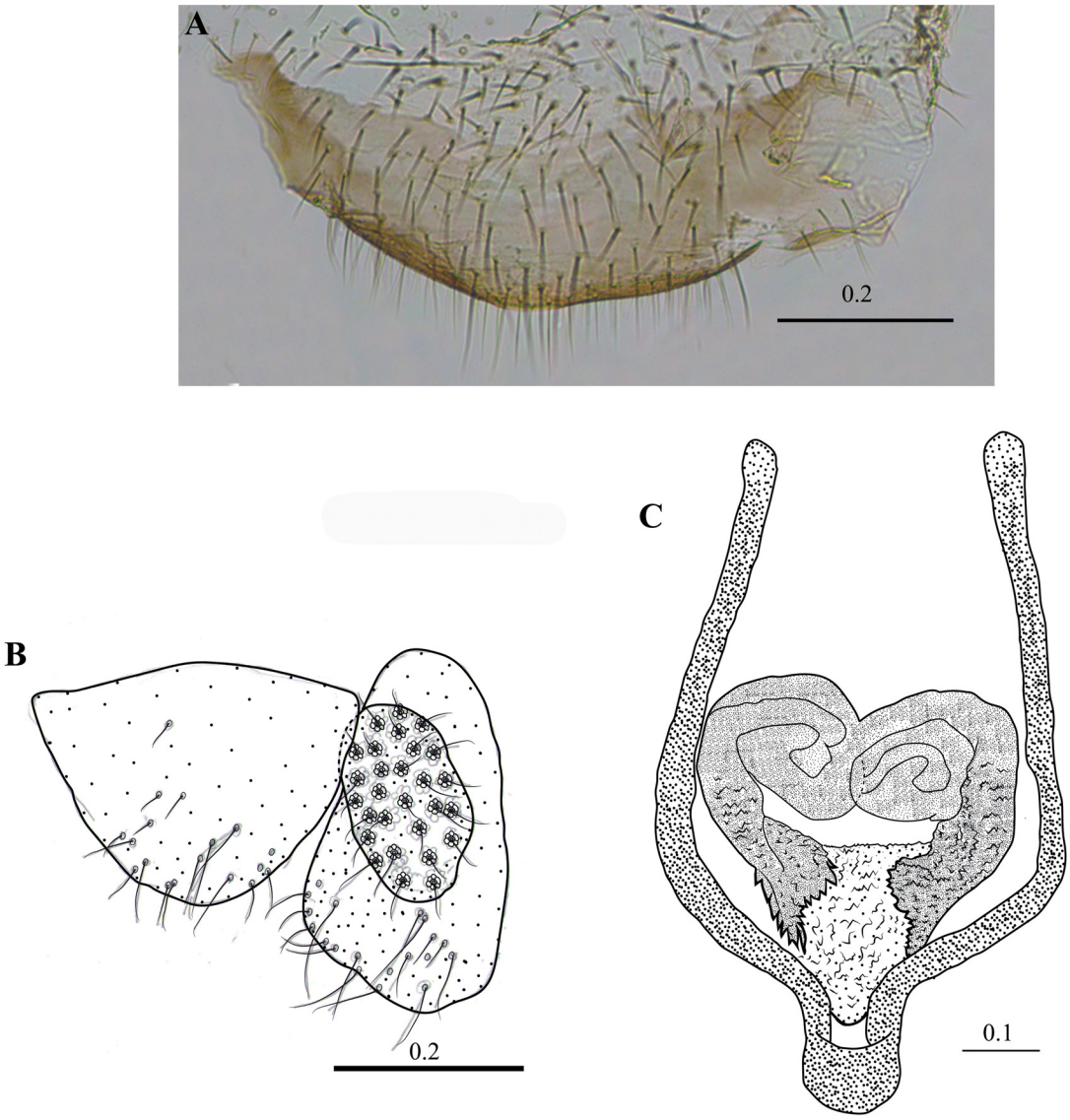

Fig. 13. *Neurostigma patriciae* sp. nov., holotype, ♂ (INPA-PSO 000036). **A**. Hypandrium. **B**. Right paraproct and epiproct. **C**. Phallosome. Scale bars in mm.

with field of microsetae towards outer margin, sensory fields with 28–29 trichobothria on basal rosettes (Fig. 13B).

Measurements (in μm). FW: 2924, HW: 2211, F: 704, T: 1127, t1: 460, t2: 116, MX2: 122, MX4: 129, IO: 445, D: 255, d: 211, PO: 0.827.

Neurostigma spinosum sp. nov.
urn:lsid:zoobank.org:act:6731CF58-D473-46DC-9E38-1AA97DD69CE7
Figs 14–17, 22

Diagnosis

The new species belongs in species group II of Mendivil-Nieto *et al.* (2020). It is similar to *Neurostigma willkeniae* sp. nov., *N. lienhardi*, and *N. thorntoni* in having anchor-shaped spines in the endophallus. It is closer to *N. thorntoni* in the venation of the forewing but differs in that it does not have a spot between the CuP veins and the A vein. The areola postica has Cua_1 touching wing margin at a parallel point after the second bifurcation of vein M (Fig. 16A–B); the phalossome has a subquadrate posterior process of the aedeagal arch with an abrupt indentation of the external margin; the endophallus has the median region deeply septate with a V-shaped indentation, laterally membranous with seven distinct rows of spines, separated by a membranous area (Fig. 17B).

Etymology

The specific name is a latin word '*spinae*' = 'thorns', in reference to the endophallus of the phallosoma being full of spines.

Type material

Holotype

BRAZIL • ♂; Amazonas, Tefé, Locação São Marcus; 04°48′24″ S, 65°40′06″ W; 7–16 Sep. 1990; P.F. Buhrnhein *et al.* leg.; Pennsylvania trap; INPA, INPA-PSO 000037.

Description

Male

Coloration. Head uniformly pale yellow (Fig. 14A–C), lateral areas of head light yellow, compound eyes black, ocelli hyaline with ochre centripetal crescents (Fig. 14D–E). Scapes, pedicels and flagellomeres hyaline. Clypeus light yellow; labrum hyaline, with dark brown labral sclerites (Fig. 15A), labium with prementum, labial palpi, paraglossas and glossas light brown (Fig. 15B); mandibles hyaline with yellowish and brownish ends (Fig. 15C–D); laciniae hyaline with yellowish distal region (Fig. 15E–F). Tergal lobes of mesothorax hyaline, tergal lobes of metathorax dark brown (Fig. 14C), thoracic pleura hyaline (Fig. 14B). Forewings with two rounded brown spots, one in medial region between CuP and M+Cu veins, another in proximal region of bifurcation that originates M and CuA veins, dark brown spot running through R1 vein (Fig. 16A–B). Hindwing with brownish spot in basal region between A vein and CuP vein (Fig. 16C). Abdomen hyaline (Fig. 14A).

Morphology. Head with macrosetae, more concentrated on vertex (Fig. 14A–B); compound eyes large, widely separated, laterally rounded in shape (Fig. 14D–E), vertex bilobed, approximately at same level as upper edge of compound eyes (Fig. 14D–E). Labium with prementum narrow, labial palpi with round shape, paraglossa with round shape, slender glossa (Fig. 15B). Mandibles asymmetrical, elongate and with outer margin angled (Fig. 15C–D), outer cusp of lacinial tip broad, with eight to ten denticles (Fig. 15E–F). Tergal lobes with setae (Fig. 14C). Forewings with many setae, especially on margins, right forewing pterostigma with four crossveins (Fig. 16A), left wing pterostigma with five crossveins

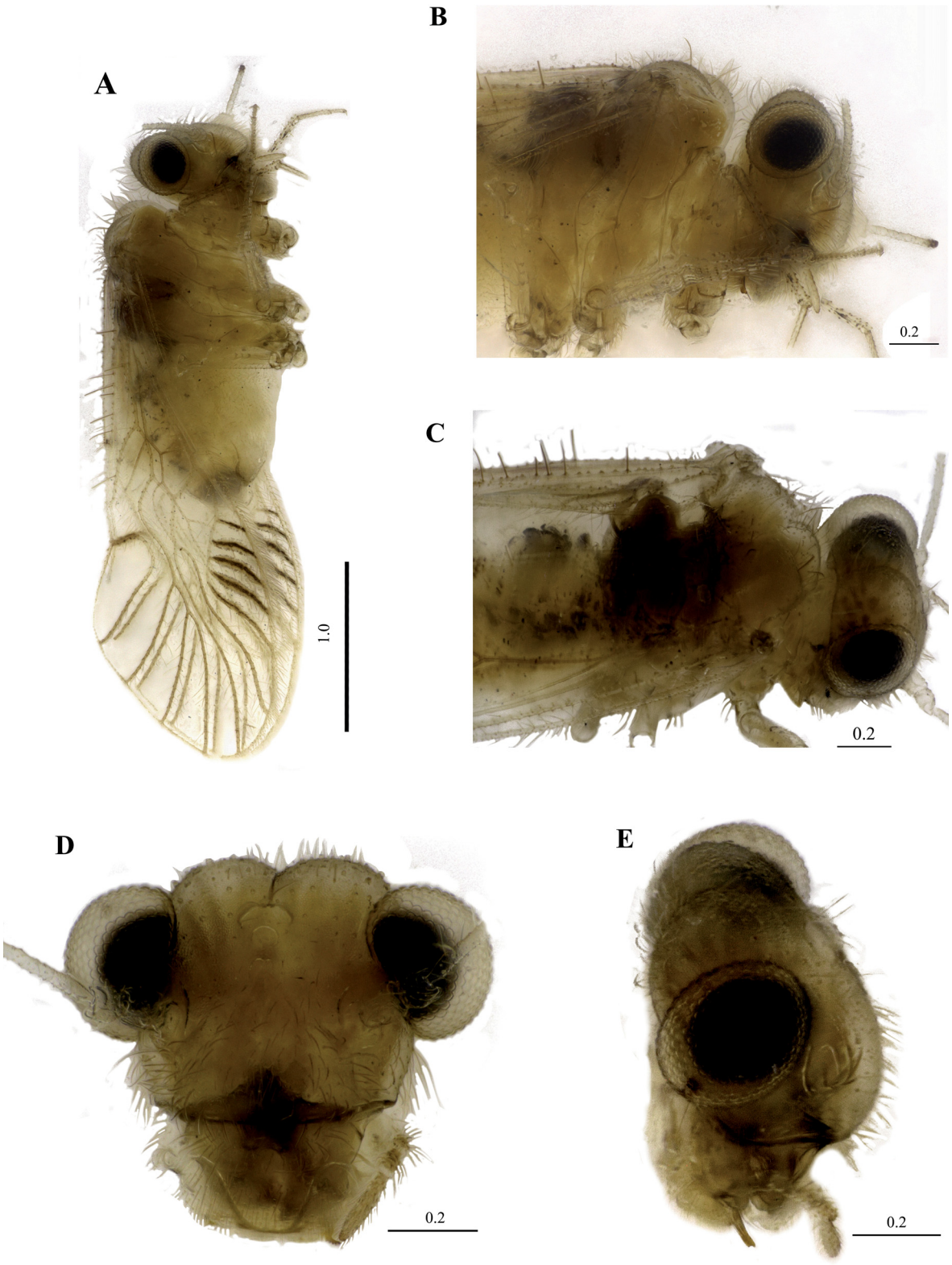

Fig. 14. *Neurostigma spinosum* sp. nov., holotype, ♂ (INPA-PSO 000037). **A**. Lateral view. **B**. Thorax and head in lateral view. **C**. Thorax and head in dorsal view. **D**. Front view of head. **E**. Lateral view of head. Scale bars in mm.

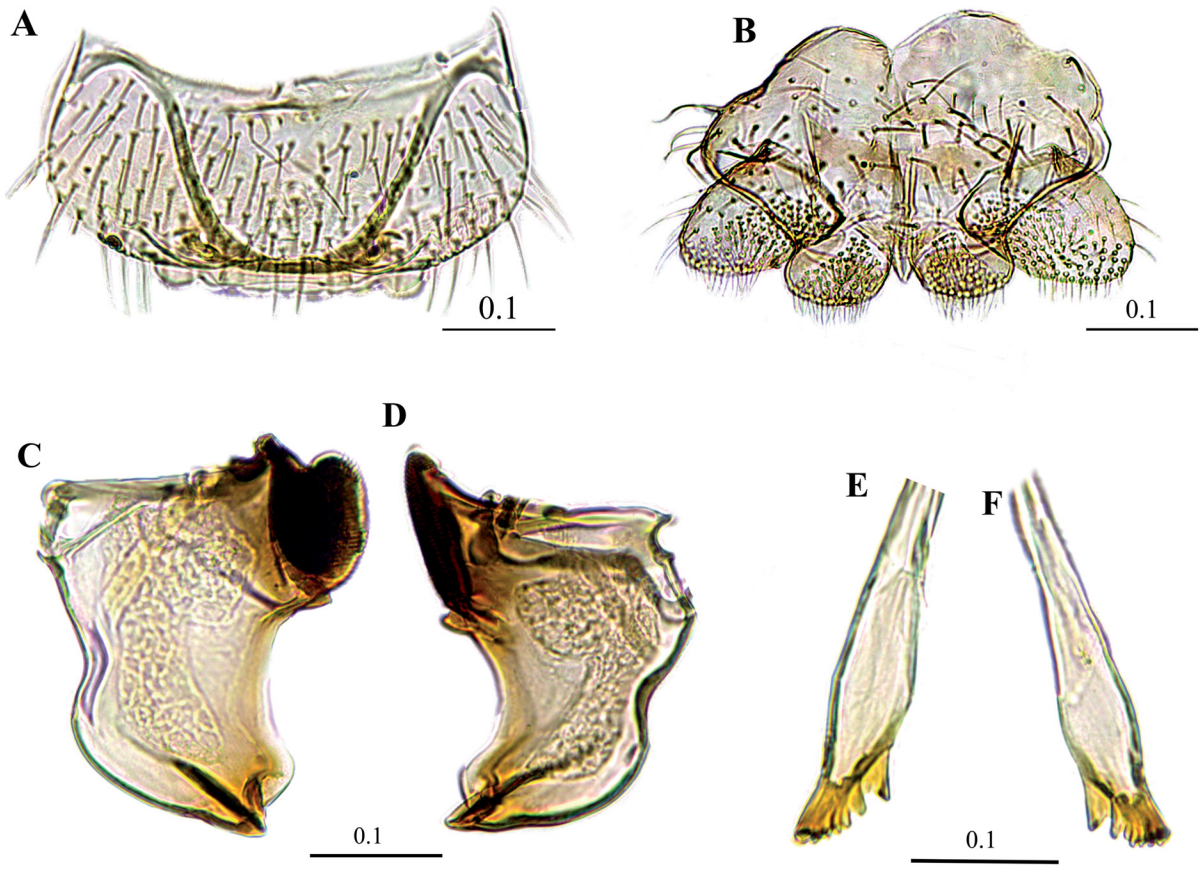

Fig. 15. Mouthparts of *Neurostigma spinosum* sp. nov., holotype, ♂ (INPA-PSO 000037). **A**. Labrum. **B**. Labium. **C**. Right mandible. **D**. Left mandible. **E**. Right lacinia. **F**. Left lacinia. Scale bars in mm.

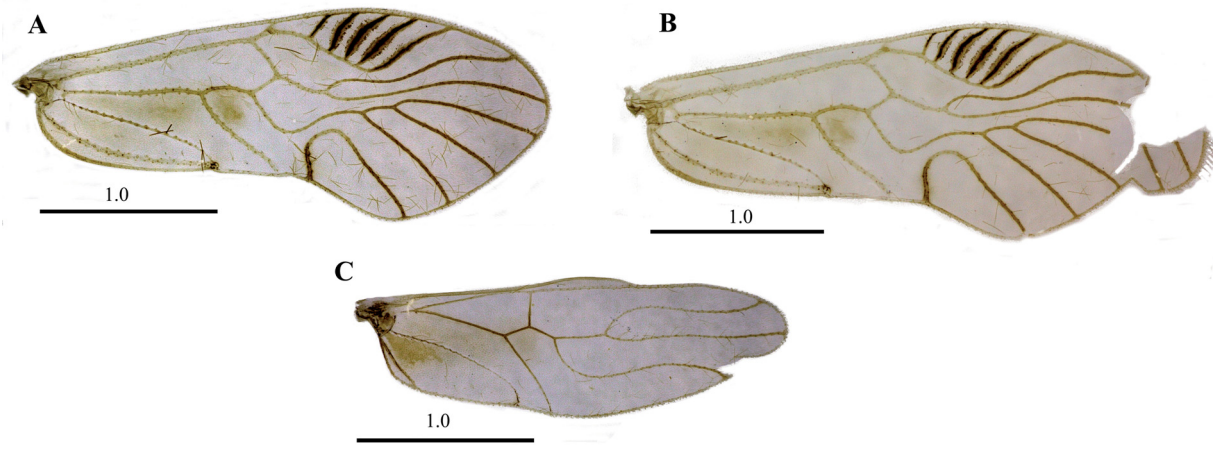

Fig. 16. *Neurostigma spinosum* sp. nov., holotype, ♂ (INPA-PSO 000037). **A**. Right forewing. **B**. Left forewing. **C**. Right hindwing. Scale bars in mm.

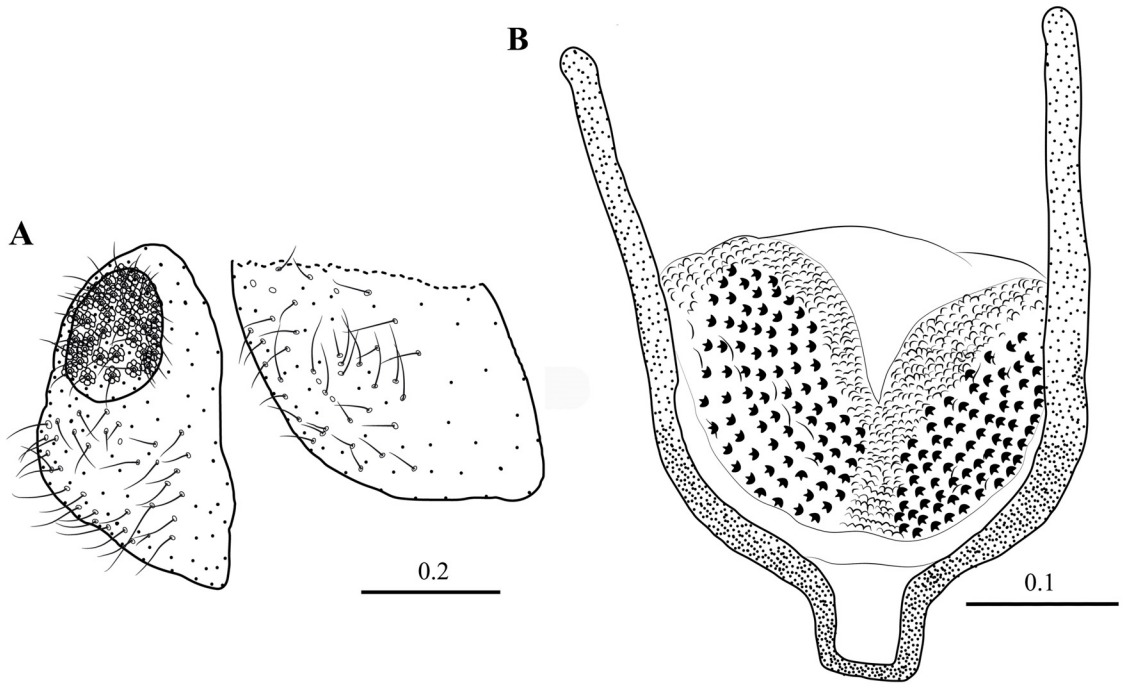

Fig. 17. *Neurostigma spinosum* sp. nov., holotype, ♂ (INPA-PSO 000037). **A**. Right paraproct and epiproct. **B**. Phallosome. Scale bars in mm.

(Fig. 16B). M vein before its firts bifurcation gently concave U-shaped (Fig. 16A–B). Hindwing with sinuous R_{2+3} and straight R_{4+5}, M sinuous (Fig. 16C). Posterior process of aedeagal arch subquadrate, with abrupt indentation of external margin; endophallus with median region deeply septate with V-shaped indentation, laterally membranous with seven distinct rows of spines, separated by membranous area (Fig. 17B). Epiproct with concave posterior margin, with slightly angulated sides, field of microsetae in medial and distal region (Fig. 17A). Paraproct with narrow base, widening distally, with microsetae field towards outer margin, sensory fields with 30–37 basal rosettes (Fig. 17A).

Measurements (in μm). FW: 3097, HW: 2198, F: 643, T: 752, t1: 293, t2: 121, IO: 443, D: 350, d: 271, PO: 0.774.

Neurostigma willkeniae sp. nov.
urn:lsid:zoobank.org:act:2F344899-1DF5-45AB-9887-025DF52C9BEA
Figs 18–22

Diagnosis

The new species belongs in species group II, of Mendivil-Nieto *et al*. (2020). It is similar to *Neurostigma thorntoni*, *N. lienhardi*, and *N. spinosum* sp. nov., in having anchor-shaped spines in the endophallus. It is closer to *Neurostigma spinosum* in the venation of the forewing, but it differs from it by having a spot between the base of the pterostigma and the Rs vein (Fig. 20A–B), and by having a robust posterior process of the aedeagal arch, with a slight indentation of the inner margin, and an abrupt relief on the external margin (Fig. 21C). The anterior region of the endophallus has a slight central indentation, and a field of spines close to the posterolateral margins with numerous small spines on the posterior edges, separated by a large membranous area (Fig. 21C).

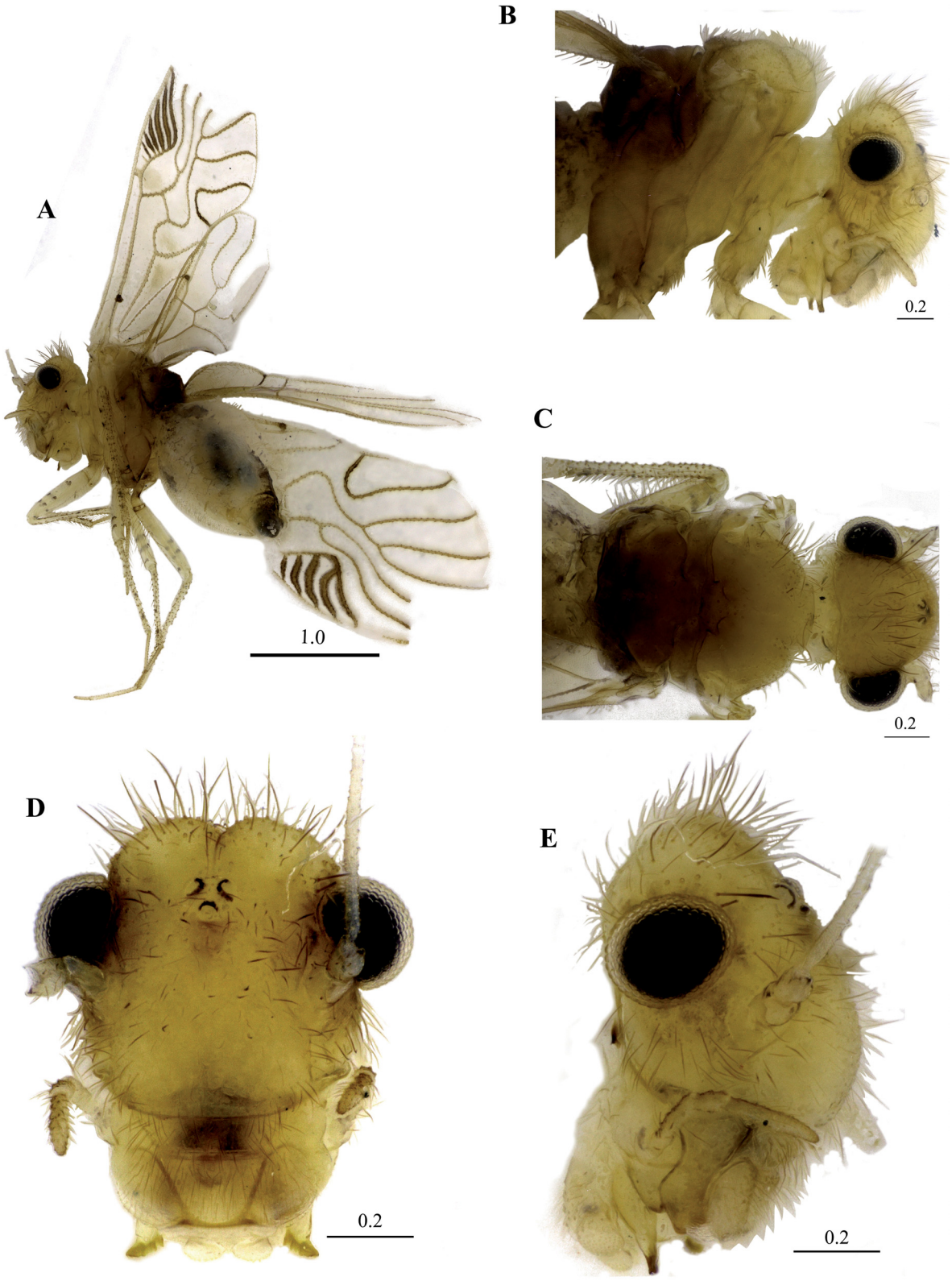

Fig. 18. *Neurostigma willkeniae* sp. nov., holotype, ♂ (INPA-PSO 000038). **A**. Lateral view. **B**. Thorax and head in lateral view. **C**. Thorax and head in dorsal view. **D**. Front view of head. **E**. Lateral view of head. Scale bars in mm.

Etymology

This species is dedicated to Dr Dayse Willkenia Almeida Marques, from the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA), in recognition of her enthusiasm in deciphering the female genitalia of *Neurostigma.*

Type material

Holotype

BRAZIL • ♂; Amazonas, Presidente Figueiredo; 02°57′48.0″ S, 59°55′22.2″ W; 9 Apr. 2013; J.A. Rafael leg.; light trap; INPA, INPA-PSO 000038.

Description

Male

Coloration. Head uniformly pale yellow; lateral areas of head light yellow; compound eyes black, ocelli hyaline with ochre centripetal crescents (Fig. 18A–E). Scape, pedicels and flagellomeres hyaline. Clypeus light yellow (Fig. 18D), labrum hyaline with dark brown labral sclerites (Fig. 19A), labium with light brown prementum, with labial palpi, paraglossas and glossas light brown (Fig. 19B), mandibles hyaline with yellowish and brownish ends (Fig. 19D–E), laciniae hyaline with yellowish distal region (Fig. 19F–G). Tergal lobes of mesothorax hyaline, tergal lobes of metathorax dark brown (Fig. 18C), thoracic pleura hyaline (Fig. 18B). Forewings with three light brown spots, first in medial region between

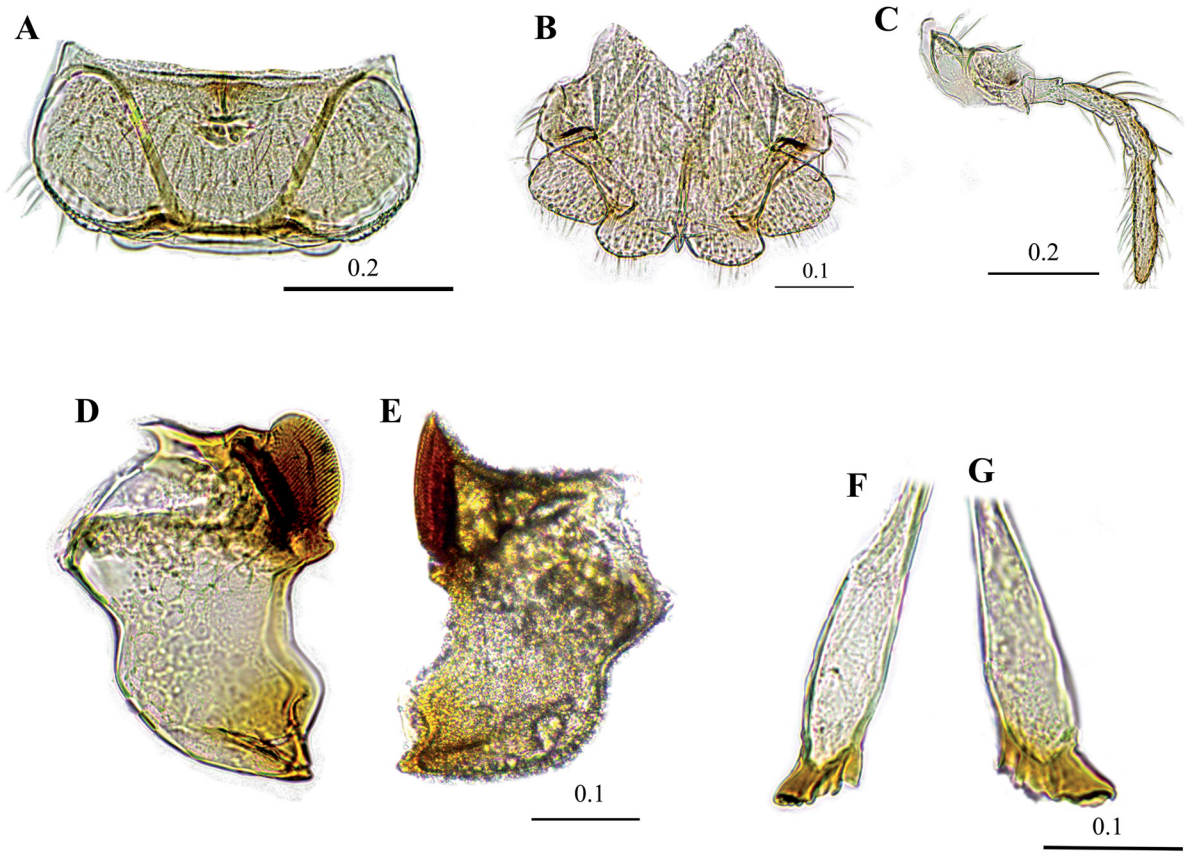

Fig. 19. Mouthparts of *Neurostigma willkeniae* sp. nov., holotype, ♂ (INPA-PSO 000038). **A**. Labrum. **B**. Labium. **C**. Right maxillary palp. **D**. Right mandible. **E**. Left mandible. **F**. Right lacinia. **G**. Left lacinia. Scale bars in mm.

CuP and M+Cu veins, second in basal region of bifurcation of M+Cu veins, third in basal region between base of pterostigma and Rs vein (Fig. 20A–B); hindwings with brownish spots in basal region from vein A to CuP (Fig. 20C–D). Legs thighs yellowish, trochanters light brown, femurs with blackish spots basally, and rounded black spots medially and distally (Fig. 20E), tibiae with two rounded black spots distally, tarsomeres 1 dark brown, tarsomeres 2 dark brown (Fig. 20E). Abdomen hyaline (Fig. 18A).

Morphology. Head with macrosetae, more concentrated on vertex (Fig. 18D–E), compound eyes large, widely separated, laterally rounded in shape (Fig. 18D–E), vertex bilobed, approximately at same level as upper border of compound eyes (Fig. 18D). Labium with prementum narrow, labial palpi with round shape, paraglossa with round shape, glossa slender (Fig. 19B). Mandibles asymmetrical, elongate and with outer margin angled (Fig. 19D–E), outer cusp of lacinial tip broad, with eight to nine denticles (Fig. 19F–G). Tergal lobes with setae (Fig. 18C). Forewings with many setae, especially on margins; right forewing pterostigma with four crossveins (Fig. 20A); left forewing pterostigma with six crossveins (Fig. 20B); M vein before its first bifurcation abruptly concave U-shape (Fig. 20A–B). Hindwing with R_{2+3} and R_{4+5} almost straight, M sinuous (Fig. 20C–D). Hypandrium with abundant setae, distally rounded, gently concave, wirh sides not angled, more sclerotized on sides (Fig. 21A). Posterior

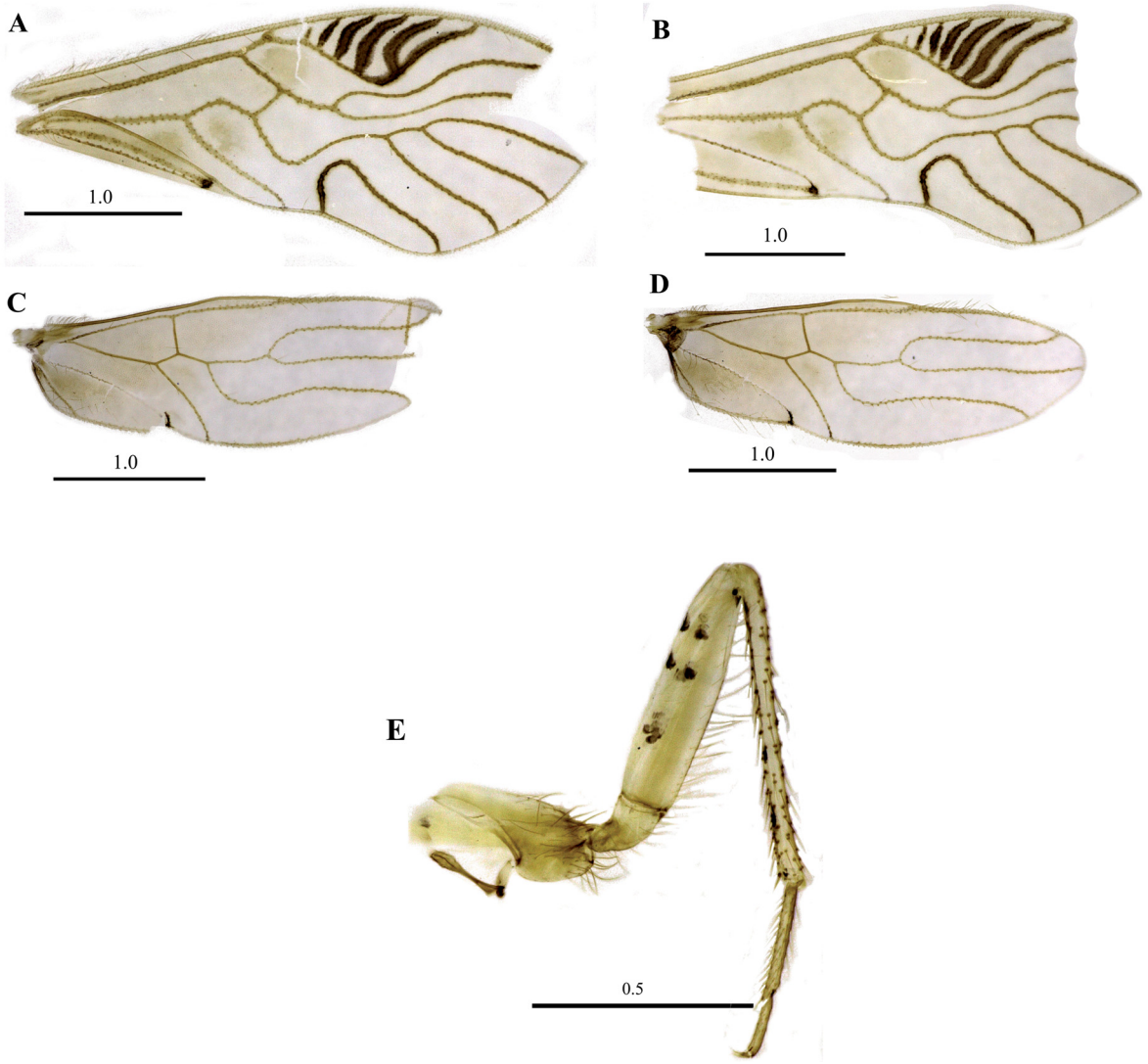

Fig. 20. *Neurostigma willkeniae* sp. nov., holotype, ♂ (INPA-PSO 000038). **A**. Right forewing. **B**. Left forewing. **C**. Right hindwing. **D**. Left hindwing. **E**. Right hind leg. Scale bars in mm.

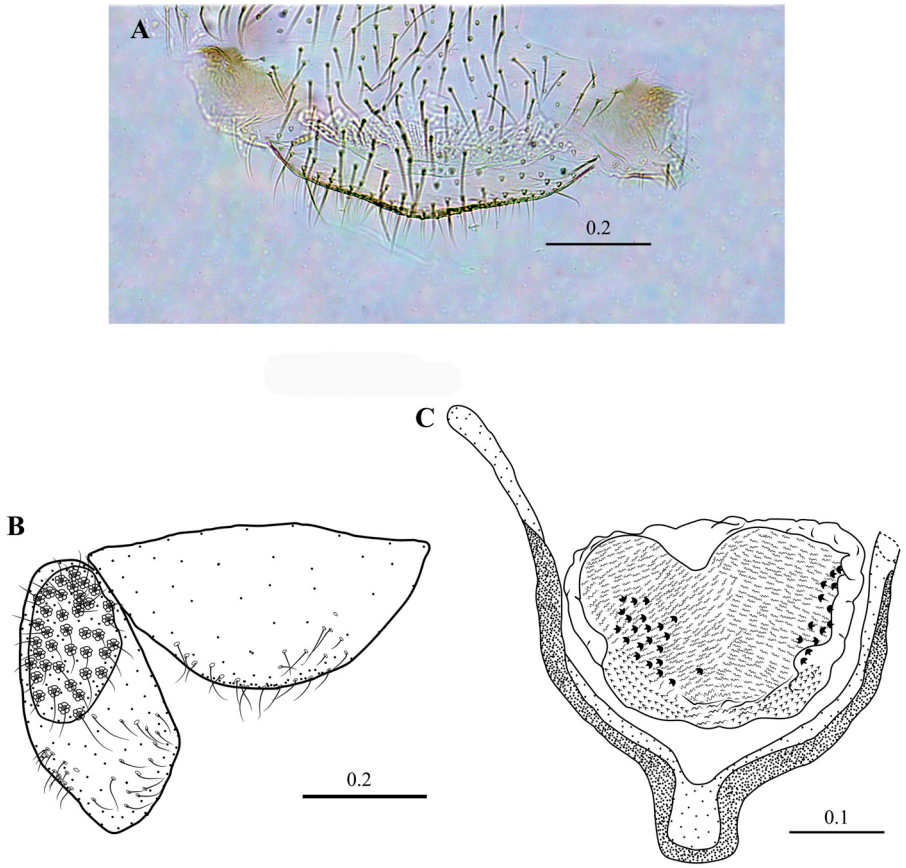

Fig. 21. *Neurostigma willkeniae* sp. nov., holotype, ♂ (INPA-PSO 000038). **A**. Hypandrium. **B**. Right paraproct and epiproct. **C**. Phallosome. Scale bars in mm.

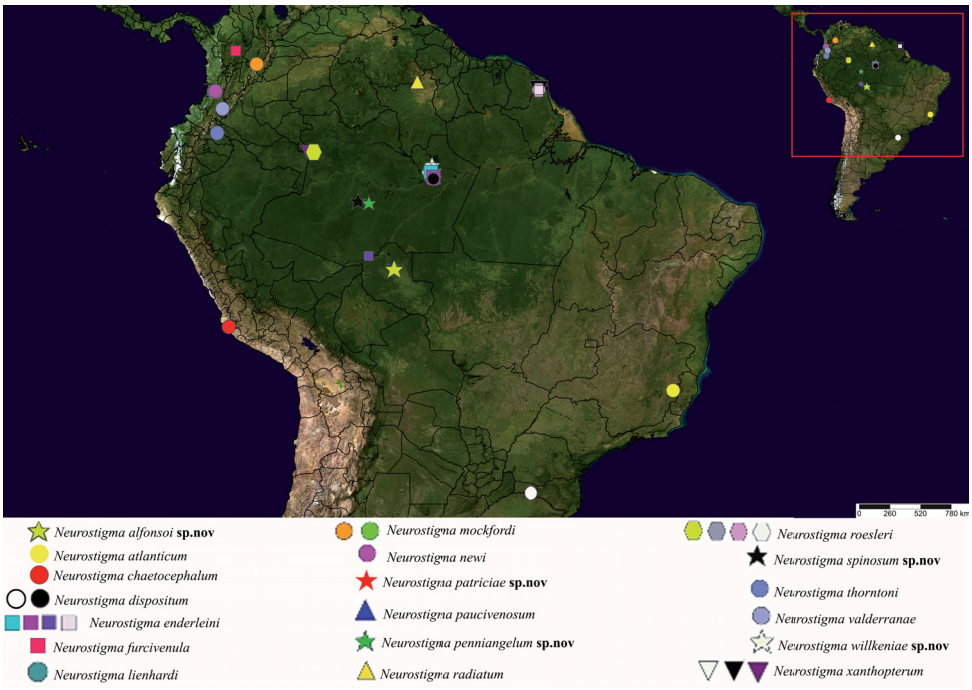

Fig. 22. Geographic distribution of all known species of *Neurostigma* Enderlein, 1900.

process of aedeagal arch with slight indentation of inner margin, with abrupt relief on external margin (Fig. 21C); anterior region of endophallus with slight central indentation, with a field of spines, close to posterolateral margins with numerous small spines on posterior edges, separated by large membranous area (Fig. 21C). Epiproct with concave posterior margin, with field of microsetae in distal region (Fig. 21B). Paraproct with narrow base, widening distally, with straight distal region, with microsetae field towards outer margin, sensory fields with 38–39 basal rosettes (Fig. 21B).

Measurements (in μm). FW: 3658, HW: 2661, F: 627, T: 788, t1: 284, t2: 145, MX2: 113, MX4: 226, IO: 503, D: 245, d: 184, PO: 0.751.

Key to males of Neurostigma

Neurostigma furcivenula and *N. chaetocephalum* are excluded from the key as their male genitalia remain unknown..

1. Forewing with areola postica fused with M; M vein concave with a V-shape before bifurcation (Fig. 23H–K) 2
– Forewing with areola postica free, not fused with M; M vein concave with a U-shape before bifurcation (Figs 3A–B, 8A–B, 12A–B, 16A–B, 20A–B, 23A–G) 4

2. Proximal half of forewing homogeneously pigmented (Fig. 23K) .....***N. enderleini*** New, 1980
– Proximal half of forewing not homogeneously pigmented, with some areas having lighter pigmentation and other areas having distinctly darker pigmentation (Fig. 23H–J) 3

3. Large irregular dark brown spots from base of pterostigma to CuP (Fig. 23I) or only from M+CuA to CuP (Fig. 23H); small dark brown spot at pterostigma base transverse veins pigmented along its entire length (Fig. 23H–I) .....***N. xanthopterum*** New, 1980
– Almost continuous spot from base of areola postica to CuP, with central discontinuity; no irregular spot between half of anal vein and wing margin strongly pigmented spot along M+Cu (Fig. 23J) ... .***N. atlanticum*** Reategui, Rafael & Silva-Neto, 2022

4. Forewing completely hyaline (Fig. 23E–G) 5
– Forewing not hyaline (Figs 3A–B, 8A–B, 12A–B, 16A–B, 20A–B, 23A–D) 7

5. M with three primary branches and third branch unforked (Fig. 23E); phallosome not as below 6
– M with three primary branches, M_3 forked into M_{3a} and M_{3b} (Fig. 23F); posterior process of aedeagus short and straight distally; endophallus with two groups of small spines separated by reticulated area (Fig. 24A) ....***N. lienhardi*** González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021

6. Areola postica narrow, with Cua_1 touching wing margin at a point parallel to the second bifurcation of M (Fig. 23E); distal process of aedeagal arch wide and short; endophallus with two sclerites with numerous small spines, directed antero-laterally (Fig. 24E) ....***N. newi*** González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021
– Areola postica wide, with Cua_1 touching wing margin at a parallel point after the first bifurcation of M vein (Fig. 23G); posterior process of edeagal arch long and narrow with slight indentation of outer margin; endophallus with sharp spines directed antero-mesally, with long spicules on outer margin and dense field of short spines and spicules latero-posteriorly (Fig. 24H) ....***N. roesleri*** New, 1980

7. M+Cu has with slight concavity before bifurcation that gives rise to Cu_A and M (Fig. 8A–B) 8
– M+Cu straight, without concave region (Figs 3A–B, 16A–B, 20A–B, 24A–D) 9

8. Posterior process of aedeagal arch long and wide, with slight indentation of external and internal margins; anterior margin of endophallus with U-shaped indentation, originating two areas similar to 'angels' wings, extremely membranous, ending posteriorly with six strongly sclerotized and acuminate projections (Fig. 9C) ..... ***N. angelicum*** sp. nov.
– Posterior process of aedeagal arch long, wide, with long indentation of external margin, and slight indentation of internal margin; endophallus with two distinctly sclerotized areas, with separate endophallic sclerites touching anteriorly, separated posteriorly by membranous area, each sclerite with denticulated posterior margin with numerous small acuminate projections coiled anteriorly, giving rise to spiral area (Fig. 13C) ..... ***N. patriciae*** sp. nov.

9. Pterostigma with spot on distal half, M gently concave before first bifurcation (Fig. 23D); endophallus subquadrate with recess, originating two symmetrical regions composed of two lobes with numerous rows of vertical spines (Fig. 24G) ..... ***N. paucivenosum*** New, 1980
– Pterostigma without spots or with spot only along crossveins; M vein gently concave with U-shaped before its bifurcation (Figs 3A–B, 16A–B, 20A–B, 23A–C) 10

10. R_{2+3} four times as long as section Rs (Fig. 23B); endophallus region without sclerites or spines 11
– R_{2+3} two times as long as section Rs (Fig. 24I); endophallus region with sclerites or spines 12

11. M_3 unbifurcated; areola postica rounded distally (Fig. 23B); edeagal arch posterior process robust, rounded apically (Fig. 24C) ..... ***N. mockfordi*** González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021
– M_3 bifurcated into M_{3a} and M_{3b}; areola postica almost triangular distally (Fig. 23A); aedeagal arch distal process narrow, almost truncate apically (Fig. 24B) ..... ***N. valderramae*** González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021

12. Aedeagal arch posterior process short and wide, apically U-shaped; endophallus with pair of golf club-shaped sclerites separated by membranes (Fig. 24I) ..... ***N. dispositum*** Roesler, 1940
– Aedeagal arch posterior process robust and long; endophallus with sclerites sepated by membranes (Figs 4C, 17B, 21C, 24A–F) 13

13. Endophallus with sclerites and spines V-shaped (Figs 4C, 24F) 14
– Endophallus without sclerites and with anchor-shaped spines (Figs 17B, 21C, 24D) 15

14. Areola postica wide, with Cua_1 touching wing margin at parallel point, after second bifurcation of M (Fig. 23C); endophallus with two distinctly long, sclerotized and acuminate sclerites directed antero-laterally, arising from dense field of small spines (Fig. 24F) ..... ***N. radiatum*** Mockford, 1991
– Areola postica narrower basally, with Cua_1 touching wing margin at point parallel between first and second bifurcation of M (Fig. 3A–B); endophallus with numerous V-shaped small spines, radula with two sclerites, these almost together in middle of endophallus, basally almost triangular and weakly sclerotized, posteriorly strongly sclerotized, with numerous acuminate projections, with two medially detached projections (Fig. 4C) ..... ***N. alfonsoi*** sp. nov.

15. Endophallus with indentation in anterior region, laterally with rows of spines (Fig. 24D) ..... ***N. thorntoni*** González-Obando, Carrejo-Gironza, Mendivil-Niero & García Aldrete, 2021
– Endophallus not as above (Figs 17B, 21C) 16

16. Endophallus with slight central indentation, with field of spines close to posterolateral margins with numerous small spines on posterior edges, separated by large membranous area (Fig. 21C) ..... ***N. willkeniae*** sp. nov.
– Endophallus with median region deeply septate with V-shaped indentation, laterally membranous with seven distinct rows of spines, separated by membranous area (Fig. 17B) ..... ***N. spinosum*** sp. nov.

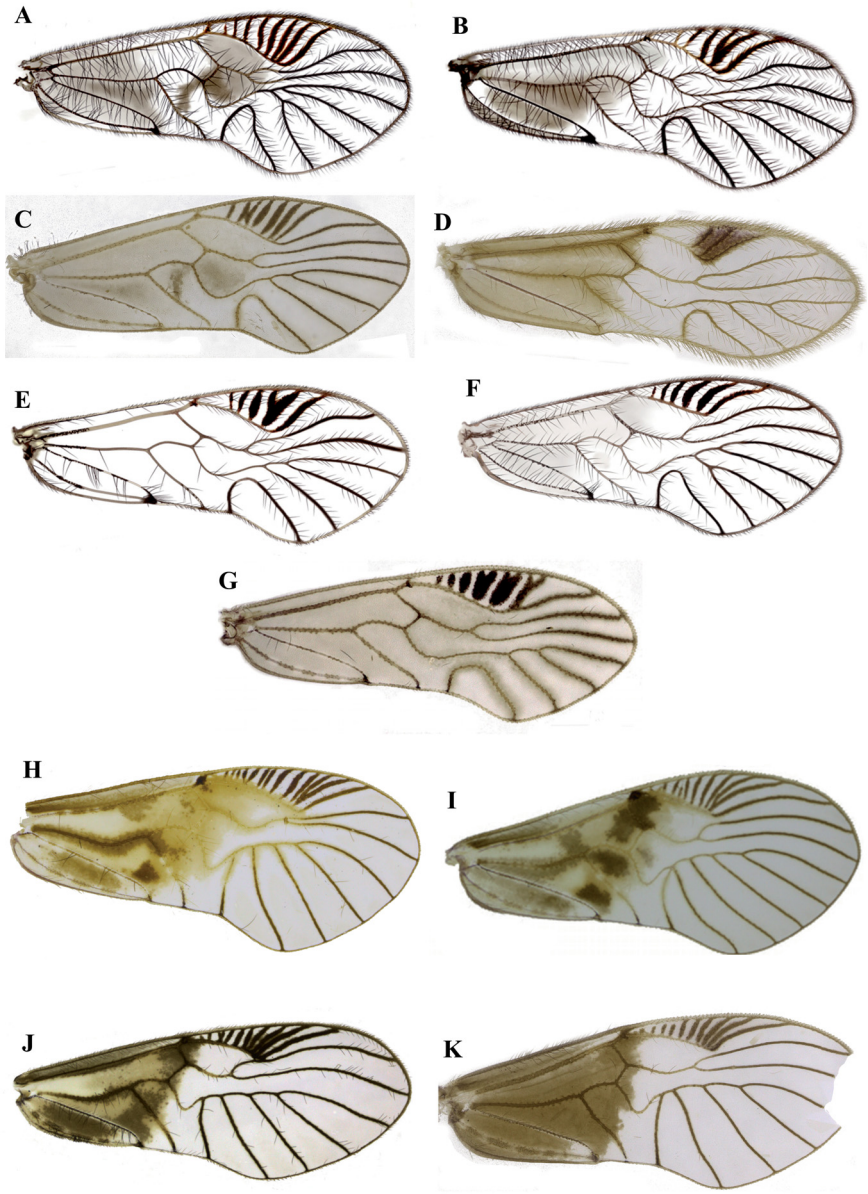

Fig. 23. Forewings of *Neurostigma* spp., ♂. **A**. *N. valderramae* González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021 (adapted from González-Obando *et al*. 2021: fig. 25). **B**. *N. mockfordi* González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021 (adapted from González-Obando *et al*. 2021: fig. 7). **C**. *N. radiatum* Mockford, 1991 (photo of the forewing from the slide with the type specimen, INPA-PSO 000166). **D**. *N. paucivenosum* New, 1980 (photo of the forewing from the slide with the type specimen, INPA-PSO 000165). **E**. *N. newi* González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021 (adapted from González-Obando *et al*. 2021: fig. 13). **F**. *N. lienhardi* González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021 (adaptaded from González-Obando *et al*. 2021: fig. 1)**. G**. *N. roesleri* New, 1980 (adapted from Reategui *et al*. 2024: fig. 18d; INPA-PSO 000029). **H**. *N. xanthopterum* New, 1980 (adapted from Reategui *et al*. 2022b: fig. 10c; INPA-PSO 000164). **I**. *N. xanthopterum* (adapted from Reategui *et al*. 2022b: fig. 10d; INPA-PSO 000164). **J**. *N. atlanticum* Reategui, Rafael & Silva-Neto, 2022 (adapted from Reategui *et al*. 2022a; fig. 3). **K**. *N. enderleini* New, 1980 (adapted from Reategui *et al*. 2024: fig. 1b; INPA-PSO 000163).

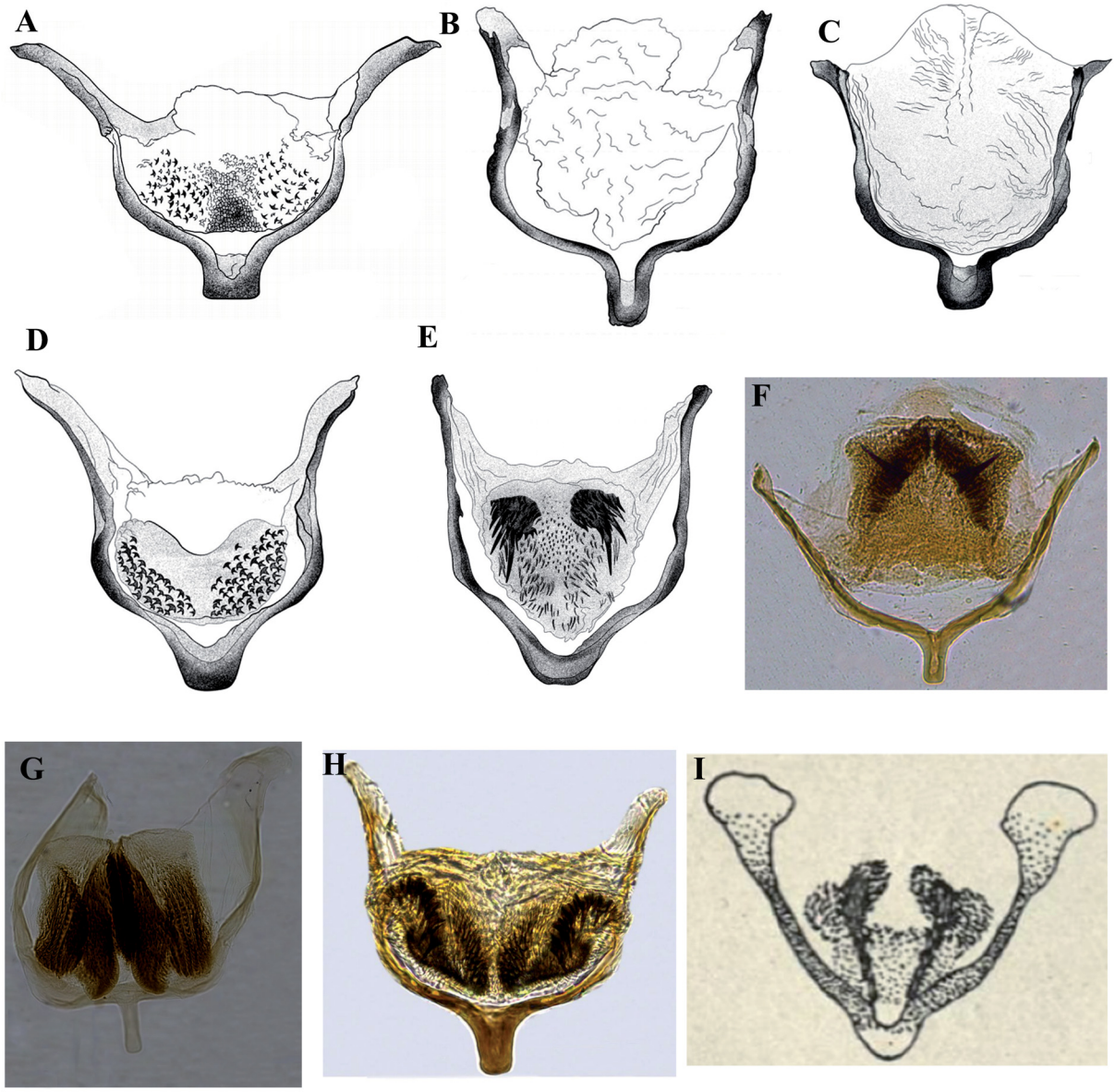

Fig. 24. Phallosomes of *Neurostigma* spp., ♂. **A**. *N. lienhardi* González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021 (adapted from González-Obando *et al*. 2021: fig. 6). **B**. *N. valderramae* González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021 (adapted from González-Obando *et al*. 2021: fig. 30). **C**. *N. mockfordi* González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021 (adapted from González-Obando *et al*. 2021: fig. 12). **D**. *N. thorntoni* González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021 (adapted from González-Obando *et al*. 2021: fig. 24). **E**. *N. newi* González-Obando, Carrejo-Gironza, Mendivil-Nieto & García Aldrete, 2021 (adapted from González-Obando *et al*. 2021: fig. 18). **F**. *N. radiatum* Mockford, 1991 (photo of the phallosome from the slide with the type specimen, INPA-PSO 000166). **G**. *N. paucivenosum* New, 1980 (photo of the phallosome from the slide with the type specimen). **H**. *N. roesleri* New, 1980 (adapted from Reategui *et al*. 2024b: fig. 18h). **I**. *N. dispositum* (adapted from Roesler 1940: fig. 47; INPA-PSO 000165).

Table 1. Species of *Neurostigma* Enderlein, 1900, general distribution and distribution in Brazilian states (between parentheses).

Species	Sexes known	Distribution
N. chaetocephalum Enderlein, 1900	Male	Peru
N. dispositum Roesler, 1940	Both	Brazil (Amazonas, Mato Grosso, Santa Catarina, São Paulo Rondônia), México, Peru
N. enderleini New, 1980	Both	Brazil (Amazonas)
N. xanthopterum New, 1980	Both	Brazil (Amazonas), Colombia
N. paucivenosum New, 1980	Male	Brazil (Amazonas)
N. roesleri New, 1980	Both	Brazil (Amazonas, Amapá), Colombia
N. radiatum Mockford, 1991	Male	Brazil (Roraima)
N. atlanticum Reategui, Rafael & Silva-Neto, 2022	Male	Brazil (Minas Gerais)
N. furcivenula Badonnel, 1986	Female	Colombia
N. lienhardi González-Obando, Carrejo-Gironza, Mendivil-Nieto & Garcia-Aldrete, 2021	Male	Colombia
N. mockfordi González-Obando, Carrejo-Gironza, Mendivil-Nieto & Garcia-Aldrete, 2021	Male	Colombia
N. newi González-Obando, Carrejo-Gironza, Mendivil-Nieto & Garcia-Aldrete, 2021	Male	Colombia
N. thorntoni González-Obando, Carrejo-Gironza, Mendivil-Nieto & Garcia-Aldrete, 2021	Male	Colombia
N. valderramae González-Obando, Carrejo-Gironza, Mendivil-Nieto & Garcia-Aldrete, 2021	Male	Colombia

Discussion

Currently, there are 14 recognized species of *Neurostigma* (Table 1). Among these, *N. furcivenula* was described based only on female specimens with hyaline wings. *Neurostigma furcivenula* is distinguished by its forewings venation, featuring the medially forked vein M_3, originating veins M_{3a} and M_{3b} (Badonnel 1986: fig. 70).

Most of the new species described in this study have hyaline wings with diffuse spots in some cells of the forewings, as observed in *N. alfonsoi* sp. nov., *N. spinosum* sp. nov., and *N. willkeniae* sp. nov. This characteristic readily distinguishes them from *N. furcivenula* and the differences described in wing venation confirm it.

Notably, *N. angelicum* sp. nov. and *N. patriciae* sp. nov. stand out by having a pigmented basal region of the wing (Figs 8A–B, 12A–B). Considering that most species with associated males and females in Psocoptera (and in *Neurostigma* as well) do not differ in terms of wing pigmentation, these characters,

along with venation patterns, suggest that the new species described from male specimens cannot be conspecific with *N. furcivenula*.

The five new species of *Neurostigma* described in this article belong to species group II, as they do not present the areola postica fused to vein M (Mendivil Nieto *et al.* 2020). *Neurostigma patriciae* sp. nov., *N. angelicum* sp. nov., *N. spinosum* sp. nov., and *N. willkeniae* sp. nov. contribute to the known diversity of the genus in the Amazon region (Fig. 22). *Neurostigma patriciae* and *N. angelicum* are unique in having a slight sinuosity in the vein M+CuA near the bifurcation, distinguishing them from other known species. With further collections, we will determine if this characteristic remains exclusive to these species. With these four new species, Amazonas becomes the most species-rich state for *Neurostigma* in Brazil, with eight recorded species, one of which is shared with Colombia (Table 1). The species *Neurostigma alfonsoi* sp. nov. is described here, representing the first record of the genus for the state of Rondônia, Brazil. With this new addition, the number of species of Psocoptera known for the state increases to eight (Silva-Neto & García Aldrete 2020).

The description of the new species raises the number of species of the genus *Neurostigma* recorded for the Brazilian Amazon to nine, significantly expanding the known diversity for the region. Two of these species, *N. xanthopterum* and *N. roesleri*, are shared with the Colombian fauna (Table 1).

The variations in pterostigma venation detected in the new species also occur in other species of the same genus, such as *N. xanthopterum*, *N. enderleini* and *N. roesleri* (Reategui *et al*. 2022a, 2024). This reinforces that these characteristics are not good for diagnosing species of *Neurostigma* (Reategui *et al*. 2022a). In most of the specimens that have already been studied, as well as the new species presented here, we observed this phenomenon, which appears to be frequent in *Neurostigma*. These observations are important because they provide valuable insights into the taxonomy of the genus.

With this study, we significantly contributed to the knowledge of the diversity of the genus, which today has 19 species (Fig. 22).

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