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Two new monotypic genera of Epipsocidae (Psocodea: 'Psocoptera' : Psocomorpha) from Valle del Cauca, Colombia

Dos nuevos géneros monotípicos de Epipsocidae (Psocodea : 'Psocoptera' : Psocomorpha) de Valle del Cauca, Colombia

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ABSTRACT

Two genera of Epipsocidae, from Valle del Cauca, Colombia, are here defined, each based on a new species which are here described and illustrated; both genera have the hindwing vein M branched, and the forewing with supernumerary venation. *Anastomopsocus* n. g., is close to *Mesepipsocus* and *Mesepipsocoides*, while *Periepipsocus* n. g., is close to *Epipsocus*. An identification key to the genera of Epipsocidae present in Colombia is included. The types are deposited in the Entomology Museum, Universidad del Valle, Santiago de Cali, Colombia (MUSENUV).

Key words: Neotropics, taxonomy, Epipsocetae, South America.

RESUMEN

Se definen aquí dos géneros de Epipsocidae de Valle del Cauca, Colombia; cada uno de ellos está basado en una nueva especie, que es descrita e ilustrada; ambos tienen la vena M de la ala posterior ramificada, y el ala anterior presenta venación supernumeraria. *Anastomopsocus* n. g., es cercano a *Mesepipsocus* y a *Mesepipsocoides*, en tanto que *Periepipsocus* n. g., es cercano a *Epipsocus*. Se incluye una clave de identificación para los géneros de Epipsocidae que se encuentran en Colombia. Los tipos están depositados en el Museo de Entomología de la Universidad del Valle, en Santiago de Cali, Colombia (MUSENUV).

Palabras clave : Neotrópico, taxonomía, Epipsocetae, Sud América.

INTRODUCTION

We recently collected in Valle del Cauca, Colombia, several specimens that represent two genera belonging in clade A of Epipsocidae (see Figure 124 in Casasola González, 2006). One has the hindwing vein M two branched, and the forewing Rs three branched, with crossveins joining the pterostigma; the forewing M is five branched, with some degree of anastomosis, forming a network. The other species has the hindwing vein M three branched; the forewing Rs is three branched, and the forewing M is five branched, with the two branches near the areola postica forked, resulting in seven branches. As these species are not assignable to any of the known epipsocid genera, the purpose of this paper is to erect a new genus for each, and to describe and illustrate them. Also, an identification key to the epipsocid genera found in Colombia is included.

This work is dedicated to Dr. Miguel Ángel Morón Ríos, of the Instituto de Ecología, A. C., in Jalapa, Veracruz, México, in recognition to his important contributions in the taxonomy of the Scarabaeoidea.

MATERIAL AND METHODS

Two males and three females of one species, and one male and three females of the second species were available for study. The specimens were dissected in 80%

ethanol, and their parts (head, right antennae, right wings and legs as well as genitals) were mounted, following standard procedures, in Canada balsam. Measurements, in μm , were taken on parts on the slides; abbreviations of parts measured are as follows: FW, HW: lengths of right fore- and hind- wings ; F, T, t_1 , t_2 : respectively, lengths of femur, tibia and tarsomeres 1 and 2 of right hind leg ; ctt_1 : number of ctenidiobothria on t_1 of right hind leg ; $f_1 \dots f_n$: length of flagellomeres 1...n of right antenna; Mx4: length of fourth segment of right maxillary palpus ; IO, D, d: respectively, minimum distance between compound eyes, antero-posterior diameter and transverse diameter of right compound eye in dorsal view of the head. PO: d/D. The measurements were taken on a Nikon E200 compound microscope. The specimens are deposited in the Entomology Museum, Universidad del Valle, Santiago de Cali, Colombia (MUSENUV).

RESULTS

Anastomopsocus n. g.

Diagnosis. Forewing Rs three branched (R4+5 forked), crossveins between Rs and R2+3 and pterostigma, M five branched, with crossveins as illustrated in figures 1 and 7, resulting in some degree of reticulation; areola postica with a crossvein to last branch of M. Hindwing (Figs 1, 7), with M two branched, occasionally with R4+5 and M2 forked.

Phallosome (Fig. 12), simple, open anteriorly, with small external parameres; aedeagal arch extended posteriorly to form a wide, posteriorly straight projection; endophallus membranous.

Type species. *Anastomopsocus vallecaucanus* n. g., n. sp.

Etymology. The generic name is a compound word, with the root derived from the Greek 'anastomosis'=forming a network, in reference to the reticulation resulting from the connection of branches of M, and crossveins between Rs-R1 and R1-R2+3, plus 'psocus', common in 'Psocoptera', as in *Psyllipsocus*, *Ectopsocus*, *Elaphopsocus*.

***Anastomopsocus vallecaucanus* n. sp.**
(Figs 1–12)

Female. Color. (in 80 % ethanol). Body creamy, with brown spots as indicated below. Head (Fig. 2) pale brown, compound eyes black, ocelli hyaline, with ochre centripetal crescents; a large dark brown spot on vertex, a dark brown band from each compound eye to epistomal sulcus, above the antennal fossae; postclypeus brown, with V shaped slender brown bands; anteclypeus and labrum brown. Antennae: scape and pedicel brown; first flagellomeres pale brown, darkening gradually to the end of the flagellum. Mx 1–4 pale brown. Legs: Coxa, trochanter and femur of front leg pale brown; coxa and trochanter of mid- and hindlegs dark brown; femur of midleg dark brown, with a pale subapical band; femur of hindleg dark brown; tibiae and tarsi of all legs pale brown. Forewing hyaline, pterostigma with a dark brown spot distally, and brown spot on nodulus. Hindwing hyaline, with pale brown spot distally on cell Cu2. Clunium brown, epiproct with sides and posterior border brown, central area creamy. Paraprocts creamy, with anterior border brown. Subgenital plate brown, with postero-lateral borders more pigmented. Gonapophyses brown, IX sternum pale creamy.

Morphology. Outer cusp of lacinial tip broad (Fig. 3), with 5–6 denticles; five distal labral sensilla, a central placoid, flanked at a distance by a pair trichoid-placoid; ocellar group with two setae at the level of the middle ocellus; compound eyes with interommatidial setae, mostly dorsally. Forewings (Fig. 1): pterostigma wider distally; vein Rs three branched, a crossvein from Rs to pterostigma and a crossvein from R2+3 to pterostigma, a short vein stub basally on first branch of R4+5; vein M with five primary branches, some specimens with four primary branches; veins M3–M5 forked, with branches joined, crossvein from areola postica to second branch of M5, resulting in variable reticulation; areola postica irregularly trapeziform. Hindwing (Fig. 1): vein M two branched, some specimens with second branch forked. Coxa of hind leg with Pearman's organ; trochanters of all legs with two long setae proximally; tarsi of front legs without ctenidiobothria; t1 of mid legs with 20 ctenidiobothria; t2 without ctenidiobothria. Subgenital plate (Fig. 5) broad, with sides converging to straight posterior border; a sclerotized, slender band on

each side, wider proximally. Gonapophyses (Fig. 6): V1 absent, V2+3 with a proximal, short, stout heel, a field of 8 setae on V3, distal process almost straight, slender and distally acuminate, with a field of microspines. IX sternum (Fig. 6) almost unpigmented, with spermapore slightly towards anterior border. Paraprocts (Fig. 4) broad, with a row of setae along outer border, other setae as illustrated; sensory fields with 24–26 trichobothria on basal rosettes. Epiproct (Fig. 4), with setal field mesally and a row of setae along posterior border.

Measurements (in μm). FW: 3600, HW: 2625, F: 775, T: 1325, t_1 : 630, t_2 : 140, ct_1 : 29, f_1 : 630, f_2 : 530, f_3 : 380, f_4 : 320, IO: 460, D: 160, d: 260, IO/d: 1.76, PO: 1.6.

Male. Color. (in 80% ethanol). Head (Fig. 8), legs, epiproct, paraprocts and wings as in the female; hypandrium brown, with postero-lateral borders dark brown.

Morphology. Outer cusp of lacinial tip broad (Fig. 9), with 6–7 denticles; distal labral sensilla, and setae on ocellar group as in the female. Wings essentially as in the female (Fig. 7), but basal vein stub on R4+5 missing, also, crossveins only between M4–M5, and M5 with vein extended from areola postica (compare with Fig. 1). Hypandrium (Fig. 11) symmetric, almost trapeziform, with long setae. Phallosome (Fig. 12), anteriorly open, external parameres short, slender; side struts slender, aedeagal arch projected in the middle, process straight posteriorly; endophallus membranous, without sclerites. Paraprocts (Fig. 10): broad, ovoid, setose as illustrated; sensory fields with 21–24 trichobothria on basal rosettes. Epiproct (Fig. 10), with short setae mesally and posteriorly, and a field of microsetae next to posterior border.

Measurements (in μm). FW: 3475, HW: 2500, F: 775, T: 1425, t_1 : 650, t_2 : 140, ct_1 : 29, f_1 : 650, f_2 : 530, IO: 430, D: 190, d: 280, IO/d: 1.53, PO: 1.47.

Specimens studied. Holotype male. **COLOMBIA.** Valle del Cauca. La Cumbre, La Virginia, 3°38'18.1"N: 76°32'55.3"W, 1783 m., 18.IX.2012, N. Carrejo & R. González. Paratypes: 2 females, same data as the holotype. 1 female, Valle del Cauca, Darién, Puente Tierra, 3°53'21.5"N: 76°24'W, 1600 m., 6.XI.2010, R. González. 1 male, Valle del Cauca, Yumbo, Dapa, Finca Palo Alto, 3°34'9.0"N: 76°34'13.6"W, 1866 m., 16.X.2010, R. González. All specimens deposited in the Entomology Museum, Universidad del Valle, Santiago de Cali, Colombia. Slide codes 25765–69 (MUSENUV).

Etymology. The specific name refers to Valle del Cauca, Colombia, from where this taxon is endemic.

Remarks. *Anastomopsocus* is related to *Mesepipsocus* and *Mesepipsocoides* on account of the lack of V1. It differs from them on wing venation details, e.g., *Mesepipsocus* has the forewing vein Rs 2-branched, occasionally with a crossvein from R2+3 to pterostigma (e.g., *M. arborescens* New & Thornton), occasionally with Rs dichotomously branched and with a crossvein from Rs to pterostigma [e.g., *M. taitubai* (New)], and occasionally with Rs 4-branched and crossveins from R2+3, and Rs to pterostigma [e.g., *M.*

brasiliensis (New)]. In *Mesepipsocus* the forewing M is either 3-branched, or dichotomously branched, or with four main branches, often the last one, next areola postica, forked; in the hindwing, M is always unbranched. *Anastomopsocus* differs from *Mesepipsocoides* García Aldrete & Casasola González (2008), in head pattern, in having the hindwing M 2-branched, and in forewing venation. In the latter, Rs is 2-branched, without crossveins joining the pterostigma, and M is dichotomously branched, with M3 forked; also, the subgenital plate is more projected in the middle than in the former.

***Periepipisocus* n. g.**

Diagnosis. Forewings (Figs 13, 19), with Rs three branched (R4+5 forked), M of four primary branches, M1, M3 and M4 forked, resulting in seven branches at wing margin. Hindwing (Figs 13, 19) with vein M three branched. Gonapophyses complete (Fig. 18). Phallosome simple, endophallus with wide, transverse radula (Fig. 24).

Type species. *Periepipisocus caliensis* n. g., n. sp.

Etymology. The genus name means « around *Epipsocus* », in reference to the closeness to *Epipsocus*.

***Periepipisocus caliensis* n. sp.**

(Figs 13–24)

Female. Color (in 80% ethanol). Head (Fig. 14) brown, vertex creamy, with a dark brown triangular area on each side: an apex of each triangle on the inner edge of the compound eye, other apex in the lower margin of the lateral ocellus, and the third apex on one side of the antennal fossa; a pale brown band from the inner margin of each compound eye to each lateral ocellus; gena and postgena dark brown; compound eyes black, ocelli hyaline, with ochre centripetal crescents; postclypeus with slender brown bands converging towards the middle; anteclypeus and labrum brown. Antennae with scape and pedicel brown, flagella pale brown. Mx1 brown, Mx 2–4 pale brown. Coxae, trochanters and femora of front legs creamy; coxae and femora of mid and hindlegs dark brown; trochanters of mid and hind legs creamy; tibiae and tarsi of all legs pale brown. Forewings almost hyaline, pterostigma with dark brown spot distally, and a small brown spot in the middle, on lower posterior margin; brown marginal spots at veins forks; a brown spot at nodulus. Hindwings hyaline, a brown spot at end of Cu2. Clunium brown. Epiproct and paraprocts creamy. Subgenital plate brown, postero-lateral borders dark brown. Gonapophyses brown. IX sternum creamy.

Morphology. As in generic diagnosis plus the following: outer cusp of lacinial tip broad (Fig. 15), with 7–8 denticles; distal labral sensilla, setae of ocellar group, and interommatidial compound eyes setae, as in *Anastomopsocus vallecaucanus*. Subgenital plate (Fig. 17) broad, setose, rounded posteriorly, pigmented area slightly concave anteriorly. Gonapophyses (Fig. 18), V1 short, slender, acuminate; V 2+3 with proximal, short, stout heel, a field of seven setae on V3; posterior process straight,

distally acuminate, with a field of microspines. IX sternum (Fig. 18), unpigmented, with spermapore slightly towards anterior border. Paraprocts (Fig. 16), broad, with long setae, and a field of microsetae along posterior border; sensory fields with 22 trichobothria on basal rosettes. Epiproct (Fig. 16), almost trapeziform, proximally wide, narrowing to straight posterior border, setose, with a row of setae along posterior border.

Measurements (in μm). FW: 3500, HW: 2600, F: 750, T: 1425, t_1 : 570, t_2 : 130, ctt_1 : 29, f_1 : 650, f_2 : 550, f_3 : 390, IO: 420, D: 180, d: 280, IO/d: 1.5, PO: 1.5.

Male. Color (in 80% ethanol). Head (Fig. 20), legs, epiproct, paraprocts and wings as in the female. Hypandrium brown, with posterior border dark brown.

Morphology. Outer cusp of lacinial tip broad (Fig. 21), with eight denticles; Wings same as the female (Fig. 19). Hypandrium (Fig. 23), wide, narrow, with setae as illustrated. Phallosome (Fig. 24), anteriorly open, V shaped; side struts straight, dilated posteriorly, aedeagal arch projected posteriorly in the middle, as illustrated, projection wide, distally straight; a large, transverse radula, deeply concave anteriorly; posteriorly straight, formed by numerous, strongly sclerotized, hooked sclerites. Paraprocts (Fig. 22), elongate, ovoid, with short setae and a field of microsetae along posterior border, sensory fields with 22–24 trichobothria on basal rosettes. Epiproct (Fig. 22), wide based, rounded posteriorly, setae as illustrated.

Measurements (in μm). FW: 3425, HW: 2500, F: 800, T: 1425, t_1 : 640, t_2 : 150, ctt_1 : 30, f_1 : 630, f_2 : 510, f_3 : 410, f_4 : 330, IO: 370, D: 230, d: 330, IO/d: 1.12, PO: 1.43.

Specimens studied. Holotype male. **COLOMBIA.** Valle del Cauca. Santiago de Cali, La Buitrera, 3°32'14.1"N: 76°45'19.0"W, 1140 m., 29.I.2011, R. González. Paratypes: 1 female, X.2011. 1 female, 29.I.2011. 1 female, 11.VI.2011, all from same locality and collector as the holotype. All specimens deposited in the Entomology Museum, Universidad del Valle, Santiago de Cali, Colombia. Slide codes 25770–73 (MUSENUV).

Etymology. The specific name refers to the type locality: Santiago de Cali, Colombia, from where this taxon is endemic.

Remarks. Other than the wing venation characters, *Periepipisocus* could be assigned to *Epipsocus*; the forewing veins are supernumerary, as in the genera *Goja*, *Ianthorntonia* and *Edmockfordia* García Aldrete. It differs from *Ianthorntonia* and *Goja* in that these genera have the phallosome anteriorly closed, and they present well defined endophallic sclerites, while *Periepipisocus* has a well developed radula. It differs from *Edmockfordia* in that the latter has the endophallus membranous, lacking mesal sclerites or radula. The endophallus in *Periepipisocus* is shared with *Neurostigma* and some *Epipsocus* species, but it is distinct from *Neurostigma* in the absence of transverse veins in the pterostigma, and from both genera, both of which have caeciliusid venation (forewing Rs two branched, M three branched; hindwing M unbranched).

Key to the genera of Epipsocidae found in Colombia

1. Forewings with a series of transverse, pigmented bands in the pterostigma *Neurostigma* Enderlein
- Forewings without transverse, pigmented bands in the pterostigma 2
2. Hindwings with a crossvein between Rs and M or these veins fused in a point 3
- Hindwings with Rs and M fused for a variable length ..4
3. Forewings (males) with caeciliusid venation
..... *Gojaoides* García Aldrete (part)
- Forewings (males) with supernumerary venation
..... *Goja* Navás
4. Forewings with supernumerary venation 5
- Forewings with caeciliusid venation 7
5. Forewings with Rs 2-branched and M 4-branched. Phallosome V-shaped, side struts stout, proximally curved outward, aedeagal arch projected posteriorly in the middle; external parameres well developed and sclerotized, endophallus membranous, without sclerites; male epiproct with a distinct papillar field
..... *Edmockfordia* García Aldrete
- Forewings with Rs 3-branched, M with more than four branches. Phallosome V- shaped 6
6. Hindwings with M 2-branched. Forewings with crossveins between pterostigma-Rs and R2+3; and between areola postica-M5, external parameres small, endophallus without sclerites *Anastomopsocus* n. g.
- Hindwings with M 3-branched. Forewings without crossveins as above; Rs 3-branched, M 4-branched; external parameres absent, endophallus with broad, transverse radula *Perieipsocus* n. g.
7. Phallosome simple, open anteriorly, V-shaped 9
- Phallosome complex, closed anteriorly 8
8. Endophallic sclerites well defined; external parameres present, variable *Gojaoides* García Aldrete (part)
- Endophallus with radula; without external parameres ...
..... *Terryerwinia* García Aldrete
9. External parameres slender, bow-shaped, distally rounded; endophallic radula with a longitudinal slit
..... *Gonzobandia* García Aldrete
- External parameres and endophallus not as above 10
10. Females with at least remnants of V1.. *Epipsocus* Hagen
- Females without V1 *Mesepipsocus* Badonnel

DISCUSSION

Among the 27 genera presently recognized in the family Epipsocidae (Casasola González 2006; García Aldrete 2009; 2012) only in four of them (*Goja* Navás, *Ianthorntonia* García Aldrete, *Incapsocus* García Aldrete, and *Mesepipsocoides* García Aldrete & Casasola González), the hindwing vein M is branched. *Incapsocus* and *Mesepipsocoides* belong in clade A of Epipsocidae (see Casasola González, 2006), in which the male phallosome, with the exception of *Papillopsocus* García Aldrete, is a simple structure, formed by two side struts and an aedeagal arch often projected in the middle. The other two

genera belong in a subclade of clade B of Epipsocidae (Casasola González, 2006), presently including the genera *Phallofractus*, *Gonzobandia*, *Gojaoides*, *Rogojiella* and *Ianthorntonia*, all erected by García Aldrete, plus *Goja* Navás. In this group the male phallosome is decidedly more complex than the simple phallosome of the genera in clade A.

The two genera here described belong in clade A of Epipsocidae (see Fig. 124 in Casasola González, 2006). That clade contains the genera *Edmockfordia*, *Epipsocus*, *Incapsocus*, *Mesepipsocus*, *Mesepipsocoides*, *Neurostigma*, *Papillopsocus* and *Terryerwinia*. Forewings with reticulated venation also occur in the distant, mostly Oriental genus *Epipsocopsis*. The two genera here erected are based on striking autapomorphies in the fore- and hindwings, and there is certainly the risk that the genera most related to them become paraphyletic, as Lienhard (2012) has well pointed out. In this case however, the creation of the new genera is justified, as we will explain in what follows. *Anastomopsocus* can not be assigned to *Mesepipsocus*, because most of the species in *Mesepipsocus* have either caeciliusid venation, or the forewing M is dichotomously branched, resulting in four M branches, and all the known species have the hindwing M unbranched. It can not either, be assigned to *Mesepipsocoides*, because that genus presents the forewing Rs of only two branches, and although M has four primary branches, there are no crossveins in the M or R sectors or with the branch from pterostigma; also, the hindwing M is of three primary branches. *Perieipsocus* can not be assigned in the close genus *Epipsocus*, because, although the male and female genitals are identical, all the species in the later genus have the hindwing M unbranched, and in all but two of the described species, the forewing venation is caeciliusid; *E. fuscareolatus* New has the forewing Rs three branched and M of four branches, and *E. opticus* New & Thornton, has the forewing M four branched. Then, inclusion of *Anastomopsocus*, either in *Mesepipsocus* or in *Mesepipsocoides* and inclusion of *Perieipsocus* within *Epipsocus*, would necessitate a widening of the limits of those genera, actions that presently we consider unadvisable.

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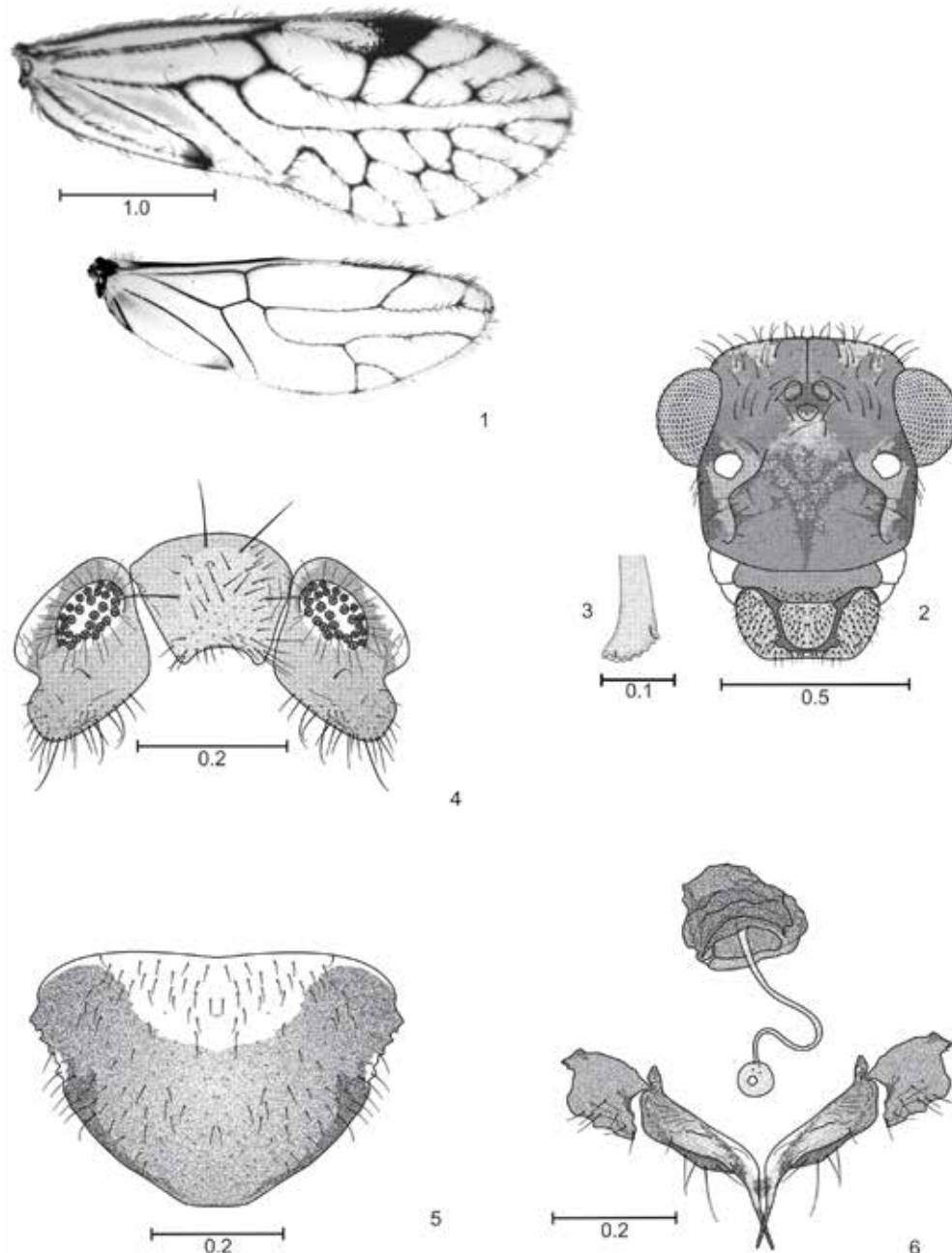
ANGA and RGO thank the Vicerectoría de Investigación, Universidad del Valle, for a grant to conduct a survey of the Psocoptera of Valle del Cauca, Colombia (Project CI 7874). JAM and RGO thank Departamento de Biología, Facultad de Ciencias Naturales y Exactas, Universidad del Valle, Santiago de Cali, Colombia, for research support. JAM thanks particularly the program “Young Researcher” of COLCIENCIAS, and the Vicerectoría de Investigación, Universidad del Valle. ANGA thanks Instituto de Biología, Universidad Nacional Autónoma de México, for continuous research support.

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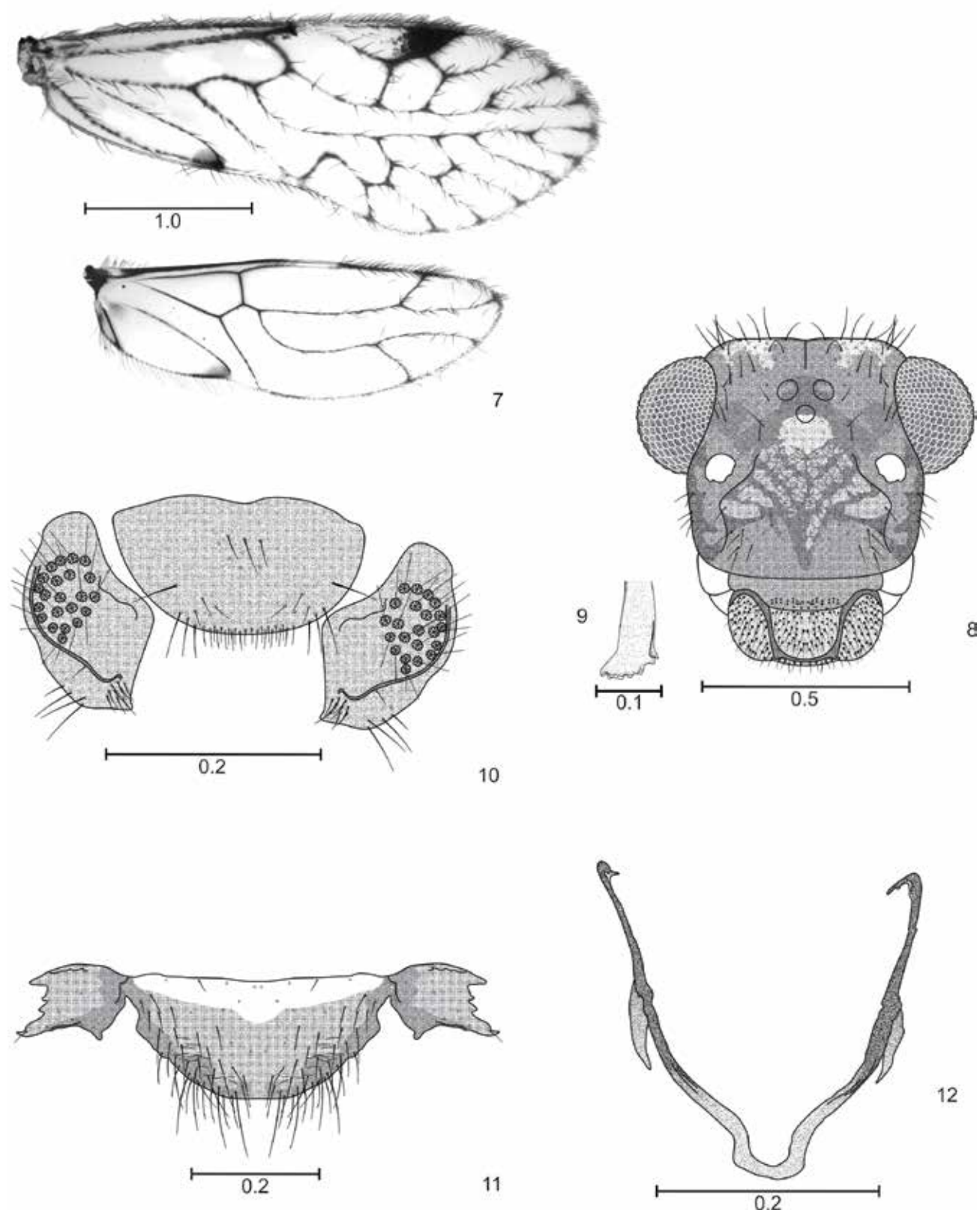
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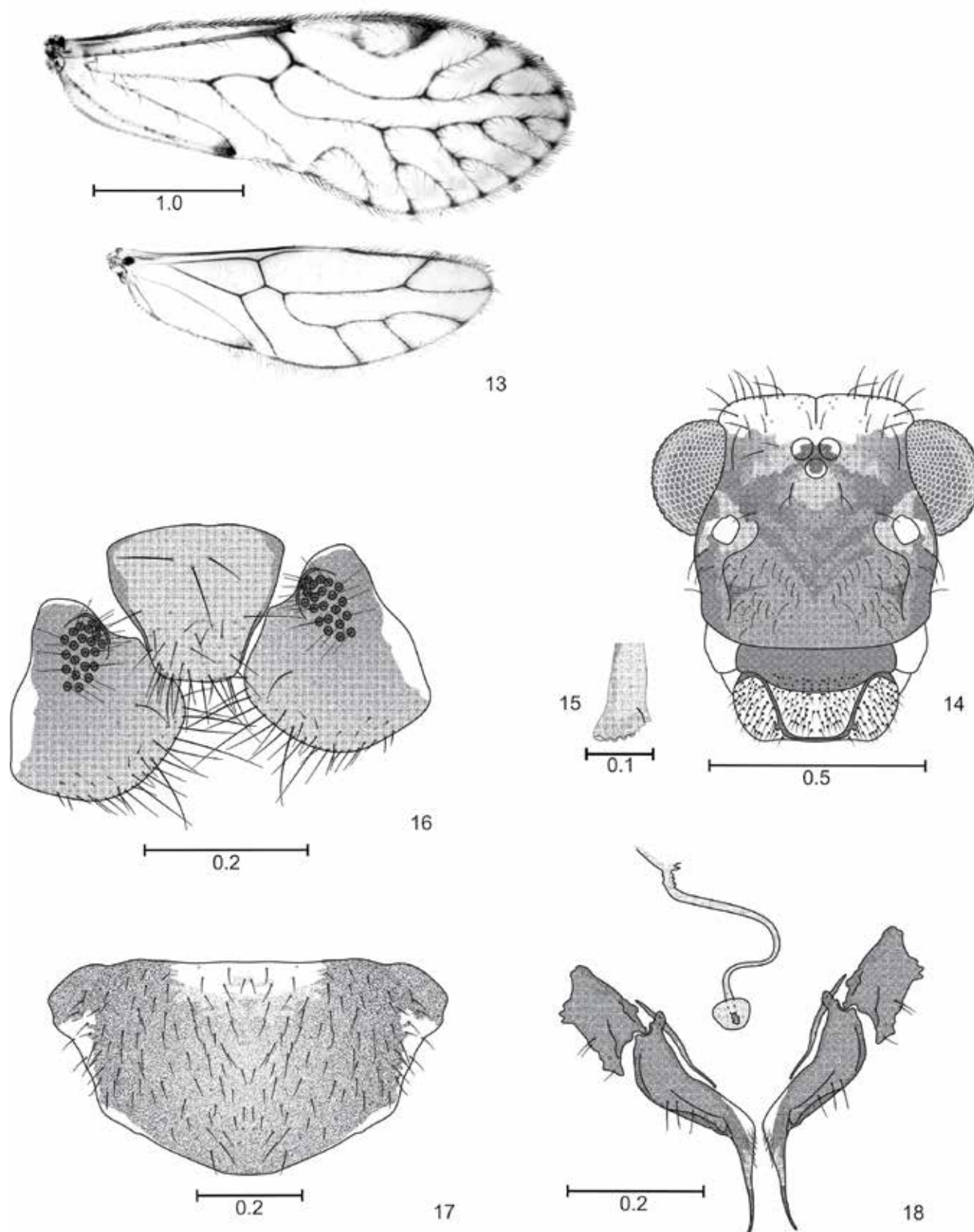
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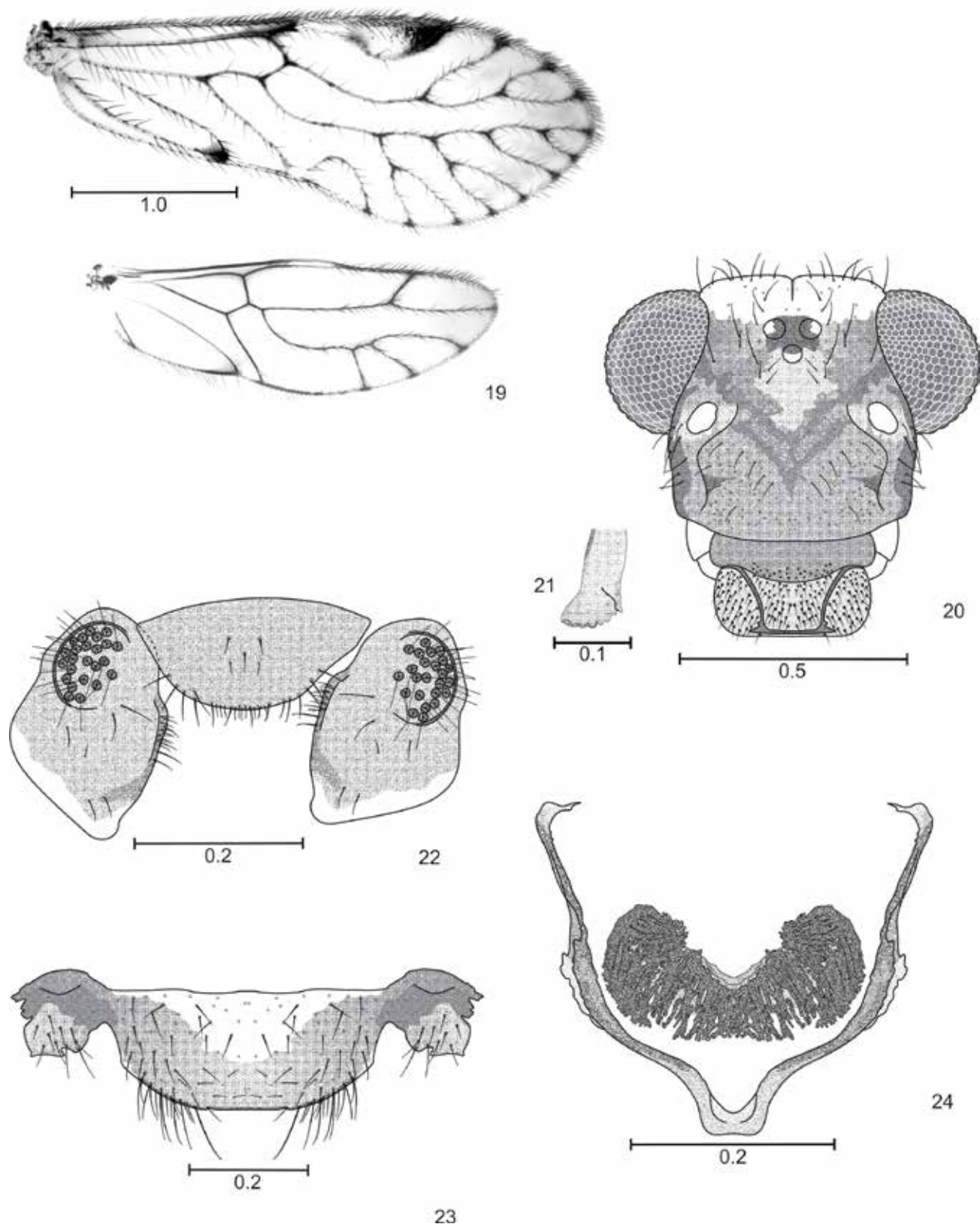
Figures 1–6. *Anastomopsocus vallecucanus* n. g., n. sp. Female. 1. Forewing and hindwing. 2. Front view of head. 3. Lacinial apex. 4. Epiproct and paraprocts. 5. Subgenital plate. 6. Gonapophyses, ventro-lateral parts of clunium and IX sternum with spermatheca.



Figures 7–12. *Anastomopsocus vallecucanus* n. g., n. sp. Male. 7. Forewing and hindwing. 8. Front view of head. 9. Lacinial apex. 10. Epiproct and paraprocts. 11. Hypandrium and ventro-lateral parts of clunium. 12. Phallosome. Scales in mm.



Figures 13–18. *Periepipocus caliensis* n.g., n. sp. Female. 13. Forewing and hindwing. 14. Front view of head. 15. Lacinial apex. 16. Epiproct and paraprocts. 17. Subgenital plate. 18. Gonapophyses, ventro-lateral parts of clunium and IX sternum with spermathecal duct. Scales in mm.



Figures 19–24. *Periepiplocus caliensis* n. g., n. sp. Male. 19. Forewing and hindwing. 20. Front view of head. 21. Lacinal apex. 22. Epiproct and paraprocts. 23. Hypandrium and ventro-lateral parts of clunium. 24. Phallosome. Scales in mm.