

Three new species of *Euplocania* Enderlein (Psocodea, 'Psocoptera', Ptiloneuridae), for the state of Roraima, Brazil

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Abstract. The three new species of Brazilian *Euplocania* are described and illustrated, two species belong in the *amabilis* species group (*Euplocania maraca* sp. nov. and *Euplocania ufr* sp. nov.) and one species belong in the *marginata* species group (*Euplocania macuxi* sp. nov.). Information on species groups, species subgroups and distribution by Brazilian states is included for known species of *Euplocania*.

Keywords. Biodiversity; Epipsocetae; Neotropics; Taxonomy.

INTRODUCTION

Euplocania Enderlein (1910) is one of 12 recent genera in the psocopteran family Ptiloneuridae. It presently includes forty-seven described species, subdivided into 14 species groups. One of these fourteen *Euplocania* species groups is the *amabilis* species group, of García Aldrete *et al.* (2013), characterized by having forewing with broad, pigmented marginal band from R₄₊₅ to A and Cu2 cells, pterostigma angulate, extended towards Rs, hypandrium of three sclerites, a large central sclerite, flanked by two small ones and central sclerite with two lateral posterior projections. It is the most specious species group of *Euplocania* with twenty-one species included (Silva-Neto *et al.*, 2019).

Vinasco-Mondragón *et al.* (2018) based on the morphology of the hypandrium central sclerite and the mesal endophallic sclerite diagnosed six subgroups of species included in the *amabilis* group as follows: subgroup *ariasii*, subgroup *badonneli*, subgroup *lasdelicias*, subgroup *manauensis*, subgroup *picta* and subgroup *tocantina*. The most specious subgroup of the *amabilis* group is subgroup *picta* with seven species included: *Euplocania bujariensis* Silva-Neto, García-Aldrete & Rafael, *Euplocania caldasi* Vinasco-Mondragón, González-Obando & García-Aldrete, *Euplocania ecuatoriana* Vinasco-Mondragón, González-Obando & García-Aldrete, *Euplocania picta* New, *Euplocania pictaoides* García-

Aldrete, *Euplocania pseudopictaoides* Silva-Neto, García-Aldrete & Rafael and *Euplocania vaupesiana* Vinasco-Mondragón, González-Obando & García-Aldrete (Silva-Neto *et al.*, 2019). The subgroup *picta* is characterized by having forewings pterostigma completely dark, projection angulated, postero-lateral processes of the central sclerite of hypandrium medium sized, bifurcated, forming an inverted V and mesal endophallic sclerite with median and usually postero-lateral process (Vinasco-Mondragón *et al.*, 2018). Another subgroup of the *amabilis* group is subgroup *manauensis* with four species included: *Euplocania cearensis* Silva-Neto, García Aldrete & Rafael, *Euplocania manauensis* Vinasco-Mondragón, González & García Aldrete, *Euplocania metensis* Vinasco-Mondragón, González & García Aldrete and *Euplocania rafaelli* Vinasco-Mondragón, González & García Aldrete (Silva-Neto *et al.*, 2019). It is characterized by having postero-lateral processes of the central sclerite of hypandrium anteriorly slightly or distinctly bulged, with rough thorns, posteriorly forming a short to medium sized projection, directed inwards, transverse mesal endophallic sclerite with well-developed mid posterior projection and external parameres with strong and sclerotized internal projection (Vinasco-Mondragón *et al.*, 2018).

Another of these fourteen *Euplocania* species groups is the species group *marginata*, of García Aldrete *et al.* (2013), characterized by having

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Table 1. Brazilian species of *Euplocania*, species group, species subgroup and distribution by Brazilian States (between parenthesis). (—) means that there are no species subgroups in this species group.

Species	Species group	Species subgroup	Distribution
<i>E. ariasi</i> Vinasco-Mondragón, González & García Aldrete	<i>amabilis</i>	<i>ariasi</i>	Brazil: (Goiás)
<i>E. atlantica</i> Silva-Neto	<i>marginata</i>	—	Brazil: (Bahia)
<i>E. badonneli</i> New & Thornton	<i>amabilis</i>	<i>badonneli</i>	Brazil: (Rondônia), Colombia, Peru
<i>E. bujariensis</i> Silva-Neto, García Aldrete & Rafael	<i>amabilis</i>	<i>picta</i>	Brazil: (Acre)
<i>E. cearensis</i> Silva-Neto, García Aldrete & Rafael	<i>amabilis</i>	<i>manausensis</i>	Brazil: (Ceará)
<i>E. cerata</i> New	<i>cerata</i>	—	Brazil: (Amazonas), Peru
<i>E. equorum</i> Vinasco-Mondragón, González & García Aldrete	<i>amabilis</i>	<i>badonneli</i>	Brazil: (Pará)
<i>E. hutchingsi</i> Silva-Neto, García Aldrete & Rafael	<i>amabilis</i>	<i>ariasi</i>	Brazil: (Acre)
<i>Euplocania macuxi</i> sp. nov.	<i>marginata</i>	—	Brazil: (Roraima)
<i>E. manausensis</i> VinascoMondragón, González & García Aldrete	<i>amabilis</i>	<i>manausensis</i>	Brazil: (Amazonas)
<i>Euplocania maraca</i> sp. nov.	<i>amabilis</i>	<i>manausensis</i>	Brazil: (Roraima)
<i>E. picta</i> New	<i>amabilis</i>	<i>picta</i>	Brazil: (Amazonas)
<i>E. pseudopictaoides</i> Silva-Neto, García Aldrete & Rafael	<i>amabilis</i>	<i>picta</i>	Brazil: (Acre)
<i>E. quinquedivisa</i> Silva-Neto, García Aldrete & Rafael	<i>quinquedivisa</i>	—	Brazil: (Amazonas)
<i>E. rafaelli</i> Vinasco-Mondragón, González & García Aldrete	<i>amabilis</i>	<i>manausensis</i>	Brazil: (Paraná)
<i>E. tocantina</i> Mondragón, González & García Aldrete	<i>amabilis</i>	<i>tocantina</i>	Brazil: (Pará)
<i>E. uariniensis</i> Silva-Neto, García Aldrete & Rafael	<i>marginata</i>	<i>marginata</i>	Brazil: (Amazonas)
<i>Euplocania ufrs</i> sp. nov.	<i>amabilis</i>	<i>picta</i>	Brazil: (Roraima)
<i>E. xavieri</i> Silva-Neto, García Aldrete & Rafael	<i>amabilis</i>	<i>tocantina</i>	Brazil: (Amazonas)

forewing with pigmented marginal band from R₄₊₅ to A and Cu₂ cells, pterostigma rounded, not angulate nor extended towards Rs, hindwing with pigmented marginal band from R₄₊₅ to A and Cu₂ cells and hypandrium of three sclerites, central one large, with two medians, stout, acuminate posterior projections. Actually includes only three species: *Euplocania marginata* New & Thonton, *Euplocania uariniensis* Silva-Neto, García Aldrete & Rafael and *Euplocania atlântica* Silva-Neto (Silva-Neto et al., 2019, Silva-Neto, 2021, Vinasco-Mondragón et al., 2018).

As far as known, *Euplocania* is restricted to the Neotropical region and its species occur in Nicaragua, Colombia, Peru, Brazil, Ecuador and Paraguay (Silva-Neto et al., 2019). Brazil is the second-most diverse in terms of *Euplocania* species, with sixteen known species distributed to seven Brazilian States (Table 1) (Silva-Neto & García Aldrete, 2020, Silva-Neto, 2021). Actually, the subgroup *picta* is represented in Brazil by three species (*E. bujariensis*, *E. picta* and *E. pseudopictaoides*), the subgroup *manausensis* by three species (*E. cearensis*, *E. manausensis* and *E. rafaelli*) and the *marginata* group by two species (*E. uariniensis* and *E. atlantica*) (Table 1).

Recently, one of us (AFP) found in a miscellany of insects preserved in 80% ethanol, at the Universidade Federal of Roraima, three different specimens of *Euplocania* collected in Brazilian states of Roraima. Two of these *Euplocania* specimens belonging to the *amabilis* species group, one belonging of the subgroup *picta* and not recognizable as any of the known species this subgroup has; another specimen belonging to the subgroup *manausensis* and not assignable to any of the known species of this subgroup. The third specimen of *Euplocania* found belonging of the *amabilis* species group and not recognizable as any of the known species of this species group. The purpose of this paper is to describe and illustrate, based on male specimens, two new species for group *amabilis* and one species for group *marginata*.

MATERIAL AND METHODS

Three male specimens were available for study. They were dissected in 80% ethanol, and their parts were mounted on glass slides in Canada balsam. Standard measurements (in µm) were taken with a filar micrometer. Abbreviations of parts measured are as follows: **FW and HW**: right fore- and hind- wing lengths; **F, T, t1, t2 and t3**: lengths of femur, tibia and tarsomeres 1, 2 and 3 of right hind leg; **f1...fn**: lengths of flagellomeres 1...n of right antenna; **Mx4**: length of fourth segment of right maxillary palpus; **IO**: minimum distance between compound eyes in dorsal view of head; **D and d**: antero-posterior and transverse diameter, respectively, of right compound eye in dorsal view of head; **PO**: d/D. The specimens studied were stored in CD boxes, as described by Silva-Neto et al. (2016).

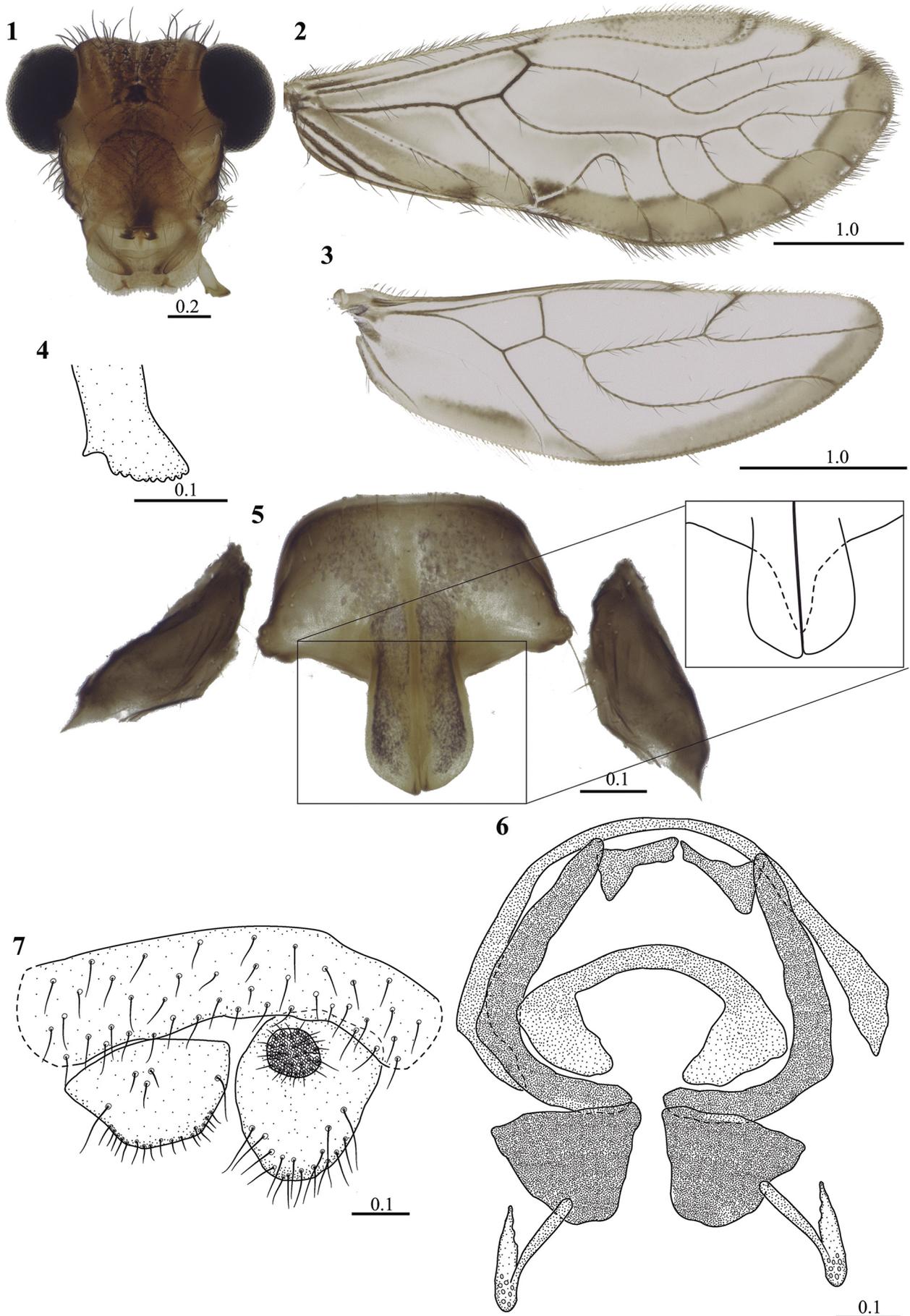
Photographs of the parts mounted were taken with a Leica DFC500 digital camera attached to a Leica M205C stereomicroscope, connected to a computer with the Leica Application Suite LAS V3.6 software, which includes an Auto-Montage module (Syncroscopy software). The types will be deposited in the Collection of the Instituto Nacional de Pesquisas da Amazônia, in Manaus, Amazonas, Brazil (INPA).

RESULTS

Euplocania macuxi sp. nov. (Figs. 1-7)

Male

Diagnosis: Belonging in *marginata* species group of García Aldrete et al. (2013). Differing from the known species of this group, in having central sclerite of hypandrium almost straight anteriorly, posteriorly with a median



Figures 1-7. *Euplocania macuxi* sp. nov. (Holotype male). (1) Front view of head. (2) Forewing. (3) Hindwing. (4) Lacinial tip. (5) Hypandrium. (6) Phallosome. (7) Clunium, right paraproct and epiproct. Scales in mm.

stout triangular process, underlaid by a stout bifid posterior process, with each arm machete shaped, widening posteriorly, distally curved slightly inwards; mesal sclerite of phallosome U-shaped, anteriorly convex, narrow, posteriorly widening with postero-lateral corners projected, these almost triangular, three pairs of endophallic sclerites, with an antero-lateral pair, boomerang shaped, almost the same width along its entire length and with a posterior pair, broad, trapeziform with sides converging to almost straight posterior border.

Color (in 80% ethanol): Compound eyes black, ocelli hyaline, with ochre centripetal crescents, head pattern (Fig. 1). Scape and pedicel brown, f1-f3 pale brown. Legs with coxae and trochanters brown, femora pale brown; tibiae proximally dark brown, then pale brown and dark brown distally; tarsomere 1 pale brown, tarsomeres 2-3 brown. Forewings veins brown, a wide, marginal pigmented band from R_{4+5} to A1 and Cu2 cells, with a small, hyaline area on each side of vein ends, at wing margin, from M1 to M4; Rs and crossvein Rs-M dark brown. Pterostigma peripherally pale brown, with small irregular brown spots and with a transverse brown spot distally as a false vein (Fig. 2). Hindwings with a homogeneous brown band from R_{4+5} to A1; veins brown (Fig. 3).

Morphology: Head with vertex slightly concave, emarginated; compound eyes without interommatidial setae (Fig. 1). Outer cusp of lacinial tip broad, with eight denticles (Fig. 4). Forewing pterostigma basally narrow, wider in the middle, narrowing posteriorly, areola postica tall, wide, with round apex, slanted and sinuous posteriorly. Rs stem almost straight, R_{2+3} almost straight, R_{4+5} sinuous; M stem slightly concave proximally, then almost straight, with four primary branches, M_1 almost straight, M_2 - M_4 sinuous (Fig. 2). Hindwing Rs, R_{2+3} and R_{4+5} straight, M sinuous (Fig. 3). Hypandrium of three sclerites, a large central sclerite almost straight anteriorly, with posterior corners almost triangular, posteriorly with a median stout triangular process, underlaid by a stout bifid posterior process, with each arm machete shaped, widening posteriorly, distally curved slightly inwards; side sclerites almost lozenge, narrowing at the ends and, posteriorly distally acuminate, setae as illustrated (Fig. 5). Phallosome (Fig. 6) with side struts basally fused, U-shaped, widening posteriorly and distally almost triangular. External parameres V-shaped, with a field of pores distally, with inner arm tubular and distally rounded, outer arms posteriorly rounded and anteriorly acuminate. Mesal sclerite wide, almost U-shaped, anteriorly convex, narrow, posteriorly widening with postero-lateral corners projected, these almost triangular. Three pairs of endophallic sclerites, an antero-mesal pair, small, strongly sclerotized, almost touching in the middle of endophallus, narrow basally, with sides widening posteriorly and almost triangular; an antero-lateral pair, elongated, boomerang shaped, almost the same width along its entire length, distally curved inward; a posterior pair, strongly sclerotized, broad, trapeziform with sides converging to almost straight posterior border, located

between the antero-lateral pair and the external parameres. Epiproct (Fig. 7) broad, sides converging to almost straight posterior border, three mesal setae near anterior border, setal fields on posterior edge and one macroseta on each side. Paraprocts broadly, elliptic; sensory fields with 29-30 trichobothria on basal rosettes, setae as illustrated (Fig. 7).

Measurements (in microns): FW: 4791, HW: 3019, F: 1307, T: 1963, t1: 807, t2: 92, t3: 134, f1: 910, f2: 870, f3: 562, Mx4: 311, IO: 571, D: 511, d: 337, PO: 0.66.

Material examined: Holotype male (INPA). BRAZIL. Roraima. Amajari. Tepequém. 03°24'11.5"N, 61°39'13.7"W. 23.v-03.vi. 2017. Malaise grande. Rede Bia. R. Boldrini & J.A. Rafael.

Etymology: Macuxi is a noun that applies to the South American indigenous population, located in the circum-Roraima region of the Brazilian state of Roraima. Currently, Macuxi is used informally to define the natives of Roraima. By extension, it is given to this species as a noun in apposition, and makes reference to the Brazilian state of origin of this species.

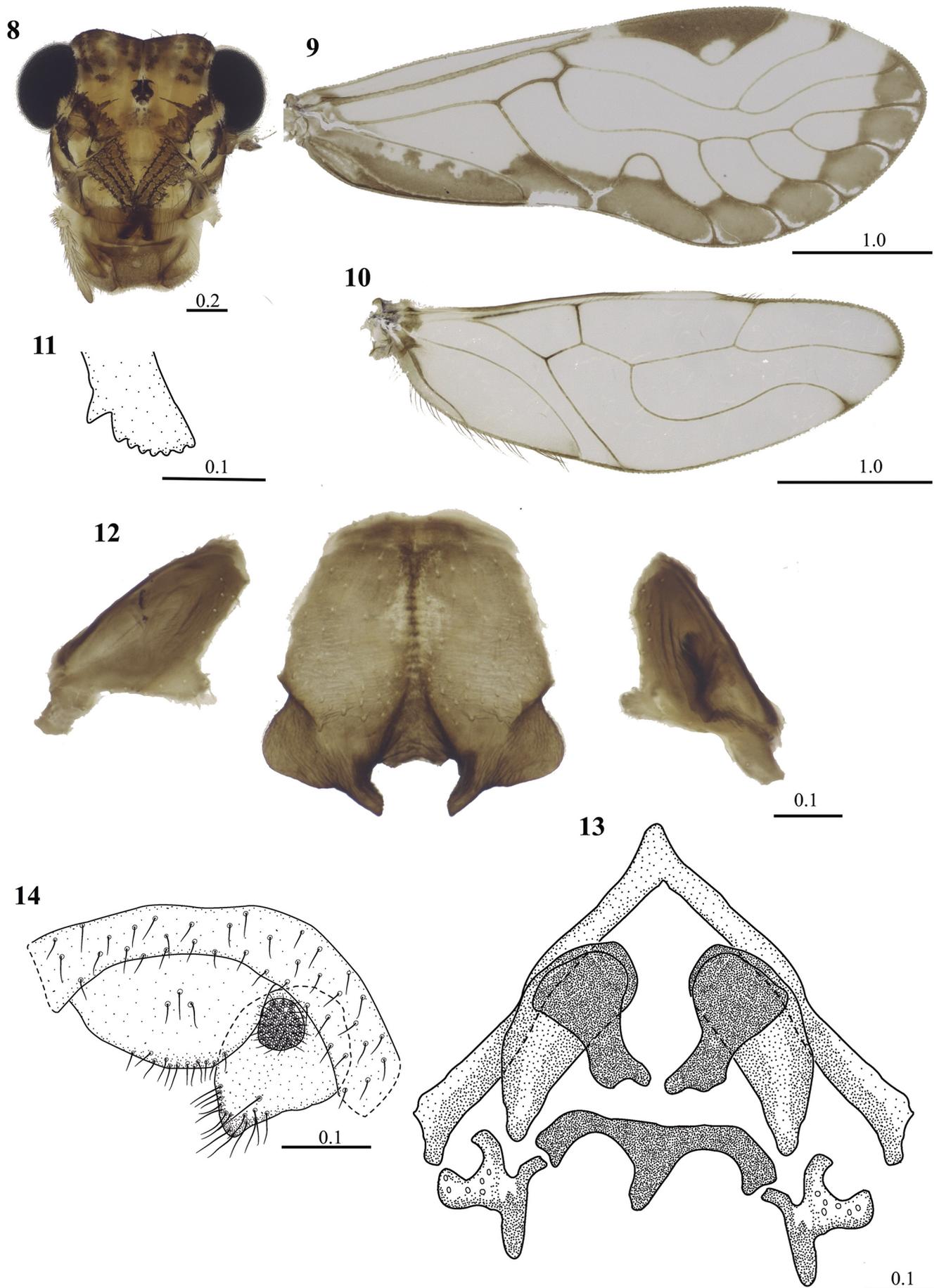
***Euplocania maraca* sp. nov.** (Figs. 8-14)

Male

Diagnosis: Belonging in species group *amabilis* of García Aldrete *et al.* (2013) and subgroup *manausensis* of Vinasco-Mondragón *et al.* (2018). Differing from the known species of this subgroup, in having postero-lateral processes of the central sclerite of hypandrium anteriorly distinctly bulged, not sinuous, leaving between them two small triangular projections, by having mesal endophallic sclerite with median process narrowing distally, almost triangular, with postero-lateral corners projected, these almost rectangular, posteriorly with a slight indentation each.

Color (in 80% ethanol): Compound eyes black, ocelli hyaline, with ochre centripetal crescents, head pattern (Fig. 8). Scape dark brown, pedicel yellow, f1 pale yellow. Mx4 yellow with apex dark brown. Legs with coxae, trochanters and femora brown, tibiae yellow with apex dark brown; tarsomere 1 yellow with end dark brown, tarsomeres 2-3 dark brown. Forewings veins brown, with a dark brown spot at wing margin, a marginal pigmented band from R_{4+5} to A2 with two hyaline areas, boomerang shaped, on each side of the distal ends of the veins at wing margin; Rs and crossvein Rs-M dark brown, R_{2+3} with a brown spot distally at wing margin. Pterostigma dark brown, with a hyaline window, almost elliptical at lower angle (Fig. 9). Hindwings (Fig. 10), almost hyaline, veins brown, each with a brown spot distally at wing margin.

Morphology: Compound eyes without interommatidial setae (Fig. 8). Outer cusp of lacinial tip broad, with



Figures 8-14. *Euplocania maraca* sp. nov. (Holotype male). (8) Front view of head. (9) Forewing. (10) Hindwing. (11) Lacinial tip. (12) Hypandrium. (13) Phallosome. (14) Clunium, right paraproct and epiproct. Scales in mm.

six denticles (Fig. 11). Forewing pterostigma angulate, almost triangular, areola postica tall, with round apex, slanted posteriorly, Rs stem almost straight, R_{2+3} and R_{4+5} sinuous; M stem slightly concave proximally, then almost straight, with four primary branches, M_1 straight, M_2 - M_4 sinuous (Fig. 9). Hindwing Rs and R_{2+3} straight, and R_{4+5} convex in the middle, M sinuous (Fig. 10). Hypandrium of three sclerites, a large central sclerite with postero-lateral processes anteriorly distinctly bulged, not sinuous, leaving between them two small triangular projections; side sclerites large, broadly, posteriorly forked (Fig. 12). Phallosome (Fig. 13) with side struts basally fused, V-shaped, widening posteriorly and distally almost triangular. External parameres stout, K-shaped, with pores in outer arm. Two pairs of endophallic sclerites, antero-mesal pair strongly sclerotized, rounded basally, almost square posteriorly, with apex slightly forked; an antero-lateral pair stout, elongate, proximally wide, narrowing posteriorly, blunt ended. Epiproct wide basally, with sides converging to straight posterior border, three setae mesally, other setae as illustrated (Fig. 14). Paraprocts broad, wide basally, posteriorly narrowing at the end, with apex rounded, sensory fields with 30-31 trichobothria on basal rosettes, setae as illustrated (Fig. 14).

Measurements (in microns): FW: 4539, HW: 2915, F: 1342, T: 1846, t1: 712, t2: 98, t3: 149, f1: 528, Mx4: 320, IO: 645, D: 476 d: 327, PO: 0.68.

Material examined: Holotype male (INPA). BRAZIL. Roraima. Alto Alegre. Estação ecológica Maracá. 03°21'59"N, 61°26'04"W. 10-25.xii. 2015. Malaise grande. Rede Bia. R. Boldrini & J.A. Rafael.

Etymology: The specific epithet is given to this species as a noun in apposition and refers to the ecological station Maraca in Brazilian state of Roraima, where the holotype was collected.

***Euplocania ufrr* sp. nov.**
(Figs. 15-21)

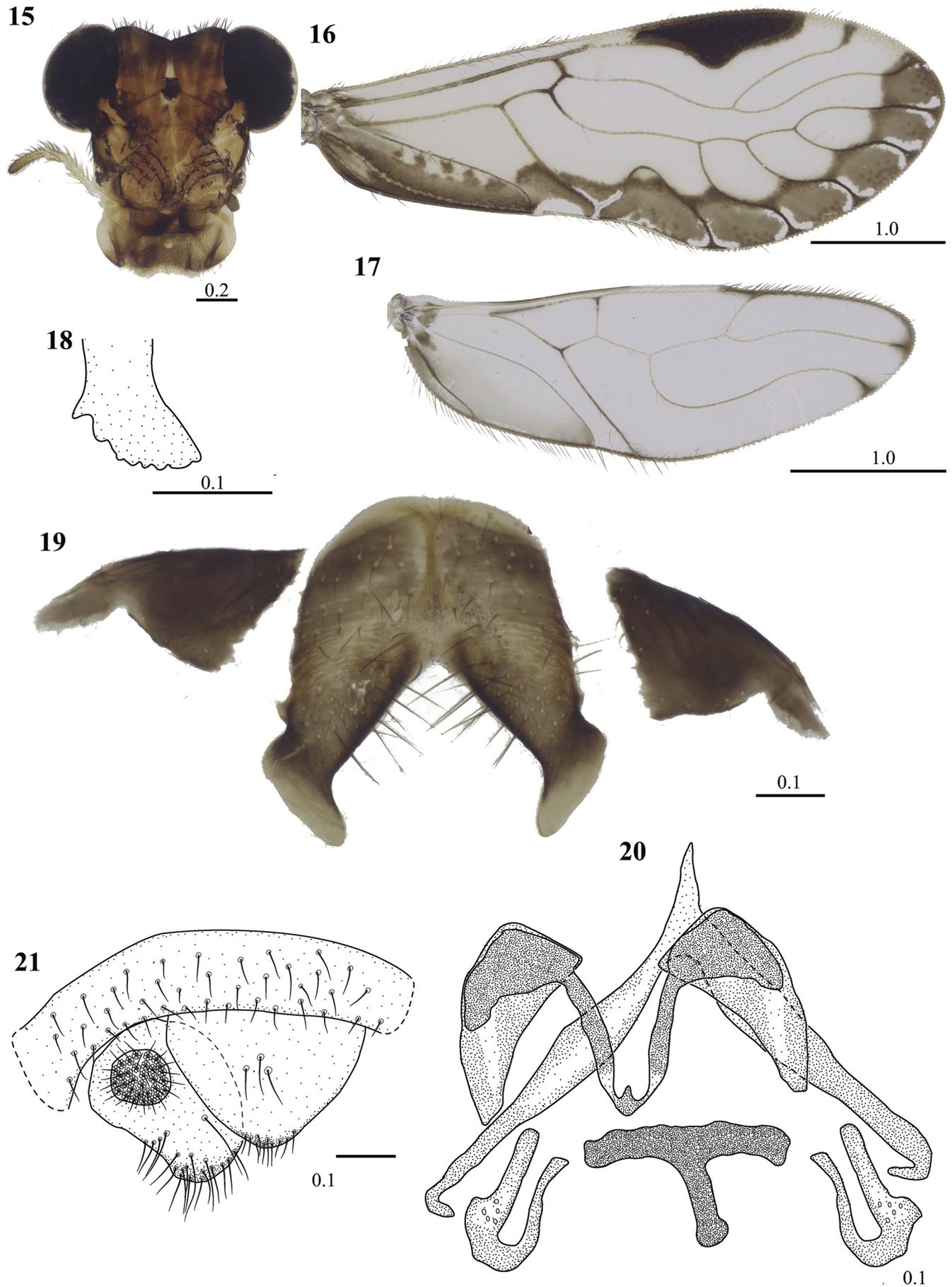
Male

Diagnosis: Belonging in species group *amabilis*, of García Aldrete *et al.* (2013) and subgroup *picta*, of Vinasco-Mondragón *et al.* (2018). It is close to *E. bujariensis* in the general shape of the hypandrium, especially by having postero-lateral processes of the central sclerite of hypandrium as long as its antero-posterior length, instead the anteroposterior length of the basal part of the hypandrium two or three times longer than the length of the its postero-lateral processes as occurs in the other six species included in this subgroup and by having the lateral posterior projections of the hypandrium with the apex of the inner margin not acuminate. Differing from *E. bujariensis* by having pterostigma without a small hyaline window at lower angle, by having basal part of the hypandrium semi oval instead

of sub square as in *E. bujariensis*, by having distal part of postero-lateral processes of the hypandrium about three times longer than it is wide, rather than just twice as long as it is wide as in *E. bujariensis*, and by having mesal endophallic sclerite without postero-lateral processes, with median process widening distally (compare Figs. 16, 19 and 20 in this paper with figs. 2, 6 and 7 in Silva-Neto *et al.*, 2019).

Color (in 80% ethanol): Compound eyes black, ocelli hyaline, with ochre centripetal crescents, head pattern (Fig. 15). Scape and pedicel dark brown, f1-f3 yellow. Mx4 yellow with apex brown. Legs with coxae, trochanters and femora pale yellow, tibiae pale brown, with apex dark brown; tarsomere 1 yellow, tarsomeres 2-3 dark brown. Forewing veins brown, with a dark brown spot at wing margin; a marginal pigmented band from R_{4+5} to A2 with two hyaline areas, boomerang shaped, on each side of veins, distally at wing margin, from R_{4+5} to Cu1a; Rs and crossvein Rs-M dark brown. Pterostigma completely dark brown (Fig. 16). Hindwings (Fig. 17), almost hyaline, veins brown, each with a brown spot distally at wing margin.

Morphology: Head with vertex concave in the middle, slightly above the level of the upper border of the compound eyes, these without interommatidial setae (Fig. 15). Outer cusp of lacinial tip broad, with five denticles (Fig. 18). Forewing pterostigma angulate, projected in the middle towards Rs, areola postica tall, with round apex; Rs stem almost straight, R_{2+3} and R_{4+5} sinuous; M stem slightly concave proximally, then almost straight, with four primary branches, M_1 almost straight, M_2 - M_4 sinuous (Fig. 16). Hindwing Rs straight, R_{2+3} straight, R_{4+5} slightly concave proximally, then almost straight, M stem sinuous (Fig. 17). Hypandrium of three sclerites, a large central sclerite, basally semi-oval, with a small acuminate projection on each side, anterior to each postero-lateral processes, these last with distal part about three times longer than it is wide, with the apex of the inner margin not acuminate, setae as illustrated (Fig. 19). Phallosome (Fig. 20) with side struts basally fused, V-shaped, widening in the middle and narrowing at the ends, distally curved inwards. External parameres U-shaped with a field of pores in the middle. Mesal sclerite wide, strongly sclerotized, tripartite into three equal parts, transversely y-shaped, with a central projection in the middle, widening at the end. Two pairs of endophallic sclerites, an antero-mesal pair fused in the middle of the phallosome, giving rise to a type of second mesal sclerite, anteriorly wide, triangular, posteriorly narrowing, V-shaped, ending in the possible fusion zone, it with a small acuminate projection; an antero-lateral pair wide basally, with sides narrowing posteriorly, with apex truncate. Epiproct wide basally, with sides converging to triangular posterior border, three setae mesally, other setae as illustrated (Fig. 21). Paraprocts broad, wide basally, posteriorly narrowing at the end, with apex straight, sensory fields with 30-31 trichobothria on basal rosettes, setae as illustrated (Fig. 21).



Figures 15-21. *Euplocania ufr* sp. nov. (Holotype male). (15) Front view of head. (16) Forewing. (17) Hindwing. (18) Lacinal tip. (19) Hypandrium. (20) Phallosome. (21) Clunium, left paraproct and epiproct. Scales in mm.

Measurements (in microns): FW: 4848, HW: 3285, F: 1422, T: 2041, t1: 837, t2: 95, t3: 179, f1: 845, f2: 804 f3: 710, Mx4: 325, IO: 537, D: 550 d: 372, PO: 0.67.

Material examined: Holotype male (INPA). BRAZIL. Roraima. Amajari. Tepequém. Sesc. Igarapé Cocal. 03°45'12.00"N, 61°42'42.00"W. Pensilvânia. 03-05.x.2020. Boldrini, Oliveira & Pereira.

Etymology: The specific epithet is an invariable combination of letters in apposition, corresponding to the acronym of the Universidade Federal de Roraima (UFRR), an emblematic educational and research institution of the state of Roraima.

DISCUSSION

The three *Euplocania* species here described raise to 50 the number of species in the genus, and raise to 19 the species recorded in Brazil (38% of the total), two of them (*E. badonneli* New & Thornton and *E. cerata* New) shared with Peru, and one (*E. cerata* New) shared with Colombia; the rest are possibly endemic to Brazil (Table 1). Among the regions of Brazil, the Northern region is the most diverse in *Euplocania* species (fifteen species) with the state of Amazonas represented by six species (Table 1). The three new species of *Euplocania* described in this paper, are the northernmost record in Brazil for *Euplocania* and the first record of this genus in the Brazilian state of Roraima.

The *Marginata* species group is diagnosed by characteristics of the wings and by characteristics of hypandrium (see diagnose above). However, as mentioned by Silva-Neto (2021), the authors García Aldrete *et al.* (2013) illustrated the hypandrium and the forewing of the unknown male of *E. marginata* (see figs. 16, 17 in García Aldrete *et al.*, 2013), but the authors did not provide a taxonomic description of this male. In this way the phallosome and other morphological details of the *E. marginata* male remains unknown. Despite the lack of knowledge about the phallosome of the *E. marginata*, *Euplocania macuxi* **sp. nov.** easily differs from it and all other species of the *marginata* group by having an autopomorphic hipandrium as described in its diagnosis.

Future phylogenetic studies, using morphological and molecular data will be necessary to test the monophyly of these groups and subgroups and to understand the *Euplocania* evolution.

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CONFLICTS OF INTEREST: Authors declare there are no conflicts of interest.

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