First records of *Bosminopsis brandorffi* Rey et Vasquez, 1989 and *Chydorus parvireticulatus* Frey, 1987 (Cladocera) from Colombia

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ABSTRACT: Analysis of plankton samples from the lagoonal system La Española, Orinoquía region in Colombia yielded 2 new records of cladocerans: *Bosminopsis brandorffi* Rey et Vásquez, 1989 and *Chydorus parvireticulatus* Frey, 1987 (Crustacea: Cladocera). Morphological characters of *B. brandorffi* conforms to the original descriptions and can easily be identified by its important diagnostic characters: 1) preanal margin of postabdomen forming a long and robust projection; 2) ocular dome strongly projected; 3) large compound eye. *C. parvireticulatus* can be discriminated from its congeners in the *faviformis*-group: 1) anal margin of postabdomen longer than preanal and postanal porton, 2) valve covered by over 200 small honeycomb meshes, 3) the tip of rostrum acute and tapered. Both species are recorded for the first time in Colombia in the Orinoquia region.
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KEY WORDS: Orinoquía, new record, taxonomy, microcrustaceans.

Первые находки *Bosminopsis brandorffi* Rey et Vasquez, 1989 и *Chydorus parvireticulatus* Frey, 1987 (Cladocera) из Колумбии

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РЕЗЮМЕ: В пробах из системы озер Ла Эспаньола, Оринокский регион Колумбии, обнаружено два новых для региона вида ветвистоусых ракообразных: *Bosminopsis brandorffi* Rey et Vásquez, 1989 и *Chydorus parvireticulatus*, Frey, 1987 (Crustacea: Cladocera). Все морфологические признаки обнаруженных особей *B. brandorffi* соответсвуют первоописанию, основные диагностические признаки вида: 1) преанальный край постабдомена образует длинный массивный вырост; 2) сильно выпуклый глазной купол; 3) крупный сложный глаз. *C. parvireticulatus* четко отличается от других видов группы *faviformis* следующими признаками: 1) анальный край постабдомена длиннее, чем его преанальная и постанальная части; 2) створки несут более 200 ячеек; 3) вершина рострума коническая, заостренная. Оба вида впервые отмечены на территории Колумбии.
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КЛЮЧЕВЫЕ СЛОВА: Оринокийский регион, новая находка, таксономия, микроракообразные.

Introduction

Cladocera is a superorder of Branchiopoda (Crustacea) with animals ranging usually from 0.2 to 5.0 mm in size. They play a significant role in the recycling of nutrients and transfer of energy from primary producers to the top trophic levels in aquatic food webs (Hudson *et al*., 1999; Choedchim *et al*., 2017) but they also are important in aquaculture and ecotoxicological studies (Gogoi *et al.*, 2016; Pociecha *et al*., 2019; Macêdo *et al*., 2022). This superorder is distributed all around the world (Forró *et al*., 2008; Bhandarkar, Paliwal, 2021) principally in freshwater, but they can be also found in marine and estuarine systems (Atienza *et al*., 2006). Some genera of this order can chiefly dwell in the limnetic region such as: *Daphnia* O.F. Müller, 1785, *Moina* Baird, 1850 and *Diaphanosoma* Fryer, 1968 (Bhandarkar, Paliwal, 2021). Others are typical of the benthos*: Ilyocryptus* Sars, 1862, *Leydigiopsis* G.O. Sars, 1901*, Leydigia* Kurz, 1875 (Kotov, 2006)*.* Some of them can be found (but not exclusively) in bromeliads: *Alona* Baird, 1843, *Disparalona* Fryer, 1968 (Smirnov, 1988; Neretina *et al*., 2019) and sponges: *Flavalona* Sinev et Dumont, 2016 (Ghidini, Santos-Silva, 2011). However, most of cladocerans are associated with the macrophytes: *Chydorus* Leach, 1816*, Coronatella* Dybowski et Grochowski, 1894*, Bergamina* Elmoor-Loureiro, Santos-Wisniewski et Rocha, 2013 (Fuentes-Reinés *et al*., 2012, 2023a, 2024). This superorder comprises about 700 species worldwide (Forró *et al*., 2008), of these 220 are distributed in the Neotropical region (Sousa *et al*., 2022).

In Colombia, the knowledge of the cladoceran fauna is incomplete, probably owing to the scarcity of Colombian specialists; hitherto 126 species have been reported to date including two new records reported herein (Fuentes-Reinés *et al.*, 2023b, present data). Nevertheless, the knowledge of the diversity in this group has maintained constant progress during the last decades (Fuentes-Reinés *et al*., 2018, 2019, 2021, 2022, 2023a, b, 2024).

The aim of this paper is to report on our finding of *Bosminopsis brandorffi* Rey et Vásquez, 1989 and *Chydorus parvireticulatus* Frey, 1987 for the first time in Colombia.

Materials and methods

Our samples were taken from limnetic zone and aquatic vegetation in May 2023 by horizontal dragging using a plankton net (with the mesh size of 55 μm) and preserved in 96% ethanol. In the laboratory, samples were stained with Rose Bengal and concentrated up to 50 mL volume. Specimens were sorted from all the samples, transferred to 70% ethanol, and then

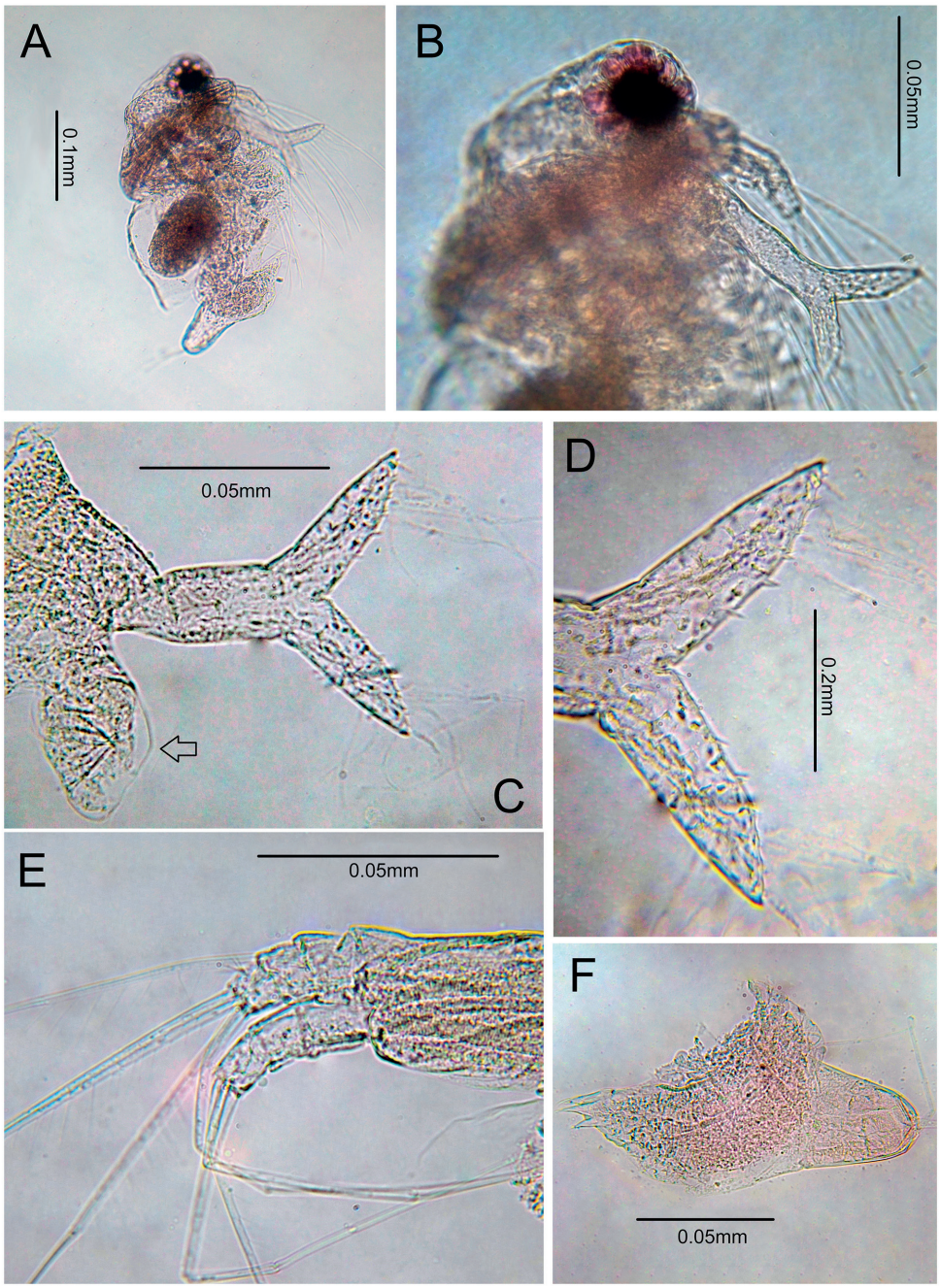

Fig. 1. *Bosminopsis brandorffi* Rey et Vásquez, 1989, parthenogenetic female from lagoon La Española. A — habitus; B — rostrum; C — antenna I and labrum; D — distal portion of antenna I; E — antenna II; F — postabdomen.

Рис. 1. *Bosminopsis brandorffi* Rey et Vásquez, 1989, партеногенетическая самка из озера Ла Эспаньола. A — внешний вид; B — рострум; C — антенна I и лябрум; D — дистальная часть антенны I; E — антенна II; F — постабдомен.

processed for taxonomical identification, including examining the whole specimen and dissection of selected appendages. The dissection was made by sharp tungsten needles. The dissected appendices were mounted in a drop of glycerin on slides and sealed with Canada balsam.

The morphology of appendages and other structures was examined using a high-power compound microscope at 1000× magnification. Images were taken with a Kodak Easy Share C140 digital camera attached to the microscope. The specimens were placed in a lateral position and measured from the anterior end of the rostral area to the posterior margin of the valve using an eyepiece micrometer. The description style follows Van Damme (2016), splitting the anatomic structures into general habitus, carapace, cephalic, thoracic limbs, and postabdomen. The enumeration of limb setae follows the criteria of Kotov (2000a, b) and Kotov *et al.* (2010).

Identifications of these species were made according to the publications of Rey & Vásquez (1989), Kotov & Garibian (2021), Frey (1987), and Smirnov (1996). The vouchers were deposited at the Museo de Historia Natural Unillanos (MHNU), Colombia, where they are available for consultation and/or further examination.

Results

Class Branchiopoda Latreille, 1817
Order Anomopoda Sars, 1865
Family Bosminidae Baird, 1845
sensu Sars, 1865
Genus *Bosminopsis* Richard, 1895
Bosminopsis brandorffi Rey et Vásquez, 1989
Fig. 1.

MATERIAL EXAMINED. Three adult female specimens collected by JMV from lagoon La Española located in Meta, Colombia (4°20′36.6″ N, 72°03′35.2″W) in May of 2023.

REMARKS: At present, five valid species of the genus *Bosminopsis* have been accepted worldwide (Kotov, Garibian 2021; Garibian *et al*., 2021): *B. zernovi* Linko, 1901, *B. negrensis* Brandorff, 1976, *B. deitersi* Richard, 1895, *B. brandorffi* Rey et Vásquez, 1989, and *B. africanus* (Daday, 1908). Except for *B. africanus*, these species occur in the Neotropics. Of these, only *B. deitersi* has been previously recorded in Colombia (Kotov, Fuentes-Reinés, 2015).

B. brandorffi was described originally from the Orinoquía and Amazon systems (Brazil and Venezuela) (Rey, Vásquez, 1989), then redescribed by Kotov & Garibian (2021) from Brazil. This species was included in the genus *Bosminopsis* based on: (1) postabdomen tapering distally, with a strong basal spine; (2) proximal portion of antennae I fused; (3) exopod and endopod of antenna II 3-segmented (Kotov, Garibian, 2021).

The studied specimens (three adult females) conform to the descriptions of Rey & Vásquez (1989) and Kotov & Garibian (2021) and can be readily identified by its important diagnostic characters such us: 1) preanal margin of postabdomen forming a long and robust projection; 2) ocular dome strongly projected; 3) large compound eye.

General shape ovoid, with a slight depression at posterior head portion (Fig. 1A), body length of the Colombian female specimens = 322–336 μm (n = 3, average length = 331 μm). Postero-dorsal angle of valve with a slightly ovoid projection, head in lateral view with a strong ocular dome, eye large (Fig. 1B), labrum elongated and wide at the middle portion, apex ovoid (arrowed in Fig. 1C)

Antenna I robust, basal portions of two antennae I fused to the rostrum, but both lateral portions divergent (Fig. 1C), distal marginal portion with small denticles and long sensory papillae (Fig. 1D). Antenna II with setal formula: 0-0--3/1-1-3 (Fig. 1E). Postabdomen bulged in postanal margin, preanal margin ending as a long and robust projection, postabdominal claw with a strong basal spine, both claw and basal spine slightly curved (Fig. 1F)

The specimens from Colombia agree with descriptions by Kotov & Garibian (2021); nevertheless, some subtle differences were observed: 1) labrum wider at the middle portion in Colombia specimens (Fig. 1C) than Brazilian populations (Rey, Vásquez, 1989, fig. 4, Kotov, Garibian, 2021, fig. 5C), 2) postero-dorsal angle of valve with an slightly ovoid projection in the Colombian specimens (Fig. 1A) whereas in Brazil populations the postero-dorsal angle was rounded (Rey, Vásquez, 1989, figs 1,2, Kotov, Garibian, 2021, fig. 5A). Despite these differences, we do not believe that the Colombian populations belong to a separate species.

DISTRIBUTION: *Bosminopsis brandorffi* is considered a Neotropical species; it has been recorded in Venezuela and Brazil (Rey, Vázquez, 1989; Kotov, Garibian, 2021). It is the first report from Colombian waters.

Family Chydoridae Dybowski
et Grochowski, 1894
Subfamily Chydorinae Dybowski
et Grochowski, 1894
Genus *Chydorus* Leach, 1816
Chydorus parvireticulatus Frey, 1987
Figs 2–3.

MATERIAL EXAMINED. Four adult female specimens collected by JMV from lagoon La Española located in Meta, Colombia (4°20′36.6″N, 72° 03′35.2″W) in May of 2023.

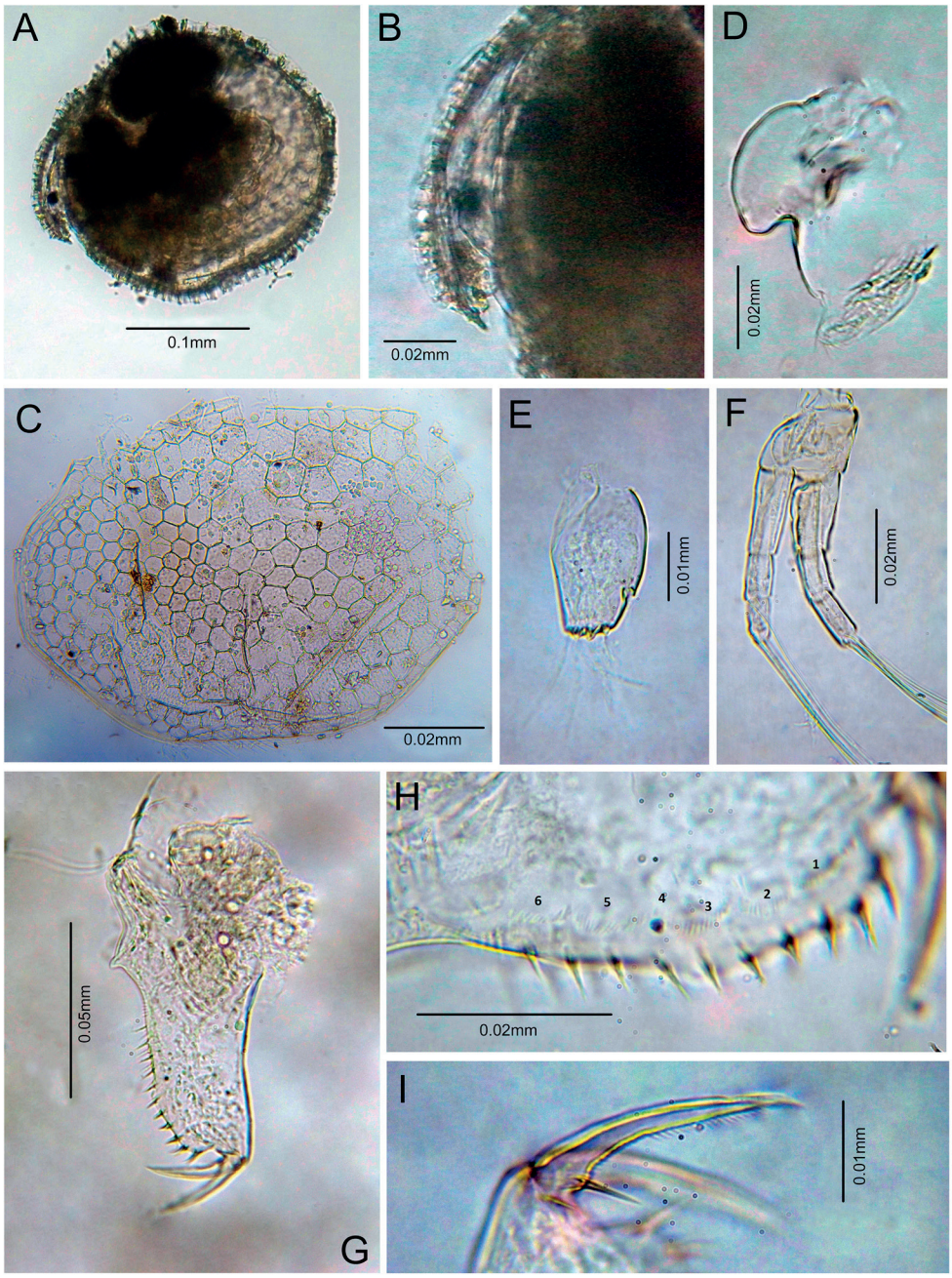

Fig. 2. *Chydorus parvireticulatus* Frey, 1987, parthenogenetic female from lagoon La Española. A — habitus; B — rostrum; C — valve; D — labrum; E — antenna I; F — antenna II; G — postabomen; H — lateral fascicles of postabdomen (given as 1–6); I — postabdominal claw.

Рис. 2. *Chydorus parvireticulatus* Frey, 1987, партеногенетическая самка из озера Ла Эспаньола. A — внешний вид; B — рострум; C — створка; D — лябрум; E — антенна I; F — антенна II; G — постабдомен; H — латеральные группы сетул постабдомена (пронумерованы цифрами 1–6); I — зубец постабдомена.

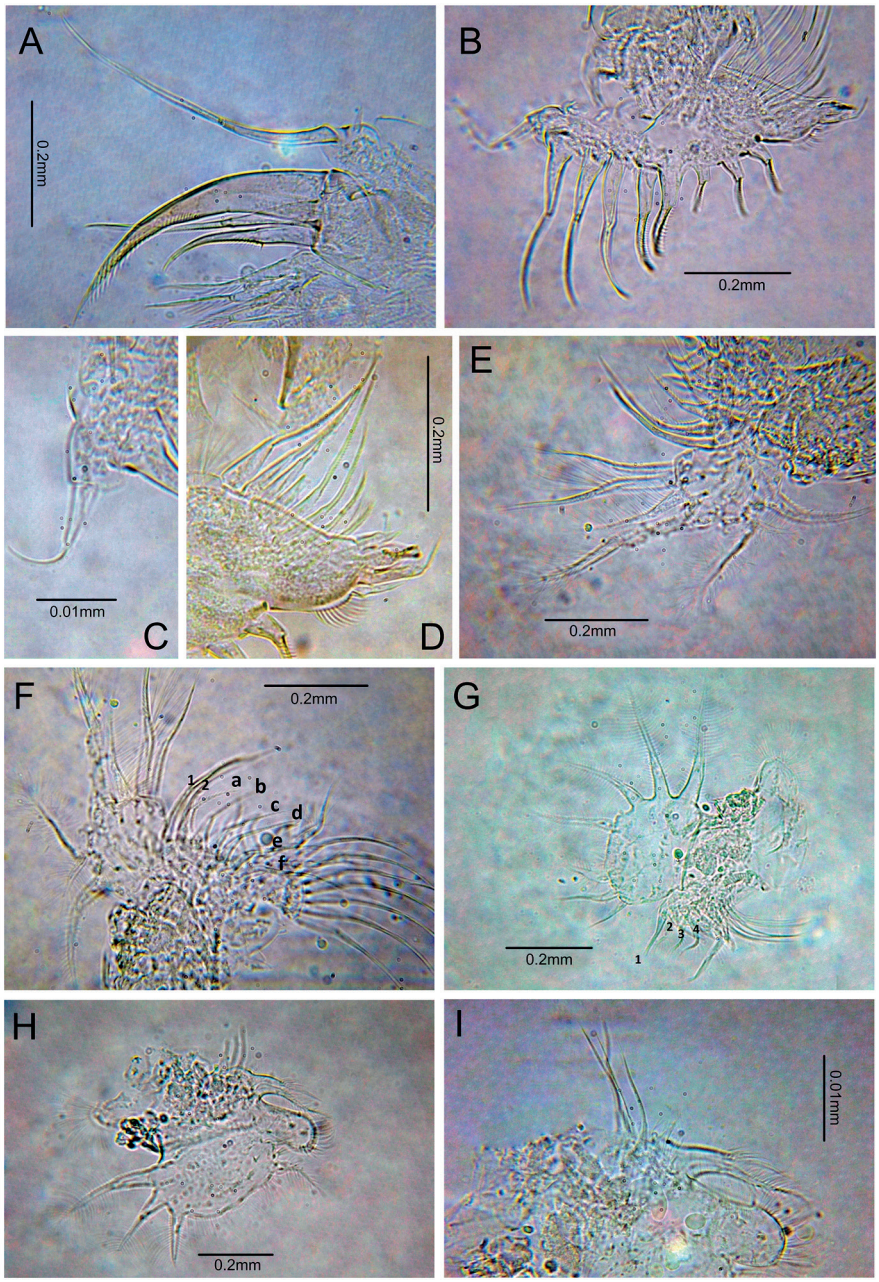

Fig. 3. *Chydorus parvireticulatus* Frey, 1987, parthenogenetic female from lagoon La Española. A — IDL and ODL of limb I; B — limb II; C — exopodite of limb II; D — gnatobase of limb II; E — exopodite of limb III; F — inner portion of limb III; G — limb IV; H — limb V; I — inner lobe of limb V.

Рис. 3. *Chydorus parvireticulatus* Frey, 1987, партеногенетическая самка из озера Ла Эспаньола. A — внешняя и внутренняя дистальные доли торакопода I; B — торакопод II; C — экзоподит торакопода II; D — гнатобаза торакопода II; E — экзоподит торакопода III; F — внутренняя часть торакопода III; G — торакопод IV; H — торакопод V; I — внутренняя лопасть торакопода V.

REMARKS. In Colombia, five valid species of *Chydorus* have been recorded: *C. eurynotus* Sars, 1901, *C. nitidulus* (Sars, 1901), *C. ovalis* (Kurz, 1875), *C. pubescens* Sars, 1901, and *C. ventricosus* Daday, 1905 (Kotov, Fuentes-Reinés, 2015). With the addition of *C. parvireticulatus*, the total valid species of *Chydorus* in Colombia becomes six.

Chydorus parvireticulatus was initially reported as *C. faviformis* (Birge, 1893; De Ferrato, 1966; Brandorff *et al*., 1982) from South America, but later it was described as new species by Frey (1987) from water of Rio Grande do Sul, Brazil. It belongs to the *faviformis*-group which contains another seven *Chydorus* species: *C. faviformis* Birge, 1893, *C. bicornutus* Frey, 1982, *C. bicollaris* Frey, 1982, *C. obscurirostris obscurirostris* Frey, 1987, *C. opacus* Frey, 1987, *C. angustirostris* Frey, 1987, and *C. izvekovae* Sinev, Novichkova et Chertoprud, 2022 (Sinev *et al*., 2022).

C. parvireticulatus from Colombia share the diagnostic features of the specimens previously reported from Brazil (Frey, 1987). General shape rounded (Fig. 2A), small animal-sized, with length ranging 273–336 μm (n = 4, average = 292 μm), in lateral view, length /height ratio about 1.2. Rostrum acute (Fig. 2B). Valves covered with meshes like a honeycomb (Fig. 2C), labrum with a broad, regularly convex labral keel, apex more or less blunt (Fig. 2D). Antenna I with antennular seta thin, located ¼ from the tip of antenna (Fig. 2E). Antenna II with setal formula: 0-0-3/0-1-3 (Fig. 2F). IDL with three unequal setae, the largest thick, strong, claw-like, ODL with two setae, one of them very small (Fig. 3A). Limb II (Fig. 3B), subtriangular, seta on exopodite about two times longer than exopodite itself (Fig. 3C), inner portion with eight scrapers, scrapers 1–5 gradually decreasing in size towards gnathobase, scrapper 4–5 with strong denticles, sixth scrapper shortest, scrapper 7–8 evenly decreasing basally, gnathobase with four modified elements distally, filter comb with eight setae, the posteriormost members shorter than the others (Fig. 3D). Limb III with exopodite subquadrangular bearing 7 setae (Fig. 3E). Distal endite with 3 scraping setae, setae 1–2 longest, seta 3 minute. Distal armature of gnathobase with four elements (not illustrated), basal endite with six plumose setae (a–f) slightly increasing in size basally (Fig. 3F).

Limb IV (Fig. 3G) with pre-epipodite setulated and epipodite oval, exopodite with seven setae, three latter shortest, inner portion of limb IV with four setae, four inner setae increasing in length basally (not illustrated), filter plate with six setae.

Limb V (Fig. 3H–I). Pre-epipodite setulated; epipodite oval, exopodite ovoid, with four plumose setae, inner lobe narrow and setulated at inner margin, with two different unequal setae at inner face, filter plate with four long setae (Fig. 3I).

Postabdomen elongate, tapering distally, length/height ratio about 2.53 times (Fig. 2G–H), anal margin about 1.84 and 1.41 longer than postanal and preanal margin respectively. Postanal part with 11 denticles and with a row of 6 broad lateral groups of very tiny setules, preanal margin concave. Postabdominal claw about as long as postanal margin, with two basal spines, the first one shortest (Fig. 2I).

C. parvireticulatus can be separated from its congeners in the *faviformis*-group by: 1) anal margin longer than preanal and postanal porton, 2) valve with over than 200 small honeycombed meshes, 3) the tip of rostrum acute and tapered (Frey, 1987).

DISTRIBUTION: *Chydorus parvireticulatus* is a Neotropical species recorded in Brazil and Argentina (Elmoor-Loureiro, 2023). It is the first record to Colombian waters.

Discussion

With the addition of these new records, in Colombia the number of species belonging to the genera *Bosminopsis* and *Chydorus* increased to two and six respectively. These reports increase the total number of Cladocera for Colombia to 126 species, which constitutes about 18% of the Cladocera fauna worldwide, and 40 species for the department of Meta, which represents 34.92% of the Colombian territory.

The cladocerans species number in the Meta department and especially in Orinoquia region is still limited taking into consideration that some common taxa *viz. Acroperus* cf. *harpae* Baird, 1843*, Coronatella poppei* (Richard, 1897)*, Ephemeroporus acanthodes* (Frey, 1982) have been reported in the same Orinoquia region of Venezuela (Zoppi, Lopez, 2008) and they are not yet recorded. We consider that the lacking of records of these species is due to insufficient surveying efforts in the Meta department.

Taking into consideration that hitherto only two months (November, Fuentes-Reinés *et al.* (2023b) and May, present data) have been sampled in this system, it is very probable that the richness of Cladocera will increase after further studies in the future. Therefore, it would be necessary to keep sampling this waterbody and its surroundings. In this community, the richness is always influenced by rare species (Fuentes-Reinés *et al*., 2022).

Studies of cladocerans in the area should be continued with a strong taxonomic base; and it is expected that the number of Cladocera will grow and reveal additional new records for Colombia and the science; only reliable determinations of

species will lead to an adequate understanding of the national aquatic diversity.

Compliance with ethical standards

CONFLICTS OF INTEREST: The authors declare that they have no conflicts of interest.

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