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Original Article

So much with so little: new records of Cladocera and Cyclestherida (Branchiopoda) for Alagoas State, Brazil

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ABSTRACT

Despite the recent increase in knowledge about Brazilian Cladoceromorpha (Cladocera and Cyclestherida), this group of fauna is poorly known in some regions of the country, including Alagoas State. Based on the literature and a few original samples, the present paper reports 35 species of Cladoceromorpha from Alagoas, 18 of which are new records for the state. The observed taxa are illustrated. In addition, distributional and taxonomic comments on selected taxa are provided.

KEYWORDS

Clam shrimp, distribution records, Neotropical ecoregions, richness, water flea

INTRODUCTION

Cladoceromorpha designates the monophyletic group formed by Cyclestherida Negrea, Botnariuc and Dumont, 1999 and Cladocera H. Milne Edwards, 1840. Nevertheless, despite being a well-supported group, it is not a formal taxon (Olesen, 2009; Uozumi et al., 2021).

So far, Cyclestherida is composed of a single species, the circumtropical *Cyclestheria hislopi* (Baird, 1859), but there is evidence that it represents a complex of cryptic species (Schwentner et al., 2013). It is considered the most common "conchostracan" in Brazil (Rabet and Thiéry, 1998).

Cladocera, on the other hand, is a more diverse group, with more than 600 species (Forró et al., 2008). A recent review counted 169 cladoceran taxa in Brazil and pointed out the increasing knowledge of Brazilian cladoceran biodiversity (Elmoor-Loureiro et al., 2023). The last 25 years were distinguished by intense taxonomic research on Brazilian Cladocera

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(e.g., Kotov et al., 2004; Van Damme et al., 2005; Sinev and Elmoor-Loureiro, 2010; Sousa and Elmoor-Loureiro, 2018; Sousa et al., 2015, 2022) and checklists for some states (e.g., Rocha et al., 2011; Brito et al., 2020; Santos et al., 2021; Macêdo et al., 2022).

Despite the increase in Brazilian cladoceran knowledge, Elmoor-Loureiro et al. (2023) also revealed regions of the country where the cladoceran fauna is poorly known. One of them is the state of Alagoas in Northeastern Brazil.

Alagoas is the second smallest Brazilian state and is rich in freshwater bodies. According to Freire et al. (2022), several rivers, streams, creeks, weirs, dams, ponds, and lagoons are important elements of the landscapes of this state. However, paradoxically, its freshwater biodiversity is poorly known, at least for the Cladoceromorpha.

Cyclestherida has not been reported for Alagoas State by Rabet and Thiéry (1998). The literature search carried out for the present paper did not recover any report for this state.

Regarding Cladocera, until now, only 16 species have been recognized as occurring in Alagoas State (Elmoor-Loureiro, 2000), and these records go back to the 1930s. While working in Brazil, Otto Schubart had taken several samples in Pernambuco and Alagoas, whose cladocerans were identified by Vincenz Brehm (Brehm and Thonsem, 1936; Brehm, 1937). A few years later, an additional list was published for both states (Schubart, 1942). Since then, no other cladoceran report has been published for Alagoas State (Elmoor-Loureiro et al., 2023).

The present paper aims to report new Cladoceromorpha occurrences in Alagoas State, present illustrations of the species, review the literature records, and offer distributional and taxonomic comments on selected taxa.

MATERIAL AND METHODS

Study area

The present paper considers occurrences from the literature (sites 1–7, Tab. 1, Fig. 1) and from original samples (sites 8–11, Tab. 1, Figs. 1, 2). Lourdes M.A. Elmoor-Loureiro took the original samples, which are briefly described here: Site 8 – Mundaú Lagoon, at Rendeiras district, Pontal da Barra, 09°41'S 035°46'W, on 26.vii.1985. Site 9 – wetland in the Santo Antônio Grande River floodplain, alongside AL-101 road, 09°22'S 035°29'W, on 8.xi.2022 (in this site, three samples were taken: water flowing among macrophytes, Fig. 2A; under flooded woods, Fig. 2B; open area, among emergent macrophytes, Fig. 2C, D). Site 10 – wetland close to AL-101 road, Antunes beach, municipality of Maragogi, among macrophytes, 08°58'36"S 035°11'7"W (Fig. 2E, F; in this site, two samples were taken on 3.xi.2022 and on 10.xi.2022). Site 11 – marsh close to BR-101 road, about 3 km from the road to Japaratinga, among macrophytes, 08°52'S 035°37'W, on 26.vii.1985.

Site 1 is located in the Sertão Mesoregion of the state (Badiru et al., 2019), in the Caatinga Biome, and belongs to the São Francisco Ecoregion (Abell et al., 2008) and the São Francisco Hydrographic Region (CNRH, 2003). The climate is hot and semi-arid (steppe), BSs'h' according to the Köppen classification (Barros et al., 2012).

The remaining sites (2 to 11) are in the Litoral Mesoregion (Badiru et al., 2019), in the Atlantic Rainforest Biome, in areas characterized by Ombrophilous Forests in mosaic with pioneer formations, such as restinga (Soares et al., 2022). They belong to Northeastern Caatinga and Coastal Drainages Ecoregion (Abell et al., 2008) and Eastern Northeast Atlantic Hydrographic Region (CNRH, 2003). The climate is hot and humid, with autumn and winter rains, corresponding to As in the Köppen classification, with some local subtypes (Barros et al., 2012).

According to Badiru et al. (2019), there are 16 regional hydrographic regions in Alagoas proposed for management purposes, and the sampled sites are found in six of them (Tab. 1).

Specimen identification and data analysis

Except for site 9, the samples were totally screened under a stereoscopic microscope. For site 9, a subsample of about 500 specimens were selected and identified. The animals were observed and identified under an Axiolab Zeiss phase contrast microscope.

Table 1. List of sites in Alagoas state Brazil with information on Cladoceromorpha occurrences, the respective reference, and the Regional Hydrographic Region – RHR (Badiru et al., 2019). Localities are organized according to their ecoregions. MMLEC - Mundaú-Manguaba Lagoon-Estuary Complex. Additional information about the sites sampled in the present study can be found in the text.

Sites		Reference	RHR
São Francisco Ecoregion			
1	Paulo Afonso Fall (nowadays, Sobradinho Reservoir)	Brehm and Thomsen, 1936; Brehm, 1937; Schubart, 1942	Rio Moxotó
Northeastern Caatinga and Coastal Drainages Ecoregion			
2	Mundaú River, near Satuba	Brehm, 1937; Schubart, 1942	MMLEC
3	Maceió, Bebedouro district, unidentiffied site	Brehm, 1937; Schubart, 1942	MMLEC
4	Trapiche da Barra, puddle behind the dunes	Brehm, 1937; Schubart, 1942	MMLEC
5	Jacarecica, puddle behind the dunes	Brehm, 1937; Schubart, 1942	Rio Pratagi
6	Rio da Praia (probably Pratagi River), near Riacho Doce	Brehm, 1937; Schubart, 1942	Rio Pratagi
7	Garça Torta Beach, in a stream	Brehm, 1937; Schubart, 1942	Rio Pratagi
8	Mundaú Lagoon, Maceió	present paper	MMLEC
9	Wetland in floodplain of Santo Antônio Grande River	present paper	Rio Camaragibe
10	Wetland adjacent to AL101 road, Maragogi	present paper	Litoral Norte
11	Wetland adjacent to BR101 road	present paper	Rio Jacuípe

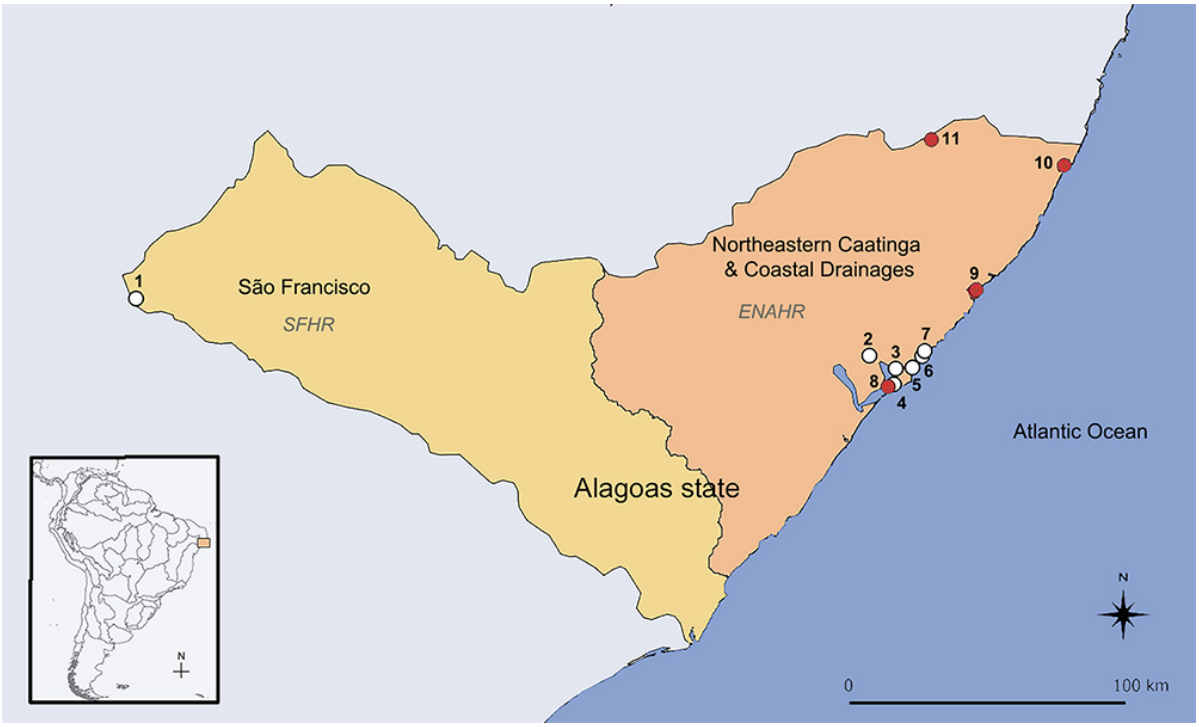

Figure 1. Map of the current known distribution of cladocerans in Alagoas State, Brazil, from literature (white circles) and original samples (red circles). Numbers (1–11) identify the sampling sites according to Tab. 1. Background colors represent the two freshwater ecoregions in the state coincident with the Brazilian hydrographic regions (SFHR, São Francisco Hydrographic Region; ENAHR, Eastern Northeast Atlantic Hydrographic Region).

Voucher specimens are deposited in the Lourdes M.A Elmoor-Loureiro collection, under access numbers EL01789, EL02848, EL03807-EL03841.

For illustration purposes, selected animals were transferred to slides containing glycerin, and photos were taken using a Digital Camera OPTO-EDU A59.4910, mounted on one of the eyepieces. To highlight some characters, the Helicon Focus stacking software (https://www.heliconsoft.com/heliconsoft-products/ helicon-focus/) was used. In some cases,

the resulting images have artificially reinforced lines, but this defect was considered acceptable to enhance the diagnostic features.

A species accumulation curve using a rarefaction method (based on the number of sites) was built to evaluate the effect of sampling effort on the richness observed (Gotelli and Colwell, 2010). In addition, the non-parametric estimators Jackknife 1 and Chao 2 were calculated to approach total richness. All analyses were obtained using the PAST software (Hammer et al., 2001).

Figure 2. Some of the sampling sites. **A**–**D**, site 9, a wetland in the Santo Antônio Grande River floodplain, municipality of Barra de Santo Antônio (**A**, arrow indicates water flow in the marginal flooded woods; **B**, flooded woods; **C**, **D**, open area). **E**, **F**, site 10, wetland close to AL-101 road, Antunes beach, municipality of Maragogi. Photographs: L.M.A. Elmoor-Loureiro.

RESULTS AND DISCUSSION

The original samples provided records of 25 Cladoceromorpha taxa, 18 representing new occurrences for Alagoas state (Tab. 2). With these new records, the total number of taxa listed for Alagoas more than doubled, reaching 35 species. With the addition of a few samples, this significant increase may seem surprising, but it was predictable, given that the lack of knowledge about the Alagoan fauna was even more remarkable.

Table 2. List of species of Cladoceromorpha reported from Alagoas state and their sites of occurrence (number code according to Table 1). * first report for the state.

Taxa	Localities
SUPERORDER CLADOCERA A. Milne-Edwards, 1840 (*sensu* Negrea, Botnariuc and Dumont, 1999)	
ORDER CTENOPODA Sars, 1865	
Family Sididae Baird, 1850	
* *Diaphanosoma brevireme* Sars, 1901	9, 10
Latonopsis australis Sars, 1888	1, 5, 4 (as *L. brevireme* and *L. occidentalis*)
* *Sarsilatona serricauda* (Sars, 1901)	10
ORDER ANOMOPODA Sars, 1865	
Family Chydoridae Dybowski and Grochowski, 1894	
* *Acroperus tupinamba* Sinev and Elmoor-Loureiro, 2010	9
Alona isabellae Sousa, Elmoor-Loureiro and Santos, 2016	6 (as *Alona intermedia*)
* *Alonella* cf *clathratula* Sars, 1896	9
* *Alonella dadayi* Birge, 1910	9, 11
Anthalona verrucosa (Sars, 1901)	5 (as *Alona verrucosa*), 9, 10
* *Biapertura ossiani* (Sinev, 1998)	9
Chydorus eurynotus Sars, 1901	2, 3 and 5 (as *Chydorus flavescens*), 9, 10
* *Chydorus nitidulus* (Sars, 1901)	9, 10
Dadaya macrops (Daday, 1898)	2, 5, 7
Disparalona sp.	3 (as *Pleuroxus chappuisi*)
Dunhevedia odontoplax Sars, 1901	2, 5, 7 (partially as *Dunhevedia odontocephala*)
* *Ephemeroporus barroisi* s.l. (Richard, 1894)	9
* *Ephemeroporus hybridus* (Daday, 1905)	9, 10
Ephemeroporus tridentatus (Bergamin, 1939)	7 (as *Chydorus* cf. *poppei*), 9
Euryalona orientalis (Daday, 1898)	2 (as *Euryalona occidentalis*)
* *Karualona muelleri* (Richard, 1897)	9, 10
Leberis davidi (Richard, 1895)	4 (*Alona davidi* and *Alonella diaphana*)
Leydigiopsis ornata Daday, 1905	3, 9, 10
Ovalona glabra (Sars, 1901)	3 (as *Alona pulchela*)
* *Oxyurella ciliata* Bergamin, 1939	9
Oxyurella longicaudis (Birge, 1910)	2 (as *Odontalona longicaudis*), 10
Family Daphniidae Straus, 1820	
* *Ceriodaphnia cornuta* Sars, 1885	1, 10
Simocephalus acutirostratus King, 1853	2 (as *Simocephalus acutirostris*)
Family Ilyocryptidae Smirnov, 1992	
* *Ilyocryptus spinifer* Herrick, 1882	9
Family Macrothricidae Norman and Brady, 1867	
* *Grimaldina freyi* Neretina and Kotov, 2017	9, 10
Macrothrix elegans Sars, 1901	5 and 7 (as *Macrothrix triserialis*), 9, 10
* *Macrothrix squamosa* Sars, 1901	9, 10
* *Streblocerus pygmaeus* Sars, 1901	9
Family Moinidae Goulden, 1968	
Moina micrura Kurz, 1875	1, 4 (as *Moina propinqua*)
* *Moina minuta* Hansen, 1899	8
Moinodaphnia macleayi (King, 1853)	7, 9, 10
ORDER CYCLESTHERIDA Negrea, Botnariuc and Dumont, 1999	
Family Cyclestheridae Sars, 1887	
* *Cyclestheria hislopi* (Baird, 1859)	10

Nonetheless, the observed richness is lower than that recorded for neighboring states: 51 species for Pernambuco (Soares and Elmoor-Loureiro, 2011) and 72 species for Bahia (Macêdo et al., 2021). It should be noted that sampling in these two states has been more intense than in Alagoas. In addition, the rarefaction curve did not reach an asymptote (Fig. 3), and the estimators (Chao 2: 46.23; Jackknife 2: 50.45) were higher than the observed richness. Thus, cladoceran species richness in Alagoas should be considered underestimated.

Concerning Cyclestherida, *C. hislopi* (Fig. 4) was found at site 9, and it was reported for the first time from Alagoas. There are reports of this species in the Federal District (Elmoor-Loureiro and Mendonça-Galvão, 2008) and several Brazilian states: Amazonas, Rio Grande do Norte, Pernambuco, Mato Grosso, São Paulo (Rabet and Thiéry, 1998), Maranhão (Van Damme and Dumont, 2010), Pará (Silva et al., 2011), Mato Grosso do Sul (Rocha and Por, 1998), Rio de Janeiro, Bahia, Espírito Santo, and Paraíba (Rogers et al., 2020). As mentioned before, the status of *C. hislopi* as a single species is questionable (Schwentner et al., 2013; Ferreira-Oliveira and Rohn, 2014), and a broad taxonomic revision is necessary to clarify this matter.

Regarding Cladocera, we found 24 species (Tab. 2), all illustrated in Figs. 5–9 (except the single damaged specimen of *Streblocerus pygmaeus* Sars, 1901). The aim here is not to present diagnoses of these taxa, but the figures focus on their most diagnostic characteristics, allowing us to confirm their identifications.

Most sampled species belong to the Chydoridae family, a pattern usually observed in the Neotropics (e.g., Santos-Wisniewski et al., 2011; Soares and Elmoor-Loureiro, 2011; Sousa and Elmoor-Loureiro, 2012; Brito et al., 2020; Macêdo et al., 2021; 2022). Chydoridae is the largest cladoceran family (Forró et al., 2008) and they live in association with a variety of substrata, mostly macrophytes (Fryer, 1968), which were abundant in the sampled sites (Fig. 2).

Of the reported cladoceran taxa, 17 were found for the first time in Alagoas State (Tab. 2), and almost all were previously reported for Pernambuco and/or Bahia States (Soares and Elmoor-Loureiro, 2011; Macêdo et al., 2021), which border with Alagoas. Therefore, these taxa were expected to occur in this state, except for *Oxyurella ciliata* Bergamin, 1939 (Fig. 7I–K), with no previous reports in the Northeastern Brazilian states and found in site 9. So far, *O. ciliata* was reported from São Paulo, Mato Grosso do Sul (Elmoor-Loureiro, 2000), Mato Grosso (Brito et al., 2020), Minas Gerais (Santos-Wisniewski et al., 2011), Rio de Janeiro (Macêdo et al., 2022), Acre (Cabral et al., 2021), and the Federal District (Sousa and Elmoor-Loureiro, 2012). It was also not reported from the Northeastern Caatinga and Coastal Drainages Ecoregion and Eastern Northeast Atlantic Hydrographic Region (Elmoor-Loureiro et al., 2023). Nevertheless, there is a record from the São Francisco Ecoregion and Hydrographic Region, in the Federal District (Souza et al., 2019), almost 2,000 km from site 9.

Some previous identifications were updated according to recent taxonomy (Tab. 2). Most of these updates are well documented (for a synthesis, see Kotov et al., 2013) and have been previously commented on (e.g., Elmoor-Loureiro, 2007; Soares and Elmoor-Loureiro, 2011; Macêdo et al., 2021). In addition, the distribution of these taxa in Brazilian territory was also recently revised (Elmoor-Loureiro et al., 2023). However, some taxa are worth discussing here.

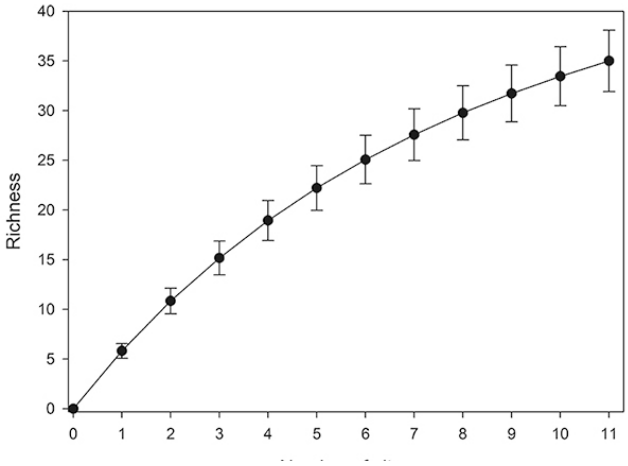

Figure 3. Rarefaction analysis based on the number of sites sampled for cladocerans in the Alagoas State. The accumulation curve does not reach an asymptote.

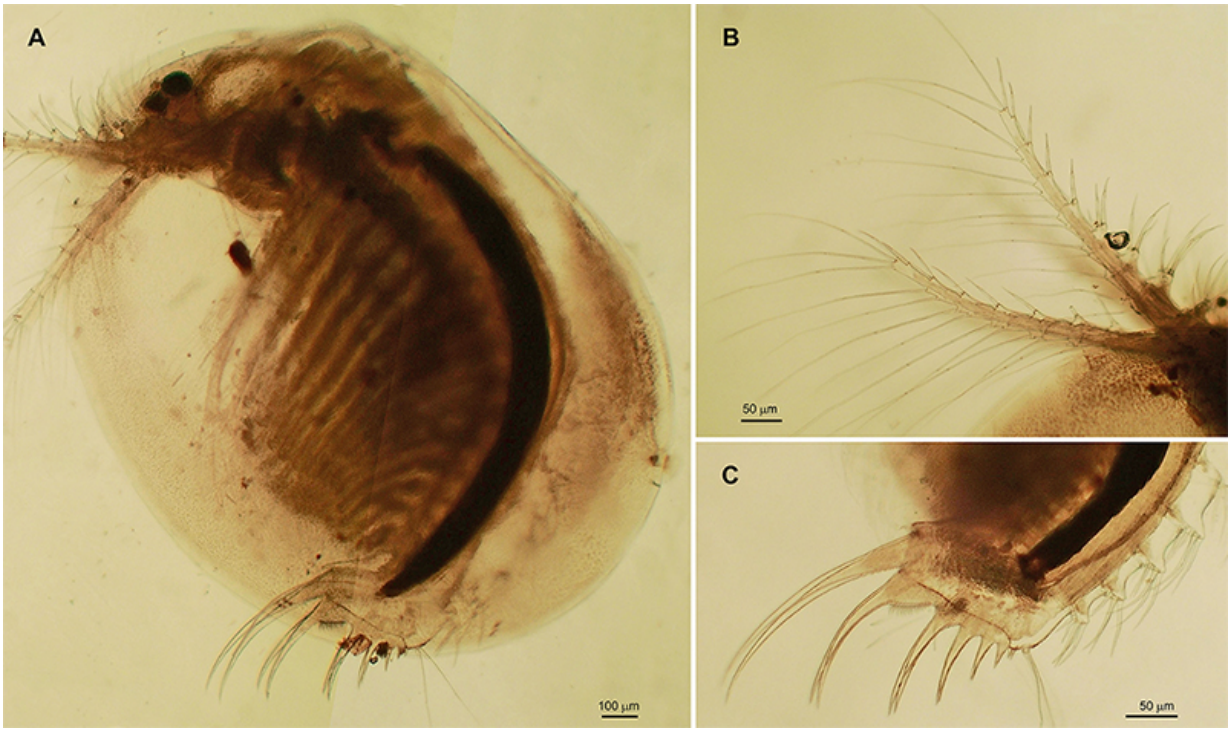

Figure 4. *Cyclestheria hislopi* from Alagoas State, Brazil. **A**, habitus; **B**, second antenna; **C**, caudal part. Photographs: L.M.A. Elmoor-Loureiro.

Brehm (1937) and Schubart (1942) reported the presence of *Alona intermedia* Sars, 1862 near Riacho Doce (site 6 in the present study). However, Sousa et al. (2016) showed that this Palearctic species does not occur in Brazil and described two new species of this complex: *Alona isabellae* Sousa, Elmoor-Loureiro and Santos 2016 and *Alona elisae* Sousa, Elmoor-Loureiro and Santos 2016. Of these two species, it is more probable that the old reports of *A. intermedia* in Alagoas belong to *A. isabellae*, which occurs in a wide distribution area and spectrum of environments. On the other hand, *A. elisae* was found only in a single rock pool in Goiás State (Sousa et al., 2016).

The decision to use the term *conferatum* for *Alonella* cf. *clathratula* Sars, 1896 (Fig. 5K–M) was initially based on the non-cosmopolitanism concept for cladoceran distribution (Frey, 1982; 1987), which has been well supported by subsequent studies (e.g., Sinev, 1998; Sousa et al., 2015; 2016; Neretina and Kotov, 2017). Furthermore, Van Damme and Dumont (2010) suggested that *A. clathratula* could represent a small species complex. A preliminary comparison of the specimens from original Sars slides, deposited in the Oslo Zoological Museum, with Brazilian specimens (unpublished data), also supports considering the Alagoan population as not belonging to true *A. clathratula*. However, a redescription of Australian specimens of *A. clathratula* is essential to define the status of South American populations.

Pleuroxus chappuisi Brehm, 1934, currently placed in *Disparalona* Fryer, 1968 (see Neretina et al., 2018), was reported in the Maceió region (site 3) (Brehm, 1937; Schubart, 1942), although Brehm (1937) observed some differences from an African population from its type locality. Furthermore, considering the non-cosmopolitanism in Cladocera, already discussed, the population from the Maceió region should not be assigned as *Disparalona chappuisi*. Sousa et al. (2018) revised the South American *Disparalona*, concluding that four species occur: *Disparalona leptorhyncha* (Daday, 1905), *Disparalona hamata* (Birge, 1879), *Disparalona lucianae* Sousa, Elmoor-Loureiro, Panarelli, Mugnai and Paggi, 2018, and *Disparalona tenuispina* Sousa, Elmoor-Loureiro, Panarelli, Mugnai and Paggi, 2018. Except for *D. hamata*, the remaining three species occur in Bahia, a neighboring state. Comments and illustrations of Brehm (1937) do not allow the Alagoan specimens to be assigned to any of these taxa.

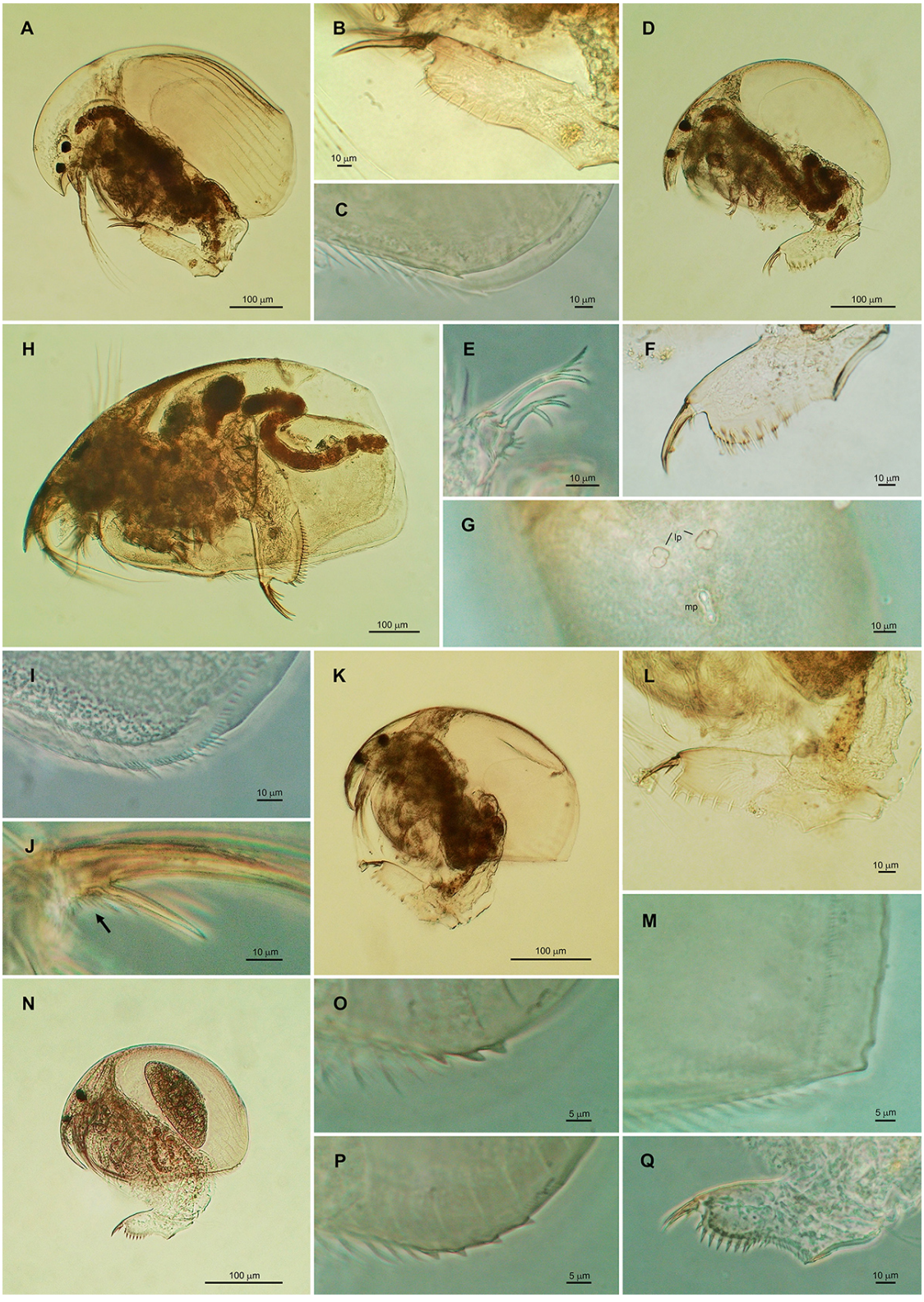

Figure 5. Cladocerans from Alagoas Brazil. **A**–**C**, *Acroperus tupinamba* (**A**, habitus; **B**, postabdomen; **C**, postero-ventral corner of carapace). **D**–**G**, *Anthalona verrucosa* (**D**, habitus; **E**, trunk limb I, setae on inner distal lobe; **F**, postabdomen; **G**, head pores – mp, main pores; lp, cosmarium-like lateral pores). **H**–**J**, *Biapertura ossiani* (**H**, habitus single specimen available partially damaged; **I**, posteroventral corner of carapace; **J**, basal spine of the postabdominal claw; arrow shows the group of setules arising proximal to its base). **K**–**M**, *Alonella* cf. *clathratula* (**K**, habitus; **L**, postabdomen; **M**, postero-ventral corner of carapace). **N**–**Q**, *Alonella dadayi* (**N**, habitus; **O**, **P**, posteroventral corner of carapace showing a variable number of denticles in a single specimen; **Q**, postabdomen). Phase contrast is used in C, E, G, I, J, M, O, P, and Q. Photographs: L.M.A. Elmoor-Loureiro.

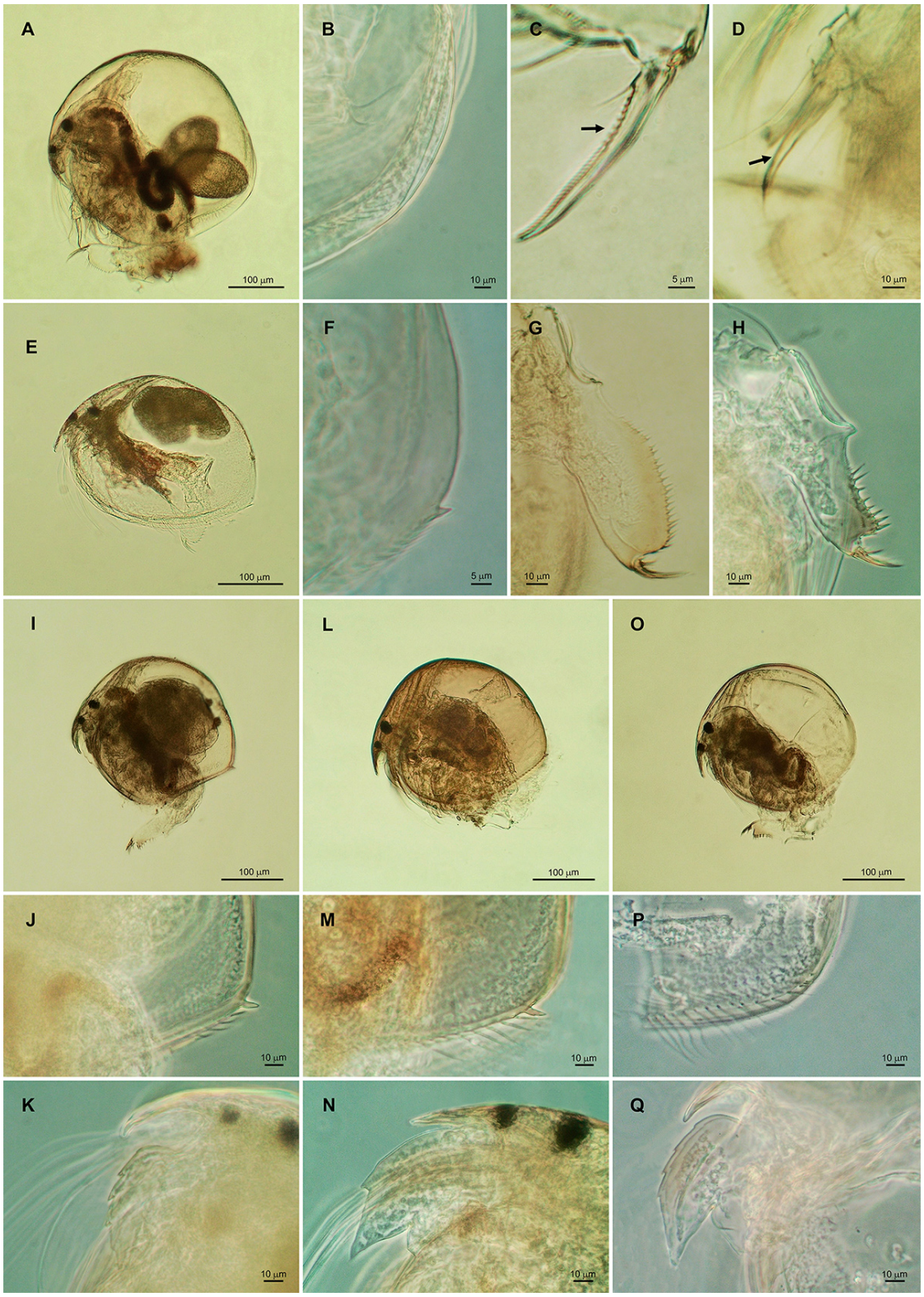

Figure 6. Cladocerans from Alagoas Brazil. **A**–**D**, *Chydorus eurynotus* (**A**, habitus; **B**, posteroventral corner of carapace; **C**, postabdominal claw; arrow shows denticles on the dorsal side; **D**, trunk limb I, arrow shows robust seta on the inner distal lobe). **E**–**G**, *Chydorus nitidulus* (**E**, habitus; **F**, posteroventral corner of carapace; **G**, postabdomen). **H**, *Ephemeroporus tridentatus*, postabdomen exemplifying the morphology of the genus. **I**–**K**, *Ephemeroporus barroisi* s.l. (**I**, habitus; **J**, postero-ventral corner of carapace; **K**, labrum). **L**–**N**, *Ephemeroporus hybridus* (**L**, habitus; **M**, postero-ventral corner of carapace; **N**, labrum). **O**–**Q**, *Ephemeroporus tridentatus* (**O**, habitus; **P**, postero-ventral corner of carapace; **Q**, labrum). Phase contrast is used in B, F, H, J, K, M, N, P, and Q. Photographs: L.M.A. Elmoor-Loureiro.

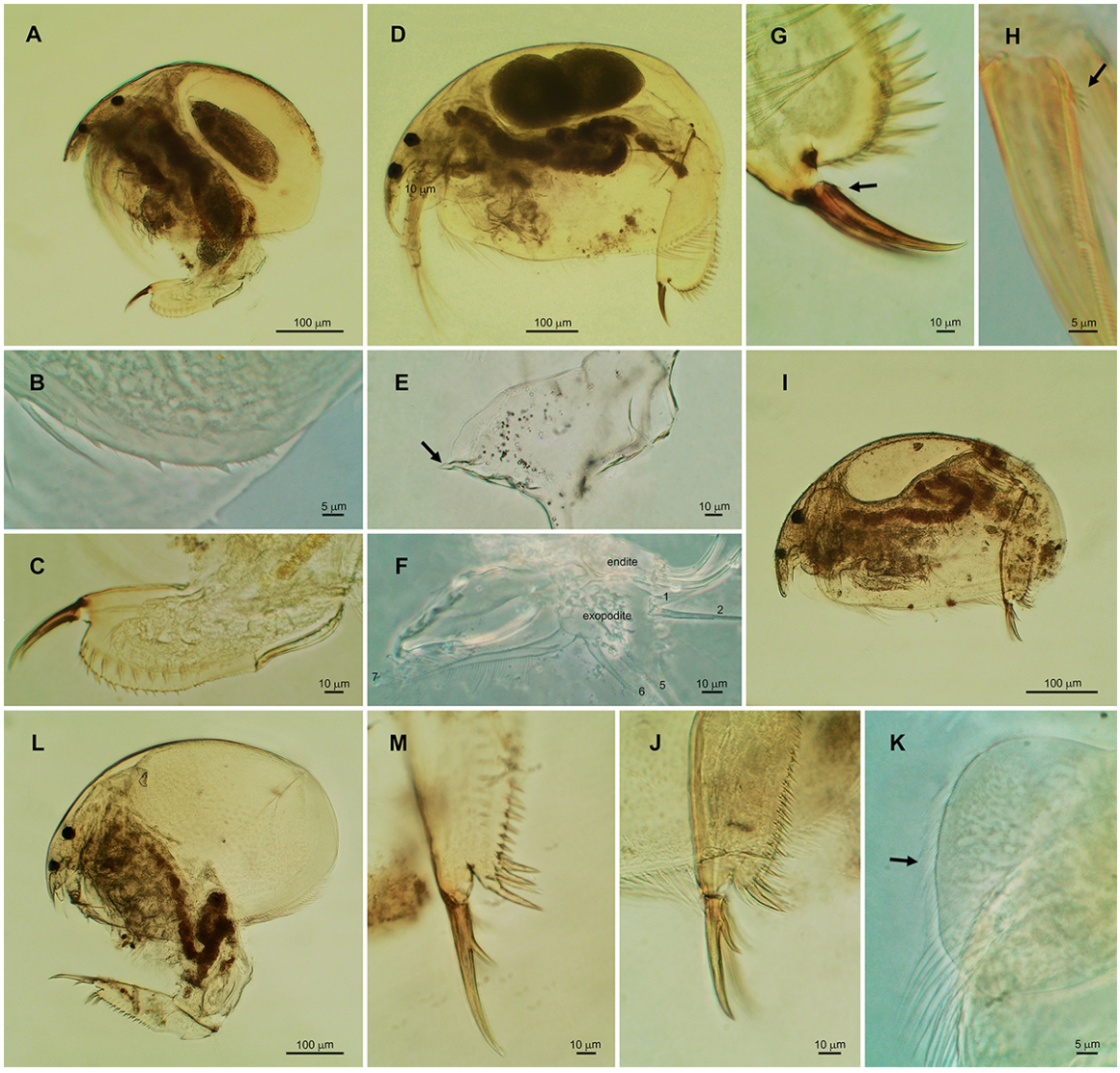

Figure 7. Cladocerans from Alagoas Brazil. **A**–**C**, *Karualona muelleri* (**A**, habitus; **B**, postabdomen; **C**, postero-ventral corner of carapace). **D**–**H**, *Leydigiopsis ornata* (**D**, habitus; **E**, labrum; arrow indicates the protruding edge; **F**, third limb; numbers indicate the exopodite setae, being seta 7 longer than seta 6; **G**, postabdominal distal end; arrow shows the basal claw spine; **H**, postabdominal claw; arrow shows multifid basal spine). **I**–**K**, *Oxyurella ciliata* (**I**, habitus; **J**, postabdominal distal end; **K**, labrum; arrow indicates marginal fine setules). **L**, **M**, *Oxyurella longicaudis* (**L**, habitus; **M**, postabdominal distal end). Phase contrast is used in B, F, H, and K. Photographs: L.M.A. Elmoor-Loureiro.

Leydigiopsis ornata Daday, 1905 is a valid Neotropical species, readily distinguished from *Leydigiopsis curvirostris* Sars, 1901, which has a longer rostrum, and from *Leydigiopsis megalops* Sars, 1901 by different post-abdominal morphology (Sinev, 2004). However, the separation from *Leydigiopsis brevirostris* Brehm, 1938 is based on fine traits, such as the relative size of seta 6 and 7 of the third trunk limb: they are unequal in *L. ornata* (Fig. 7F) and subequal in *L. brevirostris* (see Valdivia-Villar, 1984; Rey and Vasquez, 1986).

Finally, it is interesting to comment on *Sarsilatona serricauda* (Sars, 1901), a well-defined Neotropical species (Korovchisnky, 1992), already reported in Northeastern Brazilian states (Soares and Elmoor-Loureiro, 2011; Macêdo et al., 2021). In the Amazon region, it could co-occur with *Sarsilatona behningi* Korovchisnky, 1985, and the more conspicuous character distinguishing them is the dorsal protuberances of the postabdomen: *S. serricauda* presents large and pointed dorsal protuberances, while they are small and rounded in *S. behningi* (see Korovchisnky, 1992).

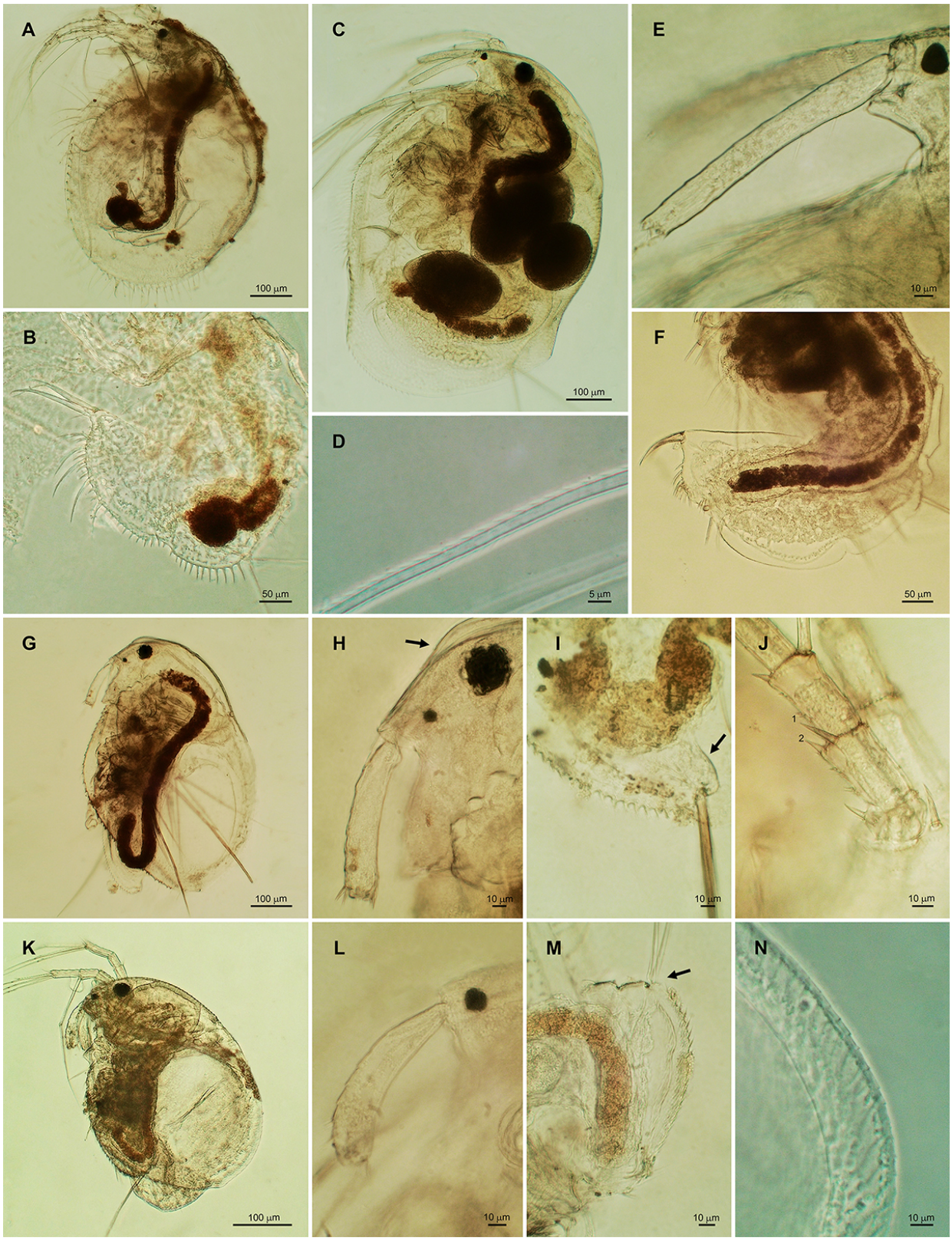

Figure 8. Cladocerans from Alagoas State, Brazil. **A**, **B**, *Ilyocryptus spinifer* (**A**, habitus; **B**, postabdomen). **C**–**F**, *Grimaldina freyi* (**C**, habitus; **D**, antenna largest seta; **E**, antennule; **F**, postabdomen). **G**–**J**, *Macrothrix elegans* (**G**, habitus; **H**, head with rod-like antennule and arrow showing supraocular; **I**, abdominal setae insertion on a dorsal prominence of postabdomen; **J**, antennal exopod, distal spines on second segment numbered, spine 1 about two times spine 2). **K**–**N**, *Macrothrix squamosa* (**K**, habitus; **L**, distally widened antennule; **M**, abdominal setae insertion without postabdominal dorsal prominence; **N**, carapace dorsal rim). Phase contrast is used in B, D, and N. Photographs: L.M.A. Elmoor-Loureiro.

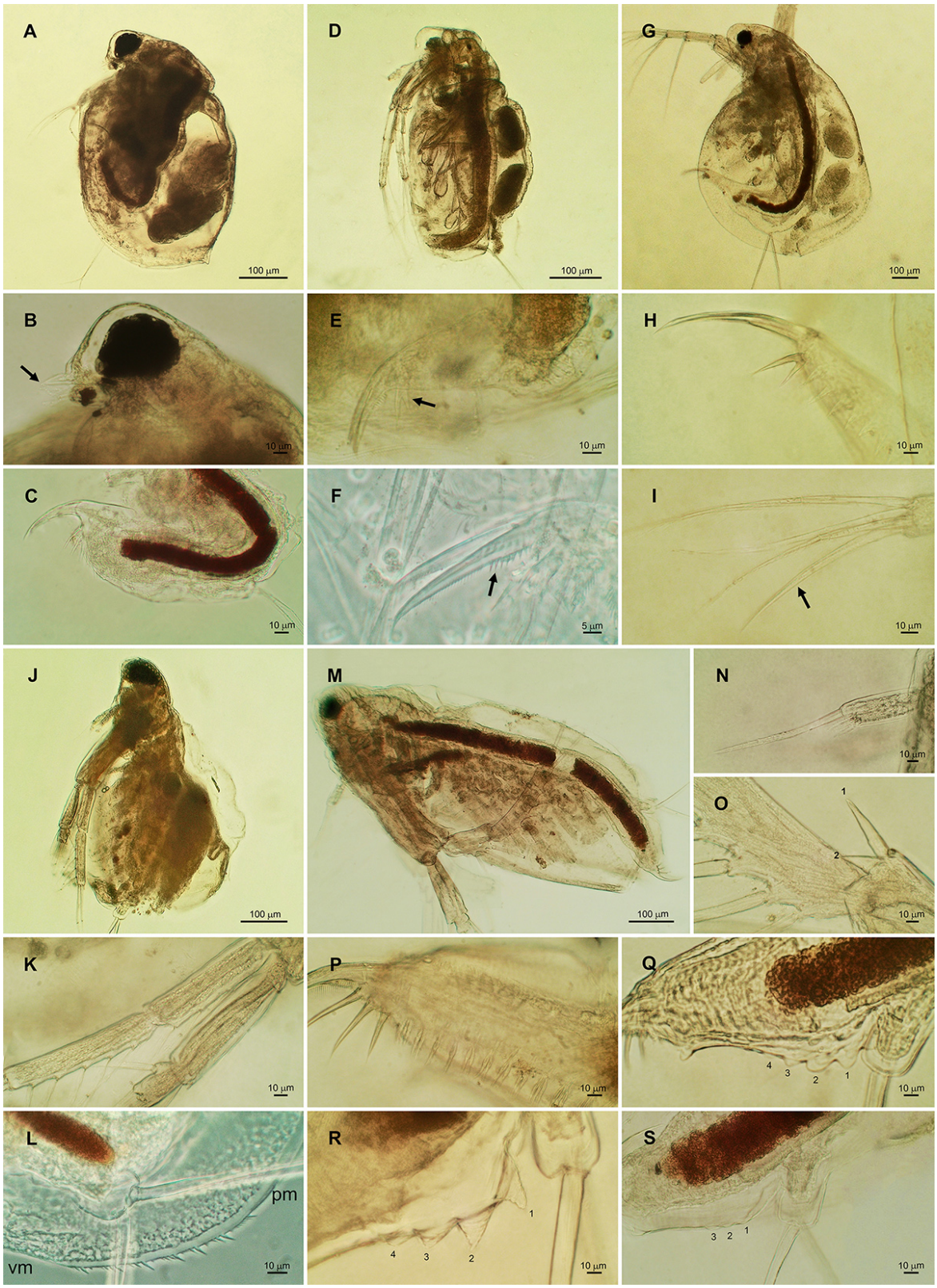

Figure 9. Cladocerans from Alagoas State, Brazil. **A**–**C**, *Ceriodaphnia cornuta* (**A**, habitus; **B**, spine on rostrum; **C**, postabdomen). **D**–**F**, *Moina minuta* (**D**, habitus; **E**, postabdomen, arrow indicates the bifid spine; **F**, postabdominal claw; arrow shows the strong basal pecten). **G**–**I**, *Moinodaphnia macleayi* (**G**, habitus; **H**, postabdomen distal end; **I**, antennal exopod, distal three setae and a long spine shown by arrow). **J**–**L**, *Diaphanosoma brevireme* (**J**, habitus; **K**, antenna; **L**, postero-ventral margin of carapace). **M**–**S**, *Sarsilatona serricauda* (**M**, habitus; **N**, antennule; **O**, antennal exopod distal, spines on second segment numbered; **P**–**S**, postabdomen, dorsal preanal protuberances numbered). Phase contrast is used in F and L. Photographs: L.M.A. Elmoor-Loureiro.

However, these protuberances could suffer variation in *S. serricauda* (see Korovchisnky, 2018), which seems to be due to instar changes (Fig. 9Q–S, LMA-EL, personal observation). Therefore, they should not be used as the unique diagnostic character and should be complemented by the analysis of other features, such as the distal spines on the first segment of the antennal exopod, which are unequal in *S. serricauda* (Fig. 9O) and sub-equal in *S. behningi* (see Korovchisnky, 1992; 2018).

In summary, Alagoas State hosts a richness of species, which is similar or superior to areas from the Neotropics with more intense sampling effort (e.g., Duré et al., 2022; Umaña-Villalobos et al., 2023). Such findings reinforce the idea of the megadiversity of Brazilian Cladocera fauna. At the same time, it is necessary to expand the effort to new aquatic habitats in Alagoas since the richness is still underestimated.

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ADDITIONAL INFORMATION AND DECLARATIONS

Author Contributions

Conceptualization and Design: LMAEL. Performed research: LMAEL, FDRS. Acquisition of data: LMAEL. Analysis and interpretation of data: LMAEL, FDRS. Preparation of figures/tables/maps: LMAEL, FDRS. Writing – original draft: LMAEL, FDRS. Writing – critical review & editing: LMAEL, FDRS.

Consent for publication

All authors declare that they have reviewed the content of the manuscript and gave their consent to submit the document.

Competing interests

The author(s) declare(s) no competing interest.

Data availability

All study data are included in the article.

Study association

Not applicable.

Study permits

Field collection and transportation of specimens were made under the SISBIO permit number 13986-1 issued to L.M.A. Elmoor-Loureiro.