MORPHOLOGY AND TAXONOMY OF THREE *CYTHERIDELLA* SPECIES (OSTRACODA, TIMIRIASEVIINAE, CYTHERIDELLINI) FROM WESTERN AMAZONIA

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Abstract. The description of *Cytheridella ilosvayi* Daday, 1905 is reviewed and new information on the morphology of the valves is presented. Traits belonging to the areas of the dorsal and antero- and postero-ventral margins of the valves are described for the first time and a novel method to evaluate the degree of inclination of the valve's dorsal margin is proposed. The data are further used for reviewing the taxonomic validity of the fossil (Neogene) *C. danielopoli* Purper, 1979, occurring in Western Amazonia. It is documented that the *C. danielopoli* described by Purper (1979) is closely related to *C. ilosvayi*. specimens presented by Gross *et al*. (2013), considered initially as variants of *C. danielopoli* Purper represent a new taxon, *C. martingrossi* Danielopol and Piller, n. sp. The information we offer are premises for an extended study we intend to complete on the morphology and systematics of *Cytheridella* species.

Key words: Non-marine Ostracoda, Tmiriaseviinae, *Cytheridella* taxonomy, comparative morphology

1. INTRODUCTION

Cytheridella Daday, 1905 is an ostracod genus belonging to the non-marine Timiriaseviinae Mandelstam, 1960, tribe Cytheridellini Danielopol and Martens, 1989. Its type species, *C. ilosvayi* Daday, 1905 is a common inhabitant of the Neotropical realm (Colin and Danielopol 1990; Wrozyna *et al.* 2018). Fossil species of *Cytheridella* were documented since the Mesozoic era (Colin *et al.* 1997).

The morphology of *Cytheridella ilosvayi* Daday, 1905, became an active subject of research (Gross *et al.,* 2013; Wrozyna *et al*., 2014, 2016, 2018, 2019; Danielopol *et al*., 2018). Here we intend to use the morphological description of the valves of this species, in order to use them as reference for comparative studies dealing with other Cytheridellini taxa. In particular, *C. ilosvayi* will be used for a comparative study with *Cytheridella danielopoli* Purper, 1979. This latter species is a Neogene fossil ostracod from Western Amazonia (Brazil), originally described by Purper (1979). Gross *et al.* (2013) identified variants of *Cytheridella danielopoli* with valves displaying morphological shapes different from those of Purper (1979). Using geometric morphometrics and multivariate techniques Wrozyna *et al.* (2016) showed that the valve shapes of *Cytheridella danielopoli (sensu* Gross *et al.,* 2013), when placed in a morphological space which included also morphotypes of *Cytheridella ilosvayi*, occupied a distant position. This observation prompted us to restudy the valves' morphology of both species in order to find new criteria for their practical taxonomic identification. One has to notice that Daday (1905) did not offer for *C. ilosvayi* a taxonomic diagnosis, but just a lengthy morphologic description. Purper (1979) described shortly *C. danielopoli* and the diagnosis offered is not useful for the differential identification of the two Neotropical species. This is due to the fact that the Neogene Brazilian species was compared with *C. ritzkowskiana* Carbonnel and Ritzkowski, 1969, an

Oligocene species from Europe, without closer phylogenetic relationships with Neotropic species.

A reanalysis of valves of *Cytheridella danielopoli (sensu* Gross *et al.*, 2013) compared to those from the original description of Purper (1979) and those of *C. ilosvayi* convinced us that the former ostracod material belongs to a new taxon that will be below described by two of us (D.L.D. & W.E.P.) as *Cytheridella martingrossi,* n. sp.

Wrozyna *et al.* (2016, 2018, 2019) offered arguments for the existence of different morphotypes within what we include into *Cytheridella ilosvayi* but which can be considered separate species with clear geographic distributions. Therefore, here too it is important to precise the diagnosis of this species in order to use it with connotation of species *sensu lato* for current research dealing with systematics, ecology and/or biogeography.

The analysis of the valves' morphology of the three *Cytheridella* species in this contribution is an opportunity to present new morphological traits useful for the systematics of other taxa of the tribe Cytheridellini Danielopol and Martens, 1989 that we intend to discuss in near future.

2. MATERIAL AND METHODS OF STUDY

2.1. Ostracod material

A rich sample of extant *C. ilosvayi* was sampled by M. G. and W. E. P., in company of Maria I. Ramos, in two small lakes, Lago Comprido and Lago Barro Branco (near Eirunepé, state of Amazonia, Brazil; Fig. 1, Annex – Table 1). The valves here used were also the object of studies completed by Wrozyna *et al.* (2014, 2016, 2018, 2019).

A right and a left valve of an adult female belonging to the same Brazilian ostracod population used by Purper (1974), stored at Museu de Paleontologia da Universide Federal do Rio Grande do Sul, collection n° MP-O-314; SEM pictures offered by Prof. Cristianini Trescastro Bergue; here Fig. 6a-b) is here used as reference for this latter species.

One Quaternary *C. ilosvayi* valve stems from Jamaica (Wallywash Pond; leg. Prof. Jonathan Holmes (UCL, London); Holmes 1998: WGP-coring site). Fossil material for *C. danielopoli* (*sensu* Gross *et al.* 2013) were obtained from the upper part of the Solimões Formation, at Aquidabã, Eirunepé (Fig. 1, Annex – Table 1).

The fossil valves of *Cytheridella danielopoli* (*sensu* Purper 1979) here illustrated (Figs. 12a-c, 14a-b, 18c, 19c) were

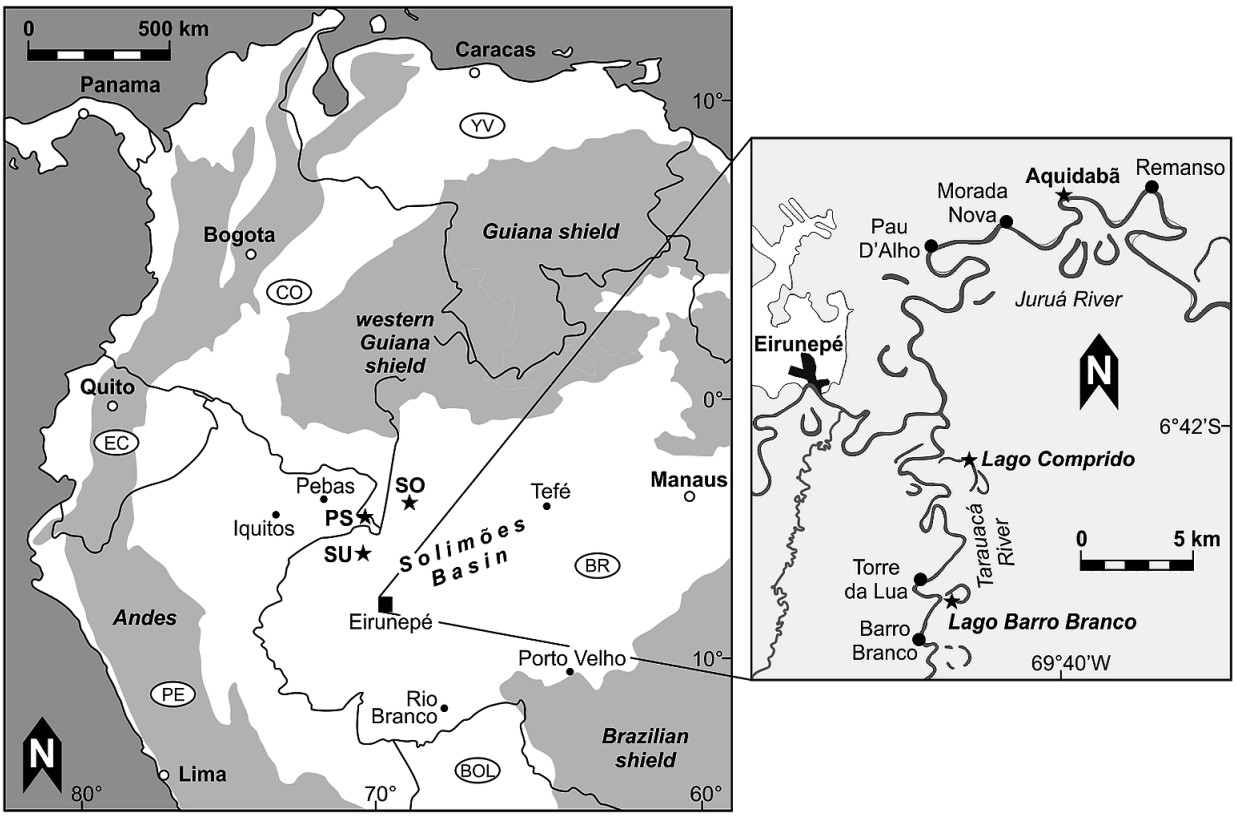


Fig. 1. Location of the sampling sites of the *Cytheridella* species discussed in the text, indicated by black stars: Lago Comprido and Lago Barro Branco - *C. ilosvayi* Daday, 1905; Aquidabã – *C. martingrossi* Danielopol & Piller, n. sp.; São Paulo de Olivença (**SO**) and Sucuriju (**SU**) - *C. danielopoli* Purper 1979; Puerto Nariño to Sofia (**PS**) – *Cytheridella danielopoli* Purper, 1979.

extracted from Purper (1979, p. 279, Plate 7, Figs. 21-24) and stem from Sao Paulo de Olivenca (Pebas Formation, possibly Late Miocene; Fig. 1, Annex – Table 1).

Additionally, one of us (M.G.) identified several valves of this species in a core at Sucuriju (Solimoes Formation; late Middle to early Late Miocene; state of Amazonia; Gross *et al.* 2014; Fig. 1, Annex – Table 1). We illustrate also a fossil valve of *Cytheridella danielopoli* (*sensu* Purper), of Miocene age from Muñoz-Torres *et al.* (1998) sampled between Puerto Nariño & Santa Sofia (near Leticia), Amazonas Department, Colombia (Fig. 1, Annex – Table 1).

2.2. Valve morphology – General aspects

The ostracod carapace is a complex organismic module on which one can visualize different morphological traits. Following West-Eberhart (2008) a "trait" is simply a discrete characteristic of an organism. We recognize qualitative (one-off traits) and quantitative traits like the meristic, length, height and width of the valves. From a functional point of view, we look also to biological traits. The inflated part of the adult female carapace of *Cytheridella* ostracods represents a brood care space within the postero-lateral domicilium (Danielopol *et al.* 1989).

Valves of *Cytheridella* display composite traits which are perceived as one part of a complex morphologic module within which more simple primary traits exist. For our search of traits useful to define taxa, these latter are of value. The central and posterior segments of the dorsal margin of *Cytheridella* valves, viewed in lateral perspective is a composite trait (Fig. 2). One can decompose it in a dorsal outer margin of the valve and a lateral curvature margin belonging to the brood space of the carapace (see next chapter).

2.3. Descriptive procedures, definition of morphologic traits, acronyms

For a reproducible analysis of valves' morphology, one needs to adopt a standardized orientation, especially for description of their lateral side. Here we use the bounding-box procedure for valves placed with the outer side up (Danielopol *et al.* 2023). The procedure allows to measure the maximal length (**Lmax**) and height (**Hmax)** of the valve. The maximal width (**Wmax**) was approximated on both the carapace or valves viewed from the dorsal side.

Shape and outline of the valves, procedure of description – We use the terms in common language (Fig. 2a) and also with its geometric-morphometrics meaning. For this latter the valve is a 2D outline (Fig. 3), "a configuration of points that are invariant to changes in translation, rotation and scale" (Baltanás and Danielopol 2011). The outlines in the present case are configuration lines enclosing the silhouette of valves (Annex – Figs. 1 and 2).

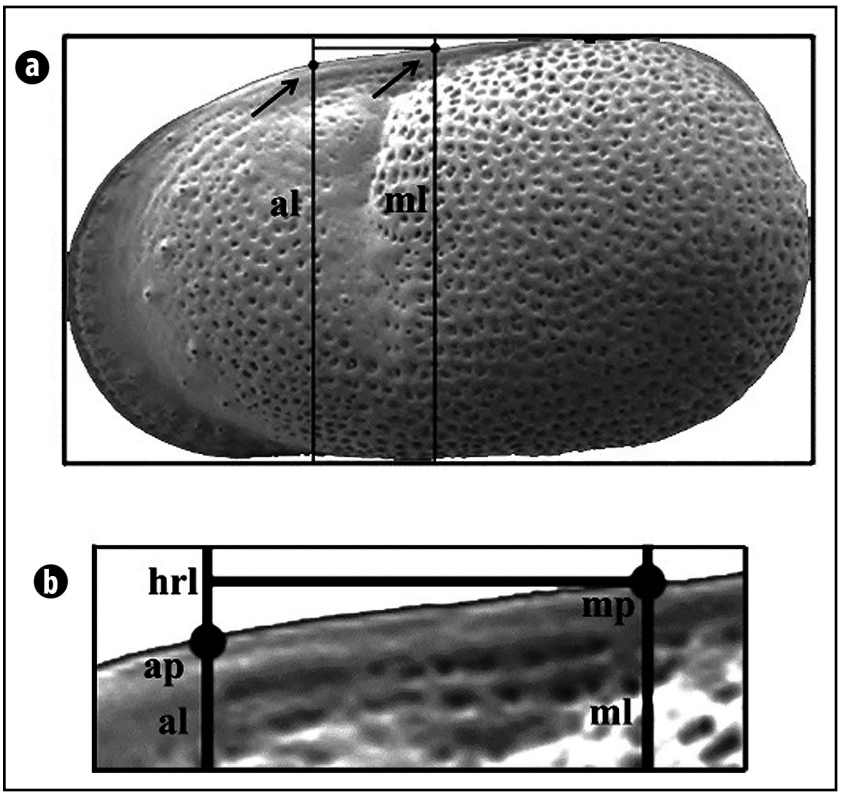


Fig. 2. Illustration of the way the inclination of the dorsal margin of the *Cytheridella* valves is computed: (**a**) – general view, **LVf-ex** of *Cytheridella martingrossi* n. sp., circumscribed within a bounding box; (**b**) – enlarged section of the area used for computation of the inclination degree of the dorsal line (additional details in text).

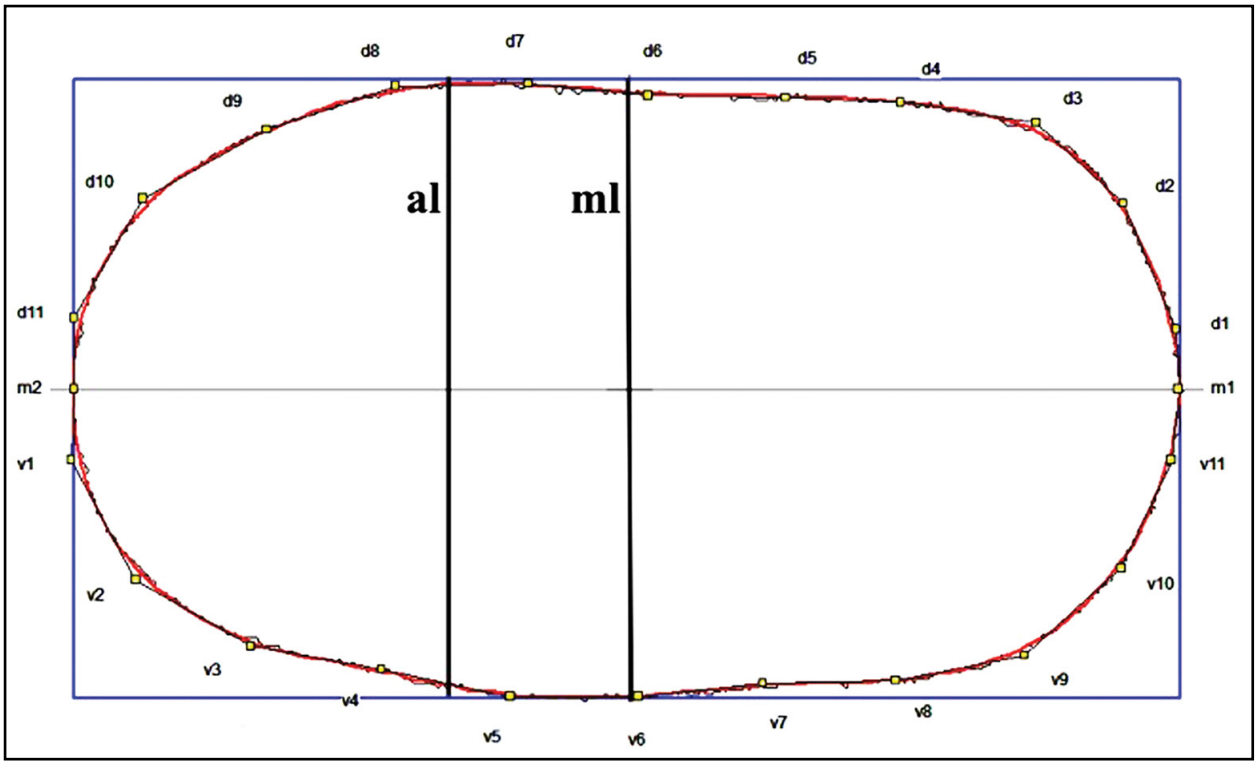


Fig. 3. *Cytheridella danielopoli* Purper: position of the **LVf** outline within a bounding box, using the B-spline algorithm in the computer program "Morphomatica" (the outline belongs to the valve from Fig. 12a); the **m1-m2** line traversing the centroid point, divides the outline in dorsal and ventral parts; **d1- d11**, **v1-v11**, control points used for the computed outline (in red); black line, digitized valve outline.

Outlines of *Cytheridella* were computed with the application "Morphomatica" version 1.6 (Brauneis *et al.* 2008). It uses a B-spline algorithm which draws polynomial curves of low degree and smoothly fit together (Neubauer and Linhart 2008). The elementary curves are defined by a reduced number of control points (**CP**). We use a standardized number of 24 **CP**. The precision of reconstructing the geometric outline with "Morphomatica" can be appreciated on figure 3 where the computed outline of the valve shape (red line) superimposed on the original digitized outline (black line) fit together perfectly. On the figure 3 the squares on the red line indicate the position of each **CP** specified also by a letter-number. They help to delineate specific segments of the general outline.

The synoptic view of the morphologic disparity of the valves belonging to the three *Cytheridella* species as well as their degree of similarity were studied with the multivariate statistics procedure Canonical Analysis of Principle Coordinates (**CAP**), using the routine existing in the computer-package PRIMER version 6 and PERMANOVA+ for PRIMER v.6 (Clarke and Gorley, 2006; Anderson *et al.*, 2008). The **CAP** analysis offers a way to see how well predefined groups can be discriminated or correctly identified.

Definitions of most of the terms we use for valve description exist in the following publications: Triebel (1950), Van Morkhoven (1962), Sylvester-Bradley and Benson (1971), Horne *et al.* (2002), Yamada (2007), Danielopol *et al.* (2018, 2023). Therefore, we will not repeat their explanation here, except when necessary.

The lateral shape of the valve (Figs. 2a, 3) is divided in three parts by two vertical lines: the **al** line, limits the anterior third of the valve from the rest of the shape, and the **ml** line separates the anterior half of the valve shape from the posterior one. This separation has a meaning, namely the anterior part displays high numbers of pores bearing sensilla (Wrozyna *et al.* 2016; Danielopol *et al.* 2018) while the posterior half covers the inflated brood space within the domicilium (Fig. 2a). The upper extremities of the **al** and **ml** in the figure 2b are the points **ap** and **mp** which define the control segment of the dorsal part of the outer margin (**om**). The latter term is defined in Yamada (2007). The segment delineated by **ap** and **mp** is used for the evaluation of the inclination of the dorsal **om** (Figs. 2a and b). It is measured with a protractor on the angle built by the control segment **ap** – **mp** with its basis line or horizontal line (**hrl**).

Curvature margin (**cm**) is the line which delineates the curved margin of the valve along the dorsal, the posterior and the ventral part, specifically in the case of valves which build the brood care space of the domicilium (Fig. 8a). The **cm** on the ventral part of the valve covers the **om** up to the anterior junction point (**jp**). The LV and RV of the carapace of *Cytheridella* species are generally symmetric, like in the

example of *C. ilosvayi* from Eirunepé (individual E25, Figs. 4a, b). The outlines of the opposed valves were superimposed and compared with the geometric morphometrics technique as described above. The symmetric shape of the pair outlines is confirmed (Fig. 4c).

On the outside of the valve a shallow central groove appears (Figs. 2a, 8a). On its bottom the central muscle scars (**cms**) are visible; for details of similar structures see Van Morkhoven (1962). At the surface of the outer lamella of the valve there are so-called normal pores with emerging sensilla. *Cytheridella ilosvayi* displays two types of such pores, the **A1** and **A2** (Figs. 10b, d). Their characteristics are described in Danielopol *et al.* (2018). They differ from the marginal pores (**mp**) with their marginal sensilla (**ms**) (Fig. 9b) which traverse the fused zone (**fz**) of the valve (Figs. 12c, d and Horne *et al.* 2002). [Note the acronym **mp** was used also for the median point of the dorsal **om,** as illustrated in Fig. 2b] The proximal limit of the **fz** is the line of concrescence (**lc,** Fig. 12d and Horne *et al.* 2002).

On the outside of the outer lamella develops anteriorly the flange (**fl**), an inflated ridge, which can be delineated on its distal side by a shallow groove (Figs. 9b, 13a, 17a). An external lip (**el**), as defined by Triebel (1950) and further mentioned in Danielopol *et al.* (2023), is visible in the case of *Cytheridella ilosvayi* from Jamaica (Fig. 8a) and *Cytheridella martingrossi* (Fig. 17b, c). This is a ridge behind which a series of foveolae (minute pits as described by Sylvester-Bradley and Benson 1971) appear. Distally to the **el** opens a series of marginal pores. The flat surface between the **el** and the **om** builds the anterior marginal zone. This latter part of the valve is well developed in the case of *Microceratina* species (Danielopol *et al.* 2023).

On the inner side of the valve one of the most important morphologic traits is the marginal infold (**mi**), known also as the inner lamella (Yamada 2007). It is built by a peripheral calcified part (**cail**) and a cuticular one (**cuil**). The limit between the two parts is known as the inner margin (**im**). We expressed the lateral extension of the calcified part of the marginal infold as the distance of the calcified lamella from the **om** to the **im**, measured at the 50% of the **Hmax**.

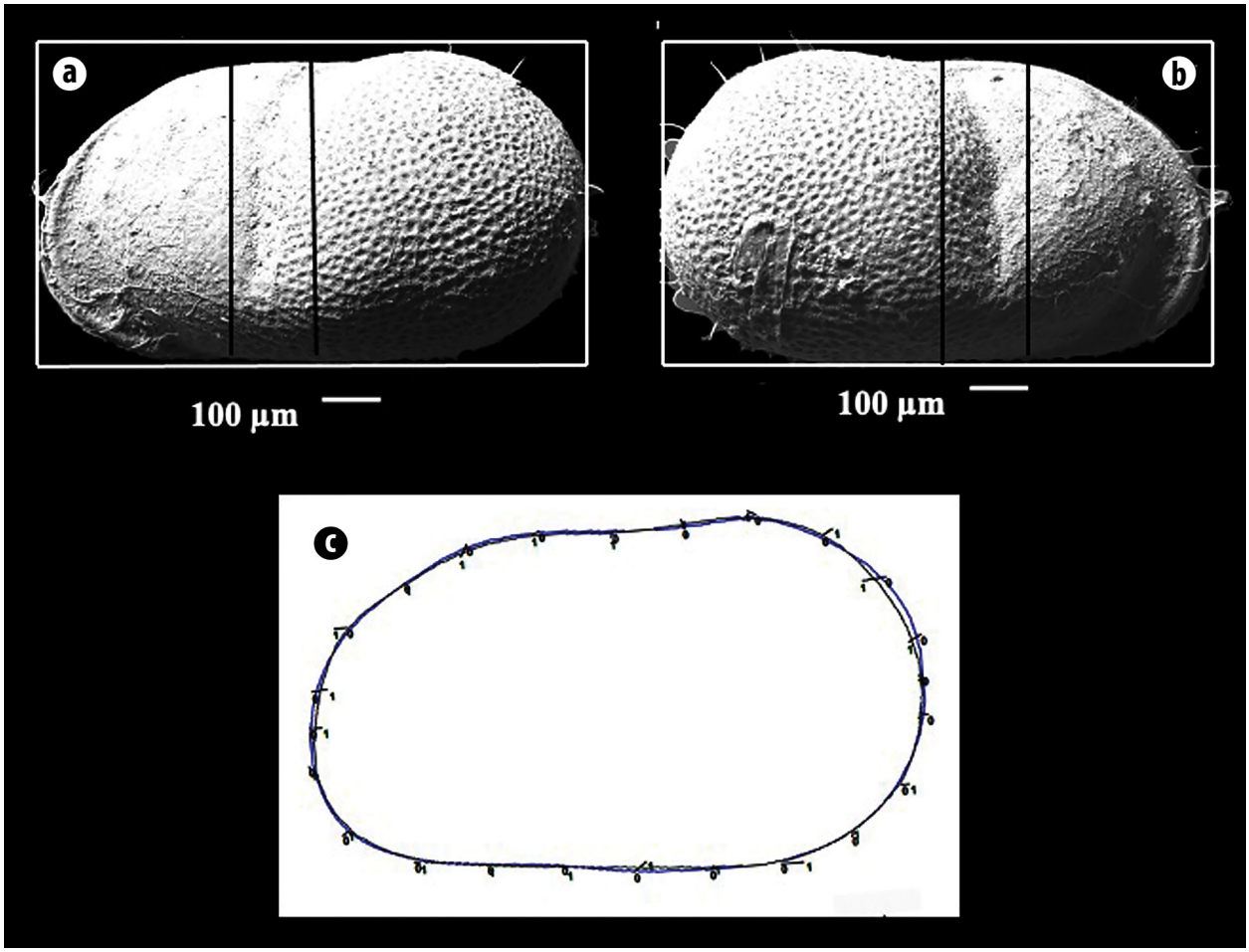


Fig. 4. *Cytheridella ilosvayi* Daday: illustration of the quasi-symmetric outline-shape of the valves, E25-L (A) and its counterpart E25-R (B). C-superimposition on the **LV**, blue line (0) the **RV**, black line (1) computed after standardization for equal surfaces with the B-spline algorithm in the program "Morphomatica"; the **al** and **ml** lines point out the quasi-horizontal position of the dorsal margin within the section defined by these lines.

On the peripheral part of the **cuil** 1-2 rows of thin setulae, cuticular filaments (**cf**), are visible (Figs. 9c, d).

Below the calcified **mi** there is a small vestibulum (**ve**), limited by the **lc** on the distal side and the **im** on the proximal side (Figs. 12c, d).

The selvage (**se**) is a ridge which plays an important role in closing tightly the carapace (Van Morkhoven 1962; Yamada 2007). The **se** in the case of *Cytheridella* species divides the **mi** in an external or peripheral part of marginal infold (**pmi**) and an internal area which extends from the **se** to the **im**. We named this part inner marginal infold (**imi**). For additional information see figure 8b. On the postero-ventral side of the peripheral part of the **pmi** a series of pores from which distally trifurcated sensilla (**s**) emerge. This is a morphological trait which is here for the first time described. Additionally, on the inner side of the valve below the hinge groove, in the central part of the calcified wall we noticed (Fig. 8b) an anti-slip bar (**as-b**) as described by Van Morkhoven (1962).

3. RESULTS

3.1. *Cytheridella ilosvayi* Daday, 1905 - Morphology of valves, with emphasis on diagnostic traits

This section deals with two aspects of the valve morphology: (1) The strange illustration of *C. ilosvayi* by Daday (1905). If correct, it could imply that under the *C. ilosvayi´s* description two species are mixed. (2) A detailed examination of *C. ilosvayi* valves offers us new morphologic details useful to make the diagnosis of this species more robust than those provided for the first time by Purper (1974, p. 639). This latter author mentions the following diagnostic details: "Left valve a little bigger than the right. In lateral view the dorsal margin of the left valve is practically straight, while that of the right valve forms a symmetrical double arc passing smoothly into the anterior and posterior margins". We will show below that there is much more information to be extracted from the valves of *C. ilosvayi* than it was perceived.

3.1.1. The paradox of Daday's illustration of C. ilosvayi *valves*

Daday (1905, p. 262) starts the description of his new species *Cytheridella ilosvayi* saying that the valves display a kidney-shape and the RV and the LV differ very little. However, in his plate 17 the representation of this species appears differently! We reproduce here (Figs. 5a-e) the images of Daday´s plate 17, figures 15-19 and 21. One notes an important difference of valve shapes in lateral view between LV (Fig. 5a) and RV (Fig. 5b). The LV illustrated with the outer side up displays a quasi-rectangular outline shape with horizontal dorsal and ventral margins in the central part and a marked slope in the antero-dorsal margin (Fig. 5a). The RV has a quasi-ovoid shape and the dorsal margin displays a marked down-slope oriented anteriorly (Fig. 5b). The ventral margin in the central part of the valve is either convex when the valve is illustrated with the outer side up (Fig. 5b) or concave when the same part is illustrated with the inner side up (Fig. 5c). Note that for this latter one the explanation is incorrect in Daday´s caption to the figure, namely it is marked as LV. The same for the male´s RV which is also marked LV (Fig. 5e). The carapace in its dorsal perspective at both the female (Fig. 5d) and the male (Fig. 5f) displays symmetric valves.

We compared these figures with the LV and RV originally belonging to an adult carapace deposed by Dr. Ivone Purper at Museum of Palaeontology of the Univ. Federal do Rio Grande do Sul. These valves belong to the series of specimens used in Purper (1974) for the redescription of *C. ilosvayi.* The LV (Fig. 6a) and the RV (Fig. 6b) are quasi-symmetric. When superimposed these outlines on those of the original LV female of Daday illustrated above (Fig. 6c) we note the resemblance of the quasi-rectangular shape between the Brazilian valves and those of Daday from Paraguay. Therefore, we accept Purper´s claim that her material from Rio Grande do Sul belongs to *C. ilosvayi,* however with the connotation of *C. ilosvayi sensu lato* as we note differences in the anterior and the postero-ventral part of their outline shapes (Fig. 6c).

The RV of the female illustrated by Daday presented above with its marked slope of the dorsal margin resemble female valves belonging to what we describe here as *Cytheridella martingrossi* n. sp. (Fig. 7a). When on Daday´s RV we superimposed a RV of our new species we obtained a surprising close fit of their outlines (Fig. 7b). This brought us for a moment to the suspicious idea that Daday used two species for the description of *C. ilosvayi*. However, because we noted a series of misrepresentations in his illustration, as pointed out above, lead us to consider that the RV in both external and internal view is an artefact. Of course, our intuitive explanation can be anytime falsified if extant individuals of *C. martingrossi* will be discovered. For the moment this latter species is known only from fossil material of Miocene age (Gross *et al.* 2013).

3.1.2. New features of the valve morphology

In a previous publication (Danielopol *et al.*, 2018) we showed the advantage for the taxonomy and systematics of the ostracod Timiriaseviinae the use of minute structures of the valves, like the sieve-type pore canals (StPC), visible with SEM-techniques only at high magnifications. We will explore here using the same approach the details of *C. ilosvayi* from the Wallywash Pond (Saint Elizabeth, Jamaica) that were already studied by Danielopol *et al.* (2018). These data will be further compared with those offered by specimens of *C. ilosvayi* from Eirunepé, Western Amazonia, already studied by Wrozyna *et al.* (2014, 2016). We will make also reference to the material of Purper from Charco at Porto Alegre. Most of the data presented here is extracted from left valves of adult females.

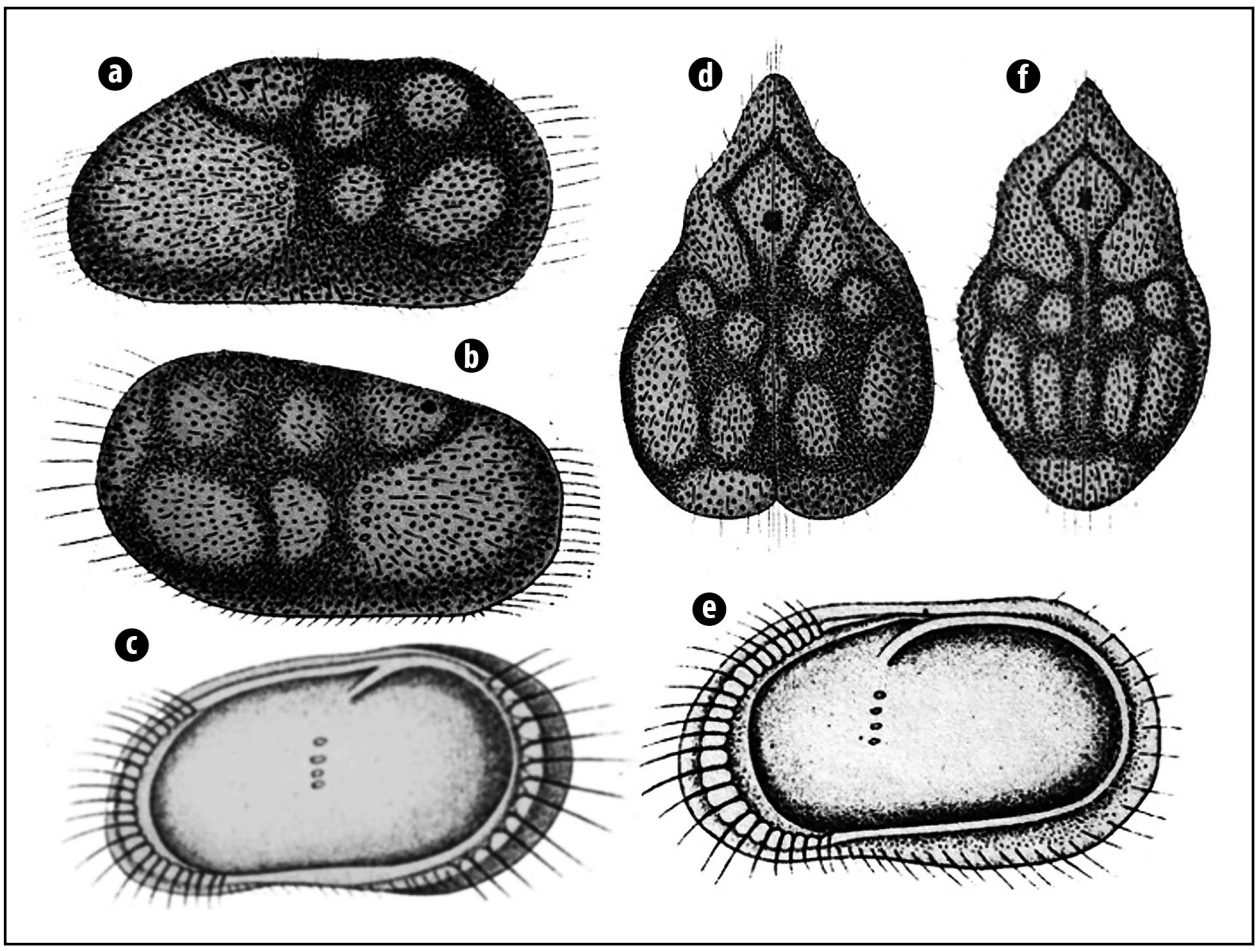


Fig. 5. *Cytheridella ilosvayi* Daday: illustration of the valves and carapaces, originally figured by Daday (1905, Pl. 17, Figs. 15-19 and 21): (**a**) – **LVf-ex**; (**b**) – **RVf-ex**; (**c**) – **RVf-in**; (**d**) – **Cf-do**; (**e**) – **RVm-in**; (**f**) – **Cm-do; ex, in, do** – outer, inner, dorsal view. Note that Daday (1905, p. 371) erroneously labelled the valves here figured in C and E as **LV-in**.

In lateral view the outer side of the valve displays a dorsal margin which appears straight or slightly bent (Table 1). It confirms the descriptions of Daday (1905), Purper (1974), Wrozyna *et al.* (2014). The inflation part of the brood care space of the valve in its dorso-posterior part (or better, the posterior third of the valve) and the posterior part of the valve builds at its periphery a curvature margin which covers the outer margin (Figs. 8a-b, 18a). The curvature margin continues ventrally down to the junction point (Fig. 8a).

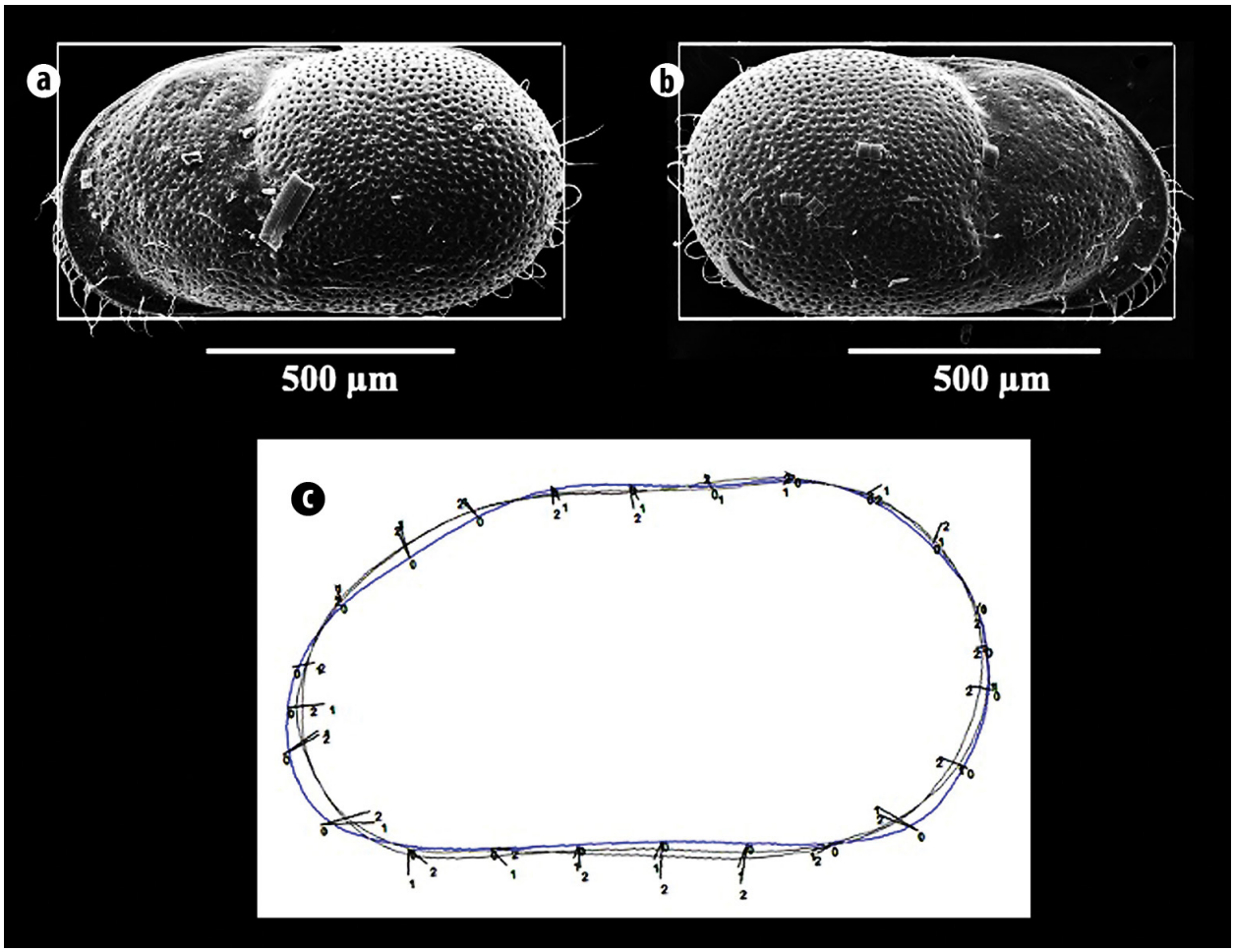
The central part of the ventral segment of curvature margin appears either as a straight line or slightly convex, depending on the configuration of the inflated brood chamber in the lateral and posterior part of the valve (Annex – Figs. 1, 2).

The outer margin is clearly visible on the antero-dorsal part continuing anteriorly down to the junction point (**jp**). The marginal line of the male is represented by the outer margin which extends on the whole dorso-posterior and posterior sections. The curvature margin in this part of the valve lays inside the outer margin (Fig. 10c).

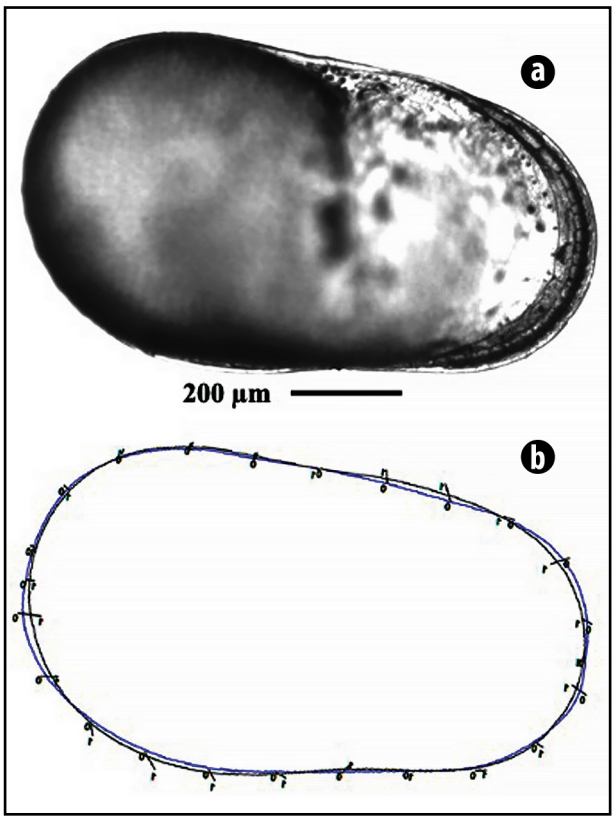
Valves from the Wallywash Pond in Jamaica display a flat anterior marginal zone which is proximally delineated by a rim representing the external lip (Fig. 8a). Behind this rim a row of foveolae exists. At the base of the external lip or directly on its rim are visible the marginal pores with sensilla. The Brazilian valves from Eirunepé and from Charco present a flange and the anterior marginal zone is represented by a strait groove within which marginal pores and stiff setae are visible (Figs. 9a, b, 17a).

C. ilosvayi presents both the **A1** and **A2** normal pores and setae (Figs. 9a, b). The female valve has an **A1** pore without a rim and the seta is short and stiff. The **A2** displays a pore either with a rim or placed on a conulus (Figs. 9b, 10b). The sensillum is long and slim. The male displays long and flexible **A1** setae in contrast to the homologue seta of the female.

In dorsal view the posterior half of the valve has maximal width of 38% of the length and is placed at about the second third of the longitudinal axis (Fig. 18a). The basis of the posterior part is largely round. The male´s valve in dorsal view (Fig. 19a) is about a fourth less inflated than its female homologue trait. The posterior extremity is pointed.



▲ **Fig. 6.** *Cytheridella ilosvayi* Daday: comparative aspects of the valve shape: (**a**,**b**) – **LVf** and **RVf** labelled MP-0-314 (repository M.P. at U.F.R.G.S.); (**c**) – representation of the superimposed outlines of the **LV** and **RV** from A and B on the outline of the **LVf** figured by Daday (1905, Pl. 17, Fig. 15, here Fig. 4A); data computed with "Morphomatica" using the B-spline algorithm for equal surfaces of outlines; blue line (0) the Daday's LVf, black lines, the outlines of the **LVf** (1) and **RVf** (2) figured in A and B; lines crossing the outlines represent vectors of the degree of dissimilarity of valve segments measured between the reference control point of the Daday outline (0) and the outlines 1 and 2 of the valves belonging to the MP-0-314 specimen.



◀ **Fig. 7.** Comparative aspects of **RVf**: (**a**) - *Cytheridella martingrossi* n. sp., AQ19-37-**RVf**, in **TLM**; (**b**) – superimposed outlines using the B-splines algorithm of Morphomatica, blue line (0) Daday's valve (Fig. 4b), black line (1) *C. martingrossi* n. sp. illustrated in (a).

Table 1. *Cytheridella* taxa – length of female valves and their degree of inclination for the dorsal margin; Left (L) and Right (R) valves, (see Annex, Figs. 1, 2)

Taxon Valve name		Valve length (mm)	Angular degree
***C. danielopoli* Purper**			
1.	MP-0-529-L	0.88	+1°
***C. ilosvayi* Daday**			
2.	MP-0-314-L	0.96	-1°
***C. martingrossi* n. sp.**			
3.	AQ 19-01-L	1.03	-5.5°
4.	AQ 19-03-R	1.12	-5°
5.	AQ 19-04-R	1.03	-5°
6.	AQ 19-05-R	1.1	-5.5°
7.	AQ 19-06-R	1.02	-5°
8.	AQ 19-37-R	1.08	-6.5°
9.	AQ 19-38-R	1.06	-7.5°
10.	AQ 19-39-L	1.03	-5°
11.	AQ 19-40-L	1.04	-5°
***C. ilosvayi* (Eirunepé)**			
1.	E04-L	0.9	0°
2.	E05-L	0.91	0°
3.	E08-L	0.9	0°
4.	E17-L	1.05	+1°
5.	E19-L	0.88	+1°
6.	E21-L	0.9	-1°
7.	E24-L	0.92	-1°
8.	E25-L	0.96	-1°
9.	E26-L	0.89	+1

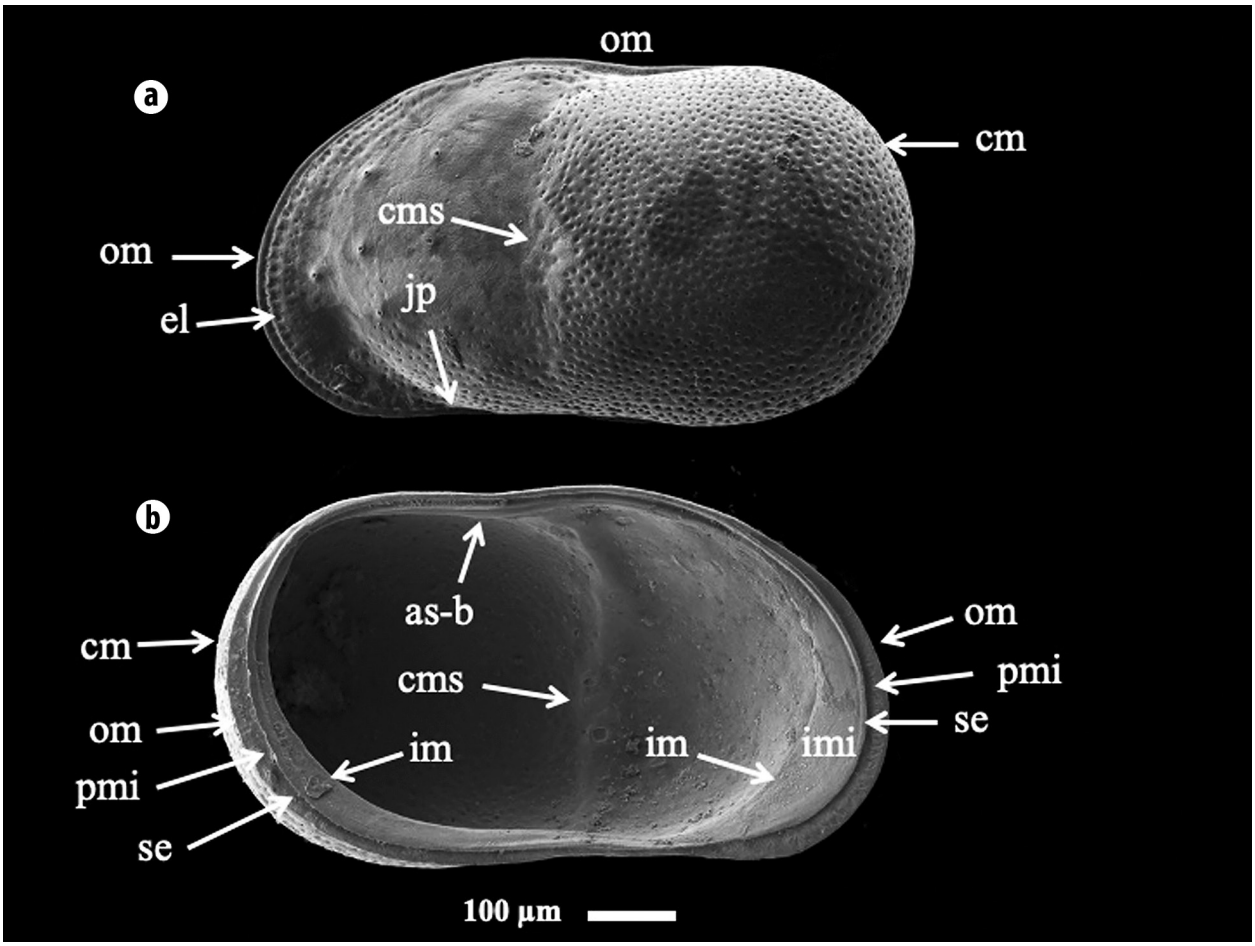


Fig. 8. *Cytheridella ilosvayi* Daday, LVf, Wallywash Great Pond, Jamaica, specimen WGP2-2, lateral position: (**a**) – outside view; (**b**) – inner-side aspect; acronyms: **pmi** - peripheral area of the marginal infold, **imi** - inner area of the marginal infold, **cms** - central muscle scars, **el** - external lip, cm - curvature margin, **im** - inner margin, **as-b** – antislip-bar, **jp** -junction point, **se** - selvage, **om** – outer margin.

The inner side of the valves in lateral view can be characterized as following: the anterior part of the marginal infold (**mi**) has a calcified part which represents more than 10% of the valve´s length (Fig. 8b). The selvage in the case of the Wallywash Pond is placed more inwards and divides the anterior marginal infold in a peripheral part (**pmi**) and an inner one (**imi**). This latter one, much larger than the **pmi** (Fig. 8b).

On the dorsal part of the valve below the lower bar of the hinge groove exists an antislip-bar (Fig. 8b). The four adductor muscle scars (**cms**) are separated in two groups. The upper two scars have a quasi-vertical position while the lower two are oriented slightly backward (Fig. 8b).

The Eirunepé valves display a selvage placed in a more peripheral position (Fig. 9c). In this latter image the separation of the calcified-mi (**cail**) from the cuticular one (**cuil**) through the inner margin (im) is visible. On the cuil one or two rows of cuticular filaments (setulae) are visible (Figs. 9c, d).

The posterior part of the valve has a peripheral marginal infold on which a row of minute pores from which thin sensilla distally trifurcate emerge (Figs. 11a-c).

3.2. *Cytheridella danielopoli* Purper, 1979 - Review of the original description, with addition of new diagnostic traits

3.2.1. Purper´s original data

Purper (1979, p. 243) offered the following diagnosis for *C. danielopoli*: "Dorsal and ventral margins parallel, in lateral view; anterior and posterior margins equally arched. In dorsal view the male presents the outline of the posterior portion slightly arched, directed backward towards the junction of the valves. Short marginal pore canals." This diagnosis is based on the left valves that we illustrate here as figures 12a-c, 14a-b and 19c.

The examination of the outline of the left valve of the female (Fig. 12a) using the geometric morphometric technique in Morphomatica (Fig. 3) allows us to see the quasi rectangular shape with the dorsal margin in its central part slightly oblique (see also Fig. 12a and Table 1).

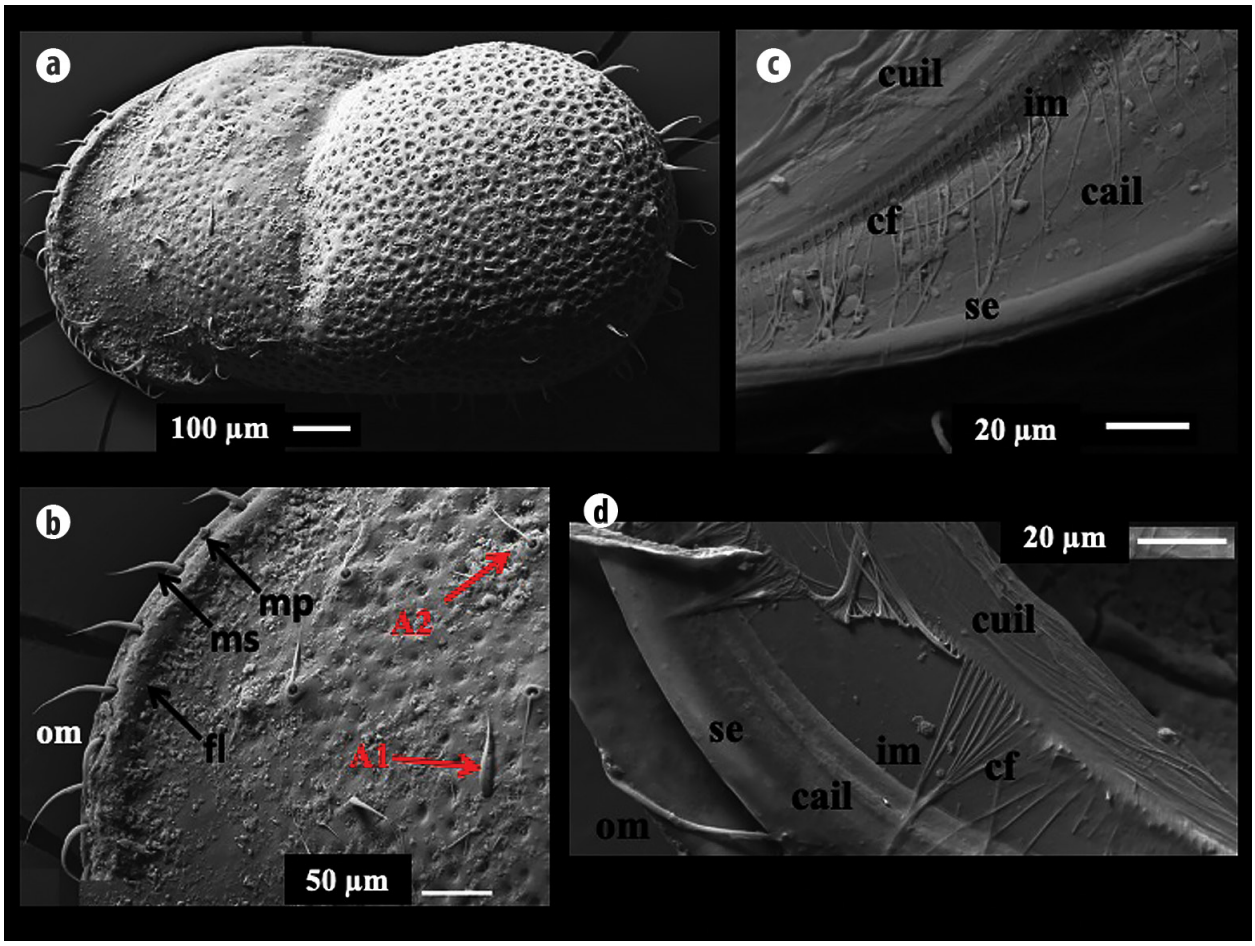


Fig. 9. *Cytheridella ilosvayi* Daday, (**a**-**c**) - female and (**d**) - male, morphologic details of Eirunepé valves: (**a**,**b**) – specimen E35-LV-ex; (**a**) – general view; (**b**) – detail of the upper part of the anterior area; (**c**,**d**) – anterior-inner side areas; (**c**) - specimen E26-LV-in; (**d**) – specimen E32-RV-in; acronyms: **cuil** - cuticular inner lamella, **cail** - calcified inner lamella, **cf** - cuticular filaments (setulae), **im** - inner margin, **om** - outer margin, **se** - selvage, **fl** - flange, **ms** - marginal seta, **mp** - marginal pore, **A1**- normal seta without rim, **A2**-normal seta with rim.

The maximum height lays in the anterior half near the control points (**cp**) **d5** and **v5** (Fig. 3). The ventral margin between the **cp v4-v7** is slightly convex in its central part. The same segment of the male is less convexly shaped. The maximum width of the female left valve, in dorsal view, (Fig. 18c), is placed at about two thirds of the **Lmax**. Expressed as **Wmax/Lmax** it represents 33%. The **Wmax/Lmax** of the male is only 28.4% because of the absence of the brood care space (Fig. 19c). The marginal infold is large, more than 10% of the **Lmax** (Fig. 14a), due to the extension of the imi section (Fig. 14b, red line).

3.2.2. New features of valve morphology and diagnostic traits

Two valves recovered from a core sample extracted at Sucuriju (Fig. 1 and Annex – Table 1) allows us to complement the description of *C. danielopoli*. The size of the valves displays the same length as those of Purper (1979) from São Paulo de Olivença (Fig. 1). The length of the left female valve is 0.88 mm with **Hmx/Lmax** 57% and those of the right valve male, 0.83 mm with **Hmx/Lmax** 55%. The general shape of the female left valve (Fig. 13a) is similar to those illustrated by Purper (1979, here Fig. 12a).

The outer side in lateral view of the female and male valves display the following details:

The dorsal margin is represented at both the female and the male valves by the outer margin. The curvature margin starts below the om in the dorso-posterior part (Figs. 13a, c); in the posterior section it has the same extension as the **om** (Fig. 13b). The same aspect is visible also on Purper´s valve in dorsal view (Fig. 18c) where the posterior limit of the cm appears at the same level as the **om**.

The ventral margin of the male valve is incomplete (Fig. 13d). On the marginal anterior part of the valves a flange is developed and the anterior marginal zone is narrow (Figs. 13a, c).

On the inner side of the valve in lateral view one sees on the periphery of its shape only the outer margin. The marginal infold is partly visible on the right valve of the male (Fig. 13c).

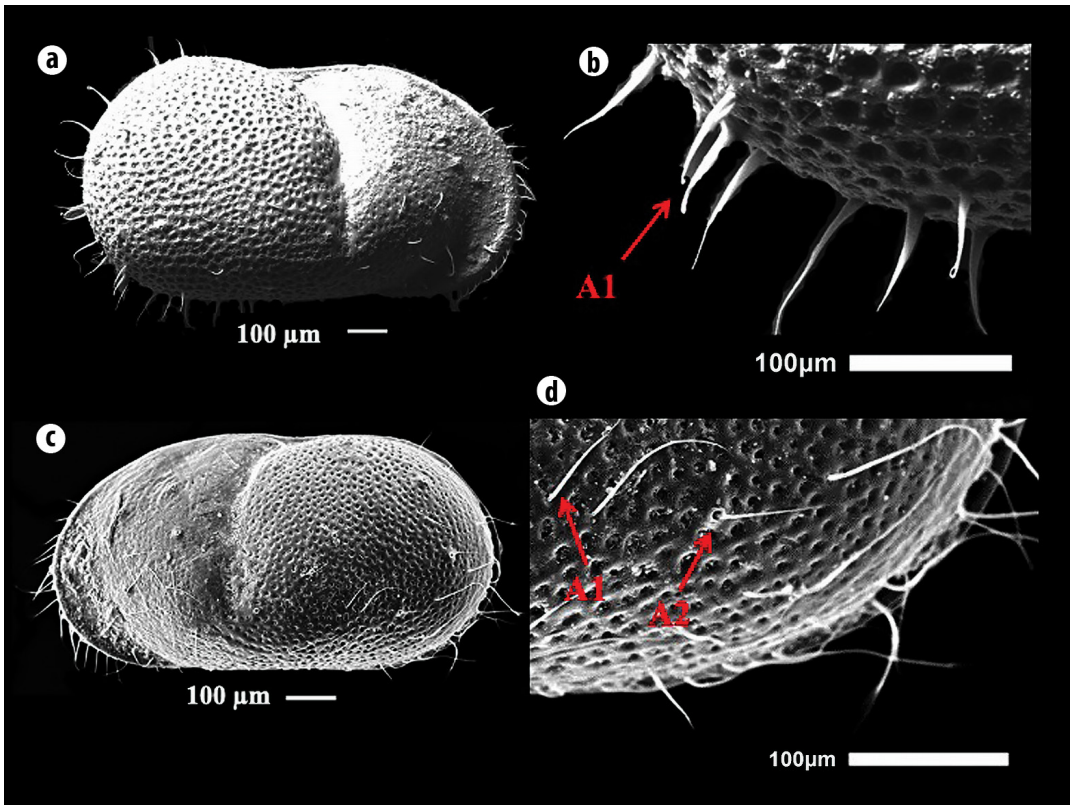


Fig. 10. *Cytheridella ilosvayi* Daday, details of postero-ventral setae on the external side of valves: (**a**,**b**) – **RVf,** specimen E35-RV- ex; (**c**,**d**) – **LVm**, specimen E02-LV-ex; (**a**,**c**) – general view; (**b**) –**A1** seta; (**d**) – **A1** and **A2** setae.

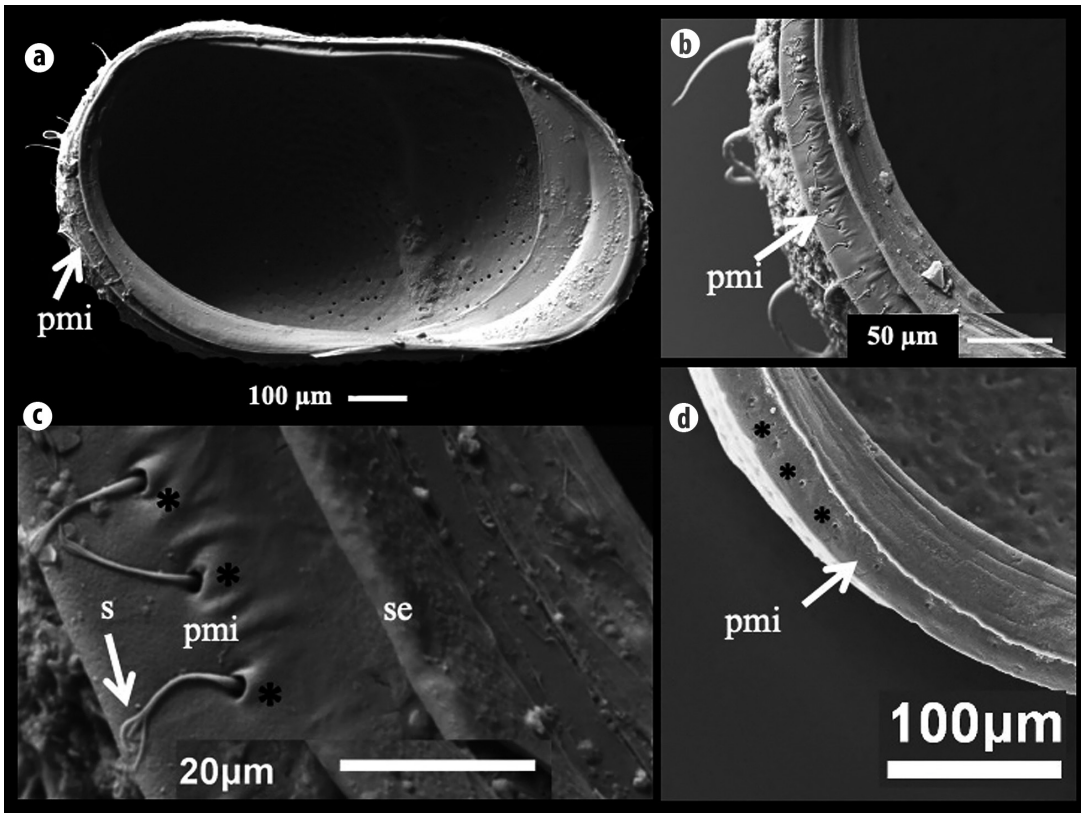


Fig. 11. *Cytheridella ilosvayi* Daday (**a**-**c**) and *Cytheridella martingrossi* n. sp. (D), details of postero-ventral areas on the **LVf**, inner side: (**a**) – specimen E24-LV-in; (**b**,**c**) – specimen E25-LV-in, morphologic details; (**d**) – specimen AQ 19-01-LV-in; acronyms: **pmi** - peripheral marginal infold, **se** - selvage, **s** - sensilum (trifurcate type), black star - pores on the **pmi** area.

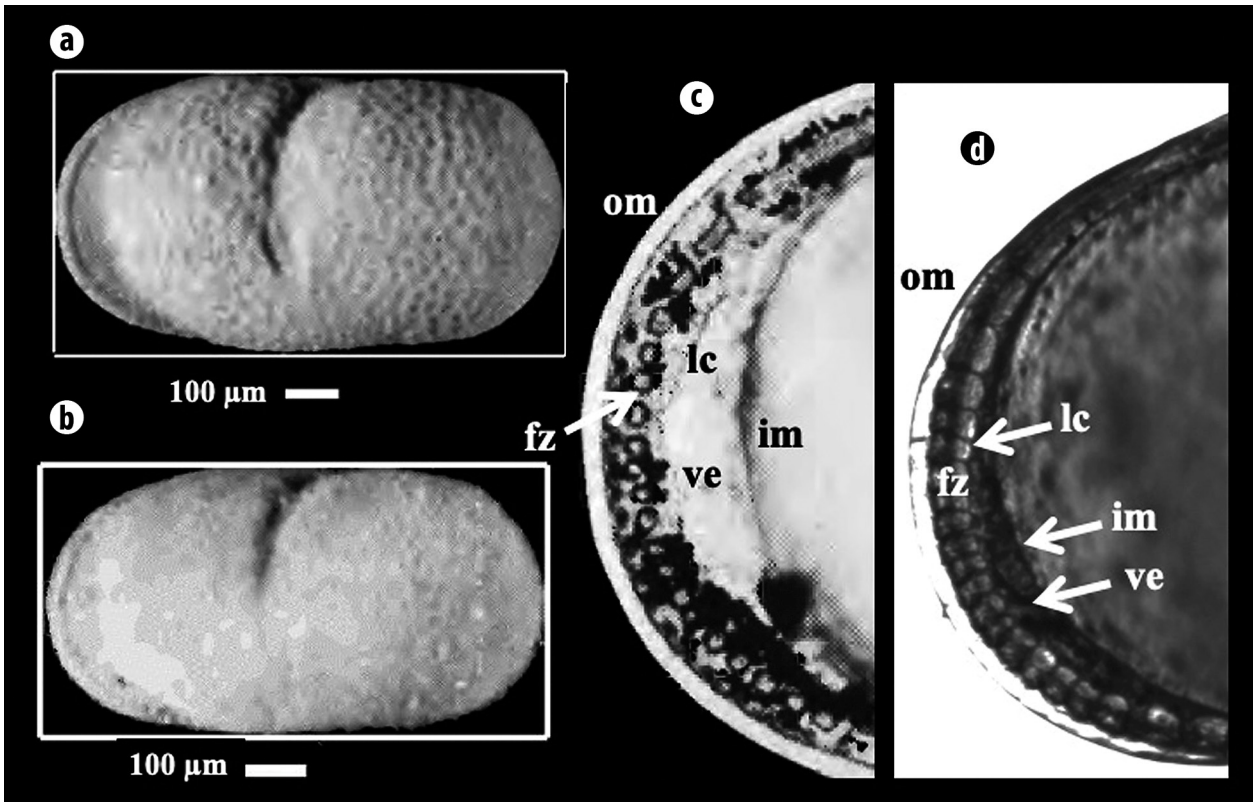


Fig. 12. *Cytheridella danielopoli* Purper, (**a**-**c**) – illustration reproduced (with permission) from Purper (1979, Pl. 7, Figs. 22, 23, 26) and *Cytheridella martingrossi* n. sp. (**d**) – morphologic aspects of the LV: (**a**,**b**) – lateral view, general aspect; (**c**,**d**) – details of the anterior area of the valve viewed in **TLM**; (**a**) – LVf, specimen MP-0-529 (holotype, Fig. 23 of Purper 1979); (**b**) – LVm, MP-0-530 (paratype, Fig. 22 of Purper 1979); (**c**) – detail of the specimen MP-0-529 (Fig. 26 of Purper 1979); (**d**) – specimen AQ 19-01-LVf; acronyms: **om** - outer margin, **fz** - fused zone, **lc** - line of concrescence, **im -** inner margin, **ve** - vestibulum.

The central muscle scars, well visible, are divided in two groups with a slightly different orientation (Figs. 13b, d). The selvage, inward the outer margin, is visible on the anterior, posterior and the ventral margins (Figs. 13b, d).

Finally, we want to note that the general valve shape of *Cytheridella danielopoli* considered by Munoz-Torres *et al.* (1998, here Fig. 13e) a possibly A-1 juvenile resembles the male´s valve of *C. danielopoli* from Sucuriju (Fig. 13d). Unfortunately, no documentation of adult females is available for this Colombian *Cytheridella*. Such additional material would allow a precise taxonomic identification.

3.3. *Cytheridella martingrossi* Danielopol and Piller n. sp. – Taxonomic characterisation

3.3.1. Introduction and taxonomic setting

Gross *et al.* (2013) described a *Cytheridella* species that was attributed to *C. danielopoli* Purper, 1979. The documentation offered by Gross *et al*. (2013) is excellent and its re-examination suggested now that we deal with a new species that two of us dedicate to our colleague Martin Gross. A further examination of morphological details of the Aquidabã material allows us to offer a robust diagnosis of this species.

***Cytheridella martingrossi* Danielopol and Piller, n. sp.**

Cytheridella danielopoli Purper, 1979: Gross *et al.* 2013: Pl. 2, Figs. 15-19; Pl. 3, Figs. 1-28.

Cytheridella danielopoli Purper, 1979: Wrozyna *et al.* 2016: Fig. 5.

Holotype:

LVf - AQ 19-01-L; Inv. Nr. MPEG-92-M:
Collection Museo Paraense Emílio Goeldi, Belém.
Figures: 11d; 12d; 15a; 16a,b; 17b,c; Annex – Fig. 1/3.
Original Figures: Gross *et al.* 2013: Pl. 2, Fig. 15; Pl. 3, Figs. 1, 28.
Type locality: Aquidabã, 22 km NE Eirunepé (06°31'40.8"S, 69°39'52.0"W), Amazonia, BR.
Dimensions: **Lmax** – 1.01 mm; **Hmax** – 0.59 mm.

Paratypes:
RVf - AQ 19-37-R; Inv. Nr. MPEG-101-M:
Collection Museo Paraense Emílio Goeldi, Belém.
Figures: 7a; 15b; 16c,d; Annex – Fig. 1/8.
Original Figures: Gross *et al.* 2013: Pl. 2, Fig. 16; Pl. 3, Fig. 9.
Type locality: same as for the holotype.
Dimensions**: Lmax** – 1.03 mm; **Hmax** – 0.61 mm.

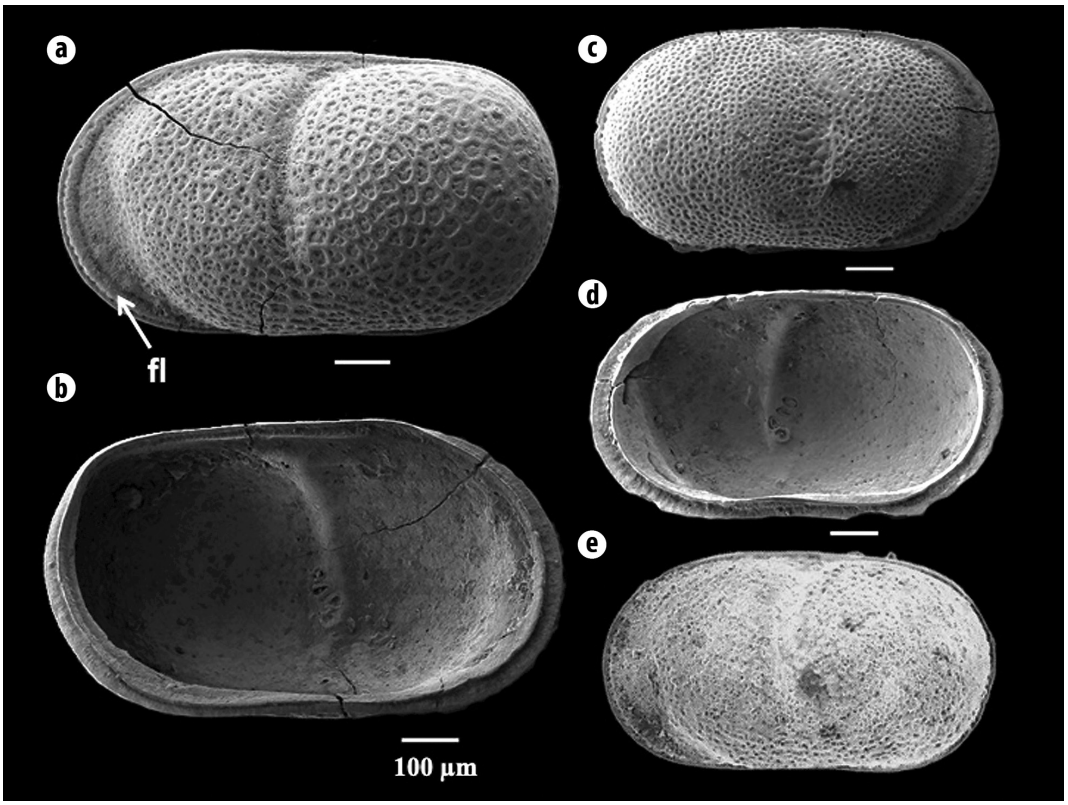


Fig. 13. *Cytheridella danielopoli* Purper, 1979, general view of the valves: (**a**,**b**) – valve AM-10-15-40 (LVf) in outer (**a**) and inner view (**b**); (**c**,**d**) – valve AM-10-15-39 (RVm), valves from Sucuriju; (**e**) – *Cytheridella danielopoli* Purper, 1979 – **LV** illustration from Muñoz-Torres *et al.*, 1998, Pl. 6, Fig. 13.

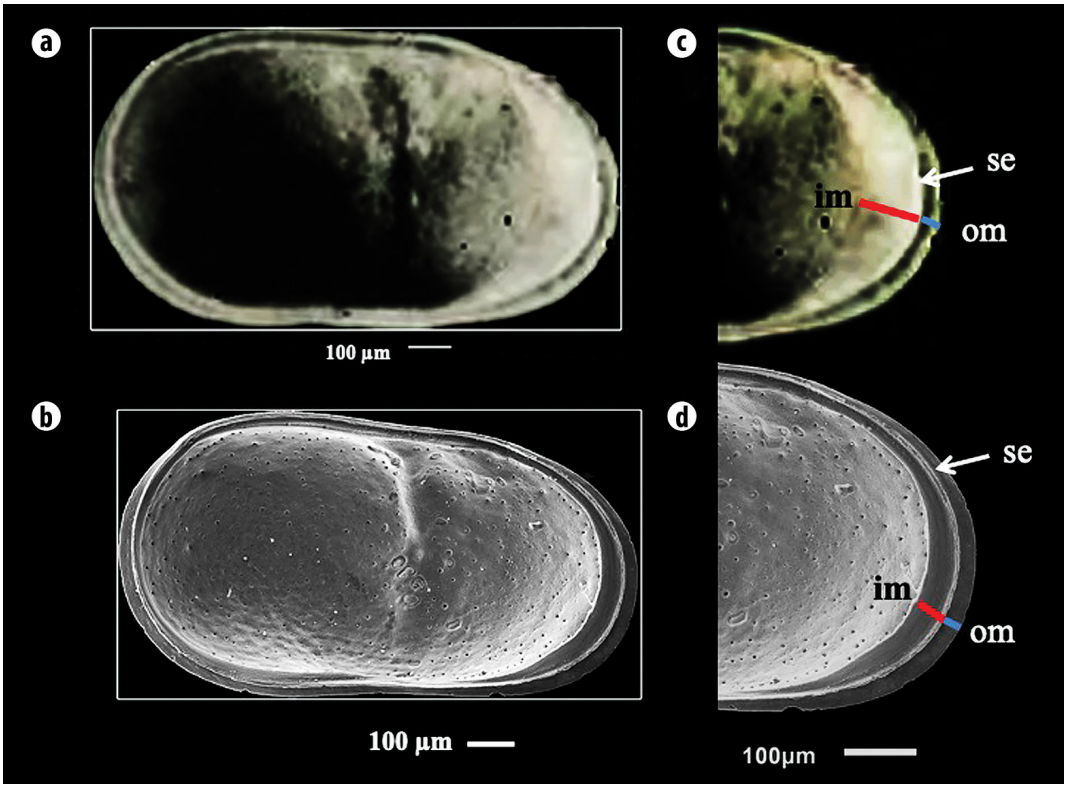


Fig. 14. *Cytheridella danielopoli* Purper, 1979 (**a**,**b**) and *Cytheridella martingrossi* n. sp. (**c**,**d**), inner view of the LVm; (**a**,**b**) – general view, (**b**,**d**) – details of anterior area from (a) and (c); (**a**,**b**) - specimen MP-0-586 (Fig. 21 of Purper 1979, Pl 7, reproduced with permission); (**c**,**d**) – specimen AQ 19-09- Li from Aquidabã; acronyms: **se** – selvage, **om** – outer margin, **im** – inner margin; red and blue lines mark the extension of the **imi** and **pmi** sections of the anterior marginal infold.

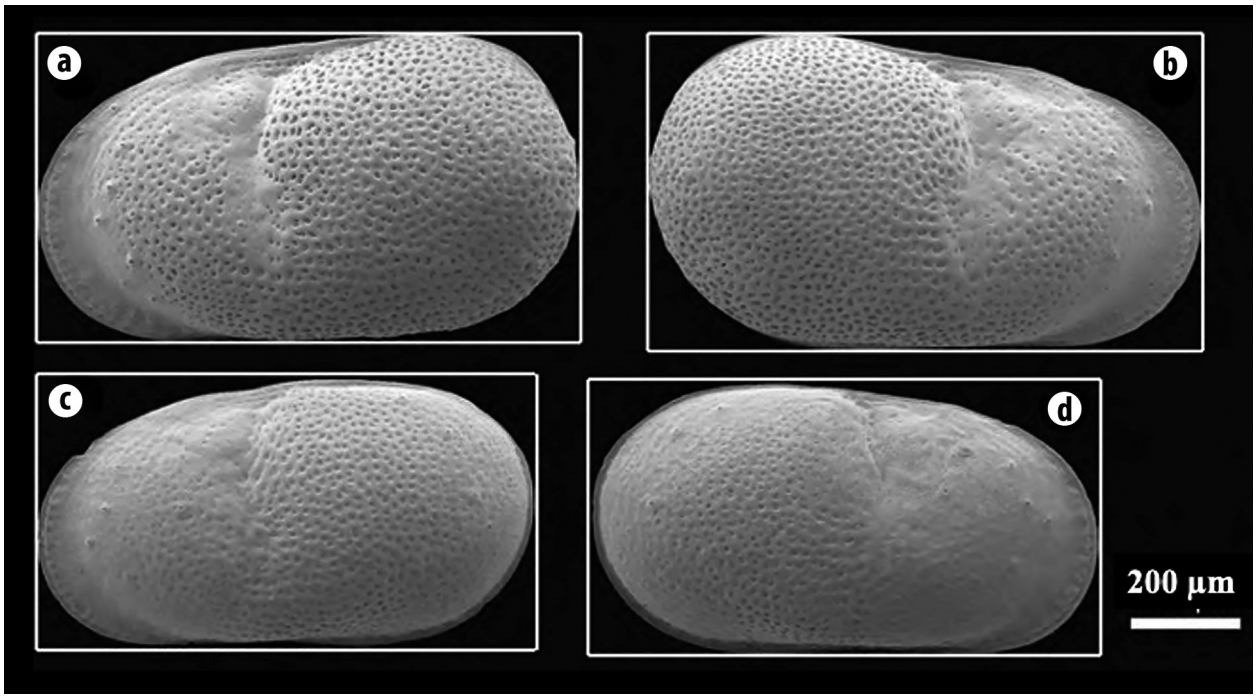


Fig. 15. *C. martingrossi* n. sp. lateral outer side view of valves: (**a**) – Holotype – **LVf**, specimen AQ 19-01; (**b**-**d**) Paratypes: (**b**) – **RVf,** specimen AQ 19-37, (**c**) – **LVm**, specimen AQ 19-07, (**d**) – **RVm**, specimen AQ 19 -23.

LVm - AQ 19-09-L; Inv. Nr. MPEG-94-M:
Collection Museo Paraense Emílio Goeldi, Belém.
Figures: 14c,d; 19b.
Original Figures: Gross *et al.* 2013: Pl. 2, Fig. 18; Pl. 3, Fig. 27.
Type locality: same as for the holotype.
Dimensions**: Lmax** – 0.93 mm; **Hmax** – 0.51 mm.

RVm - AQ 19-23-R; Inv. Nr. MPEG-96-M:
Collection Museo Paraense Emílio Goeldi, Belém.
Figure: 15d.
Original Figures: Gross *et al.* 2013: Pl. 2, Fig. 19; Pl. 3, Fig. 10, 22.
Type locality: same as for the holotype.
Dimensions: **Lmax** - 0.95 mm; **Hmax** – 0.51 mm.

Additional paratypes used for this study: see Annex – Table 1.

3.3.2. Diagnostic traits

The general shape of the valves in lateral view is ovoid. The **Hmax** is placed in the posterior third of the valves at both the female (Figs. 16a, b) and the male (Figs. 16c, d). The dimorphism of the **Hmax** between the female with her enlarged brood care space and the male without a brood space is visible, the former varies between 57 and 60% of the length of the valve while the latter varies between 53 and 55%. The dorsal margin displays a marked inclination towards the anterior part of the valve. In the central segment of the dorsal margin the om is visible and its angularity varies between 5° and 7.5° (Table 1). The dorso-posterior margin of the female is represented in some specimens by the curvature margin (**cm**), below which lays the outer margin, in other specimens the outer margin displays the external limit while the **cm** is slightly placed inwards. The postero-ventral margin covers the om (Fig. 18b). The ventral margin, generally straight, is a continuation of the **cm**. The margin of the anterior part of the valves is represented by the **om**. The male outline is represented by a visible **om** on all its parcourse (Figs. 14c, d; 15c, d).

The maximal width of the valve is about 20% of the length and at the female is placed in the lower quarter of the valve length (Fig. 18b). The posterior part of the male, in dorsal view, is pointed. The maximal width is located in the central third and approaches 15% of the **Lmax** (Fig. 19b).

The anterior part of the outer lamella of valves displays at its periphery an external lip, as a thin rim, on which marginal pores open. Behind the rim foveolae are placed on a flat area (Figs. 17b, c).

The marginal infold on the inner side of the female valves (Figs. 16b, d) is narrow, about 8% of the valve´s length. The same with the **mi** of the male (Figs. 14c, d). The selvage divides the **mi** (Fig. 14d) in a straight **pmi** (blue line) and a larger **imi** section (red line). The fused zone is straight and traversed by short marginal canals. From the line of concrescence starts a small vestibule delineated inwards by the inner margin (Fig. 12d; 16a). On the postero-ventral part of the **pmi** a series of minute pores is visible (Fig. 11d).

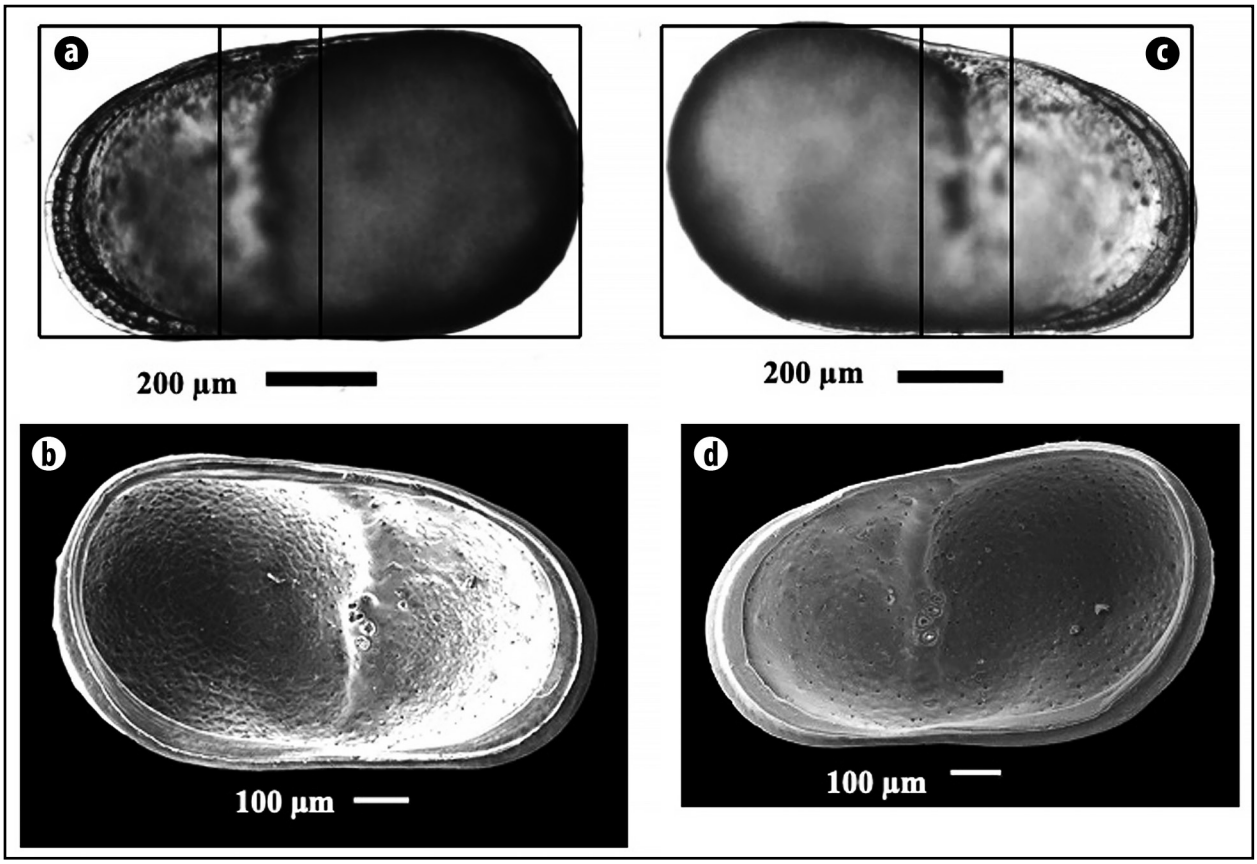


Fig. 16. *C. martingrossi* n. sp. lateral view of valves: (**a**,**b**) – **LVf**, specimen AQ 19-01; (**a**) – valve viewed in **TLM**; illustration for position of the al and ml on the valve circumscribed within a bounding box; (**b**) – **SEM** of the valve, viewed on its inner side; (**c**,**d**)– **RVf,** specimen AQ 19-37; (**c**) - valve viewed in **TLM** with the position of the **al** and **ml;** (**d**) – **SEM**-picture of the inner side of the **RVf**.

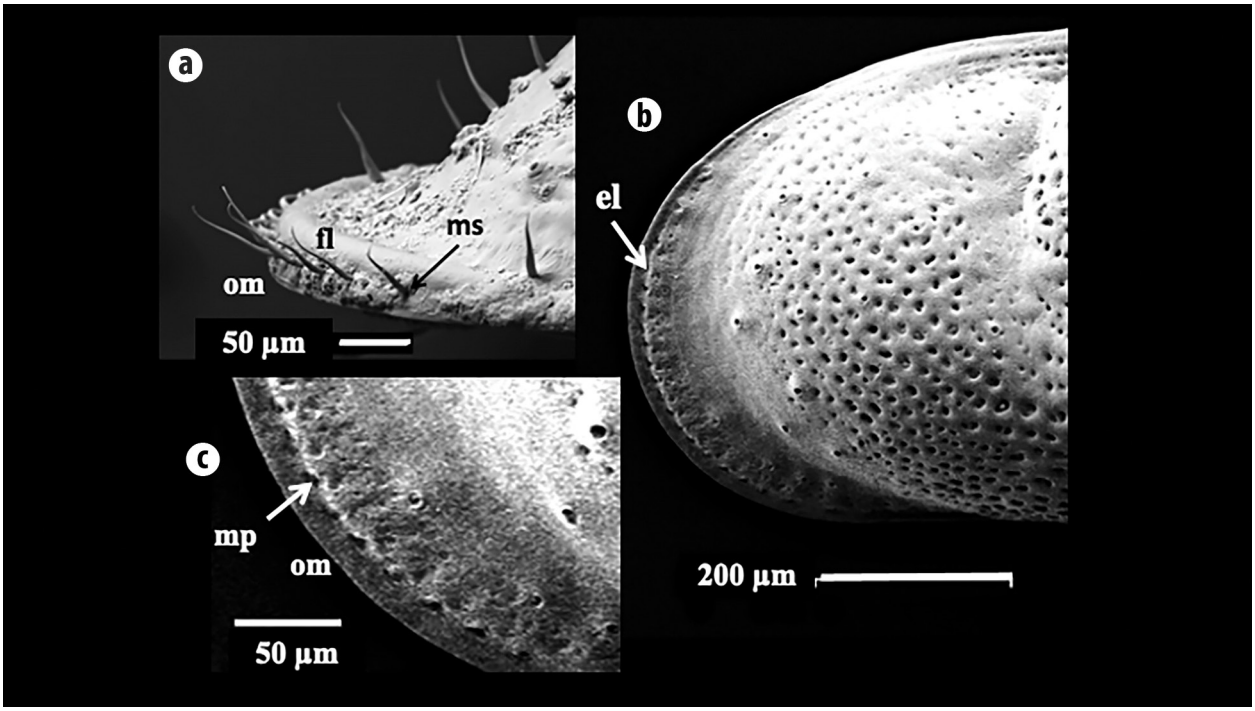


Fig. 17. *C. ilosvayi* Daday (**a**) and *C. martingrossi* n. sp. (**b**,**c**), details of the anterior area of **LVf**: (**a**) – specimen E33-L; (**b**,**c**) – specimen AQ 19-01-L. Acronyms: **om** - outer margin, **fl** - flange, **el** - external lip, **ms** - marginal seta, **mp** - marginal pore.

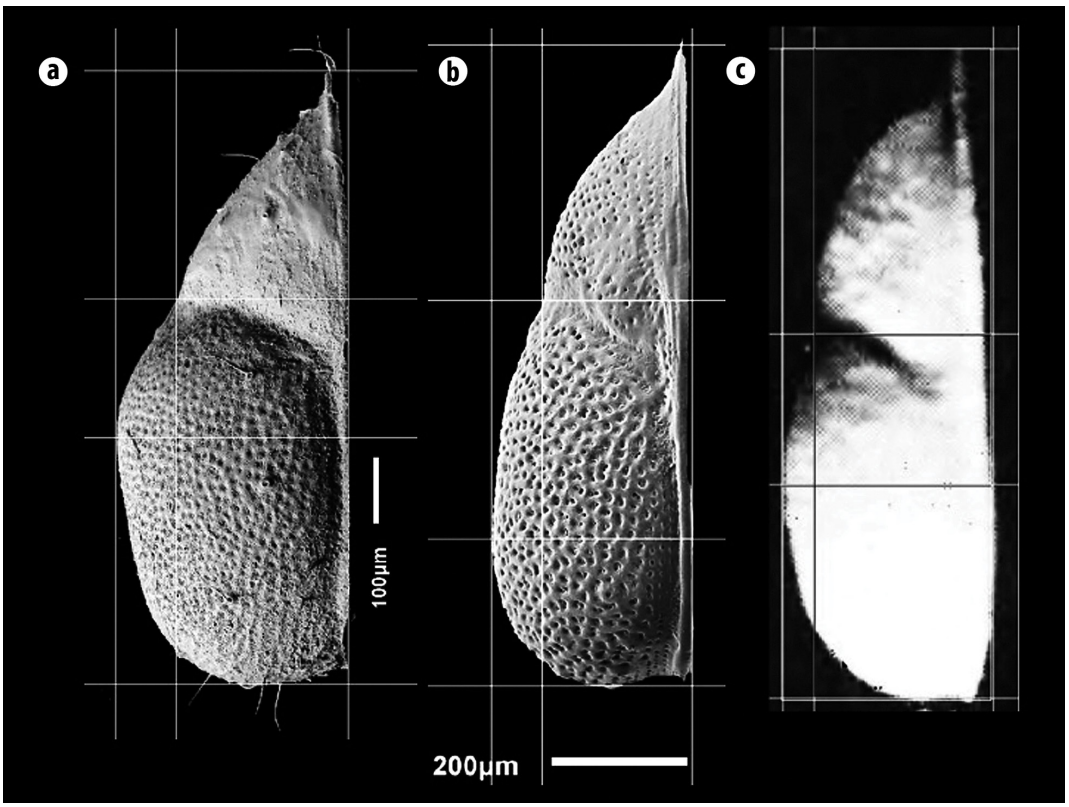


Fig. 18. *Cytheridella* species, **LVf**, dorsal view: (**a**) – *C. ilosvayi* Daday, specimen E04-Ld; (**b**) - *C. martingrossi* n. sp., specimen AQ 19-01-L; (**c**) - *C. danielopoli* Purper, specimen MP-0-529, illustration from Purper (1979, Pl. 7, Fig 24).

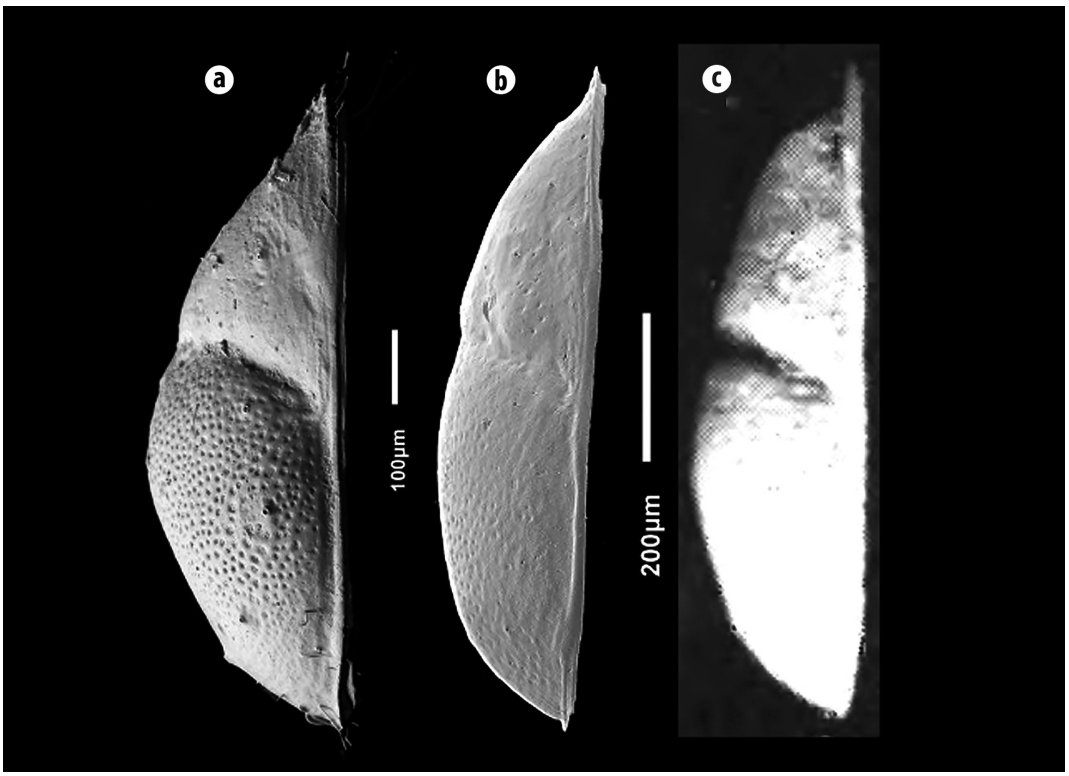


Fig. 19. *Cytheridella* species, **LVm**, dorsal view: (**a**) – *C. ilosvayi* Daday, specimen E04-Ld; (**b**) - *C. martingrossi* n. sp., specimen AQ 19-09-L; (**c**) - *C. danielopoli* Purper, specimen MP-0-530, illustration from Purper (1979, Pl. 7, Fig 25).

3.4. Synoptic comparative characterisation of *Cytheridella ilosvayi* Daday, 1905, *C. danielopoli* Purper, 1979 and *C. martingrossi* Danielopol and Piller, n. sp.

In the following, a synthetic view of the way one can characterize the three species, using especially morphologic traits of the female valves, is presented.

Figure 20 shows the distribution of morphotypes of the three species within a 2D morphospace using a **CAP** analysis made on the outlines of their valves. *Cytheridella martingrossi* outlines are 100% recognised as differing from those of *C. ilosvayi* and *C. danielopoli*. The shape of this latter outline is placed within the cloud of outlines of Eirunepé. The outline of the **LV** from the original description of Daday (1905) is also incorporated within the morphospace of the valves from Eirunepé.

We offer bellow and in Table 2 the morphologic traits which by comparative examination build the diagnoses of the three *Cytheridella* species here studied. We follow in this way the recommendations of the ICZN (2000). In this latter document (p. 103) a diagnosis is defined as "a statement in words that purports to give those characters which differentiate the taxon from other taxa with which it is likely to be confused".

C. ilosayi: displays an approaching rectangular shape with quasi-horizontal margins on the dorsal and ventral parts of the valve. The quasi-straight dorsal margin resembles those of *C. danielopoli*. The curvature margin covers the outer margin in the dorso-posterior and the posterior part of the valve. Through this characteristic it differs from *C. martingrossi* which displays a more variable extension of the curvature margin (Table 2). In dorsal view the brood space of the carapace is placed in the posterior half of the valve and displays maximal width values of more than a third of the valve length. The other two species display a less developed brood space (Table 2). *C. ilosvayi* differs from *C. martingrossi* also by the position of the **Wmax** along the maximal length of the valve, at the latter species it is placed in a lower position (Figs. 18a, b). *C. ilosvayi* develops on the external side of the valve on its marginal zone either a flange or just a rim representing the external lip. The extension of the marginal infold on the inner side of the anterior part of the valve represents more than 10% of the total length of the valve and it resembles those of *C. danielopoli*.

C. danielopoli: displays a quasi-rectangular shape with the ventral margin of the valve slightly convex while in the other two species it is quasi-horizontal (sometimes slightly concave in the case of *C. ilosvayi*). Another peculiar aspect of of *C. danielopoli* is its maximal height placed in the anterior half of the valve, while at *C. ilosvayi* and *C. martingrossi* it is placed in the posterior half of the valve. The brood chamber of *C. danielopoli* displays a more reduced lateral extension as compared to *C. ilosvayi* and the curvature line in the dorso-posterior part of the valve is placed inward the outer margin (Table 2). *C. danielopoli* displays a flange resembling in this way *C. ilosvayi* from Brazil.

C. martingrossi: shows a quasi-ovoid shape which differs from *C ilosvayi* and *C danielopoli* by its marked slope forward oriented. The two other species have a quasi-rectangular shape with a dorsal margin in a horizontal position.

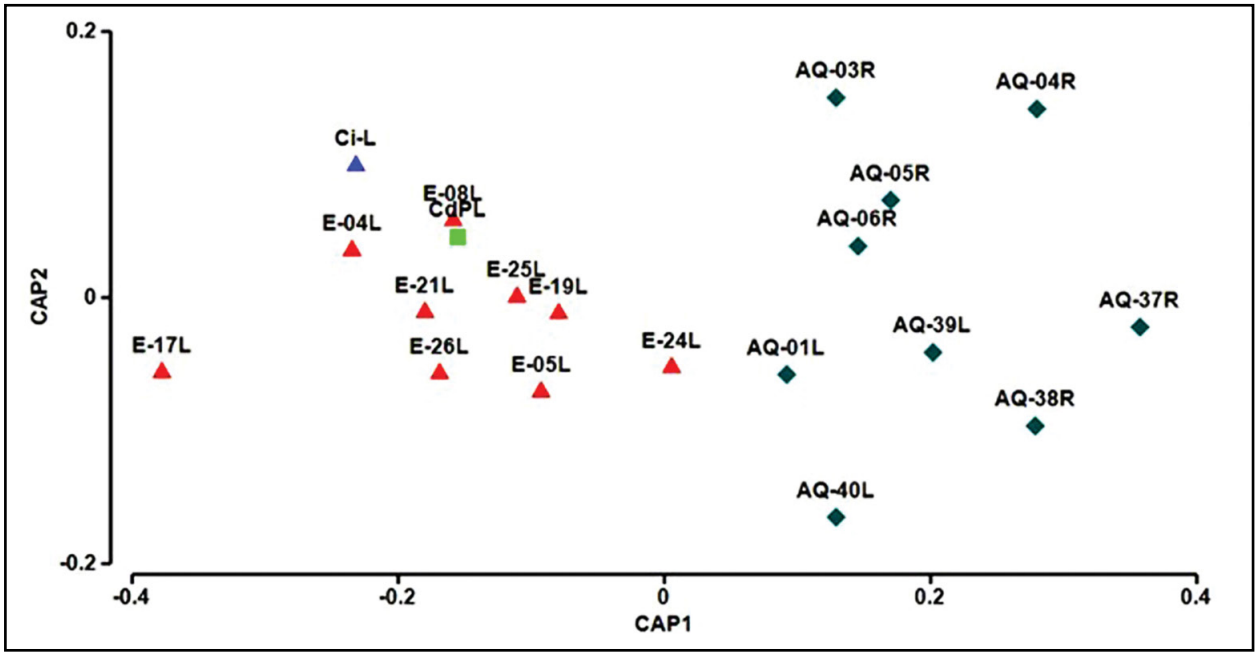


Fig. 20. Plot by Canonical Analysis of Principle Coordinates (**CAP**) of the dissimilarity distribution of outlines for **LVf**: *C. ilosvayi* Daday triangles, (original valve of Daday species in blue, Eirunepé valves in red); *C. danielopoli* Purper green square; *C. martingrossi* n. sp. olive rhombus; acronyms: name of specimens illustrated in the Annex – Figs. 1, 2.

Table 2. Traits of the three *Cytheridella* species, *C. ilosvayi* Daday, 1905, *C. danielopoli* Purper, 1979, *C. martingrossi* Danielopol and Piller n. sp. using adult female and left valve.

N° Tr.	Morphologic traits left valve	*C. ilosvayi* Daday,1905	*C. danielopoli* Purper, 1979	*C. martingrossi* D.L.D. & W.E.P., n. sp.
1	general shape, lateral view	quasi-rectangular	quasi-rectangular	quasi-ovoid shape
2	dorsal margin	quasi-horizontal	quasi-horizontal	marked slope
3	ventral margin	quasi-horizontal/slightly concave	quasi-horizontal/slightly convex	horizontal
4	dorso-post. marg. 1/3p cm / om	cm > om	om > cm	cm > om om > cm
5	posterior margin, cm / om	cm > om	cm = om	cm > om
6	position Hmax	posterior 1/2L	anterior 1/2L	posterior 1/2L
7	brood chamber - size (Wmax/L)	> 1/3L	= 1/3L	< 1/3L
8	brood chamber - position of Wmax	~2/3L	~2/3L	~3/4L
9	flange/external lip	both	flange	external lip
10	extension of mi (mi/L%)	>10%	>10%	< 10%

Acronyms: cm – curvature margin; **om** – outer margin; **mi** – marginal infold; dorso-post. marg.; **1/3p** – the dorso-posterior margin on the posterior third of the valve.

Table 1 offers details on the angularity of the position of this morphologic trait. The size of the posterior curvation-margin, as compared to the anterior outer margin, when examined in lateral position, is larger in the case of *C. martingrossi* as compared to those of the other two species.

The maximal width of the brood chamber and its position in dorsal view is in the case of *C. martingrossi* smaller than those of *C. ilosvayi* and *C. danielopoli*; its position is placed in the posterior quarter of the carapace (Fig. 18b, Table 2). The valves of the females of *C. martingrossi* are slightly longer than those of the two other species (Table 1). *C. martingrossi* presents an external lip and a flat anterior marginal zone instead of the inflated flange and a shallow groove closely located to the outer margin as it appears in the case of the other two species. On the inner face of the valve, the extension of the marginal infold of *C. martingrossi* is smaller as compared to those of the other two species when measured at 50% of the maximal height of the valve; it represents less than 10% of the valve´s length (Table 2).

4. DISCUSSION

The taxonomical research on ostracods progressed during the last years from simple morphological presentations to more rational descriptions which combine morphology with aspects of phylogeny, ecology, biogeography and biostratigraphy (Matzke-Karasz *et al.* 2007). The present study is an example of this new tradition in the sense that we tried to offer clear morphological descriptions useful for building new standards for the systematics of the Cytheridellini. They will be helpful for collateral research as those mentioned above by Matzke-Karasz *et al.* (2007).

Three aspects merit to be discussed in order to stress out the relevance of our study for future developments of the *Cytheridella* systematics: (1) the value of diagnoses for an objective recognition of the taxonomic units; (2) the importance of the selection of stable morphologic traits for building taxonomic diagnosis, as a necessary practice that has to be periodically reviewed and if necessary improved by discarding unnecessary traits or by adding new stable ones; (3) the observation of ostracod morphology with the idea that a better understanding of the origin and function of the different structural parts can help to use them as new diagnostic traits.

4.1. The value of a solid taxonomic diagnosis

A taxonomic diagnosis offers the possibility to recognize in an objective and efficient way a given taxon. The stability of the taxon depends on the robustness of the morphologic traits which are used for the diagnosis. When a new species is described a diagnosis based on morphologic traits remains open to be challenged for their robustness (with the meaning of morphologic stability). At a higher level of generality, the robustness of a diagnosis increases with the number of the stable morphologic traits.

Having now proposed a diagnosis for *C. ilosvayi* (see Table 2) the strange illustration of the RV published by Daday (1905) and here reproduced as figure 5b could be due to incorrect drawing of the dorsal margin, where the line of the dorso-posterior curvature is not separated from the dorsal outer margin. Therefore, we consider Daday´s representation an artefact. We accept Daday´s illustration of the left valve as an approximate representation (here Fig. 5a). It is a reference when one tries to identify *C. ilosvayi* resembling as close as possible the original material of Daday from Paraguay.

4.2. Selection of morphologic traits

The ability to find solid diagnostic traits depends on the way we observe the structural complexity of ostracod morphology, both the carapace and the limbs. The example of the dorsal outline of the female valves for two of the *Cytheridella* species which represents a composite trait that have to be decomposed in two traits, each with its significance for the systematics of *Cytheridella* is a good example for the way morphologic details become visible only after careful inspection. The fact that we found a method to describe the two traits of the dorsal part of the *Cytheridella* valves in an objective (reproducible) way is an innovative aspect of the present contribution and will be useful for our future research on other Cytheridellini.

One aspect that merits to be stressed out is the usefulness of the illustration of 2D outline-shapes of the valves belonging to the three *Cytheridella* species as silhouettes. Combined with geometric morphometrics techniques and multivariate statistical algorithms they allowed to improve our perception on the possible taxonomic and phylogenetic relationships. Figure 20 summarizes this aspect, specially, the separation of *C. martingrossi* from the two other *Cytheridella* species and the close relationship of *C. danielopoli* with *C. ilosvayi*.

4.3. Search for new morphologic traits

The detailed description of the anterior marginal zone of the outer lamella as well as the marginal infold on both the anterior and the posterior sides represents an innovative approach. It allowed to discover the marginal pores on the posterior part of the marginal infold, from which at the extant individuals of *C. ilosvayi* we observed the emergent sensilla distally trifurcated. These latter morphologic details were until now unknown to exist on the valves of other ostracods. Probably, they can be used as diagnostic traits for the genus *Cytheridella*.

A potential morphologic structure useful for the taxonomy of Cytheridellini is the series of filamentous setulae, which cover the cuticular inner lamella of *C. ilosvayi* valves. They were until now unknown in the case of the Cytheridellini.

The presence of a flange and a very short anterior marginal zone of the valves of *C. ilosvayi* from Western Amazonia as compared to an external lip and a flat and slightly larger anterior marginal zone of the Jamaica individual, offers an argument to the idea to consider two morphotypes occurring in two widely separated geographic regions, as distinct species. This claim was advanced first by Wrozyna *et al.* (2018).

The central muscle scars divided in two groups, the upper one with two scars quasi-vertical placed and a lower one with two muscles backward oriented. This type of orientation is considered a diagnostic trait of *Cytheridella*. It differs from the vertical oriented scars as in *Gomphocythere* (Park *et al.* 2002).

The presence on the external side of *C. ilosvayi* valves of two types of pores with different sensilla is an aspect which was observed for this species for the first time by Danielopol *et al.* (2018). They are similar to the A1 and A2 pores existing at different Timiriaseviinae representatives, like *Gomphocythere besni* Külköylüoğlu, Yavuzatmaca, Cabral & Colin, 2015, *Gomphodella aura* Karanovic, 2009 and *Kovalevskiella* sp. (Danielopol *et al.* 2018). Therefore, they should be considered diagnostic traits, characterising the Subfamily Timiriaseviinae Mandelstam, 1960.

5. CONCLUSION

Our contribution to the systematics of the genus *Cytheridella* can be summarized as following:

1. The three *Cytheridella* species we studied display now clear diagnose, useful for their identification.
2. *Cytheridella ilosvayi,* Daday, 1905, treated here with the connotation of *C. ilosvayi sensu lato* covers different species that remains to be described, a claim made also by Wrozyna *et al.* (2018).
3. *Cytheridella martingrossi* Danielopol and Piller, n. sp. differs markedly from *C. danielopoli* Purper and *C ilosvayi* Daday.
4. *Cytheridella danielopoli* Purper, 1979 is closely related to *C. ilosvayi*.
5. *Cytheridella danielopoli* in Munoz-Torres *et al.* (1998) displays a questionable taxonomic status.
6. Continuing to describe and/or to review Cytheridellini species using the subtle details of the valve morphology, examined on both sides with high resolution of electron microscopy, represents an effective way to achieve further progress in the taxonomy and systematics of this ostracod group. In our case, such a project is under way.

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REFERENCES

Anderson, M.J., Gorley, R.N., Clarke, K.R. (2008). *PERMANOVA+ for PRIMER: Guide to Software and Statistical Methods*:1-214, Primer-E Ltd., Plymouth.

Baltanás, A., Danielopol, D.L. (2011). Geometric Morphometrics and its use in ostracod research: a short guide. *Joannea Geologie und Paläontologie*, **11**: 235-272.

Brauneis, W., Neubauer, W., Stracke, A. (2008). MORPHOMATICA – Programme Description. *Berichte des Institutes für Erdwissenschaften Karl-Franzens-Universität Graz,* **13**: 43-68.

Carbonel, P., Colin, J.-P., Danielopol, D.L., Löffler, H., Neustrueva, I. (1988). Paleoecology of limnic ostracodes: a review of some major topics. *Palaeogeography, Palaeoclimatology, Palaeoecology,* **62**: 413-461.

Carbonnel, G., Ritzkowski, S. (1969). Ostracodes lacustres de l'Oligocène (Melanienton) de la Hesse (Allemagne). *Archives des Sciences (Genève),* **22**(*1*): 55-82.

Clarke, K.R., Gorley, R.N. (2006). PRIMER v6: *User-manual/Tutorial*: 1-190, PRIMER-E Ltd., Plymouth.

Colin, J.-P., Danielopol, D.L. (1980). Sur la morphologie, la systématique, la biogéographie et l'évolution des ostracodes Timiriaseviinae (Limnocytheridae). *Paléobiologie continentale*, **11**: 1-51.

Colin, J.-P., Tambareau, Y., Krasheninnikov, V.A. (1997). An early record of the genus Cytheridella Daday, 1905 (Ostracoda, Limnocytheridae, Timiriaseviinae) from the Upper Cretaceous of Mali, West Africa: palaeobiogeographical and palaeoecological considerations. *Journal of Micropalaeontology*, **16**: 91-95.

Daday, E. (1905). Untersuchungen über die Süsswasser-Mikrofauna Paraguays. *Zoologica Stuttgart*, **44** (*4*) Ostracoda: 234-270.

Danielopol, D.L., Martens, K., Casale, L.M. (1989). Revision of the genus Leucocythere Kaufmann, 1892 (Crustacea, Ostracoda, Limnocytheridae), with the description of a new species and two new tribes. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Biologie*, **59**: 63-94.

Danielopol, D.L., Cabral, M.C., Lord, A., Carbonel, P., Gross, M., Stoica, M., Humphreys, W.F., Namiotko, T., Tóth, E., Külköylüoglu, O., Piller, W., Nunes, T. (2018). Sieve-type pore canals in the Timiriaseviinae. A contribution to the comparative morphology and the systematics of the Limnocytheridae (Ostracoda, Crustacea). *Zootaxa*, **4495**(*1*): 1-64.

Danielopol, D.L., Cabral, M.C., Horne, D.J., Namiotko, T., Lord, A.R. (2023). Reconciling diagnostic traits in living and fossil taxa: the taxonomy and evolution of the genus Microceratina (Crustacea, Ostracoda, Cytheruridae). *Zootaxa,* **5244**(*4*): 301-340.

Gross, M., Ramos, M.I.F., Caporaletti, M., Piller, W.E. (2013). Ostracods (Crustacea) and their palaeoenvironmental implication for the Solimões Formation (Late Miocene; Western Amazonia/Brazil). *Journal of South American Earth Sciences,* **42**: 216-241.

Gross, M., Ramos, M.I.F., Piller, W.E. (2014). On the Miocene Cyprideis species flock (Ostracoda; Crustacea) of Western Amazonia (Solimões Formation): Refining taxonomy on species level. *Zootaxa*, **3899**(*1*): 1-69.

Holmes, J.A. (1998). A late Quaternary ostracod record from Wallywash Great Pond, a Jamaican marl lake. *Journal of Paleolimnology*, **19**: 115-128.

Horne, D.J., Cohen, A., Martens, K. (2002). Taxonomy, morphology and biology of Quaternary and living Ostracoda. *In*: Holmes, J.A., Chivas, A.R. (Eds.), *The Ostracoda- Applications in Quaternary research*: 5-36, American Geophysical Union, Washington, D.C..

ICZN (2000). *International code of zoological nomenclature*: 1-126. International Trust for Zoological Nomenclature, London.

Karanovic, I. (2009). Four new species of Gomphodella De Deckker, with a phylogenetic analysis and a key to the living representatives of the subfamily Timiriaseviinae. *Crustaceana*, **82**: 1133-1176.

Külköylüoglu, O., Yavuzatmaca, M., Cabral, M.C., Colin, J.-P. (2015). Gomphocythere besni n. sp. (Crustacea, Ostracoda) from a man-made pool (Adıyaman, Turkey). *Zootaxa*, **3937**(*3*): 456-470.

Mandelstam, M.I. (1960). The subfamily Timiriaseviinae, Mandelstam, Subfam. Nov. *In*: Orlov, Y. (Ed.), *Fundamentals of Paleontology*. *In*: Chernysheva, N.E. (Ed.), *A manual for Paleontology and geologists of the USSR,* **8** (*Arthropoda-Crustacea*): 372-375, National Science-Technical Publishing House, Moscow [in Russian].

Matzke-Karasz, R., Schudack, M., Martens, K. (2007). Ostracodology in time and space: looking back on fifteen International Symposia on Ostracoda, and the times in between. *Hydrobiologia*, **585**: 1-11.

Muñoz-Torres, F., Whatley, R.C., van Harten, D. (1998). The endemic non-marine Miocene ostracod fauna of the Upper Amazon Basin. *Revista Española de Micropaleontología,* **30**: 89-105.

Neubauer, W., Linhart, J. (2008). Approximating and distinguishing Ostracoda by the use of B-splines. *In*: Danielopol, D.L., Gross, M., Piller, W.E. (Eds.), *Contributions to Geometric Morphometrics. Berichte des Institutes für Erdwissenschaften, Karl-Franz-Universität Graz,***13**: 21-42.

Park, L.A., Martens, K., Cohen, A.S. (2002). Phylogenetic relationships of Gomphocythere (Ostracoda) in Lake Tanganyika, East Africa. *Journal of Crustacean Biology*, **22**: 15-27.

Purper, I. (1974). Cytheridella boldii Purper, sp. nov. (Ostracoda) from Venezuela and a revision of the genus Cytheridella Daday, 1905. *Anals da Academia Brasileira de Ciências*, **46**: 635-662.

Purper, I. (1979). Cenozoic Ostracodes of the Upper Amazon Basin, Brazil. *Pesquisas,* **12**: 209-281.

Sylvester-Bradley, P.C., Benson, R.H. (1971). Terminology for surface features in ornate ostracodes. *Lethaia*, **4**: 249-286.

Triebel, E. (1950). Homöomorphe Ostracoden-Gattungen. *Senckenbergiana*, **31**: 313-330.

van Morkhoven, F.P.C.M. (1962). *Post-palaeozoic Ostracoda, their morphology, taxonomy, and economic use*. **Vol. 1** (*General*): 1-204, Elsevier Publ. Comp., Amsterdam.

West-Eberhard, M.J. (2008). Are genes good markers of biological traits? *Biosocial Surveys*, **9**: 175-193. *In* Weinstein, M., Waupel, J.W., Wachter, K.W. (Eds)., National Research Council, The National Academies Press, Washington, D.C.

Wrozyna, C., Piller, W.E., Gross, M. (2014). Morphotypes of Cytheridella ilosvayi (Ostracoda) detected by soft and hard part analyses. *Crustaceana,* **87**: 1043-1071.

Wrozyna, C., Neubauer, T.A., Meyer, J., Piller, W.E. (2016). Shape variation in Neotropical Cytheridella (Ostracoda) using semilandmarks-based geometric morphometrics: a methodological approach and possible biogeographical implications. *PloS ONE,* **11**: 1-16.

Wrozyna, C., Meyer, J., Gross, M., Ramos, M.I.F., Piller, W.E. (2018). Definition of regional ostracod (Cytheridella) morphotypes by use of landmark-based morphometrics. *Freshwater Science*, **37**: 573-592.

Wrozyna, C., Meyer, J., Gross, M., Ramos, M.I.F., Piller, W.E. (2019). Sexual, ontogenetic, and geographic variation of the Neotropical freshwater ostracod Cytheridella ilosvayi. *BMC Zoology,* **4**: 1-19.

Yamada, S. (2007). Ultrastructure of the carapace margin in the Ostracoda (Arthropoda: Crustacea). *Hydrobiologia*, **585**: 201-11.

ANNEX

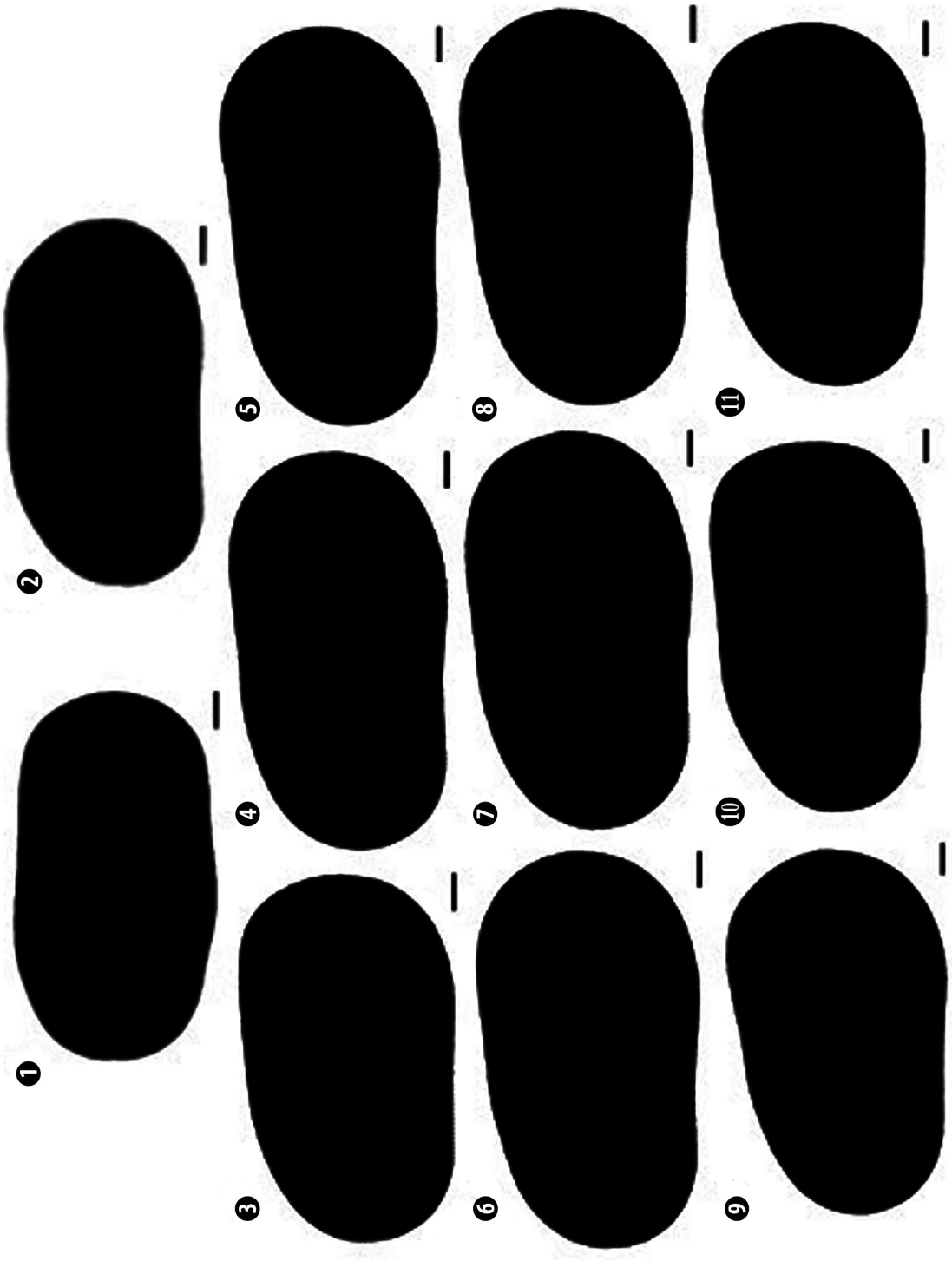

Fig. 1. *Cytheridella* species, silhouette view of female valves: (**1**)– *C. danielopoli* Purper 1979, **LV** specimen MP-0-529 (0.88 mm); (**2**) – *C. ilosvayi* Daday, **LV** specimen MP-0-314 (0.96 mm); (**3-11**): *C. martingrossi* n. sp., (specimens: (**3**) – AQ 19-01-L (1.03 mm), (**4**) – AQ 19-03-R (1.12 mm), (**5**) – AQ 19-04-R (1.03 mm), (**6**) – AQ 19-05-R (1.1 mm), (**7**) – AQ 19-06-R (1.025 mm), (**8**) – AQ 19-37-R (1.08 mm), (**9**) – AQ 19-38-R (1.06 mm), (**10**) – AQ 19-39-L (1.03 mm), (**11**) – AQ 19-40-L (1.04 mm).

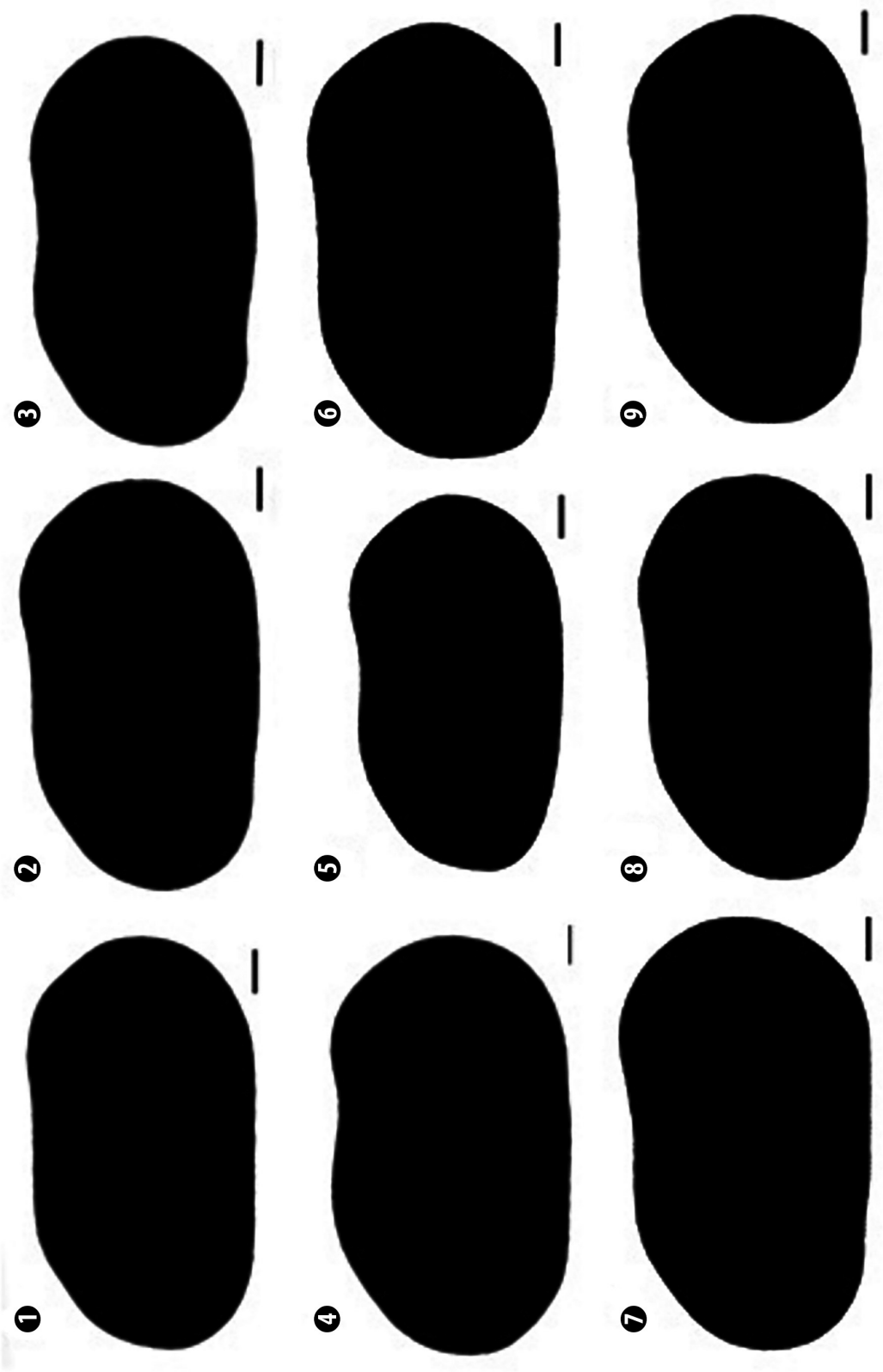

Fig. 2. *Cytheridella ilosvayi* Daday, silhouette view of Eirunepé **LVf** with their length; acronyms, name of the specimen: (**1**) – E04 (0.90 mm), (**2**) – E05(0.91 mm) , (**3**) – E08 (0.90 mm), (**4**) – E-17 (1.05 mm), (**5**) – E19 (0.88 mm), (**6**) – E21 (0.90 mm), (**7**) – E24 (0.92 mm), (**8**) – E25 (0.89 mm), (**9**) – E-26 (0.89 mm).

Table 1. List of the ostracod valves used with indication on their origin (sampling site), prior mention and present location in museum collections.

species	gender/ stage	specimen no. here	locality	coordinates	author	figure here	stored	
C. martingrossi	female	AQ 19-01-L	Aquidabã (22 km NE Eirunepé; Amazonia, BR)	06°31′40.8″S, 69°39′52.0″W	Gross *et al.* 2013: pl. 2, fig. 15; pl. 3, fig. 1, 28	Fig. 11d; Fig. 12d; Fig. 15a; Fig. 16a,b; Fig. 17b,c; Annex – Fig. 1/3	MPEG-92-M	Museo Paraense Emílio Goeldi, Belém
C. martingrossi	female	AQ 19-03-R	Aquidabã (22 km NE Eirunepé; Amazonia, BR)	06°31′40.8″S, 69°39′52.0″W	Gross *et al.* 2013	Annex – Fig. 1/4	UMJGP 210903	Universalmuseum Joanneum, Graz
C. martingrossi	female	AQ 19-04-R	Aquidabã (22 km NE Eirunepé; Amazonia, BR)	06°31′40.8″S, 69°39′52.0″W	Gross *et al.* 2013	Annex – Fig. 1/5	UMJGP 210903	Universalmuseum Joanneum, Graz
C. martingrossi	female	AQ 19-05-R	Aquidabã (22 km NE Eirunepé; Amazonia, BR)	06°31′40.8″S, 69°39′52.0″W	Gross *et al.* 2013	Annex – Fig. 1/6	UMJGP 210903	Universalmuseum Joanneum, Graz
C. martingrossi	female	AQ 19-06-R	Aquidabã (22 km NE Eirunepé; Amazonia, BR)	06°31′40.8″S, 69°39′52.0″W	Gross *et al.* 2013	Annex – Fig. 1/7	UMJGP 210903	Universalmuseum Joanneum, Graz
C. martingrossi	male	AQ 19-07-L	Aquidabã (22 km NE Eirunepé; Amazonia, BR)	06°31′40.8″S, 69°39′52.0″W	Gross *et al.* 2013: pl. 3, fig. 2	Fig. 15c	MPEG-93-M	Museo Paraense Emílio Goeldi, Belém
C. martingrossi	male	AQ 19-09-L	Aquidabã (22 km NE Eirunepé; Amazonia, BR)	06°31′40.8″S, 69°39′52.0″W	Gross *et al.* 2013: pl. 2, fig. 18; pl. 3 fig. 27	Fig. 14c,d; Fig. 18b; Fig. 19b	MPEG-94-M	Museo Paraense Emílio Goeldi, Belém
C. martingrossi	male	AQ 19-23-R	Aquidabã (22 km NE Eirunepé; Amazonia, BR)	06°31′40.8″S, 69°39′52.0″W	Gross *et al.* 2013: pl. 2, fig. 19; pl. 3, fig. 10, 22	Fig. 15d	MPEG-96-M	Museo Paraense Emílio Goeldi, Belém
C. martingrossi	female	AQ 19-37-R	Aquidabã (22 km NE Eirunepé; Amazonia, BR)	06°31′40.8″S, 69°39′52.0″W	Gross *et al.* 2013: pl. 2, fig. 16; pl. 3, fig. 9	Fig. 7a; Fig. 15b; Fig. 16c,d; Annex – Fig. 1/8	MPEG-101-M	Museo Paraense Emílio Goeldi, Belém
C. martingrossi	female	AQ 19-38-R	Aquidabã (22 km NE Eirunepé; Amazonia, BR)	06°31′40.8″S, 69°39′52.0″W	Gross *et al.* 2013	Annex – Fig. 1/9	UMJGP 210903	Universalmuseum Joanneum, Graz
C. martingrossi	female	AQ 19-39-L	Aquidabã (22 km NE Eirunepé; Amazonia, BR)	06°31′40.8″S, 69°39′52.0″W	Gross *et al.* 2013	Annex – Fig. 1/10	UMJGP 210903	Universalmuseum Joanneum, Graz
C. martingrossi	female	AQ 19-40-L	Aquidabã (22 km NE Eirunepé; Amazonia, BR)	06°31′40.8″S, 69°39′52.0″W	Gross *et al.* 2013	Annex – Fig. 1/11	UMJGP 210903	Universalmuseum Joanneum, Graz

Table 1 (continued)

species	gender/ stage	specimen no. here	locality	coordinates	author	figure here	stored	
C. ilosvayi	female	E26-L	Lago Comprido (LC01; 15.6 km ESE Eirunepé; Amazonia, BR)	6°43'52.7"S, 69°44'33.9"W	Wrozyna *et al.* 2014, 2016, 2018, 2019	Fig. 9c; Annex – Fig. 2/9	MPEG*	Museo Paraense Emílio Goeldi, Belém
C. ilosvayi	male	E32-R	Lago Comprido (LC01; 15.6 km ESE Eirunepé; Amazonia, BR)	6°43'52.7"S, 69°44'33.9"W	Wrozyna *et al.* 2014, 2016, 2018, 2019	Fig. 9d	MPEG*	Museo Paraense Emílio Goeldi, Belém
C. ilosvayi	female	E33-L	Lago Comprido (LC01; 15.6 km ESE Eirunepé; Amazonia, BR)	6°43'52.7"S, 69°44'33.9"W	Wrozyna *et al.* 2014, 2016, 2018, 2019	Fig. 17a	MPEG*	Museo Paraense Emílio Goeldi, Belém
C. ilosvayi	female	E35-L, R	Lago Comprido (LC02; 15.6 km ESE Eirunepé; Amazonia, BR)	6°43'52.7"S, 69°44'33.9"W	Wrozyna *et al.* 2014, 2016, 2018, 2019	Fig. 9a,b; Fig. 10a,b	MPEG*	Museo Paraense Emílio Goeldi, Belém
C. ilosvayi	female	WGP2-2	Wallywash Pond (Saint Elizabeth, JA)	c. 17°58'N, 77°48'W	Danielopol *et al.* 2018	Fig. 8a,b	UMJGP 211257	Universalmuseum Joanneum, Graz
C. danielopoli	female	MP-0-529-L	CPCAN-III-São Paulo de Olivença, depth 19.50-20.78 m (Amazonia, BR)	c.3°27'S, 68°48'W	Purper 1979: pl. 7, fig. 23, 24, 26 (holotype)	Fig. 12a,c; Fig. 18c; Annex – Fig. 1/1	MP-0-529	Universidade Federal do Rio Grande do Sul, Porto Alegre
C. danielopoli	male	MP-0-530	CPCAN-III-São Paulo de Olivença, depth 19.50-20.78 m (Amazonia, BR)	c.3°27'S, 68°48'W	Purper 1979: pl. 7, fig. 22, 25, 27 (paratype)	Fig. 12b; Fig. 19c	MP-0-530	Universidade Federal do Rio Grande do Sul, Porto Alegre
C. danielopoli	male	MP-0-586	CPCAN-III-São Paulo de Olivença, depth 19.50-20.78 m (Amazonia, BR)	c.3°27'S, 68°48'W	Purper 1979: pl. 7, fig. 21 (paratype)	Fig. 14a,b	MP-0-586	Universidade Federal do Rio Grande do Sul, Porto Alegre
C. danielopoli	female	AM-10-15-40	core 1AS-10-AM, depth 95.0 m (Sucuriju; Amazonia, BR)	c. 04°50'S, 70°22'W	cf. Gross *et al.* 2014	Fig. 13a,bB	UMJGP 211038	Universalmuseum Joanneum, Graz
C. danielopoli	male	AM-10-15-39	core 1AS-10-AM, depth 95.0 m (Sucuriju; Amazonia, BR)	c. 04°50'S, 70°22'W	cf. Gross *et al.* 2014	Fig. 13c,d	UMJGP 211038	Universalmuseum Joanneum, Graz
C. danielopoli	juv A-1?	LA-1	sections on the left side of the Amazon river (c. 69-36 km NW Leticia; Amazonas, CO)	c. 3°51'S, 70°13'W	Munoz-Torres *et al.* 1998: pl. 6, fig. 13	Fig. 13e	FM\UAB\F1	University of Wales, Aberystwyth

* *Cytheridella ilosvayi* from Eurinnepé, Amazonia will be deposed at Museo Paraense Emilio Goeldi, Belém, BR.

Table 1 (continued)

species	gender/ stage	specimen no. here	locality	coordinates	author	figure here	stored	
C. ilosvayi	female	MP-0-314-L	Charco, km 128 on road Porto Alegre-Tramandaí (Rio Grande do Sul, BR)	c. 29°57′S, 50°13′W	Purper 1974	Fig. 6a,b; Annex Fig. 1/2	MP-0-314	Universidade Federal do Rio Grande do Sul, Porto Alegre
C. ilosvayi	male	E02-L	Lago Barro Branco (BB02; 22.4 km SE Eirunepé; Amazonnia, BR)	6°50′18.3″S, 69°45′37.0″W	Wrozyna *et al.* 2014, 2016, 2018, 2019	Fig. 10c,d	MPEG*	Museo Paraense Emílio Goeldi, Belém
C. ilosvayi	female	E04-L	Lago Barro Branco (BB01; 22.4 km SE Eirunepé; Amazonnia, BR)	6°50′18.3″S, 69°45′37.0″W	Wrozyna *et al.* 2014, 2016, 2018, 2019	Fig. 18a; Fig. 19a; Annex Fig. 2/1	MPEG*	Museo Paraense Emílio Goeldi, Belém
C. ilosvayi	female	E05-L	Lago Barro Branco (BB01; 22.4 km SE Eirunepé; Amazonnia, BR)	6°50′18.3″S, 69°45′37.0″W	Wrozyna *et al.* 2014, 2016, 2018, 2019	Annex Fig. 2/2	MPEG*	Museo Paraense Emílio Goeldi, Belém
C. ilosvayi	female	E08-L	Lago Barro Branco (BB01; 22.4 km SE Eirunepé; Amazonnia, BR)	6°50′18.3″S, 69°45′37.0″W	Wrozyna *et al.* 2014, 2016,2018, 2019	Annex Fig. 2/3	MPEG*	Museo Paraense Emílio Goeldi, Belém
C. ilosvayi	female	E17-L	Lago Barro Branco (BB01; 22.4 km SE Eirunepé; Amazonnia, BR)	6°50′18.3″S, 69°45′37.0″W	Wrozyna *et al.* 2014, 2016, 2018, 2019	Annex Fig. 2/4	MPEG*	Museo Paraense Emílio Goeldi, Belém
C. ilosvayi	female	E19-L	Lago Comprido (LC02; 15.6 km ESE Eirunepé; Amazonia, BR)	6°43′52.7″S, 69°44′33.9″W	Wrozyna *et al.* 2014, 2016, 2018, 2019	Annex Fig. 2/5	MPEG*	Museo Paraense Emílio Goeldi, Belém
C. ilosvayi	female	E21-L	Lago Barro Branco (BB01; 22.4 km SE Eirunepé; Amazonnia, BR)	6°50′18.3″S, 69°45′37.0″W	Wrozyna *et al.* 2014, 2016, 2018, 2019	Annex Fig. 2/6	MPEG*	Museo Paraense Emílio Goeldi, Belém
C. ilosvayi	female	E24-L	Lago Barro Branco (BB01; 22.4 km SE Eirunepé; Amazonnia, BR)	6°50′18.3″S, 69°45′37.0″W	Wrozyna *et al.* 2014, 2016, 2018, 2019	Fig. 11a; Annex Fig. 2/7	MPEG*	Museo Paraense Emílio Goeldi, Belém
C. ilosvayi	female	E25-L	Lago Comprido (LC01; 15.6 km ESE Eirunepé; Amazonia, BR)	6°43′52.7″S, 69°44′33.9″W	Wrozyna *et al.* 2014, 2016, 2018, 2019	Fig. 4a,b; Fig. 11b,c; Annex Fig. 2/8	MPEG*	Museo Paraense Emílio Goeldi, Belém

* *Cytheridella ilosvayi* from Eurinnepé, Amazonia will be deposed at Museo Paraense Emilio Goeldi, Belém, BR.