

Notes and Comments

## First record of Kelleridae in Brazilian waters. A geographical range expansion and a new *Kelleria* (Gurney, 1927) morphotype

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Kelleridae is a copepod family found in all continents, mainly in tropical latitudes (Oomoto and Ueda, 2016) and is composed by 21 valid species, all in the genus *Kelleria* (Walter and Boxshall, 2021). It has a coastal epibenthic habit, with occasional presence in the plankton (Gurney, 1927; Gómez, 2006; Oomoto and Ueda, 2016; Walter and Boxshall, 2021). Oomoto and Ueda (2016, p. 47) noted that “Most species are probably endemic to their type localities. [...] about half of these species are described together with other congeners from the same sampling site or region”.

Açu and Iquipari lagoons (40°59'00"W; 21°55'04"S and 41°01'27"W; 21°44'17"S respectively), sampled in this study, are located in the São João da Barra district, northern coast of the Rio de Janeiro State, Brazil. They have a narrow sand bar from the sea, which does not prevent the salinity to intrude its continental waters and Açu can become hypersaline during the dry season (Chagas and Suzuki, 2005; Rocha et al., 2019). Both lagoons are shallow (less than 1.5 m) with sandy sediment and seasonal benthic macroalgae near the sand bar and aquatic macrophytes on the inner area (Suzuki et al., 2002; Chagas and Suzuki, 2005; Monteiro and Gomes-Junior, 2005).

Samples were taken 330 and 1,500 meters away from shore at the Açu lagoon and 150 meters at the Iquipari lagoon by filtering 200L of surface water with a graduated bucket through a 60µm mesh plankton net and preserved in 4% buffered formalin. Aliquots were analyzed using stereoscopic and optical microscopes until efficiency rate of 0.8 (Pappas and Stoermer, 1996; Cardoso and Marques, 2004) was achieved. Stacks of images at different focal distances, produced by a digital camera attached to a Biofocus Blue-1000 B-I-L-BI optical microscope, were assembled using Adobe Photoshop® and used as templates in Adobe Illustrator® to create vector graphic illustrations.

Results showed the first record of Kelleridae in Brazil. General view and taxonomic features of the collected specimens are shown in Figure 1. We found two different species of *Kelleria*. One is identified to *Kelleria reducta* (Gómez, 2006) and the other has some unique morphological features, indicating the possibility of an undescribed *Kelleria* species.

Our first record of *Kelleria reducta* in Brazil was at the Açu lagoon in November of 2016 (39.0 salinity), and the

other *Kelleria* species (*Kelleria* sp.1) was first registered at Iquipari lagoon, in January 2017 (2.4 salinity) (Table 1). Since then, *K. reducta* was found again in April and October of 2019 and March of 2021 at the Açu lagoon and *Kelleria* sp.1 in February of 2020, also at the Açu lagoon, indicating a stable and reproductively viable population in the region with the presence of juvenile forms.

*Kelleria reducta* was described on an estuarine system at Sinaloa, Mexico (Gómez, 2006) as the first *Kelleria* species found in the American continent. After that, *K. reducta* was found in 2012 at a coastal lagoon and in the littoral zone in Colombia (Suárez-Morales and Fuentes-Reinés, 2015; Fuentes-Reinés and Suárez-Morales, 2017).

Female specimens of *Kelleria reducta* found in our study have two mediobasal teeth of mandibular blade, which are much larger than the others (Figure 1B), and maxillipedal basis with one long distal and on shorter proximal spines (Figure 1C), which are the main diagnostic characters for the species (Gómez, 2006). Regarding the caudal rami length/width ratio, our individuals have about 2.0 (Figure 1A), same as the Colombian specimen (Suárez-Morales and Fuentes-Reinés, 2015), while Gómez (2006) described a 3.0 ratio. The body size ranged from 1.00 to 1.05 mm (n = 5), which is within the range found by Gómez (2006). Leg 5 has a serrate margin (Figure 1D), which is also a characteristic feature of the species.

Specimens of *Kelleria* sp.1 is similar to *K. regalis* (Gurney, 1927) by having a bifid proximal spine on the second segment of the maxilliped and a pointed medial process at the first segment (Gurney, 1927) (Figure 1F). However, our individuals also have distinct features from what was described in Gurney (1927) and in Humes and Ho (1969) (Table 2) such as: 1) shorter body length (0.9 mm) [between 1.25 and 1.45 mm in *K. regalis*]; 2) prosome shape in dorsal view (Figure 1E) [wider than *K. regalis*]; 3) relative size of distal spines on the maxilla (Figure 1F); 4) 15 spinules on the maxilla proximal spine (Figure 1G) [12 spinules in *K. regalis*] and 5) serrate margin around leg 5 (Figure 1H) [absent in *K. regalis*].

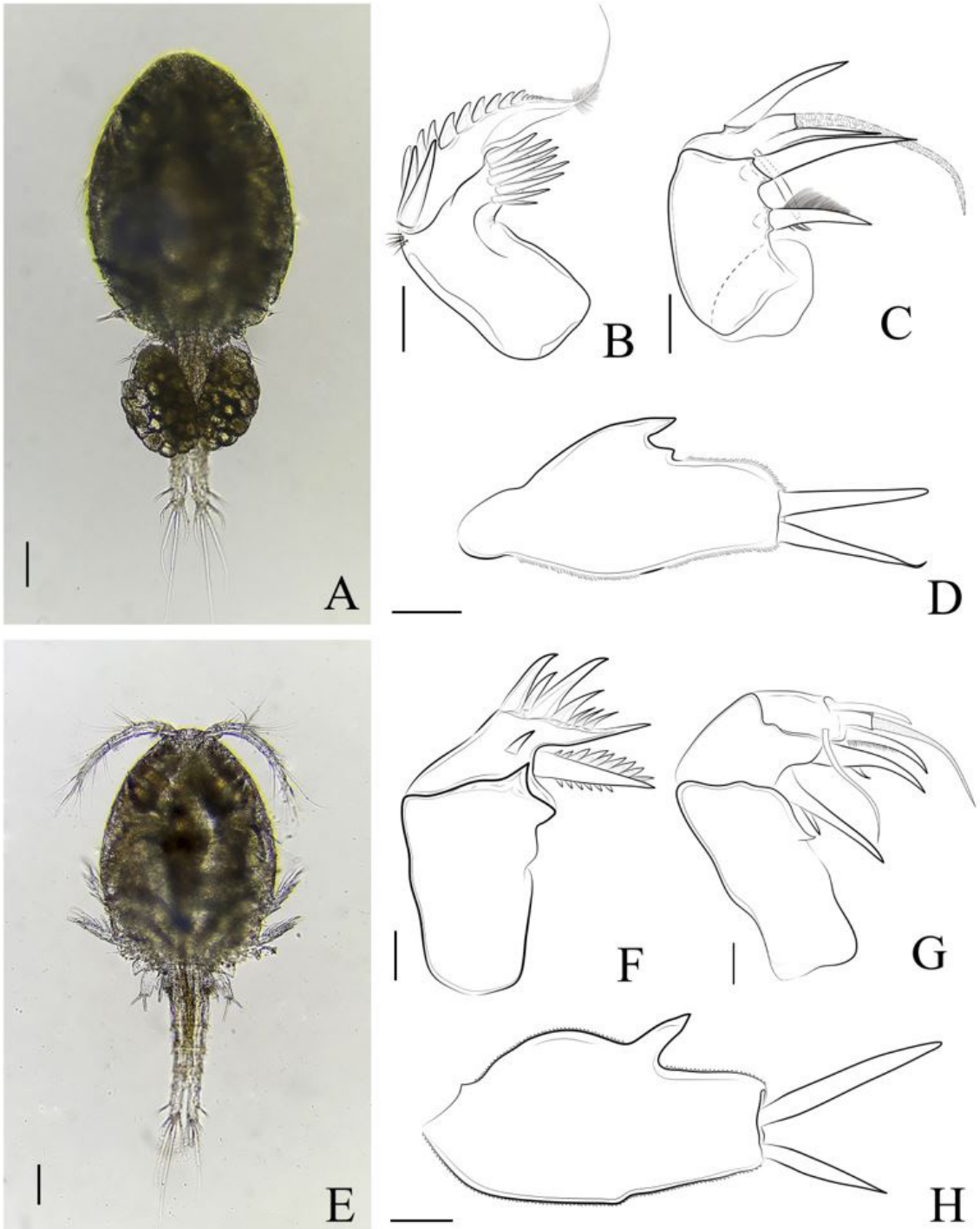
*Kelleria* is considered epibenthic and their abundance in the plankton would greatly depend on water turbulence and life history of the species. We found over 11% relative abundance of the genus among the zooplankton community

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**Figure 1.** General view and taxonomic features. *Kelleria reducta*: adult female (A), mandible (B), maxilliped (C) and leg 5 (D). *Kelleria* sp1: adult female (E), maxilla (F), maxilliped (G), leg 5 (H). Scale bar: adult individuals - 90µm. Appendages - 22.5µm.

at the Açu lagoon in December of 2017, suggesting a planktonic life stage for copepodite. Because we repeatedly found juvenile forms of *Kelleria* at both lagoons, it is likely that populations of both species are well established in the region, reinforcing *Kelleria* as a widespread genus of

Copepoda, as is well known since its first occurrence in the American continent (Gómez, 2006).

The present paper expands *K. reducta* southern range distribution from Colombia to Brazil which appears to be an endemic species from the American continent, as well

**Table 1.** Density of *Kelleria* species found at the Açú and Iquipari lagoons from 2016 to 2021.

| Month/Year  | Lagoon   | <i>Kelleria</i> sp.1    | <i>K. reducta</i>     | <i>Kelleria</i> spp (juvenile) |
|-------------|----------|-------------------------|-----------------------|--------------------------------|
| November/16 | Açú      | -                       | 37 ind/m <sup>3</sup> | -                              |
| January/17  | Iquipari | 250 ind/m <sup>3</sup>  | -                     | -                              |
| December/17 | Açú      | -                       | -                     | 34,500 ind/m <sup>3</sup>      |
| April/19    | Açú      | -                       | 12 ind/m <sup>3</sup> | -                              |
| October/19  | Açú      | -                       | 24 ind/m <sup>3</sup> | -                              |
| February/20 | Açú      | 750 ind/ m <sup>3</sup> | -                     | 375 ind/ m <sup>3</sup>        |
| March/21    | Açú      | -                       | 25 ind/m <sup>3</sup> | -                              |

“-” absence of taxa

**Table 2.** Morphological comparison of *Kelleria* sp1 females in the present study with *K. regalis* previously described. Table adapted from Oomoto and Ueda (2016).

|   | <i>Kelleria regalis</i>   | <i>Kelleria</i> sp.1  |   |
|---|---|---|---|
| Reference and Locality                    | <i>sensu stricto</i> Gurney (1927),<br>Egypt<br>Suez Canal, Egypt | <i>sensu</i> Humes & Ho (1969)<br>Nosy Bé, Madagascar       | present study Rocha et al.<br>(2024)<br>São João da Barra, Brazil |
| Body length                               | 1.45 mm   | 1.25-1.37 mm  | 0.9 mm  |
| Caudal ramus L/W                          | 3   | 2.3   | 3   |
| Maxilla                                   |   |   |   |
| Distal spines                             | **7 (4 <sup>th</sup> is less than half of 3 <sup>th</sup> )       | **8 (4 <sup>th</sup> is less than half of 3 <sup>th</sup> ) | 7 (4 <sup>th</sup> is more than half of 3 <sup>th</sup> )         |
| Spinules on proximal spine                | ** top side with 8 spinules<br>and basal side with 4              | ** both sides with 6 spinules                               | Top side with 9 spinules and<br>basal side with 6                 |
| Pointed process at top of<br>basal joint  | **absent  | present   | present   |
| Center setae at second joint              | absent  | present   | present   |
| Maxilliped                                |   |   |   |
| Second segment, proximal<br>spine bifid*  | present   | present   | present   |
| First segment, pointed<br>medial process* | present   | present   | present   |
| Leg 5 free segment                        |   |   |   |
| Inner medial process                      | slender, acute tip  | slender, blunt tip  | broad, acute tip  |
| Inner apical spine length                 | 1.5 to outer spine  | 1.0 to outer spine  | 1.5 to outer spine  |

\*main diagnostic character; \*\*according to the figures.

as *Kelleria* sp.1, yet to be fully described, that appears to be endemic to Brazil. This pattern and the occurrence of two congener species of *Kelleria* in the same region reinforces Oomoto and Ueda (2016) statement, as quoted above.

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