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SHORT NOTE

SIZE VARIATIONS IN THE MORPHOLOGICAL STRUCTURES OF *THERMOCYCLOPS DECIPIENS* (KIEFER 1929) (COPEPODA CYCLOPOIDA) FROM SOUTH-SOUTHEAST BRAZILIAN RIVERS

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Size variation in the morphological structures of microcrustaceans has been frequently reported for temperate environments (Einsle, 1988; Ricarddi and Mariotto, 2000). According to Dole-Olivier et al. (2005) these variations can be adaptative responses to different environmental factors, such as predation, competition, temperature and density. Most of these conclusions are based on studies of cladocerans and ostracods (Dole-Olivier et al. 2005). For copepods studies have shown the influence of temperature, food availability, predatory avoidance and mainly in reproductive performance, due to the sexual reproduction strategy (Tonolli, 1971; Riera and Estrada, 1986; Einsle, 1988; Ricarddi and Mariotto, 2000; Dole-Olivier et al., 2005; Iepure, 2005).

The genus *Thermocyclops* (Copepoda Cyclopoida) is largely distributed in Brazilian freshwater ecosystems, represented mainly by *Thermocyclops decipiens* (Kiefer 1929) and *Thermocyclops minutus* (Lowndes, 1934). Both species are frequently mentioned in studies on ecology of zooplankton communities, considering temporal and spatial fluctuation, trophy interactions and also reproductive aspects (Padovesi-Fonseca et al., 2002, Lansac-Tôha et al., 2004; Silva and Matsumura-Tundisi, 2005; Sartori et al., 2009). These species can also be used as efficient bioindicators of environmental conditions. *Thermocyclops decipiens* has successfully occupied meso and eutrophic waters, while *T. minutus* is more frequently registered in oligo and mesotrophic environments (Padovesi-Fonseca et al., 2002; Silva and Matsumura-Tundisi, 2005; Landa et al., 2007; Nogueira et al., 2008).

The goal of this study was to investigate differences in size proportion of *T. decipiens* morphological structures. The analyzed animals were obtained from zooplankton samples of four Brazilian hydrographic basins (Fig. 1): Paraná River – in Patos Lagoon, adjacent to Ivinhema River (22º49’29’’S and 53 º33’40’’W); Paranapanema River - Chavantes Reservoir (23º14’08’’S and 49º39’35’’W); Jordão River (Iguaçu River Basin) - Santa Clara Reservoir (25º37’57’’S and 51º55’58’’W) and in the Uruguay River - Itá Reservoir (27º17’58’’S and 52º21’36’’W). The sampling sites correspond to limnetic zones of large and deeper hydroelectric reservoirs (> 40m depth), except for Patos Lagoon (Paraná River), a shallow floodplain lake characterized by well developed littoral zone colonized by aquatic macrophytes (Lansac-Tôha et al., 2004).

The hypothesis is that the different populations of these aquatic ecosystems can exhibit morphological variations.

Thirty adult females from each site were dissected and 20 individual morphological structures were measured in microscope with micrometric scale (Zeiss Standard 20): body total length (BTL), caudal setae - medial external length (MESL), medial internal length (MISL) and internal length (ISL), cephalothoraxes widths (CP1W, CP2W, CP3W, CP4W), genital width (GSW), basis of setae - caudal medial external width (MESW), medial internal width (MISW) and internal width (ISW), coxopodit width (CoxW), inter-coxal sclerites of L4 width (ISW), and length and width measures of furca (FL and FW), L4 endopod (L4L and L4W) and apical thorn of L4 (ATL and ATW) (Fig. 2A).

Several of the measured morphological structures were the same ones analyzed by Iepure (2005).

The variability of individual differences was checked by multivariate analysis of variance (Manova/ Pillai’s test). Differences of all structures were significant

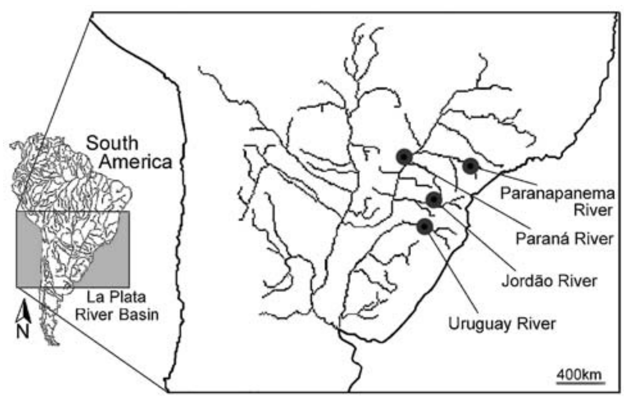

Figure 1 - Map of study area in La Plata River Basin.

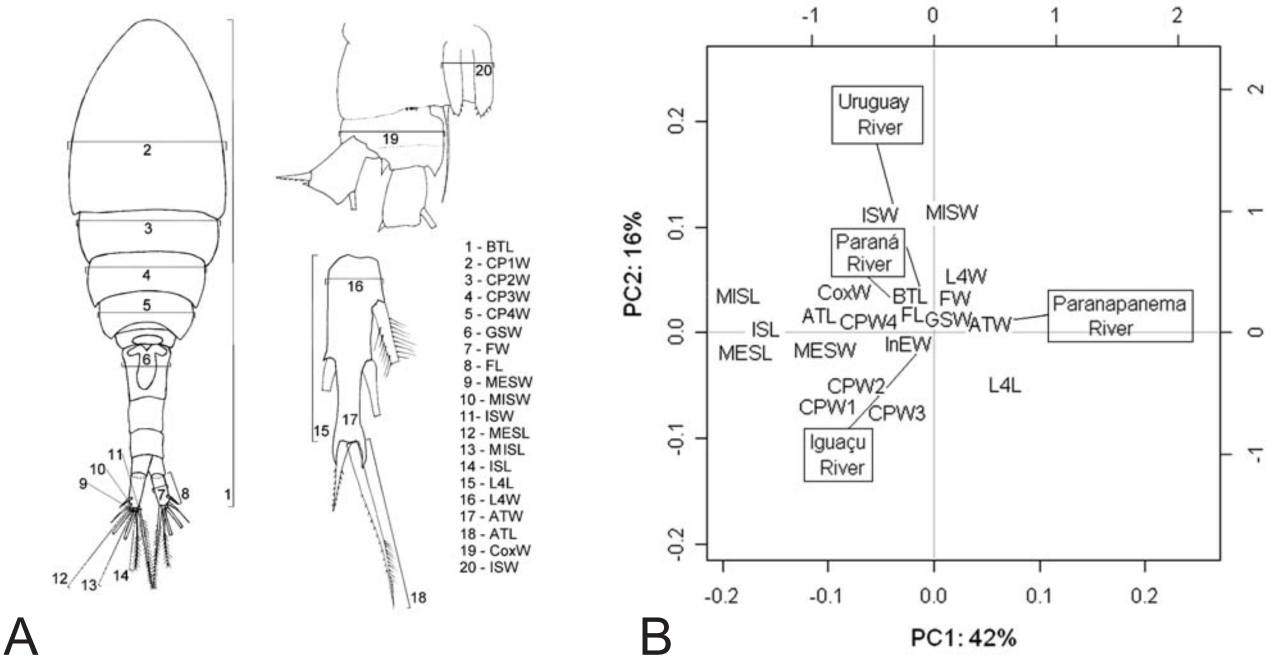

Figure 2 - (A.) Morphological structures measured in each individual and (B.) biplot of Principal Component Analysis for morphological structures and different river basins. Codes: body total length (BTL), caudal setae - median extern length (MESL), median intern length (MISL) and intern length (ISL), cephalothoraxes widths (CP1W, CP2W, CP3W, CP4W), genital segment width (GSW), basis of setae - caudal median extern width (MESW), median intern width (MISW) and intern width (ISW), coxopodit width (CoxW), inter-coxal sclerites of L4 width (ISW), and two measures of furca (FL and FW), L4 endopod (L4L and L4W) and apical thorn of L4 (ATL and ATW).

($p < 0.05$) among the river basins. For data ordination it was used a principal component analysis (PCA), which explained 58% of total variance (first and second components) (Fig. 2 B). The first component was positively associated with L4W, ATW and L4L, and with Paranapanema River, and negatively associated with MISL, ISL, MESL, MESW, CP1W, CP2W, ATL, CP4W, ISW and CoxW, and with the other rivers. The second component was positively correlated with MISW, ISW, L4W, MISL, CoxW, BTL and Uruguay and Paraná Rivers, and negatively with CP3W, CP2W, CP1W, L4L and Jordão River.

The PCA results showed that the individual morphological variations are spatially (inter-basin) complex. For Paranapanema River there was an evident higher width and length of L4 and its apical spine. In Jordão River there was an association with higher width of cephalothoraxes and in Uruguay River with higher width of internal caudal setae. Intermediate measurements were associated with Paraná River (Patos Lagoon).

These morphological variations may reflect different habitat conditions, as the sampling stations are more than 400 km distant from each other. Studying *Acanthocyclops reductus propinquus* from European environments Iepure (2005) showed the existence of clear morphological variations. It was detected a higher coefficient of variation for body length, followed by cephalothoraxes width, L4 endopod length, L4 endopod width and furca length and width. Based on the observed variations the author proposed the separation of two species of *Acanthocyclops* (Iepure, *pers. comm.*, April 2008). This is probably not the case of *T. decipiens* in the La Plata River Basin, where it has been frequently observed and it is considered a well known taxa.

Historical and actual limnological conditions can determine zooplankton communities adjustments. *T. decipiens* can tolerate lower concentrations of dissolved oxygen, generally observed near to the hypolimnion, and the distribution of this species can also be related to high total phosphorus and chlorophyll-a concentrations (Padovesi-Fonseca et al., 2002; Landa et al., 2007). However, additional limnological and morphological studies are still necessaries in order to explain micro (local) and macro scale (regional) influence on this species distribution and on its biological and ecological features. The environment conditions can act with more or less intensity on food supply (qualitative and quantitatively) and, as a consequence, on the development of early stages of the species.

The results of the present study were conclusive about the existence of important size differences in the morphological structures among populations of *T. decipiens* from the analyzed basins. The basins of Paranapanema, Iguaçu and Uruguay River exhibited different positions in the PCA, while the Paraná River was intermediary located. The study demonstrates that taxonomical examination should be based on population analyses, as they reflect particular limnological conditions of the water bodies and historical processes of each river basin.

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REFERENCES

Dole-Olivier, M.J.; Galassi, D.M.P.; Marmonier, P. & Des Châtelliers, M.C. 2000. The biology and ecology of lotic microcrustaceans. Freshwater Biology, 44: 63-91.

Einsle, U.K. 1988. *Cyclops canadensis* n.sp. and *Cyclops scutifer* Sars, 1863 (Crustacea: Copepoda) from northern Canadá. Canadian Journal of Zoology, 66(10): 2146–2149.

Iepure, S. 2005. Diversitatea morfologica la nivel populational a unor specii de ostracode (Crustacea, Ostracoda) si ciclopide (Crustacea, Copepoda) din biotopurile acvatice subterane. Revista de Politica Stiintei si Scientometrie, Numar Special (ISSN-1582-1218).

Landa, G.G.; Barbosa, F.A.R.; Rietzler, A.C. & Maia-Barbosa, P.M. 2007. *Thermocyclops decipiens* (Kiefer, 1929) (Copepoda, Cyclopoida) as Indicator of Water Quality in the State of Minas Gerais, Brazil. Brazilian Archives of Biology and Technology, 50 (4): 695-705.

Lansac-Tôha, F. A.; Bonecker, C. C. & Velho, L. F. M. 2004. Composition, species richness and abundance of the zooplankton community. In: Thomaz, S. M.; Agostinho, A. A. and Hahn, N. S. (eds). The Upper Paraná River and its Floodplain: Physical Aspects, Ecology and Conservation. The Netherlands, Backhuys Publishers. 145-190pp.

Nogueira, M. G.; Reis-Oliveira, P. C. & Britto, Y. T. 2008. Zooplankton assemblages (Copepoda and Cladocera) in a cascade of reservoirs of a large tropical river (SE Brazil). Limnetica, 27(1): 151-170.

Padovesi-Fonseca, C.; Mendonça-Galvão, L. & Rocha, D.L.P. 2002. Temporal flutuation and reproduction of *Thermocyclops decipiens* (Copepoda, Cyclopoida) in an eutrophic lake of central Brazil. Revista de Biologia Tropical, 50(1): 57-68.

Reed, E.B. 1986. Esteval phenology of an *A. robustus* (Crustacea, Copepoda) in a Colorado tarn with a remarks on the *vernalis-robustus* complex. Hydrobiologia, 139: 127-133.

Riera, T. & Estrada, M. 1985. Dimension and allometry in *Tropocyclops prasinus*. Empirical relationships with environmental temperature. Verhandlungen der Internationalen Vereinigung für Theorestische und Angewandte Limnologie, 22: 3159-3163.

Sartori, L.P.; Nogueira, M.G.; Henry, R. & Moretto, E.M. 2009. Zooplanktonfluctuations in Jurumirim Reservoir (São Paulo, Brazil): a three-year study. Brazilian Journal of Biology, 69(1): 1-18.

Silva, W.M. & Matsumura-Tundisi, T. 2005. Taxonomy, ecology and geographical distribution of the species of the genus *Thermocyclops* Kiefer, 1927 (Copepoda, Cyclopoida) in São Paulo State, Brazil, with description of a new species. Brazilian Journal of Biology, 65(3): 521-531.

Riccardi, N. & Mariotto, L. 2000. Seasonal variations in copepod body length: a comparasion between different species in the Lagoon of Venice. Aquatic Ecology, 34: 243-252.

Tonolli, L. 1971. Allomorphotic relationship of antenna to body length in *Eudiaptomus vulgaris* Schmeil. Limnology and Oceanography, 16(2): 467-472.

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