

# Occurrence of *Pseudosida ramosa* Daday, 1904 (Crustacea: Cladocera: Ctenopoda) in marginal lakes of the Parapanema River, with comments on its distribution

Ocorrência de *Pseudosida ramosa* Daday, 1904 (Crustacea: Cladocera: Ctenopoda)  
em lagoas marginais do Rio Parapanema, com comentários sobre sua distribuição

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**Abstract: Aim:** Contribute to the understanding of the distribution of a littoral cladoceran, *Pseudosida ramosa* Daday, 1904, in Brazil, with special reference for the Parapanema River basin (Southeast Brazil); **Methods:** The specimens were sampled in two floodplain lakes located in the middle Parapanema River basin, in the boundary of São Paulo and Paraná States, using a standard plankton net (50 µm mesh size). Trinocular microscopic with camera lucida and milimetric scale was used for the observation and measurements of the specimens; **Results:** Only three individuals were found (in winter and summer), despite of an extensive sampling program during 17 consecutive months of observations in both lakes. The largest body length was 1,146 µm. The taxonomical identification followed Korovchinsky (1992); **Conclusions:** This species have a wide geographical distribution in Brazil, but it is restricted to zones colonized by aquatic macrophytes and seems to occur in low population abundance. The scarcity of registers of *P. ramosa* demonstrates the necessity of deeper investigations of littoral habits as well as the important role of this kind of environment for the conservation of the rivers/reservoirs biota, including some possible rare species.

**Keywords:** Cladocera, marginal lakes, littoral habitats, Parapanema River.

**Resumo: Objetivo:** Contribuir para o entendimento sobre a distribuição de um cladóceros litorâneo, *Pseudosida ramosa* Daday, 1904, no Brasil, com especial referência à bacia hidrográfica do Rio Parapanema (Sudeste brasileiro); **Métodos:** Os exemplares foram coletados em duas lagoas marginais localizadas na bacia do médio rio Parapanema, na divisa dos estados de São Paulo e Paraná, utilizando-se rede padrão para coleta de plâncton (50 µm de abertura de malha). Foi utilizado microscópio trinocular com câmara clara e escala milimétrica para observação e mensuração dos espécimes; **Resultados:** Apenas três indivíduos foram encontrados (no verão e inverno), apesar do extensivo programa de amostragem, desenvolvido durante 17 meses consecutivos de observação em ambos os lagos. O maior comprimento do corpo foi 1.146 µm. A análise taxonômica foi feita em base a Korovchinsky (1992); **Conclusões:** Esta espécie tem uma ampla distribuição geográfica no Brasil, porém é restrita a zonas colonizadas por macrófitas aquáticas e aparentemente ocorre em baixas abundâncias populacionais. A falta de registros dessa espécie demonstra tanto a necessidade de investigações mais profundas das zonas litorâneas como a importância desse tipo de habitat para a conservação da biota dos rios/reservatórios, incluindo possíveis espécies raras.

**Palavras-chave:** Cladocera, lagoas marginais, habitats litorâneos, Rio Parapanema.

## 1. Introduction

Information about the geographical distribution of cladocerans in the neotropics, including diversity patterns and microhabitat utilization, is controversial (Dumont, 1997), mostly because of the insufficiency of data (Sarma et al., 2005). Additionally, many data are not published in specialized journals or remain restricted in internal institutional reports and academic monographs. Thus, studies on taxonomy and distribution of cladocerans species, particularly of rare ones (those with low population abundance), are very important for the regional biodiversity assessment

and the determination of priority conservation areas in the hydrographic basins.

The species *Pseudosida ramosa* Daday 1904 has been considered endemic to the neotropical region (Korovchinsky, 1992). Nevertheless, according to Sonoamuang (1998) it also occurs in Southeast Asia, Thailand. In Brazil, it has been reported for different environments, such as: the Amazon River basin, low Nhamundá River region, Amazonas State (Brandorff et al., 1982); Paraguay River basin, Pantanal Matogrossense, Mato Grosso State (Neves et al., 2003);

Araguaia/Tocantins basin, Paran  River Valley, Goi s State (Elmoor-Loureiro, 2007); Mogi-Gua u River basin, Ecological Station of Jata , S o Paulo State (Rocha and G ntzel, 1999; Freitas and Rocha, 2006a, b); and Paran  River basin, upper Paran  River floodplain, S o Paulo/Paran  States (Lansac-T ha et al., 2009). There are also reports of this species occurrence in other countries of the neotropical region: Paraguay, Venezuela (Rey and Vasquez, 1986), Cuba, Guatemala (Korovchinsky, 1992) and Mexico (Elias-Guti rrez et al., 2001).

Freitas and Rocha (2006a) evaluated the life-cycle parameters of *P. ramosa* under experimental conditions, at 25 and 30  C, reporting a better performance (e.g. fecundity, growth, longevity) at the lower temperature. Freitas and Rocha (2006b) also tested the effect of water hardness on *P. ramosa*, showing that the lethal concentration, after which 50% (CL50) of the individuals does not survive, is  $84 \pm 5.6 \text{ mgCaCO}_3 \cdot \text{L}^{-1}$ . Korovchinsky (1992) registered this species occurring in a pH range from 5.0 to 6.37, in Central and South America environments.

Despite extensive zooplankton samplings carried out since the 1970's in the Paranapanema River basin (see Nogueira et al., 2008), the presence of *P. ramosa* was reported only three times. Gralh z (2005), studying the cladocerans composition in several floodplain areas ("v rzeas") along the river, found *P. ramosa* only once, during summer, in the mouth of the Pari-Veado River, a tributary of Canoas I Reservoir (middle Paranapanema basin). Elmoor-Loureiro (unpublished data) also found this species in the Coqueiral Lake (floodplain lake), in the upstream zone of Jurumirim Reservoir (upper Paranapanema basin). The third register corresponds to the present work.

## 2. Material and Methods

Samples were taken monthly, for zooplankton studies (Debastiani J nior et al., in preparation) (standard plankton net – 50  m mesh size), in two lateral floodplain lakes of Paranapanema River (Pedra Branca – 22  56' 28" S and 49  58' 02" W and Guarit  – 22 56' 17" S and 49  57' 39" W), from March/05 to July/06.

Trinocular microscopic with camera lucida and milimetric scale was used for the specimens observation and measurements. The identification was performed according to Korovchinsky (1992): eye large, antennules long with sensory papillae on the apex of a large lateral growth of the basal part; antennal setae (5-6)-(9-10)/0-1-3; one spine of the tip of the first segment of the upper 2-segmented antennal branch much longer than the neighboring one; anal teeth with two rows on each side: one long with 9-12 clusters and, a second with 4-8 (mostly 5-6) clusters.

The material is deposited at the Continental Waters Microcrustacean Scientific Collection of the Institute of Biosciences, State University of S o Paulo, Campus of Botucatu (CCMAC-UNESP 029 to 031).

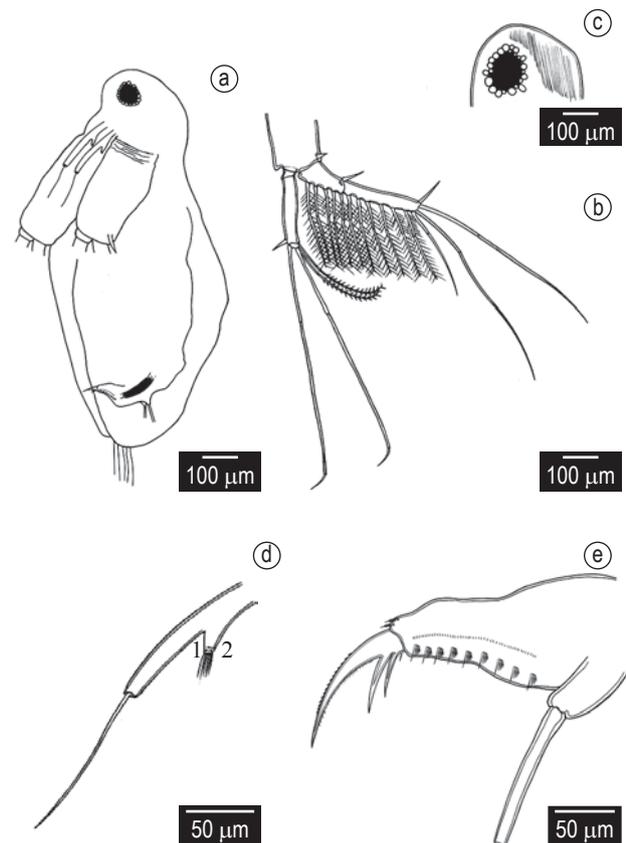
## 3. Results

Only two adult females and one juvenile female of *P. ramosa* were found during the extensive sampling period (17 consecutive months). The individuals occurred in May (autumn-dry) and November/05 (spring-rainy) in Pedra Branca Lake and in June/06 (winter-dry) in the Guarit  Lake.

In the present study the species was registered in different temperature (20-27  C) and pH (6.7-7.8) conditions.

The morphological structures of taxonomical interest, based on the observed specimens, are illustrated in Figure 1. The following measurements ( m) were taken from the collected individuals (two adult females and one juvenile female, respectively): total body length (1,146; 1,042; 573); post-abdomen length (166; 171; 74); claws basal spines length (38.4/33.4/9.6; 48/38.4/9.6; no measure); claw spine width (24; 19.2; no measure); antennule length (220.5; 235.2; 83.3); length of the margin of the antennule projection from its distal (Figure 1d<sup>1</sup>) and proximal (Figure 1d<sup>2</sup>) insertion, respectively (24.5/39.2; 34,2/49; no measure/14.7).

The characteristics of the studied individuals, collected in the Paranapanema River marginal lakes, are in



**Figure 1.** *Pseudosida ramosa* Daday, 1904. a) General view; b) Antenna; c) Cephalic region; d) Antennule (antennule lateral projection margin: distal (1) and proximal (2) insertions); e) Post-Abdomen.

agreement with the diagnosis presented by Korovchinsky (1992), based on the analysis of material from South and Central America.

#### 4. Discussion

The species *P. ramosa* has been considered endemic of the neotropical region (Korovchinsky, 1992), but this assumption is questionable, once it has been also reported for Thailand (Sanoamuang, 1998). Nevertheless, Cladocera is a relatively unsolved group with many species complexes that require further investigations.

Longitudinally, considering the Paranapanema River main channel, Pedra Branca and Guaritá are about 230 km downstream the Coqueiral Lake, where the species was registered by Elmoor-Loureiro (unpublished) and 55 km upstream from the local studied by Gralhóz (2005). In all these three areas of the Paranapanema basin where *P. ramosa* was observed there is a prominent presence of floating (e.g. *Eichhornia*, *Salvinia*) as well as rooted (e.g. *Egeria*) aquatic macrophytes. All the other cited reports of this species were also made for areas with this characteristic.

The influence of environmental factors on the distribution of *P. ramosa* is not clear enough. The occurrence of this species, reported by Korovchinsky (1992), was associated to slightly acid pH, lower than 6.37, but in the present study it was found between 6.7 and 7.8. Regarding the temperature, Freitas and Rocha (2006a) observed a better performance (life-cycle studies) at 25 °C, comparing to 30 °C. In Paranapanema marginal lakes we registered *P. ramosa* between 20 to 27 °C. In relation to hardness, high values seem to limit the species distribution (Freitas and Rocha, 2006b), but in general this is an unusual condition in Brazilian superficial fresh waters. The wide range of these data, despite little information presently available, permit to assume that, when considered predominantly physical and chemical conditions, a potentially wide distribution of *P. ramosa* could be expected, at least regionally (e.g. State of São Paulo).

However, other factors should be considered in order to explain the *P. ramosa* distribution. For instance, the Paranapanema River has been deeply impacted by dam constructions. Presently there are 11 hydroelectric reservoirs along a 700 km stretch. This human major interference on the river must have affected the original biota, mainly the species with small populations and exhibiting particular spatial distribution, such as *P. ramosa*. This statement is based on the hypothesis that these populations would have fewer individuals to reestablish the population after disturbances. In this context the presence of this species could be an indicator of desirable environmental characteristics. The presence of well developed littoral compartments, for instance, could favor this species colonization and indicates an advanced succession state of the local community.

The low number of individuals observed in this study could have been caused by the sampling methodology, as plankton standard nets can not reach the totality of the community associated with the aquatic macrophytes. Nevertheless, the sampled lakes are shallow (3 m maximum depth) and densely colonized by submerged plants. Gralhóz (2005) sampling directly among the macrophytes stands in the Paranapanema basin, also found very few specimens. Therefore, these results show that *P. ramosa* occurs in a very low population abundance, which could indicate a rare distributional pattern.

#### 5. Conclusions

The endemism of *P. ramosa* to the neotropical region is doubtful and new inventories need to be carried out.

The present and previous registers of this species indicate that its distribution in Brazil occur in a large geographical range and predominantly, or probably exclusively, in habitats with dense colonization of aquatic macrophytes.

Despite the little information about the influence of environmental variables on the *P. ramosa* distribution, its tolerance to temperature, water hardness and pH, for instance, indicate a potentially wide distribution.

The scarcity of reports of *P. ramosa* in traditional zooplankton studies can indicate a tendency of predominantly low population abundance or even a rare distribution. Nevertheless, more appropriated methodological approaches should be developed to the study of cladocerans associated to macrophytes.

Finally, the presence of *P. ramosa* can be used as a complementary bio-indicator of priority areas for conservation in hydrographic basins.

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#### References

- BRANDORFF, GO., KOSTE, W. and SMIRNOV, NN. The composition and structure of Rotiferan and Crustacean communities of the lower rio Nhamundá, Amazonas, Brazil. *Stud. Neotrop. Fauna Environm.*, 1982, vol. 17, no. 2-3, p. 69-121.
- DUMONT, HJ. Cladoceran studies: where do we go from here? *Hydrobiologia*, 1997, vol. 360, no. 1-3, p. 301-303.
- ELÍAS-GUTIÉRREZ, M., SMIRNOV, NN., SUÁREZ-MORALES, E. and DIMAS-FLORES, N. New and little known cladocerans (Crustacea: Anomopoda) from southeastern Mexico. *Hydrobiologia*, 2001, vol. 442, no. 1-3, p. 41-54.

- ELMOOR-LOUREIRO, LMA. Phytophilous cladocerans (Crustacea: Anomopoda and Ctenopoda) from Paraná River Valley, Goiás, Brazil. *Rev. Bras. Zool.*, 2007, vol. 24, no. 2, p. 344-352.
- FREITAS, EC. and ROCHA, O. The life cycle of *Pseudosida ramosa*, Daday 1904, an endemic Neotropical cladoceran. *Acta Limnol. Bras.*, 2006a, vol. 18, no. 34, p. 293-303.
- FREITAS, EC. and ROCHA, O. Efeito da dureza total do meio de cultivo na sobrevivência do cladóceros *Pseudosida ramosa* (Crustacea, Cladocera). In *Anais do XIV Jornadas de Jovens Pesquisadores da Associação de Universidades do Grupo Montevideo*, 2006b. (vol. 1). Available from: [http://www.cori.unicamp.br/jornadas/completos/UFSCAR/CA4007%20-%20Emanuela %20C%20de%20Freitas.doc](http://www.cori.unicamp.br/jornadas/completos/UFSCAR/CA4007%20-%20Emanuela%20C%20de%20Freitas.doc). Access in: 06/04/2009.
- GRALHÓZ, G. *Associações de Cladocera (Crustacea Branchiopoda) e fatores limnológicos em áreas de várzea do rio Paranapanema (SP-PR)*. Botucatu: Universidade Estadual Paulista, 2005. 273 p. [Dissertação de Mestrado].
- KOROVCHINSKY, NM. *Sididae & Holopedidae: guides to the identification of microinvertebrates of the continental waters of the World*. The Netherlands: SPB Academic Publishing, 1992. 82 p. (no. 3).
- LANSAC-TÔHA, FA., BONECKER, CC., VELHO, LFM., SIMÕES, NR., DIAS, JD., ALVES, GM. and TAKAHASHI, EM. Biodiversity of zooplankton communities in the Upper Paraná River floodplain: inter-annual variation from long-term studies. *Braz. J. Biol.*, 2009, vol. 69, no. supl. 2, p. 539-549.
- NEVES, IF, ROCHA, O., ROCHE, KF. and PINTO, AA. Zooplankton community structure of two marginal lakes of the river Cuiabá (Mato Grosso, Brazil) with analysis of Rotifera and Cladocera diversity. *Braz. J. Biol.*, 2003, vol. 63, no. 2, p. 329-343.
- NOGUEIRA, MG., OLIVEIRA, PCR. and BRITTO, YT. Zooplankton assemblages (Copepoda and Cladocera) in a cascade of reservoirs of a large tropical river (SE Brazil). *Limnetica*, 2008, vol. 27, no. 1, p. 151-170.
- REY, J. and VASQUEZ, E. Cladocères de quelques corps d'eaux du bassin moyen de l'Orénoque (Venezuela). *Ann. Limnol.*, 1986, vol. 22, no. 2, p. 137-168.
- ROCHA, O. and GÜNTZEL, A. Branchiopoda, Cladocera. In ISMAEL, D., VALENTI, WC., MATSUMURA-TUNDISI, T. and ROCHA, O. (Eds.). *Biodiversidade do Estado de São Paulo, Brasil: síntese do conhecimento ao final do século XX*. São Paulo: Fapesp, 1999. p. 107-120. (vol. 4, Invertebrados de água doce).
- SARMA, SSS., NANDINI, S. and GULATI, RD. Life history strategies of cladocerans: comparisons of tropical and temperate taxa. *Hydrobiologia*, 2005, vol. 542, no. 1, p. 315-333.
- SANOAMUANG, LO. Contributions to the knowledge of the Cladocera of northeast Thailand. *Hydrobiologia*, 1998, vol. 362, no. 1-3, p. 45-53.

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