Check List the journal of biodiversity data

NOTES ON GEOGRAPHIC DISTRIBUTION

Check List 13(3): 2144, 17 June 2017 https://doi.org/10.15560/13.3.2144
ISSN 1809-127X

First record of *Moina dumonti* Kotov, Elías-Gutiérrez & Granado-Ramírez, 2005 (Branchiopoda: Anomopoda) in Brazil

Daniel da Silva Farias,[1, 3] **Lourdes Maria Abdu Elmoor-Loureiro**[2] & **Christina Wyss Castelo Branco**[1]

[1] Núcleo de Estudos Limnológicos, Universidade Federal do Estado do Rio de Janeiro, Av. Pasteur, 458, IBIO, sala 403, CEP 22290-240, Rio de Janeiro, RJ, Brazil
[2] Laboratório de Zoologia, Universidade Católica de Brasília, QS 7 lote 1, Bloco M, sala 331, CEP 71966-700, Taguatinga, DF, Brazil
[3] Corresponding author. E-mail: fariassd@gmail.com

Abstract. The cladoceran *Moina dumonti* Kotov, Elías-Gutiérrez & Granado-Ramírez, 2005 (Anomopoda: Moinidae) was found in a hypereutrophic lagoon, Lagoinha, Rio de Janeiro, Brazil. It represents the first record of this species in Brazil and in the Southern Hemisphere; it also represents the first record of this species in a perennial lagoon. The reasons for the success of the species in Lagoinha are discussed.

Key words. Cladocera; Moinidae; Rio de Janeiro; zooplankton.

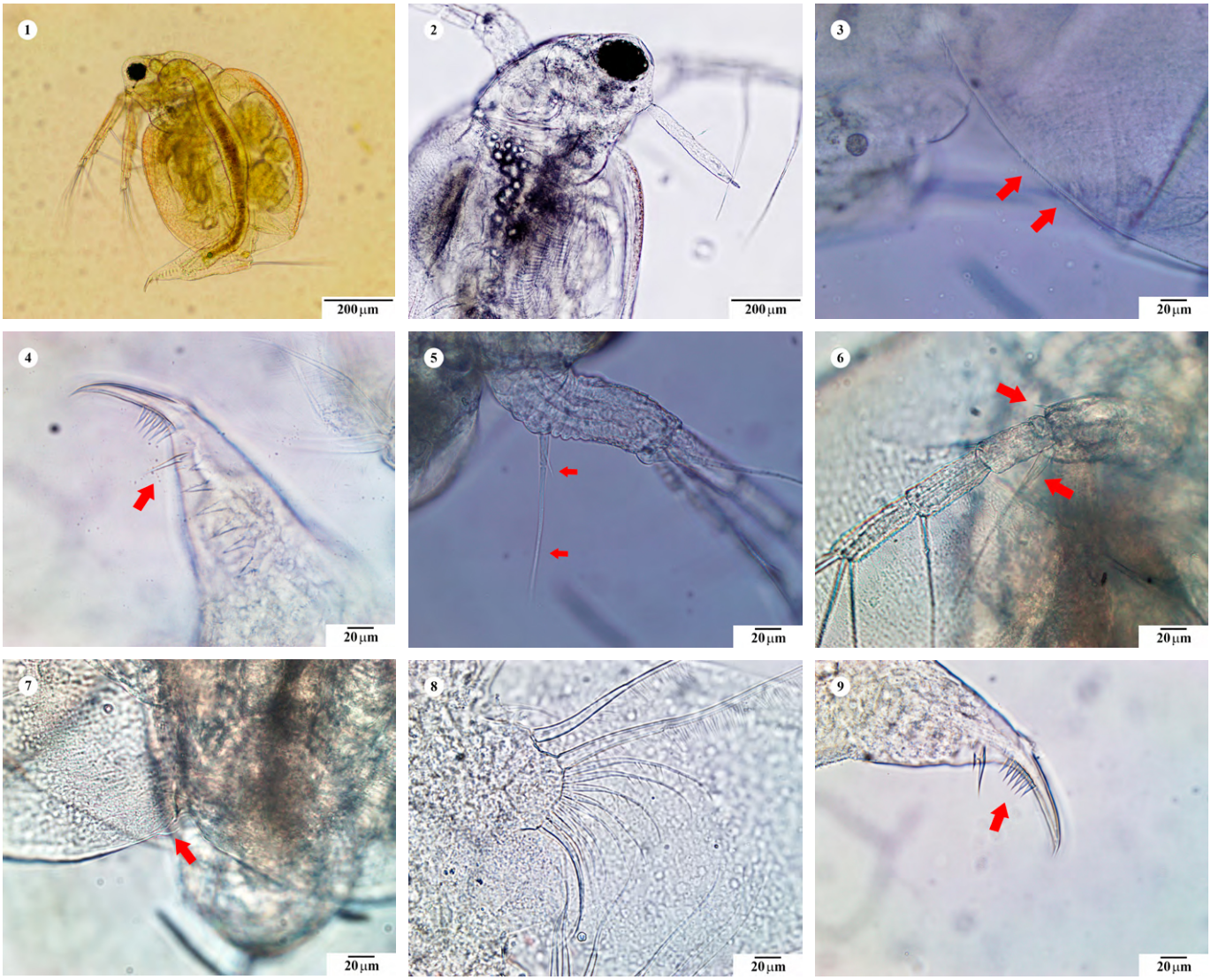
Species of the family Moinidae are present in almost all biogeographic regions except in the Antarctic (Forró et al. 2008) and are most common in brackish or ephemeral environments that are commonly warm and nutrient rich (Petrusek 2002, Dumont et al. 2013, Padhye & Dumont 2014). According to Forró et al. (2008), approximately 60% of the species are endemic to their type localities. Results from genetic analysis also suggest that their diversity is greatly underestimated, at least in Eurasia (Petrusek et al. 2004, Bekker et al. 2016). To date, *Moina dumonti* Kotov, Elías-Gutiérrez & Granado-Ramirez, 2005 was recorded only at its type locality in Mexico and in Cuba (Kotov et al. 2005). The *M. dumonti* group is comprised by 2 closely related species that are characterized by a prominent pecten at the terminal claw: *M. dumonti* and *M. hemanti* Padhye & Dumont, 2014. The morphology of *M. hemanti* closely resembles *M. dumonti*, but differs in the number of filtering setae on the gnathobase of the second thoracic appendix (P2) (Padhye & Dumont 2014). Both species are similar in their ecology and were only recorded from temporary water bodies with low concentrations of dissolved oxygen (Kotov et al. 2005, Padhye & Dumont 2014). *Moina hemanti* is restricted to its type locality in India (Padhye & Dumont 2014).

During an inventory of the zooplankton community in an oligohaline and hypereutrophic lagoon (Lagoinha; 23°01′24.80″ S, 043°28′17.93″ W) located in the Chico Mendes Municipal Natural Park in the city of Rio de Janeiro, several specimens of *M. dumonti* were found. The lagoon is dominated by floating macrophytes of the genus *Eichhornia* Kunth that cover much of the water surface and has also *Lemna minor* L. in marginal areas. This waterbody is part of the lagoon system of Jacarepaguá, which also includes the lagoons of Jacarepaguá, Camorim, Tijuca and Marapendi (Soares 1999). The lagoon system is polluted by the inflow of rainwater drainage, untreated sewage, and wastes from various other sources. The park is known to be a refuge for the wildlife of large aquatic vertebrates, including populations of Capybaras (*Hydrochoreus hydrochaeris*) and the Broad-snouted Caiman (*Caiman latirostris*).

A semiannual survey of the zooplankton community and limnological features of the lagoon has been carried out since 2013. Specimens were collected by horizontal hauls and with buckets at subsurface. A plankton net (68 µm mesh) was used for sample filtration. The collected material was immediately fixed in buffered formaldehyde solution (4% of the total volume). Samples without the adding of fixative solution were also collected for the analysis of living organisms in the laboratory. The specimens were studied with a binocular microscope with attached digital camera. The limnological conditions of the water were evaluated with multiparametric probes (YSI 6600V2-4 and turbidity meter TU-2016 Lutron®). Five voucher specimens were deposited in the crustacean collection of the Museu Nacional, Universidade Federal do Rio de Janeiro (MNRJ28420). Another set of 3 vouchers are kept in the Elmoor–Loureiro collection, at the Universidade Católica de Brasília (EL02928).

The specimens of *M. dumonti* were found in only 2 sampling campaigns, in July 2014 and May 2016. The limnological conditions of the water when the species was present were as follows: water temperature 22.38 / 26.00 °C; electrical conductivity 908 / 3,101 µS·cm^{-1}; total dissolved solids 621 / 2,498 mg·L^{-1}; depth 0.22 / 0.20 m; pH 8.00 / 7.56; Turbidity 71.0 / 87.0 NTU; Chlorophyll-*a* 182.6 / 74 µg·L^{-1} and dissolved oxygen 3.37 / 0.39 mg·L^{-1}.

In both sampling dates only parthenogenetic females were collected. Examined specimens (n = 56) had sizes ranging from 527.81 to 746.24µm, with a mean (± standard deviation) of 651.46µm (± 48.94). The specimens analyzed showed morphological characteristics of *M. dumonti* (Kotov et al. 2005):



Figures 1–9. Specimens of *Moina dumonti* from Lagoinha, Rio de Janeiro, RJ, Brazil. **1.** Habitus and detail of color. **2.** Ocellus and antenna I. **3.** Denticles of the dorsal edge of the carapace (arrows indicate group of denticles). **4.** Post-abdomen (arrow point to bident tooth). **5.** Coxal sensory satae on the base of the antenna II (arrows indicate coxal sensory setae). **6.** Antenna II (arrows indicate distal spine and sensory setae). **7.** Setulated hook on the back of the dorsal valve. **8.** Gnathobase of P2. **9,** Basal pecten (arrow point to set of teeth).

live animals are red (Fig. 1); ocellus present on the base of the antenna I (Fig. 2); denticles of the dorsal edge of the carapace organized into groups (Fig. 3); post-abdomen with a row of 6 triangular teeth and a bident tooth with the distal branch significantly larger than the basal branch (Fig. 4); antenna II with 2 coxal sensory setae of very different sizes (Fig. 5); basal segment of antenna II with a short distal spine on anterior face, and a long distal sensory setae on the posterior face (Fig. 6); presence of a setulate hook in the dorsal-most portion of the posterior margin of the valve (Fig. 7); gnathobase of P2 with 10 filtering setae (Fig. 8). According to Kotov et al. (2005), *M. dumonti* shows 3 to 5 spines in the basal pecten of terminal claw, but the specimens collected from Lagoinha showed a variation from 3 to 6 spines (Fig. 9). This is the only difference observed between these specimens and the original description (Kotov et al. 2005).

Moina dumonti has tolerance to low concentrations of dissolved oxygen (Kotov et al. 2005). Adaption to hypoxia together with possible reduced predation pressure under such conditions may be favoring *M. dumonti* in the Lagoinha. On the 2 occasions when *M. dumonti* was found, it dominated the zooplankton community in terms of relative abundance. Some limnological characteristics of the sampling location in Lagoinha lagoon were similar to those at the type locality (Kotov et al. 2005), such as shallow depth (0.20 m), oligohaline conditions (0.01%), high electrical conductivity (383 $\mu S \cdot cm^{-1}$), and low dissolved oxygen content (0.28 $mg \cdot L^{-1}$).

The present record expands the distribution of *M. dumonti* to South America (Fig. 10), and it is the first record of this species in a perennial lagoon (Table 1). *Moina dumonti* can be easily distinguished from congeneric species by its remarkable morphology, especially the basal pecten. It is difficult to explain the large gaps in the known distribution of populations of *M. dumonti* except that this species remains overlooked in other regions due insufficient sampling efforts. Despite the great richness and variety of existing inland aquatic ecosystems in the Neotropics, we need to consider the lack of sampling effort and scarcity of taxonomic studies on zooplankton communities in highly eutrophic ecosystems, such as shallow lagoons and temporary ponds. Shallow lagoons and temporary ponds

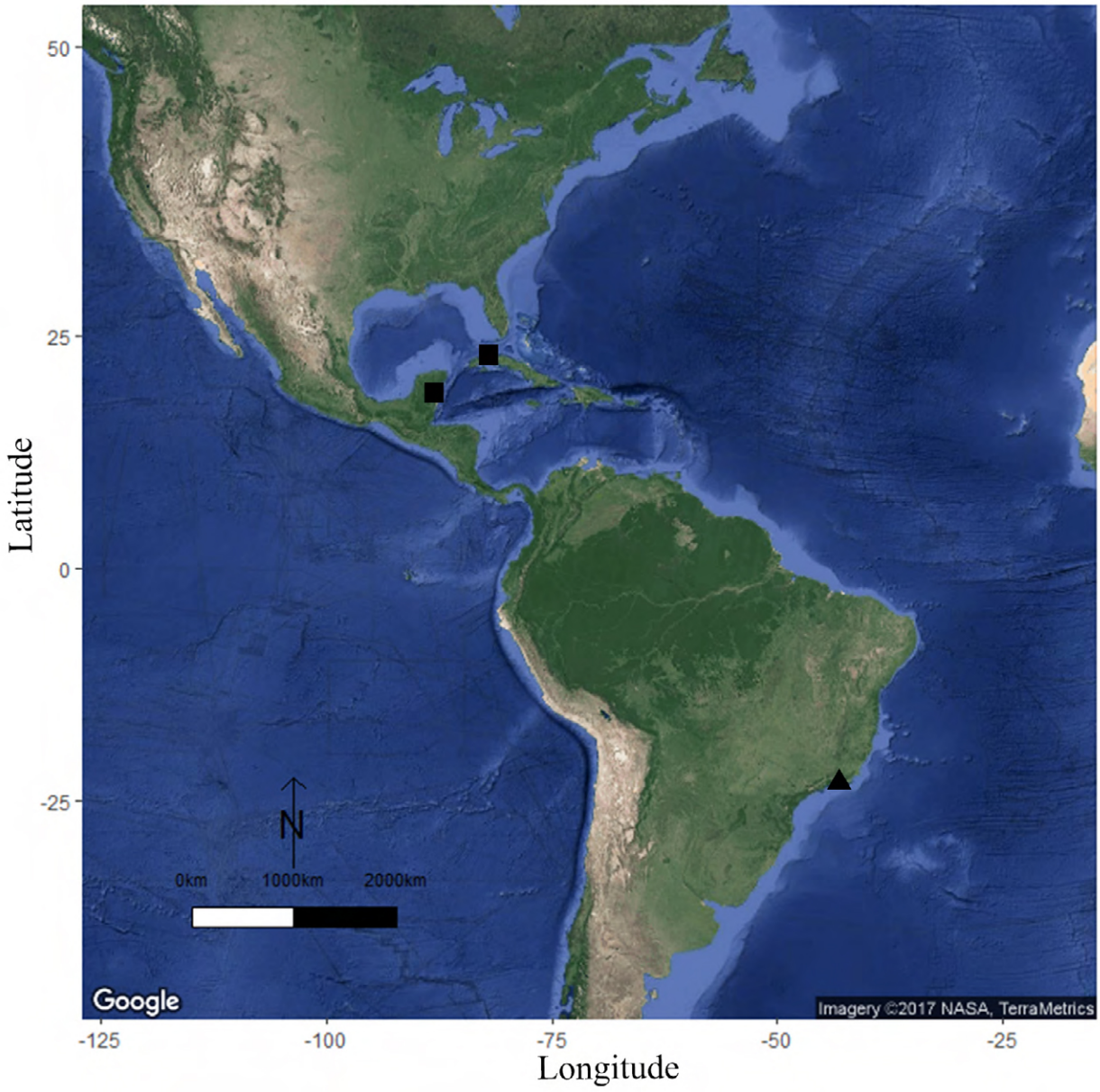


Figure 10. Previous registered localities of *Moina dumonti* (black squares) and new occurrence in Rio de Janeiro, Brazil (black triangle).

Table 1. Occurrences of *M. dumonti*

Locality	Kind of habitat	Source
Felipe Carrillo Puerto, Mexico	shallow pond	Kotov et al. 2005
Playa de Guanabo, Cuba	shallow pond	Kotov et al. 2005
Rio de Janeiro, Brazil*	perennial lagoon	Present study

*First record of *M. dumonti* in South America.

are commonly neglected in taxonomic studies compared to lakes and reservoirs. Because *M. dumonti* naturally occurs in such habitats, further studies may reveal new occurrences of cladoceran species, including *M. dumonti*. Cladoceran species can produce diapause eggs, which disperse easily over long distances attached to other species such as birds (Panov et al. 2004, Green et al. 2007) or to man-made apparatuses such as vehicles, industrial equipment, and footwear (Havel & Shurin 2004, Panov et al. 2004, Waterkeyn et al. 2010). Thus, it is possible that this may be another case of manmade dispersion as suggested for *M. macrocopa* (Straus, 1820) (Elías-Gutiérrez & Zamuriano-Claros 1994, Paggi 1997). *Moina macrocopa* rapidly dispersed in Neotropical waterbodies and was already reported in Brazilian waters by Elmoor-Loureiro et al. (2010) and Rietzler et al. (2014). The observation of male, ephippial eggs and sexual females, along with molecular analysis, could elucidate the relationship between the populations of *M. dumonti* from Brazil, Mexico and Cuba and the systematic position of Brazilian specimens.

ACKNOWLEDGEMENTS

The authors are grateful to MSc. Denise Monsores the Manager of the Chico Mendes Municipal Natural Park for field support.

The authors also want to thank Juliana Oliveira for editing the figures in the publishing format and 3 anonymous referees for the suggestions.

LITERATURE CITED

Bekker, E.I., D.P. Karabanov, Y.R. Galimov, & A.A. Kotov. 2016. DNA barcoding reveals high cryptic diversity in the north Eurasian *Moina* species (Crustacea: Cladocera). PLoS ONE 11: e0161737. https://doi.org/10.1371/journal.pone.0161737

Dumont, H.J., A.C. Rietzler & E. Kalapothakis. 2013. *Micromoina arboricola* n. gen., n. spec. (Crustacea: Cladocera), a new moinid living in a forest tree-hole in Minas Gerais, Brazil. Zootaxa 3652: 533–546. https://doi.org/10.11646/zootaxa.3652.5.3

Elias-Gutierrez, M. & R. Zamuriano-Claros. 1994. Primer registro de *Moina macrocopa* (Daphhniiformes: Moinidae) en Bolivia. Revista de Biología Tropical 42**:** 1–2.

Elmoor-Loureiro, L.M.A., J. M. Santangelo, P.M. Lopes & R.L. Bozelli. 2010. A new report of *Moina macrocopa* (Straus, 1820) (Cladocera, Anomopoda) in South America. Brazilian Journal of Biology 70: 225–226. https://doi.org/10.1590/S1519-69842010000100031

Forró, L., N.M. Korovchinsky, A.A. Kotov & A. Petrusek. 2008. Global diversity of cladocerans (Cladocera; Crustacea) in freshwater. Hydrobiologia 595: 177–184. https://doi.org/10.1007/978-1-4020-8259-7_19

Green, A.J., K.M. Jenkins, D. Bell, P.J. Morris & R.T. Kingsford. 2008. The potential role of waterbirds in dispersing invertebrates and plants in arid Australia. Freshwater Biology 53: 380–392. https://doi.org/10.1111/j.1365-2427.2007.01901.x

Havel, J.E. & J.B. Shurin. 2004. Mechanisms, effects, and scales of dispersal in freshwater zooplankton. Limnology and Oceanography 49: 1229–1238. https://doi.org/10.4319/lo.2004.49.4_part_2.1229

Kotov, A.A., M. Elías-Gutiérrez & J.G. Granados-Ramírez. 2005. *Moina dumonti* sp. nov. (Cladocera, Anomopoda, Moinidae) from southern Mexico and Cuba, with comments on moinid limbs. Crustaceana 78: 41–57. https://doi.org/10.1163/1568540054024565

Padhye, S.M. & H.J. Dumont. 2014. *M. hemanti* sp. nov., a new species of the genus *Moina* s.l. (Branchiopoda: Anomopoda) from Pune, India. Zootaxa 3860: 561–570. https://doi.org/10.11646/zootaxa.3860.6.4

Paggi, J.C. 1997. *Moina macrocopa* (Straus, 1820) (Branchiopoda, Anomopoda) in South America: another case of species introduction? Crustaceana 70: 886–893.

Panov, V.E., P.I. Krylov & N. Krylov. 2004. Role of diapause in dispersal and invasion success by aquatic invertebrates. Journal of Limnology 63: 56–69. https://doi.org/10.4081/jlimnol.2004.s1.56

Petrusek, A. 2002. *Moina* (Crustacea: Anomopoda, Moinidae) in the Czech Republic: a review. Acta Societatis Zoologicae Bohemicae 66: 213–220.

Petrusek A., M. Černy & E. Audenaert. 2004. Large intercontinental differentiation of *Moina micrura* (Crustacea: Anomopoda): one less cosmopolitan cladoceran? Hydrobiologia 526: 73–81. https://doi.org/10.1023/b:hydr.0000041612.08425.f0

Rietzler, A.C., P.M. Maia-Barbosa, M.M. Ribeiro & R.M. Menendez. 2014. On the first record of the exotic *Moina macrocopa* (Straus, 1820) in Minas Gerais state, Brazil. Brazilian Journal of Biology 74: 518–520. https://doi.org/10.1590/1519-6984.14113

Soares, M.L.G. 1999. Estrutura vegetal e grau de perturbação dos manguezais da Lagoa da Tijuca, Rio de Janeiro, RJ, Brasil. Revista Brasileira de Biologia 59: 503–515.

Waterkeyn, A., B. Vanschoenwinkel, S. Elsen, M. Anton-Pardo, P. Grillas & L. Brendonck. 2010. Unintentional dispersal of aquatic invertebrates via footwear and motor vehicles in a Mediterranean wetland area. Aquatic Conservation: Marine and Freshwater Ecosystems 20: 580–587. https://doi.org/10.1002/aqc.1122

Authors' contributions. CWCB designed and coordinated the sampling; DSF and CWCB analyzed the samples; LMAEL confirmed the species identification; DSF, CWCB and LMAEL wrote the paper.

Received: 11 March 2017
Accepted: 7 May 2017
Academic editor: Raquel Xavier