

Occurrence of the exotic freshwater snail *Melanoides tuberculatus* (Mollusca: Gastropoda: Thiaridae) in an estuary of north-eastern Brazil

C.X. BARROSO¹ AND H. MATTHEWS-CASCON^{1,2}

¹Laboratório de Invertebrados Marinhos, Departamento de Biologia, Centro de Ciências, Universidade Federal do Ceará, Campus do Pici – Bloco 909 – CEP: 60455-760, Fortaleza, CE, Brazil, ²Instituto de Ciências do Mar, Universidade Federal do Ceará, Avenida Abolição, 3207 – Meireles – Fortaleza, CE, Brazil, CEP: 60.165-08

Melanoides tuberculatus is an Afro-Asiatic thiarid, common in freshwater environments, now present in a wide portion of the tropical and subtropical regions of the New World. The present study had as its objective to register the occurrence of *M. tuberculatus* in the area of mangrove of the estuary of the Ceará River, verifying its density and the salinity which the specimens were submitted to verify its euryhalinity. Specimens of *M. tuberculatus* were collected in mangrove areas of the estuary of the Ceará River, located on the boundary of Caucaia and Fortaleza. Some specimens collected by hand in February 2006 were kept in an aquarium for a month. The abundance of *M. tuberculatus* in the studied areas varied from 0.76–10.22 individual/cm². The salinity of the areas varied from 0–30 in the studied months. The presence of *M. tuberculatus* in these mangrove areas, whose salinity reached a peak of 30, and their survival in the laboratory, under a salinity of up to 35, prove the adaptation of this limnetic gastropod to euryhalinity.

Keywords: salinity, mangrove, Ceará

Submitted 19 December 2008; accepted 18 March 2009

INTRODUCTION

Melanoides tuberculatus (Müller, 1774) is an Afro-Asiatic thiarid, originally from the Middle East, eastern Africa and south-eastern Asia (Fernandez *et al.*, 2002). It is a gastropod common in freshwater environments, and is now present in a wide portion of the tropical and subtropical regions of the New World, as a consequence of species introductions that took place initially during the last century (Madsen & Frandsen, 1989).

The first record of *M. tuberculatus* in Brazil was in 1967 in Santos, State of São Paulo (Vaz *et al.*, 1986), since then, it has been reported for 17 Brazilian states, including Ceará (Fernandez *et al.*, 2003). Other studies show the presence of *M. tuberculatus* in freshwater environments in Brazil (Rocha-Miranda & Martins-Silva, 2006; França *et al.*, 2007). The first record of *M. tuberculatus* for Ceará was in Crato county, southern part of the state, reported by Melo Júnior & Cordeiro (1999).

The finding of *M. tuberculatus* is of great importance to those involved in public health and sanitation because this snail is the first host for several trematodes, some of them parasitizing man, besides the fact that it has been employed, in some countries, as a tool in biological control of planorbids

susceptible to infection by *Schistosoma mansoni* (Vaz *et al.*, 1986; Pointier, 2001; Bogéa *et al.*, 2005).

Biological invasions constitute one of the most serious threats to global biodiversity, being surpassed only by destruction of habitats (Everett, 2000). Being an alien mollusc which occurs in high population densities in Brazil, *M. tuberculatus* may become a threat to the native mollusc fauna and its occurrence must be monitored and documented (Fernandez *et al.*, 2003; França *et al.*, 2007).

The objective of this study was to register the occurrence of *M. tuberculatus* in the area of mangrove of the estuary of the Ceará River, verifying its density and the salinity to which the specimens were submitted to verify its euryhalinity.

MATERIALS AND METHODS

Specimens of *M. tuberculatus* were collected by hand and with the aid of a PVC-made cylindrical sampler (core) on the intertidal zone of two mangrove regions in the estuary of the Ceará River, located on the boundary of Fortaleza and Caucaia counties (Area 1: 03°41'19"S and 38°35'19"W and Area 2: 03°45'10"S and 38°39'15"W) (Figure 1), in September, October and November 2005, and in February, March and April 2006.

In each area of samples, a transect of 10 m perpendicular to the riverbed was determined, throughout which samples of sediment had been taken by a 'core, with 10 cm in diameter and 15 cm in height. The samples were made to each 2 m,

Corresponding author:

C.X. Barroso

Email: cristianexb@gmail.com

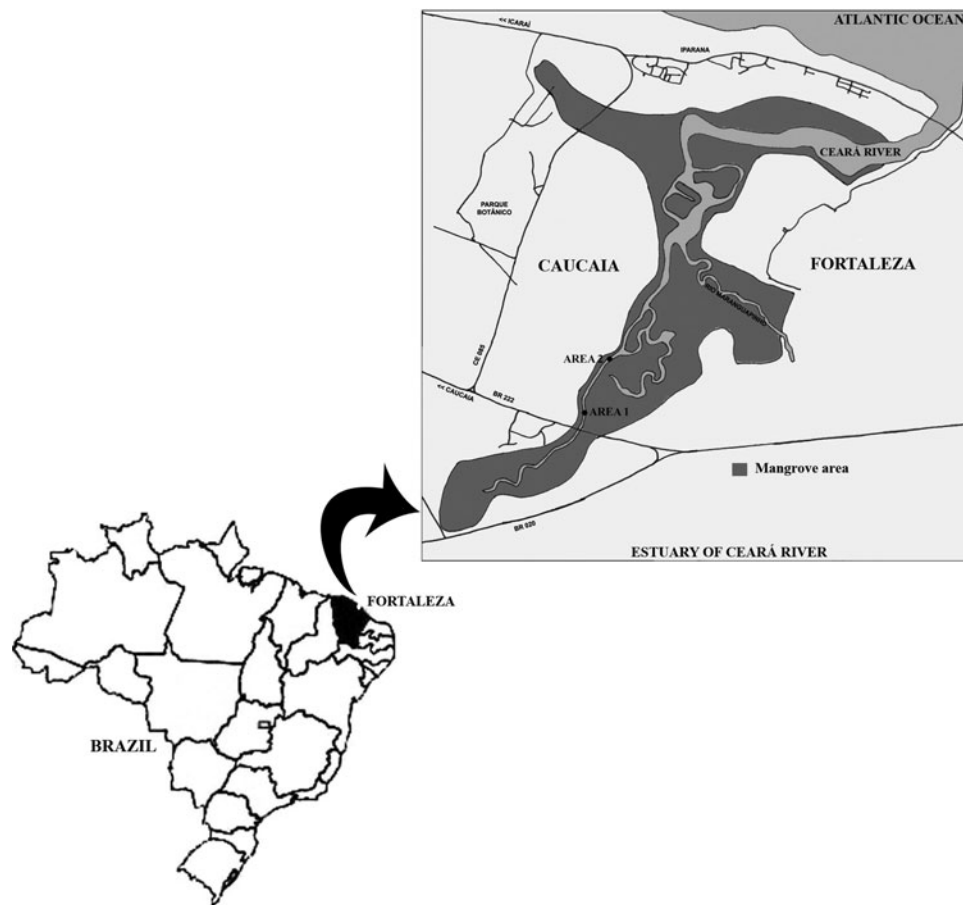


Fig. 1. Study area, in the Ceará River, Ceará, north-eastern Brazil.

thus totalling five samples (Q2, Q4, Q6, Q8 and Q10) in each area of study. The samplings had been made in the low tide. The sampled sediments had been conditioned in plastic bags. In the laboratory, the collected samples of sediment had been passed in mesh of 0.5 mm of opening. The restrained sediment was conserved in ethyl alcohol 70%. After that, the sampled sediments were examined under a compound microscope. The specimens collected with the aid of the core were preserved in ethyl alcohol 70%. The animals were deposited in the Professor Henry Ramos Matthews' Malacological Collection of the Universidade Federal do Ceará, Fortaleza.

In each one of the two areas, water samples of the surface of the river were collected for the measurement of the salinity using a refratometer.

In order to test the hypothesis that *M. tuberculatus* is actually inhabiting the mangrove area and that it was not brought by the stream from the upper part of the river, 30 live specimens collected by hand in February 2006 were kept in an aquarium (4 l) for a month, under salinities ranging from 25–35. The variation of the salinity in the aquarium occurred with the evaporation of the water. The salinity was measured every day using a refratometer. During the experiment, the specimens were fed fish flakes.

Data on the monthly total precipitation had been collected by the Fundação Cearense de Meteorologia e Recursos Hídricos (FUNCEME). These data referred to the Pluviometric Rank, Caucaia, located in the city of Caucaia (CE), adjacent to the study area.

RESULTS

On the estuarine areas where the specimens of *M. tuberculatus* were collected (Area 1 and Area 2), salinity ranged from 0–30 and the precipitation ranged from 0–336.6 mm, during the sampled months (Figure 2).

This species showed population density ranging from 0.76–10.22 individuals/cm², with higher rates occurring near the banks of the Ceará River in both areas (Area 1 and Area 2). During the six samples months, 4,234 individuals were collected with the aid of the core; 2,994 on Area 1, and 1,240 on Area 2. The number of individuals during the sampled months showed variation in the period between September 2005 and April 2006 (Figures 3 & 4).

The specimens of *M. tuberculatus* in the aquarium had remained active between the salinities of 25 and 35.

DISCUSSION

In their studies on the estuarine region of Shatt al Arab, Plaziat & Younis (2005) observed that annual rain, which coincides with the beginning of the hot weather, is apt to limit an increase in salinity caused by evaporation. Thus, the estuarine fauna from Shatt al Arab consists, mainly, of freshwater molluscs, except in the region adjacent to the mouth of the estuary. However, some freshwater species that are euryhaline, such as *M. tuberculatus*, can tolerate salinities above 2 during the lesser intake of

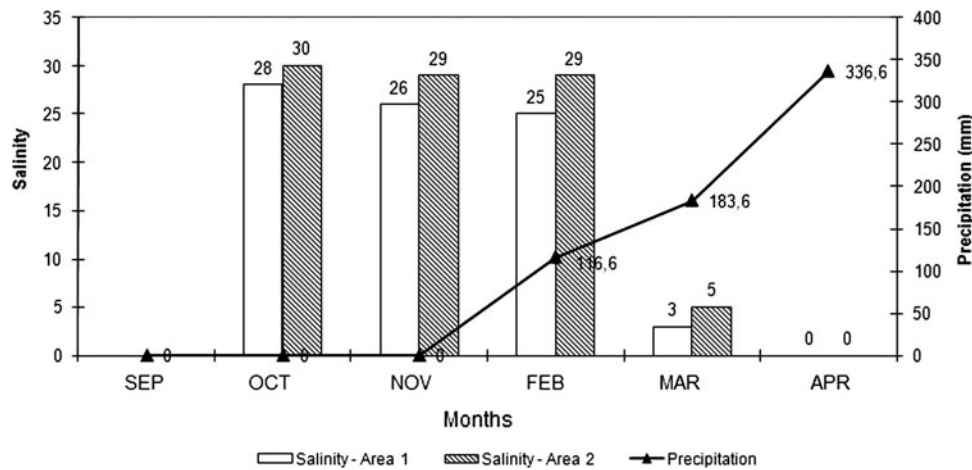


Fig. 2. Relation between salinity and precipitation in two mangrove areas of the estuary of Ceará River during the sampled months (September, October and November 2005 and February, March and April 2006).

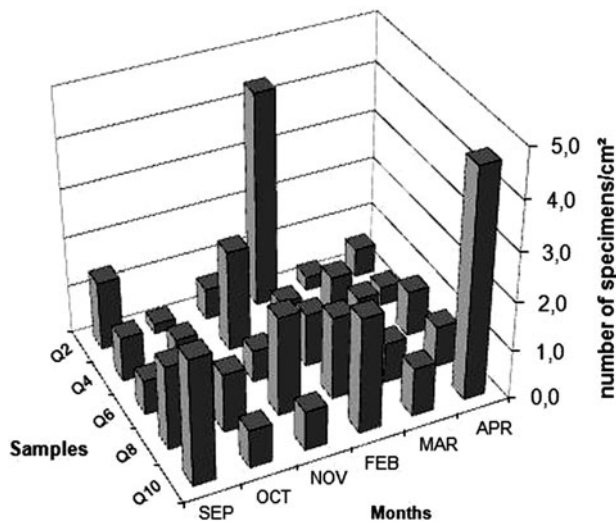


Fig. 3. Density of *Melanoides tuberculatus* in different samples from Area 1 of the estuary of Ceará River during the sampled months (September, October and November 2005 and February, March and April 2006).

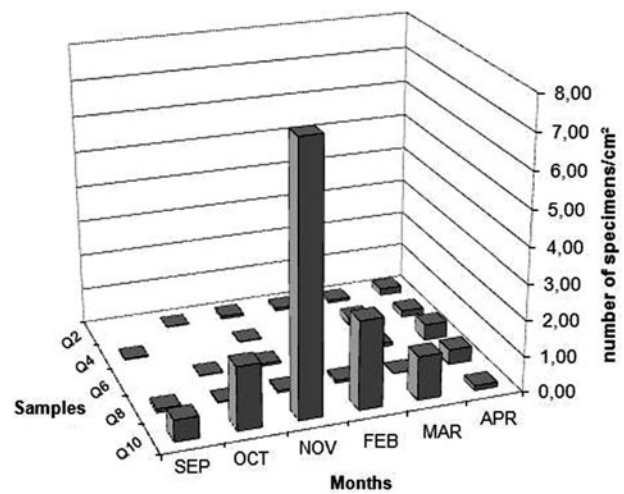


Fig. 4. Distribution of *Melanoides tuberculatus* in the different samples from Area 2 of the estuary of Ceará River during the sampled months (September, October and November 2005 and February, March and April 2006).

freshwater, being able to live and even predominate on most of the estuary. According to these authors, *M. tuberculatus* is an euryhaline species, usually associated to low salinity environments (0.2–3), where it is predominant, but it is capable of tolerating salinities over 23. Also Englund *et al.* (2000) reported the presence of *M. tuberculatus* in Oahu, Hawaii, in environments whose salinity ranged from 0–34.

Because *M. tuberculatus* is a typical freshwater species, its presence on the estuary of Ceará River, where salinity reached a maximum of 30, may be explained by the fact that this species is euryhaline, being able to stand the great variation on salinity resulting from annual rains that occur in this estuary (Figure 3). The present study corroborates the observations by Plaziat & Younis (2005).

The presence of *M. tuberculatus* in the mangrove area in estuary of Ceará River, whose water salinity reached a maximum of 30, and their survival in the laboratory, under a salinity of 35, demonstrates the adaptation of this limnetic gastropod to euryhalinity.

REFERENCES

- Bogéa T., Cordeiro F.M. and Gouveia J.S. (2005) *Melanoides tuberculatus* (Gastropoda: Thiariidae) as intermediate host of Heterophyidae (Trematoda: Digenea) in Rio de Janeiro metropolitan area, Brazil. *Revista do Instituto de Medicina Tropical de São Paulo* 47, 87–90.
- Everett R.A. (2000) Patterns and pathways of biological invasions. *Trends in Ecology and Evolution* 15, 177–178.
- Englund R.A., Arakaki K., Preston D.J., Coles S.L. and Eldredge L.G. (2000) *Nonindigenous freshwater and estuarine species introductions and their potential to affect sportfishing in the lower stream and estuarine regions of the south and west shores of Oahu, Hawaii*. Honolulu. Bishop Museum Technical Report, No. 17, 121 pp.
- Fernandez M., Thiengo S. and Simone L.R.L. (2002) Distribuição atual de *Melanoides tuberculatus* e de *Corbula fluminea* no Brasil. *Resumos do V Congresso Latinoamericano de Malacologia*, São Paulo, 229–230.
- Fernandez M., Thiengo S. and Simone L.R.L. (2003) Distribution of the introduced freshwater snail *Melanoides tuberculatus* (Gastropoda: Thiariidae) in Brazil. *Nautilus* 117, 78–82.

- França R.S., Suriani A.L. and Rocha O.** (2007) Composição das espécies de moluscos bentônicos nos reservatórios do baixo rio Tietê (São Paulo, Brasil) com uma avaliação do impacto causado pelas espécies exóticas invasoras. *Revista Brasileira de Zoologia* 24, 41–51.
- Madsen H. and Frandsen F.** (1989) The spread of freshwater snails including those of medical and veterinary importance. *Acta Tropica* 46, 139–146.
- Melo Júnior H.N. and Cordeiro L.N.** (1999) Ocorrência de *Melanooides tuberculata* no Açude Thomaz Osterne de Alencar (Umari), Crato, Ceará. *Resumos do XVI Encontro Brasileiro de Malacologia, Recife*, 161.
- Plaziat J.C. and Younis W.R.** (2005) The modern environments of molluscs in southern Mesopotamia, Iraq: a guide to paleogeographical reconstructions of Quaternary fluvial palustrine and marine deposits. *Carnets de Géologie/Notebooks on Geology, Brest, Article 2005/01*, 18 pp.
- Pointier J.P.** (2001) Invading freshwater snails and biological control in Martinique Island, French West Indies. *Memórias do Instituto Oswaldo Cruz* 96, 67–74.
- Rocha-Miranda F. and Martins-Silva M.J.** (2006) First record of the invasive snail *Melanooides tuberculatus* (Gastropoda: Prosobranchia: Thiariidae) in the Paraná River basin, GO, Brazil. *Brazilian Journal of Biology* 66, 1109–1115.
- and
- Vaz J.F., Teles H.M.S., Correa M.A. and Leite S.P.S.** (1986) Ocorrência no Brasil de *Thiara (Melanooides) tuberculata* (O.F. Müller, 1774) (Gastropoda, Prosobranchia), primeiro hospedeiro intermediário de *Clonorchis sinensis* (Cobbold, 1875) (Trematoda, Platyhelminthes). *Revista de Saúde Pública de São Paulo* 20, 318–322.
- Correspondence should be addressed to:**
C.X. Barroso
Laboratório de Invertebrados Marinhos
Departamento de Biologia
Centro de Ciências
Universidade Federal do Ceará
Campus do Pici – Bloco 909 – CEP: 60455-760
Fortaleza, CE
Brazil
email: cristianexb@gmail.com