



## Scientific Note

### ***Melanoides tuberculatus* (Müller, 1774): Occurrence extension of the invasive gastropod in Bahia, Brazil**

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**Abstract.** *Melanoides tuberculatus* is a benthic invasive species that has established extensive wildlife populations throughout the tropic water bodies. There are many places in Salvador where these gastropods are found and which may be causing ecological damage.

**Key words:** mollusc, invasive species, bioinvasor control

**Resumo.** *Melanoides tuberculatus* (Muller, 1774): expansão da ocorrência do gastrópode invasor na Bahia, Brasil. *Melanoides tuberculatus* é uma espécie bentônica invasora que estabeleceu populações ao longo dos corpos d'água tropicais. Há muitos lugares em Salvador, onde essa espécie invasora é encontradas e que podem estar causando danos ecológicos.

**Palavras chave:** molusco, espécie invasora, controle de bioinvasor

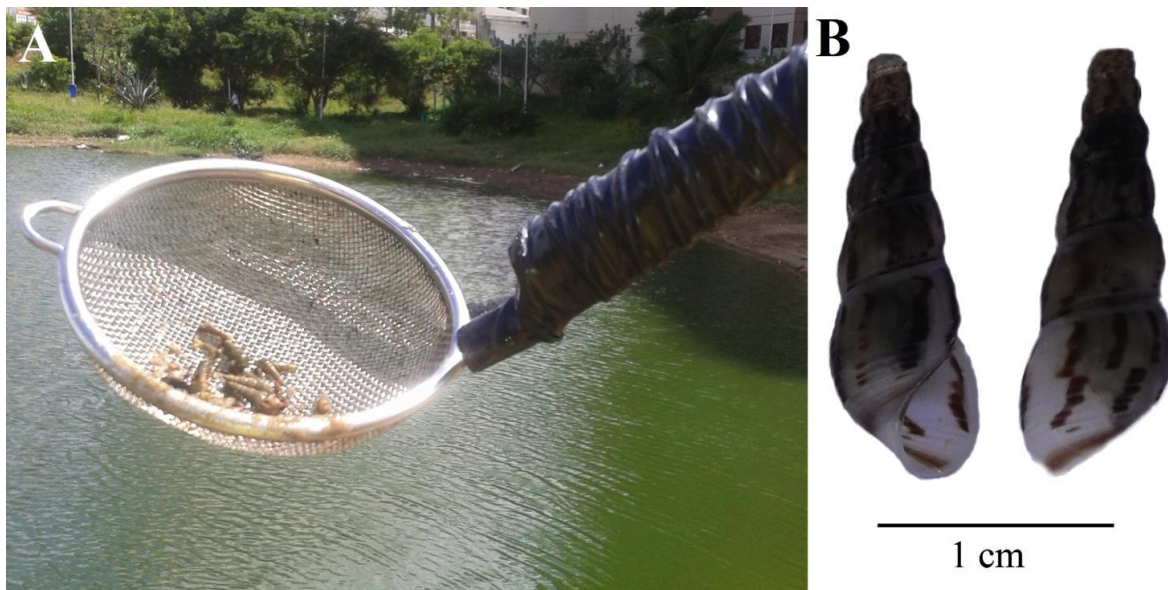
Invasive organisms are those that occur outside their natural environment (exotic species), reproduce and disperse in a new environment causing effects (positive or negative) to the economy, the environment or human health (Carlton 1996, Mack et al. 2000, Cowie 2001, Souto et al. 2011). The introduction of exotic species into natural communities is often mediated by human activity and can impact on native biological diversity (Souza et al. 2009, Everett 2000), exceeded only by the habitats destruction (Everett 2000, Cain et al. 2011). At Brazil, the Ministry of Environment (MMA 2006) produced a "National Report of Invasive Species in Brazil", covering flora, fauna and microorganisms in different environments, the results showed there are a total of 543 invasive species, being 176 terrestrial species, 66 marine species, 49 limnic species, 155 species for the production systems and 97 species affecting human health. The non-native gastropod *Melanoides tuberculatus* (Müller, 1774) (Gastropoda, Thiaridae),

is a benthic species that occurs in consolidated and unconsolidated substrates (Beeston & Morgan 1979). It is native from Asia and East Africa, has established extensive wildlife populations throughout the tropics (Pointier 1999) and threatens the health quality of various water bodies (Vaz et al. 1986). This gastropod is considered one of the main Brazilian invaders in freshwaters, reaching high densities, (up to 17.000 ind/m<sup>2</sup>), due the females parthenogenesis reproduce ability (Jesus et al. 2007). The country introduction is probably related to trade in plants and ornamental fish (Fernandez et al. 2003). Santos & Eskinazi-Sant'Anna (2010) and Silva & Barros (2011) state that several studies indicate that the species has a wide distribution, being first reported to Brazil in 1967, at Santos (SP). Currently it is widely distributed in Brazil, from the inner country to the coast and insulars island (e.g. Ilha Grande), occurring at Minas Gerais (Silva et al. 1994), Paraíba (Paz et al. 1995), Rio de Janeiro (Thiengo 2001, 2002, Santos et al. 2007), Ceará

(Melo & Cordeiro 1999), Paraná (Pereira 2000), Brasília (Vaz et al. 1986, Garcez & Martins-Silva 1997), Pará, Mato Grosso, Mato Grosso do Sul, Pernambuco, Piauí, Rio Grande do Norte, Tocantins, Espírito Santo and Bahia (Fernandez et al. 2003), Goiás (Fernandez et al. 2003, Rocha-Miranda & Martins-Silva, 2006) and Sergipe (Souto et al. 2011). In Bahia, the species was found in Caririnha, Coaraci, Itajuípe and Salvador cities (Fernandez et al. 2003). Despite the record to Salvador, no detail was presented yet (habitat, location, etc). Thus this paper aims to register a detailed expansion of species occurrence, detailing the habitats structure and locations of occurrence in Salvador city.

During November 2013 (between 03rd and 15th) *Melanoides tuberculatus* were collected by surface collection using a 1.0 mm manual net (Fig. 1A) in different aquatic ecosystems (e.g. lakes, rivers and mangroves) at Salvador, Bahia, Brazil

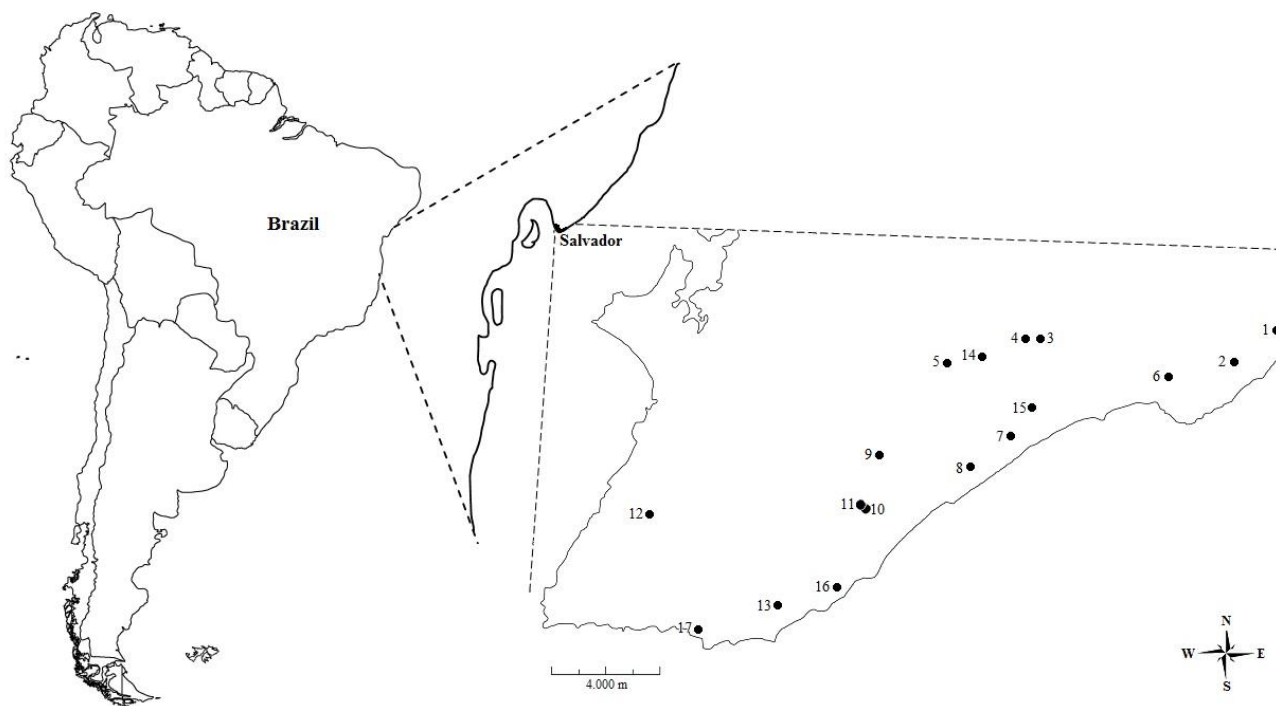
(Table 1). The net was introduced into the bottom two centimeters and dragged 50 cm three times in different areas (five or six areas) of each site. The collection was taken using a net, because the individuals were found buried at the sediment, sheltered from light, under plants, decaying leaves or other substrates. The *M. tuberculatus* (Fig. 1B) were preserved in 10% formalin and deposited in the Malacological Collection of the Núcleo Integrado de Estudos em Zoologia, Universidade Católica do Salvador (zoological collection bath number 52, 53, 54, 55, 56, 57, 58, 59 and 60). In the sites visited (Fig. 2), were visually checked the type of marginal substrate (rock, sand, mud), the presence of vegetation (aquatic or terrestrial), presence of possible predators (birds and fish) and man-made structures, to note if the ecosystem physical structure could influence the species occurrence.



**Figure 1.** (A) Net used to collect *Melanoides tuberculatus*; (B) *M. tuberculatus* from Pituvaçu lake.

*Melanoides tuberculatus* were found at nine of the 17 sites visited, and occupies lakes and mangroves. When there is not a flat margin (too steep) and aquatic birds occur *M. tuberculatus* was not found. The gastropod had no preference for substrate being found in all types of marginal substrates (mud, sand and stone), and it may or may not occur where there are man-made structures (Table 1). The man-made structures can be used as substrate at deep locations by *Melanoides tuberculatus*, down 4m depth, preferring areas up to 2m deep (SUDECAP 1990), facilitating its occurrence and distribution, but not negatively affecting the animal, thus showing also that the existence of margin in ecosystems has great

influence, which can be replaced by other structures. *M. tuberculatus* is a benthic species that occurs in consolidated and unconsolidated substrates (Beeston & Morgan 1979), so occurring in all types of marginal substrate found (mud, sand and stone) and without demonstrating substrate preference. At Salvador the temperature in 2013 was between 21.94 °C to 29.12 °C (INMET 2013), being within the ideal range for *M. tuberculatus* (16 °C to 37 °C; Okumura 2006), thus contributing to its better dispersion, development and condition of life. According to Okumura (2006) the gastropod does not tolerate temperatures below 15 °C and above 31 °C, finding favorable temperatures to stabilize at tropical areas.



**Figure 2.** Aquatic ecosystems sampled in Salvador, Brazil. 1. Flamengo's lake; 2. Stella Maris's lake; 3. Paralela Avenue lake 1; 4. Paralela Avenue lake 2; 5. CHESF's lake; 6. Abaeté's lake; 7. Passa Vaca's mangoove; 8. Pituauçu's lake; 9. Imbuí's lake; 10. STIEP's lake (Frades); 11. Armação's lake; 12. Tororó's lake; 13. Pituba's lake (Patos); 14. UniJorge's lake; 15. Villa dos Ipês's lake; 16. Camarajipe's river; 17. Lucaia's river.

**Table 1.** Characteristics of habitat structure of marginal aquatics ecosystems sampled in Salvador, Brazil.

Name of the Aquatic Ecosystem	Occurrence	Marginal substrate	Potential Predators	Man-made structures	Geographic Coordinates
Flamengo's lake	Yes	Mud; Sand	No	Yes	12°55'28.0"S 38°19'05.0"W
Stella Maris's lake	Yes	Mud; Sand	No	No	12°55'59.0"S 38°19'34.0"W
Paralela Avenue lake 1	Yes	Mud; Sand	No	No	12°55'59.2"S 38°23'38.9"W
Paralela Avenue lake 2	Yes	Mud	No	Yes	12°56'00.1"S 38°23'27.7"W
CHESF's lake	No	Stone	No	No	12°56'26.5"S 38°25'06.9"W
Abaeté's lake	No	Sand	Yes	No	12°56'43.9"S 38°21'28.7"W
Passa Vaca's mangoove	Yes	Sand	No	No	12°57'42.0"S 38°23'59.0"W
Pituauçu's lake	Yes	Sand	No	No	12°58'01.1"S 38°24'43.81"W
Imbuí's lake	Yes	Sand	No	No	12°58'02.6"S 38°26'18.5"W
STIEP's lake (Frades)	Yes	Stone Sand	No	Yes	12°58'55.7"S 38°26'32.1"W
Armação's lake	No	Mud; Sand	No	No	12°59'00.0"S 38°26'43.0"W
Tororó's lake	No	Mud; Sand	No	No	12°59'02.4"S 38°30'17.5"W
Pituba's lake (Patos)	No	Mud; Sand	Yes	No	13°00'20.6"S 38°27'56.5"W
UniJorge's lake	Yes	Mud; Sand	No	Yes	12°56'19.0"S 38°24'34.9"W
Villa dos Ipês's lake	No	Sand	Yes	Yes	12°57'04.8"S 38°23'34.6"W
Camarajipe's river	No	Sand	No	No	12°59'52.2"S 38°26'58.1"W
Lucaia's river	No	Sand	No	No	13°00'45.4"S 38°29'20.6"W

*M. tuberculatus* and others invasive species can be controlled by potential competitors or predators, as the african catfish *Clarias gariepinus* (Gashaw *et al.* 2008), the exotic carp *Mylopharyngodon piceus* (Ben-Ami & Heller 2001) and exotic gastropod *Pomacea canaliculata* (Kwong *et al.* 2009). The various stages of a species can be used as food by a high diversity of predators. According Teo (2001) the native aquatic birds can control the invasive gastropods (e.g. *P. canaliculata*). In this work, we did not found *M. tuberculatus* in areas where there were aquatic birds, indicating that these birds could be a possible predator. Thus, would not use new exotic species to control, avoiding biggest environmental problems.

This study showed an expansion of the occurrence of the invasive gastropod *Melanoides tuberculatus*, detailing the structure and location of habitats in lakes, rivers and a mangrove of Salvador. Also showed that probably, these animals do not have preference for any specific type of substrate (mud, sand or stone), the presence of human structures does not inhibit or encourage its occurrence and that the presence possible predators, such as aquatic birds, can help in its control. However a more targeted study to prove the theory of biological control for aquatic animals should be performed.

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