

Occurrence and distribution of fresh-water molluscs in the Riacho Fundo Creek Basin, Brasilia, Brazil

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Abstract: To study the distribution of molluscs in the Riacho Fundo Creek (cerrado region of central Brazil), five creek sites were sampled once every two months for one year. Molluscs were sampled using standardized kick-net sampling. Four species of molluscs were found: *Physella cubensis*, *Melanoides tuberculata*, *Biomphalaria straminea* and *Pisidium* sp. The most abundant were *P. cubensis* and *Pisidium* sp. *Physella cubensis* was most abundant in the dry season and *Pisidium* sp. was most abundant in the rainy season, probably reflecting the rainy season increase of water currents.

Key words: Mollusca, Gastropoda, Bivalvia, distribution, river, South America, Brazil.

Freshwater molluscs are benthic invertebrates whose occurrence and distribution are influenced by various factors, including availability of dissolved salts, type of sediment, pH of the water, pollution and water velocity (Grisolia and Freitas 1985).

The molluscan population of Brasilia region has been under investigation since the construction and founding of Brasilia (April of 1960). Most research has focused on gastropods. The genus *Biomphalaria* was intensely studied due to its relation to the schistosomiasis (Crespo *et al.* 1965, Magalhães 1966, Paraense 1972, Freitas 1976, Barbosa and Coimbra 1979). Monteiro and Dias (1980) also studied the occurrence of the genus *Pomacea*. The gastropods *Melanoides tuberculata* and *Physella cubensis* have been identified in the São Bartolomeu River basin (Kattar and Martins-Silva in press, Rocha *et al.* in press) and the Maranhão River basin (Barros and Martins-Silva 1997), which are also located near Brasilia. A genus of bivalve mollusc,

Pisidium, has also been found in the latter. In Paranoa Lake, Vieira (1990) identified only *M. tuberculata*, however Monteiro and Dias (1980) found *Lymnaea* sp., *Physa* sp. and two species of *Biomphalaria* in Paranoa Lake basin. In the Riacho Fundo Creek the gastropods *B. straminea*, *B. tenagophila*, *M. tuberculata*, *P. cubensis*, *L. cf. columella*, *Gundlachia concentrica* and *Drepanotrema* sp. and the bivalve *Pisidium* sp. were investigated by Medeiros (1997).

The study of these organisms is important due to the fact that the occurrence of some species is related to polluted areas, while for others, the presence of clean, unpolluted water is essential for their occurrence. In such a way, through the identification of the species occurring in the Riacho Fundo Creek basin, it may be possible to evaluate the present conditions of this main tributary of the Paranoa Lake, and consequently the impact it may have on the quality of the water. The present study aimed at investigating the occurrence and distribution

of freshwater molluscs present in one of the main and more polluted tributaries of the Paranoa Lake, the Riacho Fundo Creek basin.

MATERIALS AND METHODS

Study Area: Brasilia is located in the Cerrado (Brazilian savanna) region of central Brazil, in which well established rainy and dry seasons are observed. The hydrographic system is composed of rivers and lakes (natural and artificial).

Paranoa Lake is an artificial lake of 40 km² formed by the construction of the Paranoa Dam, which generates electricity for Brazil's capital, humidifies the air, and provides recreational opportunities (Monteiro and Dias 1980, Rocha 1994). The lake has four main tributaries: the Riacho Fundo Creek and Gama Creek at its south portion, and the Bananal and Torto Creek on the north. The south region of the lake and its tributaries are densely populated and suffer from rapid processes of pollution, deforestation and erosion. To the north, the tributaries are more preserved due to the presence of Brasilia's National Park through out most of this region (Rocha 1994).

The Riacho Fundo Creek is located at a high-populated region of Brasilia and receives waters from Vicente Pires Creek, Guará Creek and Ipê Creek.

Methods: Five sites on the Riacho Fundo Creek basin (Fig. 1) were sampled once every two months, during the period of November, 1996 and September, 1997 (rainy season: November/1996, January/1997 and March/1997; dry season: May, July and September/1997). Molluscs were sampled using a D-frame net with approximately 30 x 20 cm in a border area of 2 m². Three replicate samples were taken at each site. All samples were preserved in 70 % alcohol. In the laboratory, samples were washed in two sieves (2 and 0.5 mm mesh) and sorted using a light microscope under 10 x magnification.

Water samples were also made for an analysis of the abiotic variables (pH, color, tur-



Fig. 1 Map showing the sites of data sampling.

bidity, calcium, alkalinity and suspended material) in May/1997. Samples of the sediment were made using a core with 10 cm diameter for granulometric composition (May/1997).

The sampler used in this work for collecting molluscs is, according to Turner and Trexler (1999), one of the best sampler for collecting invertebrates at meshes. In Riacho Fundo Creek the sites studied were bordered by macrophytes. According to Dorazio (1999), quantitative sampling that includes excavation and sieving of sediments appears to be an effective method for collecting freshwater molluscs. Quantitative sampling also exploits the relatively sedentary nature of freshwater molluscs. In our work we used a D-frame net with three replicate samples in an area of 2 m² every two months. This method gives us information about the occurrence and distribution of molluscs in the five sites sampled.

RESULTS

A total of 522 molluscs were collected. *Physella cubensis* was the most abundant (58.4 %), followed by *Pisidium* sp. (29.8 %), *Biomphalaria straminea* (10.4 %) and *Melanoides tuberculata* (1.4 %).

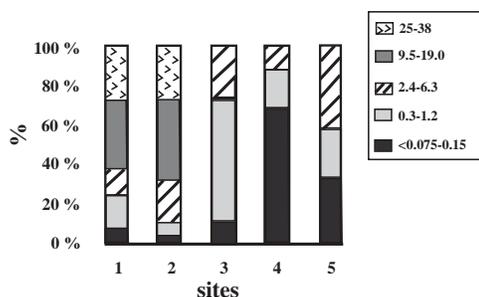


Fig. 2. Granulometric composition of the sediment in the five sites studied.

At sites 1 and 3 no molluscs were found. Sites 1 and 3 had larger sediment grains, but mixed with fine grains (Fig. 2). This indicates probably the great movement of the sediment due to the proximity of Riacho Fundo city. At site 2, molluscs were present only in the rainy season and at sites 4 and 5 molluscs were found in both seasons.

Three species of gastropod molluscs, *P. cubensis*, *M. tuberculata* and *B. straminea* were found in the Riacho Fundo Creek basin. *Physella cubensis* was the most abundant species among the gastropods found. This species was more abundant during the dry season, mainly at site 5 (Fig. 3). *Melanooides tuberculata* occurred, though in a smaller numbers, during the same season at site 5, while during the rainy season, it was present at sites 4 and 5. *Biomphalaria straminea* was identified at site 5 during the dry season and at sites 2, 4 and 5 during the rainy season (Fig. 3). The bivalve genus *Pisidium* was the most abundant at sites 2, 4 and 5 during the rainy season, but found only at site 4 during the dry season. *Pisidium* was more abundant in the rainy season.

Analysis of the granulometric composition of the sediment (Fig. 2) indicates that site 5 had most of its grains ranging from 2.4 and 6.3 mm, site 4 between < 0.075 and 0.15 mm and site 2 between 9.5 and 19 mm. The results of the water analysis (Table 1) presented great variations for most of the variables analyzed. The pH pattern was relatively consistent along the sites sampled.

DISCUSSION

The species of molluscs identified in the present report can be associated with polluted and altered environments (Oliveira and Krau 1970, Berry and Kadri 1974, Freitas 1976, Trauben and Olive 1983, Grisolia and Freitas 1985).

Physella cubensis was always found cohabiting with other species of molluscs, as found in other studies (Monteiro and Dias 1980). This species was found at sites 4 and 5, which had extensive bordering aquatic vegetation. According to Pennak (1978), these gastropods prefer substrates with decomposed organic matter or macrophytes in the water. This kind of substrate can be associated with degraded regions (Rocha 1994, Medeiros 1997) and *P. cubensis* has been found abundantly in polluted regions (Trauben and Olive 1983).

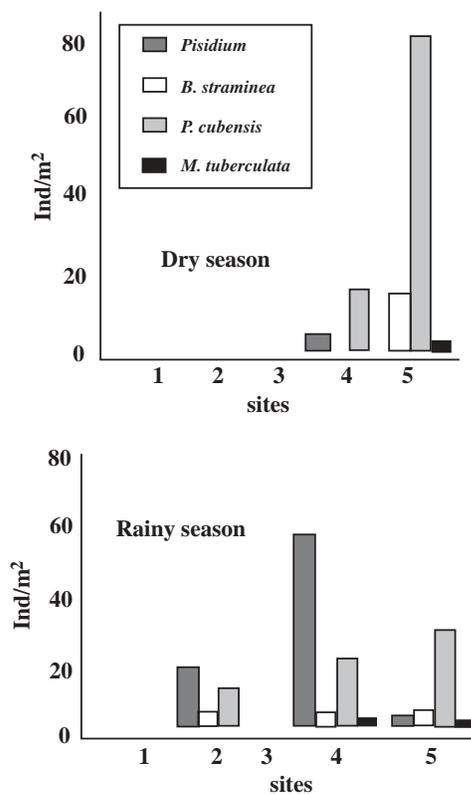


Fig. 3. Number of individuals/m² in the dry and rainy seasons at the five sites of Riacho Fundo Creek.

Some species found during this study such as *B. straminea* (Magalhães 1966, Monteiro and Dias 1980) and *M.tuberculata* (Vieira 1990) are due to accidental human introductions. Destruction of the original habitat was favorable for another species of this genus, *B. tenagophila*, in this region (Grisolia and Freitas 1985). This genus has a great resistance and adaptation potential, being found only in polluted areas (Oliveira and Krau 1970, Freitas 1976, Grisolia and Freitas 1985). *Melanoides tuberculata* can occupy a great diversity of habitats (Berry and Kadri 1974) and occurred mainly in organically polluted areas. As indicated in Table 1, high rates of alkalinity, conductivity and suspended material can be associated to site 5, suggesting that this area is more polluted than the other locations studied. Medeiros (1997) found seven species of molluscs in his study and we found four species. This difference maybe due to the fact that he sampled twelve sites and we sampled five sites in the same region, but not in the same sites.

Bivalve molluscs are considered more sensitive to water quality (Pennak 1978, Salmon and Green 1982, Hanson *et al.* 1988). However, species of the genus *Pisidium* tolerate greater nutrient concentration and are used, like some gastropods, as a bioindicator of water quality (Metcalf 1989). *Pisidium* sp. occurred only at site 4 during the dry season, but in the rainy season it was present at sites 2, 4 and 5. At site 4, in which this mollusc was most abundant, the sediment was composed of small grains, water was less polluted and had higher concentration of calcium (Table 1).

Therefore, this site may be a good area for the occurrence of this species.

The pH of the water of this region is usually acid due to the acid soil of the cerrado (Barros 1994). An acid pH is unfavorable to the occurrence of molluscs, which prefer slightly alkaline environments, such as site 5 (Andrade *et al.* 1955, Grisolia and Freitas 1985, Makela and Oikari 1992). Conductivity less than 10 mS/cm is usually found in preserved environments (Rocha 1994). However, the values for conductivity found in the Riacho Fundo Creek were greater. Variations of the calcium concentrations may indicate that this variable might not be the determining factor influencing the occurrence of these invertebrates in this region.

The dry/rainy season variation had a great impact on the occurrence and distribution of the molluscs of the Riacho Fundo Creek basin. A decrease in the number of animals found during the rainy season was expected. However, the opposite effect was observed, mainly due to the increase in the abundance of *Pisidium* sp. during this period. The other abundant species (*P. cubensis*), decreased in the rainy season. During this period, water currents may increase and could therefore influence directly the occurrence and abundance of this species, by carrying the molluscs to the Paranoa Lake, or indirectly through changes in the granulometric composition of the sediment (Freitas 1976, Salmon and Green 1982, Esteves 1988, Hornback *et al.* 1992). Species of the genus *Pisidium* occupy the sediment and a possible increase of water velocity may not be an important factor influencing its occurrence and distribution.

TABLE 1
Water parameters analyzed in the samples sites in Riacho Fundo Creek Basin

Water Parameters	Site 1	Site 2	Site 3	Site 4	Site 5
pH	6.7	6.7	6.9	6.7	7.2
Color (UC)	10	5	10	15	10
Turbidity (UT)	8.9	6.4	7.2	10	6.6
Calcium (mg Ca ⁺² /l)	1.8	1.1	3.3	3.6	11.1
Alkalinity (mg Ca CO ₃ /l)	2.5	2.4	5.2	5.2	12
Conductivity (mS/cm)	27	28	44	37	91
Suspended Material (mg/l)	18	19	30	25	62

The present study suggests that the Riacho Fundo Creek Basin is an environment altered mainly by human action, and that the species of molluscs found may be good bioindicators for this kind of study.

RESUMEN

Para estudiar la distribución de moluscos en Riacho Fundo Creek (región cerrado del centro de Brasil), se muestrearon cinco sitios en un arroyo una vez cada dos meses durante un año. Los moluscos fueron muestreados usando muestreos estandarizados de "kick-net". Se encontraron cuatro especies de moluscos: *Physella cubensis*, *Melanoïdes tuberculata*, *Biomphalaria straminea* y *Pisidium* sp. Los más abundantes fueron *P. cubensis* y *Pisidium* sp. *Physella cubensis* fue la más abundante en la estación seca y *Pisidium* sp. fue la más abundante en la estación lluviosa, problemente reflejando el aumento de corrientes de agua en la estación lluviosa.

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