

First record of a bloom of the invasive species *Ceratium furcoides* (Levander) Langhans 1925 in Rio Grande do Sul state, Brazil

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Ceratium Schrank is dinoflagellate genus commonly found in marine environments, and considered invasive in continental waters (Silva et al., 2012). Species of this genus are able to develop blooms due to their mobility and resistance to sedimentation, to the occupation of the surface layer and optimised use of resources such as light and nutrients (Donagh et al., 2005). Even though its blooms are not toxic, they still bring harmful effects to aquatic communities as anoxic conditions causing the death of a local population of lobsters (Pitcher and Probyn, 2011).

In Brazil, the occurrence of a species of this genus has been recently registered in freshwater ecosystems. Santos-Wisniewski et al. (2007) recorded a bloom of *C. furcoides* in Furnas reservoir, Minas Gerais state, and Matsumura-Tundisi et al. (2010) in Billings reservoir, São Paulo state, both eutrophic environments. In the rivers semi-arid region of Brazil the occurrences of *C. furcoides* and also of *C. hirundinella* were described by Oliveira et al. (2011). *C. furcoides* e *C. hirundinella* are ecologically and morphologically similar (Gil et al., 2012) differing only in the number of apical plates (Santos-Wisniewski et al., 2007).

Regarding Rio Grande do Sul state, the study by Cardoso et al. (2010) in four meso-eutrophic reservoirs identified eight species of Dinophyceae. Species of *Ceratium*, however, were not registered by these authors, so this genus had not, to date, been registered in freshwater reservoirs within the state. This note, thus, documents the first observation of a bloom of *C. furcoides* in Rio Grande do Sul state.

The upper Jacuí hydrographical basin located in Rio Grande do Sul, Brazil, has an area of 12.985,44 km² and belongs to the Guaíba hydrographical region (Sema, 2009). The upper course of the Jacuí river is characterised by the presence hydroelectric power stations, where five water reservoirs were constructed forming a cascade system. Phytoplankton samples were collected in the water reservoir for the Itaúba Hydroelectrical power station. It is the fourth reservoir in the Jacuí cascading system. It has an area of 13.29 km², a perimeter of 140.55 km, and maximum depth of approximately 90 m. Its main tributary is the river Ivai (Sema, 2009).

On 31st August 2012 four sampling stations (Figure 1) were visited and at each station samples were taken from three different depths (Figure 2). A five litre Van Dorn bottle was used to collect the water. The samples were concentrated *in situ* using a plankton net (10 µm pore size) and preserved with 1% Lugol solution. An analysis of the whole phytoplankton community was carried out and taxonomic identification to genus level followed Bicudo and Menezes (2006) and Santos-Wisniewski et al. (2007). Quantitative analyses followed Uthermöhl (1958) using an inverted microscope (Motic AE31).

Generally, the sampling stations at the Itaúba reservoir had an average depth of 45 m. Water transparency varied between 0.50 and 1.65 m and the occurrence of *C. furcoides* (Figure 3) was registered at every sampling station in the reservoir.

In the phytoplankton community 36 species, belonging to eight classes were identified. Chlorophyceae and Bacillariophyceae were the classes with the highest species richness, but *C. furcoides* was the dominant species in all samples. In Figure 2 it is noticeable that the highest cell concentration was found at the sampling stations located close to the dam: Ss1 and Ss2. It is also clear that the concentration decreases with increasing distance to the barrage, shifting between 2036 cell·mL⁻¹ at Ss1, 1500 cell·mL⁻¹ at Ss2 and 272 cell·mL⁻¹ at Ss3. Such densities may be considered high when compared to those found at Furnas reservoir: 285 cell·mL⁻¹ (Santos-Wisniewski et al., 2007) but relatively low when compared to the Billings reservoir: 21.000 cell·mL⁻¹ (Matsumura-Tundisi et al., 2010). Exceptionally at sampling station Ss4, where the lowest surface density (74 cell·mL⁻¹) was found, the lower limit of the euphotic zone was 4.95 m. This lower density allowed light availability to a greater depth, where the vertical distribution of the species differed from the other sampling stations, with a higher density in the lower limit of the euphotic zone (205 cell·mL⁻¹).

Algal bloom events may cause harmful effects in aquatic communities, affecting the ecosystem balance, so constant monitoring is necessary. Furthermore, Itaúba reservoir is part of a cascading system, linked to a number of other reservoirs, where the occurrence of *C. furcoides*

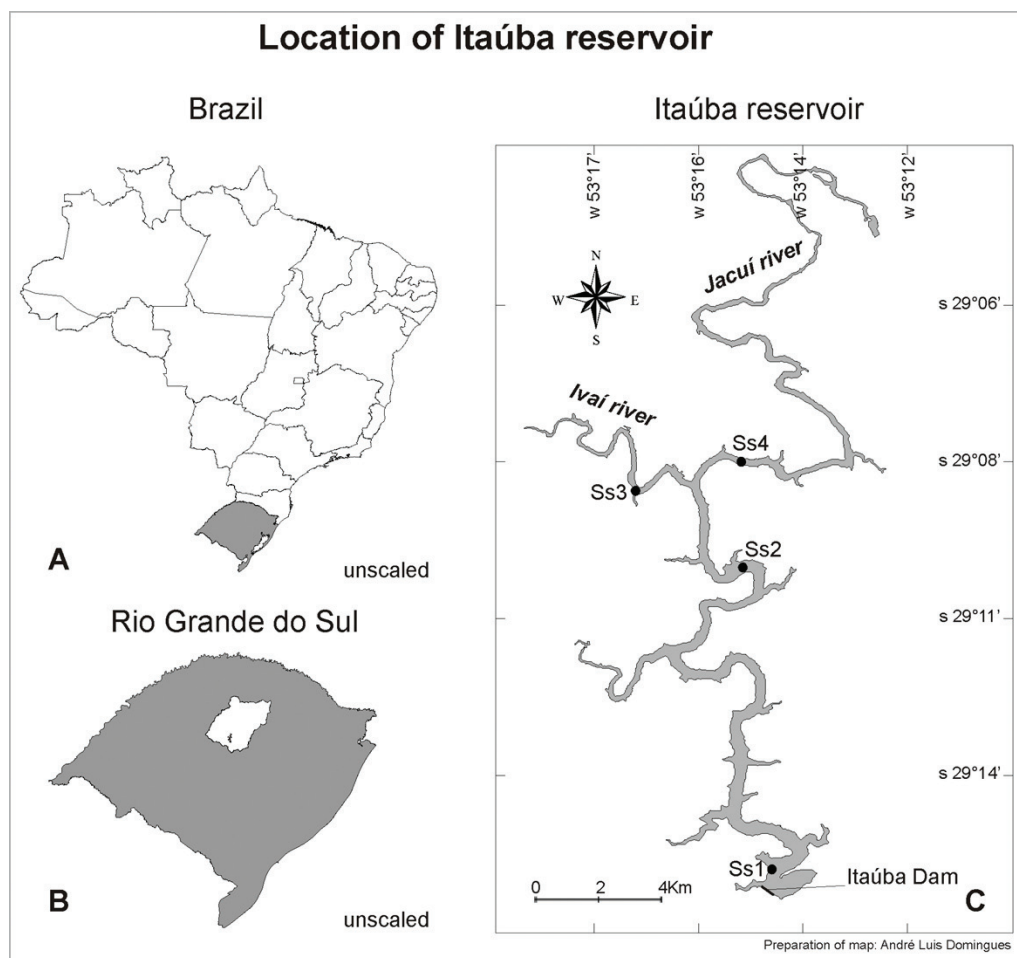


Figure 1. Location of Itaúba reservoir, (A) in grey Rio Grande do Sul state, southern Brazil; (B) in white the upper course of Jacuí hydrographical basin and the Itaúba reservoir; (C) Itaúba reservoir map with its main tributaries and the location of the four sampling stations (Ss).

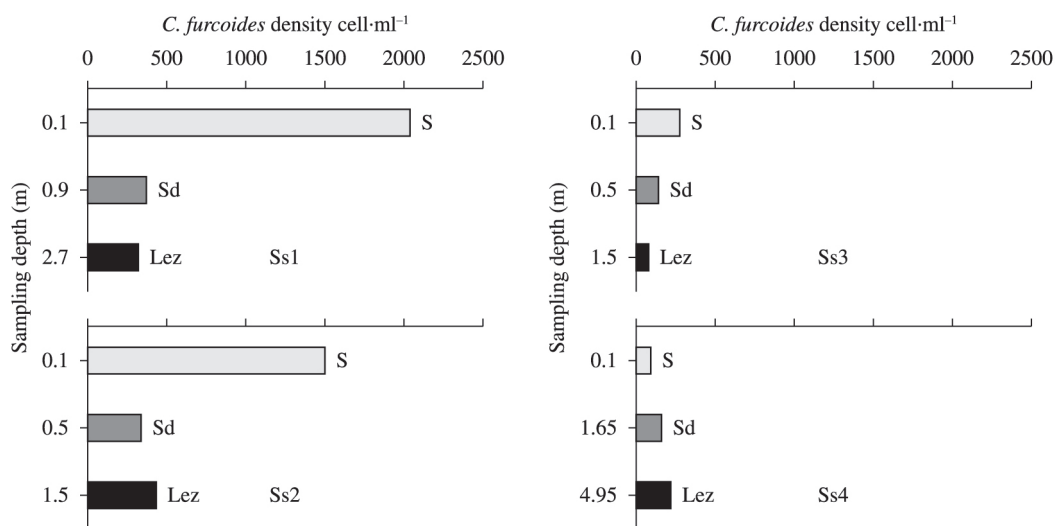


Figure 2. Cell density (cell·mL⁻¹) of *Ceratium furcoides* in four sampling stations (Ss) and three different depths in the Itaúba reservoir, August 2012. S: surface layer; ds: secchi disk depth; zf: lower limit of the photic zone.

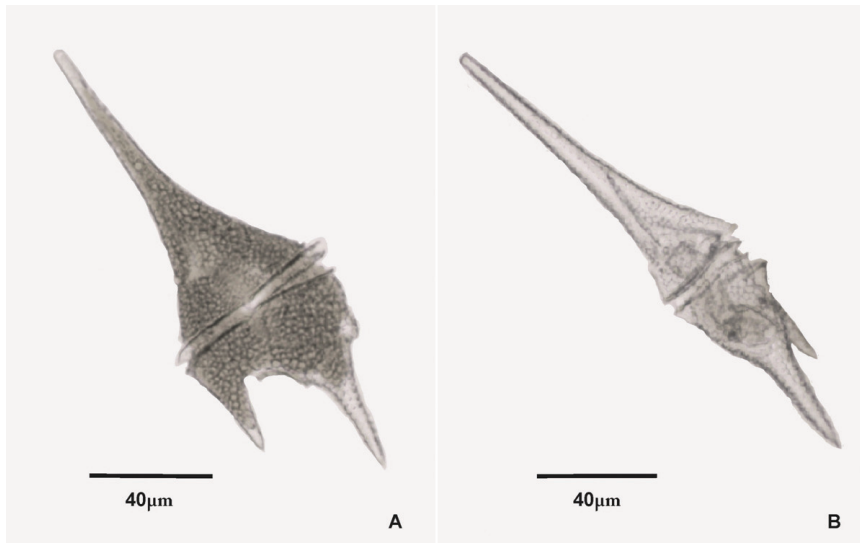


Figure 3. *Ceratium furcoides* (Levander) Langhans 1925. (A) dorsal view ; (B) lateral view. Length:173-150 µm (162 µm average); width: 60-39 µm (45 µm average). (Photos: Domingues, A.L.).

is also under study, in order to describe the extent of the establishment of this invasive species in the hydrographical basin, its ability to form blooms and the interferences caused on the local communities.

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