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EPIILITHIC FRESHWATER DIATOMS FROM ELEPHANT ISLAND, SOUTH SHETLANDS, ANTARCTICA

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Abstract: *Epilithic diatom species from six sampling stations on Elephant Island, South Shetlands, Antarctica, are presented in this paper. Samples were taken in the austral summer of 2011-2012 from submerged stones in two lakes and four streams. Species identification was carried out by light and scanning electron microscopy. A total of 19 species in 12 genera were determined. The most representative genera considering number of species were Gomphonema Ehr. and Pinnularia Ehr. Compared to species inventories on other islands of the South Shetlands archipelago, species richness on Elephant Island is low, and further investigation is needed in order to determine the causes, whether environmental or result of biotic interactions.*

Keywords: Periphyton, Bacillariophyceae, Maritime Antarctica

Introduction

One of the main archipelagos in the South Atlantic Ocean are the South Shetlands, a group of 11 mountainous islands, located 160 km North of the Antarctic Peninsula (Van de Vijver *et al.*, 2009). Elephant Island is the northernmost of the islands, located at 885 km from Cape Horn, Chile. Studies carried out on the diversity of freshwater periphytic diatoms (Bacillariophyceae) in Antarctic freshwater habitats are scarce, even though a recent interest in this flora has arisen (Spaulding *et al.*, 2010). Accounts of diatom floras on Elephant Island are limited to planktonic marine species (Villafañe *et al.*, 1993, 1995), with no published articles on diversity of epilithic communities of lakes and temporary streams on the island. The periphytic community is composed of algae and other microorganisms attached to or associated with different substrates. Algae are the main producers in these communities and diatoms are of great quantitative importance. In locations of melting ice, the epilithic type of periphyton (developing on submerged stones and rocks) is the most abundant. Since species composition in the communities is determined by hydrological

conditions, trophic state and type of substrate available for colonization (chemical composition, roughness, etc.) as well as ecological preferences of the containing species (Charles & Charles, 2003), information on diversity is crucial for a better understanding of environment dynamics. The species diversity of diatoms of inland habitats in Antarctica is low compared to both temperate and Arctic regions, due, in part, to physical isolation of the continent. The freshwater diatom flora of the Antarctic Islands is unique with several endemic species (Van de Vijver *et al.*, 2001; 2002; 2004) and some species which are restricted to only one island or group of islands, whereas others occur more widely in the region (Van de Vijver *et al.*, 2008). Also, diatoms are one of the most abundant groups of freshwater algae in terrestrial subantarctic habitats (Jones, 1996).

Due to the great ecological importance of periphytic diatoms in these habitats, as well as the key role of microalgae in the characterization of freshwater habitats, this study aimed at describing the diatom flora in five shallow freshwater systems of Elephant Island.

Materials and Methods

Samples were taken in the austral summer of 2011-2012 during the 30° Brazilian Antarctic Operation (Operantar XXX). Six different freshwater systems were sampled on Elephant Island: station 1 (61°13'58.6"S and 055°21'38.5"W), station 2 (61°13'57.3"S and 055°21'19.3"W), station 4 (61°13'19.0"S and 055°21'40.2"W), and station 5 (61°13'21.5"S and 055°21'42.4"W) were melting ice streams (station 1 ran across a penguin breeding ground); station 3 (61°13'55.4"S and 055°21'03.0"W) was located on Endurance Lake and station 6 (61°13'18.5"S and 055°21'48.0"W) on Skua Lake.

Epilithic diatom samples were obtained from stones scrubbed with a toothbrush and rinsed with distilled water. Each sample was bottled, fixed with 4% formaldehyde and transported to the Phycology Lab at Universidade Federal de Santa Maria at the end of the expedition. Samples were processed and cleaned by boiling with hydrogen peroxide

(H₂O₂) 1:1 solution for three hours, in order to remove any organic matter from the diatom frustules and organic content from the periphytic matrix. Permanent slides were mounted in Styrax (1,6 RI) for light microscopy analyses, which were carried out using a Leica DM750 light microscope. For scanning electron microscopy the oxidized samples were mounted on aluminum stubs after air-drying. The stubs were sputter coated with 50 nm of Au and studied in a JEOL SEM at 10 kV.

Species identification was carried out by population analysis, with measurements of length (C), width (L) and density of striae in 10 µm taken from at least 25 individuals of each species. All recorded individuals were photographed.

Results

An average of 400 individuals was observed on each glass slide (each representing one sampling site). A total of 19 species in 12 genera were determined, listed in Table 1. The

Table 1. list of genera and species of epilithic diatoms recorded in six sampling stations on Elephant Island, South Shetlands, in the austral summer of 2011-2012.

Genus	Species
<i>Achnanthyidium</i>	<i>Achnanthyidium delicatulum</i> Kützing
<i>Amphora</i>	<i>Amphora</i> sp
<i>Chamaepinnularia</i>	<i>Chamaepinnularia krookiiiformis</i> (Krammer) Lange-Bertalot & Krammer
<i>Fragillaria</i>	<i>Fragillaria capucina</i> Desmazieres
	<i>Fragillaria capucina</i> var <i>voucheriae</i> (Kütz) Lange-Bertalot
<i>Geissleria</i>	<i>Geissleria subantarctica</i> Van de Vijver & Le Cohu
<i>Gomphonema</i>	<i>Gomphonema parvulum</i> (Kütz) Kütz
	<i>Gomphonema</i> sp1
	<i>Gomphonema</i> sp2
<i>Luticola</i>	<i>Luticola multicopsis</i> (Van Heurck) D.G. Mann
<i>Mayamaea</i>	<i>Mayamaea atomus</i> (Kützing) Lange-Bertalot
<i>Navicula</i>	<i>Navicula gregaria</i> Cholnoky
<i>Nitzschia</i>	<i>Nitzschia gracilis</i> Hantzsch
	<i>Nitzschia hamburugiensis</i> Lange-Bertalot
<i>Pinnularia</i>	<i>Pinnularia microstauron</i> (Ehr.) Cleve
	<i>Pinnularia</i> sp1
	<i>Pinnularia</i> sp2
	<i>Pinnularia</i> sp3
<i>Psammonthidium</i>	<i>Psammonthidium papilio</i> (D.E.Kellogg) Van de Vijver & Kopalová

most representative genera considering number of species were *Gomphonema* Ehr. and *Pinnularia* Ehr.

Discussion

Despite the significant progress made in the past 15 years with respect to the diversity of non-marine diatom flora from the Antarctic islands (Van de Vijver *et al.*, 2013), species inventories and community studies are still scarce, with the majority of the studies concentrating in taxonomic reviews of genera and families. Of the few existing references for the South Shetlands, Kawecka *et al.*, (1998) observed 78 diatoms species in shallow water bodies in the vicinity of H. Arctowski Polish Antarctic Station, on King George Island. Also on the same island, Lobo *et al.*, (1998) identified 25 epilithic diatom species in nine genera from lakes around the Brazilian Antarctic Station Comandante Ferraz, collected in 1989 and 1990. On James Ross Island, situated off the southeast side and near the northeastern extremity of the Antarctic Peninsula, Kopalová *et al.*, (2012) listed 69 benthic diatom species in 26 genera from 34 samples collected between 2004 and 2009.

Despite the still limited number of studies, it is possible to say that the non-marine diatom flora of the Antarctic islands is currently under revision, with the description of several new species, previously believed to be cosmopolitan, but recently proven to be typical of Antarctic habitats (Van de

Vijver *et al.*, 2008). The most species rich genus on Elephant Island was *Pinnularia* Ehr., a common and diverse taxon in Antarctic freshwaters (Kellogg & Kellogg, 2002). Several new species of this genus have recently been described (Van de Vijver *et al.*, 2002; Van de Vijver *et al.*, 2008) in Antarctica.

Conclusion

When compared to numbers from other Antarctic islands, the species richness registered on Elephant Island is low, and further investigation is needed in order to determine the causes, whether environmental or resulting of biotic interactions.

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