



MICROBIOLOGICAL IMAGE

Possible role of bacteria in the degradation of macroalgae *Desmarestia anceps* Montagne (Phaeophyceae) in Antarctic marine waters



Posible rol de las bacterias en la degradación de la macroalga *Desmarestia anceps* Montagne (Phaeophyceae) en las aguas marinas antárticas

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Bacterioplankton is a relevant component of coastal marine food webs. In Antarctica, environmental conditions strongly limit the growth rates and metabolic activity of the biota. Macroalgae, such as the large perennial brown algae *Desmarestia anceps* Montagne (Fig. 1), are one of the main primary producers in this environment. The organic matter released as a result of the death and decomposition of these macroalgae is considered a key event in the supply of nutrients to other components of the Antarctic marine biota.^{4,5} Some bacteria associate to algal debris and directly obtain from it inorganic and organic nutrients for their own

growth. During this activity, significant amount of organic molecules (proteins, carbohydrates and organic acids) are released into the marine environment, constituting the dissolved organic matter (DOM) stock, which is unavailable to most marine organisms but can be used by a fraction of the bacterioplankton as a carbon and energy source.³ This trophic pathway is known as the “microbial loop” and allows dissolved organic carbon (DOC) to return to higher trophic levels via its incorporation into bacterial biomass.¹ The microbial loop is coupled with the classic food chain formed by phytoplankton-zooplankton-nekton.

In Antarctic marine environments, the time for decomposition and the physical mechanisms required for an effective biodegradation of algal debris is not fully understood. However, the association of marine bacteria to

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Figure 1 Huge mats of the dominant macroalgae *D. anceps* inhabit the coastal rocky substrates of Potter Cove, 25 de Mayo (King George) Island, South Shetland Islands, Antarctica. Although the fate of the different fractions of the biomass flux released by senescent individuals of these macroalgae is not yet well known, it is likely that they greatly impact on nutrient cycling dynamics in Antarctic coastal marine ecosystems.

D. anceps thallus can be clearly appreciated in the SEM images (Fig. 2) obtained from initial studies on bacteria-related algal degradation in the Potter Cove ecosystem. Preliminary results showed that viable heterotrophic bacterial

numbers increased over time during algal degradation. Nevertheless, the time required for a significant microbial-mediated damage of extremely long thalli at the typical sea water temperatures of the Cove ($\sim 1-2^{\circ}\text{C}$) and its effectiveness closely depends on the prior mechanical breakdown mediated by icebergs and stones, which are driven by strong winds, currents and tides.²

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that no patient data appear in this article.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

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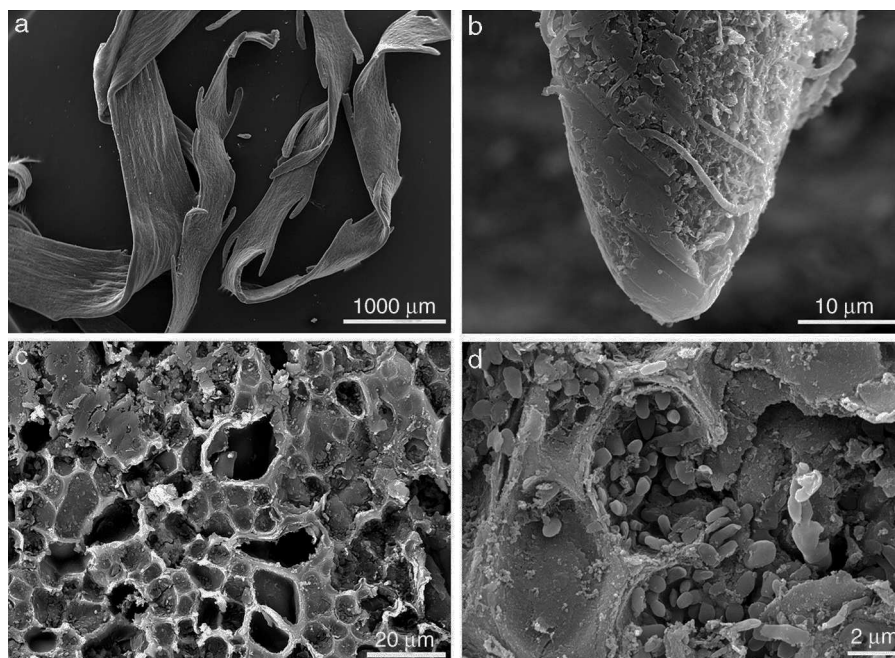


Figure 2 Bacteria associated to debris of macroalgae *D. anceps*. Detail of different parts of thalli (a). Apical regions of *D. anceps* thalli (b). When macroalgal thalli are mechanically damaged by the abrasion of sea ice and stones, the components of their cell walls are exposed (c) and the cavities of dead cells are colonized by a great number of bacteria, probably obtaining and releasing inorganic and organic nutrients from cell debris (d).

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