AMBIO

Antarctic Microbial Biodiversity: The importance of geographical and ecological factors

DURATION OF THE PROJECT
Phase 1: 15/12/2006 – 31/01/2009
Phase 2: 01/02/2009 – 31/01/2011

BUDGET
857.900 €

KEYWORDS
Antarctica, Microbial Biodiversity, Biogeography, Protection

CONTEXT

AMBIO aims to explore the microbial diversity on the Antarctic continent. Microorganisms dominate most Antarctic ecosystems, they form the basis of the food webs and are the main actors in the biogeochemical cycles. However, little is known about their diversity. We therefore lack the baseline information needed to understand the contribution of various processes responsible for the geographical patterns in microbial diversity and community composition and to monitor possible future changes due the ecosystem changes and/or human introductions.
In the frame of the International Polar Year, AMBIO will take part in the IPY MERGE (# 55) project concerning the microbial and ecological responses to global environmental changes in Polar Regions. It will also participate in the SCAR programme "Evolution and Biodiversity in Antarctica" (EBA).

PROJECT DESCRIPTION

Objectives

The AMBIO project aims to determine the microbial diversity in Antarctic aquatic ecosystems, using an integrated and standardised analysis.
The specific objectives are:
1. To explore and discover the microbial diversity in wet terrestrial habitats in Sub-Antarctica, maritime and continental Antarctica.
2. To enlarge the database of ribosomal RNA operon sequences of bacteria, cyanobacteria and microalgae through the collection and analysis of new samples.
3. To enlarge the collections of Antarctic bacteria (particularly Proteobacteria and Bacteroidetes), cyanobacteria, green algae and diatoms, with new characterised isolates.
4. To study the community turnover within each taxonomic group among different/comparable habitats along ecological and geographical gradients.
5. To select in each of the taxonomic groups, particular taxa that displays striking distribution patterns (environmental specialisations, potentially endemic or cosmopolitan) for further detailed study (specific genotypic analyses on a large number of varied samples). This approach will enable to better analyse the importance of ecological and historic factors.
6. To identify regions of unique microbial diversity that deserve to be protected.

Methodology

1. A molecular approach to assess the microbial diversity using DGGE (Denaturating Gradient Gel Electrophoresis) and clone libraries. These methods are based on the amplification of a taxonomic molecular marker, the ribosomal RNA, by using specific primers for bacteria, cyanobacteria and microalgae.
2. Strain isolations will be carried out for the same samples. Bacteria (with a focus on Proteobacteria and Bacteroidetes), cyanobacteria and microalgae (green algae and diatoms) will be purified and characterised from the same samples. .
3. A detailed study of representative taxa using specific primers and probes with a combination of several techniques, namely DGGE, QRT-PCR (Real time quantitative PCR) and dot-blot hybridisations.
4. Statistical analyses will be performed to assess the importance of local (ecological) versus regional (historical) factors in relation to differences in diversity and community composition between regions and sites.

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INTERACTION BETWEEN THE DIFFERENT PARTNERS

Each partner has specific experience concerning the groups of microorganisms. Therefore, the study of the cyanobacteria will be carried out by Partner 1 (CIP). Partner 2 (PAE) and 3 (LM-UGent) will work on the strain isolations of protists and bacteria, respectively, and will cooperate for the study of the non-cultivated diversity. These analyses will be carried out in parallel on the same samples, using standardised analysis protocols. The statistical analyses will involve all partners and will be centralised by Partner 2.

EXPECTED RESULTS AND/OR PRODUCTS

During the first 2 years, a database of samples will be created as well as 3 strain collections: bacteria, cyanobacteria and microalgae. Strains will be characterised and preserved. New bacterial taxa will be stored in the public collection BCCM/LMG. At the end of the project, protocols and probes will be published on the project website. The obtained results will be published in international peer reviewed scientific journals and presented at international scientific symposia and workshops. Communication and outreach will be performed through a website as well as a powerpoint presentation: 'Antarctica is a microbial continent'. The role of microbial diversity in determining fragile and unique sites which could be proposed as ASPA (Antarctic Specially Protected Area) to the CEP (The Committee for Environmental Protection) will be evaluated. A final workshop with international speakers will be organised.

PARTNERS - ACTIVITIES

Partner 1 : The CIP group studies the diversity, taxonomy and evolution of cyanobacteria. Molecular tools have been developed for natural samples' investigation and for a polyphasic characterisation of strains.

Partner 2: The PAE group studies the biology and biodiversity of protists, and their role in freshwater and marine ecosystems. Fossil remains of these protists are used as biological proxies in paleoclimatological studies.

Partner 3: The LM-UGent group studies the microbial diversity, the identification of bacteria in various ecosystems (aquatic, terrestrial and clinic) and of plant and food associated bacteria.

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Follow-up Committee

For the complete and most up-to-date composition of the Follow-up Committee, please consult our Federal Research Actions Database (FEDRA) by visiting http://www.belspo.be/fedra or http://www.belspo.be/ssd

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