Effects of Sahara Dust Aerosols in the Tropical Western Atlantic

Roy Armstrong (1), Yasmín Detrés (1) and Sasha Steiner (2)

(1) Bio Optical Oceanography Laboratory
    Department of Marine Sciences
    University of Puerto Rico at Mayagüez

(2) Institute of Tropical Marine Ecology, Dominica
• The input of Sahara dust aerosols into the Caribbean region might be responsible for an increased incidence of asthma and allergies in humans and other diseases in marine organisms.

• It has been established that Sahara dust transports a wide variety of microorganisms (fungi, bacteria, and viruses) that can cause diseases in plants and animals, including humans.
Saharan Dust Seasonality

- Aerosols from Africa travel across the Tropical Atlantic Ocean and reach the Caribbean region during the summer months.
- Desert dust aerosol particle size range from 0.1 to 10 μm.
PM 2.5 CONCENTRATION & ANALYSIS
Air Monitoring - PM 2.5 Station

Puerto Rico
Dominica

SeaWiFS Derived Chl a Product
• Dominica is located in the middle of the Lesser Antilles and is not influenced by adjacent islands to windward that could contaminate the air samples.

• Tropical wet and warm climate, heavy humidity and a steady flow of the northeast trade winds.
Castle Bruce, Dominica
(15°25' N, 61°15' W)

• A sequential air sampler was installed in Castle Bruce, Dominica on March 31, 2002 and operated continuously until August 1, 2002.

• Sampling logistic was coordinated in collaboration with Dr. Sascha Steiner from Institute of Tropical Marine Ecology (ITME).
The four year climatology of Aerosol Optical Thickness (AOT) for Dominica shows higher aerosol concentrations for the period of May and June with peak AOT values during the last week of June.
MODIS TERRA
Tau 865

Feb 2002  April 2002  May 2002
June 2002  July 2002  August 2002
Three types of filters samples were collected:
1) PM 2.5 – 24 hour sampling for fungal spores
2) PM 2.5 – 72 hour samples for mass concentration
3) PM 10 – 24 hours samples (July 20 to August 1).
Fungi Characterization Protocol

Inoculated in Malt Extract Agar (MEA) with lactic acid and incubation at 28°C

Colony counting

Isolation of colonies

Classification to the genus level using macroscopic features and microscopic evaluation of reproductive structures

Protocol developed in Collaboration with Dr. C. Betancourt (Biology Department, UPRM)
Molecular Characterization

Growth of culture in liquid media

Micelial mats for DNA extraction

Lysis of cells and tissues

PCR (ITS region)

Sequencing

Gene Bank Search

DNA extraction & electrophoresis
AOT vs Fungi Colonies

AOT

# colonies / m^3

0.0 0.1 0.2 0.3 0.4 0.5 0.6

Apr 3 Apr 13 Apr 23 May 3 May 13 May 23 Jun 2 Jun 12 Jun 22 Jul 2 Jul 12

2.5 2.0 1.5 1.0 0.5 0.0

# colonies / m^3
Fungi Isolation

Aspergillus sp.
Aspergillus sp.
Aspergillus sp.
Aspergillus sp.
Aspergillus sp.
Penicillium sp.
Light microscopy – Nomarski Technique

- Penicillium sp.
- Nigrospora sp.
- Aspergillus sp.
Sahara Dust Fungi Identification

Dominica

• Characterized samples are from genera: Aspergillus, Penicillium, Eupenicillium, Fusarium, Cladosporium, Curvularia and Phanerochaete.

• Some of the species are human and plant pathogens and some are environmental allergens and agents of asthma and infection.

• Most of these species are considered opportunistic, primarily affecting immunocompromised hosts.

• Saharan dust is an important source of small fungal spores from species that are not common in the Caribbean region that might have adverse public health implications.
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