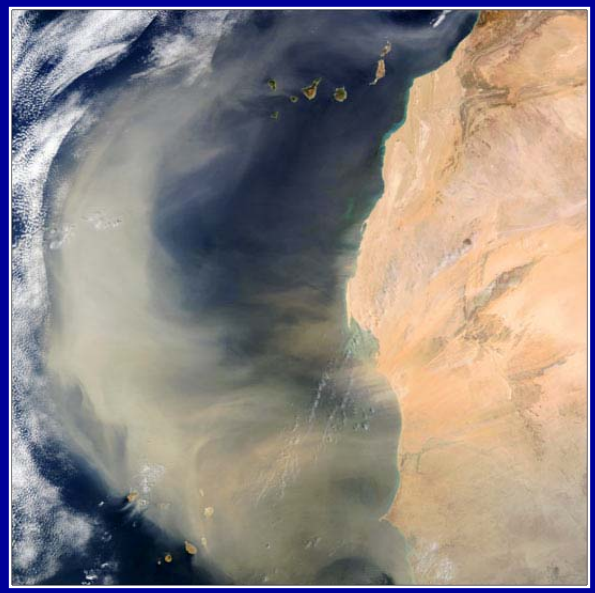
NOAA Center for Atmospheric Sciences (NCAS)

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

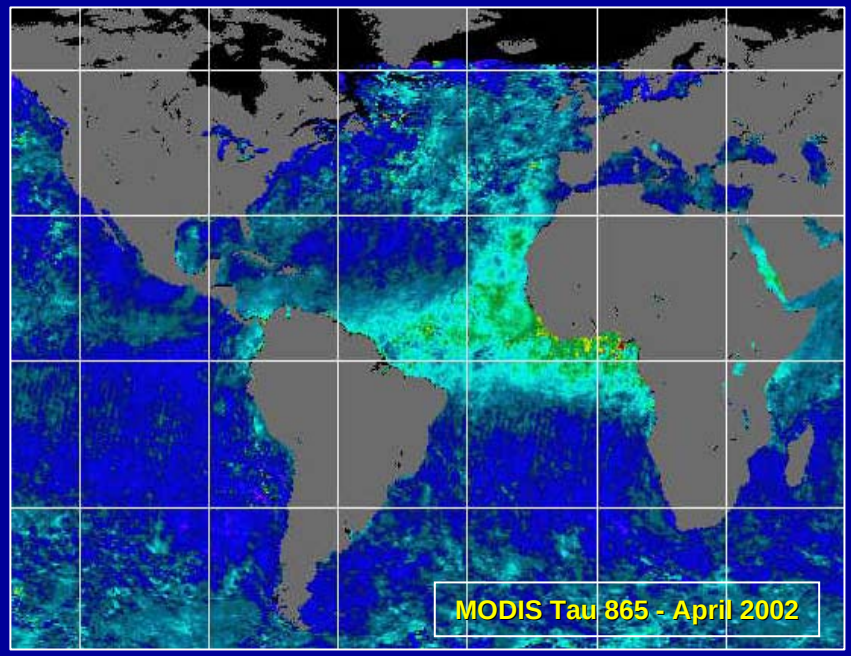
[(2)] Institute of Tropical Marine Ecology, Dominica

- 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.

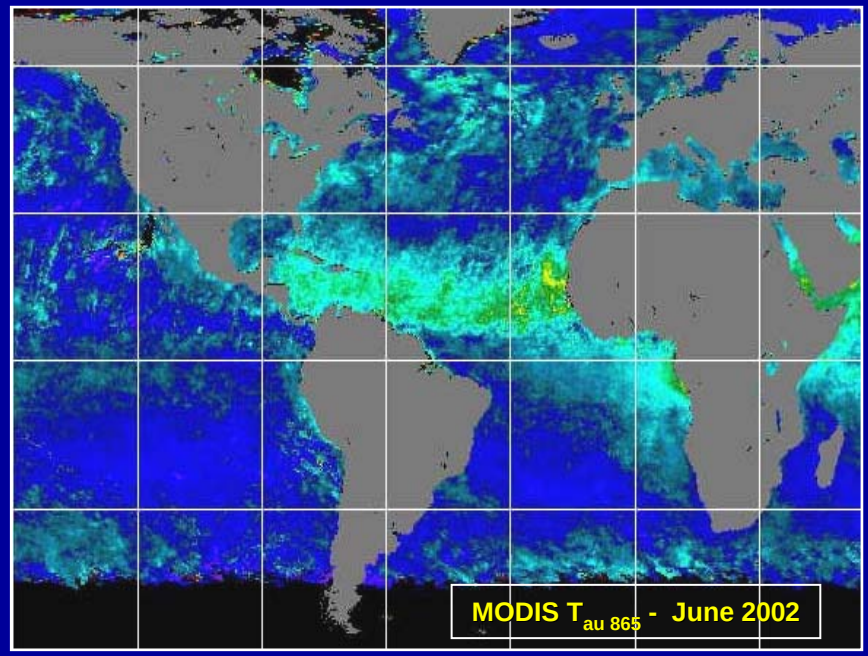
- It has been established that Sahara dust transports a wide variety of microorganisms (fungi, bacteria, and viruses) that can cause diseases in plants and animals, including humans.

January 6, 2002 - MODIS

Saharan Dust Seasonality



Feb – April
South America / Eastern Amazon Basin
13 million tons per year

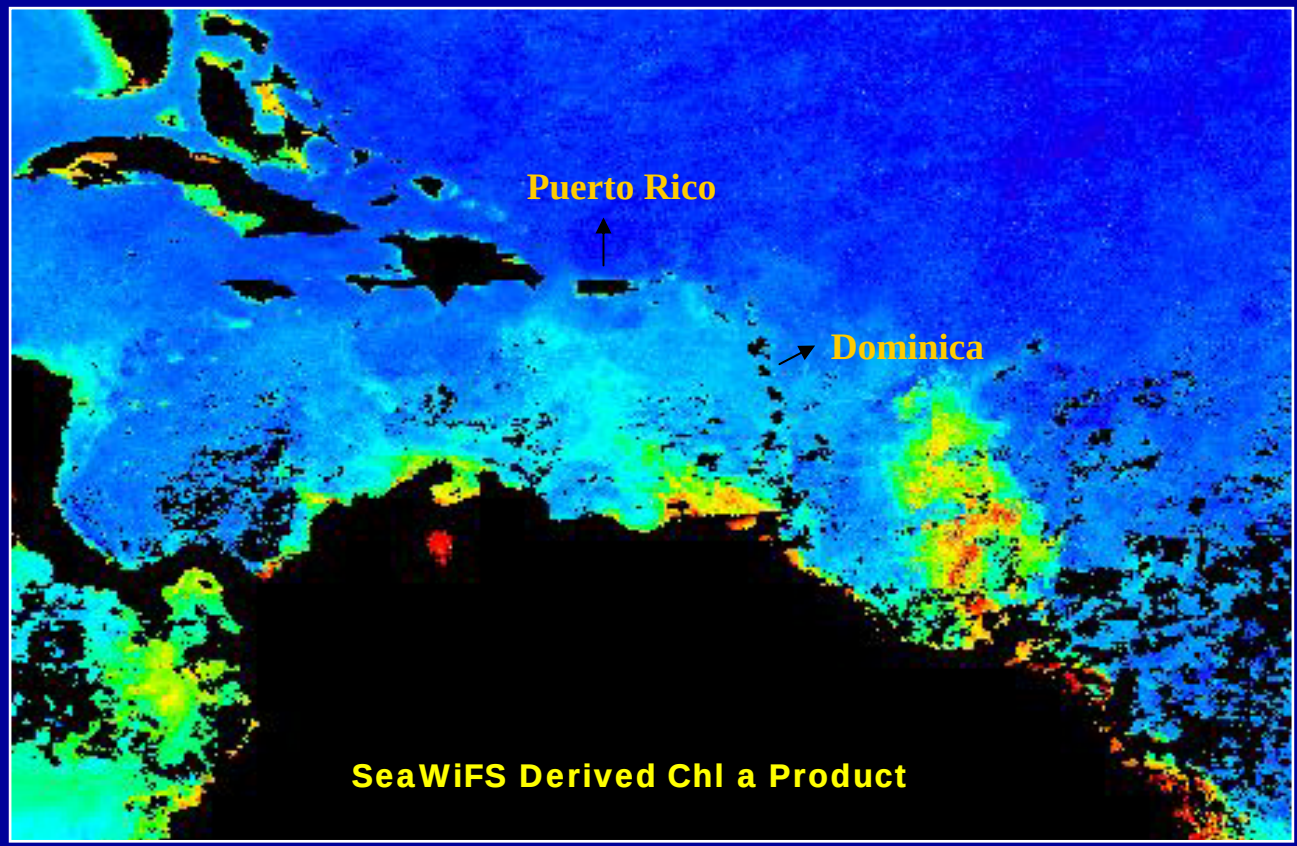


May – Sept
Caribbean, Central and N. America
20 million tons per year

- 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



Study Site

- 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.

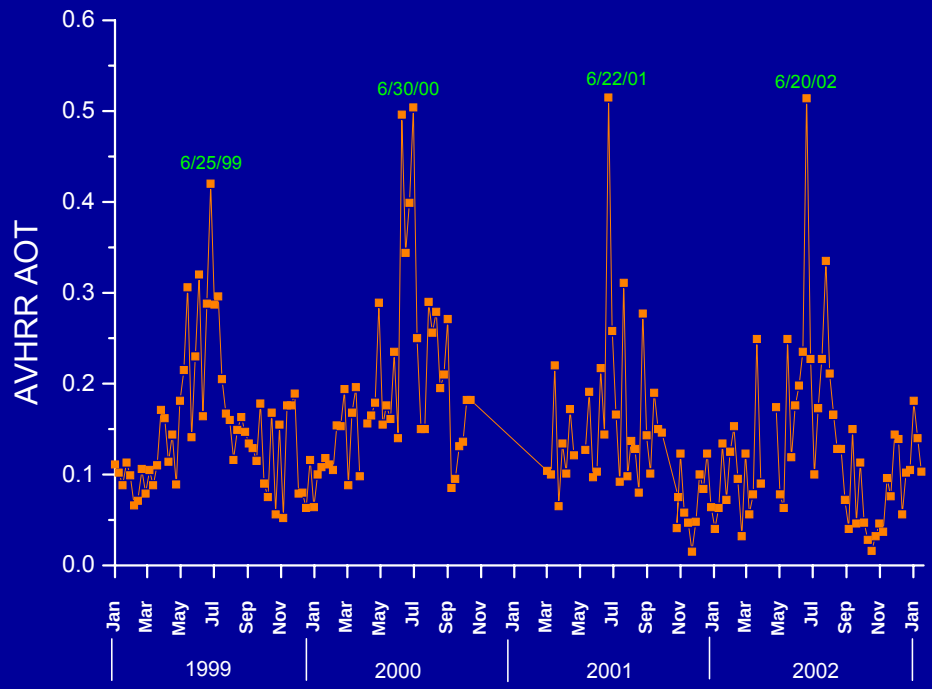
Castle Bruce, Dominica (15°25' N, 61°15' W)

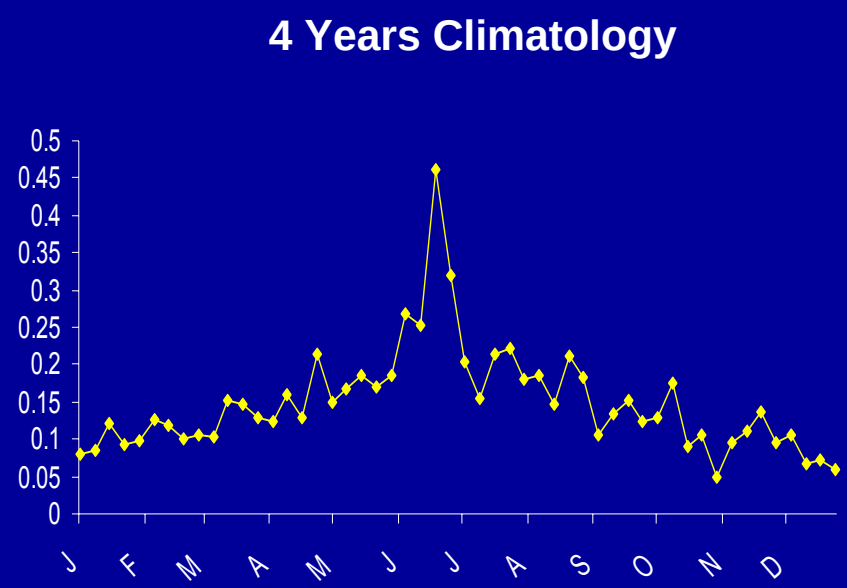
Partisol Plus Model 2025 - Sequential Air Sampler
Rupprecht and Patashnick Co., Inc.

- 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).

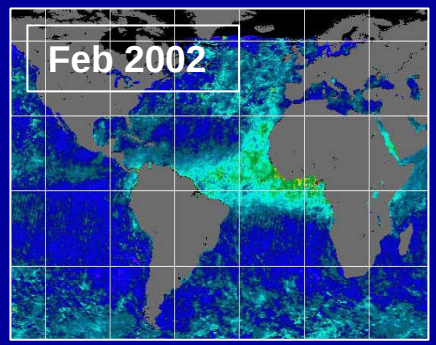
Aerosol Optical Thickness (AOT) - AVHRR
Dominica (15°25' N - 61°15' W)

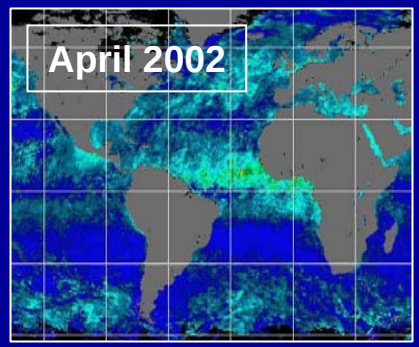


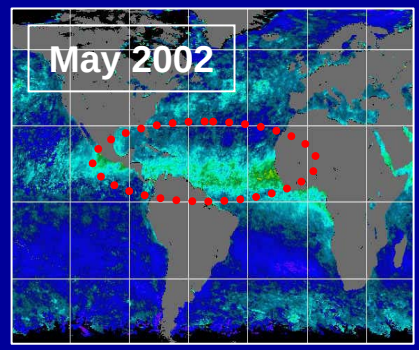


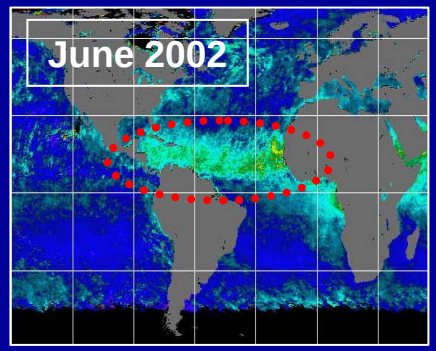
The four year climatology of Aerosol Optical Thickness (AOT) for Dominica shows higher aerosol concentrations for the period of May and June with peak AOT values during the last week of June.

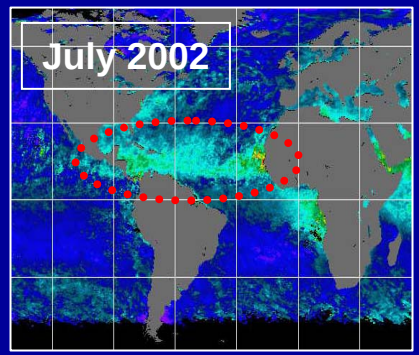
MODIS TERRA
Tau 865

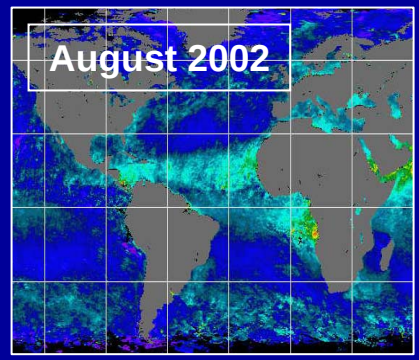




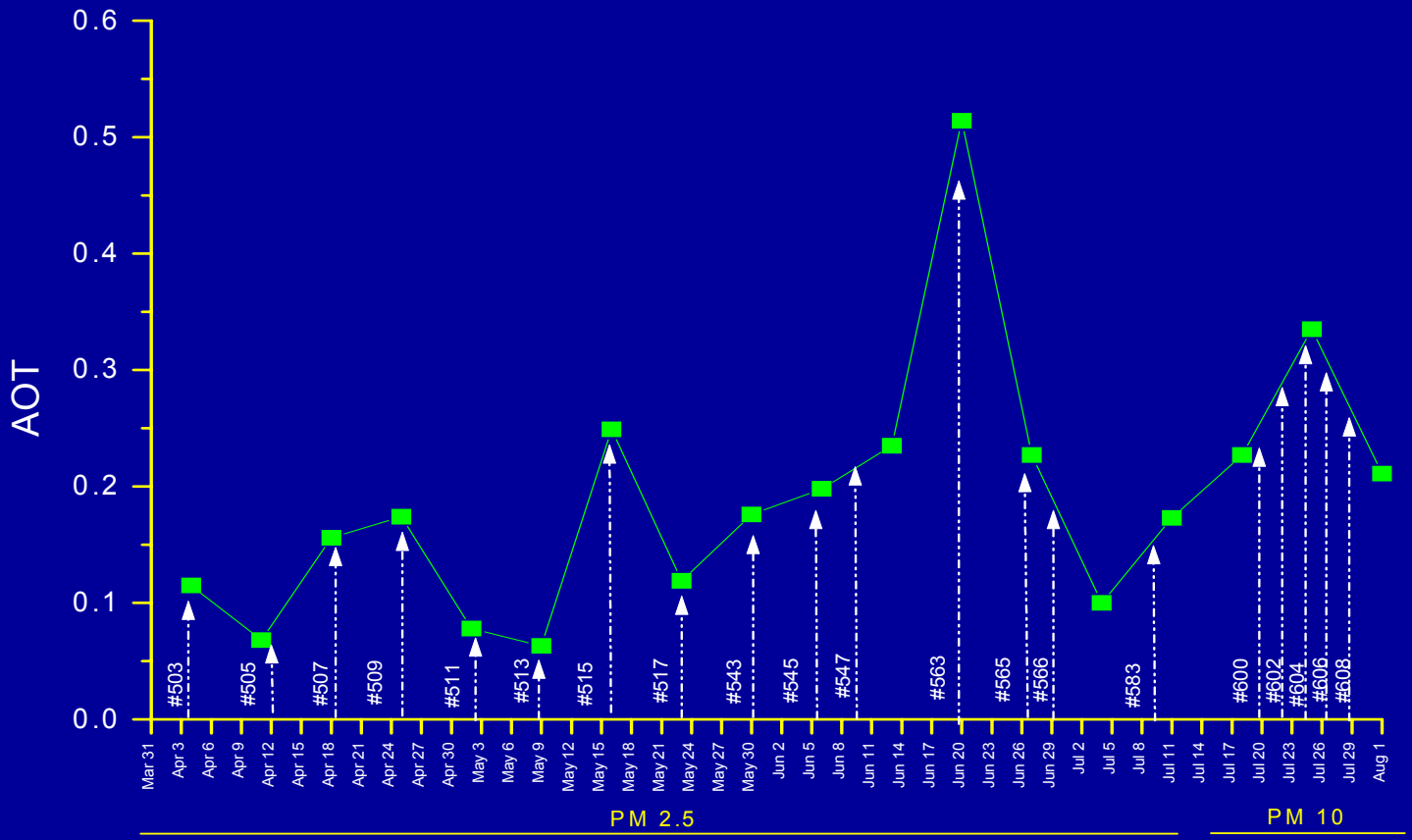








AOT & Filter Number
Castle Bruce, Dominica – (April – August, 2002)

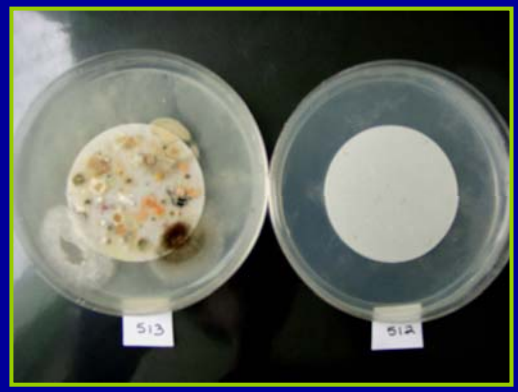


Three types of filters samples were collected:

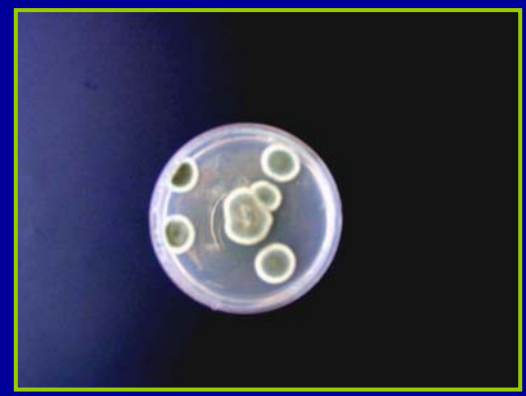
1) **PM 2.5 – 24 hour sampling for fungal spores**
2) **PM 2.5 – 72 hour samples for mass concentration**
3) **PM 10 – 24 hours samples (July 20 to August 1).**

Fungi Characterization Protocol

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



Colony counting



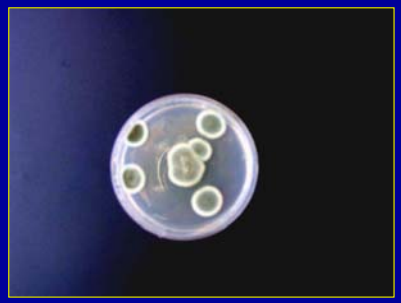
Isolation of colonies

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

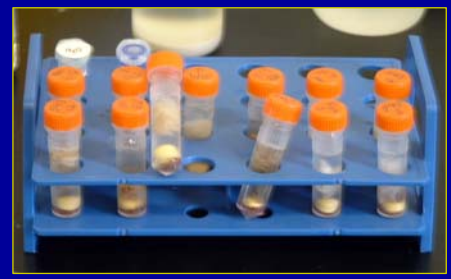
Protocol developed in Collaboration with Dr. C. Betancourt (Biology Department, UPRM)

Molecular Characterization

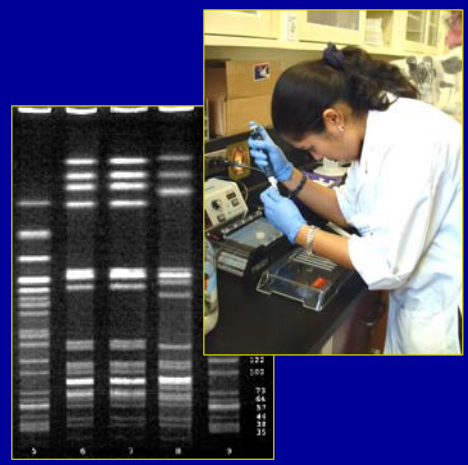
Growth of culture in liquid media



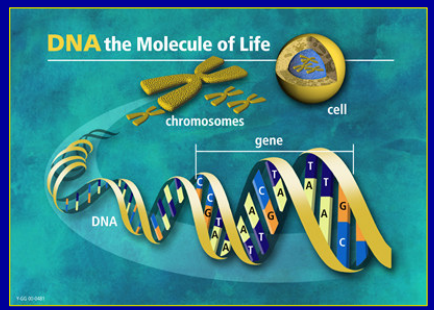
Micelial mats for DNA extraction



Lysis of cells and tissues

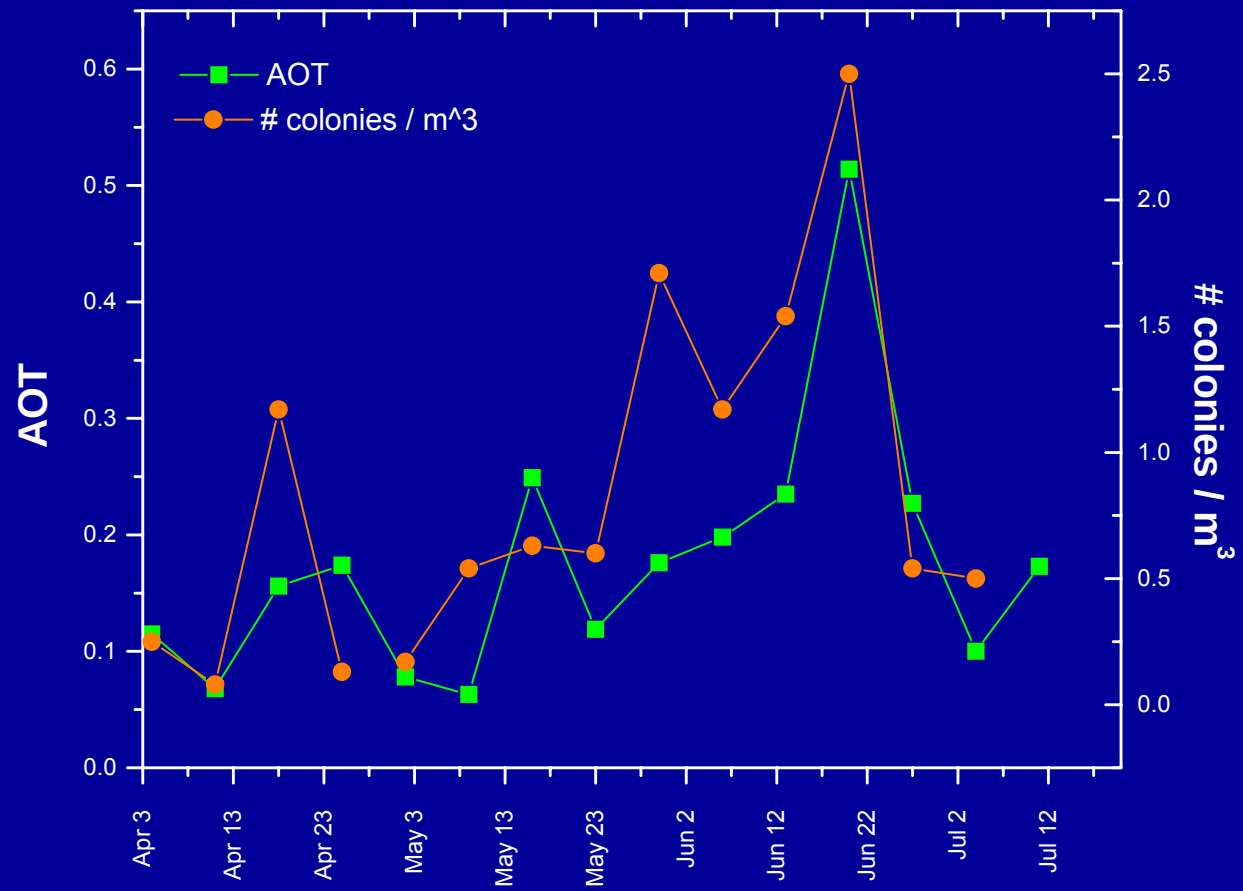


DNA extraction & electrophoresis



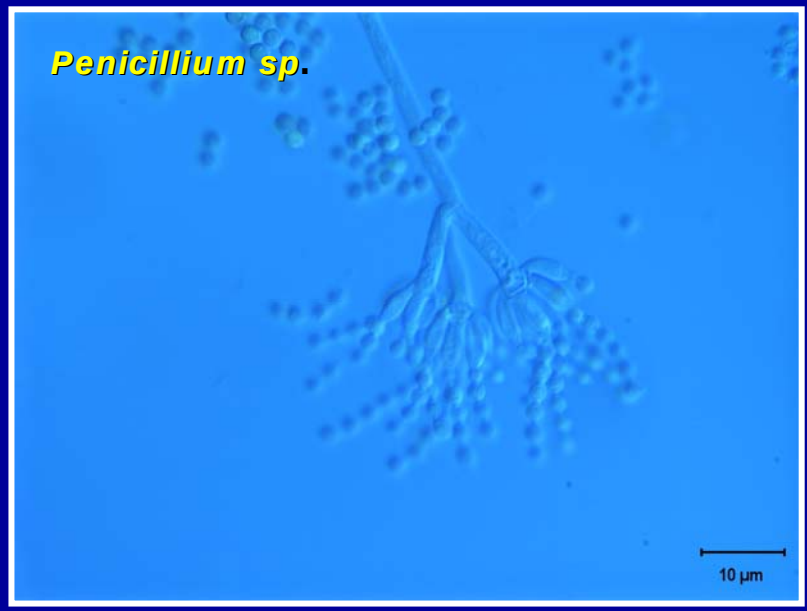
PCR (ITS region)
Sequencing
Gene Bank Search

AOT vs Fungi Colonies



Fungi Isolation

Light microoscopy – Nomarski Technique



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.

Acknowledgements

- NOAA Center for Atmospheric Sciences (NCAS) – NOAA/EPP/MSI
- Dr. Braulio Jiménez – Medical Sciences Campus, University of Puerto Rico
- Dr. Carlos Betancourt – Biology Department, University of Puerto Rico at Mayagüez
- Omayra Rivera & Alina de la Mota - Biology Department, University of Puerto Rico at Mayagüez