AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

# CARIBBEAN FOOD CROPS SOCIETY

# 47

**Forty-Seventh**
**Annual Meeting 2011**

**Bridgetown, Barbados**
**Volume XLVII – Number 1**
**T-STAR Invasive Species Symposium**

PROCEEDINGS
OF THE
47th ANNUAL MEETING

Caribbean Food Crops Society
47th Annual Meeting
July 3–8, 2011

Lloyd Erskine Sandiford Centre
Bridgetown, Barbados

**"Assuring Caribbean food and nutrition security in the context of climate change"**

**United States Department of Agriculture,**
**T-STAR Sponsored Invasive Species Symposium**

**Toward a Collective Safeguarding System for the Greater Caribbean Region: Assessing Accomplishments since the first Symposium in Grenada (2003) and Coping with Current Threats to the Region**

**Special Symposium Edition**
**Edited by**
**Edward A. Evans, Carlton G. Davis, and Fredy Ballen**

**Published by the Caribbean Food Crops Society**

© Caribbean Food Crops Society, 2011

ISSN 95-07-0410

Copies of this publication may be received from:

Secretariat, CFCS
c/o University of the Virgin Islands
USVI Cooperative Extension Service
Route 02, Box 10,000
Kingshill, St. Croix
US Virgin Islands 00850

Or from

CFCS Treasurer
P.O. Box 506
Isabella, Puerto Rico 00663

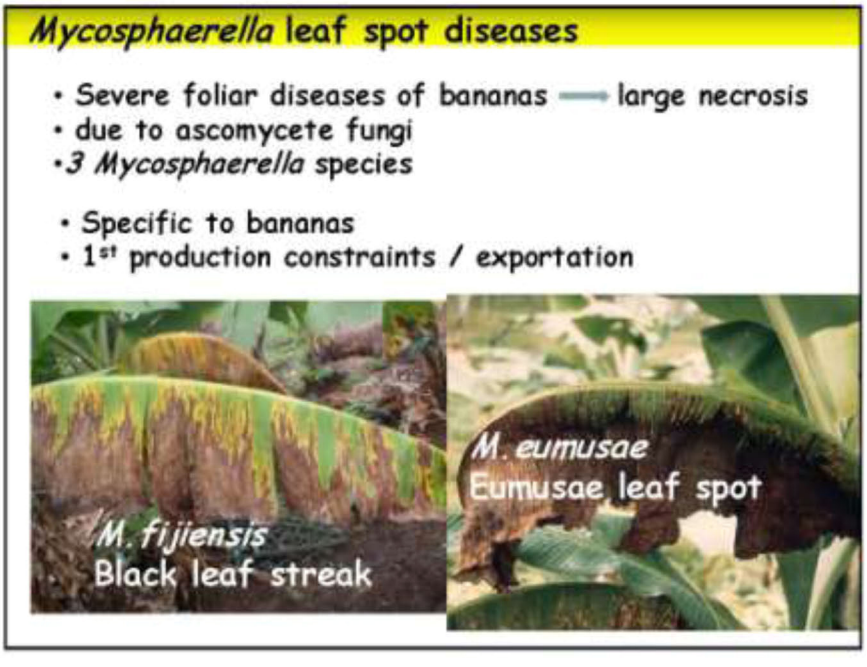
Mention of company and trade names does not imply endorsement by the Caribbean Food Crops Society.

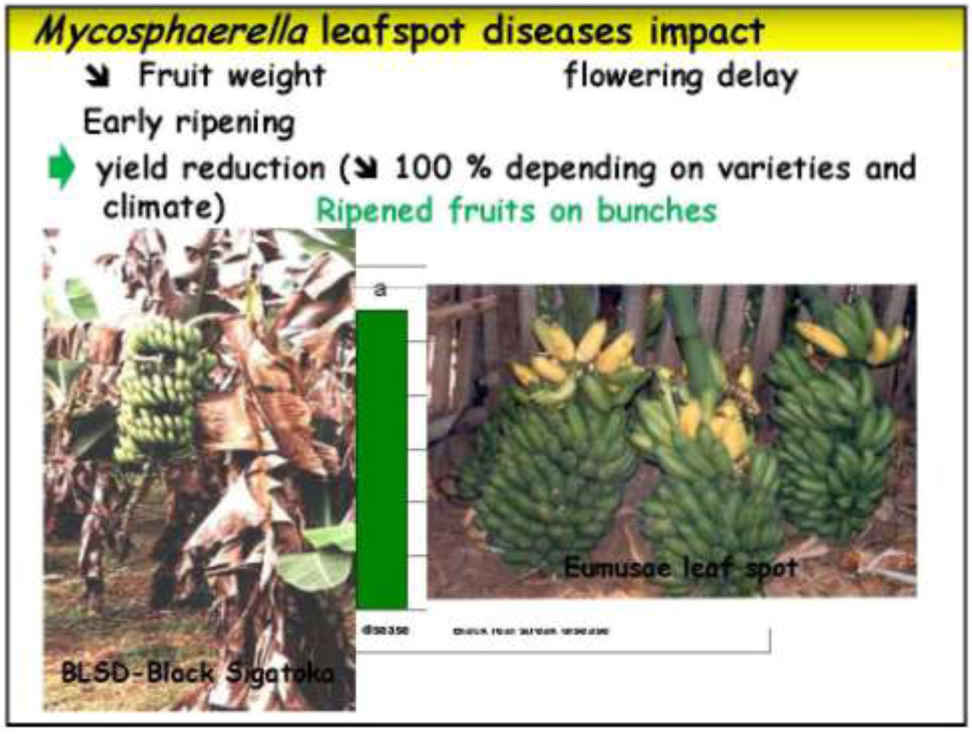
The Caribbean Food Crops Society is not responsible for statements and opinions advanced in its meeting or printed in its proceedings; they represent the views of the individuals to whom they are credited and are not binding on the Society as a whole.

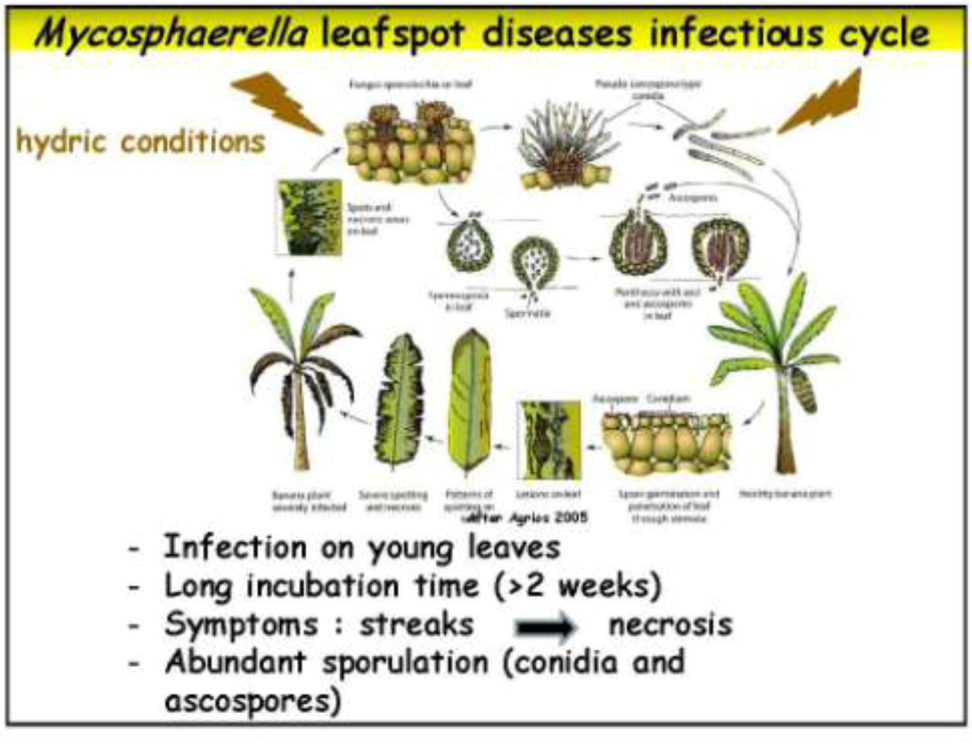
**SESSION 2: BANANAS: MAJOR BANAMA DISEASES**

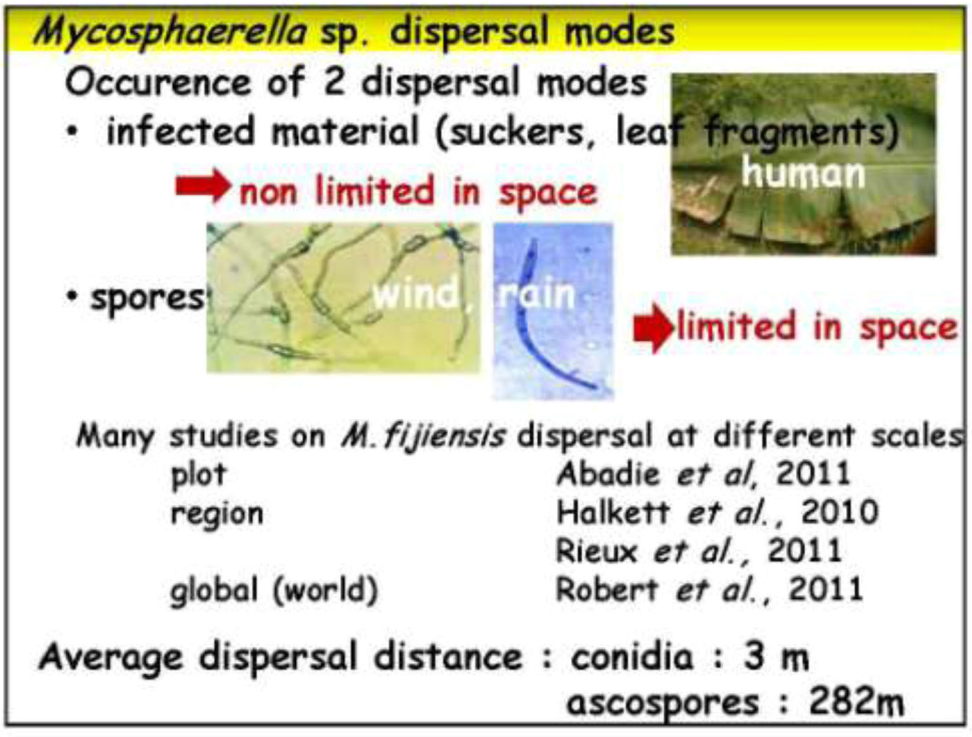
# BLACK LEAF STREAK AND EUMUSAE LEAFSPOT: TWO DESTRUCTIVE AND INVASIVE LEAFSPOT DISEASES OF BANANA

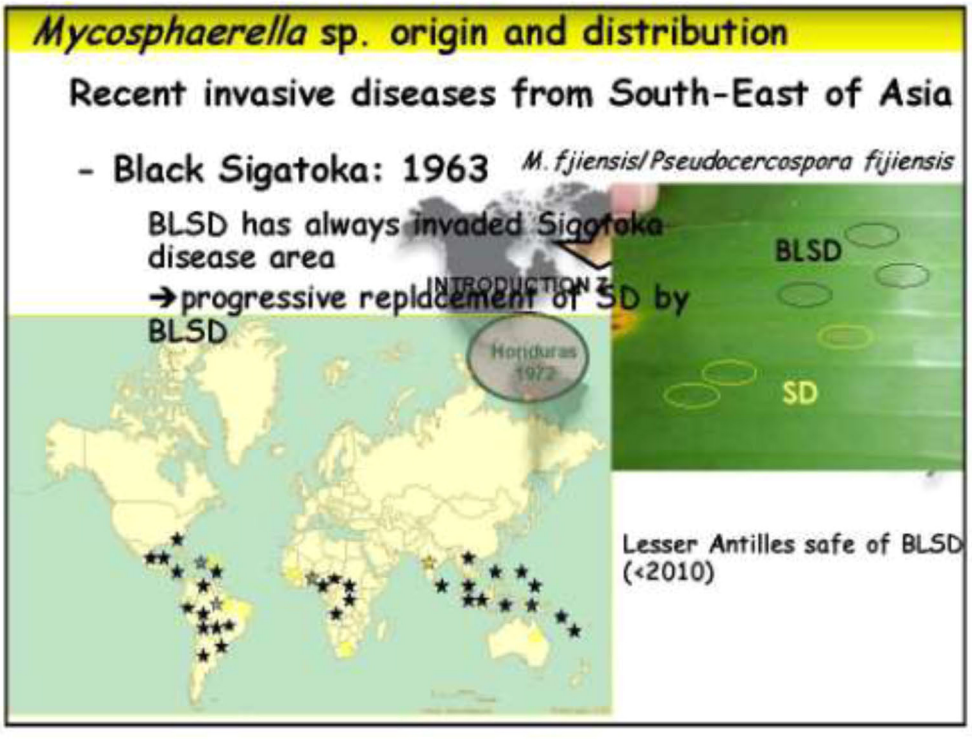
*Catherine Abadie, Marie Zapater, Stephanie Robert, Virginie Ravigne, Francois Bonnot, and Jean Carlier, CIRAD, UMR-BGPI, Campus International de Baillarguet, 34398 Montpellier Cedex 5, France. Telephone: 590-5-90-86-17-66; Email: catherine.abadie@cirad.fr.*

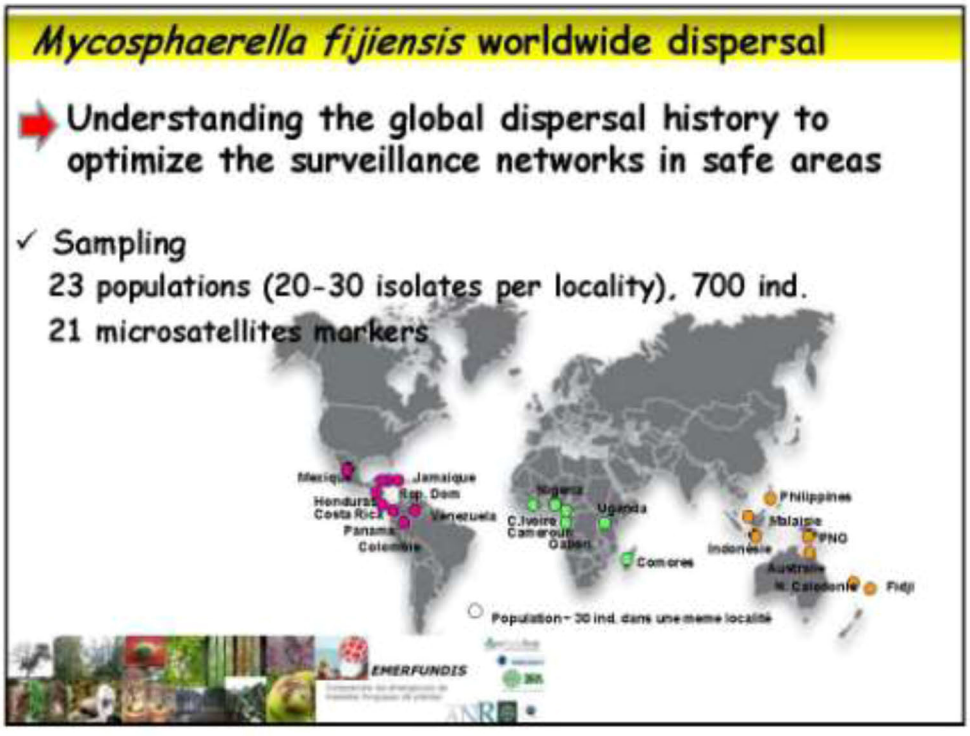


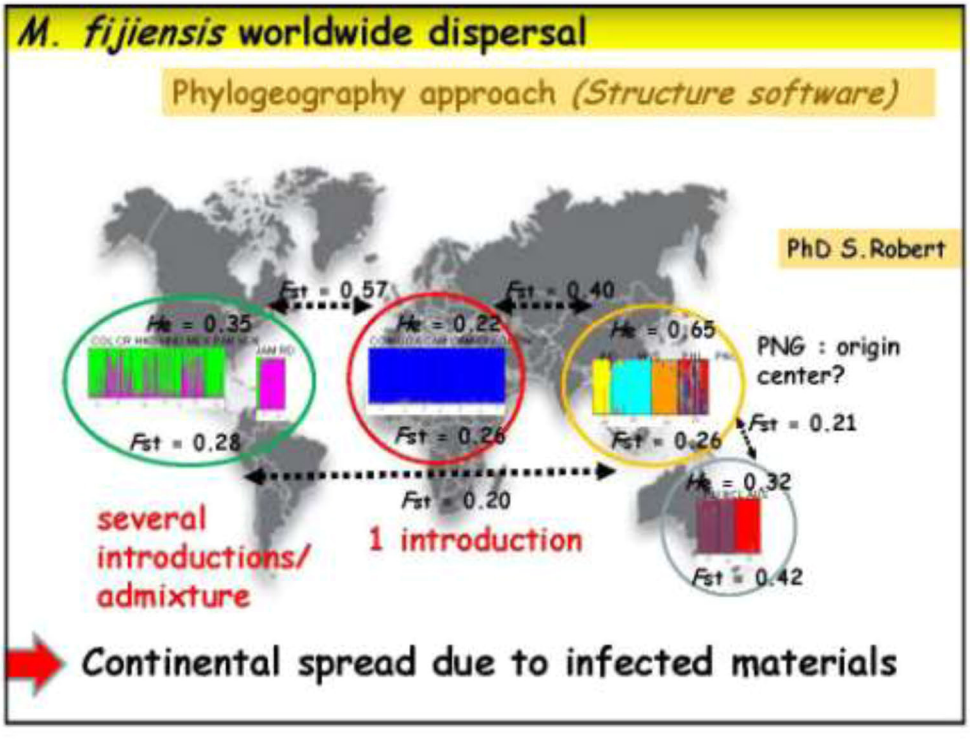

*Mycosphaerella* leafspot diseases impact
Fruit weight
flowering delay
Early ripening
yield reduction (100 % depending on varieties and climate)
Ripened fruits on bunches
a
Eumusae leaf spot
BLSD-Black Sigatoka

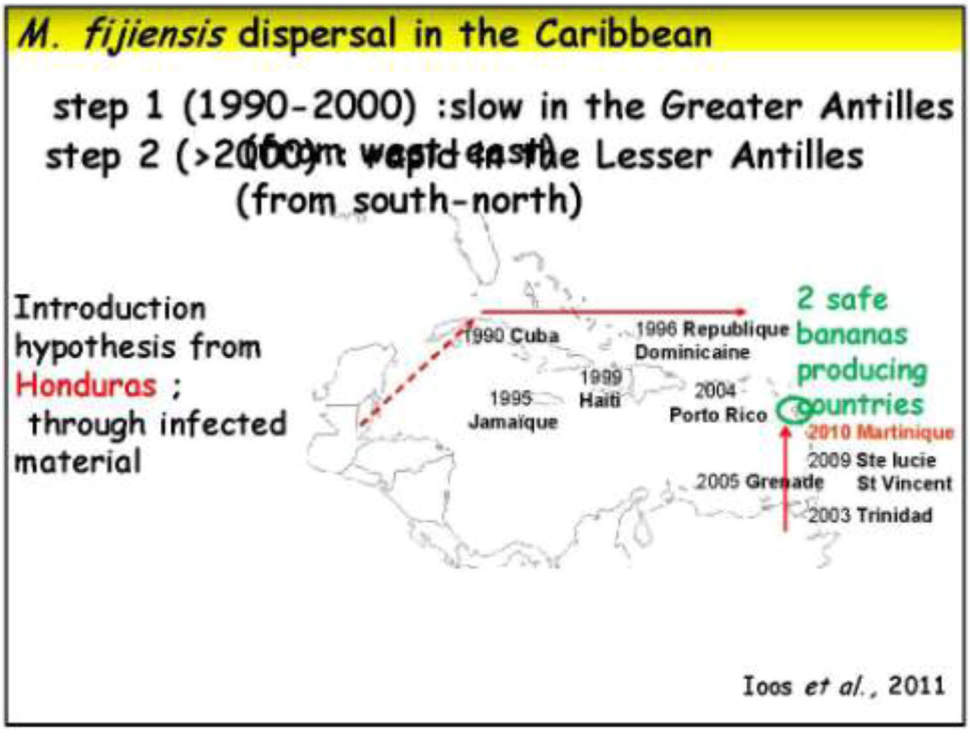

*Mycosphaerella* leafspot diseases infectious cycle
hydric conditions
- Infection on young leaves
- Long incubation time (>2 weeks)
- Symptoms : streaks → necrosis
- Abundant sporulation (conidia and ascospores)

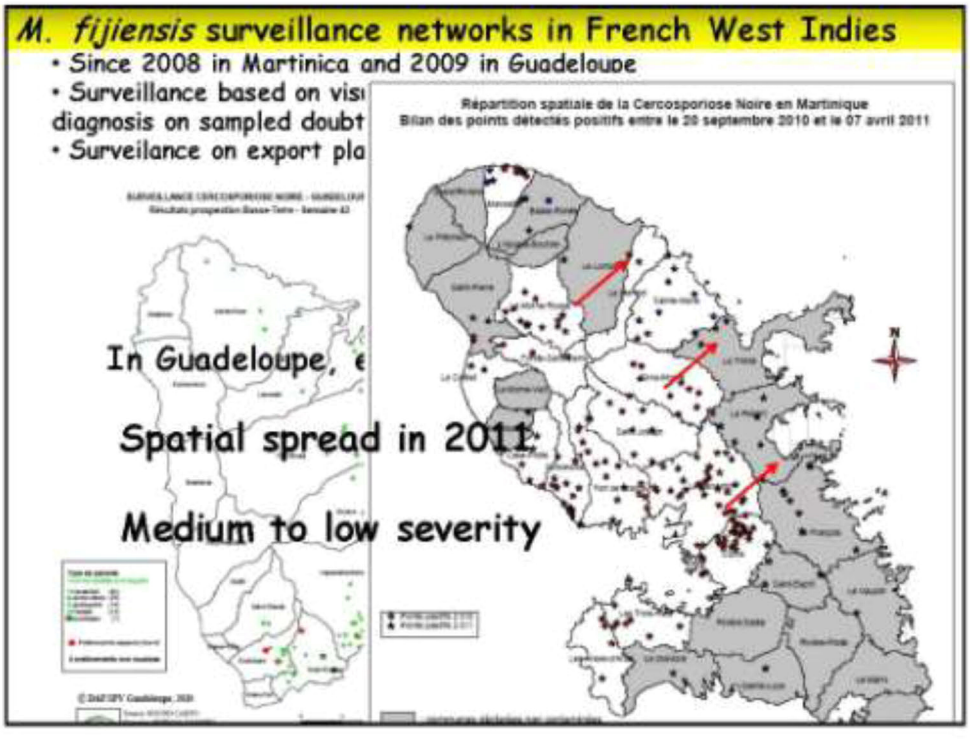

*Mycosphaerella* sp. dispersal modes
Occurence of 2 dispersal modes
• infected material (suckers, leaf fragments)
human
non limited in space
• spores
wind
rain
limited in space
Many studies on *M. fijiensis* dispersal at different scales
plot
Abadie *et al*, 2011
region
Halkett *et al.*, 2010
Rieux *et al.*, 2011
global (world)
Robert *et al.*, 2011
Average dispersal distance : conidia : 3 m
ascospores : 282m

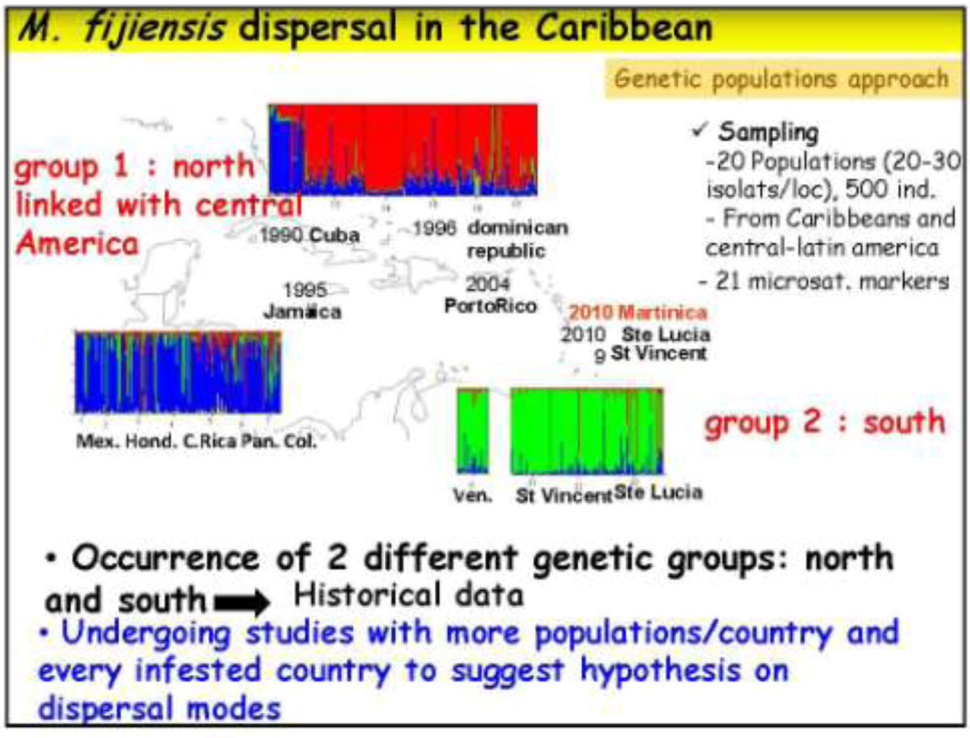

*Mycosphaerella* sp. origin and distribution
Recent invasive diseases from South-East of Asia
- Black Sigatoka: 1963
*M. fjiensis/Pseudocercospora fijiensis*
BLSD has always invaded Sigatoka disease area
→progressive replacement of SD by BLSD
INTRODUCTION
Honduras 1972
BLSD
SD
Lesser Antilles safe of BLSD (<2010)

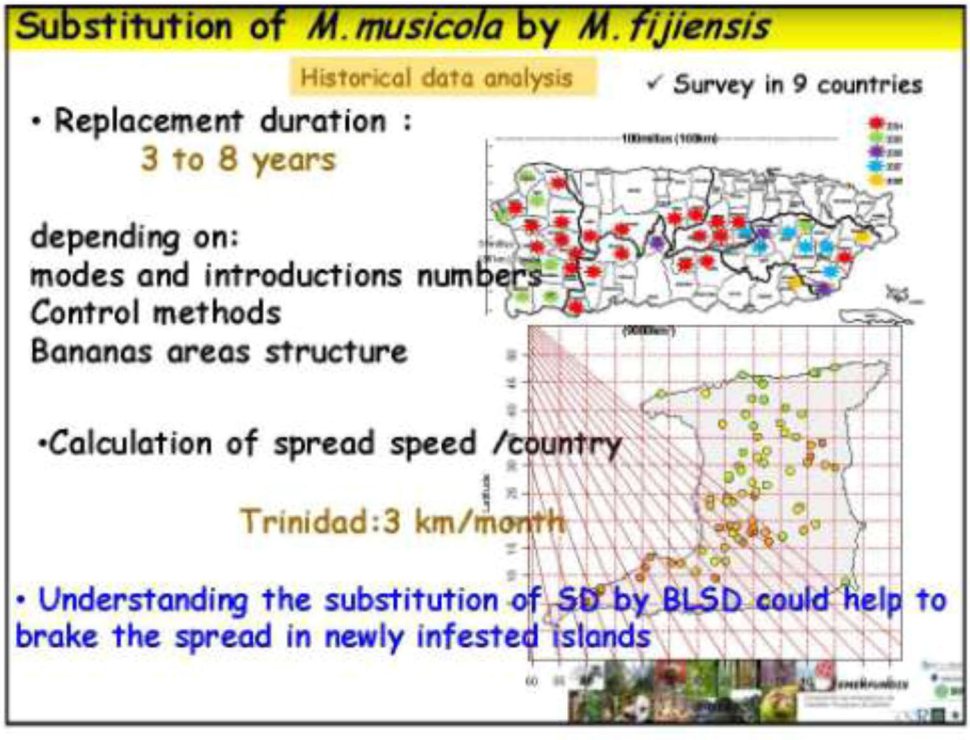

*Mycosphaerella fijiensis* worldwide dispersal
Understanding the global dispersal history to optimize the surveillance networks in safe areas
✓ Sampling
23 populations (20-30 isolates per locality), 700 ind.
21 microsatellites markers
Mexique
Jamaïque
Rep. Dom
Honduras
Costa Rica
Panama
Colombie
Venezuela
Nigeria
C.Ivoire
Cameroun
Gabon
Ouganda
Comores
Philippines
Malaisie
PNG
Indonésie
Australie
N. Calédonie
Fidji
Population ~ 30 ind. dans une même localité
EMERFUNDIS
ANR


*M. fijiensis* worldwide dispersal
Phylogeography approach (*Structure software*)
PhD S.Robert
Fst = 0.57
Fst = 0.40
He = 0.35
He = 0.22
He = 0.65
PNG : origin center?
Fst = 0.28
Fst = 0.26
Fst = 0.26
Fst = 0.21
Fst = 0.20
He = 0.32
Fst = 0.42
several introductions/ admixture
1 introduction
Continental spread due to infected materials


M. fijiensis dispersal in the Caribbean
step 1 (1990-2000) :slow in the Greater Antilles
step 2 (>2000) : rapid in the Lesser Antilles
(from south-north)
Introduction hypothesis from Honduras ; through infected material
1990 Cuba
1996 Republique Dominicaine
1999 Haiti
1995 Jamaïque
2004 Porto Rico
2 safe bananas producing countries
2010 Martinique
2009 Ste lucie
St Vincent
2005 Grenade
2003 Trinidad
Ioos et al., 2011


M. fijiensis surveillance networks in French West Indies
• Since 2008 in Martinica and 2009 in Guadeloupe
• Surveillance based on visu
diagnosis on sampled doubt
• Surveilance on export pla
Répartition spatiale de la Cercosporiose Noire en Martinique
Bilan des points détectés positifs entre le 20 septembre 2010 et le 07 avril 2011
In Guadeloupe, e
Spatial spread in 2011
Medium to low severity


M. fijiensis dispersal in the Caribbean
Genetic populations approach
group 1 : north linked with central America
1990 Cuba
1996 dominican republic
1995 Jamaica
2004 PortoRico
2010 Martinica
2010 Ste Lucia
St Vincent
✓ Sampling
-20 Populations (20-30 isolats/loc), 500 ind.
- From Caribbeans and central-latin america
- 21 microsat. markers
Mex. Hond. C.Rica Pan. Col.
group 2 : south
Ven.
St Vincent
Ste Lucia
• Occurrence of 2 different genetic groups: north and south ➡ Historical data
• Undergoing studies with more populations/country and every infested country to suggest hypothesis on dispersal modes


Substitution of M.musicola by M.fijiensis
Historical data analysis
✓ Survey in 9 countries
• Replacement duration :
3 to 8 years
depending on:
modes and introductions numbers
Control methods
Bananas areas structure
•Calculation of spread speed /country
Trinidad:3 km/month
• Understanding the substitution of SD by BLSD could help to brake the spread in newly infested islands

## *Mycosphaerella eumusae* invasion

**Second recent invasive *Mycosphaerella* leafspot disease**

- ***Eumusae* leafspot disease (ELSD)**

SYMPTOMS

similar to those of SD but

Primary brown lesion

Oval necrosis (low pressure)

HOST RANGE

various:

Cavendish, Gros-Michel (highly infested)

Plantains

Sucrier

Pisang lilin, Mysore (partially resistant to BLSD)

## *Mycosphaerella eumusae* pathogen

TAXONOMY

perfect stage : *M. eumusae*

imperfect stage : *Pseudocercospora eumusae*

(revised after Septoria)

Carlier et al., 2000
Crous and Mourichon, 2002

DIAGNOSIS

- morphology of conidia and conidiophores

conidiophores septate
conidia thiner and shorter than others sp.

Zapater *et al.*, 2008

- molecular markers

quantitative PCR

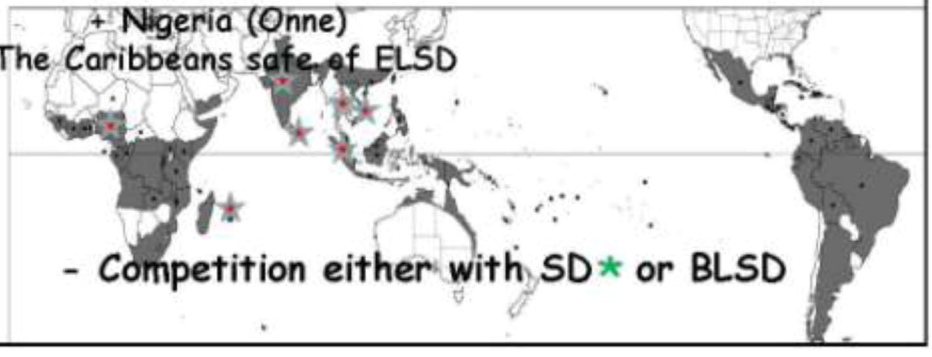
Arzanlou *et al.*, 2007

## *Mycosphaerella eumusae* origin and distribution

ORIGIN
South-East of Asia

DISTRIBUTION
ELSD described in 2000
on samples collected between 1989 and 2000

Geographically located to Southeastern Asia:
India, *Sri Lanka,*Thailand, Vietnam, South Malaysia
+ Mauritius* and Reunion*
+ Nigeria (Onne)
The Caribbeans safe of ELSD



- Competition either with SD* or BLSD

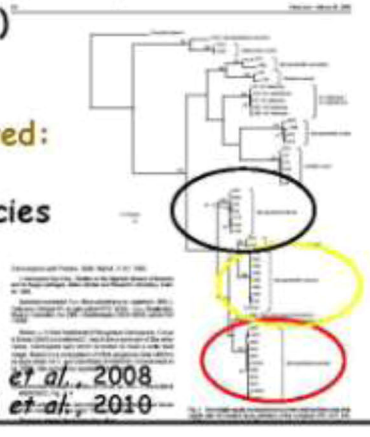
## Invasion *Mycosphaerella sp.* leafspots perspectives

- Many information and development of tools occur on *M. fijiensis* (which has been sequenced)
- Further studies on *M. fijiensis* to precise the modes of dispersal in the Caribbeans
- For *M. eumusae,* many topics to study (distribution, control methods..)

Recent phylogenetic studies showed:

Commun ancestor for 3 main species

20 species of *Mycosphaerella* on bananas



Arzanlou *et al.*, 2008
Arzanlou *et al.*, 2010

CIRAD TEAM ON MYCOSPHAERELLA SP.
UMR
BGPI
Population genetics
UPR 26
PhD students
resistance to
fungicides
Control practices
Cropping system
agressiveness
Modeling
Epidemiology, modeling