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

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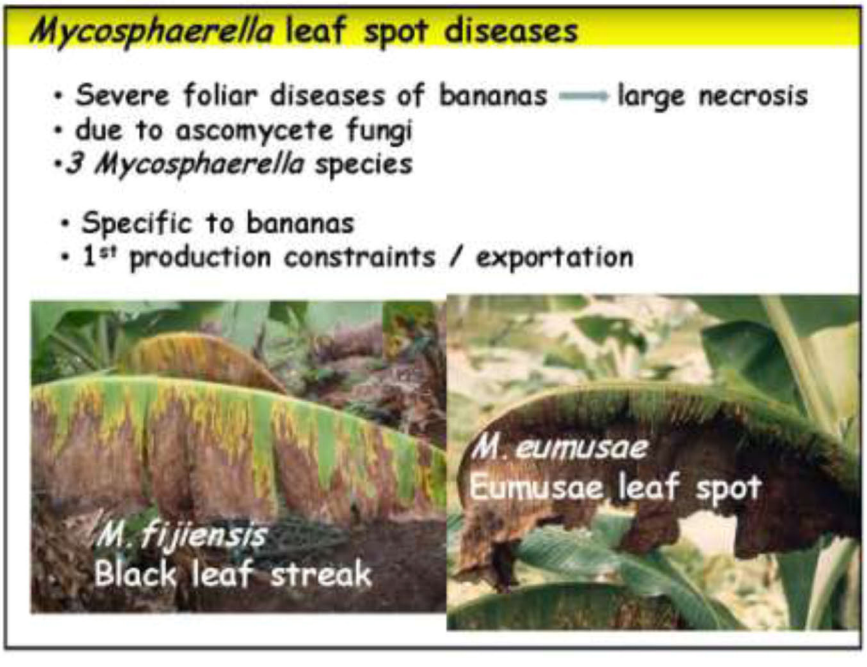
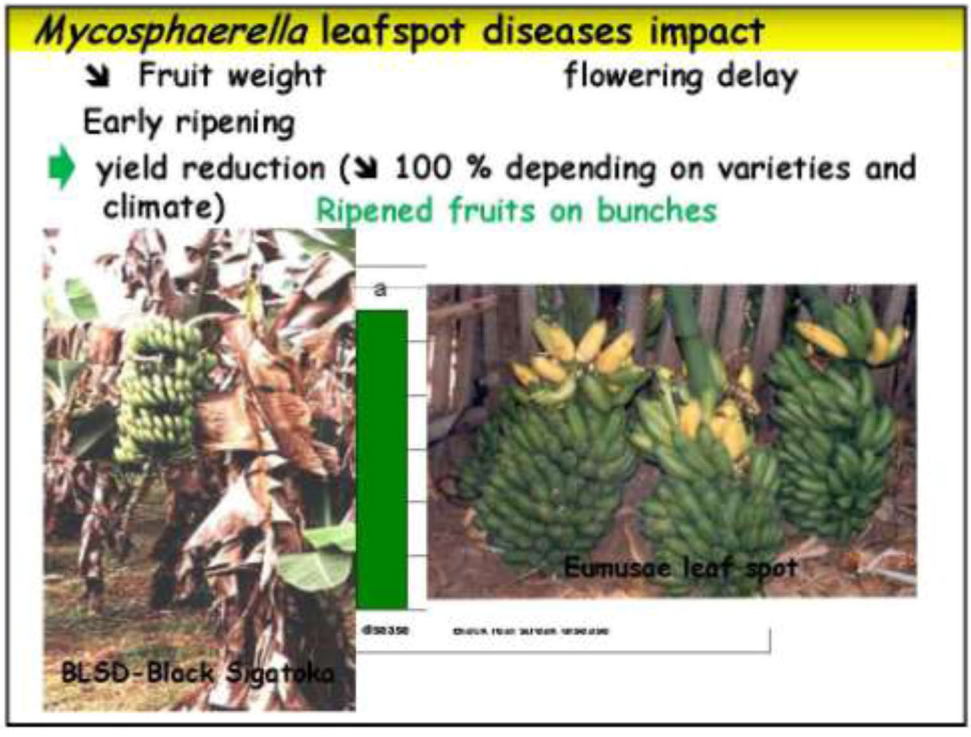
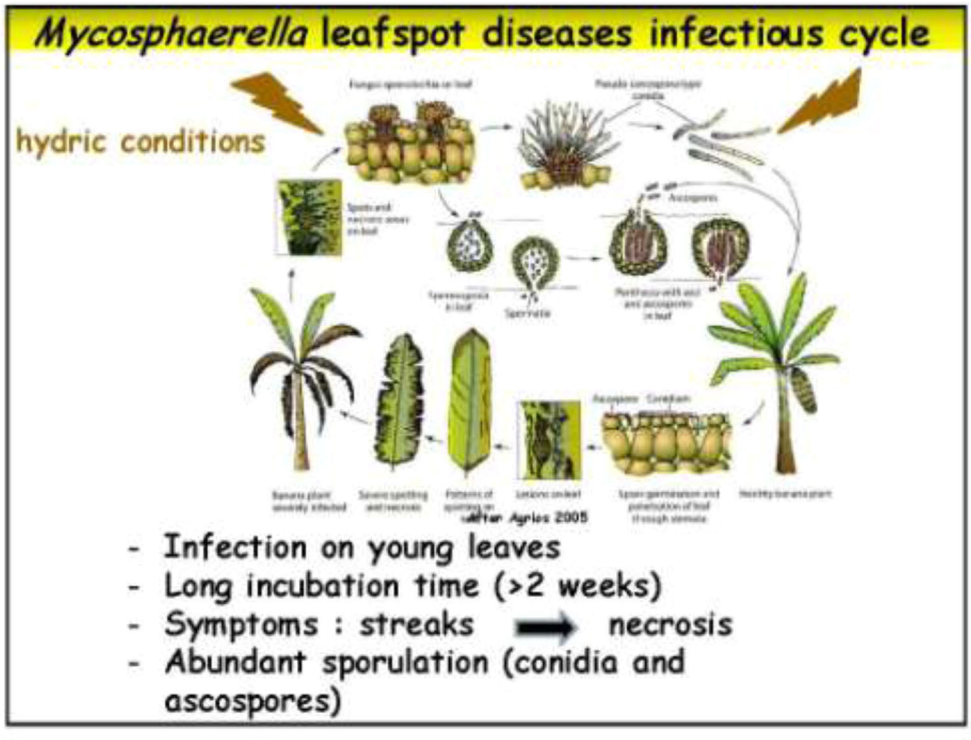
SESSION 2: BANANAS: MAJOR BANAMA DISEASES

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)

➡ non limited in space

- spores

➡ 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

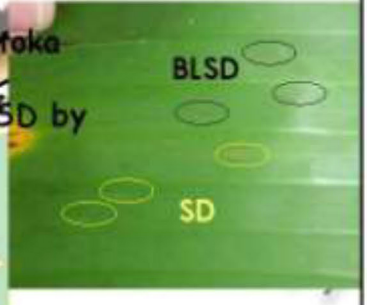
Mycosphaerella sp. origin and distribution

Recent invasive diseases from South-East of Asia

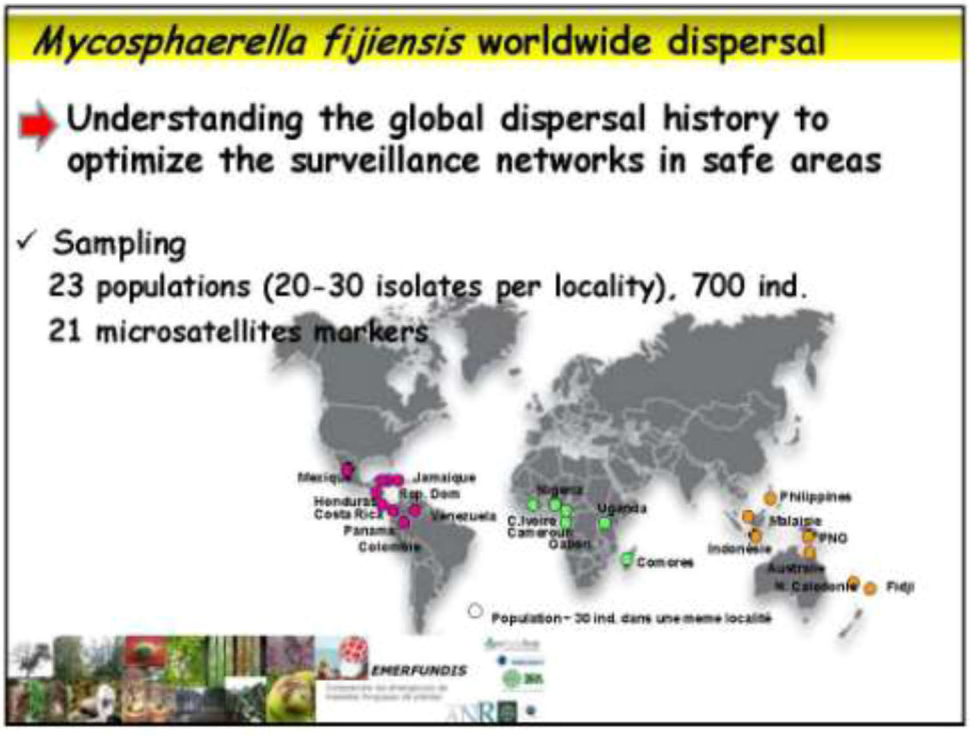
- Black Sigatoka: 1963 *M. fjiensis*/*Pseudocercospora fijiensis*

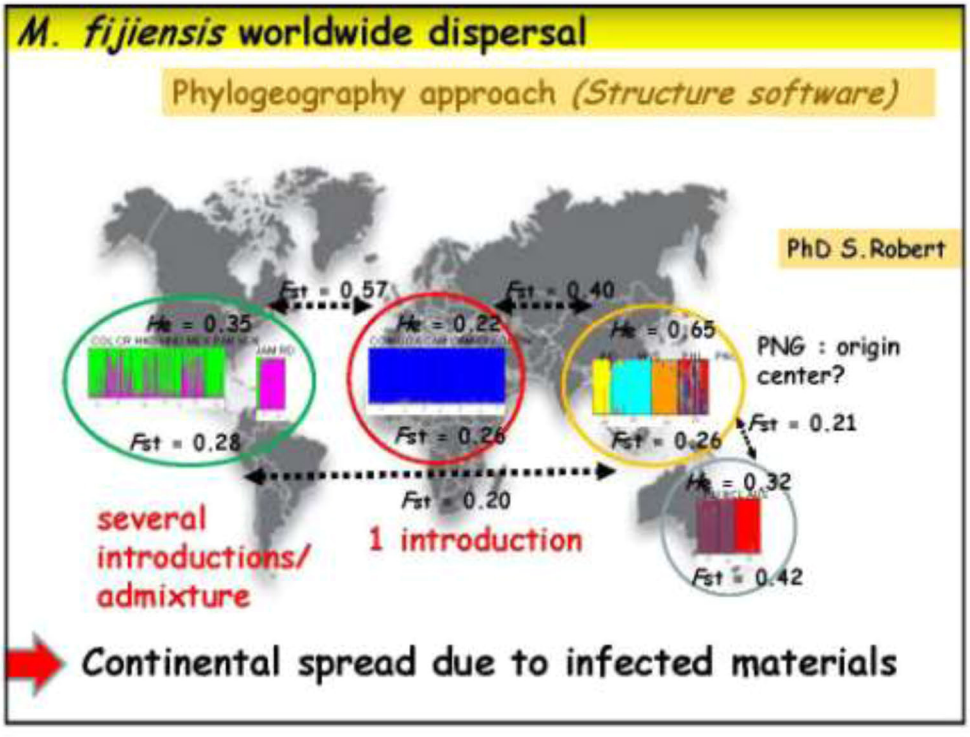
BLSD has always invaded Sigatoka disease area

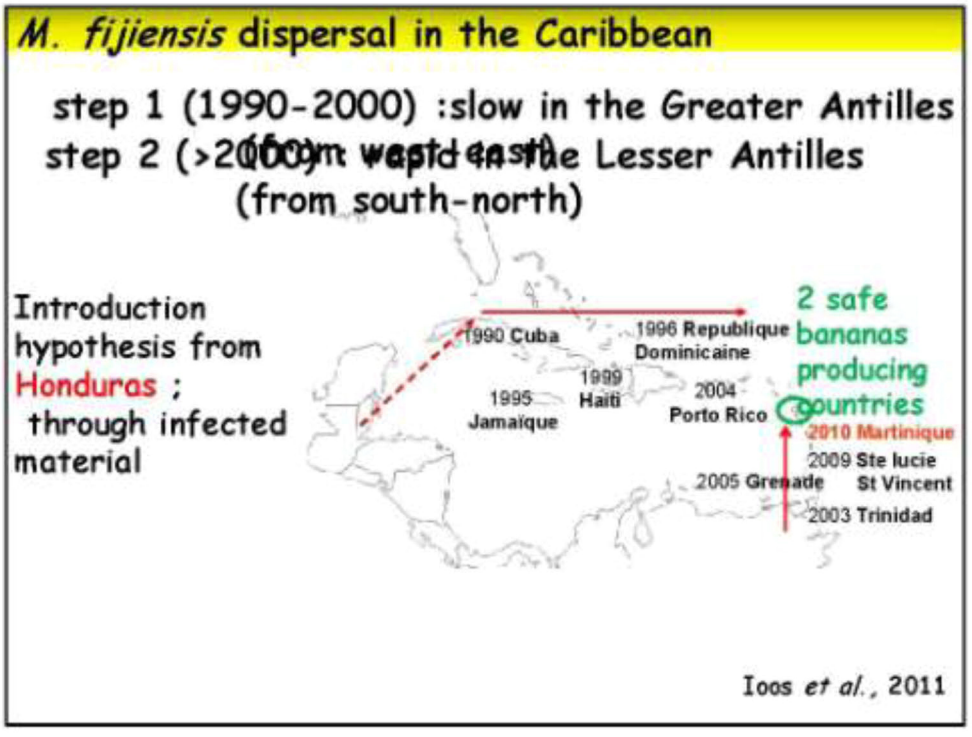
➔progressive replacement of SD by BLSD

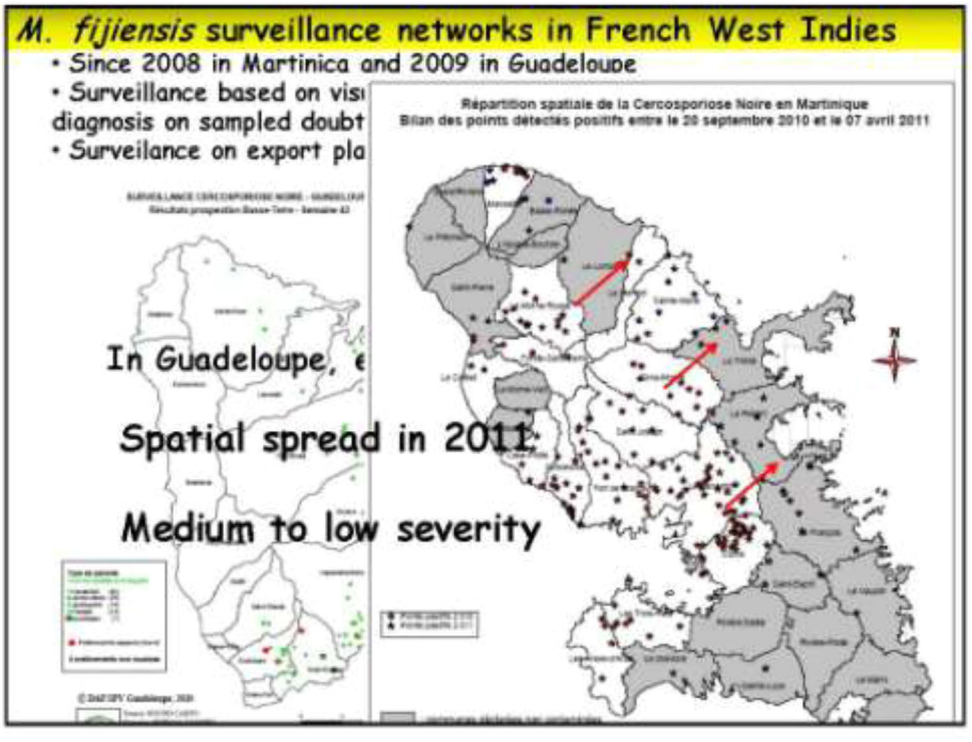


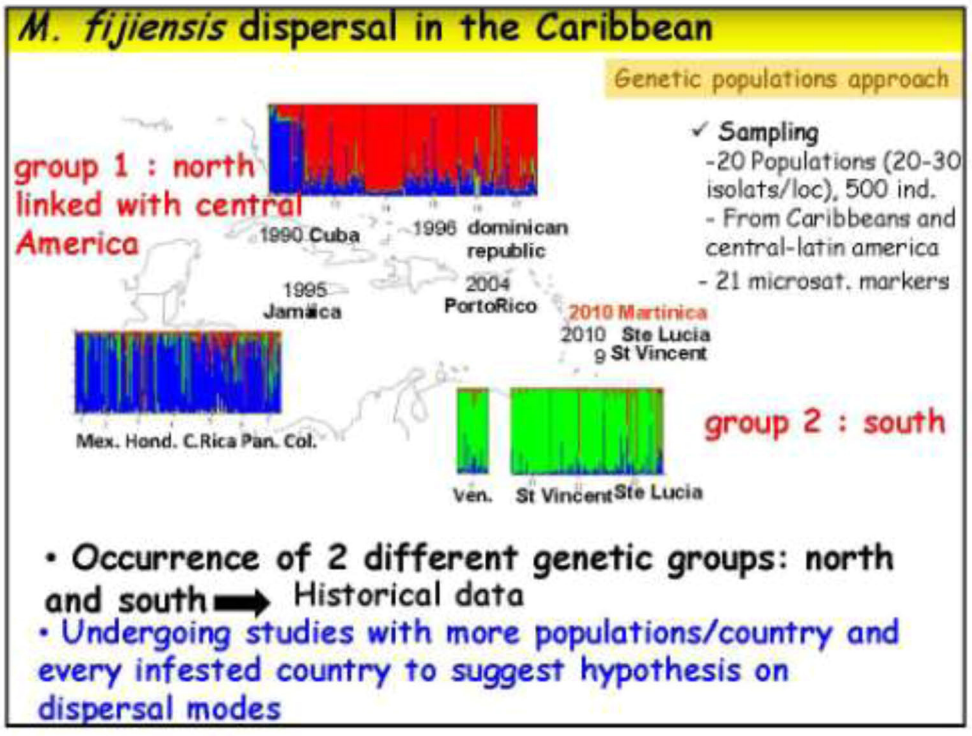
Lesser Antilles safe of BLSD (<2010)

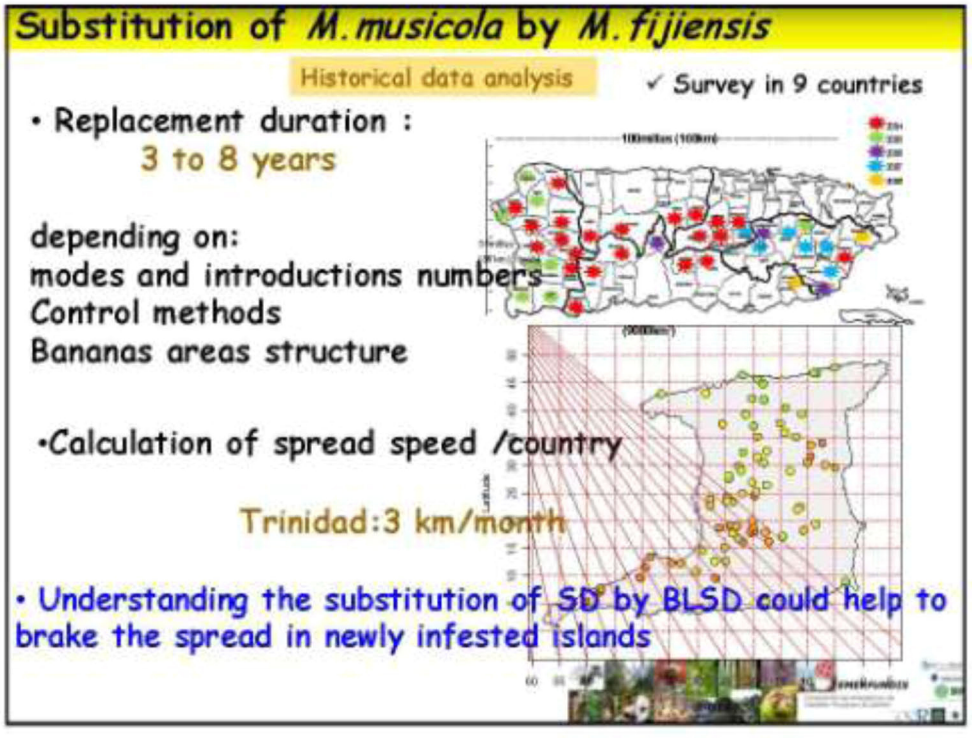

Mycosphaerella fijiensis worldwide dispersal
Understanding the global dispersal history to optimize the surveillance networks in safe areas
✓ Sampling
23 populations (20-30 isolates per locality), 700 ind.
21 microsatellites markers
Mexique
Jamaique
Rep. Dom
Honduras
Costa Rica
Panama
Colombie
Venezuela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


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 = 0.21
Fst = 0.28
Fst = 0.26
Fst = 0.26
He = 0.32
Fst = 0.20
several introductions/ admixture
1 introduction
Fst = 0.42
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
Mex. Hond. C.Rica Pan. Col.
Ven.
St Vincent
Ste Lucia
group 2 : south
✓ Sampling
-20 Populations (20-30 isolats/loc), 500 ind.
- From Caribbeans and central-latin america
- 21 microsat. markers
• 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*

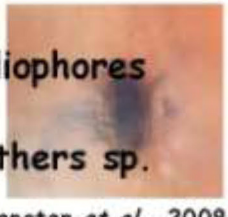
(revised after Septoria)

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

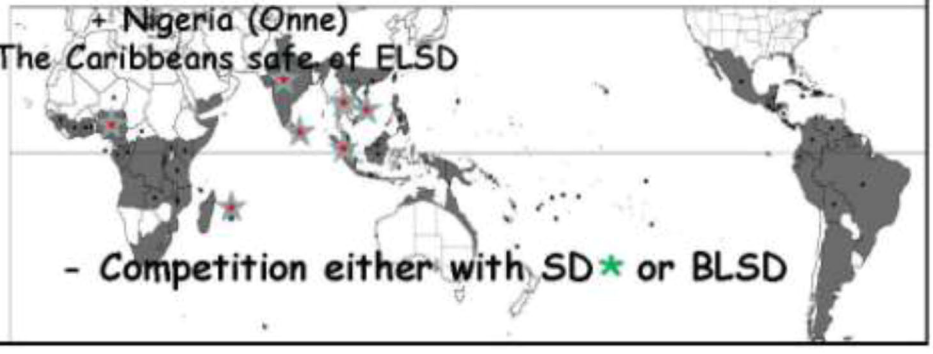
Mycosphaerella eumusae origin and distribution

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

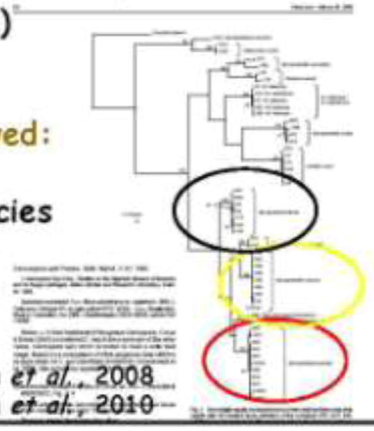
Invasion *Mycosphaerella sp.* leafspots perspectives

- 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