



**Cacao Research Center**  
Ilhéus-Bahia-Brazil

# Preventive Development and Testing of Clones Resistant to Frosty Pod Rot in Brazil

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# Frosty Pod Rot or Moniliasis

## Symptoms & Dispersal Potential

### Symptoms



### Dispersal



**Moniliasis (*Moniliophthora roreri*)**

7 billion spores/pod (350 million viable)

9 months survival

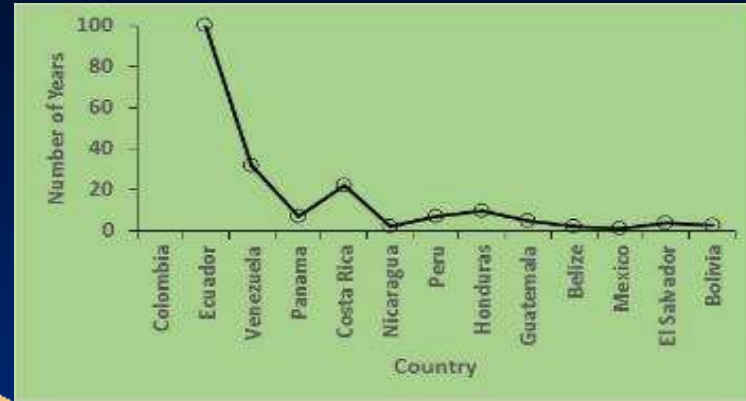
(Campuzano 1981, Ram 1989)

# Moniliasis Outbreaks

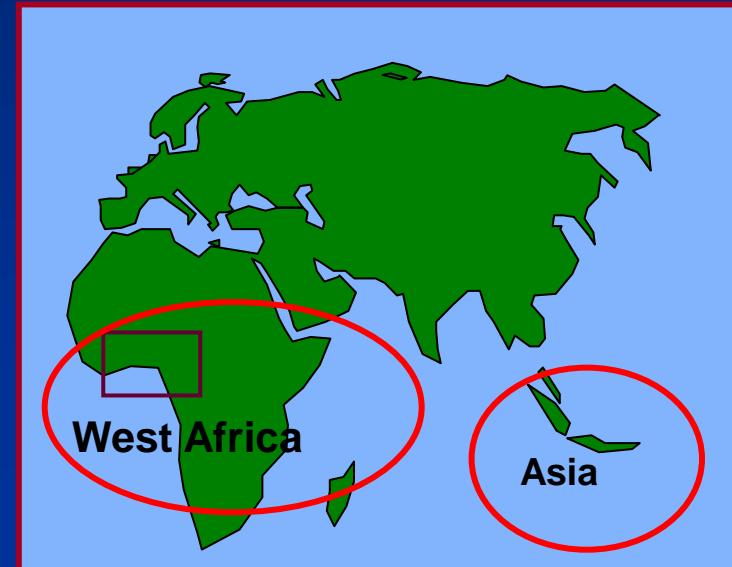
(*Moniliophthora roreri*)



Moniliasis - Years to Reach a New Country



Adaptado de: Phillips-Mora et al.(2007)





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# Preventive Breeding for Moniliasis Resistance Strategy (2009)

## Other Countries

(C.Rica, Ecuador, France, Mexico, Peru)

**Resistant Germplasm**  
(7 accessions)

### Information

- Genomic Selection (5k trees, 5 years)
- Multi-spp Genome Chip (3k SNPs, 27 spp)
- Genetic Parameters ( $h^2$ , GCA)
- Knowing the Fungal Population
- Genomic Diagnostic Kits
- etc

## On-Station Clonal Trials

(Ecuador, Costa Rica, Peru?, Mexico?)

## Brazil

**Resistant Germplasm**  
(7 Accessions)

**Advanced Selections**  
(Cepec Breeding Program)

## Breeding Populations

(32,000 seedlings → 14,000 trees)

## On-Farm Clonal Trials

(233 clones, 12 on-farm, 10,000 trees)

WB+BP Program

Release to Farmers

Quarantine  
7 clones

Information

Evaluation

Selection

Quarantine  
200 clones

Information

Evaluation

Selection



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# Selection in the Absence of Moniliasis

## Genomic Selection

Genomic Value (Ranking) - Moniliasis

$$R_{\text{Monilíase}} = a_1(M_1) + a_2(M_2) + \dots + a_{10000}(M_{10000})$$

Resistant

Ranking	Clones
---------	--------

1-10

8 Selections SCP (**Selection CePec**)

2

UF-712

4

EET-233

16

ICS-95

**Resistant to Moniliasis**

23

EET-75

27

UF-273

79

Sca-6

**Resistant to Witches' Broom**

125

Sca-12

330

Salob-3

386

CCN-51

455

IP-01

**Released to farmers in Brazil**

469

SJ-02

574

PS-13.19

592

PH-16

**599**

**P-7**

**Susceptibility Control**

Susceptible

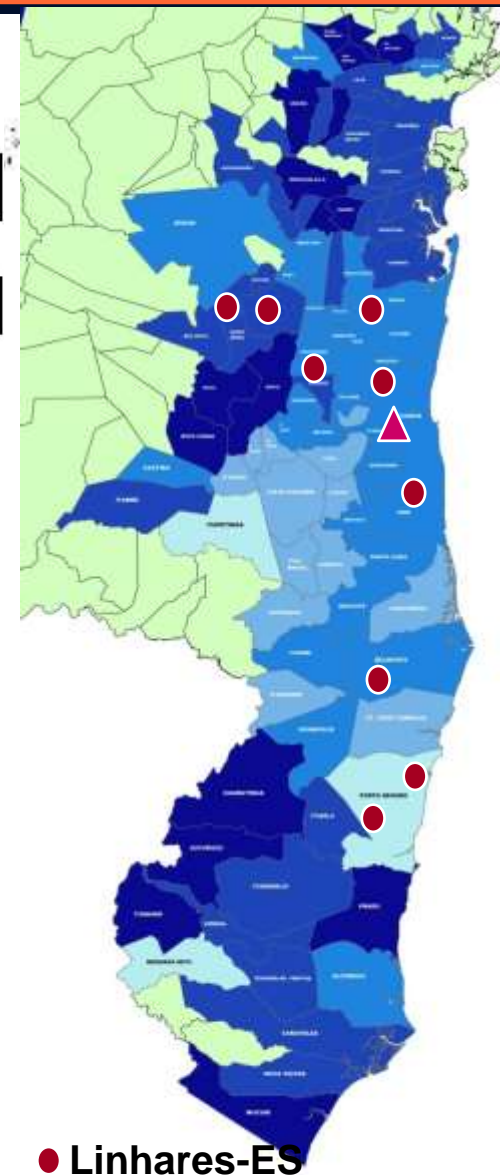
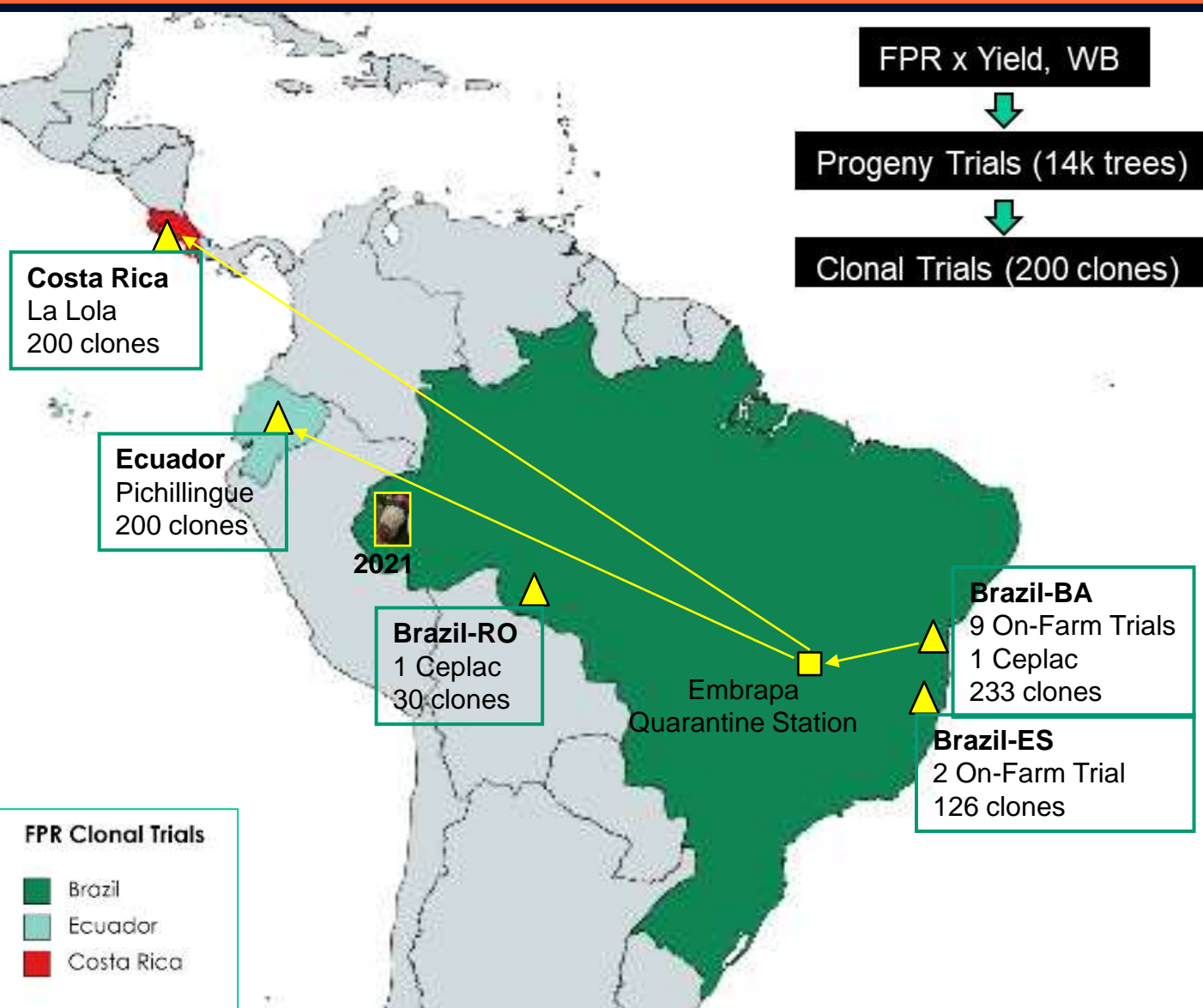
663

Br-2536



# Preventive Breeding for Moniliasis Resistance

## Clonal Trials





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# Preventive Breeding for Moniliasis Resistance

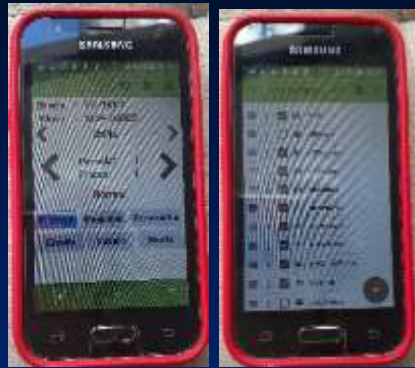
## Clonal Trials - Evaluation



**Dedo de Deus Farm Trial**



**Batalha Farm Trial**



**Electronic Data Collection**

**Yield Components and Partition: 5700 pods, 186,000 beans**



**SCP-16050**

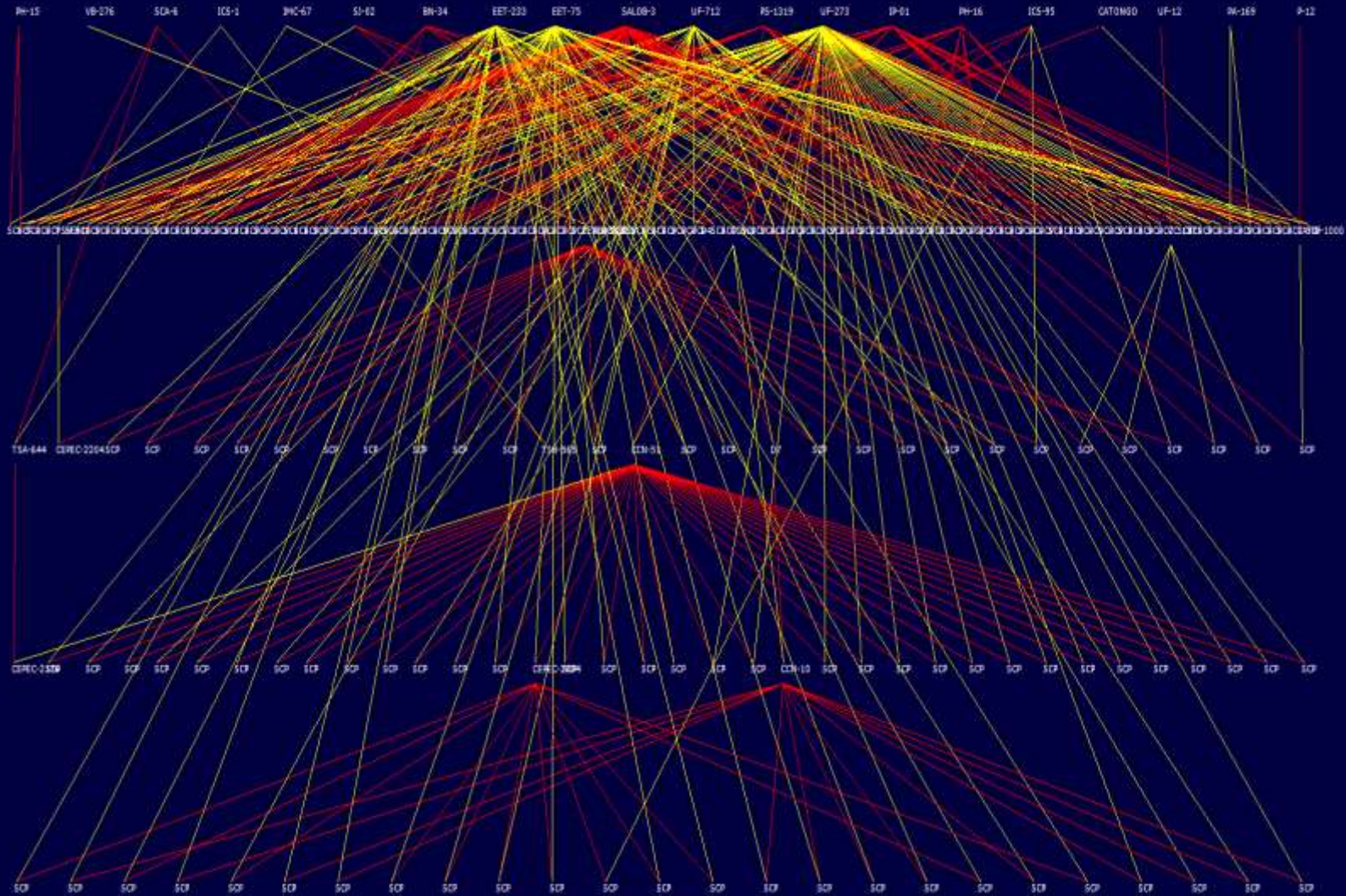
**Evaluating other traits**



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# Preventive Breeding for Moniliasis Resistance

## Pedigree of SCP Clones being Tested



- Moniliasis Resistant Parent (Imported)
- “Local” Parent (Yield, Witches’ Broom, etc)





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# Preventive Breeding for Moniliasis Resistance

## On-Farm Trial - Clonal Performance

Performance of 228 clones tested in 7 trials in Brazil (Age 2 to 4 years, Average=3.4 years)

Rank	Clone	GV	SWPHa	WPS	PI	WUE
			(kg/ha)	(g)	(Pods/@)	(l/kg)
1	SCP-16037	791.8	1558.0	1.1	414.5	8.2
2	SCP-17110	484.9	914.3	1.2	362.6	10.9
3	SCP-17145	454.1	926.0	1.3	434.6	12.2
4	SCP-15002	411.7	673.0	1.0	434.8	8.9
5	SCP-17086	411.1	834.1	1.0	496.7	8.2
6	SCP-17059	406.2	1356.2	1.4	315.6	12.1
7	SCP-17073	366.1	986.9	1.2	422.5	8.7
8	SCP-17054	361.0	718.1	1.4	251.6	6.0
9	SCP-16066	355.4	809.5	1.2	355.9	9.4
10	SCP-16015	348.9	455.7	1.2	268.7	7.6
29	CCN-51	175.9	718.8	1.4	274.9	9.8
42	BN-34	129.2	300.4	1.5	276.5	8.8
74	CEPEC-2002	51.4	196.0	1.0	399.1	10.6
116	PH-16	-1.4	108.1	1.5	267.3	9.4
131	PS-1319	-22.5	397.1	1.2	331.8	8.9
179	CC-137	-101.3	21.2	1.7	281.1	8.5
208	ICS-95	-258.9	68.0	1.2	375.2	10.7
227	SCP-17018	-583.8	154.1	1.4	308.6	9.9
228	SCP-17204	-611.3	189.1	1.2	410.6	16.6

**GV** = Predicted Genotypic Value  
(Additive+NonAdditive)

**SWPHA** = Seed weight per ha

**WPS** = weight per seed

**PI** = Pod Index (Pods/@=15kg)

**WUE** = Water Use Efficiency  
(Liters water/kg dry bean)

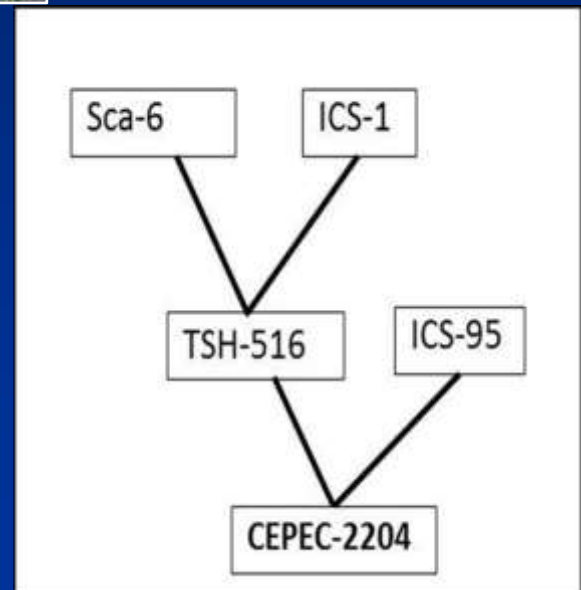


SCP-16050



# Varietal Release - Moniliasis Resistance

## Cepec-2204 (Released 2018)





# Thanks

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## Catie (Costa Rica)

Wilbert Phillips (Breeding/Pathology)  
Allan Mata-Quirós (Breeding)  
Rolando Cerda (Breeding)

## Cirad (France)

Didier Clement (Genomics)  
Claire Lanaud (Genomics)

## Iniap (Ecuador)

Karina Solis (Phytopathology)  
Danilo Vera (Phytopathology)

## Ict(Peru)

Enrique Arévalo (Phytopathology)

## Inifap (Mexico)

José Luis Solis (Breeding)

## Embrapa-Cenargen (Brazil)

Dário Grattapaglia (Genomics)  
Norton Polo Benito (Quarantine)

## Ceplac (Brazil)

Karina Gramacho (Genomics/Pathology)  
José Luis Pires (Breeding)  
Uilson Lopes (Breeding)

## Financing

Brazilian Ministry of Agriculture  
Fundação de Amparo à Pesquisa da BA (Fapesb/SECTI-BA)  
Fondation Agropolis (France)

## Farmers



## To those who Pollinate, Seed, Graft, Care, ... THANKS





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