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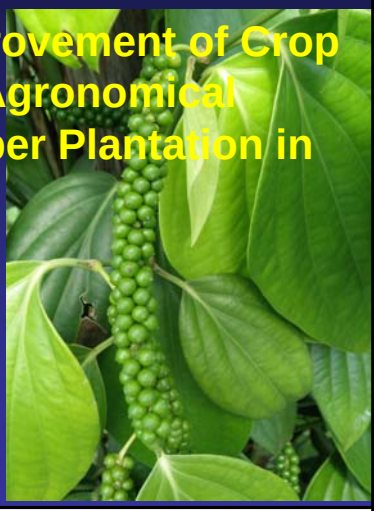
THE 38th ANNUAL SESSION/MEETINGS OF INTERNATIONAL PEPPER COMMUNITY

35th Peppertech Meeting

Breeding Strategies for Improvement of Crop Production and Good Agronomical Management of Black Pepper Plantation in Brazil



Oriel Filgueira de Lemos
Ph.D. in genetics and plant breeding

8th – 12th Nov. 2010
Taj Gateway Hotel, Cochin, India

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System of production

How do we Produce ?



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Rootstock Production

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Cultivation

Dead tutor´s uso Fruits harvest Plants growing

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➢ **Occurrence of diseases**

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Attack of Diseases

"Fusariosis" (*Fusarium solani f. Sp.*)

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Symptoms

Causal agent
(*Fusarium solani* f.sp. *Piperis*)

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VIRUS

PYMoV

CMV

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➢ Difficulties in using dead tutor

- ✓ Environments laws
- ✓ Live tutor´s use (Gliricídia) - alternative

Gliricídia (*Gliricidia sepium (Jacq.) Walp.*) as live tutor

➢ Healthy rootstocks production

- ✓ Disease free mother plants
- ✓ Certified nurseryman for MAPA (Ministry of agriculture)

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Clonal Cleaning

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➢ high production costs

- ✓ Manpower (harvesting)
- ✓ Fertilizer costs
- ✓ Price of dead tutor

Objectives

- Fusariosis resistance;
- Same or high productivity at the cultivars currently used;
- Long spikes, hermafroditic flowers, heavy and big fruits;
- Drought tolerance;
- Precocious and good architecture of plant;
- Cycle produce defined;
- Adaptation to the live tutor´s use.

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What are the bases of the program?

- ❖ Genetic variability
- ❖ Selection
- ❖ Confirmation

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Where to find?

- ❖ Genetic variability
  - Germoplasm bank
  - Genetic recombination
  - Mutagenesis
  - Introduction of genetic material

➢ Plant Breeding Methods

- ➢ Introduction and evaluation of genetic materials (exchange germplasm)
- ➢ Intraspecific hybridization
- ➢ Interspecific hybridization

What's in the germplasm bank of Embrapa

In 1999, it was formed by 35 accessions. From 2002 there was decline due to PYMoV. Then, there are currently:

- 07 cultivars (Cingapura, Bragantina (Pannyur), Guajarina (Karimunda), Iaçará, APRA, Kottanadan e Kuthiravally)
- 07 other species (*P. aduncum*, *P. hispidinervium*, *P. attenuatum*, *P arboreum*, *P. colubrinum*, *P. divaricatum)*

Table 1. Main characteristics from cultivars used in the black pepper breeding program of Embrapa Eastern Amazon.

Cultivar	Spikes (cm)	Weight of Spike (g)	Number of fruit/spike	Performance black pepper (Kg/ha)	Maturation period	Yellow wilt resistance
Cingapura	8	6	27	2300	Jun/Oct	High
Bragantina	14	14	77	2700	Jun/Oct	Average
Guajarina	12	12	68	2900	Jun/Oct	Without
Iaçara	10	8	40	2500	Sep/Nov	High
Kottanadan	11	12	54	2800	Sep/Nov	High
APRA	12	14	78	**3100**	Sep/Nov	High
Kuthiravally	12	13	75	2700	Sep/Nov	High

Intraspecific hybridization method

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Bragantina X Apra

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Bragantina X Cingapura

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Bragantina X Iaçará

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Bragantina X Kottanadan

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Bragantina X Kuthiravally

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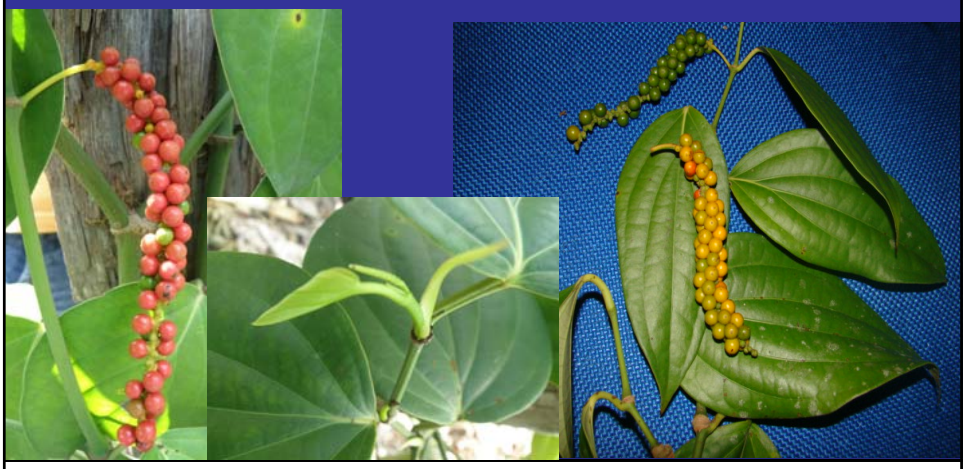
Bragantina X Guajarina



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Interspecific hybridization method

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P. nigrum L. x Native *Piper*

P. Aduncum

P. Hispidinervium

Bragantina X *P. colubrinum*

P. Attenuatum

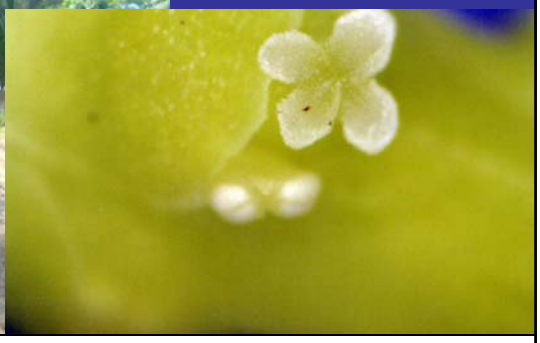
P. arboreum

BACKCROSSING WITH *P. nigrum* (Bragantina)

Technologies to support the program

Controled pollination

Use only the part of the spike where florets have opened



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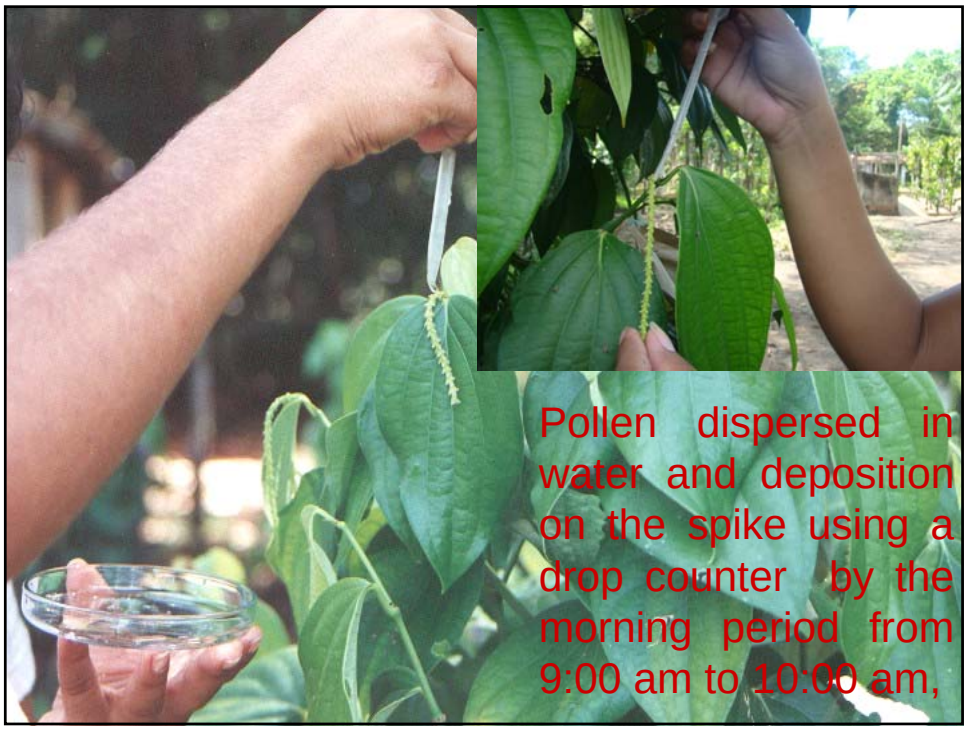
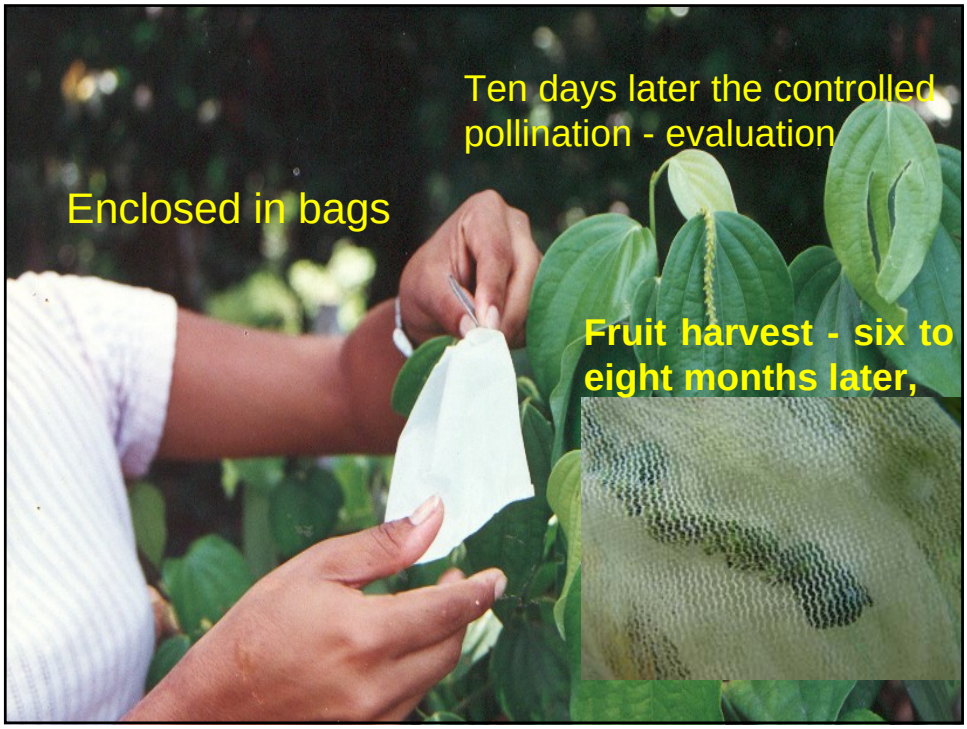


Pollen dispersed in water and deposition on the spike using a drop counter by the morning period from 9:00 am to 10:00 am,



Selection for resistance to *Fusarium*

The fungal culture

spore suppression of the fungus

The symptoms appeared after one to two months after inoculation of the fungus and it was observed yellowish leaves with chlorosis and going through necrosis.

The concentration of $2x10^6$ spores/ml caused 100% death of the plants after six months

Cytogenetics

central objective

- Cytogenetics characterization of *Piper* accessions is from the Germplasm Bank of Embrapa Eastern Amazon understood as the description of chromosomes, highlighting:

✓ Accurately determine the number of chromosomes of species of interest, varieties, cultivars

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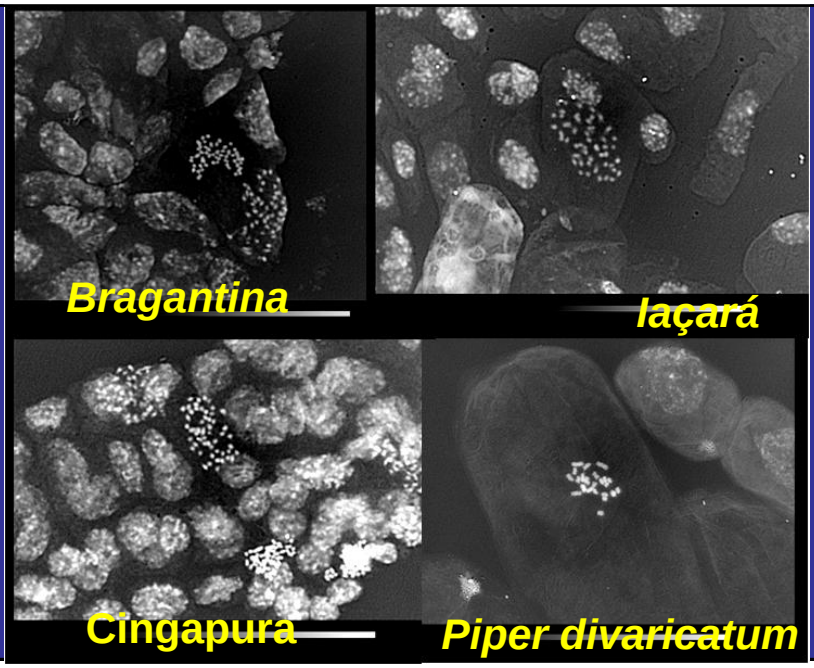

In vitro germination

- Rescue of hybrids;
- to obtain explants donor sources

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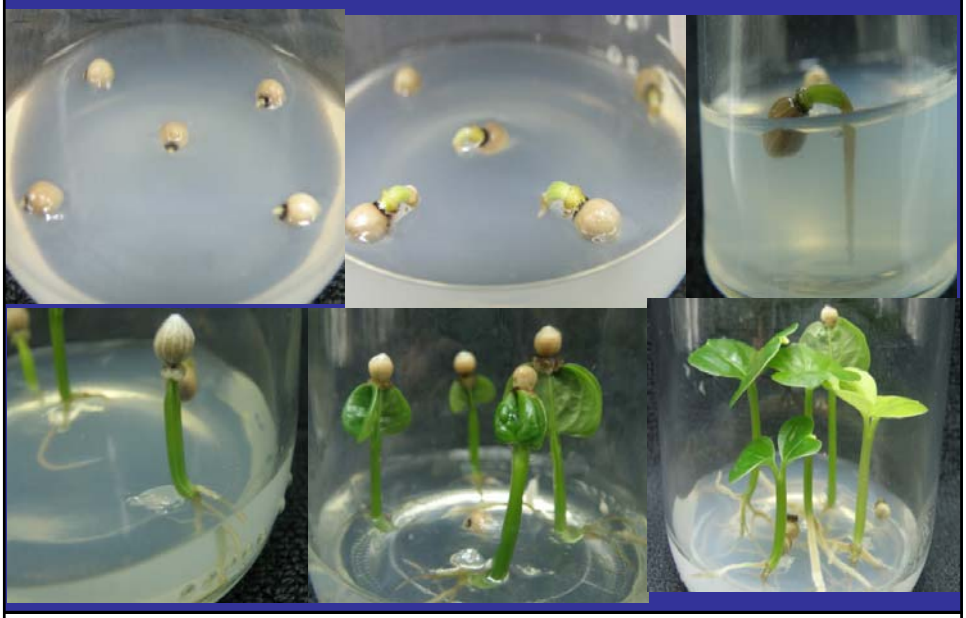

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Micropropagation

- Hybrids Cloning
- Multiplication and availability of cultivars to farmers and nurseryman

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Micropropagation

Induction, multiplication and rooting of shoots and acclimatization of black pepper microplants.

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Micrografting in Black pepper plants

- ✓ It is an efficient method to obtain propagative material free of diseases and with high genetic quality;
- ✓ Research aims to obtain a micrografting protocol for this culture, using different cultivars as scion and native Amazon Piperaceae species, resistant to the pathogen, as rootstocks for black pepper

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Development of micrografting process

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Development of molecular markers

❖ Embrapa Eastern Amazon has developed and characterized microsatellite markers for *Piper nigrum* L.

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The microsatellites developed and identified Will be used in the germplasm characterization of *Piper nigrum* and in the genetic breeding of this species

Genotyping using a microsatellite locus

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Identification of genes

This is being worked on the identification of fungi putative sequences related to the interaction with black pepper. This research can permit the comprehension of plant-pathogen interaction process, and also identify potential target sequences of the fungus, related to the fungus pathogenicity. Also, this strategy can indicate those with higher pathogen control. Secondly, once it is known which genes are responsible for the infection process, kits can be produced for the early detection of the fungus and eliminate susceptible plants in the beginning of fungus infection into breeding program.

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Infrastructure

Key Laboratories: biotechnology, plant pathology, molecular genetics.

Others: greenhouses, conservation area and experimental field for conducting fieldwork.

Plant pathology laboratory

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Biotechology laboratory

Key team of researchers (PhD)

Alessandra de Jesus Boari	Plant Pathology - Virology
Célia Regina Tremacoldi	Plant pathology - Mycology
Elisa Ferreira Moura	Genetics and Breeding – molecular genetics
Ilmarina Campos de Menezes	Molecular Byology
Marli Costa Poltronieri	Plant Breeding – Conventional Methods
Mateus Mondin	Cytogenetics
Oriel Filgueira de Lemos	Genetics and Breeding - Cell Biology
Simone de Miranda Rodrigues	Genetics and Breeding - Functional Genomics

Grato pela atenção!

➢ Considering that a major challenge in black pepper sustainability worldwide may be related to the low genetic variability associated to production cultivars, it is critical to introduce and breed genetic material from a broad source of countries that cultivate black pepper. This will allow the generation of genetic variability for the main features of interest and the selection and release of new cultivars that attend the demands of farmers.

Proposal for germplasm exchange

➢ Through bilateral or similar agreement for germplasm exchange among member countries, all genetic material and cultivars generated from such introductions will be stored out of producing areas and kept aside from disease and extreme climate changes and/or variations, protecting for future generations, besides benefiting all through the assignment of propagules of new cultivars for multiplication.


Thanks for your attention!
Oriel Filgueira de Lemos
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