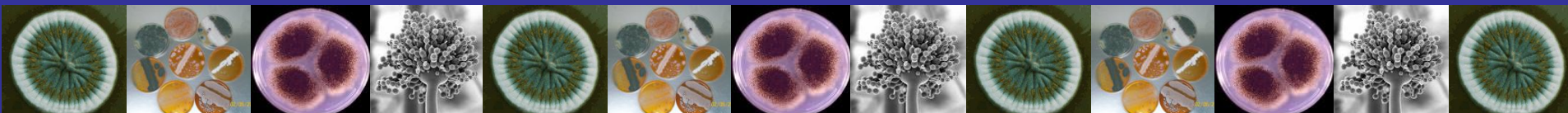


# MICROBIAL GENETIC RESOURCES FOR FOOD AND AGRICULTURE



Side event – ABS 9 - II  
Montreal – Canada  
July, 2010

Maria Jose Amstalden Sampaio



# MICROORGANISMS : HABITATS



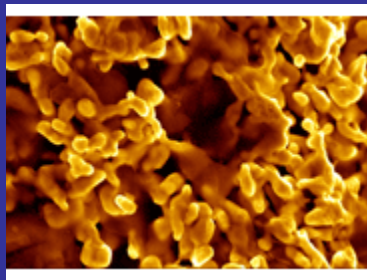
Plants



Marine



Soil



Bacteria in gold grains



Bacteria and archaea in hydrothermal environment



Associations with animals

# MICROORGANISMS – HOW MANY ?

- BACTERIA

- ARCHAEA



prokaryotes

- FILAMENTOUS FUNGI AND YEAST

- PROTOZOAN

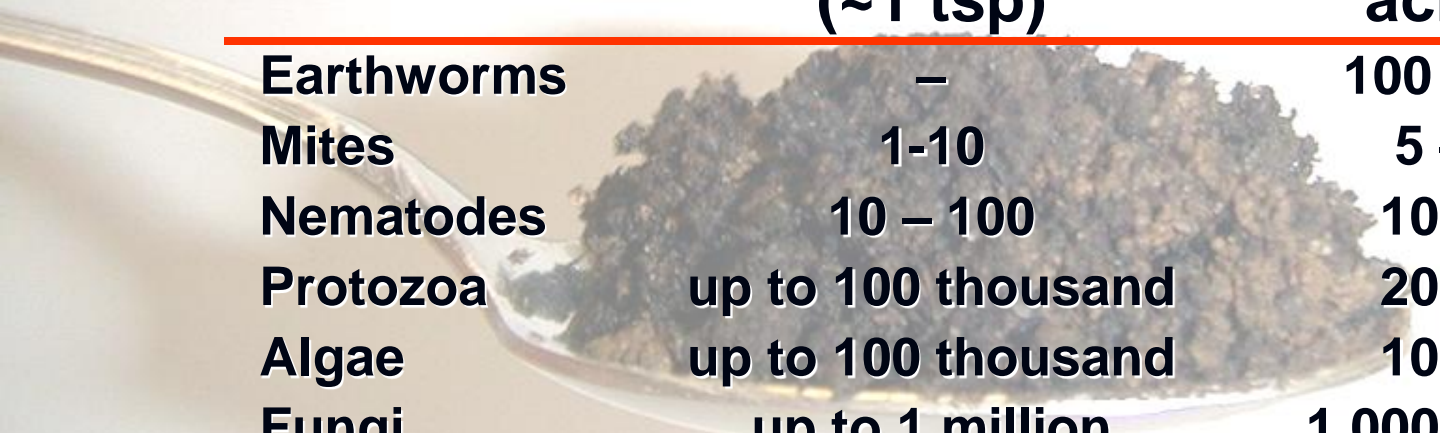
- MICROSCOPIC ALGAE

- VIRUS



eukaryotes

# ABUNDANCE OF SOIL ORGANISMS



<b>Organism</b>	<b>Number per gram soil (~1 tsp)</b>	<b>Biomass<sup>1</sup> (lbs per acre 6")</b>
<b>Earthworms</b>	<b>–</b>	<b>100 – 1,500</b>
<b>Mites</b>	<b>1-10</b>	<b>5 – 150</b>
<b>Nematodes</b>	<b>10 – 100</b>	<b>10 – 150</b>
<b>Protozoa</b>	<b>up to 100 thousand</b>	<b>20 – 200</b>
<b>Algae</b>	<b>up to 100 thousand</b>	<b>10 – 500</b>
<b>Fungi</b>	<b>up to 1 million</b>	<b>1,000 – 15,000</b>
<b>Actinomycetes</b>	<b>up to 100 million</b>	<b>400 – 5,000</b>
<b>Bacteria</b>	<b>up to 1 billion</b>	<b>400 – 5,000</b>

<sup>1</sup> Biomass is the weight of living organisms

# 29 COLLECTIONS WITH AROUND 30,000 SPECIMENS

ENVIRONMENTAL USE

FUNGI AND BACTERIA FROM  
INVERTEBRATES

ENTOMOPATHOGENIC  
MICROORGANISMS

PHYTOPATHOGENIC  
MICROORGANISMS

DIAZOTROPHIC  
BACTERIA

ANIMAL DISEASES

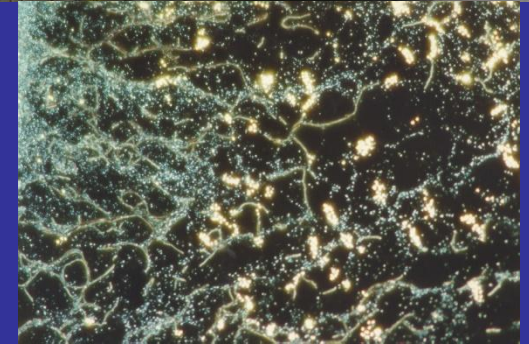
VIRUS



## Culture Collection holdings world wide

Continent	Collections	Strains
Africa	11	12 255
Asia	177	322 195
Europe	173	1 005 930
America	121	326 297
Oceania	<u>43</u>	<u>89 786</u>
	<b>525</b>	<b>1 756 463</b>

World Data Centre for Microorganisms (WDCM) <http://wdcm.nig.ac.jp>



**WFCC position on Access and benefit sharing**

[http://www.wfcc.info/NEWSLETTER/GG\\_TSPUstyx2\\_bba.de-31757-6599860-DAT/WFCC-NL-January-2009.pdf](http://www.wfcc.info/NEWSLETTER/GG_TSPUstyx2_bba.de-31757-6599860-DAT/WFCC-NL-January-2009.pdf)

# AGRICULTURE DIFFERENT PROCESSES

BIOLOGICAL  
CONTROL



NUTRIENT  
ABSORPTION

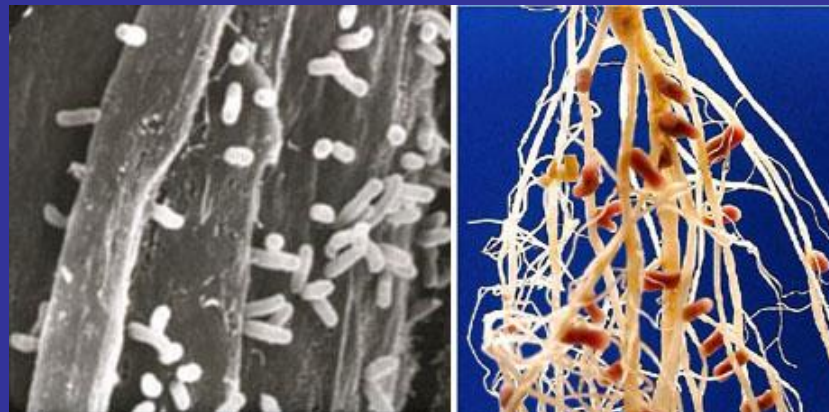
Mycorriza  
ROOTS



*Metarhizium anisopliae*



*Cordyceps sinclairii*



NITROGEN  
FIXATION

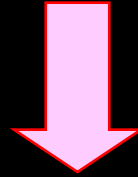


*Rhizobium*

# NITROGEN FIXATION IN SOYBEAN



*Bradyrhizobium*



**~ all the soybean in BR  
grows without added  
Nitrogen fertilizer**



**~US\$ 50 million/year - saved in Nitrogen fertilizer**

**THE TECHNOLOGY IS ONE OF THE PROGRAMS  
LAUNCHED IN 2010 TO HELP TO DECREASE  
EMISSIONS OF GHG**





# BIOLOGICAL CONTROL PRODUCTS REGISTERED IN LATIN AMERICA IN 2010

685 pesticidEs  
97 BIOLOGICAL  
CONTROL AGENTS



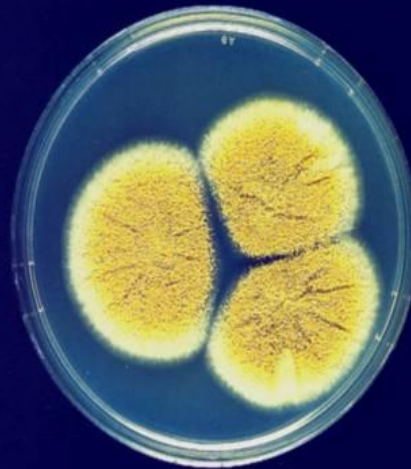
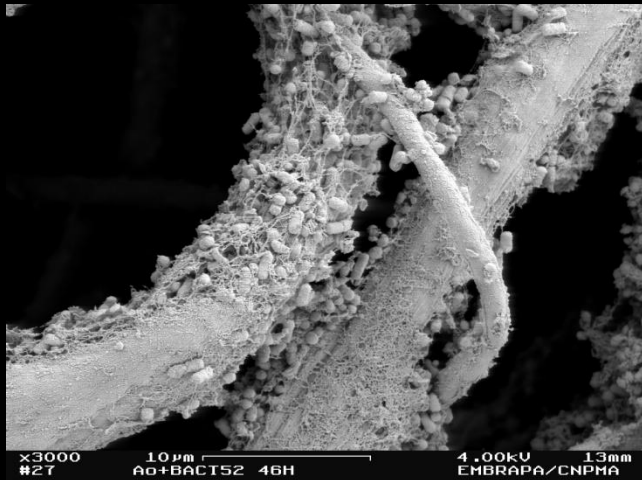
1.339 pesticides  
16 BIOLOGICAL  
CONTROL AGENTS

1.519 pesticides  
30 BIOLOGICAL  
CONTROL AGENTS

3.227 pesticides  
23 BIOLOGICAL CONTROL AGENTS

Os produtos de Controle Biológico representam apenas uma pequena porcentagem dos pesticidas registrados na América do Sul. Certamente, o processo de registro é a principal razão

**BIOLOGICAL CONTROL  
OF  
*Aspergillus ochraceus*  
WITH ENDOPHYTIC  
BACTERIA ISOLATED  
FROM COFFEE PLANTS**



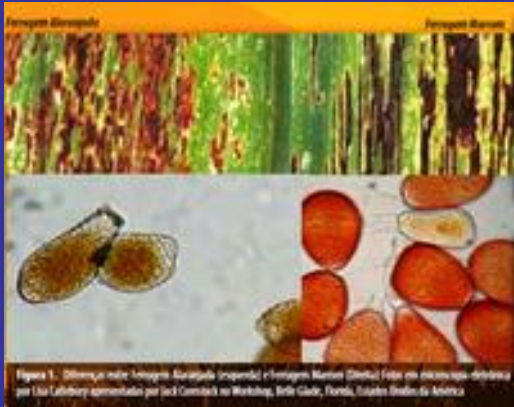
# MANY APPLICATIONS IN AGRICULTURE

- » Nitrogen fixation in legumes – *Rizobium*
- » Inoculants for corn – *Azospirillum helibiogrio*
- Ectomicorrizae– *Pisolithus tinctoriu*
- Growth promoters – *Trichoderma harzianum*
- » Fungicide Gadder-G) – *P. fluorescens*
- Fungicide (Binab) – *T. harzianum*
- » Fungicide (Quantum 4000 HB) – *Bacillus subtilis*
- » Fungicide (Itaforte) – Brasil - *T. harzianum*
- » Fungicide (Tricovab) Brasil – *T. stromaticum*
- Inseticide – *Bacillus thuringiensis*



**GOOD FOR THE ENVIRONMENT – LOW TECH  
VERY USEFUL FOR ORGANIC FARMING**

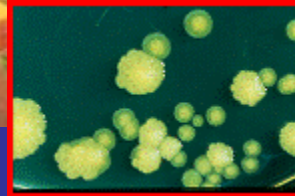
# PLANT AND ANIMAL HEALTH QUARANTINE EFFORTS TO CONTROL PESTS



Orange Rust  
Sugar Cane



Citrus disease (*X. fastidiosa*)



Citrus disease  
(*X. axonopodis*)



AFTOSA

COMPLEX INTERNATIONAL FRAMEWORK  
TRADE BARRIERS TO GLOBAL COMMERCE  
NON TRADE BARRIERS - SAFETY

**GLOBAL  
INTERDEPENDENCE  
TO DEVISE METHODS OF  
DIAGNOSTICS AND CONTROL**

# INTERDEPENDENCE FOOD INDUSTRY



*Lactobacillus bulgaricus*  
*Streptococcus thermophilus*



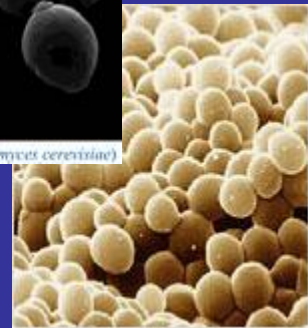
*Lentinula edodes*



*Penicillium roquefortii*



Yeast (*Saccharomyces cerevisiae*)



*Saccharomyces cerevisiae*

# ENVIRONMENT BIORREMEDIATION

DEGRADATION OF  
ENVIRONMENTAL  
POLLUTANTS  
(PESTICIDES) BY  
FUNGI AND BACTERIA



# GROWING APPLICATIONS

INOCULANTS FOR FEED STOCKS

BIOFUEL PRODUCTION

BIOMASS CONVERSION – ENERGY  
(e.g. BIOGAS)

INDUSTRIAL USE IN MORE  
NATURAL AND SUSTAINABLE  
PROCESSES - ENGINEERED “BUGS”

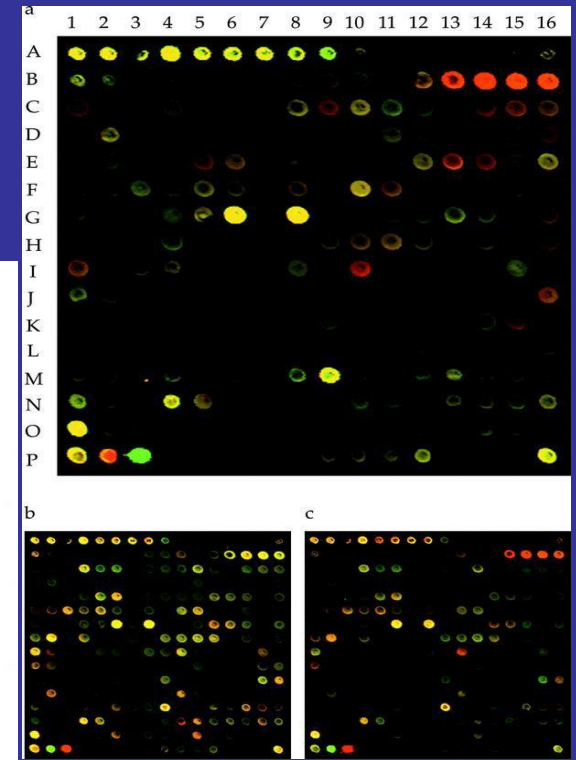
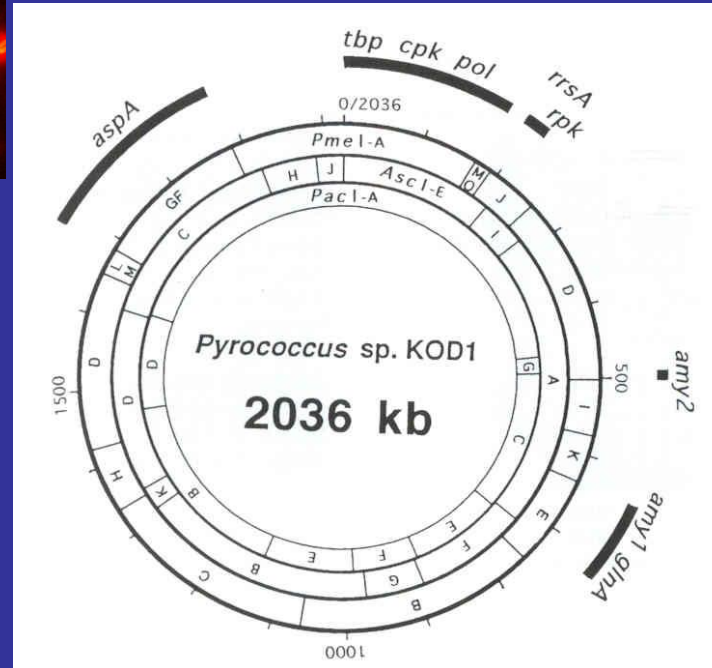
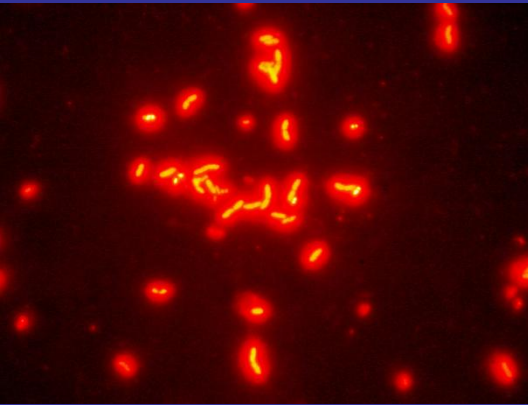
# “ADVANCED” APPLICATIONS

## BIOTECHNOLOGY

CLONING VECTORS /  
TRANSFORMATION /  
EXPRESSION VECTORS  
(biofactories)

METAGENOMICS  
DNA SHUFFLING – NEW  
FUNCTIONAL DNA  
SEQUENCES NOT FOUND  
IN NATURE





# INTERDEPENDENCE ON INFORMATION GENOME SEQUENCES AND PROTEOMICS PUBLIC DATA-BASES

# QUESTIONS FOR POLICY MAKERS



- **COUNTRY OF ORIGIN DEFINITION APPLIED TO MICROORGANISMS**

Who owns a “bug” ??? BEFORE AND AFTER 92 ?

SAME SPECIES OF MICROORGANISMS FOUND IN MANY COUNTRIES ? – DIFFERENT STRAINS

CULTURE COLLECTIONS – outside the collecting territory

- ***IN SITU* CONDITIONS DEFINITION APPLIED TO MICROORGANISMS**

IS IT THE SOIL OR THE WATER OF A GIVEN COUNTRY ??

IS IT THE ANIMAL GUTS ?? When the animal is an exotic breed ?

IS IT THE PETRI DISH IN A LAB ? (microbes have a different life span !)

- **BENEFIT SHARING CHAIN FOR “NATIVE” MICROORGANISMS AND FOR MODIFIED MICROORGANISMS**



THANK YOU

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