



**Fungal
Biodiversity and
Systematics
Group**



University of Santo Tomas

Research Center for the Natural and Applied Sciences

Fungal Biodiversity and Systematics Group:

At the forefront of fungal research in the Philippines

Dr. Thomas Edison E. dela Cruz

Email: tedelacruz@mnl.ust.edu.ph



ASEAN Network on Microbial Utilization: Inaugural Meeting
21 February 2014, Bangkok, Thailand

University of Santo Tomas



University of Santo Tomas



- ✚ **Oldest existing university in Asia (April 28, 1611)**

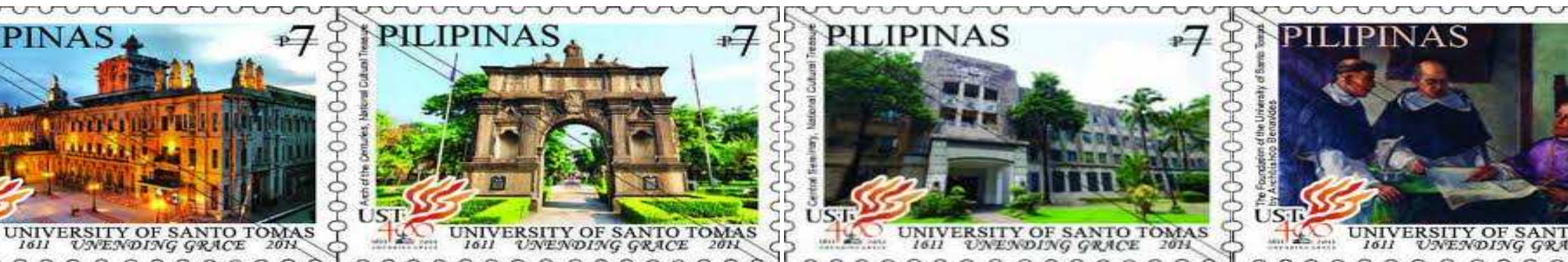
- ✚ Bishop Miguel de Benavides, O.P.
- the third Archbishop of Manila

- ✚ **largest Catholic University in the world in a single campus**

UNIVERSITY OF SANTO TOMAS 1611 UNENDING GRACE 2011



UST
@ 400



Campus Life at UST



Research at UST

The Varsitarian

THE OFFICIAL STUDENT PUBLICATION OF THE UNIVERSITY OF SANTO TOMAS

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Latest

- UST admin bares causes of deadlock with faculty union
- Rival parties clash in miting de avance
- Growling legends prevail over 2006 UST champs
- UST Golden Tigresses upset Adamson
- UST Tiger Spikers end season with win

Most Read

LATEST NEWS

Growling legends prevail over 2006 UST champs

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50 years of science research in UST

By GIULIANI RENZ G. PAAS

CHANGING times call for more discoveries.

With the University celebrating the 50th year of the UST Research Center (on the natural and physical sciences), more Thomasian scientists and engineers are being encouraged to create innovations that would address the demands of modernization.

Before, faculty members and Dominican priests who were inclined toward the natural and physical sciences had dedicated themselves in scientific research..

Sci-Tech

- Marijuana legalization: risks outweigh benefits

News

- UST admin bares causes of deadlock with faculty union
- Rival parties clash in miting de avance
- CBA negotiations end in deadlock
- Admin, faculty union to go back to negotiating table
- UST moves academic year opening
- Collective bargaining deadlock looms

Research at UST



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UNIVERSITY OF SANTO TOMAS
THE CATHOLIC UNIVERSITY OF THE PHILIPPINES

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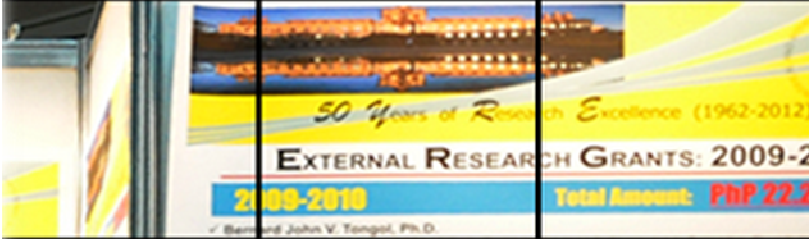
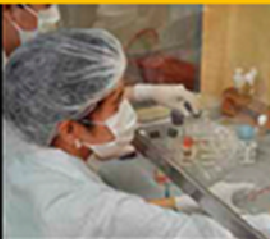
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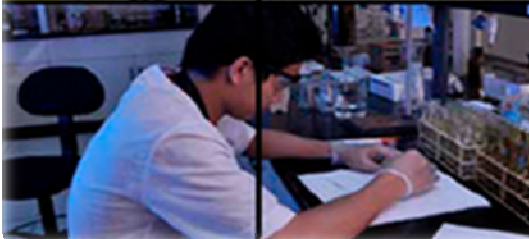
[Faculty](#)

[Support Staff](#)



EXTERNAL RESEARCH GRANTS: 2009-2018
Total Amount: PhP 22.2

Project Title	Amount of Grant
Technology Research and Development (PCASTRO)	PhP 2,000 M
Local, Occidental Mindoro in the Philippines (Philippine Society of America (PSA))	US\$ 2,500.00 (PhP)
Angels to Educate: Strengthening Immunity and Decoding (Decoding) of PCR protocols (DOST-JSPS)	PhP 10.0 M
Strengthening Immunity and Decoding (Decoding) of PCR protocols (DOST-JSPS)	PhP 4.0 M



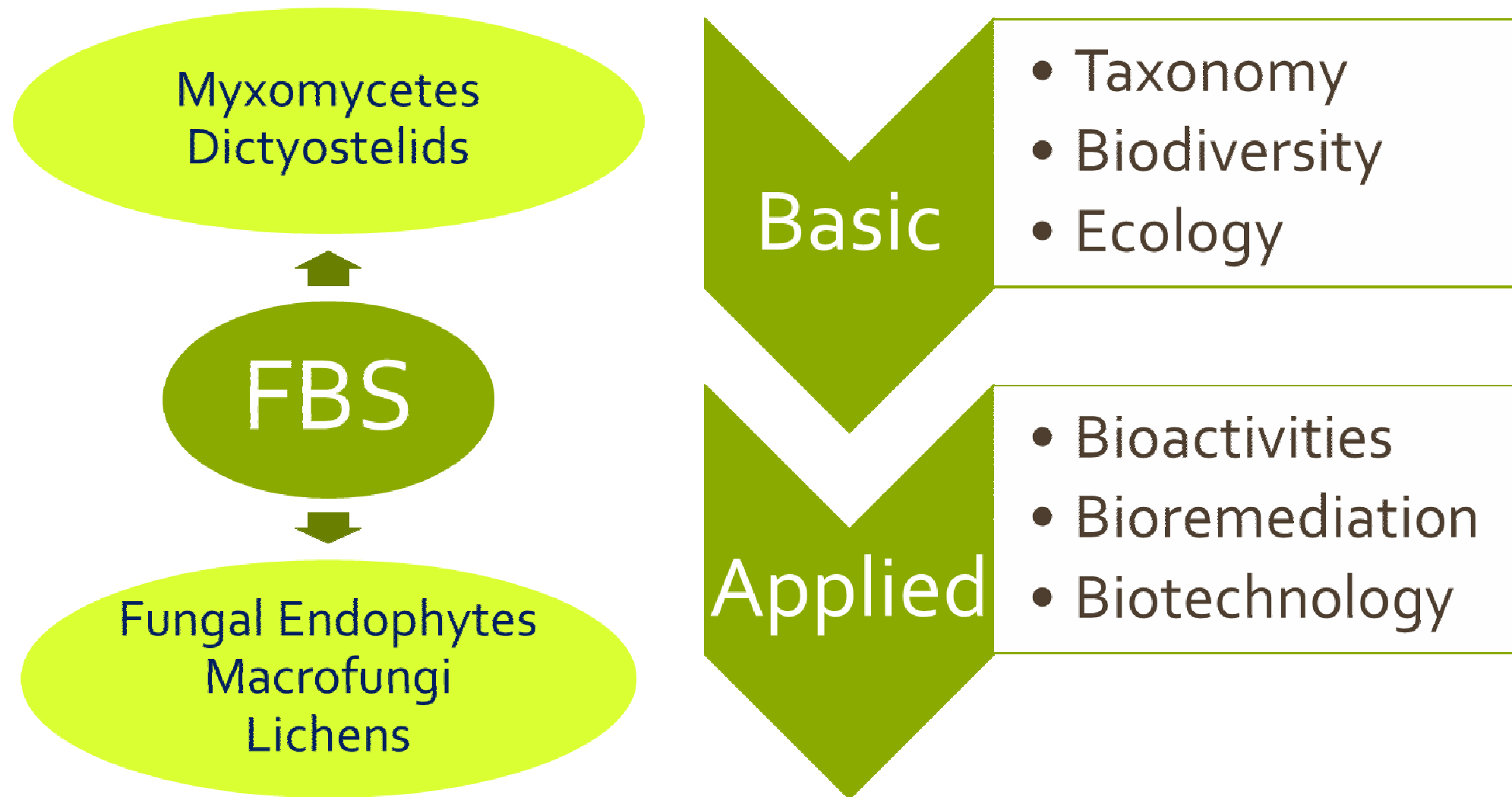
Research Center for the Natural and Applied Sciences

- ❑ Biosensors and Chemical Sensors
- ❑ Nanotechnology
- ❑ Material Sciences & Biofuels
- ❑ Natural Products
- ❑ Pharmacology
- ❑ Biochemistry
- ❑ Molecular Diagnostics
- ❑ Biodiversity: Flora and Fauna

- ❑ **Pure and Applied Microbiology**



The Fungal Biodiversity and Systematics Group





Fungal Biodiversity and Systematics Group



Fungal Endophytes

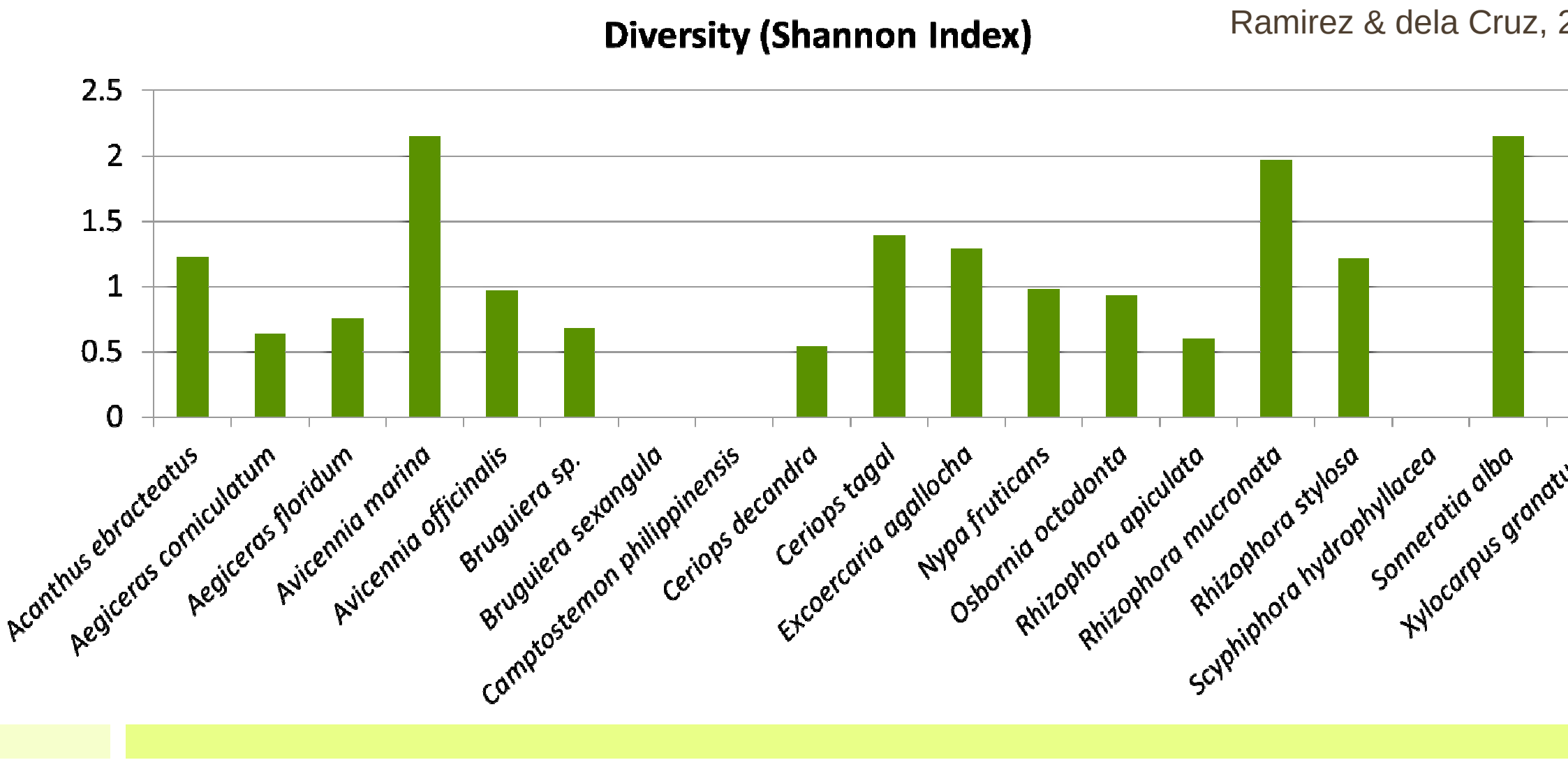
- Fungi inhabiting the inner tissues of their host plants without causing any harm to its host (Petrini, 1991)
- Varied life strategies (Schulz & Boyle, 2005)
 - Mutualists
 - Latent pathogens
 - Latent saprotrophs
 - Commensalists



THE STUDY SITES



Diversity Indices Per Host Mangrove (Healthy Green Leaves)



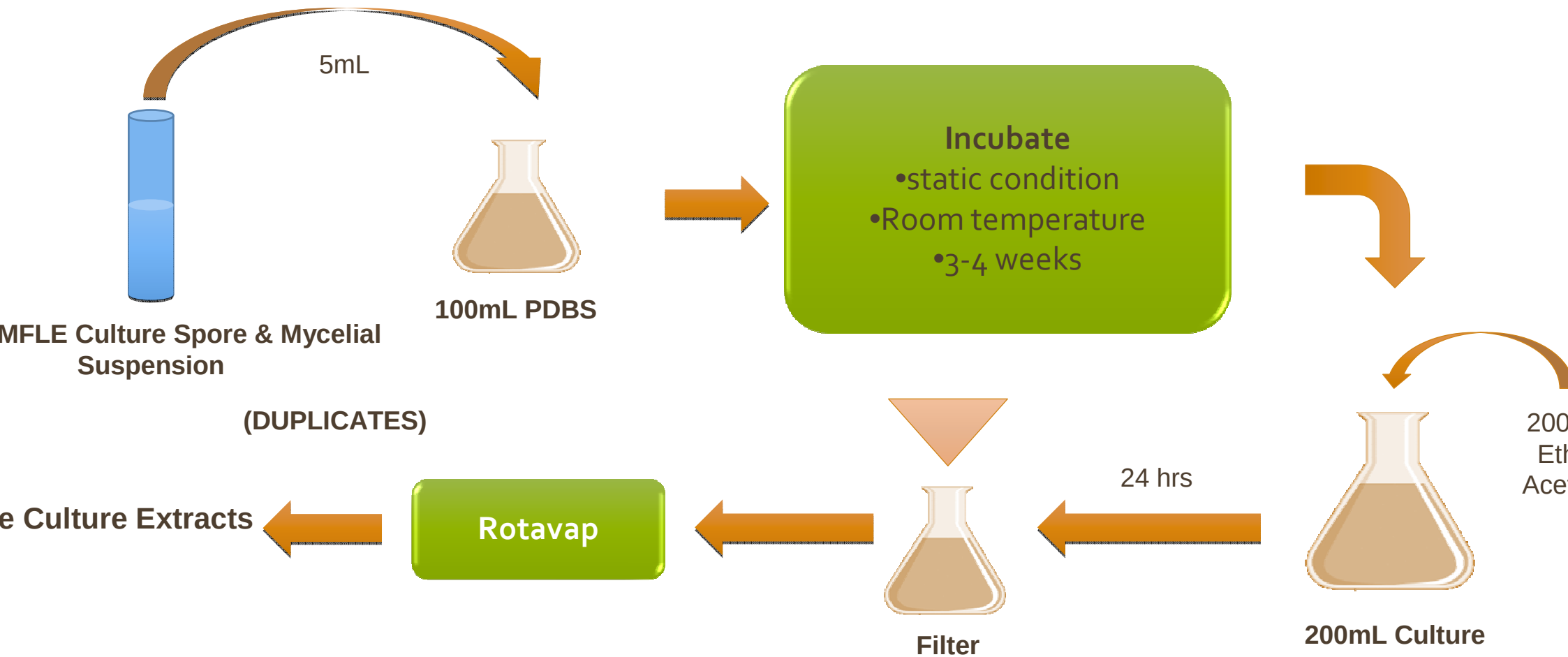
Diversity Indices Per Host Mangrove

(Yellow and Brown Decayed Leaves)

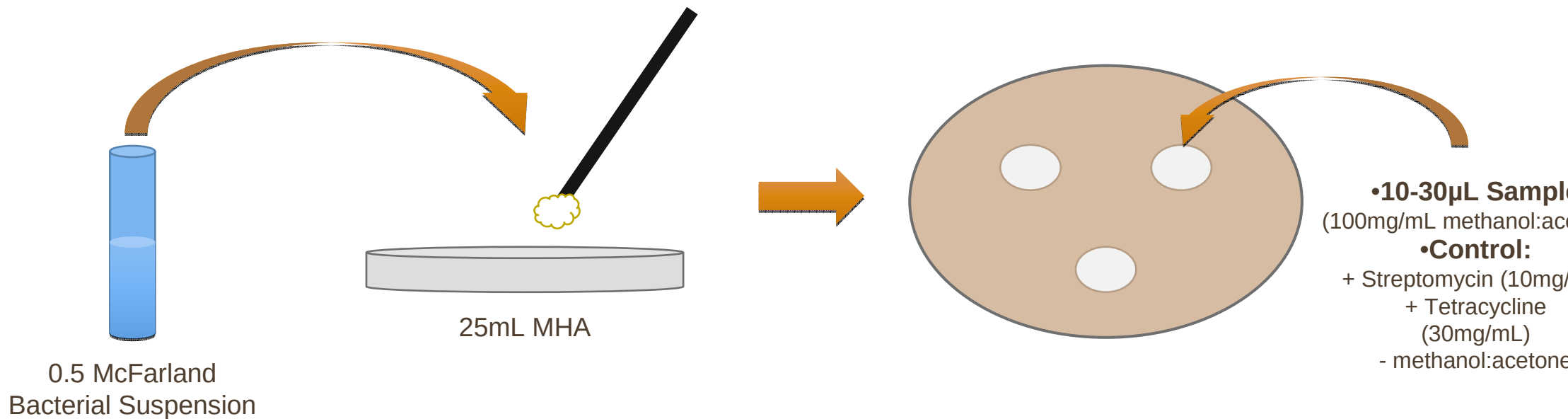
Mangrove	Species richness H_G	Evenness E	Dominance D	Shannon-Wiener diversity index H_S	Simpson's diversity index S
<i>Bruguiera parviflora</i>	0.64	0.43	0.431	1.07	0.569
<i>Bruguiera cylindrica</i>	0.67	0.60	0.348	1.20	0.652
<i>Avicennia marina</i>	2.01	0.46	0.160	2.04	0.840
<i>Sonneratia alba</i>	2.29	0.44	0.127	2.30	0.873
<i>Rhizophora mucronata</i>	3.03	0.41	0.132	2.32	0.868
<i>Rhizophora apiculata</i>	2.30	0.52	0.101	2.44	0.899

Torres & dela Cruz, 2011

Mass Production and Metabolite Extraction



Assay for Antibacterial Activities



Test Bacteria:

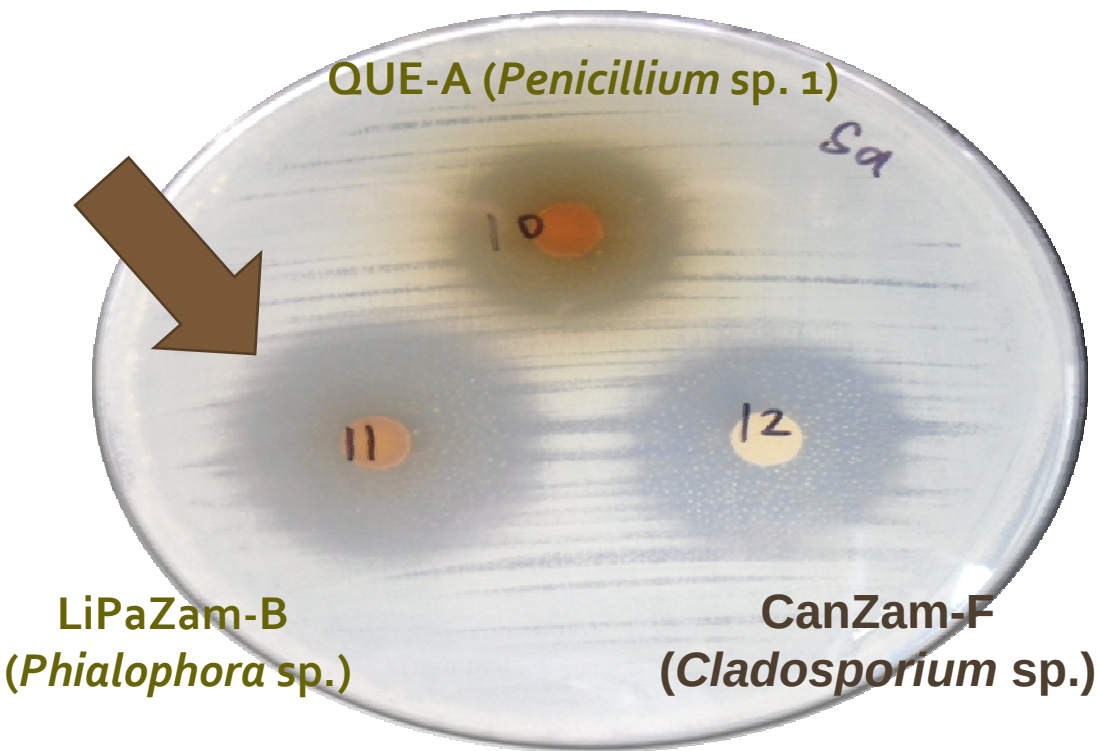
Gram Positive:

- *Micrococcus luteus*
- *Staphylococcus aureus*
- *Bacillus megaterium*
- *Bacillus subtilis*

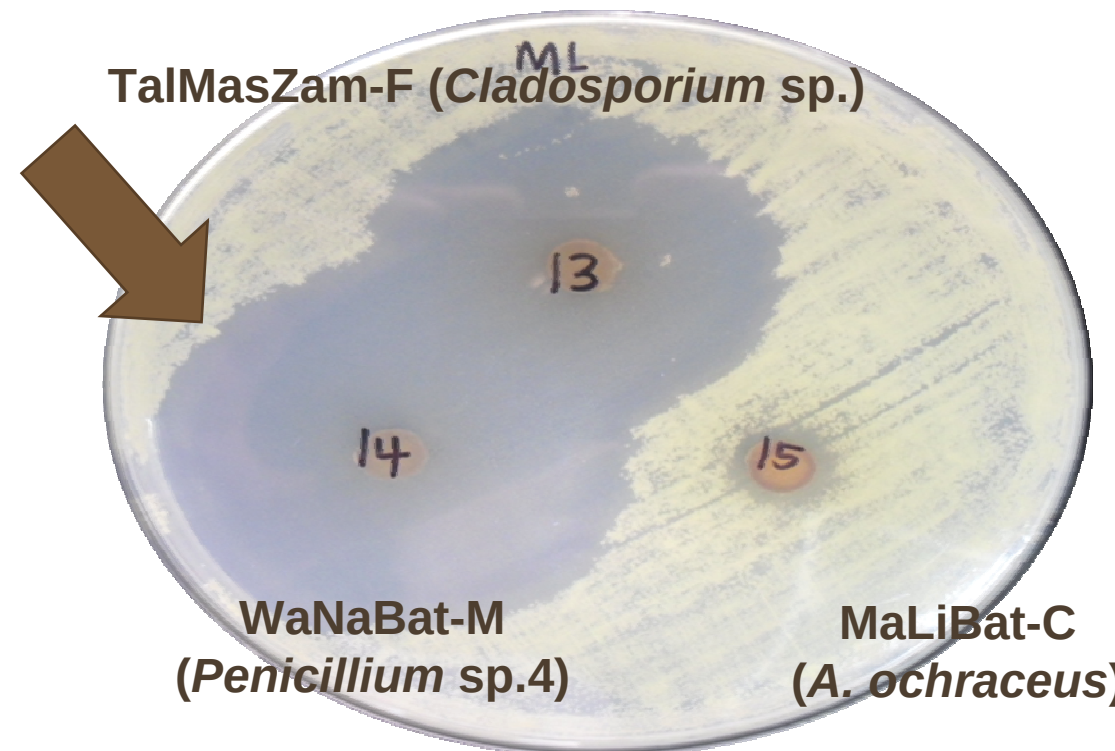
Gram Negative:

- *Klebsiella oxytoca*
- *Pseudomonas aeruginosa*
- *Escherichia coli*
- *Serratia marcescens*

Inhibitory Activities of MFLE against Gram Positive Bacteria



S. aureus
(reverse side)

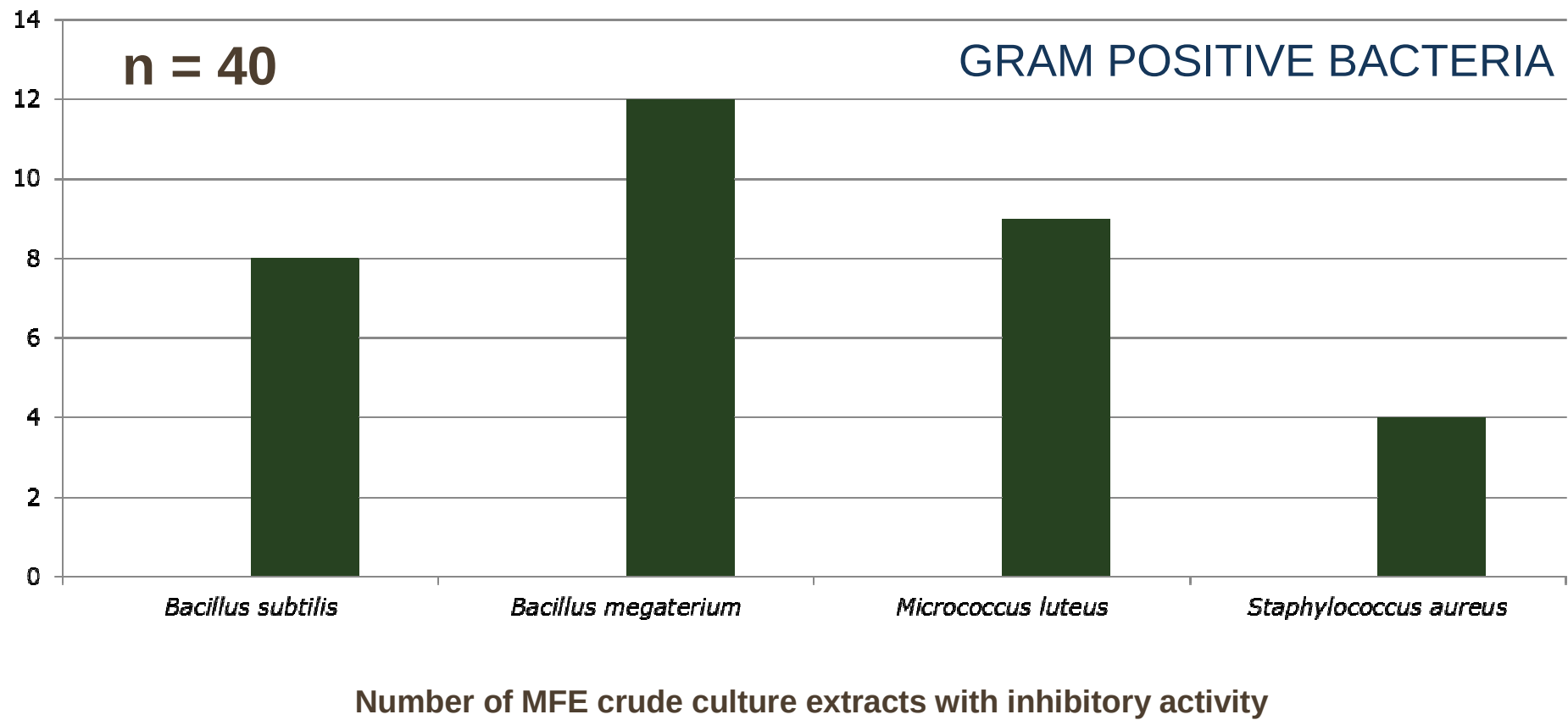


M. luteus
(reverse side)

Ramirez & dela Cruz, 2

Inhibitory Activities of MFE against Gram-Positive Bacteria

Moron & dela Cruz, 20



Xylanase Production By Mangrove Fungal Endophytes

Screening of selected strains in 1% xylan agar
(Pointing, 1999)

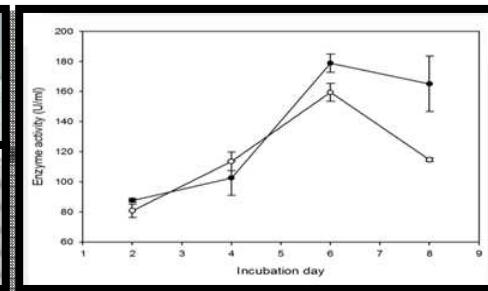
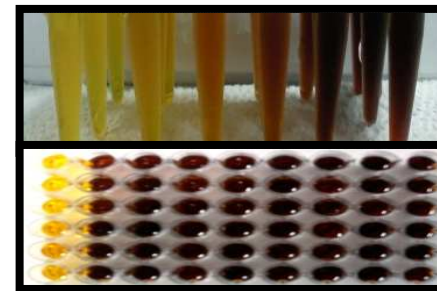


Xylanase production in 1% xylan medium
w/ or w/o marine salts



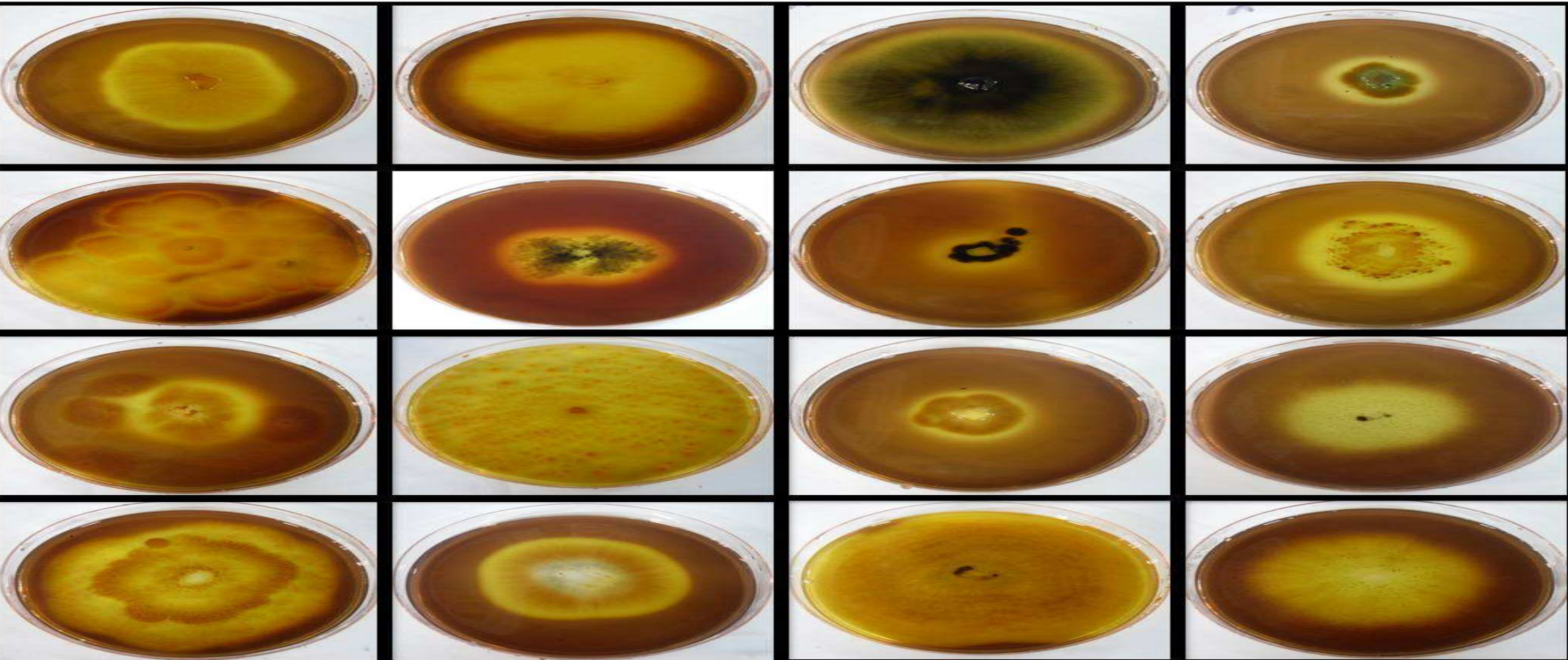
Determination of xylanase activity and biochemical
characterization (BIOTEC, 2010)

Optimum temperature (at 35, 50, and 65°C)
Optimum pH (at pH 4, 7, and 9)
Thermostability (for 60 minutes)
pH stability (for 60 minutes)
Substrate specificity (for 1% carboxymethylcellulose)



Screening for xylanolytic activity

Torres & dela Cruz, 2011



93% (41 out of 44) of the tested mangrove fungi exhibited xylanolytic activity

Xylanase Production By Magrove Fungal Endophytes

Fungal xylanase	Xylanase			Cellulase	Potential application
	Maximum activity (U/ml)	Optimum temperature (°C)	Optimum pH	CMCase activity (U/ml)	
<i>Aspergillus</i> sp. PAQ-H	169	50	7	7.8	pulp bleaching, lignocellulosic biomass
<i>Neobasidium</i> sp. 2LIPA-M	133	65	4	5	animal feed improvement, fruit processing
<i>Pleurotium</i> sp. WABA-L	121	50	7	9.2	pulp bleaching, lignocellulosic biomass
<i>Trichoderma</i> sp.1 KAWIT-A	131	65	7	4.4	breadmaking, pulp bleaching
<i>Trichomyces</i> sp. FDCAB-7	136	50	7	8	pulp bleaching, lignocellulosic biomass
<i>Trichoderma</i> sp.1 LIABA-L	107	50	7	8.9	pulp bleaching, lignocellulosic biomass
<i>Trichoderma</i> sp. 2SANQ-F	141	50	7	4.3	pulp bleaching, lignocellulosic biomass
<i>Trichoderma</i> sp. MACA-J	179	50	9	21.4	pulp bleaching, detergents, lignocellulosic biomass

Torres & dela Cruz, 20

The Search for Novel Species...



g 01 – Guig 12



Genomic DNA Extraction



PCR Amplification of Target Genes



Single- and Multi-Gene Analysis

ITS
ACT
TEF
GAPDH



Maximum Parsimony and Bayesian Analysis using Multi-Loci Gene

7 Guig Isolates

Taxa:

- ☐ *Guignardia*: 3
- ☐ *Phyllosticta*: 15

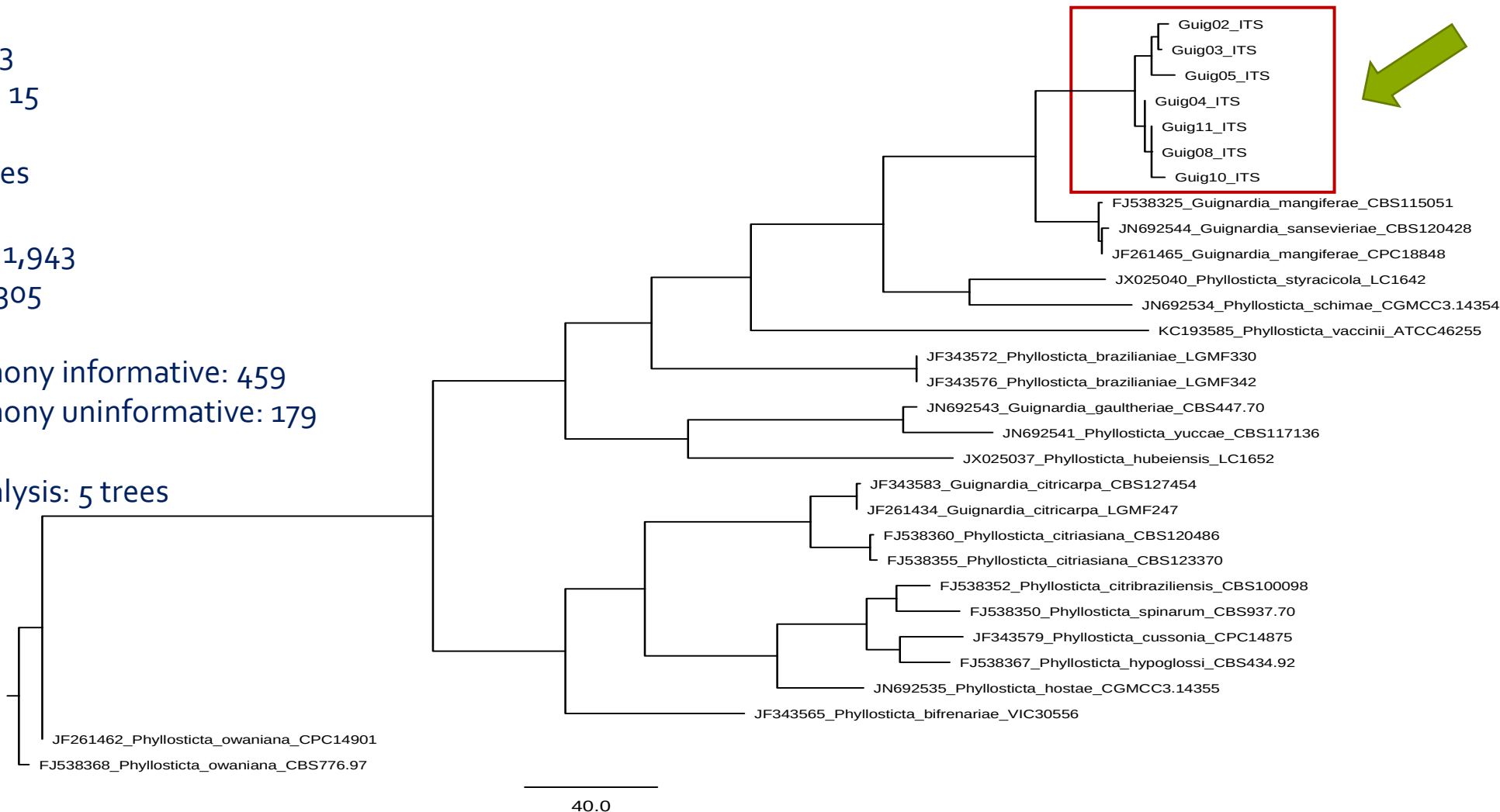
Total: 30 sequences

Total Characters: 1,943

- ☐ constant: 1,305
- ☐ variable:
 - ☐ parsimony informative: 459
 - ☐ parsimony uninformative: 179

Parsimonious analysis: 5 trees

- ☐ TL: 1298
- ☐ CI: 0.649
- ☐ RI: 0.810
- ☐ RC: 0.526
- ☐ HI: 0.351



How many fungi do we have?

□ Hawksworth (2001)

- an estimate of 1.5 million species of fungi
- British Isle: 1:6 ratio of vascular plants and fungi
 - Esher Common in Surrey = 1: 7.5
 - Mickleham Down in Surrey = 1:8

The Philippines: Fauna & Flora

Taxonomic Group	Species	Endemic Species	Percent Endemism
Plants	9,253	6,091	65.8
Mammals	167	102	61.1
Birds	535	186	34.8
Reptiles	237	160	67.5
Amphibians	89	76	85.4
Freshwater Fishes	281	67	23.8

1 Plant : 6 Fungi = 36,000 species

The **PhilFUB** Project:

Exploring

Philippine

Fungal

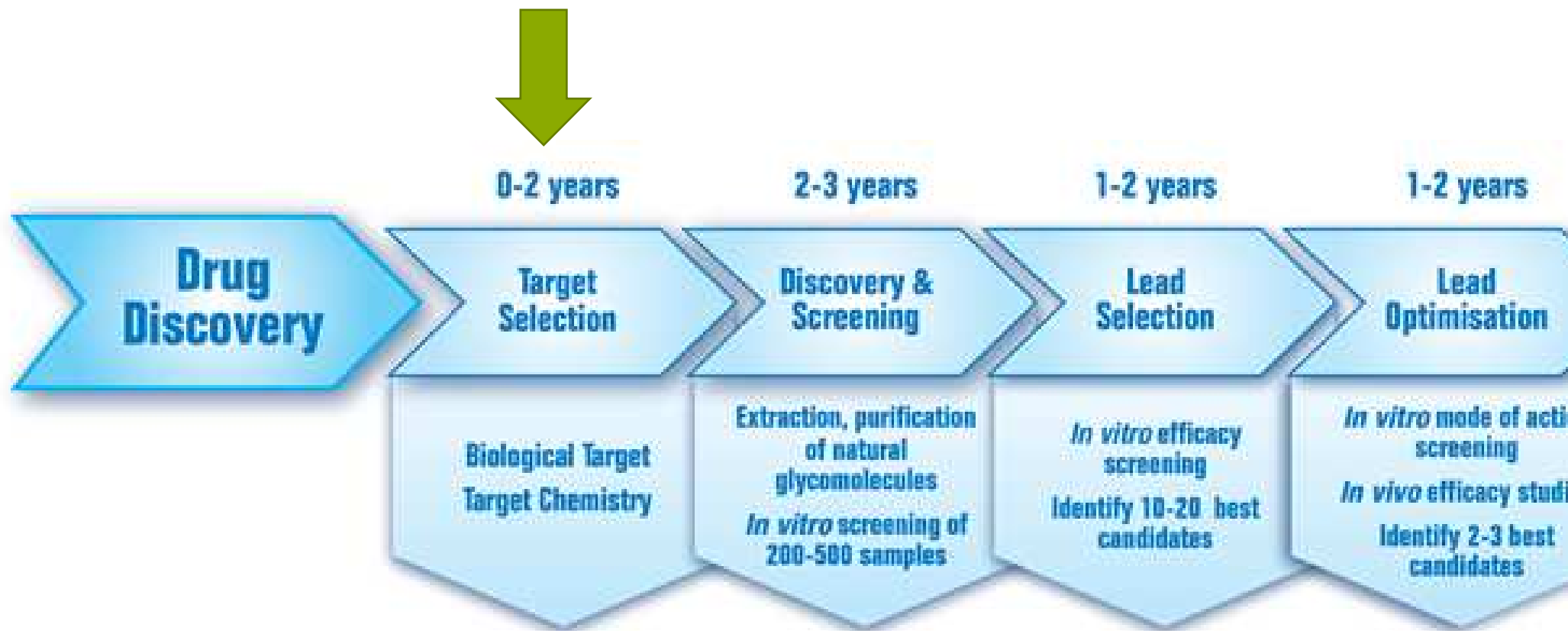
Biodiversity

for the Filipino Community

What we can offer for the **Network**?

- ✓ Unique **Fungi**: Exciting **Biodiversity**
- ✓ A pool of talented **graduate students** and **faculty researchers**
- ✓ Platform for **Basic Research**
- ✓ Enthusiasm for **Collaborative Research**

The Road to **DRUG DISCOVERY**

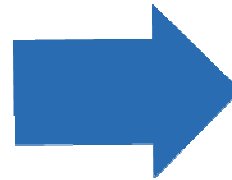


What we need from the **Network**?

- ✓ Trainings for **Capacity Building**
- ✓ Facilities for **Advanced/Applied Research**
- ✓ Comparative **Biodiversity** Studies
- ✓ Joint-Research **Collaborations** and **Publications**

A model solution:

University of Greifswald
University of Hamburg
University of Arkansas



- Nikki Dagamac
- Michael Solis
- Jeremy Torres
- Sittie Macabago

University of Santo Tomas

- Host University for Initial/Some Phases of Research Project
- Joint PhD Supervisorship



Maraming Salamat Po!

