

Challenges in the New Millennium for Science and Technology



NATIONAL ACADEMY OF SCIENCE AND TECHNOLOGY
22nd Annual Scientific Meeting
5-6 July 2000, Manila Hotel



NATIONAL ACADEMY OF SCIENCE AND TECHNOLOGY

22nd Annual Scientific Meeting

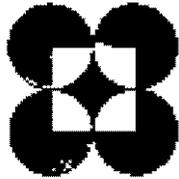
"Challenges in the New Millennium for Science and Technology"

*5-6 July 2000
Manila Hotel
One Rizal Park, Manila*

TABLE OF CONTENTS

	Page
✧ Messages	1
✧ NAST History	4
✧ NAST Mandates and Functions	5
✧ Objectives of the Annual Scientific Meeting	5
✧ Program	6
✧ NAST Awardees	13
✧ Abstracts of Technical Oral Papers by Division	26
<i>Mathematical, Physical, and Engineering Sciences</i>	26
<i>Biological Sciences</i>	30
<i>Agricultural Sciences</i>	34
<i>Health Sciences</i>	37
<i>Social Sciences</i>	44
✧ Abstracts of Technical Poster Papers by Division	49
<i>Mathematical, Physical, and Engineering Sciences</i>	49
<i>Biological Sciences</i>	67
<i>Agricultural Sciences</i>	92
<i>Health Sciences</i>	134
<i>Social Sciences</i>	143
✧ NAST 21 st Annual Scientific Meeting (1999)	145
✧ NAST Executive Council and Secretariat	152
✧ Members of NAST (1978-2000)	153
✧ Outstanding Young Scientists (1980-2000)	155

MESSAGES



Department of Science and Technology



I would like to extend my warmest congratulations to the National Academy of Science and Technology (NAST) for successfully organizing its 22nd Annual Scientific Meeting (ASM).

For more than two decades, the Academy has continuously led the country's most authoritative public forum on science and technology through its Annual Scientific Meeting.

Since NAST started its first ASM in 1979, it has become a continuing venue for discussion of the country's pressing issues and concerns on S&T. It has also provided an opportunity for scientists here and abroad to exchange views on recent scientific and technological advances based on their respective country experiences.

For the first year of the new millennium, the ASM has for its theme "*Challenges in the New Millennium for Science and Technology*." I hope that as in previous conventions, the 22nd ASM will see a dynamic exchange of ideas as participants resolve issues in health care, environmental and climatic changes, transportation and traffic management, information and communications technology, and modern biotechnology in agriculture.

I wish the National Academy of Science and Technology a fruitful 22nd Annual Meeting.

Dr. Filemon A. Uriarte, Jr.
Secretary





National Academy of Science and Technology

The new millennium brings before us many challenges that we have to address effectively and efficiently. The emerging and re-emerging problems and concerns on health, environment, and climatic changes require immediate and appropriate action and policies.

The traffic and transportation situations in the country, especially in Metro Manila, are becoming increasingly serious and need special attention and implementable solutions.

With the advancement in and accessibility to information and communications technology (ICT), a new kind of economy surfaces in which knowledge plays a vital role in the creation of wealth of the country. We should properly address the issues and concerns in ICT if we are to survive and prosper in the highly competitive twenty-first century.

The controversial yet very important concerns on biotechnology and genetic engineering have to be approached scientifically.

As the government's highest advisory body on science and technology, the Academy has the responsibility of advising our decision and policy makers on all the vital concerns mentioned. I am pleased that the public and many experts in different scientific fields are interested to participate in this very important event. I hope we can put all our bright ideas together to come up with resolutions that would best serve our country and the whole of humanity.

To the winners of NAST Awards, I would like to extend my warmest congratulations. Continue to aspire for greater scientific advancement in your chosen fields.

Welcome to the NAST 22nd Annual Scientific Meeting!


Acad. Perla D. Santos Ocampo, M.D.
President





National Academy of Science and Technology



I am honored to be given the task of organizing the National Academy of Science and Technology's (NAST) 22nd Annual Scientific Meeting. With the theme "*Challenges in the New Millennium for Science and Technology*", the Academy will tackle issues on health and environment; climate and environment changes; transportation and traffic management; information and communications technology; and modern biotechnology in agriculture.

An integral part of the Annual Scientific Meeting is the poster and simultaneous oral presentations of technical papers in different scientific fields. This year, the total number of posters to be exhibited during the two-day meeting is 135. A total of 29 technical papers will be presented orally (six for mathematical, physical, and engineering sciences; five for biological sciences; five for social sciences; five for agricultural sciences; and eight for health sciences).

The NAST ASM is not only a scientific forum, but also a venue to recognize the outstanding achievements of Filipino scientists in science and technology. As the highest recognition body of the government on science and technology, the Academy will hold its awarding ceremonies in the afternoon of 6 July.

At the end of the ASM, the Academy will all come out with appropriate resolutions for implementation.


Acd. Jose O. Juliano, Ph.D.
Chair, ASM Steering Committee



NAST History

The National Academy of Science and Technology (NAST) originated as the brainchild of several scientists in the University of the Philippines Diliman. Among the notable members of this small group were Dr. Joventino D. Soriano, a cytogeneticist; Dr. Gregorio T. Velasquez, a phycologist; his wife, Dr. Carmen G. Velasquez, a parasitologist; Dr. Edgardo Gomez, a marine biologist; Dr. Edito Garcia, a public health specialist.

After a series of impromptu meetings held at the UP Institute of Small-Scale Industries, the task of preparing a formal proposal for a science academy was assigned to Dr. Soriano. In May 1976, the proposal was submitted to Dr. Melecio S. Magno, who had been appointed Chairman of the NSDB with Cabinet rank. Chairman Magno fully endorsed the plan for a government-funded academy of science.

On October 6, 1976, a presidential decree creating the National Academy of Sciences was signed by President Ferdinand E. Marcos (P.D. 1003). However, it was only on December 17, 1976 that the enabling legislation was promulgated by President Marcos and endorsed **Presidential Decree No. 1003-A**, "*Creating the National Academy of Science and Technology*". The two decrees—P.D. 1003 and P.D. 1003-A—were basically the same except for the title and the expanded membership. However, P.D. 1003-A came to be known as the enabling legislation that started the Academy. NAST has been mandated to recognize outstanding achievements in science and technology and to serve as a reservoir of competent scientific and technological manpower for the country.

In 1982, through **Executive Order 818**, the Academy was also formally charged with the function of advisory body of the President of the Republic of the Philippines and the Cabinet on policies concerning science and technology in the country.

Advisory Function. In any nation, the science academy plays an important role as an adviser to the government and the science community. It is the body that the government turns to for disinterested advice on science and technology. The Academy, through its advisory activities, addresses issues and concerns on S&T at national and local levels. *Suggestions on S&T issues and concerns for roundtable discussions are welcome, but subject to final decision of the NAST Executive Council.*

Recognition Function. The Academy recognizes outstanding achievements in science and technology, primarily those made by Filipino scientists in all fields of science. Along with this, the Academy provides meaningful incentives to those engaged or would like to engage in scientific and technological endeavors.

Deadline for submission of nominations is on the last working day of November.



Scientific Linkages. As early as 1978, the Academy started forging international and national scientific linkages with other science, engineering, and technology academies and similar organizations. Written in the NAST policy objectives is the commitment on international and national linkage aimed at: (1) promoting collaborative efforts among Filipino scientists, and between Filipino and foreign scientists; (2) promoting and encouraging scientific cooperation through Scientists Exchange Visit Program under the memorandum of agreement between NAST and a foreign science academy; (3) endorsing participation in international conferences, meetings, fora, seminars, workshops, and similar scientific activities; and (4) publishing and exchanging scientific literatures. *Scientists can avail of various grants for scientific and technological undertakings, including fellowships, research grants, study visits, and grants for other possible collaborative projects.*

NAST Mandates

1. To recognize outstanding achievements in science and technology as well as provide meaningful incentives to those engaged in scientific and technological researches (P.D. 1003-A).
2. To advise the President and the Cabinet on matters related to science and technology (E.O. 818).
3. To engage in projects and programs designed to recognize outstanding achievements in science and promote scientific productivity (E.O. 818).
4. To embark on programs traditionally and internationally expected of an academy of science (E.O. 818).

NAST Functions

1. Recognition of outstanding achievements in science and technology.
2. Provision of meaningful incentives to National Scientists/Academicians engaged in research.
3. Promotion of scientific productivity.
4. Promotion and improvement of scientific climate in the country through advisory activities.
5. Establishment of international linkages.
6. Promotion of awareness in science and technology.

Objectives of the Annual Scientific Meeting

1. To serve as a venue for exchange of ideas on relevant and timely issues and concerns on science and technology among the Academicians, other local and foreign scientists, policy and decision makers, and the public.
2. To serve as a forum for the presentation and discussion of latest advancements in science and technology.



P R O G R A M

05 July (Day 1), MORNING

8:00 - 9:00 **REGISTRATION**

9:00 - 9:45 **OPENING CEREMONIES** (Polkabal Ballroom)

Entry of Colors UP Manila Rayadillo

Doxology FNRI Choir

National Anthem FNRI Choir

Welcome Address **Academician Perla D. Santos Ocampo**
President, National Academy of Science
and Technology

Opening Remarks **Dr. Filemon A. Uriarte, Jr.**
Secretary, Department of Science and Technology

Musical Number FNRI Choir

*Introduction of the
Keynote Speaker* **Academician Apolinario D. Nazarea**
Vice-Chair, ASM Program Committee

Keynote Address **Academician Onofre D. Corpuz**
Professor Emeritus
University of the Philippines Diliman

9:45 - 10:15 **OPENING OF POSTER SESSION** (Pandango Ballroom)

Ribbon Cutting **Honorable Filemon A. Uriarte, Jr.**
Academician Perla D. Santos Ocampo

Master of Ceremonies
Academician Jose O. Juliano
Secretary, NAST



PLENARY SESSIONS (Open Forum follows after each session) (Polkabal Ballroom)

10:15 - 11:15 PLENARY SESSION I - "ENVIRONMENT AND HEALTH"

DRUG AVAILABILITY/ACCESSIBILITY-IMPACT ON HEALTH

- Speaker* : **Dr. William D. Torres**
Director, Bureau of Food and Drugs
- Moderator* : **Academician Quintin L. Kintanar**
Member, National Academy of Science and Technology
- Rapporteur* : **Dr. Carmelo A. Alfiler (OYS 1982)**
College of Medicine, University of the Philippines Manila

11:15 - 1:00 LUNCHEON MEETING (Centennial Hall)

- Guest Speaker* : **Hon. Edgardo J. Angara**
Secretary, Department of Agriculture
- Emcee* : **Academician Ruben L. Villareal**
Vice President, National Academy of Science and Technology
- Rapporteur* : **Dr. Rhodora R. Aldemita (OYS 1997)**
Philippine Rice Research Institute

AFTERNOON

1:00 - 2:00 PLENARY SESSION II - "CLIMATIC AND ENVIRONMENTAL CHANGES"

**THE DETECTION OF CLIMATE AND ENVIRONMENTAL CHANGES
FROM SATELLITE AND IN SITU OBSERVATIONS**

- Speaker* : **Dr. Josefino C. Comiso**
Senior Research Scientist
NASA Goddard Space Flight Center, U.S.A.
- Moderator* : **Academician Lourdes J. Cruz**
Marine Science Institute
University of the Philippines Diliman
- Rapporteur* : **Dr. Porfirio Alexander M. Aliño (OYS 1993)**
Marine Science Institute
University of the Philippines Diliman



2:00 - 3:00 **PLENARY SESSION III - "TRANSPORTATION AND TRAFFIC MANAGEMENT"**

**A LOOK AT THE TRANSPORTATION SITUATION IN METRO MANILA
AND MITIGATING MEASURES TO ALLEVIATE THE IMPACTS OF TRAFFIC**

- Speaker* : **Dr. Hussein S. Lidasan**
Director, National Center for Transportation Studies
University of the Philippines Diliman
- Moderator* : **National Scientist Gelia T. Castillo**
Member, National Academy of Science and Technology
- Rapporteur* : **Dr. Angelina M. Bacala (OYS 1993)**
Mindanao State University–Iligan Institute of Technology

3:00 - 4:00 **PLENARY SESSION IV - "INFORMATION AND COMMUNICATIONS
TECHNOLOGY"**

- Speaker* : **Mr. Ramon Dimacali**
IBM Philippines
- Moderator* : **Academician Bienvenido F. Nebres, S.J.**
President, Ateneo de Manila University
- Rapporteur* : **Dr. Eliezer A. Albacea (OYS 1996)**
Institute of Computer Science
University of the Philippines Los Baños

4:00 - 5:00 **PLENARY SESSION V - "MODERN BIOTECHNOLOGY IN
AGRICULTURE"**

SUSTAINABLY PRODUCTIVE AGRICULTURE WITH GENETICALLY MODIFIED CROPS

- Speaker* : **Academician Emil Q. Javier**
Technical Advisory Committee to the Consultative Group
on International Agriculture Research, Rome
- Moderator* : **National Scientist Dolores A. Ramirez**
Member, National Academy of Science and Technology
- Rapporteur* : **Dr. Alicia M. Aguinaldo (OYS 1993)**
Research Center for the Natural Resources
University of Santo Tomas

5:00 - 6:00 **COCKTAIL RECEPTION (NAST members and awardees, PAASE
members, and DOST officials)**



06 JULY (DAY 2), MORNING

8:00 - 8:30 **REGISTRATION**

8:30 - 12:00 **SIMULTANEOUS SCIENTIFIC SESSIONS**

✧ **Mathematical, Physical, and Engineering Sciences** (Mabuhay Palace 2)
(Moderator: Academician Evelyn Mae T. Mendoza)

<u>Time</u>	<u>Speaker</u>	<u>Title of Paper</u>
8:30	Jose Maria P. Balmaceda	Type II Matrices and Spin Models
9:00	Sergio R. Canoy, Jr.	Henstock Integration in a Hilbertian Countably Normed Space with Nuclearity
9:30	Jose Ramon T. Villarin	Construction of a Scanning Lidar System for Boundary Layer Height Measurements
10:00	Rosemarie R. Terio	Measurement of Cosmic Ray Flux in Iligan City
10:30	Eric R. Punzalan	The Metal-Halogen Exchange Reaction and the Rearrangement of Organoalkalis
11:00	Joseph L. Samonte	Encapsulation of Various Heteropolyanions in Artificial Phospholipid Vesicles: Effect of Size, Charge, and Polarity on Encapsulation Efficiency

✧ **Biological Sciences** (Sampaguita Hall)
(Moderator: Academician Salcedo L. Eduardo)

8:30	Merab A. Chan	Influence of Elevated CO ₂ and Photon Flux Density on Growth, Carbohydrate Content, and Survival of <i>Pinus radiata</i> Shoot Cultures Supplied with Varying Sucrose Levels
9:00	Danilo B. Largo	"Ice-Ice" Disease Infection Mechanism in the Red Seaweed <i>Kappaphycus alvarezii</i> Elucidated Using Immunofluorescent Method
9:30	Maynoll D. Montalbo	Isozyme and Morphometric Analyses of Natural Populations of the Asian Honey Bee (<i>Apis cerena</i> FABRICUS) from Different Geographical Areas in the Philippines



- 10:00 Cynthia Palmes-Saloma Neurogenesis and Synaptogenesis in the Mammalian Brain
- 10:30 Jewel Racquel S. Unson Biodegradation of Surfactants (LAS & CFAS) by a Mixed Culture of Indigenous Micro-organisms from Pasig River

❖ **Agricultural Sciences** (Mabuhay Palace 1)
(Moderator: Academician Benito S. Vergara)

- 8:30 Ruben M. Gapasin Antagonistic Plants for the Management of the Rice Root-Knot Nematode, *Meloidogyne graminicola* in Rice-Onion System
- 9:00 Rhodora R. Aldemita Bacterial Blight Resistant and Agronomically Desirable Transgenic IR72 Lines Containing *Xa21* Gene Identified
- 9:30 Dindo Agustin A. Tabanao Estimation of Genetic Relatedness in Rice Using DNA Marker Data
- 10:00 Gina Villegas-Pangga Straw Quality Index (SQI): A Potential Tool in Assessing the Quality of Crop Residue Materials in Crop-Residue Management Systems
- 10:30 Conrado H. Balatero Molecular Tagging of Resistance Genes to *Ralstonia solanocearum* Causing Bacterial in Tomato (*Lycopersicon esculentum* MILL.)

❖ **Health Sciences** (Polkabal Ballroom)
(Moderator: Academician Ernesto O. Domingo)

- 8:30 Vicente Y. Belizario, Jr. A Simple Model for School-Based Intestinal Helminth Control Using Mass Treatment: Preliminary Results of an On-going Study
- 8:55 Shingo Inoue Detection of Chikungunya Virus from Sera of Dengue-Suspected Patients in the Philippines
- 9:20 Ronald R. Matias Co-Infection of Epstein-Barr Virus and Human Papilloma Virus from Biopsies of Patients with Head and Neck Carcinoma
- 9:45 Bernadette L. Ramirez Genetic Variation in in Geographic Isolates of the Philippine Strain of *Schistosoma japonicum*



- 10:10 Edna A. Amparado Invasive Ductal Carcinoma: Search for Filipino Specific Characters
- 10:35 Merlyn S. Mendioro Cytogenetic Effects of Aqueous Bark Extract of Duhat (*Syzygium cumini* L. SKEEL) and Leaf Extract of Periwinkle (*Catharanthus roseus* L.) Medicinal Plants for Diabetes on Human Leucocytes Cultured In Vitro
- 11:00 Jaime C. Montoya Diagnosis of Tuberculous Meningitis Using Enzyme-Linked Immunosorbent Assay Utilizing A 30,000-Dalton Native Antigen of *Mycobacterium tuberculosis*
- 11:25 Cynthia Palmes-Saloma Topical Tretinoin Teratogenesis: Effects on Brain and Craniofacial Development

✧ **Social Sciences** (Sampaguita Salon)
(Moderator: Academician Ledivina V. Cariño)

- 8:30 Rosana Mula Coping with Mother Nature: Households' Livelihood Security and Coping Strategies in a Situation of a Continuing Disaster in Tarlac, Philippines
- 9:00 Fe L. Porciuncula Human Resettlement as an Intervention in Community Development
- 9:30 Lutgarda L. Tolentino Partnering in Agricultural Extension: Is it Possible After All?
- 10:00 Erlyn A. Sana The Social Reproduction of the Medical Profession: The Case of the University of the Philippines-Philippine General Hospital Medical Center
- 10:30 Alfredo V. Lagmay The Filipino Culture Bearer: Epistemic Issues in Philippine Social Psychology
- 12:00 - 1:00 **LUNCH** (Centennial Hall)



12:00 - 1:30 **General Assembly Meeting of the Outstanding Young Scientists, Inc.**
(Centennial Hall)

AFTERNOON

1:30 - 3:30 **CLOSING CEREMONIES** (Polkabal Ballroom)

PROCESSIONAL

PRESENTATION OF NAST AWARDS

- ✧ **BEST POSTERS**
- ✧ **OUTSTANDING SCIENTIFIC PAPERS**
- ✧ **OUTSTANDING BOOKS/MONOGRAPHS**
- ✧ **SPECIAL CITATION FOR SCIENTIFIC JOURNALS**
- ✧ **PHILIPPINE TALENT SEARCH FOR YOUNG SCIENTISTS**
- ✧ **NAST-TWAS SCIENCE PRIZE**
- ✧ **OUTSTANDING YOUNG SCIENTISTS**

to be presented by: **Academician Perla D. Santos Ocampo**
President, NAST

assisted by: **Academician Ruben L. Villareal**
Vice President, NAST
Academician Jose O. Juliano
Secretary, NAST
Academician Quintin L. Quintanar
Chair, Board of Judges, Best Poster Awards

MUSICAL NUMBER

MIRDC Choir

INVESTITURE OF NEW ACADEMICIAN

by: **NAST President Perla D. Santos Ocampo**

assisted by: **NAST Vice President Ruben L. Villareal**

MUSICAL NUMBER

MIRDC Choir

PRESENTATION OF RESOLUTIONS

Academician Ruben L. Villareal
Chairman, Resolutions Committee

EXIT OF COLORS

UP Manila Rayadillo

Master of Ceremonies
Academician Jose O. Juliano
Secretary, NAST





Republic of the Philippines
The National Academy of Science and Technology

presents this

2000 OUTSTANDING SCIENTIFIC PAPER AWARD

to

JOSELITO A. UY

"On the Span of Graphs in the Euclidean n -Space". *Matimyas Matematika* 24(1): 25-32 (1999).

EDANJARLO J. MARQUEZ

"Deep-sea Foraminiferal Distribution of Eastern South China Sea". *Journal of the Geological Society of the Philippines* 54(1 & 2): 19-34 (1999).

**AMELITA J. BARTOLOME
CHRISTINA A. BINAG
FORTUNATO B. SEVILLA III**

"Triacylglycerol Biosensor Based on Conducting Polypyrrole". *KIMIKA* 14(2): 53-59 (1998).

MA. EMMA CONCEPCION D. LIWAG

"What Do Young Children Think About Thinking? Exploring Preschoolers' Understanding of Pag-iisip". *Philippine Journal of Psychology* 32(1): 1-29 (1999).

JEZIE A. ACORDA

"Application of Acupuncture Analgesia in Sheep". *The Philippine Agricultural Scientist* 82(4): 386-409 (1999).





Republic of the Philippines
The National Academy of Science and Technology

presents this

2000 OUTSTANDING BOOK/MONOGRAPH AWARDS

to

**VICENTE Y. BELIZARIO, JR.
JUAN ANTONIO A. SOLON**
(Editors)

Philippine Textbook of Medical Parasitology, ISBN 971-8982-12-4, Published by the University of the Philippines Manila, 1998.

LEONARDO D. DE CASTRO
(Author)

Pagkatao at Teknolohiya: Mga Isyu ng Etika sa Makabagong Medisina, ISBN 971-8781-89-7, Published by the Sentro ng Wikang Filipino, Sistema ng Unibersidad ng Pilipinas, Quezon City, 1998.

**ALLAN BENEDICT I. BERNARDO
MARIANO R. STO. DOMINGO
EDITH LIANE F. PEÑA**
(Authors)

Cognitive Consequences of Literacy: Studies on Thinking in Five Filipino Communities, ISBN 971-8797-70-X, Published by the UP Educational Research Program and DECS-Bureau of Nonformal Education, Quezon City, 1995.



**PANFILO G. DE GUZMAN
MARIECHEL J. NAVARRO
AGNES R. CHUPUNGCO
LIBORIO S. CABANILLA
AGNES C. ROLA**

(Authors)

Agricultural Biotechnology: Priorities and Policies in the Philippine Setting, ISBN 971-547-161-7, Published by the Institute of Strategic Planning and Policy Studies, College of Public Affairs, University of the Philippines Los Baños, Laguna, 1999.

**CORAZON A. NGELANGEL
MARIO R. FESTIN
BENIGNO F. AGBAYANI
JUANITO S. JAVIER**

(Editors)

PG.H. Handbook on Medical Research, Published by the Philippine General Hospital, Manila, 1997.





Republic of the Philippines
The National Academy of Science and Technology

presents this

**SPECIAL CITATION FOR A
JOURNAL AWARD**

to

**THE PHILIPPINE PEDIATRICS
SOCIETY, INC.**

for the publication of

The Philippine Journal of Pediatrics, 1998-1999 Issues.

**CROP SCIENCE SOCIETY
OF THE PHILIPPINES**

for the publication of

The Philippine Journal of Crop Science, Volume 23 (1): 1-63 (1998).



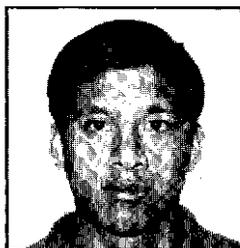


Republic of the Philippines
The National Academy of Science and Technology

presents this

2000 PHILIPPINE TALENT SEARCH FOR YOUNG SCIENTISTS

to



RICARDO C.H. DEL ROSARIO, Ph.D.

(Applied Mathematics)
FIRST PRIZE

In recognition of his outstanding scientific research in the LQR control of thin shell dynamic formulation and numerical implementation.



MA. CORAZON A. DE UNGRIA, Ph.D.

(Molecular Biology)
SECOND PRIZE

In recognition of her significant scientific research in the molecular characterization and interstrain variability of pHPS1, a plasmid isolated from the Sydney Strain (SS1) of *Helicobacter pylori*.





RENANDO O. SOLIS, Ph.D.

(Biological Resources)

THIRD PRIZE

In recognition of his significant scientific and technological research in the establishment of alternative gene cloning strategy for rice.



JOCELYN P. REYES, M.S.

(Chemistry)

SPECIAL CITATION

In recognition of her significant research on porous biphasic calcium phosphate ceramic for anophthalmic socket implant.





Republic of the Philippines
The National Academy of Science and Technology

and

The Third World Academy of Science

present this

**2000 NAST-TWAS SCIENCE PRIZE
(Mathematics)**

to



ELIEZER A. ALBACEA, Ph.D.
(Theoretical Computer Science)

In recognition of his significant contributions in the mathematics of algorithms, specifically on the design and analysis of algorithms. The most significant is his discovery of a new sorting algorithm called Leapfrogging Samplesort, and for designing the first optimal parallel algorithms for several graph problems.





Republic of the Philippines
The National Academy of Science and Technology

presents this

2000 OUTSTANDING YOUNG SCIENTIST AWARDS

to



ROBERTO M. MALALUAN

Dr. of Engineering (Chemical Engineering)

In recognition of his pioneering work on rapid hydrolysis of cellulose in supercritical water to recover high value chemicals. His method of converting glucose by reaction with supercritical water to erythrose in as high as 50 wt% has an advantage over other conventional methods and results in comparatively high yield of erythrose. His work on an alternative process for extraction of oil by supercritical CO₂ is considered to overcome negative aspects of the traditional techniques and have a great potential to be commercialized.

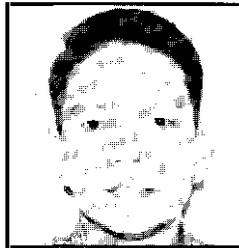


ISHMAEL D. ORDÓÑEZ, Ph.D.

(Chemistry)

In recognition of his contributions in the field of chemistry, particularly his research program at UP Diliman which resulted in the establishment of the Materials Science Research laboratory wherein students can do research at the undergraduate and graduate levels on various topics such as conducting polymers, biosensors, photo catalysis, and rechargeable batteries.





JOSE RAMON T. VILLARIN, Ph.D.

(Atmospheric Physics)

In recognition of his significant contributions in the field of atmospheric physics, specifically his aerosol studies and the differential optical absorption spectroscopy (DOAS) which measures criteria pollutant gases such as SO_2 , NO_x , and tropospheric O_3 . His scientific research on the regular monitoring of particulate matter (10 and 2.5 microns), the most serious pollutant in Metro Manila and his involvement in modeling the transport and distribution of air pollution due to transport in the metropolis have led him to establish a sustainable and state-of-the-art climate research infrastructure within the Manila Observatory, since climate change will be one of the more critical issues of the 21st century.

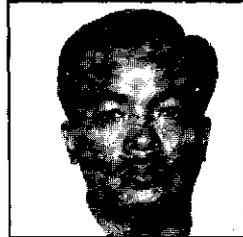


PERRY S. ONG, Ph.D.

(Behavioral Ecology and Evolutionary Biology)

In recognition of his significant contributions to our knowledge and better understanding of the diversity of Philippine wildlife resulting in a greater public awareness and appreciation of the importance of this valuable biological resource in the whole ecosystem. Further, this has drawn the active participation of the academe, private sector, and NGOs towards the management and conservation of our protected areas, including fauna and flora.





IRENEO L. LIT, JR., M.S.
(Entomology)

In recognition of his outstanding contributions in Entomology, particularly on the systematics of scale insects and mealybugs (Coccoidea, Hemiptera) of which he is the leading authority in the Philippines and in Southeast Asia. The information generated from his researches is basic and vital to the control or management of these pests of agronomic, horticultural, and forestry species. His works on the systematics of this group are also of paramount importance in knowing the biodiversity in various islands of the Philippines, the host plants each pest feeds on, and how to recognize them in the field.



FRANCISCO A. MAGNO, Ph.D.
(Political Science)

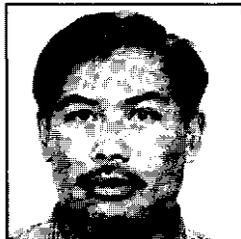
In recognition of his outstanding contributions to scholarship by applying the tools of scientific inquiry in examining the power relations and institutional forces shaping resource conflicts and environmental management systems. Dr. Magno's engagement in the analytical study of issues revolving around the politics of the environment offers not only new insights but also suggests ways on how we manage the earth.





ARNEL N. DEL BARRIO, Ph.D.
(Ruminant Nutrition)

In recognition of his significant contributions not only to the existing body of knowledge in the field of animal science, particularly in ruminant nutrition, but also to the improvement of the carabao gene pool in the country. Dr. del Barrio spearheaded the implementation of the carabao development program in Regions IV and V using the artificial insemination technology.



PABLITO M. MAGDALITA, Ph.D.
(Plant Breeding)

In recognition of his significant contributions in plant breeding, specifically to the development of interspecific hybrids between papaya and its wild relatives to incorporate resistance to the papaya ringspot virus (PRSV); identification of DNA markers in identifying *Carica* series and their hybrids; varietal development and propagation of papaya, guava, pineapple, and chico; genetic transformation for delayed ripening of papaya.





RAFAEL C. BUNDOC, M.D.
(Orthopaedics)

In recognition of his pioneering works and accomplishments as a professor of medicine, clinician, and a scientist. Dr. Bundoc exerted much of his efforts in research in bioengineering and inspired him to take the challenge of locally producing technologies that are otherwise unavailable or unaffordable. Widely adopted by many health institutions are jet-lavage for contaminated wounds, simplified external bone fixation device, among others. The first ever locally made Continuous Passive Motion Machine has been very useful for the rehabilitation of post-trauma, stroke, and arthritic patients. He also discovered the process of replicating human bones, the first local Biochemical, Biomaterial Testing, and Plastination Laboratories.



RICARDO JOSE D. QUINTOS II, M.D.
(Vascular Surgery)

In recognition of his contributions in the field of vascular surgery by demonstrating the art of applying new knowledge obtained from the basic medical sciences to clinical problems. He exemplifies the "physician-scientist-community leader" which the World Health Organization is advocating for. Dr. Quintos' researches which range from the molecular basis of vascular disease to mathematical modeling of perfusion based on biophysical principles, e.g., innovative surgical approaches to limb salvage, gene and antibody therapies, and development of a virtual vascular laboratory using computed fluid design. The development and invention of medical devices for therapeutic purposes reflect his broad comprehension and panoramic approach to the problems of vascular disease and earned him an award from the National Cardiovascular Center in Osaka, Japan for his "arteriovenous flow reversal management of the ischemic limb". He has authored chapters in the latest edition of the specialty textbook - "Rutherford's Textbook of Vascular Surgery".





Republic of the Philippines
The National Academy of Science and Technology

Confers the Rank and Title of

ACADEMICIAN

to



FILEMON A. URIARTE, JR.
Ph.D. (Chemical Engineering)
Carnegie-Mellon University, Pittsburg, Pa.,
U.S.A., 1970

In recognition of his scientific work on the application of the modern theory of flocculation/ aggregation for multicomponent solutions and suspensions and the subsequent engineering applications to environmental pollution control.



*Mathematical, Physical, and
Engineering Sciences*

TYPE II MATRICES AND SPIN MODELS

JOSE MARIA P. BALMACEDA

*Department of Mathematics, College of Science
U.P. Diliman, 1101 Quezon City*

A type II matrix is a square matrix with non-zero complex entries with the property that the sum of the entrywise quotients of any two distinct rows is zero. Hadamard matrices and character tables of finite abelian groups are examples. Spin models from statistical mechanics are Type II matrices satisfying additional conditions and are used to obtain invariants of knots and links in 3-space. For each type II matrix W , a commutative algebra $N(W)$, closed under both ordinary and entry-wise multiplication can be constructed. If W is a spin model, then W itself belongs to $N(W)$.

In this paper, we will consider some type II matrices obtained from a subgroup of the Suzuki simple group $Sz(8)$ and investigate the structure of the corresponding algebra constructed as well as the existence of spin models. For instance, the algebra obtained has the modular invariance property, an important ingredient in the recently introduced theory of codes over finite abelian groups.

Key words: spin models, type II matrices, Bose-Mesner algebra, Suzuki group, modular invariance property



HENSTOCK INTEGRATION IN A HILBERTIAN COUNTABLY NORMED SPACE WITH NUCLEARITY

SERGIO R. CANOY, JR.

*Department of Mathematics
College of Science and Mathematics
MSU-Iligan Institute of Technology
9200 Iligan City*

Henstock integration of real-valued functions had been extended to functions with values in normed spaces. Cao, who considered Banach-valued functions, showed that Henstock's lemma, which plays an important role in the real-valued case, does not always hold in infinite dimensional Banach spaces. Nakanishi showed that Henstock's lemma holds in a ranked space called Hilbertian CN-space with nuclearity. In this paper, we revisit this space, define r -differentiability of a function with values in an r -separated ranked space, and give results concerning the primitives of Henstock integrable functions with values in this space. Further, we shall give a descriptive definition of the Henstock integral defined by Nakanishi.

Key words: Henstock integral, ranked CN-space, Hilbertian nuclearity, r -separated, r -differentiability, HL-integral, strong Lusin

CONSTRUCTION OF A SCANNING LIDAR SYSTEM FOR BOUNDARY LAYER HEIGHT MEASUREMENTS

SUSIE D. DAZA, ANNE AARON COLUMBO ENAJE, JAKE CASTAÑEDA,
and JOHN L. HOLDSWORTH

*Department of Physics and Engineering
Ateneo de Manila University, Loyola Heights, 1108 Quezon City*

GENELITA G. TUBAL

*Environmental Science Program, College of Science
U.P. Diliman, 1101 Quezon City*

JOSE RAMON T. VILLARIN

*National Center for Climate Studies, Manila Observatory
Ateneo de Manila University, Loyola Heights, 1108 Quezon City*

In addition to a variety of molecules, our atmosphere contains a rich brew of particulates and aerosols that exist largely within the lowest part of the atmosphere, the boundary layer. To date, pollution monitoring in Metro Manila is via air volume sampling techniques and does not yield a volume estimation of pollution, nor lend itself to modeling of the airshed. The topic of this paper is the design, development, and construction of an automated scanning LIDAR facility capable of recording a Mie back-scattered signal from the boundary layer particularly the convective mixed layer. The biaxial, vertically-point Mie



Scattering LIDAR system has been changed to a scanner LIDAR system with automated control and data handling. The mechanical set-up allows two rotational axes of freedom and the control system allows two modes of operation. The automated LIDAR system has four major components: the Laser Source, the Motion Devices, the Position Sensors, and the Data Acquisition Devices. The system has been operational in its vertically pointing mode with the automated data acquisition rate of one profile/30 sec to 20 profiles/sec. The LIDAR is capable of triple wavelength operation at 355nm, 529 n, and 1064 of the Nd:YAG laser but most data recorded to date have been obtained using only the 5ns duration, 150ml/pulse, 532nm second harmonic of the Nd:YAG laser. A LabView control and data handling program has been developed which allows automated operation for long measurement periods. Data gathered reveal the variation and dynamics of the convective mixed layer which proves the feasibility of the system.

Key words: scanning LIDAR, boundary layer height

MEASUREMENT OF COSMIC RAY FLUX IN ILIGAN CITY

ROSEMARIE R. TERIO¹, EUFEMIO F. NINOFRANCO²
RUELSON S. SOLIDUM¹, and ANGELINA M. BACALA¹

¹*Department of Physics, MSU-Iligan Institute of Technology, 9200 Iligan City*

²*MSU-General Santos, 9500 General Santos City*

Sea level cosmic ray flux is measured anew in Iligan City using two plastic scintillators of area 100 cm x 10 cm which are stacked vertically by a spacing of 150 cm. Each scintillator is coupled to a Hamamatsu H1161-RB9038 photomultiplier tube to constitute a detection-amplification system. This assembly of detectors is then connected to Nuclear Instrumentation Modules (NIM) to discriminate and count coincident signals over a fixed interval of time.

Standard methods of statistical data analysis are used to interpret recorded coincidence rates to determine nighttime and daytime variations of the cosmic ray flux on per hour basis. The result is then compared to the previous measurements done in the High Energy Physics (HEP) Laboratory and to the standard measurements obtained from the Review of Particle Properties, Physical Review. Results indicated no significant flux variation in daytime and nighttime observations and this closely agreed, as compared, to the previous measurement.

A Monte Carlo simulation is also done in order to further verify the consistency of the experimental set-up used for the measurement of cosmic ray flux. The simulation establishes agreement between the measured and estimated results. Persistent acquisition of coincidence rates is carried through the months of August and September by the year 1999 at the MSU-IIT HEP-Laboratory, Iligan City.

Key words: NIM, CAMAC, cosmic ray flux, scintillators



THE METAL-HALOGEN EXCHANGE REACTION AND THE REARRANGEMENT OF ORGANOALKALIS

ERIC R. PUNZALAN

*Chemistry Department, De La Salle University
2401 Taft Avenue, Malate, 1004 Manila*

Early attempts to utilize the metal-halogen exchange reaction for the preparation of primary alkyllithiums have, with a few notable exceptions, met with little success owing to the reversible nature of the exchange and the capricious behavior of alkyl halides when treated with an alkyllithium. Competing reactions such as β -elimination, α -metallation and Wurtz-type coupling further complicate the exchange reaction. Recent developments, however, have shown that these difficulties may be avoided under appropriate conditions. Primary alkyllithiums may be prepared in good to excellent yields by using primary alkyl iodides (not bromides or chlorides) and a highly reactive alkyllithium such as *t*-butyllithium and the exchange done at low temperatures.

Unsaturated organolithiums, on the other hand, were found to undergo facile isomerization into cyclic products. This is particularly easy for 5-hexenyllithiums where there is a 5-bond separation between the lithium atom and the double bond system.

In this paper the development of these methodologies will be presented together with how the metal-halogen exchange reaction was used to prepare unsaturated organolithiums capable of isomerization to interesting molecular frameworks. The synthetic utility of the process will also be discussed.

Key words: organoalkalis, organolithium, lithium-halogen exchange, cyclization, TMEDA, PMDTAA, first-order kinetics, super-bases, 5-exo-trig, isomerization

ENCAPSULATION OF VARIOUS HETEROPOLYANIONS IN ARTIFICIAL PHOSPHOLIPID VESICLES: EFFECT OF SIZE, CHARGE, AND POLARITY ON ENCAPSULATION EFFICIENCY

JOSEPH L. SAMONTE

*Physical Sciences Department
De La Salle University - Dasmariñas
Dasmariñas, 4114 Cavite*

active research work is presently being conducted on the medical applications of heteropolyanions. Studies have shown that polyoxometalates exhibit selective enzyme inhibition, *in vitro* and *in vivo* antitumoral activity, and anti-AIDS activity. Although several types have been screened *in vitro* and to some extent *in vivo*, many questions regarding toxicity, stability, and delivery remains. This research work is aimed at exploring some ways in which heteropolyanions, stable at physiological pH, might be modified to enhance lipid solubility.



A procedure for the encapsulation of heteropolyanions in artificial phospholipid vesicles was developed. Vesicles with encapsulated heteropolyanions were found to be some 10-fold larger than "empty" vesicles. X-ray microprobe analysis and adsorption studies verified that the heteropolyanions were associated with the vesicles and not with the liquid medium.

The relative fraction of dissolved heteropolyanions that was encapsulated (3-18% under standardized conditions) increased as the surface charge density decreased, e.g., from $[\text{CoW}_{12}\text{O}_{40}]^{6-}$ to $[\text{P}_2\text{W}_{18}\text{O}_{62}]^{6-}$.

Further, heteropolyanions possessing distinct organic regions on their surfaces, such as $\{(\text{BuSn})_3(\text{P}_2\text{W}_{15}\text{O}_{59})\}^{\ominus}$, had much higher encapsulation levels than expected from their charge to volume ratios.

Key words: encapsulation, vesicle, heteropolyanion, size, charge, polarity, phospholipid vesicles, anti-tumor, anti-AIDS, X-ray microprobe analysis

Biological Sciences

INFLUENCE OF ELEVATED CO₂, AND PHOTON FLUX DENSITY ON GROWTH, CARBOHYDRATE CONTENT, AND SURVIVAL OF *Pinus radiata* SHOOT CULTURES SUPPLIED WITH VARYING SUCROSE LEVELS

MERAB A. CHAN¹ and JANN CONROY²

¹Department of Biology, Ateneo de Manila University,
Loyola Heights, 1108 Quezon City

²Faculty of Horticulture, University of Western Sydney
Hawkesbury, New South Wales, Australia

The observation that sucrose supply increased growth, despite the presence of CO₂ in the headspace during the light period and provision of higher PFD, indicated that carbohydrates were limiting at 350 μL CO₂ L⁻¹. Hence, in the present study, CO₂ in the headspace was enriched to investigate whether sucrose could be eliminated from the media and fully autotrophic *Pinus radiata* plants produced in vitro. In the first experiment, sucrose was supplied at 0.3 and 6% at a PFD of 150 mmol m⁻²s⁻¹. Dry matter production and shoot height were greatly enhanced by CO₂ enrichment at all sucrose levels indicating that CO₂ enhances autotrophy. In addition, vitrified shoots were never observed at 2,000 mL CO₂ L⁻¹ and the number of senescent shoots was reduced. Increasing the sucrose supply from 0 to 3% stimulated growth even at elevated CO₂. On the assumption that more photosynthetic reducing power may have been required to fully develop autotrophy, the PFD was raised to 280 μmol m⁻²s⁻¹ in the second experiment and sucrose was supplied as in the first experiment. Substantial improvement of growth was achieved with a combination of high PFD and elevated CO₂ showing that these factors could partially substitute for an external sucrose supply. Maximum growth was achieved at 6% sucrose, 280 mmol photons m⁻²s⁻¹ and 2,000 mL CO₂ L⁻¹. The requirement for extra sucrose was observed



despite a large accumulation of starch at high CO₂. Although the reason for this starch accumulation is unknown, it may prove beneficial at planting out.

Key words: *Pinus radiata*, vitrification, photon flux density, CO₂, autotrophy, in vitro, sucrose, senescent, shoot culture

“ICE-ICE” DISEASE INFECTION MECHANISM IN THE RED SEAWEED *Kappaphycus alvarezii* ELUCIDATED USING IMMUNOFLUORESCENT METHOD

DANILO B. LARGO^{1,2}, KIMIO FUKAMI², and TOSHITAKA NISHIJIMA²

¹Department of Biology, University of San Carlos, 6000 Cebu City

²Laboratory of Aquatic Environmental Science, Faculty of Agriculture,
Kochi University, Otsu 200, Monobe, Nankoku-shi, Kochi 783-8025, Japan

The red macroalga *Kappaphycus alvarezii* (Gigartinales, Rhodophyta) is widely cultivated in southeast Asia, mainly the Philippines, for the important phycocolloid, carrageenan. The so-called 'ice-ice' disease has been affecting the seaweed crops, since the beginning of commercial farming in the early 1970s, often wiping out entire farms. It is suspected to be mainly caused by microbial pathogens after the plants are stressed by certain environmental factors. Extremes in temperature, salinity, and irradiance, were previously found to trigger the disease. The role of pathogenic bacteria was also investigated and two strains were found, namely *Vibrio* sp. P11 and *Cytophaga* sp. P25, to promote the disease early under controlled laboratory conditions. The mechanism of infection by *Vibrio* sp. P11 was investigated in vitro using a combined application of the fluorescent stains, 4', 6-diamidino-2-phenylindole (DAPI) and the P11 Pabs, into a homogenized seaweed sample (<1 g wet wt), which is pre-diluted to make bacteria countable under an epifluorescence microscope without serious interference from autofluorescing algal debris. The algal tissue homogenate is then filtered through a 0.2- μ m-pore size Nuclepore membrane filter, serving as mounting pad, and viewed using alternating UV and IB excitation filters to detect total and specific bacteria, respectively, on the same microscopic field, at the same time. Time-series infection experiments using the quantitative enumeration method revealed that this bacterium has a high affinity for the seaweed especially when the latter is stressed. The pathogen promotes the disease after a rapid increase in cell density of up to 10⁷ g⁻¹ (wet wt) in the first 24 h. This bacterial cell build-up may take only 1 - 2 h on stressed thalli, but takes about 24 h on non-stressed thalli. Build-up is not sustainable in non-stressed thalli as high density is usually followed by a sudden decline in cell number believed to result from an algal defense against potential pathogens. Inoculation of the bacterium on thalli incubated in continuous culture system extends the time of bacterial attachment due to laminar flow and, possibly, competition by already existing bacteria on the seaweed surface and in ambient seawater medium. Motility-driven cell attachment by this bacterium is suggested as an important factor for infection. The findings are important considerations in the management of the seaweed crop during culture to prevent the occurrence of 'ice-ice' disease.

Key words: DAPI, *Eucheuma*, ice-ice disease, immunofluorescent method, *Kappaphycus*, Philippines, membrane filtration method, polyclonal antibodies, *Vibrio* sp. P11



ISOZYME AND MORPHOMETRIC ANALYSES OF NATURAL POPULATIONS OF THE ASIAN HONEY BEE (*Apis cerana* FABRICIUS) FROM DIFFERENT GEOGRAPHICAL AREAS IN THE PHILIPPINES

MAYNOLL D. MONTALBO, RITA P. LAUDE, and ROSALINA N. TANDANG

*Institute of Biological Science, College of Arts and Sciences
U.P. Los Baños, College, 4031 Laguna*

Honey bees are important in the worldwide economy due to hive products such as honey, so that there is a need for the identification of variations in populations to aid in possible breeding experiments. Isozyme and morphological variability in natural populations of the Asian honey bee, *Apis cerana* F. from three different geographical areas in the Philippines designated as, Area I (Batangas, Cavite, and Bay, Laguna), Area II (Cagayan de Oro), and Area III (Bicol), were detected using starch-gel electrophoresis and morphometric analysis. Isozyme analysis revealed polymorphism in four enzymes encoded by 13 presumptive loci: four isoloci for alkaline phosphatase; three for acid phosphatase; four for esterase; and two for malate dehydrogenase. ALPH-2 of Area III and MDH-2 of Area I exhibited monomorphism. From the 13 presumptive loci in the Area I population, 8 were detected in the Area II, and 7 in the Area III. In terms of the presumptive allelozymes, EST-4 was controlled by two autosomal codominant alleles, S (slow) and F (fast) and MDH-2 by 1 allele, S. The rest of the loci were governed by three alleles namely, S, M (moderate), and F. Based on the proportion of polymorphic loci (P) and average heterozygosity (H), genetic variability was highest for the Area II population. Populations from Area I and Area III showed low genetic and genotypic identities and high genetic distance suggesting the occurrence of a possible mechanism of subspeciation. A dendrogram based on gene frequencies showed the distinctness of the Area I bees. Morphometrics using the Principal Component Analysis (PCA) of the 31 characters (composed of 11 wing venation angles, 15 size-related variables, and 5 secondary parameters) yielded three possible clusters of bees namely: Bicol; Cagayan de Oro; Batangas + Cavite; and Bay. Discriminant Analysis of the grouping resulted in 100% correct classification and confirmed the pre-assigned clusters. The Cagayan de Oro population had the highest measurements for most of the size-related characters while the Bicol population had the lowest. Analysis of variance (ANOVA) of the variables showed significant homogeneity in the most of the wing venation angles and variation in most of the size-related variables. A dendrogram of the clusters showed two major branches, one composed of the Area I and the Cagayan de Oro populations and another composed of the very distinct Bicol population. The isozyme and morphometric analyses of *Apis cerana* consistently showed considerable distance between populations from Area I and Area III. However, the Area II population cannot be distinguished as a cluster separate from the Area I and Area III populations. The Batangas + Cavite subgroup in the Area I population in the morphometric analysis is not supported by the isozyme analysis due to small sample size.

Key words: *Apis cerana* F., isozyme(isoenzyme), allelozyme, starch-gel electrophoresis, morphometrics, alkaline phosphatase, acid phosphatase, esterase, malate dehydrogenase, dendrogram



NEUROGENESIS AND SYNAPTOGENESIS IN THE MAMMALIAN BRAIN

CYNTHIA PALMES-SALOMA¹ and KONOSUKE KUMAKURA²

*¹Neurobiology Research Group
National Institute of Molecular Biology and Biotechnology
U.P. Diliman, 1101 Quezon City*

²Sophia University, Tokyo, JAPAN

The development of an organism follows a complex interplay of several processes including cell division, migration, differentiation, growth, and death. During neurogenesis, the birth of a neuron from a precursor cell is considered as the time when the latter undergoes its last mitosis. Neurons in the central nervous system, in contrast to the peripheral nervous system, do not undergo substantial migration as well as variability in their "birthdays". During mouse ontogeny, the precise timing and mechanism of synapse formation as neurons is thought to be facilitated by the release of neurotransmitters at the synapse. This process involves a well-regulated sequence of vesicle priming, recruitment, and trafficking leading to the docking and fusion of the vesicular membrane with the plasmalemma and ultimately, to neurotransmitter exocytosis. We used confocal laser microscope imaging and image reconstruction of postgastrulation mouse embryos double-stained with either neuron or neuron-precursor specific antibodies and antibodies against vesicular (v-SNAREs) and plasmalemmal (t-SNAREs) proteins to analyze the development of neuronal connections and the localization of SNAREs during early neurogenesis. Our results reveal that synaptosomal and plasmalemmal proteins are expressed much earlier than previously thought and that they are widely distributed in the brain. These suggest that the basic mechanisms for neuron to neuron interaction are present very early in development and that they have already been laid out long before axons reach their final target tissues.

Key words: neuron, synapse, neurogenesis, synaptogenesis, CNS, neurotransmitters, axons, synaptic vesicle, SNARE proteins

BIODEGRADATION OF SURFACTANTS (LAS and CFAS) BY A MIXED CULTURE OF INDIGENOUS MICROORGANISMS FROM PASIG RIVER

JEWEL RACQUEL S. UNSON¹, CRISTINA DANCEL², and FABIAN M. DAYRIT^{1,2}

*¹Environmental Science Program and ²Department of Chemistry
Ateneo de Manila University, Loyola Heights, 1108 Quezon City*

Knowledge of the biodegradation process of cocofatty alcohol sulfate (CFAS) and liner alkylbenzene sulfonates (LAS) can be used to help address the question of the impact of surfactants on water quality. The primary biodegradation profiles of CFAS and LAS were studied under aerobic conditions using indigenous microorganisms collected from the Pasig River. The bacteria from Pasig River water were grown and maintained at room temperature using commercial LAS or CFAS as the sole carbon source. The primary biodegradation experiments were performed with inocula from this enrichment flask. The aliquots from the biodegradation solution were worked up using solid phase extraction and



the extracts were analyzed using negative ion mode Electrospray Ionization-Mass Spectrometry (neg ESI-MS).

CFAS showed primary biodegradation under aerobic conditions of seven hours using the enriched indigenous bacterial culture. Studies on the biodegradation of LAS in aerobic conditions indicated that it has a primary degradation time of two days.

Key words: surfactants, LAS, CFAS, biodegradation

Agricultural Sciences

ANTAGONISTIC PLANTS FOR THE MANAGEMENT OF THE RICE ROOT-KNOT NEMATODE, *Meloidogyne graminicola*, IN A RICE-ONION SYSTEM

RUBEN M. GAPASIN¹, EVELYN B. GERGON², SALLY MILLER³,
and CARLITO V. RANCHEZ¹

¹Department of Plant Protection
Visayas State College of Agriculture, Baybay, 6521 A Leyte

²Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija

³Ohio State University, Ohio, U.S.A.

A microplot experiment with the following treatments: *Tagetes* sp., two species of *Crotalaria* (*C. incana* and *C. mucronata*), rice, and fallow, was conducted to determine the effects of *Tagetes* and *Crotalaria* plants on the population and development of the rice root-knot nematode, *Meloidogyne graminicola*. In the two trials conducted, it was observed that no galls were formed on the roots of *Tagetes* and *Crotalaria* plants 60 and 90 days after soil infestation. The rice plants however, had a mean root gall of 305.70 at harvest (90 days). Onion growth on the plots planted previously with *Tagetes* and *Crotalaria* did not show root gall formation. However, gall formation was observed in onion planted in microplots previously planted with rice. This suggests the efficacy of *Tagetes* and *Crotalaria* as antagonists to *M. graminicola*. Onions planted after *Tagetes* and *Crotalaria* had higher fresh weight than onions planted after rice and fallow treatments. This could be due to the nematode control and to the added fertility when the biomass of these plants was incorporated in the soil before onion was planted. These results showed that planting *Tagetes* sp. or *Crotalaria* spp. in nematode-infested soil is feasible in managing the rice root-knot nematode and could increase yield of onion.

Key words: *Meloidogyne graminicola*, *Tagetes* sp., *Crotalaria incana*, *C. mucronata*, yellow granex, onion.



BACTERIAL BLIGHT RESISTANT AND AGRONOMICALLY DESIRABLE TRANSGENIC IR72 LINES CONTAINING Xa21 GENE IDENTIFIED

LAVERNEE S. GUECO¹, GLENN Y. ILAR¹, ELEANOR S. AVELLANOZA¹,
ZHANG SHIPING², CLAUDE FAUQUET², and RHODORA R. ALDEMITA¹

¹*Philippine Rice Research Institute, Maligaya, Muñoz, 3119 Nueva Ecija*

²*ILTAB, Scripps Institute, La Jolla, San Diego, California 92037, USA*

T4 generation of transgenic IR72 lines containing Xa21 gene for bacterial blight resistance were evaluated in the screenhouse for their response to 9 races of *Xanthomonas oryzae* pv. *oryzae* and 1 local Maligaya isolate as compared to untransformed IR72; IRBB21, a conventionally bred line with Xa21 gene; and IR24, a susceptible control in dry and wet season evaluations. Inoculation was done at maximum tillering stage following the clipping method and the percent diseased leaf area (% DLA) were measured 14 and 21 days after inoculation. Experiments during the dry and wet season trials revealed that IR24, obtained the highest mean percent DLA as expected. The untransformed IR72 which contain some genes for resistance to Xoo showed an intermediate response, IRBB21, a moderately resistant response, and most of the transgenic lines were resistant to moderately resistant across the lines and races. Race 6 is the most virulent while the Maligaya isolate is the weakest. All the transgenic plants showing resistant phenotypes contain the expected 1.4 kb band corresponding to the Xa21 DNA fragment as analyzed through polymerase chain reaction. Yield component determination revealed that some of the transgenic lines were comparable to the untransformed IR72 such as days to flowering and maturity, percent productive tillers, panicle length, 500 grain weight, and harvest index. However, the untransformed IR72 significantly produced taller plants and higher percentage filled grains as compared to the transgenic plants. IR72-82-3-13-1-19, IR72-82-3-4-1-2, and IR72-82-3-4-1-26 were bacterial blight resistant and possess good agronomic characteristics.

Key words: transgenic lines, *Xanthomonas oryzae*, Xa21 gene, virulence, susceptible, resistant, diseased leaf area, lesion length

ESTIMATION OF GENETIC RELATEDNESS IN RICE USING DNA MARKER DATA

DINDO A. TABANAO¹, A. L. CARPENA², A. D. ANGLACER¹,
L. R. HIPOLITO¹, and LEOCADIO S. SEBASTIAN¹

¹*Philippine Rice Research Institute, Maligaya, Muñoz, 3119 Nueva Ecija*

²*Department of Agronomy, Purdue University, West Lafayette, Indiana*

³*Department of Agronomy, U.P. Los Baños, College, 4031 Laguna*

The classical method of determining the coefficient of coancestry (f_y) between two individuals, that of using pedigree information, is often constrained by unknown parentage histories and bias due to selection. With the availability of DNA profiles, molecular marker-based estimators have been proposed



for many crops in order to circumvent the assumptions that limit pedigree-based estimation. This study aimed to using microsatellite marker data in estimating genetic relatedness in rice. A total of 45 genotypes were chosen for analysis, covering 11 modern varieties and their 34 initial, intermediate, and immediate ancestors. A total of 20 loci, covering 114 alleles, were generated from the microsatellite marker assay. The genetic relatedness computed in all pairwise combinations were obtained using the pedigree-based coancestry definition (f_y), the proportion of shared alleles (S_y), and the marker-based coancestry formula (M_{fy}). The mean values for f_y , S_y , and M_{fy} were 0.1228, 0.3503, and 0.2341, respectively. The f_y mean was the lowest among the three methods clearly because of the numerous pairwise combination that had values equal to 0 due to the fact that they are unrelated, as far as pedigree data can allege. The mean S_y was slightly higher than the mean M_{fy} due to the bias caused by marker alleles that are not identical by descent, but only alike in state. The difference between f_y and M_{fy} would be due largely to the effect of human selection in the choice of alleles for rice genetic improvement.

Keywords: rice, coefficient of coancestry, DNA markers

STRAW QUALITY INDEX (SQI): A POTENTIAL TOOL IN ASSESSING THE QUALITY OF CROP RESIDUE MATERIALS IN CROP-RESIDUE MANAGEMENT SYSTEMS

GINA VILLEGAS-PANGGA¹ and GRAEME J. BLAIR²

¹*Farming Systems and Soil Resources Institute, College of Agriculture
U.P. Los Baños, College, 4031 Laguna*

²*Division of Agronomy and Soil Science, University of New England
Armidale, New South Wales 2351, Australia*

Plant residues are an important source of nutrients for crop and carbon in agricultural systems. Much research has already been conducted to develop proper management strategies for plant residues. Knowledge on the decomposition rate and amount of nutrient released from residues will enable management systems to be devised to utilize these organic materials more effectively.

A Straw Quality Index (SQI) was developed using important descriptors of plant residue quality such as the nitrogen, digestible organic matter, and lignin concentration of rice straws (*Oryza sativa* L.). The estimates of the straw quality parameters showed a direct correlation ($r^2 = 0.84$) between SQI and cumulative C released from straw of 20 different rice varieties. The calculated index showed variability in SQI values that ranged from 13.2 for Variety Intan to 35.8 for Variety Soc Nau. When the measured C from another batch of straw was correlated with SQI, a strong positive relationship ($r^2 = 0.94$) was obtained. The results suggest that SQI has a potential in assessing the quality of the straw residue materials in predicting their usefulness in crop-residue management systems.

Key words: decomposition, crop residue, organic matter, rice straw, organic fertilization, organic material, carbon, plant residue, plant quality



MOLECULAR TAGGING OF RESISTANCE GENES TO *Ralstonia solanacearum* CAUSING BACTERIAL IN TOMATO (*Lycopersicon esculentum* MILL.)

CONRADO H. BALATERO and DESIREE M. HAUTEA

*Institute of Plant Breeding, College of Agriculture
U.P. Los Baños, College, 4031 Laguna*

PCR-based DNA marker systems such as amplified fragment length polymorphism (AFLP) and resistance gene analog (RGA) were used to develop and identify molecular markers associated with bacterial wilt resistance in tomato. F₆ recombinant inbred lines (RILs) derived by single seed descent from the cross Hawaii 7996 (resistant) and Wva700 (susceptible) were used as the mapping population. Using a non-radioactive silver staining detection system, both AFLP and RGA generated multiple bands using high resolution polyacrylamide gel electrophoresis. Percent polymorphism for AFLP was dependent on the specific EcoRI/Mse I selective primer pairs. At least 97 markers showed polymorphism between the parental lines for 18 primer pairs evaluated. For RGA, 10 of the 19 primer pairs generated a total of 202 bands of which 25 bands (12.4%) showed polymorphism between the parental lines. Three putative markers amplified using primer sequences designed on the bases of the *Pto* kinase gene were positively associated with bacterial wilt resistance.

Key words: tomato, *Lycopersicon esculentum*, bacterial wilt, *Ralstonia solanacearum*, AFLP, resistance gene analog, recombinant inbred lines, silver staining

Health Sciences

**A SIMPLE MODEL FOR SCHOOL-BASED
INTESTINAL HELMINTH CONTROL USING MASS TREATMENT:
PRELIMINARY RESULTS OF AN ON-GOING STUDY**

VICENTE Y. BELIZARIO, JR.¹, MARIA LOURDES AMARILLO², WINIFREDA U. DE LEON¹, MARK PHILIP BUGAYONG¹, ANTONIO DE GUZMAN, JR.¹, and ANA BELINDA DE LOS REYES¹

¹College of Public Health, U. P. Manila
625 Pedro Gil Street, Ermita, 1000 Manila

²College of Medicine, U. P. Manila
547 P. Gil St., Ermita, 1000 Manila

Common intestinal helminthiases are the world's leading cause of morbidity in school age children especially in developing countries like the Philippines. These infections are obstacles to the improvement



of health and nutritional status of children. There is evidence that these infections also cause poor school performance and underdevelopment of cognitive skills. There is a need therefore to seriously consider investments in intestinal helminth control to ensure increased productivity and enhanced quality of life.

Mass treatment is the currently recommended strategy for control of intestinal helminths in areas where the prevalence of infection is more than 50%. There are safe and effective drugs which are easy to administer, among them mebendazole and albendazole, which are readily available and which can be administered to school age children, the sector of the population with the highest prevalence and heaviest worm burdens. Aside from decreasing morbidity, the strategy is likely to result in benefits even for the non-treated groups by clearing the source of infection, reducing fecal contamination of the environment, and eventually diminishing transmission.

A model for school-based control of common intestinal helminths has been developed and is being tested in a public elementary school in a rapidly urbanizing community in Laguna. The model is being tested using the following parameters: acceptability and coverage of mass treatment, cure rates, egg reduction rates, improvements in anthropometric measurements (height and weight), and improvements in school performance. Third grade pupils serve as the indicator group for the whole school.

The cumulative prevalence of intestinal helminth infections among third grade pupils was 78.7% (student population: 2904). Trichuriasis was the most common infection (in 69.9% of those examined) followed by ascariasis (in 43.3% of those examined). The overall consent for treatment rate was 84.5%. Total coverage during mass treatment was 78.5%.

Among those with trichuriasis, only 37.2% exhibited clinical cure (zero egg count post-treatment), while 45.2% showed clinical improvement (lower egg counts post-treatment). Clinical failure (higher or same egg counts post-treatment) was seen in 7.7%, while 9.9% had an indeterminate clinical outcome (no follow up stool examination). Among those with ascariasis, 58.2% were shown to have clinical cure on follow up, and 31.5% were noted to have clinical improvement. Clinical failure was seen in 3.0%, while 7.3% had an indeterminate clinical outcome.

For trichuriasis and ascariasis, cure rates were highest among those with light infections at baseline (55.9% and 79.8%, respectively); cure rates were lower among those with moderate infections at baseline (26.3% and 52.2%, respectively); and, cure rates were lowest among those with heavy infections at baseline (6.3% and 21.7%, respectively). Egg reduction rates for trichuriasis were 72.6% using arithmetic mean egg counts and 97.3% using geometric mean egg counts. Egg reduction rates were 88.3% using arithmetic mean egg counts and 99.5% using geometric mean egg counts.

Mass treatment of school children is a feasible and simple control strategy, which allows easy access to the target population and makes possible reduction of morbidity and decreased transmission of infection to the rest of the community.

Key words: intestinal helminth control, intestinal helminthiases control, mass treatment, school-based intestinal helminth control



DETECTION OF CHIKUNGUNYA VIRUS FROM SERA OF DENGUE-SUSPECTED PATIENTS IN THE PHILIPPINES

SHINGO INOUE¹, RONALD R. MATIAS^{1,3}, FUTOSHI HASEBE⁴, KOICHI MORITA⁴,
JHON A. R. ALFON¹, JINGLE CANDELARIO¹, DEU J. CRUZ¹, GISELLE ESPIRITU¹,
ALMA GONZALES¹, EFREN M. DIMAANO⁶, CELIA CARLOS², KAZUNORI OISHI⁵,
AKIRA IGARASHI⁴, and FILIPINAS F. NATIVIDAD^{1,3}

¹Research and Biotechnology Division, ²Department of Pediatrics,
St. Luke's Medical Center, 1102 Quezon City

³Institute of Biology, College of Science
U. P. Diliman, 1101 Quezon City

⁴Department of Virology, ⁵Department of Internal Medicine
Institute of Tropical Medicine, Nagasaki University
1-12-4 Sakamoto, Nagasaki, 852-8523, Japan

⁶San Lazaro Hospital, Sta. Cruz, 1003 Manila

Chikungunya virus belongs to Genus *Alphavirus*, Family *Togaviridae*. It is the causative agent of chikungunya fever, a mosquito-borne disease transmitted by *Aedes aegypti* and *Aedes furcifer-taylori*. in Africa, India, and Southeast Asia, including the Philippines. Due to the similar symptoms with dengue fever (DF) and dengue haemorrhagic fever (DHF), it has been diagnosed as DF or DHF. In this study, we examined 315 serum samples which were collected from dengue-suspected patients in San Lazaro Hospital and St. Luke's Medical Center to detect chikungunya virus by RT-PCR and clarify percentage of chikungunya virus infection by IgM-indirect immunofluorescence antibody test (IgM-IFA) and IgG-indirect ELISA. We also used RT-PCR to detect dengue virus and IgM-capture ELISA to measure the percentage of dengue virus-infection. Twenty-six samples (8.3%) were positive only for chikungunya. One hundred forty-six samples (46.3%) were positive only for dengue. Twenty-two samples (7.0%) showed double positive for chikungunya and dengue. Therefore we recommend to do differential diagnosis between chikungunya virus infection and dengue virus infection by laboratory examinations.

Key words: chikungunya virus, chikungunya fever, *Togaviridae*, *Aedes aegypti*, dengue fever, dengue haemorrhagic fever, IgM-indirect immunofluorescence antibody test, IgM-capture ELISA, RT-PCR, IgG-indirect ELISA



CO-INFECTION OF EPSTEIN-BARR VIRUS AND HUMAN PAPILLOMA VIRUS FROM BIOPSIES OF PATIENTS WITH HEAD AND NECK CARCINOMA

RONALD R. MATIAS^{1,2}, LIZA P. FAUSTINO¹,
GIL M. VICENTE^{3,4}, and FILIPINAS F. NATIVIDAD^{1,2}

¹Research and Biotechnology Division, Lt. Luke's Medical Center
279 E. Rodriguez Sr. Blvd.
1102 Quezon City

²Institute of Biology, College of Science
U.P. Diliman
1101 Quezon City

³Department of Otorhinolaryngology-HNS, St. Luke's Medical Center
Quezon City

⁴Ear, Nose, and Throat-Head and Neck Section
Jose R. Reyes Memorial Medical Center
Street, District, Zip number Manila

Nasopharyngeal carcinoma NPCA is one of the most common types of cancer in the Philippines. An early manifestation, a lateral neck mass, presents itself even if repeated biopsies of the nasopharynx reveal no evidence of malignancy. A relation between NPCA and Epstein-Barr Virus EBV was postulated on the basis of finding increased antibody levels to EBV in the serum and the identification of viral genomes by in situ hybridization of epithelial tumor cells. The Human Papilloma Virus (HPV) has also been associated with a number of lymphoid and epithelial malignancies. HPV proteins E6 and E7 bind to cellular tumor suppressors and regulatory protein p53 leading to chromosome instability and malignancy. In this study, EBV and HPV as well as co-infections of both viruses, were detected by the Polymerase Chain Reaction PCR using EBV nuclear antigen 2 EBNA2 and HPV L1 primer pairs. Nasal punch NP and fine Needle aspirates FNAB were obtained from patients diagnosed with head and neck cancer from Jose R. Reyes Memorial Medical Center. Of 72 nasal punch biopsies, 43 were positive by EBNA2 primers while 33 out of 44 NP samples were positive using HPV L1 primers. Twenty-six of 44 NP biopsy samples contained both EBNA2 and HPV L1 gene. For FNAB samples, 52% (24/46) were found positive for EBNA2 primers while 88% (21/24) were found positive for the L1 gene of HPV. Co-infection for both viruses on FNAB samples was 42% (10/24). EBV strains detected in these samples are classified into Types 1 and 2 on the basis of major sequence divergence in the genes coding for EBNA. Recent serologic and PCR investigations indicate that both types have worldwide distribution, although EBV Type 1 appears to be more prevalent than Type 2.

Key words: EBV, nasopharyngeal carcinoma, HPV, PCR, nasal punch, fine needle aspirate biopsy, co-infection, EBNA2, L1 gene



GENETIC VARIATION IN GEOGRAPHIC ISOLATES OF THE PHILIPPINE STRAIN OF *Schistosoma japonicum*

BERNADETTE L. RAMIREZ¹ and ROSARIO R. RUBITE²

¹*Department of Biochemistry and Molecular Biology, College of Medicine
U.P. Manila, P. Gil, Ermita, 1000 Manila*

²*Department of Biology, College of Arts and Sciences
U.P. Manila, P. Faura, Ermita, 1000 Manila*

A polymerase chain reaction (PCR) random amplified polymorphic DNA (RAPD) technique using three decamer oligonucleotide primers (A10, P205, and P235) was employed to characterize DNA extracts of adult *Schistosoma japonicum* from four schistosomiasis-endemic geographic locations, namely, the island of Sorsogon, Mindoro, Leyte, and Agusan del Sur in the Philippines. The RAPD profile of the Mindoro and Agusan del Sur isolates were similar using all the three primers. However, using primer A10, the RAPD profile of the Leyte isolate was observed to be distinct from the rest of the isolates. Using primer P205, it was observed that the RAPD profile of the Sorsogon isolate was likewise unique compared with the other isolates.

The same RAPD technique was also employed to characterize the snail intermediate host, *Oncomelania hupensis quadrasi*. Primer A10 demonstrated differing RAPD profiles for all snail DNA from the four geographic locations earlier mentioned. Primer 205, on the other hand, discriminated the Agusan del Sur DNA extracts from the Mindoro and Leyte DNA extracts which showed almost similar RAPD profiles.

These findings may have important implications for schistosomiasis control in the Philippines and future efforts leading to the development of vaccines.

Key words: polymerase chain reaction, random amplified polymorphic DNA technique, *Schistosoma japonicum*, *Oncomelania hupensis quadrasi*, general variation, geographic isolates, strain, DNA extracts, schistosomiasis

INVASIVE DUCTAL CARCINOMA: SEARCH FOR FILIPINO SPECIFIC CHARACTERS

EDNA A. AMPARADO, ARSENIA A. CASAUAY, SONIA D. JACINTO,
and ANNABELLE A. HERRERA

*Institute of Biology, College of Science
U.P. Diliman, 1101 Quezon City*

Researches on oncology have shown that a number of cancer histological characters are race-related and have encouraged researchers to search for histological uniqueness in the race. This two-year study, a response to this rejoinder, was conducted to establish histological characters which are unique to Filipinos vis-a-vis those of the Europeans, specifically on Portuguese, which were reported by Leal (1995).

Our study on invasive ductal carcinoma included patients who had adjuvant treatment on February



pregnancy. Dermatologists, however, routinely prescribe retinoids for treating acne. Many more women of childbearing age use tretinoin-based creams and gels for cosmetic purposes to treat wrinkles and photo-aging. While it is well established that oral tretinoin causes embryofetal defects, topical tretinoin and its link to fetal malformations in humans remains a hotly debated topic. Using the mouse as an animal model, we tested the effects of topical tretinoin use by pregnant ICR mice on the development of their fetuses. Our results show that daily topical application on the prospective mother prior to as well as during the start of her pregnancy resulted in embryos with exencephaly or open brain defects similar to malformations observed when 7.5 day pregnant mice were administered all-*trans* RA by intraperitoneal injection (IP). The observed malformations were accompanied by aberrant expression of various brain region specific genes such as *Pax-2*, *Pax-6*, *Wnt-1* as detected through in situ hybridization analysis. The craniofacial defects may be attributed to the adverse effects of retinoic acid on cephalic neural crest cells which normally give rise to craniofacial bones and tissues. Taken together, these results suggest that even the topical application of RA cream to pregnant mice could cause embryofetal defects.

Key words: retinoic acid, tretinoin, vitamin A, teratogen, pregnancy, exencephaly, mouse embryo, CNS

Social Sciences

COPING WITH MOTHER NATURE: HOUSEHOLDS' LIVELIHOOD SECURITY AND COPING STRATEGIES IN A SITUATION OF A CONTINUING DISASTER IN TARLAC PHILIPPINES

ROSANA MULA¹ and ANKE NIEHOF²

¹*Department of Extension Education, College of Agriculture
Benguet State University
La Trinidad, 2601 Benguet*

²*Department of Household and Consumer Studies
Wageningen Agricultural University
Ritzema Bosweg 32a
6703 AZ Wageningen, The Netherlands*

Several studies on households and individuals coping with disasters have been made. This study provides insight into the behavior of individuals in a household faced with a disaster whose effects may carry through an indefinite period. The Philippines, being a disaster-prone area, has to grapple with the yearly damage caused by deluge or drought. The eruption of Mt. Pinatubo in 1991 has the greatest toll on the country's economy because it claimed lives, property, and resources not only at that time, but continues to do so up to the present day, which is why the disaster has been characterised as a 'lingering disaster.'

The two major activities conducted to describe the effects of the disaster on household livelihood are



the general household survey and the case study analysis. The former was done to obtain a general understanding of the disaster situation. The micro but in-depth perspective was provided by case study analysis. In both activities, information of the before and after situations were the basis of observations.

The disaster significantly affected the major livelihood sources of the households. Lahar-laden fields made rice farming difficult because of poor soil structure. It made aquaculture and sustenance fishing impractical because of too much deposition of lahar and livestock raising unfeasible because of lack of pasture. The change in cropping calendar, ecology, and various farming activities of the households indicate the changed situation. The changed natural resource base has corresponding implications for the socio-cultural resources of the households. When households are under stress, negotiation becomes all the more important. The moral dimension of the household economy and kinship relations becomes more prominent and transcends kinship relationships. The social network of an individual or household becomes the source of support, reciprocity being in the hub of this support system.

Households beset by a disaster are eclectic. As the case studies show, households respond to the changed situation through several mechanisms that are honed through time making these adaptive. Households cope by altering their production management like adjusting their cropping calendar and diversifying crops and mobilizing available resources like the forest and other traditional forms of livelihood/food systems.

Household membership tends to become very loose in a situation of a crisis. The manipulation of social relations and household membership has become a significant form of coping. Negotiations over work and other domestic responsibilities and migration of household members appeared to be part of the available coping strategies. These strategies to attain a secure livelihood do not always represent clear-cut, mutually exclusive alternatives.

Outside intervention, like government support in a crisis situation, should not just contend with emergency relief. Because disasters result in entitlement destruction, an intervention that allows for entitlement protection is essential, especially in the case of a continuing type of a disaster. Responsive disaster management articulates the need to know and understand the situation, and a genuine support programme is sensitive to the plight of vulnerable groups like women and the elderly.

Keywords: households, livelihood security, coping strategies, disasters, resource management, support system, women, migration, food security, sweet potato.

HUMAN RESETTLEMENT AS AN INTERVENTION IN COMMUNITY DEVELOPMENT

FE L. PORCIUNCULA¹ and PURA T. DEPOSITARIO²

*¹Central Luzon State University
Muñoz, 3120 Nueva Ecija*

²U.P. Los Baños, College, 4031 Laguna

As thousands of affected families were displaced and resettled because of the Mt. Pinatubo eruption, the task of re-creating an economically viable, socially satisfying, and environmentally sustainable resettlement becomes enormous with the displaced facing great uncertainties in a new and unfamiliar environment.

This study focused on the Bagong Buhay resettlement in Palayan, Nueva Ecija settled by displaced families from Pampanga and Zambales. The complexities and attendant characteristics of the resettlement



process were analyzed: the outcomes and viability of the process, the factors affecting such outcomes/ viability and the implications that may be useful in future resettlement planning, implementation, monitoring, and evaluation.

Results of the study indicated that the resettlement was a complex, stressful, and often difficult process. The resettlement of Bagong Buhay however, proved to be an important and powerful mechanism through which the displaced were assisted to rebuild their life anew.

The lessons learned from the research point to the fact that the concepts and principles of community development as an approach and field of study had a broadening effect on the resettlement process and the evolvement of Bagong Buhay as a new community. The principle of participation elicited settlers' initiative and greater involvement in the decision-making process. This broadened their roles and responsibilities through collective action developing greater reliance on themselves. The concept of goal/task orientation provided the identification and optimum distribution of interdependent tasks between GOs, NGOs, and the local people aimed at generating a capacity for growth and development. The settlers also demonstrated the principles of self-help and mutual aid- indications of their cooperation and willingness to run their own affairs in the long term. Developing a community based on social cohesion where the settlers remain capable of continuity of purpose and action was also shown, having been brought about by religious and ethnic homogeneity.

While the socio-cultural considerations stimulated the birth of a new community in Bagong Buhay, the outcomes of the resettlement process point the need for an improvement of the economic condition of the people with attendant problems and drawbacks that need to be resolved. Despite this however, results indicate that amidst the complexities and difficulties, resettlement as a process provides opportunities for the settlers to build a new productive foundation for life and develop new social relationships as well as a new social structure. Resettlement then must not be approached simply as a movement of the displaced to a new location and but as a development opportunity to enable the people to build their life anew.

Key words: resettlement, community development

PARTNERING IN AGRICULTURAL EXTENSION: IS IT POSSIBLE AFTER ALL?

LUTGARDA L. TOLENTINO, MOISES L. SALDIDO, FLORENCIA P. ELLIOT,
JUANITO B. REYES, APOLINARIO L. ZARA, PEDRITO R. BANATLAO,
IMELDA M. GESMUNDO, and MELECIO J. MAGHANOY

*Department of Agricultural Education and Rural Studies, College of Agriculture
U.P. Los Baños, College, 4031 Laguna*

In this paper the dynamics of partnerships between and among the LGUs, local SCUs, and the UPLB in delivering agricultural extension services to farmers are analyzed. The use of partnerships in agricultural extension service provision continues to be viable as long as the partners are committed to improve agriculture by maximizing the effectiveness of each participant's resources. While such endeavors are very much determined by trust, dedication to common goals, and an understanding of each other's expectations and values, there are also institutional, political, and technical conditions that facilitate and constrain partnership work.



The initiative was tried in the whole provinces of Oriental Mindoro and Marinduque, and in several towns of Laguna and Cebu. Successful partnership among these organizations has been established and is now operating in Oriental Mindoro whereas similar arrangements have not taken off from infancy stage in Marinduque. In Laguna and Cebu, where this initiative has been tried at the municipal level, its results were varied depending upon the characters of the participants as well as the institutional, political, and technical conditions that circumscribed them.

This paper is mainly based on the actual experiences of field personnel of the Agro-Industrial Development Program (AIDP), College of Agriculture, UPLB from 1993 to 1999. Its main objective is to find out the exact condition under which partnership among these institutions would work. Finding answers to this very important question is highly relevant, as the agricultural extension service has already been devolved from the Department of Agriculture to local government units (LGUs) under the Local Government Code of 1991. The modernization of agriculture, however, needs a continuous flow of new agricultural information. The LGUs can get this only from local agricultural state colleges and universities (SCUs) which do research and development. Most of the time these stakeholders have no working relationships with each other. The UPLBCA, knowing this condition, tried to bring these two stakeholders together.

Key words: partnership, agricultural extension, service provision, devolution, local government units (LGUs), state colleges and universities (SCUs), modernization of agriculture

THE SOCIAL REPRODUCTION OF THE MEDICAL PROFESSION: THE CASE OF THE UNIVERSITY OF THE PHILIPPINES- PHILIPPINE GENERAL HOSPITAL MEDICAL CENTER

ERLYN A. SANA

*National Teacher Training Center for the Health Professions
U. P. Manila
Paz Mendoza Building, Pedro Gil Street, Ermita, 1000 Manila*

This paper is a capsule presentation of a dissertation with the same title. It is a report of an investigation on the various rules and resources pertinent to the norms and traditions that pervade the clinical internship program of the University of the Philippines-Philippine General Hospital Medical Center. Rules in the study pertain to the official, operational, and hidden curricula of clinical internship. Resources of the training program come in the form of key players, e. g., interns, their clinical supervisors, and their patients, including the unique learning environment (the hospital itself). The author hoped to come up with explanations on how physicians are socialized professionally and in the process how the social reproduction of the medical profession takes place.

Data were collected through a combination of direct observations, surveys, key informant interviews, and secondary data analysis. Four blocks of medical interns and one group of clerks were observed for 54 days as they rotated in the four core clinical departments of PGH namely, the Departments of Medicine, Surgery, Pediatrics, and Obstetrics-Gynecology. Actual fieldwork was done from May to July 1998. Findings were treated as qualitative data and were subjected to several stages of analyses and interpretations.

Findings reveal the very strict rules being imposed jointly by PGH and the University of the Philippines College of Medicine (UPCM) in making sure that only the most qualified, able, and determined candidates enter and endure clinical internship. The rigid selection procedures that students have to go through, the



discipline required in order to cope with the demands of internship, and the continuous evaluation of their performance while on training describe this strict official curriculum. Furthermore, since PGH is a public tertiary hospital, it is a national referral center for clinical cases that other hospitals cannot manage. The sheer volume of patients and the cases each of these patients represent almost effortlessly assure the efficacy of the operational curriculum. The combination of the official and operational curricula partly explains why trainees at PGH are highly competent and recognized by their peers as outstanding clinicians.

Further analysis of data especially the hidden curriculum identified several traditions and practices that have strongly penetrated the clinical training program of UP-PGH. These include the tradition of excellence, the development of a very strong batch culture that goes a long way, even after graduation from internship. The batch culture, the tradition of hierarchy and inequality, and even the culture of coping in medical school were also inferred. These traditions describe the medical interns as a uniform elite group. Such a group has been described as "one which shares the attributes of having a restricted pattern for recruitment and of forming a relatively tightly knit unity". It is also a group of professionals with a monopoly of medical knowledge that sets the doctors apart from other professionals thereby creating what has been called a competence gap between doctors who assume a superordinate role and the non-doctors with subordinate role. The whole process also shows a structure that latently promotes the perpetuation of the existing rules and resources for social reproduction.

Key words: medical education, official, operational, and hidden curricula, clinical internship, clinical clerkship, social reproduction, uniform elite group

THE FILIPINO CULTURE BEARER: EPISTEMIC ISSUES IN PHILIPPINE SOCIAL PSYCHOLOGY

ALFREDO V. LAGMAY

*National Academy of Science and Technology, Philippines
Philippine Science Heritage Center Building, DOST Complex
Gen. Santos Ave., Bicutan, 1631 Taguig*

An educational system with a western perspective prevailed in Philippine psychology as a discipline. Some teachers in the universities, realizing that what they were teaching were highly culture dependent, took some effort to re-examine this perspective and the concepts that went with it. Indigenization in psychology and the attempt of the late Teodoro Agoncillo to write history from the Filipino point of view are both part of the worldwide movement in this direction. There is now a similar development in the other social sciences; there is an evolving form of scholarship that is conscious of new responsibilities - in philosophy, political science, history, education, and mass communication, in fact the whole gamut of social studies the main purpose of which is the exploration and re-discovery of Philippine culture. When the concepts of social sciences are dependent on the unique features of society and its people, new methods seem to emerge spontaneously, different from current practice. The development of these new methods has been central to the work on the indigenization of Philippine social psychology hereabouts. The Filipino culture bearer, both the researcher and the subjects of his research, is sensitive to structures and features of Filipino social situations likely different from those of other countries. This paper describes some basics for generating knowledge of our society and the Filipino.

Key words: culture bearer, cultural unconscious, indigenous psychology (epistemology), socio-linguistic context



Mathematical, Physical and Engineering Sciences

1. NONSINGULARITY CONDITIONS FOR TWO CLASSES OF CIRCULANT GRAPHS

LEONOR AQUINO-RUIVIVAR and EDGARDO S. CUREG

*Mathematics Department, De La Salle University
2401 Taft Avenue, 1004 Manila*

A graph is said to be *singular* if its adjacency matrix $A = A(G)$ is singular, otherwise, G is said to be nonsingular. For example, the complete graph K_n is known to be non-singular for $n \geq 1$, while the cycle graph C_n is singular if and only if n is divisible by 4.

A matrix $A = [a_{ij}]$ is said to be *circulant* if for each $i \geq 2$, the elements of row i are obtained by cyclically shifting the elements of the $(i-1)$ -th row one position to the right. A graph G is circulant if its adjacency matrix is circulant.

In this study, we consider two classes of circulant graphs. For $n \geq 3$ and $1 \leq r < n$, the graph C_n^r or the r -th power graph of the cycle graph C_n is obtained by forming the edge xy whenever there is a path of length less than or equal to r joining the two vertices x and y . On the other hand, we denote by $C(r, n)$ the circulant graph of order $2n$ formed by adding to the graph C_{2n}^r the edges joining opposite vertices of the cycle graph. Our aim is to determine conditions under which these two classes of graphs will be nonsingular.

Key words: singular/nonsingular graphs, circulant matrix, circulant graphs, r -th power graph, eigenvalues, adjacency matrix, cycle graph, greatest common divisor, least common multiple



2. PULSED 1064 nm Nd-YAG LASER DEPOSITION OF TITANIUM ON SILICON IN AN AMBIENT NITROGEN ENVIRONMENT

JOSE OMAR AMISTOSO, EDGARDO PABIT, MARILYN HUI,
and WILSON GARCIA

*Laser Physics Laboratory, National Institute of Physics
U. P. Diliman, 1101 Quezon City*

Pulsed laser deposition (PLD) technique was demonstrated for the deposition of titanium nitride (TiN) thin films on Si (100) substrates using 1064 nm excitation. The target material used was titanium (99.5%) and deposition was done under ambient N₂ pressure. Spectroscopic analysis of the plasma plume revealed emission lines due to Ti(I) and N(I), which are the active species that lead to the formation of TiN. Images of the films grown at different laser pulse energies show an increase in the number and size of deposited droplets and clusters with increasing laser pulse energy. A decrease in cluster and droplet size is observed, with an increase in substrate temperature. EDS data show an increase in the Ti peak relative to the Si peak as the ambient N₂ pressure is decreased. An increase in deposition time was found to bring about the growth of large clusters and irregularly shaped structures on the substrate. Post-deposition annealing of the samples enhanced the crystallinity of the deposited thin film.

Key words: pulsed laser deposition, titanium nitride, laser ablation, laser-produced plasma, optical emission, Nd-YAG laser, SEM, XRD, titanium, nitrogen

3. TOURNAMENTS THAT ARE NOT RESIDUALLY GRACEFUL

SEVERINO V. GERVACIO

*Department of Mathematics, College of Science, De La Salle University
2401 Taft Avenue, 1004 Manila*

A digraph consists of a set of vertices and some directed line segments, called arcs, joining pairs of vertices. Let m be the number of arcs of a digraph D . Label the vertices of D using distinct values from the set $\{0, 1, 2, \dots, m\}$. If x and y are vertices forming the arc xy , assign to it the value $f(x) - f(y)$, where $f(x)$ and $f(y)$ denote the labels given to the vertices x and y , respectively. If all these values assigned to the arcs are distinct modulo m , and none of them is 0, the labeling is said to be a *graceful labeling* and the digraph is called a *graceful digraph*. This was the concept introduced by Bloom and Hsu in 1982. They noted that such a concept of labeling has an application to a problem on network addressing.

In 1999, the author introduced a similar labeling as follows. Label the vertices of the digraph using distinct values from the set $\{0, 1, 2, \dots, m\}$. Also compute for the induced arc labels $f(x) - f(y)$. If these values form a complete residue system modulo m , the labeling f is called a *residually graceful labeling* and the digraph is called a *residually graceful digraph*. In an ongoing research, the author has shown that there exist digraphs that are graceful but not residually graceful, and vice versa.

In this paper, we consider a special class of digraphs called tournaments. Consider a round-robin tournament involving n players. Let the players be vertices of a digraph. We form the arc from a vertex x to another vertex y if and only if x beats y . The resulting digraph is called a tournament of order n . There



are no published results yet on residually graceful digraphs inasmuch as the concept was an original idea of the author that was introduced less than a year ago only. The author has obtained some results on graceful and residually graceful paths and circuits.

Examples of tournaments that are residually graceful are given in this paper. Likewise it establishes the existence of some tournaments that are not residually graceful. Sufficient conditions on the order of a tournament for it not to be residually graceful are established.

Key Words: digraph, vertex, arc, path, circuit, graceful labeling, residually graceful labeling, tournament

4. ASSESSMENT OF INFLUENTIAL OBSERVATIONS IN PRINCIPAL FACTOR ANALYSIS

ZENAIDA F. MATEO¹ and YUTAKA TANAKA²

¹*Department of Mathematical Sciences and Physics, Central Luzon State University,
Muñoz, 3120 Nueva Ecija*

²*Department of Environmental and Mathematical Sciences, Okayama University
Tsushima Okayama, Japan*

In the present study, a method for detecting influential observations using iterative principal factor analysis is proposed. To do this, some influence functions $I(x; LL^T)$ and $I(x; \Delta)$ were derived for the common variance matrix $T = LL^T$ and the unique variance matrix Δ , respectively. The main objective here is to investigate the influence of a small change of data on the result of the analysis. To assess the influential observations, some influence measures like the Euclidean norm of $\Delta^{(i)}$ and $T^{(i)}$ were derived which correspond to the theoretical influence functions for the two components Δ and $T = LL^T$ of the common variance decomposition. The results of the study have shown that the application of the Principal Factor Analysis (PFA) to the given data set clearly revealed a two-factor model. Furthermore, the proposed influence function at $\Delta^{(i)}$ showed that the Empirical Influence Curve (EIC) based on the differential coefficient can be used in practice instead of the Sample Influence Curve (SIC) for detecting influential observations in PFA.

Key words: influential observations; influence function; principal factor analysis; perturbation theory of eigenvalue problems; unique variance matrix; common variance matrix



5. INTRODUCTION TO THE JLC STUDY FRAMEWORK

AKIYA MIYAMOTO¹, KEISUKE FUJII¹
ALLISTER LEVI C. SANCHEZ², and ANGELINA M. BACALA²

¹High Energy Accelerator Research Organization (KEK)
Tsukuba, Japan

²IITHEP, MSU-Iligan Institute of Technology
9200 Iligan City

The importance of computers in the field of High Energy Physics (HEP) is beyond question. Computer simulations have been utilized to guide experiments, predicting the possible outcomes, providing a valid comparison to acquired data based on accepted or proposed physical theories.

In the last 10 years, wide experimental efforts have been poured to detect the last undiscovered particle in the Standard Model—the Higgs boson. Huge experimental projects have been initiated in the United States and Europe to this end. In consonance with this worldwide endeavor the Asian HEP community proposes to build its own: the Joint Linear Collider (JLC). The JLC will be built in Japan.

Here we present a software designed to meet the needs for HEP studies in the JLC: the JLC Study Framework (JSF). We then discuss the processes of event generation, simulation, event reconstruction, data acquisition, and data analysis in JSF using as an example the Standard Model Higgs production process $e^+e^- \rightarrow Z^0 H_{SM}^0 \rightarrow qqbb$.

Key words: high energy physics, JLC study framework, Higgs boson, computer simulation

6. COMPUTING IN A BEOWULF CLASS COMPUTER SYSTEM

ALLEN S. DAHILI

Computational Physics Laboratory, Department of Physics
MSU - Iligan Institute of Technology
9200 Iligan City

Current PCs have achieved a performance comparable to the high-end UNIX workstations, at a small fraction of the price. Commodity PCs have become the solution to CPU needs, even for large scale computing in physics. The development of free software has made computations even easier.

The Beowulf class computer system is a type of parallel or distributed system, which consists of interconnected commodity-of-the-shelf (COTS) personal computers working together as a single integrated computing resource. A certain computational task could be divided among the computers to fasten execution of the task.

At MSU-IIT, we built a three-node Beowulf system. Each node has two 350-MHz Pentium II processors. All softwares used are freely available in the Internet. Communication of the results between nodes is done by message passing library Message Passing Interface (MPI), or Parallel Virtual Machine (PVM).

Initial computations show that the performance of the MSU-IIT Beowulf system is 5 to 6 times faster compared to a single processor PC. Since a Beowulf computer system is expandable, installing additional nodes to the existing system increases its computational power.

We can thus build a system with performance comparable to high-end RISC-based computers at a small fraction of the price.



7. THE FULL PINCH TECHNIQUE GAUGE INVARIANT HIGGS BOSON SELF-ENERGY

CESAR P. PALISOC

*National Institute of Physics
U.P. Diliman, 1101 Quezon City*

The Pinch Technique (PT) is an algorithm that renders one-loop gauge and scalar boson self-energies of renormalizable spontaneously broken non-abelian gauge field theory gauge invariant. In scattering processes at one-loop level, PT unravels self energy contributions from vertex and box diagrams that are otherwise excluded in the conventional manner of computing self energies. In general, by itself, this pinch self-energy contribution is gauge dependent. When combined with the conventional self energy, this PT contribution exactly cancels the gauge dependence of the former rendering the combined self energy gauge invariant. The resulting PT gauge invariant self energy satisfies desirable properties like resumability, unitarity of the S-matrix, and process dependence.

The PT arose from a search for a self consistent scheme for constructing off shell Green's functions which are of utmost importance in cases where the conventional perturbation theory breaks down like in the strongly coupled theory of Quantum Chromodynamics and in the vicinity of resonance in a weakly coupled theory of electroweak interactions in the standard model.

In this work, the S-matrix PT framework inspired by Degrassi and Sirlin is implemented in calculating the full PT contribution to the Higgs boson self energy in the general renormalizable $R\xi$ gauge. The scattering process considered is a four-fermion process with the Higgs boson as intermediate state. The relevant amplitudes reflecting the gauge boson and external fermion interactions are described in terms of matrix elements of Fourier transforms of time-ordered product of current operators. Through successive current contraction with the longitudinal four-momentum found in the propagator of massive vector bosons, Ward identities are triggered. Relevant pinch contributions are then identified upon application of appropriate equal-time commutators of currents.

The results obtained have the following desirable properties. The full Higgs boson PT contribution vanishes on-shell, which is a welcome property if one adheres to the correctness and validity of the Born approximation to the decay width of the Higgs boson. In the 't Hooft-Feynman gauge, the full PT result agrees with Papavassiliou's and Pilaftsis' results. For gauges other than the 't Hooft-Feynman gauge, our results differ only with respect to the UV-quadratically divergent terms of the result whose origin may be traced to the contributions coming from tadpole and seagull graphs, which they omitted in their consideration. The significance of these UV-quadratically divergent terms should not be underestimated though, since they render the non-absorptive part of the Higgs boson self energy gauge independent as well. Finally, our result shows that the full PT gauge invariant Higgs boson self energy evaluated in the framework of the general renormalizable $R\xi$ gauge is identically equivalent to the full PT Higgs boson self energy in 't Hooft-Feynman gauge, a property likewise found in Papavassiliou and Pilaftsis.

Key words: Higgs boson self energy, elementary particle physics, electroweak interactions, non-abelian gauge field theory, S-matrix Pinch Technique, gauge invariance, radiative corrections, perturbation theory :



8. NEW MEASUREMENT OF MEAN LIFETIME OF ATMOSPHERIC MUONS

ROSARIO L. RESERVA, RUELSON S. SOLIDUM and ANGELINA M. BACALA

*Department of Physics, MSU-Iligan Institute of Technology
9200 Iligan City*

Recent measurements on the mean lifetime of atmospheric muons have been carried out through the months of August to October 1999 at IITHEP Laboratory, Iligan City. A vertical stack of three plastic detectors is utilized to identify cosmic ray muons decaying in a wooden absorber. The method employed is a measurement of the distribution in duration of the time intervals between the stopped cosmic-ray muons in plastic scintillation counters and the detection of the decaying electron in the downward direction.

The standard nuclear physics instrumentation, NIM and CAMAC, are used in this study. The experimental methods and technique are reported. A brief description on the properties and the electro weak decay of muon $\mu \rightarrow e \nu_e \nu_\mu$ are also discussed.

Muon decay time distribution curve is shown where a fit of the distribution to the exponential $(-t/\tau_\mu)$ yields a mean lifetime $\tau_\mu = 2.176 \pm 0.0429 \mu\text{sec}$, a value, which is significantly in good agreement with internationally accepted μ mean lifetime $\tau_\mu = 2.197 \pm 0.0004 \mu\text{sec}$ as presented by the Particle Data Group.

Key words: muon lifetime, NIM, CAMAC

9. MBE GROWTH OF ZnTe/Zn(S, Te) SHORT-PERIOD SUPERLATTICES

SHIRLEY TIONG-PALISOC¹, MATTHIS KORN², and WOLFGANG FASHINGER²

*¹Physics Department, De La Salle University
2401 Taft Avenue, 1004 Manila*

*²Physikalisches Institute, Universitaet Wuerzburg
Wuerzburg, Germany*

ZnTe/Zn(S, Te) short-period superlattices have been grown by our group on (001) GaAs substrates with very good structural quality. The growth conditions were found to be quite reproducible, leading to a series of samples with periods between 12 to 29 angstroms. Characterization of the samples with high resolution x-ray diffraction confirmed the high structural quality of the samples showing that all are pseudomorphically grown. The relaxation behavior is strongly influenced by the ZnTe well-width with two critical ZnTe-thicknesses observable.

A substrate temperature of 280 °C was chosen in order to avoid Tellurium clustering. ZnS was deposited from a compound source allowing the growth rate of ZnS at four different substrate-temperatures to be measured. Our group found from laser interferometric oscillations that the growth rate decreased from one Å/sec at 150 °C to 0.8 Å/sec at 220 °C. No ZnS growth could be observed at 240 °C. Zn(S, Te) barriers with low Te content were grown instead of ZnS barriers.

A 200 mm-thick GaAs buffer was grown on (001) GaAs substrate in a III-V epitaxy chamber after



oxygen desorption. The sample was then transferred under ultra-high vacuum to a II-VI chamber. A 20 nm-thick ZnSe buffer was deposited followed by a ZnTe/Zn(S, Te) superlattice structure. A series of lattice-matched samples with intended periods of 12, 18, 24, and 30 angstroms were grown. The numbers of periods were between 120 and 200 leading to a total layer thickness of between 200 nm and 400 nm.

The superlattices were grown under Zn-rich conditions. Zn, Se, and Te were evaporated from elemental sources while ZnS was used in its compound form. A growth temperature of 280 °C was chosen for all samples. The shutter opening times were varied to achieve lattice-matched samples with different periods. The beam fluxes were kept constant during the growth of the whole series. To circumvent the immediate relaxation of ZnTe grown on GaAs due to a very high lattice mismatch, the first ZnTe well was made to be only half as thick as the others. This first ZnTe well was then counterstrained by the succeeding Zn(S, Te)-barrier.

All samples were characterized with high resolution x-ray diffractometry (HRXRD). To determine the superlattice period, lattice constant and the strain, Ω -2 θ scans were performed around the (004)- and the asymmetrical (115)-reflections of the GaAs substrate. To distinguish between mosaicity and inhomogeneity, omega scans around the (004)-rehex of the zero-order satellite of the superlattice were carried out using a (200) four-crystal monochromator with an x-ray mirror on the incident side and a three reflection (220) Ge analyzer-crystal on the exit side of the diffractometer.

The results showed that short-period ZnTe/Zn(Z,Te) superlattices can be grown on GaAs substrates with high structural quality and reproducibility. The ZnTe well thickness is the crucial factor for growing samples of perfect crystalline quality. Moreover, the relaxation behavior is influenced by the amount of the average strain in the sample and the incorporation of nitrogen.

Key words: MBE, ZnTe/Zn(S,Te), short-period superlattices, substrate-temperature, ZnSe buffer, lattice-matched, relaxation, XRD, ZnTe well

10. ENERGY ANALYSIS OF A "DRAGON KILN" FOR FIRING "VIGAN JARS"

SAMUEL S. FRANCO and JAMES R. NALUNDASAN

*Department of Materials Science and Engineering, College of Engineering
Mariano Marcos State University
Batac, 2906 Ilocos Norte*

The firing of ceramic products involves the partial fusion of the body and as it proceeds, the proportion of the glassy bond increases and the apparent porosity of the fired product becomes progressively lower. In the case of "Vigan Jars", these are fired to vitrify in fuelwood fired "Dragon Kilns" with a length of 30 to 50 meters. The kilns can accommodate different types of wares of various sizes. The thermal characteristics of the kilns were evaluated to determine their energy and performance efficiencies and to find solutions to the problems of uneven heating, cracking of the wares, and fuelwood consumption.

Results of the evaluation indicate that the kilns consume an average of 30 to 50 cubic meters of fuelwood per firing, the firing cycle takes an average of five (5) days including the preheating phase. The maximum temperature recorded was 1250°C. The uneven heating of the kiln was found to be due the changes in wind directions during the firing process which resulted in cracking and over-firing.

Proper sequencing of the operation with the pre-heating process results in better fuelwood use efficiency. The installation of contraptions can reduce the occurrence of uneven heating.

Key words: ceramics, Dragon Kilns, energy, fuelwood, Vigan Jars, vitrification



11. AN INVESTIGATION ON THE POTENTIAL OF HIGHLY ABSORBENT MATERIAL OBTAINED FROM SURPLUS DIAPERS AND SANITARY NAPKINS AS LAHAR CONDITIONER

EMILYN Q. ESPIRITU, KHERVIN CHENG CHUA,
and ABIGAIL TORRES

*Environmental Science Program, Ateneo de Manila University
Loyola Heights, 1108 Quezon City*

Volcanic eruptions such as that of Mt. Pinatubo in 1991 bring about great devastation to the lives of people especially those who rely on the land for their livelihood. In line with the effort of providing assistance to the lahar affected communities, the study was undertaken to explore the possibility of using highly absorbent material such as those obtained from surplus diapers and sanitary napkins as lahar conditioner.

Treatments of lahar containing varying amounts of the absorbent material (e.g., 0.6 kg, 1.2 kg, 1.8 kg, 2.4 kg, 3.0 kg, 3.6 kg) were prepared in three replicates under two experimental set ups - one set was treated with 14-14-14 balanced fertilizer and the other without fertilizer. Controls included pure lahar and pure garden soil. Each pot was planted with five kernels of corn and was watered with a specified amount of tap water daily. Observations on the length of stalk, number of leaves, length of leaves, and other changes in the general appearance of the plants were also noted daily. At the end of the test period, physical and chemical analyses were performed to determine the following: (physical) bulk density, water holding capacity, field capacity, permanent wilting point, percent available moisture; (chemical) pH, available phosphorus, organic matter content, total nitrogen, cation exchange capacity.

The results showed that highly absorbent material produced some significant improvements of lahar such as decreased bulk density, increased water holding capacity and improved organic matter content. However, there was no improvement on the permanent wilting point and percent available moisture values. Results from the plant growth experiments show that the smaller the amount of conditioner added to lahar, the more fibrous the root system of the plant became. The additional of fertilizer resulted in healthier plants compared to their counterparts in the non-fertilized set up.

Key words: Mt. Pinatubo, lahar, garden soil, diapers, sanitary napkins

12. GENERATION OF NAFIL LOOPS OF SMALL ORDER

RAOUL E. CAWAGAS

*SciTechR&D Center, Polytechnic University of the Philippines
Sta. Mesa, Manila*

The determination of all non-isomorphic loops of a given order n is one of the difficult problems in the theory of loops and quasigroups. This paper deals with the computer generation of loops of small orders $n = 5, 6, \text{ and } 7$ belonging to the class of NAFILs (non-associative finite invertible loops). This class includes the familiar IP, Moufang, and Bol loops. However, there are many other interesting loops in this class that have not yet been studied as much as the familiar loops.



The NAFILs of orders $n = 5$ and 6 were determined at PUP in 1996 using a Pascal program called ICONSTRUCT. Because of the enormous number of possible loops of order $n = 7$, the distinct NAFILs of this order were determined only in 1999 by a collaborative work with Prof. H. Zhang (Department of Computer Science, University of Iowa, USA) using two software systems, SEM and SATO, and a super computer (with 48 Pentium II400 processors). The results are shown in the table below:

Order	5	6	7
Number	1 (CNA)	33 (7A+26NA)	2,333 (16A+2333NA)

where A = Abelian and NA = Non-Abelian. These results have been posted in various Internet discussion forums and they have attracted the attention of loop theorists.

Key words: loops, non-associative, invertible, non-isomorphic, IP, Moufang, Bol Loops, NAFIL, quasigroups

13. IMMOBILIZATION OF TOXIC HEAVY METALS FROM ACADEMIC WASTE

NOEL T. DE OCAMPO

*Research and Development Center, Rizal Technological University
Mandaluyong City*

Stabilization/solidification is known as the immobilization technology of reforming toxic heavy metals to reusable material. Stabilization is a process by which contaminants are fully or partially bound by the addition of supporting media, binders, or other modifiers. Solidification is a process employing additives by which the physical nature of the waste is altered during the process.

The concentrations of cadmium, copper, lead, manganese, mercury, and nickel was established utilizing Atomic Absorption Spectrophotometry (AAS). Varying proportions of waste, cement, fine aggregate, and coarse aggregate were mixed and solidified in metal cylindrical molds. Simulated leaching of toxic heavy metals was conducted and the amount of contaminants was determined using AAS. The compressive strengths of both control and experimental specimens were established utilizing the Universal Testing Machine. Scanning Electron Microscopy (SEM) confirmed the binding mechanism between cement and contaminants.

The SEM result supports the compressive strength and leaching data. It further confirmed that cement can immobilize the toxic heavy metals in academic waste. Whether in combination with cement alone, or with cement and aggregates, academic waste in liquid or solid form can be solidified to produce specimens with highly acceptable compressive strengths.

Key words: immobilization, solidification, stabilization, leaching, contaminants, concrete, toxic heavy metals, academic waste, compressive strength, solidified waste



14. CAUSTIC SODA RECOVERY IN A BOTTLE WASHING PLANT USING MEMBRANE TECHNOLOGY

C. VISVANATHAN¹ and ANNA MARIE M. HUFEMIA²

¹*Environmental Engineering Program, Asian Institute of Technology
Bangkok, Thailand*

²*Environmental Science Program, Ateneo de Manila University
Loyola Heights, 1108 Quezon City*

The advent of using light containers such as aluminum cans and polyethylene terephthalate (PÉT) bottles for beverage packaging has not at all phased-out the use of glass bottles. Today, glass bottles are still being reused widely by beer and softdrink companies. The reuse of such in the production process entails a thorough cleaning of these returnable bottles before refilling. During the bottle cleaning process, the beverage industry uses a large quantity of water and caustic soda solution for washing and rinsing operations.

When spent caustic soda is finally discharged, the usual practice is to treat it by neutralization using acidic waste streams. The problem with this process is that it produces a solution highly loaded with sodium that will eventually be detrimental to soil quality. Therefore, an effective way of minimizing the amount of caustic soda used and discharged from a processing plant must be found.

Membrane technology can be applied for caustic recovery. This is done by passing the caustic solution through base-stable membranes that can remove some, if not all, types of dissolved and suspended organic contaminants. Particles and colloids with size greater than 0.02 μm can be effectively rejected by microfiltration (MF). On the other hand, nanofiltration (NF) can separate molecules and ions with size less than 10^oA. When membrane filtration is employed, the caustic solution may be recovered and the amount used in the process would consequently be lessened. Likewise, the total required volume of process water would be reduced. However, very little information is available on this kind of membrane system application. Only manufacturers of alkali-stable membrane have conducted the few studies done on the feasibility of this membrane application.

This research aimed to determine the performance of MF and NF in caustic soda recovery at pilot-scale level in terms of rejection rate, optimum applied pressure, and permeate quality. The effluent stream from bottle washers of one of the largest softdrink manufacturing plants in Thailand was subjected to membrane filtration using MF and NF. The study revealed that the MF/NF system can purify the caustic soda to a certain extent and can be reused back to the bottle washing units. Within the studied pressure ranges, the optimum applied pressure was determined as 101 kPa for MF and 1,414 kPa for NF with corresponding permeate fluxes of 235 and 15 L/m²-h, respectively. Based on these figures, a large-scale installation was designed for the research site and a financial analysis was conducted for the system.

Key words: caustic soda recovery, microfiltration, nanofiltration, beverage industry, membrane technology



15. A COMPOSITE INDICATOR FOR LAKE WATER QUALITY MONITORING AND ASSESSMENT

NOELL L. GAURAN¹ and FELINO P. LANSIGAN²

¹*State Polytechnic College of Palawan
Aboclan, 5302 Palawan*

²*Institute of Statistics, College of Arts and Sciences
U. P. Los Baños, College, 4031 Laguna*

A composite indicator of water quality was formulated in this study to assess the suitability of lake ecosystem for various intended purposes, such as fisheries development. A single value is amenable to the same description and interpretation whoever is doing the assessment and prejudices on certain water quality variables would be eliminated.

The composite water quality indicator (WQI) was formulated by eliciting opinions from a panel of water quality experts the choice of variables, scaling procedures, and weights. The sampling distribution of WQI was estimated using the Monte Carlo simulation, the validity of which was verified for simple cases by showing that simulation and analytical derivation yield the same results.

Ten physicochemical and two biological variables were identified to constitute the composite indicator. The additive model was used in formulating the WQI because of its relative simplicity and sensitivity to extreme values. The WQI, which ranges from 0 (extremely worse condition) to 1 (best condition) may be classified as either very good, moderate, poor, or unacceptable by referring to a tabulated guide.

The WQI was applied to the water quality data for Laguna de Bay. The WQI has a beta distribution, although tests also showed that normality has been attained for sample size $n=4$ or higher. The standard error of the mean of WQI was $0.0513/\sqrt{n}$, where n is the number of sampling stations. The reliability of WQI may be evaluated further by constructing confidence intervals about $\mu\alpha$.

A test of hypothesis was formulated that would declare a given body of water as suitable for fisheries development if the computed composite indicator is at least 0.50. The power function was plotted for varying sample sizes and values for $\mu\alpha$. A graph showing the required sample size for fixed power and tolerance ($0.50-\mu\alpha$) was also constructed which can be used to determine a cost-effective monitoring program. Thus, 25 observations are needed to attain a power of 0.90 when the tolerance level is set at 0.03.

The WQI was also applied in the assessment of bodies of water other than Laguna de Bay. Using the same WQI, results showed that the state of water quality of Taal Lake in Batangas and Tadalak Lake in Laguna were "good" and "moderate," respectively. The ability of the composite WQI to differentiate the state of lake water quality demonstrates the potential applicability of the composite indicator.



16. DEVELOPMENT AND APPLICATION OF DECISION SUPPORT SYSTEM FOR CROP AND WATER MANAGEMENT IN THE PHILIPPINES

ORLANDO F. BALDERAMA

*Department of Agricultural Engineering, Isabela State University
Echague, 3309 Isabela*

Users of irrigation systems, large or small, have to make frequent decisions on how best they can make use of their resources in bringing about maximum production and income. Critical factors include management of available water resource, planting dates along with the choice of land area for cultivation. Under these conditions, the capability to make sound decisions requires, considerable practical experience. The advent of microcomputer technology has paved the way for speedy information processing at affordable cost. While there has been a substantial amount of research efforts put into software development for improved irrigation development, the development of software for the specific utilization of computers in irrigation systems has been moving very slowly compared to other sectors. One reason for this is maybe that the problems of irrigation systems are very site specific, complex, and diverse. In many developing countries, like the Philippines, extension workers perceive a need to integrate crucial decisions like crop selection, crop scheduling, and to optimize the size of land being cultivated during periods of drought and limited water supply.

From these considerations, an idea was developed for a simple and versatile computer program. This tool hopes to assist agricultural researchers and extensionists in understanding possible consequences of crop and water management plans and decisions.

An integrated computer program called Cropping System and Water Management Model with a three-step feature on expert system-simulation-optimization methodology was developed to address the problem on crop selection, scheduling, and optimization of water and land resources. It was written in two languages: PROLOG, a declarative programming language, and C, a deterministic programming language consisting of three modules namely; crop selection, crop scheduling, and water management modules. It is capable of simulating rainfed production, a reservoir scheme, and a complete or full irrigation scheme. The first two modules written in PROLOG are an expert system while the water management module, written in C language, is for water balance simulation and optimization by a simplex method.

The program was evaluated and applied for sustainable agricultural planning and for drought planning under Philippine conditions. Data on size of landholding, volume of water from on-farm reservoirs, rainfall probability, and recommended cropping patterns were among primary data used to run the model. Its application to sustainable agricultural and drought planning on a national scope proves the versatility and usefulness of the program. Furthermore, the popularization of small reservoir technology and other small-scale irrigation systems, the CSWM model, in its present and future versions, will always be a helpful tool. The output of the model on crop selection, scheduling, and optimization of land resource provides realistic answers on a broad range of crop and water management questions for farm advisory and policy making.

Key words: irrigation, rainfed, expert-system-simulation, optimization methodology, drought planning, sustainable agricultural planning, decision support system, small reservoir, CSWM model



17. RADIOLOGICAL ASSESSMENT OF FORMER US BASES: I. CLARK AIR BASE

EMERENCIANA B. DURAN, TERESA Y. NAZAREA, TEOFILO Y. GARCIA,
CECILE M. DE VERA, ROLANDO REYES, ALEJANDRO Q. NATO, JR.,
and ANTONIO A. ASADA, JR.

*Philippine Nuclear Research Institute
Commonwealth Avenue, Diliman, Quezon City*

Conversion of the former US Air Base at Clark, Pampanga into an economic zone with plans for extensive commercialization of the area requires radiological assessment of Clark Special Economic Zone (CSEZ). The Philippine Nuclear Research Institute, having the capability to measure radiation contamination, initiated a study to perform a radiological surveillance of the former US base in Clark. Natural and anthropogenic radiation measurements in ambient air in 131 km of CSEZ road network is achieved using a computer-based airborne gamma radiation spectrometric system (Exploranium Gr-650) equipped with a global positioning system (GPS).

Natural radioactivity concentrations by airborne gamma spectrometer for potassium (K-40), uranium (U-238), and thorium (Th-232) were measured at 316.44 ± 82.28 , 15.86 ± 3.23 , and 13.08 ± 3.16 Bq/kg sample, respectively with corresponding total absorbed dose rate in air of 26.30 ± 6.68 nGy/h. Total absorbed dose rate in topsoil of natural radionuclides (K-40, U-238, and Th-232) measured by gamma spectrometer (HPGe) is 19-22 nGy/h. These values are within the background concentration vis-à-vis terrestrial absorbed dose rate of the whole country (23 nGy/h).

Evaluation of anthropogenic or man-made source of radiation in air using the airborne gamma spectrometric system indicated man-made sources from Cs-137 gamma radiation is not present within the CSEZ. Measurements of Cs-137 in topsoil showed values (0.98 - 4.64 Bq/kg) lower than the activity range concentration of Cs-137 in the country (<0.09 - 12.77 Bq/kg dry weight). Analysis of Cs-137 in drinking water from wells including those from Cabcom and CDC main office have values lower than the lower limit of detection in HPGe. The results of radioactivity analyses of air, topsoil, and water from Clark Special Economic Zone further established that man-made radioactivity (Cs-137) is not present in the former US Base in Clark.

Key words: assessment, US military bases, natural radioactivity, anthropogenic, radionuclides, air gamma dose rate



18. CARBOXYMETHYL-"NATA": SYNTHESIS, CHARACTERIZATION AND ITS APPLICATION IN THE IMMOBILIZATION OF INVERTASE

ERWIN OLIVER V. FUNDADOR¹, VERONIGA C. SABULARSE²,
and MA. JAMELA R. REVILLEZA²

¹College of Science, U. P. Mindanao, Tagum, Davao City

²Institute of Chemistry, U.P. Los Baños, College, 4031 Laguna

The cost of scientific research has increased dramatically due to the dependence on imported reagents and supplies which are not manufactured locally. The identification of a process that would allow synthesis of chromatographic supports from locally available materials is envisioned to be scientifically and economically beneficial. Carboxymethyl-"nata" (CMN), a cation exchange resin with a degree of substitution of 0.76 was synthesized from "nata de coco", a cellulosic material as solid support by treatment with NaOH and monochloroacetic acid. Invertase, a hydrolytic enzyme was used in the production of high fructose syrups, a commodity more expensive than sucrose was immobilized on pellets containing CMN and agar via ionic and adsorptive forces. This step facilitated the conversion of the enzyme to a "shelf reagent" with enhanced stability for repeated applications. The immobilized enzyme exhibited an optimum pH of 4.5 and an optimum temperature of 55°C. The immobilized enzyme showed comparable kinetic properties with the free enzyme in terms of the V_{max} but with a slightly higher K_m value. The immobilized invertase was found to be stable on storage, on repeated and on continuous use.

Key words: carboxy methyl-nata, invertase, immobilization, enzyme, chromatography, support, cation exchange, kinetic, K_m , V_{max}

19. VISCOSITY SENSOR BASED ON A PIEZOELECTRIC QUARTZ CRYSTAL

DOMINIC S. CUADRA and FORTUNATO S. SEVILLA III

University of Santo Tomas
España St., 1008 Manila

Conventional viscosity measurements usually require a sizeable amount of liquid sample (ca. 5 to 20 mL), considerable measurement time, and some specialized personnel skills. The most commonly used devices are the capillary viscometer and the "steel ball" viscometer. In order to simplify viscosity determination, a novel viscosity sensor was developed based on a piezoelectric quartz crystal. This device exploits the effect of the viscosity of a liquid medium on the resonant frequency of a piezoelectric crystal.

In this sensor, one side of the quartz crystal was exposed to about μL of the liquid sample in a fabricated sensor cell. The piezoelectric crystal was driven to vibrate through an oscillation circuit based on a TTL device and the oscillation frequency was measured through a frequency counter. The sensor exhibited a response within 1 second and reached a steady state in 2 minutes. In the presence of the liquid sample, the sensor displayed a decreased frequency. The response was highly repeatable even at random sampling procedures. A highly linear relationship was observed between the frequency and the



square root of the product of density and viscosity. The response characteristics of this sensor could make it useful for the on-line measurement of viscosity in industrial processes.

Keyword: viscosity sensor, piezoelectric crystal, quartz crystal

20. PROCESSABLE pH SENSOR BASED ON CONDUCTING POLYANILINE

KAREN S. SANTIAGO¹ and CHRISTINA A. BINAG²

¹Chemistry Department, College of Science

²Research Center for the Natural Sciences

University of Santo Tomas

España St., 1008 Manila

Polyaniline (PAn) is one of the many organic polymers that offer commercial applications. It is being used as coating of films for corrosion protection and as material for electrochromic displays that operate rechargeable batteries and optical devices. Today, it was developed as a processable pH-sensor that serves as an alternative to glass electrode. The latter has been found impractical in clinical laboratories because of its fragility and large volume requirement of body fluids that are difficult to obtain. Whereas, a PAn-coated metal wire is robust and could be as small as 0.107 cm². Hence, it could be inserted in vivo for real time pH monitoring. The preparation of the potentiometric pH-sensor involves a straightforward procedure, and is inexpensive, making it highly processable. Absence of an internal filling solution in the sensor allows it to be used in any position - it may be placed vertically, horizontally, or upside down. Electrochemical polymerization was carried out in devising polyaniline-coated pH sensor. The optimum starting compounds and conditions for electrode fabrication are: 0.10 M aniline monomer, 30 mg Bovine Serum Albumin (BSA) dopant, 0.10 M Tris(hydroxymethyl)-aminomethane, at pH 7 30-minute polymerization time without stirring, platinum wire support and 9.34 mA cm² current density.

The sensor showed a sub-Nernstian response of -42.06 mV/pH (0.5), a linearity of 0.9985 and favorable response time of ~3 minutes for 3 replicates from pH3 to pH10 at room temperature. The conducting polyaniline-based pH sensor exhibited low hysteresis with Δm - 5.83 mV/pH, low drift with an RSD ~ <4% high reproducibility with an RSD = ~ <3% and lifetime of > 1.5 months. Through Cyclic Voltammetry, the growth of polyaniline onto a platinum disc was monitored. The voltammogram showed three forms of polyaniline: the reduced (-1.03V), conducting (-1.069V), and oxidized (+0.61 V) states.

The polymer film surface of PAn/BSA sensor was analyzed using X-ray Photoelectron Spectroscopy (XPS) and Scanning Electron Microscopy (SEM). Via XPS, a wide scan spectrum of PAn/BSA was achieved showing the elemental composition C1s, N1s, and O1s. The absence of S2p peak at $E_g \sim 1.68$ eV indicates that the BSA dopant exists mostly in the bulk of the polymer film. SEM showed hexagonal-shaped flakes of PAn film on Pt wire under 5000 magnifications. The characteristics of the devised potentiometric pH sensor based on conductive polyaniline presented are that it has good sensitivity and linearity making it a suitable alternative to the conventional pH glass electrode.

Key words: polyaniline, conducting polymer, sensor, pH, potentiometry, SEM, XPS, BSA dopant, Tris (hydroxymethyl)-amino methane buffer, Nernstian



21. FABRICATION AND CHARACTERIZATION OF CONDUCTING POLYTHIOPHENE AND POLY (3-METHYLTHIOPHENE) MODIFIED SENSORS

CHRISTINA A. BINAG¹, JELYN J. JABON², GLENN WESLEY S. CU²,
and KARINA MILAGROS R. CUI²

¹Research Center for the Natural Sciences

²Chemistry Department, College of Science
University of Santo Tomas, España St., 1008 Manila

Conducting polymer, an organic material with both electrical and mechanical properties had gained its popularity as potentiometric electrode. This kind of electrode has the advantages of being robust, and with higher mechanical strength. In this study, conducting polymers such as polythiophene (Pyp) and poly(3-methylthiophene) (P3MTp) were developed by electrochemical polymerization. The optimum polymerization conditions for P3MTp monomer, and 30s polymerization time. While the optimized polymerization conditions for PTP were 0.1 M thiophene (Tp) monomer, 10 mL chloroform, Pt solid support, 1 mA current, 0.1 M ClO_4^- dopant, and 20 s polymerization time.

The PTP-coated [H] sensor exhibited sub-Nernstian response ($335.42 + 3.80 \text{ mV/pH}$) and good linearity (-0.9925) over hydrogen ion concentrations of 10^{-3} to 10^{-10} M. The 3MTp-based electrode gave a sensitivity response of $-47.56 + 2.51 \text{ V/pH}$ with linearity of -0.99775 towards [H] in concentration range of 10^{-3} to 10^{-10} M. The potentiometric characteristics of the sensor include calibration curve, memory effect, electrode lifetime, hysteresis, electrode drift, and electrode selectivity. Scanning electron microscopy (SEM) was used to study the electrode surface morphology while the electrode surface composition was characterized by X-ray photoelectron spectroscopy (XPS).

Key words: polythiophene, poly(3-methylthiophene), conducting polymer, electropolymerization, pH, potentiometry, sensor, cyclic voltammetry, XPS, SEM

22. COMPARISON - CONTINUOUS PROCESS OF LYSINE PRODUCTION USING IMMOBILIZED AND FREE CELLS OF *Corynebacterium glutamicum*

CHAY BINH PHAM and REYNALDO V. ODIAMAR

National Institute of Molecular Biology and Biotechnology (BIOTECH)
U.P. Los Baños, College, 4031 Laguna

Different gelling agents were used to immobilize viable cells via either alginate or κ -carrageenan gel beads. Based on cell leakage from the gel beads, oxygen and glucose diffusion coefficients and toxicity of the gelling agents SrCl_2 was found to be the best for the immobilization of microbial cells not only in alginate but also in carrageenan beads. Using Sr-carrageenan gel beads, a lysine concentration of 12.5 g/L was reached in the continuous fermentation with a productivity of 0.75 g lysine/L.h.

To overcome problems of low mass transfer commonly encountered in immobilized aerobic cell fermentation, continuous l-lysine production using free cells in a stirred tank bioreactor coupled with a ceramic membrane was developed. Without ceramic membrane, batch fermentation with



Corynebacterium glutamicum (wild type) exhibited a volumetric productivity of 0.18 g lysine/L. h. with a maximum lysine concentration of 9.4 g/L. When a ceramic membrane was coupled in continuous lysine fermentation process at a dilution rate of 0.6 h⁻¹ increased volumetric activity of 1.83 g lysine/L.h. and a maximum concentration of 30.5 g/L were obtained.

Key words: continuous lysine production, *Corynebacterium glutamicum*, free cells, new gelling agent-SrCl₂, immobilized cells

23. DETERMINATION OF ANIONIC SURFACTANTS IN FRESH WATER BODIES IN THE PHILIPPINES BY NEGATIVE ION ELECTROSPRAY IONIZATION-MASS SPECTROMETRY

JEWEL RACQUEL S. UNSON¹, CRISTINA DANCEL²,
and FABIAN M. DAYRIT^{1,2}

¹Environmental Science Program ²Department of Chemistry
Ateneo de Manila University, Loyola Heights, 1108 Quezon City

The presence of branched and linear alkylbenzene sulfonates (ABS and LAS, respectively) and cocofatty alcohol sulfates (CFAS) were determined in the Pasig River, Laguna de Bay, and Balatun River (San Pablo City, Laguna) using negative ion Electrospray Ionization-Mass Spectrometry. The anionic surfactants were concentrated from the water samples by solid phase extraction (SPE) using a C2 SPE column and introduced into the MS direct injection. CFAS quantification was performed using the ratio of the m/z 237, 265 and 293 peak areas against that of m/z 247 of barium perfluorobenzene sulfonate (internal standard). LAS and ABS quantification was performed using the ratio of the m/z 297, 311, 325, 399 and 343 peak areas against that of m/z of the internal standard. The detection limits for both CFAS and ABS/LAS analytes were below 0.5 ppm. Use of formaldehyde as sample preservative improved the % recovery of CFAS, but did not affect the % recovery of LAS and ABS.

The commercial feedstock of CFAS, ABS, and LAS were analyzed to determine the respective profiles of carbon chain length.

CFAS was not detected in any of the water samples collected between September and November 1999 (below detection limit, <0.48 ppm). The combination of LAS and ABS was detected at around the limit of detection (0.28 ppm), but due to the low level, it was not possible to differentiate LAS and ABS by collision induced dissociation (CID).

Key words: surfactant analysis, LAS, CFAS, ESI-MS



24. STUDIES ON A LECTIN ISOLATED FROM THE SEEDS OF *Dolichos lablab* L. (BATAO)

SONIA D. JACINTO¹, ROBERTO ELIAS M. CAGANDA¹, LAARNI PAZ ANORICO¹, ERIKA JOY FLORES², MA. LORETA V. QUITORIANO¹, MARNIE GRACE I. SONICO¹, HANS-JOACHIM GABIUS²

¹*Institute of Biology, College of Science
U.P. Diliman, 1101 Quezon City*

²*Institut für Physiologische Chemie
Ludwig Maximilians Universität
Munich, Germany*

Crude extracts from seeds of *Dolichos lablab* L. (batao) indicated lectin activity with hemagglutination assay using human blood types A, B., AB and O. The highest activity was observed with blood type AB. Sugar inhibition assays suggested specificity for mannose and galNAc. The extracts were fractionated by saturated ammonium sulfate and affinity purified through a mannose sepharose column. SDS-PAGE showed bands of 14 and 60 kDal which stained positive to periodic acid Schiff reagent indicating a glycoprotein nature.

The purified lectin showed non specific dependence on cations when tested with Ca^{++} , Mg^{++} , Mn^{++} , and Zn^{++} . Dialysis against different concentrations of EDTA abrogated lectin activity. Hemagglutination activity was observed to be high at pH 8 to 9.0 and absent at low pH. It is stable up to 60°C.

Purified extracts showed an ability to induce release of superoxide anions in human neutrophils, indicating positive influence in phagocytic cell activity important in cells challenged by infections and tumors. Activity was observed to be dose dependent but not time dependent. The lectin was also observed to induce the release of NO_2 , also indicating positive influence on immune response. It showed minimal ability to induce the release of cytokines, TNF α and IL2 by human monocuclear white blood cells. MTT assays using cell lines A549 a non small cell human lung adenocarcinoma and human breast cell line T47, showed cytotoxic activity especially with the breast cells in a manner almost comparable to the cytotoxicity of taxol which was the positive control used. Moreover, exudates of human mononuclear white blood cells incubated with different concentrations of lectin were cytotoxic to the same cell lines.

Key words: lectin, *Dolichos lablab*, glycoproteins, cytotoxicity, immunodulatory

25. PRODUCTION OF PROTEIN-ENRICHED BANANA PEELINGS FOR ANIMAL FEED INGREDIENT

CHAY BINH PHAM and JENNIFER A. DANTE

*National Institute of Molecular Biology and Biotechnology (BIOTECH)
U.P. Los Baños, College, 4031 Laguna*

High carbohydrate, low protein, and high tannin contents of banana peeling wastes from the food processing company disposal around the country posed several environmental problems for the social



health communities. These raw materials could be beneficial to food companies if it will be processed into animal feed. The objective of this study is to convert the high tannin-carbohydrate into more digestible protein feed ingredient using solid state fermentation (SSF) process.

Total of 44 selected fungal strains and isolates were screened for protein enrichment of banana peelings with low tannin and more soluble substances of products. The criteria of selection were the whitish color rapidity of growth in the SSF process, high protein content, and no toxic compounds in the final product. The following microbial strains obtained were *Aspergillus niger* BIOTECH 3104, and its auxotrophs 1031 and 1032B, *A. niger* BIOTECH 3105 and *A. oryzae* BIOTECH 3078, and KBN 616.

Based on the protein, the crude protein (CP) content of dried product from banana peelings fermented with *A. niger* BIOTECHN 3104 had increased from 7.24% in raw material to 31.90% in the fermented products after 3 days of SSF process. On the other hand, the water soluble substances increased from 22% in the raw materials to 32% in final product. Feeding toxicity study on mice revealed that 50% substitution of soybean meal by protein-enriched banana peelings in their diets could be formulated without adverse effects on the growth performance of mice during the feeding trial.

Key words: bioconversion, banana peeling wastes, *Aspergillus niger* BIOTECH-3104, high protein product, animal feeds

Biological Sciences

26. BIOLOGICAL ASSESSMENT OF A LOWLAND FOREST IN DINALUPIHAN NATURE CENTER

EDUARDO JIMMY M. ARMA and ROSANA C. JAMON

Department of Biological Science, College of Arts and Sciences
University of Perpetual Help Rizal, Las Piñas City

LOURDES V. ALVAREZ¹ and VENANCIO SAMARITA²

¹Botany Division, National Museum
P. Burgos Street, Manila

²Zoology Division, National Museum
P. Burgos Street, Manila

A survey of forest plants and animals in Dinalupihan Nature Center Roosevelt National Park, Bataan, was conducted in June 1998. The purpose was to determine the composition, abundance, and distribution of the flora and fauna in order to establish those which are rare, threatened, and endangered. Before Dinalupihan Nature Center is developed into a park, the public must establish a level of awareness of the issues concerning the environment. Among the issues are: (1) dwindling number of what remains



as Philippine forest and the need to rapidly reforest; (2) conservation, protection, and management of the fast depleting watershed areas; and (3) enhancement of the environment. The methodology used for determining the tree species, their distribution, structure, and composition were as follows: two transects measuring 400 m which were S 34°W with four 20 x 20-m quadrats, and a 200-m S 25°W with two 20 x 20-m quadrats, were set. Each tree having a diameter breast at height of not less than 40 cm was measured, marked, and identified using tags with different numbers, consisting of a sequence of two double digits. Each specimen was identified and herbarium specimens were prepared.

The methodology for the survey of insect fauna consisted of setting a transect line 400 m in length, stretching from as low as 80 m to 180 m. Six quadrats of 1 sq m each were laid out along the transect line at an interval of 65 m apart. Random collection of insect fauna outside the transect was done using insect nets. Mist nets were set along the 400-m transect line at an interval of 50 m apart to determine bird population and related mammals and reptiles. Transect line 1 with eight mist nets was located in a forested area while transect line 2 with 4 mist nets was located in the cogonal area. Half of the nets were opened overnight for nocturnal species. Captured flying mammals were weighed, then skinned, and preserved as museological voucher specimens. Birds whether heard, sighted, or captured were noted for their frequency, estimated weight, and number of occurrence.

Results of the survey were as follows: (1) A total of 23 species of forest trees were identified. The ten most dominant trees were narra (both spiny and smooth winged) (*Pterocarpus indicus* Willd.), teak (*Tectona grandis* L.), putata [*Barrington racemosa* (L.) Blume], kupang (*Parkia roxburghii* G. Don), tangiang bayawak (*Ficus variegata* (Blume) Merrill), bingas [*Terminalia citrina* (Gaertn) Roxb.], guiijo [*Shorea guiso* (Blanco) Merrill] piling li-itan [*Canarium luzonicum* (Blume) A. Gray], balitbitan (*Cynometra ramiflora* L.), and Thailand shower (*Cassia siamea* Lam.)

A total of 104 insect fauna were identified. Fire ants (*Solenopsis* sp.) and weaver ants (*Oecophylla* sp.) both under Family Formicidae were most numerous. The subterranean termites (*Reticulitermes* spp.) ranked next. The lemon migrant (*Catopsilia pomona* Family Lepidoptera) was the most dominant butterfly while the common grass yellow butterfly (*Eurema hecabe*) ranked second. The grass moth (*Pyraustinae*) ranked the highest. The highest yield of insect fauna was collected under the big amugis tree. A total of 20 species of birds were captured. The identified reptiles were the northern watersnake, lined slender arboreal snake, brahminy blindsnake, spotted green treeskink, monitor lizard, common flying lizard, and Hawaiian toads. The few mammals noted were fruit bats and lead-nosed bats.

The findings further showed that narra and teak trees were mainly secondary in growth and were planted to meet the needs of the local people. There were remnants, however, of dipterocarps and related tree species and area can be a rescue center. Dinalupihan Nature Center is a potential economic and tourist prospecting park if it can be developed into an ecological complex of nature to serve as a scientific and information center. The municipal government can undertake a series of projects which will promote conservation practices, educational upliftment, as well as establish a place for recreation.



27. KENILWORTH MARSH RESTORATION PROJECT: AN ASSESSMENT OF THE VEGETATION AND RESTORATION EFFORT

VICTORIA C. GUERRERO

*Patuxent Watershed Land Trust, Inc.
Silver Spring, Maryland 20902*

This research project addresses the need to assess the results of wetland restoration efforts in the Chesapeake Bay for more efficient and effective restored wetland management. In this paper the results of research which I undertook in 1996 on the ecological assessment of the vegetation aspects of the National Park Service Kenilworth Marsh Restoration Project on the Anacostia River in the District of Columbia are presented. This project was inaugurated in 1992. The National Park Service funded my research for three years (1993-1996) and the Environmental Protection Agency/Chesapeake Bay Program provided funding for one year (1996-1997).

Some salient findings from my 1996-1997 research are: (1) Invasive growth of volunteer species in the three mass fills; occurrence and aggressive growth of cutgrass obliterating planted species in Mass Fill 1, and invasive growth of cattails in Mass Fill 2; (2) decrease of harmful invasive species of purple loosestrife; and (3) Phragmites in Mass Fill 1. Total number of species remained high in Mass Fill 2, and the Control, followed by Mass Fill 1, and Mass Fill 3. The appearance and disappearance of succession species varied from year to year for planted species, and even for the volunteer and the invasive species, with the exception of the cattails and the cutgrass. While the cutgrass and the cattails spread and grew rhizomatously in Mass Fill 1 and Mass Fill 2, the vegetation species in Mass Fill 3 were growing and evolving through their seeds

Key words: wetlands quality, restoration, ecology, Kenilworth Marsh, rhizomatously

28. ECOLOGICAL RISK ASSESSMENT FOR HIGH ENVIRONMENTAL QUALITY

JOSEFINO M. MAGALLANES

*Central Mindanao University
University Town, Musuan, 8710 Bukidnon*

The need to quantify the risk of adverse environmental consequences to human and non-human resources as caused by ecological hazards has generated the development of risk assessment methodology. It is a necessary instrument for a quantitative environmental impact development project. Of the many that are presently existing, most if not all, are so mathematically complicated that they cannot be easily followed and adopted by administrators, scientists, and resource management practitioners. This study represents an attempt to formulate a simple and easily usable treatment of the methodology.

It is the main goal of this study to promote high environmental quality and, to attain this, the following specific objectives are adopted:



1. to evaluate an ecological risk assessment model that measures the probability of occurrences of adverse environmental impacts as caused by ecological stresses; and
2. to use this model in assessing the acceptable concentration as the basis of developing mitigating options.

Environmental risk is determined as:

$$ER = (Obs/Exp) / S \quad \text{Eq.1}$$

where ER = coefficient of relative environmental risk factor
 Obs = number of affected cases observed in the exposed group
 Exp = number of affected cases expected in the exposed group
 S = ecological stress measured by $C \cdot I \cdot T$:
 C = concentration in units of mg / cu m
 I = standard intake in cu m
 T = number of days of exposure

The probability of occurrence of adverse environmental impacts is further evaluated as:

$$P = ER \times S \times (\sum ER / n) \quad \text{Eq.2}$$

where P = probability of occurrence of adverse impacts
 R = same as defined in Eq.1
 S = same as defined in Eq.1
 n = number of ER rates

The model was tested for prediction of adverse consequences in several studies, such as pesticide use, soil erosion control, mortality rates due to cancer, and morbidity rates due to water pollution. Pesticide use and soil erosion studies used a quasi-experimental design, comparing the exposed and non-exposed groups on the effects of the intervention. The last two studies used secondary data.

The assessments show results that indicate the model as a good predictor of adverse responses which are as good as the standard rates for the general population. The evaluations of acceptable concentrations further are consistent with what are prescribed by public agencies.

The ERA model provides a significant input to decision-making related to developing the most appropriate regulatory actions for human exposures, industrial plant emissions, ambient air and water exposure, and mitigation options formulated to control serious adverse environmental effects.

Key words: ecological risk assessment (ERA), high environmental quality, environmental risk factor, ecological stress, probability (of occurrence of adverse consequences), concentration, exposure, time of exposure and development project



29. MULTIPLE SHOOTING IN COTYLEDONARY NODES AND *Agrobacterium*-MEDIATED TRANSFORMATION IN *Pterocarpus indicus* WILLD. (FABACEAE)

MINDA P. FOLLOSCO¹ and KATSUAKI ISHII²

¹Biology Department, De La Salle University
2401 Taft Avenue, 1004 Manila, Philippines

²Tissue Culture Laboratory, Forestry and Forest Products
Research Institute (FFPRI), Tsukuba, Ibaraki, Japan

Pterocarpus indicus Willd. (Fabaceae) locally known as narra, is an indigenous tree in Southeast Asia. Its wood gives one of the best materials for furniture making. It is also a good source of red dye, has some medicinal uses, and is one of the multi-purpose trees. However, propagation of the plant by seeds is beset by problems involving their being prone to insect attack and various diseases. Thus, a manageable and efficient method of in vitro propagation is necessary to supplement the conventional method of propagation and to improve its germplasm successfully by genetic engineering.

Germination and survival rates and the response to the formation of axillary shoots in cotyledonary nodes were compared between two provenances of prickly narra. Laguna and Manila provenance seeds germinated at 39.16% after four to seven days and 50.00% after two to five days, respectively. With a survival rate higher in Manila provenance, the total node explants inoculated were 52 while in the Laguna provenance, only 26 were available for use. Murashige and Skoog (MS) and Woody Plant Medium (WPM) supplemented with 0.90 mg/L BA alone or in combination with 0.186 mg/L NAA did not have a remarkable effect on the growth of the excised embryos. However, the formation of axillary shoots on cotyledonary shoots and the quality of seedling growth were both affected by the different concentration and combination of cytokinins added to the MS multiplication medium. Seedling growth in Manila provenance was robust; Laguna seedlings were frail. Cotyledonary nodes from Laguna produced the usual 2 axillary shoots per node while in the Manila provenance, three to seven axillary shoots per node were observed in the following treatments: MS + 2.00 mg/L BA + 2.5 mg/L thidiazuron (TDZ), MS + 2.00 mg BA + 2.5 mg/L zeatin + 2.5 mg TDZ, MS + 2.00 mg/L BA + 5.0 mg/L zeatin, MS + 10.00 mg zeatin, and MS + 10.00 mg/L TDZ. This is the first report on multiple axillary shooting in cotyledonary nodes of narra and its transformation using *Agrobacterium*.

Some tissues were successfully transformed with *A. tumefaciens* LBA 4404 which harbored a binary vector, p81121 (Clontech, Palo Alto, CA) with genes for β -glucuronidase (GUS) and neomycin phosphotransferase (NPTII). The cotyledons were the best tissues that responded to transformation as shown by the appearance of a blue color in the transections under the treatment of X-GLUC (5-bromo-4-chloro-3-indolyl- β -D-glucuronide) solution. Further tests with the use of PCR-based technology are needed to supplement the result of the histochemical test for GUS activity.

Key words: cotyledonary nodes, *Agrobacterium*, transformation, *Pterocarpus indicus* Willd., narra, provenance, multiple shooting axillary shooting, zeatin, thidiazuron



30. EMBRYONIC DEVELOPMENT OF "HANGA"

VIVIAN S. TOLENTINO¹ and PRESCILLANO M. ZAMORA²

¹Department of Biology, Ateneo de Manila University
Loyola Heights, 1108 Quezon City

²Institute of Biology, College of Science
U.P. Diliman, 1101 Quezon City

"Hanga" or *Pittosporum resiniferum* Hemsl. is a potential alternative source of energy because of the petroleum-like properties of the oil from the fruit which is comparable to petroleum due to the presence of dihydroterpene and n-heptane (Bacon 1909; Noble 1978). The study was conducted to trace and describe the different stages of development of the embryo from globular to the mature stage. The modified clearing technique using NaOH and chloral hydrate was used. Seeds were removed from the fruits and the embryos in the seeds were isolated. The embryos were measured with a micrometer eyepiece using a BH-2 Olympus epifluorescent microscope. Morphological and anatomical descriptions were used as criteria for classifying the embryos in different stages. Stage 1 had embryos which were small and globular in shape. In stage 2, the embryos were in the early-heart shape, with cotyledons developing. In stage 3, the embryos were in the mid-heart shape with developed cotyledons. A suspensor, at the base of the embryo was observed. In stage 4, the late-heart-shape, the cleavage between the cotyledons was deeper and the cotyledons more rounded at their tips. The primary tissues (protoderm, procambium, and the ground meristem) were well defined.

One embryo per seed was noted. Approximately 80 to 90% of the seeds dissected showed the presence of an embryo. Most of the embryos were heart-shaped. The smallest seed (2mm) showed also the presence of an embryo. The presence of an embryo and its developmental stage are not directly related to seed size.

Key words: embryo, NaOH, chloral hydrate, suspensor, procambium, dihydroterpene, n-heptane, cotyledons, protoderm, ground meristem

31. THE CULTURE OF *Kappaphycus alvarezii* (Doty) AT THE THREE DIFFERENT WATER LEVELS IN THE MARINE WATERS OF NORTHERN POBLACION, SAN FRANCISCO, CEBU

SERAPION N. TANDUYAN

Cebu State College of Science and Technology
Fishery and Industrial College
San Francisco, 6050 Cebu

Camotes Island is noted for its Camotes Sea, one of the fishing grounds in the Philippines. It is composed of three islands namely: Pacijan Island where the municipality of San Francisco is located; Poro Island, which is divided into two municipalities, Poro and Tudela; and the smallest is Ponson Island where the municipality of Pilar is found. The fishermen in the area are complaining on the decline of their catch. The livelihood of the majority of the inhabitants are fishing and farming and they are becoming



poorer because at present they have no alternative livelihood to augment their income.

This study was undertaken to find out what level of water the *Kappaphycus alvarezii* locally known as "gozo" will grow in the marine water of San Francisco, Cebu using the randomized complete block design (RCBD), with the increase of weight as indicator for growth. There were three treatments in the study with three replicates such Treatment 1 represents the surface layer; Treatment 2 represents the middle layer, and Treatment 3 represents the bottom layer. Bamboo rafts were used to hold the plants at the three different levels. Seedlings were selected from the midpart of the whole plant up to the tip. Plant samples were weighed every 15 days for 45 days.

The area parameters are salinity, 32-39 parts per thousand (ppt); water temperature, 31-32°C; water velocity, 4 to 8 seconds per meter, water depth, 3 meters to 3.75 meters, and water transparency, 3 to 3.5 meters.

Results based on the mean weight of the plant after 45 days show that surface layer has 1,395 grams; middle layer 1,052.50 grams, and the bottom layer is 834.44 grams.

Analysis of Variance (ANOVA) table shows that there is no significant difference in all the treatments meaning all the levels are suitable for gozo culture.

Key words: *Kappaphycus alvarezii*, Camotes Sea

32. SCANNING ELECTRON MICROSCOPE (SEM) STUDY OF THE MORPHOLOGY OF ALLERGENIC POLLEN GRAINS IN RELATION TO ANEMOPHILY

LOLITA J. BULALACAO

*Department of Biological Sciences, College of Arts and Sciences
University of Perpetual Help Rizal, Pamplona, 1740 Las Piñas City*

The growing interest in pollen morphology as a way to better understand respiratory allergy in the Philippines has led to this study.

This study reports the fine sculptural features of the grass pollen and other species of allergenic pollen grains using the scanning electron microscope (SEM). This study also provides identification of the species and additional pollen characters such as sculptural modifications of the pollen exine in relation to effective wind pollination or anemophily.

Fresh pollen were obtained from wild plants growing in open spaces in Las Piñas City. These were taken to the Biological Institute, Faculty of Science in Tohoku University in Sendai, Japan for SEM analysis.

The pollen samples were subjected to acetolysis, dehydrated, centrifuged, and prepared for scanning using a Hitachi S-4100 Scanning Electron Microscope with an EP-3000 Image Processor.

The results show that nine (9) species of allergenic pollen differ morphologically. *Cenchrus echinatus* L. (karitkaritan), *Chloris barbata* Sw. (korokorosan), *Panicum maximum* Jacq. (Guinea grass) are all monoporate with an operculum, an annulus, a thin exine, and circular outline. A peculiar feature of the grass pollen as seen by SEM is the occurrence of irregularly shaped islands called frustillae, separated by grooves at the bottom where microperforations occur (Rowley, 1960). The surface of the frustillae have spinules which are either bluntly conical or acute.

The pollen of *Tridax precumbens* L. (wild daisy) and *Vernonia cinerea* L. (tagulinaw) show the



characteristic echinate and echinolate sculpturing. In *Verrornia cinerea*, the spines are greatly reduced and the ridges and depressions probably make the pollen grain more bouyant.

Mimosa pudica L. (makahiya) pollen is a small tetrahedral tetrad with exine sculpture consisting of packed granules separated by grooves. *Leucacna leucocephala* (Lam.) de Wit (ipil-ipil) pollen has a wall covered with small pits. *Anmaranthus spinsus* L. (uray) pollen has many pores. *Casuarina equisetifolia* Blanco (agoho) pollen exhibits greatly reduced spinules sparsely arranged on its surface.

Associated with anemophily, the nine (9) species of allergenic grasses fall within a size range of 20-40 μm , small and light enough to follow the air stream. For large and dense pollen grains, certain modifications of the exine occur. The grooves separating the frustillae are openings of microchannels possibly playing a role in the transit of glycoproteins, glycolipids, proteins, and carotenoid pigments (Cerceanu-Larrival, et al., 1980).

This study is significant for palynologists who are mainly interested in the function and structure of pollen grains. For allergologists, it is important for them to find out structures associated with allergens present in pollen grains.

Key words: acetolysis, anemophily, echinate, echinolate, exine, frustillae, monoporate, morphology, pollen, SEM.

33. VARIATION IN GINGER (*Zingiber officinale* Rosc.) AND RELATED TAXA USING ISOZYME PATTERNS

REMEDIOS R. RODEROS¹ and ERNA LOUISE L. ELIAS²

¹Institute of Biology, College of Science
U. P. Diliman, 1101 Quezon City

²Natural Science Research Institute
U. P. Diliman, 1101 Quezon City

Ginger (*Zingiber officinale* Rosc.), an aromatic herb with an underground rhizome, belongs to the family Zingiberaceae. In many Asian countries, it forms an essential ingredient in most dishes and is also a component of many pharmaceutical preparations. Related taxa such as *Zirtgiber zerumbet* (L.) Smith, *Z. purpureum* Rosc. (syn. *Z. cassumunar* Roxb.), *Curcuma* spp., and *Alpinia* spp. have likewise been reported to have some economic and medicinal importance. Earlier works done on *Zingiber* and other members of the ginger family, which largely deal with chemical, taxonomic, and pharmacognostic studies, revealed genetic variation for several morphological characters. However, zingiberaceous plants possess a limited number of morphological features useful in classical taxonomic evaluations, making species level identification of these plants difficult in the absence of the parts, especially floral structures, that bear these key traits. More recent biochemical studies on two genera, *Zingiber* and *Curcuma*, using differences in isozyme patterns have shown interspecific variations for a number of enzyme systems (Ibrahim, 1996); however, such diversity has not been critically evaluated. This project was thus undertaken to determine if there is significant interspecific and intraspecific variation shown through isozyme banding patterns and to ascertain if isozyme analyses could prove useful as taxonomic markers in this group of plants. To do this, protein extracts from mature leaves of 10 accessions of ginger and related taxa (7 *Zingiber*, 2 *Languas*, and 1 *Curcuma*) from at least 3 regions of the Philippines were subjected to



electrophoretic techniques using polyacrylamide gels to generate isozyme bonding patterns for 6 enzyme systems: esterase (EST), peroxidase (PRX), acid phosphatase (ACP), glutamate oxaloacetate transaminase (GOT), malate dehydrogenase (MDH), and catalase (CAT). Clustering methods using the Multi-Variate Statistical Package software were performed to analyze the variation in bonding patterns. It was found that EST, PRX, and ACP showed significant interspecific as well as intraspecific variation among the accessions. GOT and MDH revealed interspecific variation but did not substantially delineate between samples of the same species. CAT, on the other hand, exhibited little variation in all the accessions. Clustering of the *Zingiber officinale* samples was observed to be geographically affected, with samples from the north (Luzon) clustering together and those from the south (Visayas and Singapore) forming another group. These results suggest that the use of isozyme banding patterns as taxonomic markers may be possible but this feasibility would depend upon the enzyme systems being used.

Key words: Zingiberaceae, isozyme, interspecific variation, intraspecific variation, electrophoretic techniques, clustering methods

34. CORRELATION OF PANDANUS ALKALOIDS TO THE TAXONOMY OF PANDANACEAE

MARIBEL G. NONATO

*Phytochemistry Laboratory, Research Center for the Natural Sciences
University of Santo Tomas, España St, 1008 Manila*

Leaves of *P. amaryllifolius*, *P. dubius*, *P. simplex*, *P. laevis*, *P. veitchii*, and *P. variegatus* and the species described as a cross between *P. nobilis* and *P. vidalii* collected from Luzon were detected to contain alkaloids by the Culvenor Fitzgerald field test. *P. tectorius* Sol. on the other hand did not show a reproducible response to the alkaloid field-test. *P. laevis*, *P. veitchii*, and *P. variegatus* were all identified to be cultivated varieties of *P. tectorius*.

The first novel alkaloid, pandamarine, from *P. amaryllifolius* of the subgenus *Kurzia* was reported in 1992 by the team from UST RCNS. These were further substantiated by the report of 3 more new alkaloids from the same plant. Works by Garson and Sjaifullah on the same plant obtained from Indonesia reveal more new alkaloids. More recently, this researcher and the group of Prof. N. Aimi of Chiba University isolated more new alkaloids from plant materials obtained from the Philippines and Thailand. *P. dubius* Sprengel, a species classified under the subgenus, *Rykia*, gave similar alkaloids like that from *P. amaryllifolius*. The results establish the basic structure of the *Pandanus* alkaloid to be C_9NC_9 . *P. nobilis* x *P. vidalii* yields vomifoliol (blumenol A) suggesting the occurrence of a false positive reaction with the alkaloid-precipitating reagent. No alkaloid was isolated from *P. tectorius* that responded with the field test. The cultivar *P. variegatus* also did not produce any alkaloid despite its initial response to the field test. The detected alkaloids in *P. laevis* and *P. veitchii* are now being studied. True alkaloids were found present in species belonging to the subgenera *Rykia* and *Kurzia*. The subgenus *Pandanus* where *P. nobilis* x *P. vidalii*, *P. variegatus*, and *P. tectorius* belong to was found to give false positive tests for alkaloids. All of these observations proved to be important for the taxonomic classification of these plants. This paper will present the relationship of the alkaloids found to the Pandanaceae taxonomy.

Key words: Pandanaceae, chemotaxonomy, alkaloids, *Pandanus*



35. ROOT FORMATION IN *Ipomoea muricata* JACQ. (CONVOLVULACEAE) HYPOCOTYL AND LEAF EXPLANTS

THOMAS EDISON E. DELA CRUZ and CORAZON A. MENGUITO

*Research Center for the Natural Sciences, University of Santo Tomas
España Street, 1008 Manila*

Root culture of plants in vitro allows the production of bioactive compounds in large quantity. Seeds of *Ipomoea muricata* Jacq., a medicinal plant known to have antimicrobial activity, were germinated to initiate root formation. Hypocotyl and leaf explants from germinated seeds were placed on agar-solidified Murasghige and Skoog (MS) basal medium supplemented with or without 0.1, 1.0, or 10.0, mg/L α -naphthalene acetic acid (NAA): benzylaminopurine (BAP) in factorial combinations. Cultures were incubated in the dark at 28 to 32 °C for 2 to 4 weeks. Roots were formed on both explants and varied in length, diameter, and appearance as influenced by the plant growth regulators added. Elongated roots (> 30 mm in length) were observed in the absence or low levels (> 1.0 mg/L) of NAA. In higher NAA levels (> 1.0 mg/L), root formation was stimulated as shown by higher average number of roots formed /explant, but growth appeared regulated. BAP, on the other hand, had no direct influence on the root formation of *I. muricata*.

Key words: root culture, Convolvulaceae, *Ipomoea muricata* Jacq., α -naphthalene acetic acid (NAA), benzylaminopurine (BAP)

36. LITTORAL FISHES FROM A SEAGRASS AREA IN SAMAL ISLAND, DAVAO DEL NORTE, PHILIPPINES

PORFIRIO A. CARONAN and NELLIE C. LOPEZ

*Institute of Biology, College of Science
U.P. Diliman, 1101 Quezon City*

Monthly fish samplings were conducted in a seagrass coastal area in Samal Island, Davao del Norte, Philippines, from March 1998 to April 1999 to determine the composition and abundance of fish populations associated with seagrass in the area. A customized beach seine was used to collect fish during the day and at night. A total of 159 fish species comprising 43 families were caught. The pipefish, *Syngnathoides biaculeatus*, and the pufferfish, *Canthigaster bennetti*, were dominant both in total counts and biomass during the day, while at night, the dominant fishes were the rabbitfish *Siganus spinus*, *Apogon coccineus*, *A. fraenatus*, *Cheilodipterus macrodon*, and *C. quinquelineatus*. Fish total abundance and biomass were significantly higher during the day than at night. The dominant species based on total counts were mostly carnivores (39.6%), followed by planktivores (33.8%), herbivores (24.2%), and omnivores (2.6%). Fish density in the study area was 0.46 ± 0.0086 ind m^{-2} and 3.89 ± 0.7183 g wet wt m^{-2} .

Key words: seagrass fishes, Samal Island, Davao del Norte, pipefish, pufferfish, rabbitfish, carnivores, planktivores, herbivores, omnivores



37. THE EFFECTS OF SALINITY ON SURVIVAL AND GROWTH OF TILAPIA *Oreochromis niloticus* EXPOSED AT VARIOUS AGES

ARSENIA C. CASAUAY and CHRISTOPHER P. GAMBOA

*Institute of Biology, College of Science
U.P. Diliman, 1101 Quezon City*

Tolerance of tilapia, essentially a freshwater fish, to artificial seawater acclimation based on survival and growth at 1, 11, 21, 31, and 41 days post-hatching was determined. Optimum survival (100%) was observed in fry exposed to seawater very soon after hatching. Survival rates of 56.67, 76.67, 90, and 93.33% were observed for fry acclimated at 11, 21, 31, and 41 days post-hatching, respectively; indicating a trend towards increased tolerance with age. There was no further statistically significant deviation ($P < 0.05$) as compared to survival of non-acclimated control (96.67%) starting 31 days post-hatching. There were no significant effects on the growth of fish surviving through 61 days post-hatching.

Key words: tilapia artificial seawater, acclimation, fry, hatching

38. REPRODUCTIVE DEVELOPMENT OF THE SUPERMALE (YY) TILAPIA (*Oreochromis niloticus*)

ANNABELLE A. HERRERA¹, RINELLA CRUZ¹, and THE FISH GENETICS BREEDING PROGRAM-GENETIC BREEDING PROGRAM-GENETICALLY MALE TILAPIA PROJECT

¹*Institute of Biology, College of Science
U. P. Diliman, 1101 Quezon City*

²*Freshwater Aquaculture Center, Central Luzon State University
Muñoz, 3120 Nueva Ecija*

Histogenesis of the reproductive system of supermale (YY) tilapia and XY tilapia reared at the Central Luzon State University was analyzed using the paraffin technique. In the course of development, the primordial germ cells appeared at the same age in YY and XY at 8 days posthatch. These cells which were larger in the YY (1.85 μm) than in the XY male (0.9 μm) later established themselves in the gonadal anlage by days 9 to 22. The lobules appeared earlier in the YY at day 15. Blastema of the reproductive duct appeared in the YY at day 23 and in XY at day 27. By day 79, meiotically active cells were abundant in both groups. By day 95, the YY fish showed mature sperm cells in the fully differentiated testis as compared to day 105 in the XY fish. The supermale consistently demonstrated bigger testis, thicker somatic tissues, more spermatogenic cells, and more advanced developmental stage than XY fish of the same age. Germ cell and nuclear size in the YY and XY fish were not significantly different by statistical analysis although the general trend was bigger spermatogenic cells in the supermale tilapia. Anova ($\alpha 0.05$) showed significant difference in size of the testis, spermatocysts, and vas deferens. The study showed that with the same rearing conditions and same age, the larger supermale tilapia has superior reproductive capacity with its larger testis and ducts and faster histogenesis, differentiation, and spermatogenesis.

Key words: supermale, (YY) tilapia, *Oreochromis niloticus*, histogenesis, reproductive development



39. MORPHOANATOMY OF *Vivipara costata* Quoy and Gaimard (Mollusca: Viviparidae) DURING EARLY DEVELOPMENT

ZENAIDA G. BAOANAN¹, IMELDA F. PAGULAYAN²,
and ROBERTO G. PAGULAYAN²

¹Department of Natural Science and Mathematics
U.P. College Baguio, 2600 Baguio City

²Institute of Biology, College of Science
U.P. Diliman, 1101 Quezon City

The early development of the freshwater gastropod snail, *Vivipara costata* Quoy and Gaimard, was characterized by observing the live embryos in the following series: 1-cell stage, 2-cell stage, 4-cell stage, 8-cell stage, morula stage, blastula stage, gastrula stage, trochophore stage, early veliger stage, veliger at start of torsion, veliger at 90° torsion, veliger at 120° torsion, veliger at post-torsion, and juvenile stage. The trochophore larval stage was subdivided into 3 substages with different sizes and distinctive characteristics.

The fertilized egg contained small amount of yolk making the embryo transparent until late veliger stage. Cleavage was spiral. Cleavage cavity and polar lobes were absent. The blastula had a wide blastocoele. Gastrulation was by invagination. There was reduced ciliation in the prototroch of trochophore larva and apical tuft was absent. The veliger larva was of the dominant larval type.

The actual age of the embryos was not determined in this study because they were contained within the brood pouch of the mother and so the different stages were categorized based on their morphological features and relative sizes. The derivatives of the three germ layers namely, the ectoderm, mesoderm, and endoderm, were determined by histological sections using the paraffin method.

The anatomical shifting in the positions of some larval organs relative to their point of origin was attributed to torsion during differential growth. These changes included the shifting of: the heart, kidney, and ureter contained in the visceral sac from the right to the left side; the anus from left to right; the mantle cavity from posterior to anterior; and the crossing over of the right and left intestinal ganglia.

Key words: *Vivipara costata*, morphoanatomy, embryogenesis, organogenesis, trochophore, veliger, torsion, viviparous, histology, conchology

40. DIVERSITY OF THE MOLLUSCAN GASTROPODS, *Terebralia sulcata* AND *Cerithidea cingulata* IN TWO MANGROVE AREAS IN CATANDUANES, BICOL REGION

JIMMY T. MASAGCA

Biological Science Department, College of Science
De La Salle University, Dasmariñas, 4114 Cavite

Typhoons serve as major stresses in the mangrove communities of the island province of Catanduanes, Bicol region. Such disturbances can shift and change the structure of floral and macrofaunal species found in the mudflats of mangrove areas.



From October 21-22, 1998, a super-typhoon damaged the mangrove areas of the southern portion of Catanduanes, particularly in the municipalities of Bato, Virac, and San Andres. In order to understand possible changes in the diversity of bottom dwelling macrofauna, quantitative surveys were conducted from 1998-1999. This was limited to the molluscan gastropods, *Terebralia sulcata* and *Cerithedia cingulata* (Family Potamididae). The quantitative sampling of the two species of molluscan gastropods was done along a series of quadrats established in two study sites. Samples were collected by dividing a square sheet wooden frame of 1-m x 1-m into 4 parts. *T. sulcata* has very unusual abundance towards the seaward fringes, while *C. cingulata* is abundant towards the landward fringes. The former tends to have preference for high salinity seawater compared to the latter which mostly aggregate under *Nypa* palms and mangrove trees where the salinity is less.

The Panganiban mangrove area in the north is characterized by river-dominated allochthonous setting and low tidal range as evidenced by the narrow tidal changes during the day. Oco river discharge of freshwater and sediments leads to the deposition of terrigenous silts. On the other hand, the mangrove area in Virac shows a composite river and wave-dominated setting. Sto-Domingo-Pajo river provides the freshwater supply and sediments. The mangrove setting in this capital town represents a combination of high wave energy and river discharge. The sand that is debounced by this river is distributed by waves forming sand sheets.

Surveys conducted from July to September, 1998, showed the mean density values of 115.42 in Panganiban and 123.72 in Virac for *T. sulcata*. In January-February, 1999 (2 to 3 months after the super typhoon ravaged the province) field surveys were again conducted in the said locations using permanent transects and quadrats showed significantly lower mean density values of 75.42 in Panganiban and 58.25 in Virac from 100 quadrats. In December, 1999, another field survey was conducted in Virac and very low densities of both *T. sulcata* and *C. cingulata* were obtained. The decreasing density of the molluscan gastropods in consideration could be attributed to constant flooding in the mangrove areas which disturbs the macrofaunal communities in the province. Habitat change involving changing patterns of coastal landforms and geomorphic processes could explain these changes in the diversity of molluscan gastropods.

Key words: mollusks, gastropods, diversity, density, mangroves, Catanduanes



41. ELECTRON MICROSCOPE ANALYSIS OF SEXUAL INDUCTION IN A FISSIPAROUS PLANARIAN, *Dugesia ryukyuensis*

JOCELYN CABRERA¹, ANNABELLE A. HERRERA², KAZUYA KOBAYASHI³,
and MOTONORI HOSHI³

¹Nueva Viscaya Institute of Technology
Nueva Vizcaya

²Institute of Biology, College of Science
U.P. Diliman, 1101 Quezon City

³Department of Life Sciences, Tokyo Institute of Technology,
Yokohama, Japan

Minced flatworm, *Bdellocephala brunnea*, was fed to the asexual mixoploid biotype *Dugesia ryukyuensis* (Okinawa-Hiroshima strain) to determine if the asexual worm could be sexualized. Six weeks feeding led to full development of the reproductive organs of *Dugesia*. Ultrastructural observations showed features previously unreported in worms of the same group.

Key words: *Dugesia ryukyuensis*, *Bdellocephala brunnea*, sexualization, asexual worm, mixoploid biotype

42. GILL PARASITES OF *Terapon jarbua* FORSKAL FROM LINGAYEN GULF

NELLIE C. LOPEZ

Institute of Biology, College of Science
U.P. Diliman, 1101 Quezon City

Terapon jarbua (Forsk.) locally known as "bagaong", inhabits inshore waters and brackishwaters and enters freshwater bodies. It is found practically all over the Philippines where it is utilized for food. Examination of the gills of samples obtained monthly from Lingayen Gulf in La Union Province, from January to December 1998 resulted in the recovery of parasites. A total of 162 specimens ranging from 6.0 to 21.2 cm were examined. The most prevalent parasite was a monogenetic fluke, the others found were crustaceans. The parasite species recovered, prevalence (%), and intensity of infection (number per infected host) were: *Diplectanum secundum* (Tripathi) (87%, 1-135), *Caligus* sp. (59%, 1-21), *Caligus pelamydis* (Kroyer) (38%, 1-9), *Neobrachiella chevreauxii* (van Beneden) (8%, 1-7), *Chalimus* larvae (24%, 1-7), and larvae of *Gnathia* sp. (7%, 1-7). For both the monogenean and crustacean (as a group) parasites, no significant seasonal differences in prevalences of infection were observed. However, prevalences of infection were significantly higher with bigger specimens than with smaller one.

Key words: *Terapon jarbua*, Lingayen Gulf, gill parasites, *Diplectanum*, *Caligus*, *Neobrachiella*, *Chalimus*, *Gnathia*, monogenea, crustacea

43. ISOLATION OF INDIGENOUS BACTERIA FOR THE DEVELOPMENT OF PROBIOTICS IN THE BIOCONTROL OF CLINICALLY IMPORTANT PATHOGENS

DORALYN S. DALISAY, MEGAN GRACE URSUA, GLADYS MAE VASQUEZ,
CHIARA VILLARUZ, and SHEILA URETA

*College of Pharmacy and Medical Technology
University of San Agustin
Gen. Luna Street, 5000 Iloilo City*

Increasing resistance of pathogenic microorganisms to antibiotics is a major public health problem globally. Resistance of pathogenic microorganisms is leading to increased deaths and illnesses with consequential expenditure. The use of antibiotics for bacterial infections has become ineffective because of the development of bacterial resistance. This has led to the isolation of probiotics that are most likely to inhibit and control the growth of clinically important pathogens.

A total of twenty bacterial isolates were randomly collected from marine environments in Panay Island, Philippines. Inhibitory activities of these bacterial isolates against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Streptococcus* spp. were examined using cross streaking procedure and modified sensitivity test, in vitro. Eleven isolates showed a moderate inhibitory against *S. aureus*, three against *P. aeruginosa*, and two against *Streptococcus* spp. Two of the twenty isolates, coded MU4 and SU5, showed a strong inhibitory activity against *S. aureus* using the modified sensitivity test while no significant effect was observed against *P. aeruginosa* and *Streptococcus* spp. Characterization of the bacterial strains using morphological classification revealed that strains MU4 and SU5 were gram-positive bacilli and gram-negative bacilli, respectively.

Keywords: pathogenic microorganisms, probiotics, in vitro *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Streptococcus* sp., cross streaking, antibiotics, gram-positive bacilli, gram-negative bacilli

44. Δ^4 -3-KETOSTEROIDS FROM *Morinda citrifolia* L. AS POTENTIAL INHIBITORS OF *Mycobacterium tuberculosis* H₃₇Rv

JONEL P. SALUDES¹, MARY J. GARSON²,
SCOTT G. FRANZBLAU³, and ALICIA M. AGUINALDO⁴

¹Department of Chemistry, University of San Agustin
Gen. Luna Street, 5000 Iloilo City

²The University of Queensland
Brisbane, QLD 4072, Australia

³GWL Hansen's Disease Center, Louisiana State University
Baton Rouge, LA, USA

⁴Research Center for the Natural Sciences
University of Santo Tomas, España Street, 1008 Manila



Tuberculosis, a disease once thought to be under control due to the discovery of effective chemotherapeutic agents, has come back with a vengeance claiming the lives of nearly 3 million people in 1995 worldwide. According to WHO, the Philippines is ranked as the fourth country with the highest incidence of TB in 1995. This ancient scourge, which is now a global epidemic, prompted the search for compounds with antitubercular properties. One promising plant source is *Morinda citrifolia* L. (Rubiaceae). Ethnomedical studies in Hawaii, where this plant is called "noni", reported that the locals used a concoction from this plant to treat tuberculosis.

Preliminary in vitro screening conducted on the alcoholic leaf extract of this plant indicated significant inhibitory activity against the virulent *Mycobacterium tuberculosis* H₃₇Rv, the causative agent of TB. Bioassay-guided purification of the hexane-soluble constituents of the alcoholic extract of *M. citrifolia* L. leaves yielded a fraction that exhibited a minimum inhibitory concentration of <2.0 µg/mL against the test organism. Reversed phase HPLC purification of this fraction by isocratic elution using MeOH as mobile phase yielded two Δ^4 -3-ketosteroids. Elucidation of structures was carried out by infrared and nuclear magnetic resonance spectroscopy and mass spectrometry and comparison with known data. These were identified as stigmasta-4,22-dien-3-one and stigmast-4-en-3-one.

Key words: tuberculosis, chemotherapeutic agent, *Morinda citrifolia* L., Rubiaceae, noni, in vitro, *Mycobacterium tuberculosis* H₃₇Rv, Δ^4 -3-ketosteroids, stigmasta-4,22-dien-3-one, stigmast-4-en-3-one

45. PIGMENTED OFFSPRING OF ALBINO MICE: SCREENING FOR GAIN-OF-FUNCTION MUTATIONS IN FIVE EXONS OF THEIR TYROSINASE GENE BY MULTIPLEX PCR-SSCP ANALYSIS

PAOLO MIGUEL F. MANGAHAS and CYNTHIA PALMES-SALOMA

Neurobiology Research Group
National Institute of Molecular Biology and Biotechnology
U.P. Diliman, 1101 Quezon City

Albinism is a condition marked by the absence or inability to produce melanin in the body. We previously reported the serendipitous generation of pigmented (agouti) mice from albino parents. Since albinism results from loss-of-function mutations in the gene tyrosinase which encodes the key enzyme that converts phenolic compounds in the body into melanin, we screened for gain-of-function mutations in the tyrosinase gene of these agouti mice. As a rapid and sensitive procedure to detect point mutations in the gene, we simultaneously amplified multiple exons by multiplex PCR and performed single-strand conformational polymorphism (SSCP) analysis. We discuss the conditions for multiplex PCR-SSCP and the applications of this technique to screen for subtle point mutations in genes which cannot be determined from the length of PCR products alone when primers flanking exons are used.

Key words: tyrosinase, melanin, albino, multiplex PCR-SSCP, loss-of-function mutation, gain-of-function mutation



46. *Schefflera odorata* INHIBITOR OF MAPK ACTIVATION IN CULTURED AIRWAY SMOOTH MUSCLE CELLS

MARIA CRISTINA R. RAMOS¹, GLORIA D. CASTRO BERNAS¹,
and NIGEL J. PYNE²

¹Research Center for the Natural Sciences, University of Santo Tomas, España Street, 1008 Manila

²Department of Pharmacology and Physiology, University of Strathelyde
Glasgow, Scotland

Mitogen activated protein kinase (MAPK) is an enzyme belonging to the group of phosphotyrosine kinases. Phosphotyrosine kinases are enzymes that are involved in cell growth and proliferation. These enzymes are activated by phosphorylation. The effect of the leaf extract of *Schefflera odorata* on MAPK activation in airway smooth muscle (ASM) cells was investigated. Thymidine incorporation assay was done to determine if *S. odorata* can inhibit DNA synthesis of ASM cells. Fetal calf serum (FCS) was used to stimulate DNA synthesis in ASM cells. FCS-stimulated DNA synthesis was inhibited by 50% when treated with 100 µg/mL *S. odorata* extract. Almost 100% inhibition of DNA synthesis was observed when the cells were treated with 200 µg/mL. The effect of *Schefflera odorata* on phosphotyrosine kinases in ASM cells was determined by SDS-PAGE and Western Blotting. FCS was used to stimulate the activation of these enzymes. Immunoblot of the ASM cell lysates treated with FCS and *S. odorata* extract showed concentration dependent inhibition of band formation at 205, 112, and 42 kDal. The effect of *S. odorata* on MAPK activation was determined by performing two assays, MAPK SDS-PAGE mobility shift and MAPK peptide assay. In SDS-PAGE mobility shift assay, the activation of MAPK is indicated by its retarded mobility upon SDS-PAGE, as observed in ASM cells treated with FCS. However, this mobility shift was not observed when the cells were treated with FCS and 100 µg/L of *S. odorata*. No band was formed at all when the concentration of *S. odorata* was increased to 200 µg/mL. The result in the MAPK mobility shift assay was confirmed by the other assay, the MAP peptide assay.

Key words: MAPK, ASM cells, cell growth, cell proliferation, phosphotyrosine kinases, thymidine incorporation assay, MAPK SDS-PAGE mobility shift assay, PAK peptide assay, western blotting, immunoblot

47. THE EFFECT OF *Tinospora rumphii* Boerl ON OVARIAN 3 β -HYDROXYSTEROID DEHYDROGENASE ACTIVITY IN RATS

ELSE G. DAPAT and GLORINA N. POCSIDIO

*Institute of Biology, College of Science
U.P. Diliman, 1101 Quezon City*

The antifertility affects of *Tinospora rumphii* Boerl. ("makabuhai") has been demonstrated. In this study, the effect of *Tinospora rumphii* methanol extract from air-dried stems on ovarian 3 β -hydroxysteroid dehydrogenase activity in both virgin and mated (pregnant) rats was investigated. The enzyme is important in the biosynthesis of reproductive hormones. The drug in single doses of 2µ/kg, 4µ/kg, and 8µ/kg



was injected into the ovarian bursae at diestrus in virgin rats and at 5th, 9th, and 18th day of pregnancy in mated rats. Spectrophotometric determination of enzyme activity assayed levels of NADH at 4, 8, 12, 24, and 48 h after treatment. Assay results showed significant reduction of enzyme activity within the first 24 hours in all the *Tinospora* treated rats except those treated with the lowest dose. The effect of 8 μ /kg was comparable to that of 2 μ /kg 17 α -hydroxy-6 α -methoxyprogesterone acetate (positive control). There was recovery of enzyme activity after 48 hours. Nevertheless, histopathological examination on the ovaries revealed that many follicles in the *Tinospora*-treated rats had become atretic just like in the positive control but *Tinosporaca* used 72% reduction in fertility and some degenerated fetuses (and not 100% reduction and no degenerated fetuses as in the positive control).

Key words: herbal drug, atretic ovarian follicles, anti-fertility drug, steroid biosynthesis, 3 β -hydroxysteroid dehydrogenase

48. DESIGN OF A QUANTITATIVE BEHAVIORAL TEST FOR HYPERACTIVITY IN MUTANT MICE

FRANCIS ISIDORE TOTANES and CYNTHIA PALMES-SALOMA

*Neurobiology Research Group
National Institute of Molecular Biology and Biotechnology College of Science
U.P. Diliman, 1101 Quezon City*

We previously reported the serendipitous generation of pigmented mice from albino parents orally treated with a suspected mutagen, sodium nitrate. The gain-of-function mutation resulted in the birth of agouti as well as black mice in the otherwise albino population and this mutation was stably transmitted to the germline. The pigmented F₁ agouti mice were further observed to exhibit hyperactive behavior relative to same-age albino mice raising the possibility that the hyperactive behavior may be linked to the coat color phenotype. To test this possibility, we developed a quantitative hyperactivity test in conjunction with molecular and genetic studies being done. Here, we describe the experiment set up we developed to test for hyperactive behavior in mice. We show that our device could be used not only to quantify the endurance of the mouse given a particular test situation, but also to determine whether the mouse respects spatial boundaries.

Key words: hyperactive mice, gain-of-function mutation, hyperactivity test, sodium nitrate, pigmented mice

49. HEPATOTOXICITY OF METALDEHYDE

ARSENIA A. CASAUAY and FELIZARDO N. PULUMBARIT, JR.

*Institute of Biology, College of Science
U.P. Diliman, 1101 Quezon City*

The hepatotoxicity of the molluscicide metaldehyde on non-target organism such as milkfish was determined through acute exposure. *Chanos chanos* fingerlings were exposed to varying concentrations of Porsnail[®], namely: 3, 30, 60, 150, and 300 mg L⁻¹ and liver samples were processed for paraffin sectioning.



Light microscopy showed hypertrophic hepatocytes in all sublethal treatments. Except for liver sections at 3 mg L⁻¹, all other treatments revealed sections with pyknotic nuclei and chromatin clumping. Cytoplasmic vacuolization and loss of cellular architecture were evident. In liver sections of fish exposed to 300 mg L⁻¹.

Key words: hepatotoxicity, Porsnail [®], molluscicide, milkfish, fingerlings

50. ASSESSMENT OF THE ACUTE TOXICITY OF SURFACTANTS (LAS AND CFAS) USING SELECTED SPECIES OF FISH

EMILYN Q. ESPIRITU¹, ENRICO CRUZ¹, CRISTINA DANCEL²,
and FABIAN M. DAYRIT^{1,2}

¹Environmental Science Program and ²Department of Chemistry
Ateneo de Manila University, 1108 Loyola Heights, Quezon City

Despite the wide use of surfactants in the Philippines, data on the environmental toxicity of these compounds to tropical organisms is scanty. The majority of the chronic and sublethal toxicity databases that are available are limited to studies in temperate areas involving only a few commercially important types of surfactants. Hence, the present study aims to determine the acute toxicity of LAS and CFAS on three local freshwater fish species - common carp (*Cyprinus carpio*, Linneus 1758), guppy (*Poecilia reticulata*) and tilapia (*Tilapia nilotica*) - under static-renewal conditions (12h-replacement of test solution).

A series of 96-h range-finding tests was performed to determine the critical concentrations. Subsequently, 96-h definitive tests were done in order to determine the 96-h (LCSO) (mg/L). A series of reference toxicity tests with copper sulfate were performed in parallel. Test solutions were analyzed every 12 h to determine actual surfactant concentration using direct injection negative ion Electrospray Ionization-Mass Spectrometry (neg ESI-MS).

The results of the chemical analysis of the test water showed that CFAS was partially degraded after 6 h and is completely degraded after 12 h while LAS concentration remained the same even after 12 h. The rates of change of both LAS and CFAS concentration-response curves were similar and very shallow implying that large decreases in concentration will only bring about small decreases in toxicity. This further implies a possible similarity in the mode of toxic action of the two compounds on the test organisms. The results of the definitive toxicity tests showed that CFAS was found to be 2 to 3 times more toxic than LAS to all three species. Tests with the reference toxicant (copper sulfate) showed that the rank order of sensitivity among the test organisms was as follows: most sensitive was carp, followed by guppy, with tilapia as the least sensitive. In the absence of a standardized toxicity test procedure in the Philippines that can be used for testing in the aquatic environment, the procedure developed here can be used for future monitoring studies.

Key words: surfactant toxicity, LAS, CFAS, toxicity tests, carp, guppy, tilapia



51. GENERAL PROTEIN BANDING PATTERNS OF THE FRESHWATER PRAWN, *Macrobrachium lanceifrons*, COLLECTED FROM VARIOUS SITES IN LAGUNA LAKE

IVAN-MARCELO A. DUKA, MARNI E. CUENO, and VICTOR JUN M. ULAT

*Institute of Biological Science, College of Arts and Sciences
U.P. Los Baños, 4031 Laguna*

This study was undertaken to gather an overall molecular fingerprint of the fresh water prawn, *Macrobrachium lanceifrons*, using general protein banding patterns. Prawn samples collected from different sites in Laguna Lake were analyzed through sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE). General protein bands showed variation in terms of mobilities, intensities, and individual patterns. However, a general banding pattern may be deciphered from all samples analyzed; groups of cathodal and anodal protein bands are apparently separated in the prawn. Differential expression, of proteins are reflected in minor individual variations in banding patterns observed.

Key word : freshwater prawn, Laguna Lake, *Macrobrachium lanceifrons*, SDS-PAGE, protein banding pattern, polyacrylamide gel electrophoresis, molecular fingerprint, differential expression, cathodal proteins, anodal proteins

52. PURIFICATION, CHARACTERIZATION, AND ANTIMICROBIAL SPECTRUM OF A BACTERIOCIN FROM FERMENTED SAUSAGE ISOLATE

EVELYN B. DELGADO¹ and IDA F. DALMACIO²

¹*Ateneo de Manila University, Loyola Heights, 1108 Quezon City*

²*Philippine Council for Advanced Science and Technology Research and Development
Department of Science and Technology
Gen. Santos Ave., Bicutan, 1631 Taguig*

Bacteriocins are antimicrobial compounds that recently captured the interest of various industries because of their great potential of being effective natural preservatives. Some desirable characteristics are wide range of pH and heat stability, tastelessness, digestibility due to their proteinaceous nature. They have already been consumed for a long time in foods such as fermented dairy and meat products. There are reported types that prevent listeriosis and histamine poisoning and some are useful as genetic markers in the food-grade cloning and expression systems. Nisin is the well characterized and the only legally approved bacteriocin as preservative. It is classified as an additive generally regarded as safe (GRAS). Therefore, knowledge of the properties of known and new bacteriocins will help in hastening the acceptability of bacteriocin-treated products and promote their utilization.

In this study, a bacteriocin from *Pediococcus acidilactici* isolated from fermented sausage was extracted employing a current technique of pH-dependent cell adsorption-desorption of proteins. The desired metabolic product was first adsorbed onto the cell surfaces at pH 5.0 and cells removed from the culture medium by centrifugation. It was selectively released at pH 2.0 and dialyzed to remove acid



and salts. Purification under reserved phase-HPLC resulted in a yield up to 5.76×10^5 times.

Mass spectrometry gave a molecular weight of 4699 Dal, a little higher than previously reported pediocins. The bacteriocin was heat tolerant when exposed to pasteurization settings (61.8°C, 30 min and 71.5°C, 15 sec), boiling temperatures at different time intervals and autoclaving conditions. It was also stable under a wide pH range (pH 3 to 9). Well-diffusion assay showed antimicrobial activity against *Listeria monocytogenes*, a Gram-positive food pathogenic bacterium and some lactic acid bacteria such as *Lactobacillus plantarum*, *Leuconostoc mesenteroides*, and *Enterococcus faecalis*.

Partial characterization of the bacteriocin showed promising features as possible antimicrobial additive in both processed and minimally processed products.

Key words: bacteriocin, *Pediococcus acidilactici*, pediocin, purification, antimicrobial spectrum, preservative, adsorption-deposition, well-diffusion assay, anti-*Listeria*, food additive.

53. DNA FINGERPRINTING OF COBALT-60 GAMMA RADIATION-INDUCED VARIANTS OF FOLIAGE PLANTS USING AFLP-PCR

TERESA YULO-NAZAREA, ALEJANDRO Q. NATO, JR.,
and CAROL BALDOVINO-COLOMA
Philippine Nuclear Research Institute
Commonwealth Avenue, Diliman, 1101 Quezon City

DNA fingerprinting of cobalt-60 gamma radiation-induced variants of a foliage plant (*Murraya exotica*) was studied using amplified fragment length polymorphism (AFLP) coupled to polymerase chain reaction (PCR) technology. Development of the AFLP-PCR protocol was established for variants of *Murraya* and *Dracaena* where polymorphisms are observed using specific selective nucleotide primer pairs to produce unique DNA fingerprints electrophoresed in denaturing acrylamide gel. Genomic DNA used in fingerprinting study was extracted from leaves of a stable mutant of *Murraya exotica* at M1V8 vegetative stage. AFLP-PCR amplified fragments produce specific DNA fingerprints for each variant plant that could be used to identify gamma radiation-induced polymorphisms. Genetic markers induced by gamma radiation and observed in AFLP DNA fingerprints were documented against morphological changes of the variant foliage and encoded in the database for *Murraya exotica*. Graphic computer database serves as specialized catalogue of variant plants and includes actual photographs of plants showing variations in leaves, flowers, and size and data on DNA fingerprints. Thus, a simplified selection process would be available to plant breeders and commercial plant exporters which would facilitate mass propagation within a shorter growth period of desired variant plants.

Key words: AFLP, PCR, ornamentals, radiation, DNA fingerprinting



54. MITOCHONDRIAL DNA (mtDNA) POLYMORPHISM IN THE ASIAN HONEYBEE, *Apis cerana* F. IN THE PHILIPPINES

LYNN S. VILLAFUERTE¹, RITA P. LAUDE¹, and DEBORAH R. SMITH²

¹*Institute of Biological Science, College of Arts and Sciences
U.P. Los Baños, College, 4031 Laguna*

²*Department of Entomology, Haworth Hall
University of Kansas, Lawrence, KS, 66045 USA*

Mitochondrial nucleotide sequence was used to characterize the intergenic region between cytochrome oxidase I (CO I) and cytochrome oxidase II (CO II) in the mitochondrial DNA (mtDNA) of the honeybee *Apis cerana* F. from four geographically isolated islands in the Philippines (Palawan, Luzon Highland and Lowland, Visayas, and Mindanao). Sequencing data revealed a 99 base pair non-coding region predominantly composed of adenine (A) and thymine (T). It is characterized by a "stem" sequence where no sequence variation was observed but had 18 variable sites found within the segment generating eight (8) haplotypes. The mitochondrial gene tree based on these haplotypes had a branch with Luzon and two of the Visayas and Mindanao haplotypes and another branch with the Palawan together with the rest of the Visayas and Mindanao haplotypes. The 3' end of the leucine tRNA gene was also sequenced but the 29 base pair segment was too short to yield enough informative characters to differentiate between haplotypes.

The mtDNA sequences of the Philippine honeybees were also compared to known mtDNA sequences of *Apis cerana* F. from Borneo, Sulawesi, Java, and Sangihe mtDNA sequences. The mitochondrial gene tree obtained showed a branch supporting Palawan haplotype together with Borneo and Java, as well as the Ozamis and Cebu haplotype from the Visayas and Mindanao group. While the Luzon haplotypes were on the other branch with the rest of the Visayas and Mindanao haplotypes. Migration of bees during the early geologic history of the Philippines may have contributed to the gene flow, thus the shared or closely related haplotypes.

Mitochondrial genome polymorphism exists among the Philippine *Apis cerana* F. The sequence diversity supports morphometric studies on Philippine honeybees showing the distinct separation of the Palawan populations but could not, however, delineate between the Luzon Lowland and Highland region. Furthermore, it showed enormous diversity among the populations from the Visayas and Mindanao regions.

Key words: *Apis cerana* F., honeybees, mitochondrial DNA (mtDNA), intergenic region, cytochrome oxidase I and II, mtDNA sequence, polyacrylamide gel electrophoresis, haplotypes, mitochondrial gene tree, genome polymorphism



55. MECHANISM OF DNA IMMUNIZATION: HOW DNA VACCINES INITIATE IMMUNE RESPONSES

CELIA T. TORRES-VILLANUEVA¹, AKIKO IWASAKI²
BRIAN H. BARBER³, and HARRIEL L. ROBINSON⁴

¹*National Institute of Molecular Biology and Biotechnology
U.P. Diliman, 1101 Quezon City*

²*National Institutes of Health, Bethesda, Maryland, USA*

³*University of Toronto, Toronto, Canada*

⁴*Yerkes Primate Research Center, Emory University, Atlanta, Georgia, USA*

The purpose of this study is to elucidate the mechanism by which DNA immunization initiates immune responses. We found that the site of DNA inoculation (target site) played different roles in gene gun and intramuscular (IM) immunization of mice. The skin target site (following gene gun), but not the muscle, played a central, but not completely essential, role in initiating antibody and cytotoxic T lymphocyte (CTL) responses. These results indicate that the skin target site, which is rich in bone-marrow derived cells, plays a bigger role than the relatively immune-privileged muscle target site in DNA immunization. However, for both methods of immunization, CTL responses were restricted to antigen presentation by bone marrow-derived cells, not by skin or muscle cells. Furthermore, we found that antigen secretion, which presumably would lead to increased antigen migration to lymphoid tissues and increased antigen uptake by antigen-presenting cells, thus leading to increased antigen presentation in the context of MHC class II, did not enhance antibody responses. We propose a model for the mechanism of initiation of immune responses by DNA immunization based on these results and taking them within the context of results from other investigators in the field. We propose that DNA immunization initiates immune responses primarily by the direct transfection of bone marrow-derived cells that migrate rapidly out of the target site into lymphoid tissues, and that antigen expression by skin cells may be involved in raising maximal responses.

Key words: DNA immunization, DNA vaccines, antigen-presenting cells, antigen secretion, immune response

56. SEQUENCE ANALYSIS OF DNA VACCINE CONSTRUCTS: DETERMINING POTENTIAL RISK FOR HOMOLOGOUS RECOMBINATION WITH THE HUMAN GENOME AND OPTIMIZING CODON USAGE

CELIA T. TORRES-VILLANUEVA and GODWIN VIVAR

*DNA Vaccine Laboratory, National Institute of Molecular Biology and Biotechnology
U.P. Diliman, 1101 Quezon City*

DNA immunization is a novel and highly effective means of immunization whereby plasmid DNA (DNA vaccines) encoding for antigens are delivered directly into animals or patients whose cells will then express the antigen. DNA immunization comes with the potential risk of the DNA vaccine integrating



into the human genome by homologous recombination, thus possibly causing mutations that may lead to carcinogenesis. In addition, the use of gene sequences from pathogens distantly related to humans, e.g., malaria, may affect antigen expression in the human vaccinee.

This study is designed to analyze, using the BLAST family of programs, the DNA sequences of multi-epitope DNA vaccines against dengue and malaria constructed in our laboratory. The possibility of integration of the various DNA vaccines with the human genome was examined by searching for homologies between the DNA vaccines and known human genome sequences. In addition, the sequences were analyzed with respect to the mouse genome, since the animal model used in our lab is the mouse. We have extended these studies to a DNA vaccine for hog cholera, to be used in swine, to determine whether this veterinary vaccine may integrate with the pig genome. Studies will also be conducted to detect actual integration of DNA vaccines into the genomes of recipient mice.

Finally, we analyzed the sequences used for the malaria DNA vaccines and found that some of the malaria codons in our constructs are rarely used in humans and may therefore hamper efficient antigen expression in human vaccines. Malaria DNA vaccine constructs are now being designed with optimized human codon usage, which will hopefully enhance the expression, and thus the antigenicity, of these vaccines.

Key words: DNA vaccines, sequence analysis, safety, homologous recombination, codon usage

57. USE OF RIBOTYPING AND RANDOM AMPLIFIED POLYMORPHIC DNA (RAPD) TO DIFFERENTIATE STRAINS OF *Burkholderia andropogonis*

RINA D. BAGSIC-OPULENCIA¹, ALLEN CHRIS HAYWARD², and MARK FEGAN²

Microbiology Division, U.P. Los Baños, College, Laguna

²*Cooperative Research Center for Tropical Plant Pathology, The University of Queensland
St. Lucia, Brisbane, Queensland, Australia*

Burkholderia andropogonis causes leaf spots, streaks, and stripes on a wide variety of host plants such as corn, coffee, chick pea, and velvet bean. The strains of *B. andropogonis* are highly similar in phenotypic traits such as cultural, morphological, and physiological characteristics. However, the host range of *B. andropogonis* is exceptionally wide and diverse and *B. andropogonis* has wide geographical distribution. Some workers had attempted to group strains of *B. andropogonis* from different host plants based on pathogenicity and serological properties. However, the observed differences in host specificity were insufficient to warrant establishment of pathovars and no further work has been reported to support establishment of serovars. Knowing the relationship among strains of *B. andropogonis* will help to identify outbreaks, to determine its mode of acquisition, and to define preventive measures. Unlike phenotypic properties which are not reliable for strain differentiation due to their low reproducibility and inherent variability, genotypic traits are not affected by the physiological state of the organism. In this study, genotypic methods such as ribotyping and random-amplified polymorphic DNA (RAPD) were used to determine the relationship among 29 strains of *B. andropogonis*. In ribotyping, the chromosomal DNA was digested with either *Sal I*, *Pst I*, or *Xho I* and probed by digoxigen-labeled 16S rDNA of *B. andropogonis*. Hybrids were detected by chemiluminescence. In RAPD, each of the seven commercially available primers was used in low stringency polymerase chain reaction (annealing at 37°C). The



amplification products were electrophoresed on agarose gel. The difference between the pattern generated by ribotyping and RAPD was established visually on the presence or absence of one or several bands. Similarity coefficients for pairwise combination were determined by Dice coefficient and clustered by the unweighted pair group method with arithmetic mean (UPGMA) procedure. All computations were performed using the NTSYS-PC program. Numerical analysis of the ribopatterns generated by *Sal* I, *Pst* I, and *Xho* I produced a phenogram where the strains were divided into 11 clusters at a similarity of 90%. In addition, the presence of five *rrn* operons was revealed in *B. andropogonis*. RAPD analysis with seven primers grouped the strains into 12 clusters at a similarity of 90%. Comparison of the phenograms generated by ribotyping and RAPD revealed that the clusters of strains at 90% similarity were similar for these two methods. However, the relationship between clusters varied between ribotyping and RAPD, producing phenograms with different groupings of clusters and different overall structure between these two methods. There was no strict correlation between the clusters and the time when the strains were isolated or the geographical origin of the isolates; between the clusters and original host; and between the clusters and pathogenicity of the strains.

Key words: *Burkholderia andropogonis*, ribotyping, RAPD, genotypic methods

58. CLONING AND CHARACTERIZATION OF THE ACYL CARRIER PROTEIN (ACP) GENE OF THE COCONUT (*Cocos nucifera* L.) ENDOSPERM

VICTOR JUN M. ULAT¹, MERLYN S. MENDIORO¹, IVAN-MARCELO A. DUKA¹,
MARNI E. CUENO¹, MA. GENALEEN Q. DIAZ¹, RITA P. LAUDE¹, ANTONIO
LAURENA², and EVELYN MAE T. MENDOZA²

¹*Institute of Biological Science, College of Arts and Sciences
U.P. Los Baños, College, 4031 Laguna*

²*Institute of Plant Breeding, College of Agriculture
U.P. Los Baños, College, 4031 Laguna*

Acyl carrier protein (ACP) is an essential cofactor in the synthesis of fatty acids. We report here the isolation and characterization of the ACP gene from coconut. The coconut endosperm ACP gene was isolated by RT-PCR using degenerate oligonucleotide primers designed specifically for the conserved region of multiply aligned ACP gene sequences from other plant species. The ~200 bp PCR product generated was cloned into a vector. DNA-sequence analysis and Southern and Northern blot analyses were subsequently performed. The results and future prospects for the cloned coconut seed ACP gene are also discussed.

Key words: acyl carrier protein, ACP, cloning, RT-PCR, Southern Blot, Northern Blot, DNA sequence, primer design



59. THE COCONUT GENE PROJECT: PRIMER DESIGN

IVAN-MARCELO A. DUKA¹, MARNI E. CUENO¹, VICTOR JUN M. ULAT¹
MERLYN S. MENDIORO¹, MA. GENALEEN Q. DIAZ¹, RITA P. LAUDE¹,
ANTONIO C. LAURENA², and EVELYN MAE T. MENDOZA²

¹*Institute of Biological Science, College of Arts and Sciences
U.P. Los Baños, College, 4031 Laguna*

²*Institute of Plant Breeding, College of Agriculture
U.P. Los Baños, College, 4031 Laguna*

The general objective of the coconut gene project is to modify the fatty acid composition of coconut oil by genetic engineering. Genes for key enzymes in the lipid metabolism of coconut will be cloned and sequenced. Final expression of these genes in the coconut will be dependent on successful tissue culture methods already being worked out by the Philippine Coconut Authority (PCA).

Accomplishments so far include outlined steps and procedures that one may follow in designing PCR primers. Both the internet and a software called Vector NTI have been utilized in PCR primer design, a necessary start point in the said project. General guidelines for PCR primer design are hereby discussed.

Key words: vector NTI suite, primer design, lipid metabolism, Polymerase Chain Reaction (PCR), internet, annealing temperature (T_m), %GC, entropy, enthalpy, free energy

Agricultural Sciences

60. POLYMERASE CHAIN REACTION (PCR) AMPLIFICATION OF DNA GENOME SEGMENTS OF BANANA BUNCHY TOP VIRUS (BBTV)

TERESA B. DE LEON and VERMANDO M. AQUINO

*Institute of Plant Breeding, College of Agriculture
U.P. Los Baños, College, 4031 Laguna*

Banana bunchy top disease (BBTD) is one of the most devastating diseases of bananas caused by banana bunchy top virus (BBTV). The BBTV has a multi-component genome consisting of at least six single-stranded circular DNA components. In this study, the presence of DNA encoding the coat protein (CP) during systemic infection of BBTV in artificially inoculated banana was determined by the polymerase chain reaction (PCR) using specific primers. PCR amplification of nucleic acid extracts generated a 589 bp product in pseudostem 26 days after inoculation (DAI), in root and corm 31 DAI, and in rolled young leaf, older leaf and in corm 52 DAI. In naturally infected banana plants, BBTV stem loop (SL) region and



BBTV DNA component encoding the movement protein (MP) were detected in young leaves. PCR amplification of SL region and MP DNA segment generated a 1000 bp and a 380 bp product, respectively. Consistent amplification of MP DNA segment indicated that MP DNA was present in high concentration. PCR amplification using specific primers provides a useful tool in determining the presence of BBTV DNA components.

Key words: banana, polymerase chain reaction (PCR), banana bunchy top virus (BBTV)

61. CLONING, CHARACTERIZATION, AND SEQUENCING OF MATURATION-RELATED cDNAs FROM SUGARCANE (*Saccharum Officinarum* L.)

ELLEN B. TUMIMBANG, ANTONIO C. LAURENA,
and EVELYN MAE TECSON-MENDOZA

*Institute of Plant Breeding, College of Agriculture
U. P. Los Baños, College, 4031 Laguna*

The aims of this study are to generate and clone cDNAs encoding ACC synthase through Reverse Transcription - Polymerase Chain Reaction, to monitor the level of expression of the gene through northern blot, analysis, and to determine the relative number of copies in the genome by southern-analysis.

Oligonucleotides (EZ 2 and EZ 4) based on the conserved regions of ACC synthase were synthesized and used in the RT-PCR using cDNA pool from the 13-month-old apical tissue. A 1.2k b fragment was amplified which was cloned in the pGEM-T-Easy vector and later used in the transformation of *E. coli* DH5 α .

Two putative clones coding for maturation genes were identified and partial nucleotide sequences of SACS 1 (612 bp) and SACS 2 (712 bp) were determined. Computer search showed no homology of SACS 1 with known ACC synthase but has sequence similarity with a DNA binding protein. SACS 2 does not have sequence similarity with known structural genes in the Genebank due to unreliable DNA sequence containing 15% unknown nucleotide base N.

A low level expression of SACS 1 was detected on the 6th month when stalk elongation starts to slow down and increase until the 13th month when the sucrose accumulated is uniform throughout the stalk. Southern blot analysis suggests the presence of only one copy of Sacs1 in the sugarcane genome.

Key words: cloning, cDNA, *Saccharum*, sugarcane, RT-PCR, ethylene, southern blot, northern blot, oligos, maturation



62. MOLECULAR CLONING OF DNA SEGMENTS OF ABACA BUNCHY TOP VIRUS (ABTV)

MEDINO GEDEUN N. YEBRON, JR and VERMANDO M. AQUINO

*Institute of Plant Breeding, College of Agriculture
U.P. Los Baños College, 4031 Laguna*

Abaca bunchy top virus (ABTV) is assumed to be synonymous to banana bunchy top virus (BBTV) but transmission experiments show dissimilarity between the two. For studies aimed at distinguishing differences between the said viruses at the molecular level, cloning of ABTV genome segments is necessary. Polymerase chain reaction (PCR) and standard cloning procedures were used to produce gene constructs containing ABTV DNA segments. Total nucleic acid extracts were obtained from bunchy top infected abaca plants. The extracted DNA was amplified using the stem loop primers SLR and SLL. These primers were designed based on the nucleotide sequence of the conserved stem loop region of BBTV DNA genome. The PCR products were inserted into a plasmid vector and transformed into *Escherichia coli* DH5 α cells. These constructs will be used in differentiating BBTV from ABTV and in the development of transgenic abaca resistant to ABTV.

Key words: abaca, polymerase chain reaction (PCR), cloning, abaca bunchy top virus (ABTV), transformation

63. GENE INTROGRESSION IN THE NON-TUBER FORMING *Solanum*

ABELLA C. DELA VINA and DOLORES A. RAMIREZ

*Institute of Plant Breeding, College of Agriculture
U.P. Los Baños, College, 4031 Laguna*

Nineteen species of the non-tuber forming *Solanum*, including *Solanum melongena*, eggplant, obtained from the National Plant Genetic Resources Laboratory were used in the hybridization program with the aim of determining the genetic affinity among the species and ultimately transferring desirable genes (resistance to pests and diseases, prolificacy, tolerance to abiotic stresses) from the wild relatives to the cultivated eggplant. A total of 135 cross combinations were made from which only 43 cross combinations developed fruits with very few seeds recovered. The degree of genetic relationship was measured in terms of percentage seed developed and chromosomal behavior of the hybrids during meiosis. Percent seed recovery ranged from 0.0% to 80.0%. Meiotic analysis of the different species and the hybrids gave a chromosome number $2n = 24$. The chromosome behavior of the parentals was generally normal. The hybrids on the other hand exhibited partial to complete homology among the chromosomes of the parental species. Laggards and bridges were observed in both parents and hybrids. Pollen fertility of the different species ranged from 77.37% to 98% whereas the hybrids had a range of 9.74% to 30.5%. Backcrossing to the *melongena* parent was done for four generations in cross *aethiopicum* x *melongena*. Partial morphological characterization of the hybrids showed gene introgression from *S. aethiopicum* to *S. melongena*.

Key words: introgression, *Solanum melongena*, *Solanum aethiopicum*, eggplant



64. SEGREGATION ANALYSIS IN COCONUT USING MOLECULAR MARKERS

SHIRLEY J.E. SEGOVIA¹, HAYDE F. GALVEZ¹, RONNEL JOEY U. CARCALLAS¹,
CONSORCIA E. REAÑO¹, RAMON RIVERA², GERARDO A. SANTOS², and
DESIREE M. HAUTEA¹

¹*Institute of Plant Breeding, College of Agriculture
U. P. Los Baños, College, 4031 Laguna*

²*Philippine Coconut Authority, Zamboanga Research Center
San Ramon, Zamboanga City*

Selected germplasm of coconut was tested for polymorphism using microsatellite, also called simple sequence repeats (SSR), and amplified fragment length polymorphism (AFLP) marker technologies. Results showed that all the dwarf populations analyzed exhibited a high degree of homogeneity while the tall populations revealed a high degree of allelic diversity. Based on the results of the polymorphism survey, SSR, and AFLP primers were selected to test for the segregation pattern of the F₁ population from the cross between Tacuna Green Dwarf and Bago Oshiro Tall. Segregation analysis of F₁ progenies showed a 1:1 Mendelian ratio typical of a backcross population. The implication of the results of the present study in the coconut improvement program will be discussed.

Key words: coconut, *Cocos nucifera*, microsatellite, simple sequence repeats, amplified fragment length polymorphism

65. MOLECULAR TAGGING OF BRUCHID AND *Cercospora* LEAF SPOT RESISTANCE GENES IN MUNGBEAN USING AFLP AND RGA MARKERS

ALMA O. CANAMA, HAYDE F. GALVEZ, DESIREE M. HAUTEA, and
CONRADO H. BALATERO

*Institute of Plant Breeding, College of Agriculture
U. P. Los Baños, College, 4031 Laguna*

Two major constraints in mungbean production are grain loss caused by bruchid (*Callosobruchus*) damage during storage and *Cercospora* leaf spot disease. Amplified fragment length polymorphism (AFLP) and resistance gene analog (RGA) primers were used to develop and identify markers associated with resistance genes to bruchid and *Cercospora*. Sixty four selective Eco RI/Mse I primer pairs obtained from Gibco BRL/Life Tech Analysis II were used to screen for polymorphism using two mapping populations, P7 x TC and NCM 53 x Acc. 25. Thirty (30) of the 64 AFLP primer pairs with good amplification products generated a total 1,520 bands of which 336 bands (22.1%) were polymorphic between P7 and TC and 261 bands (17.2%) between NCM 53 and Acc. 25. Using a P7 near-isogenic line (RP7), putative AFLP markers associated with the introgressed resistance segment from TC were identified



using 17 AFLP primers. For RGA, 19 primer pairs were evaluated of which 10 primers gave polymorphic bands between P7 and TC. The 10 primer pairs generated a total of 268 bands of which 117 bands (43.6%) showed polymorphism between P7 and TC. The 10 RGA primers will be used to determine markers associated with bruchid resistance genes using a near isogenic line of P7.

Key words: mungbean, *Cercospora*, bruchid, *Callosobruchus*, AFLP, resistance gene analog

66. REGENERATION OF TRANSGENIC NEW PLANT TYPE LINES FROM A. *Tumefaciens*-INFECTED IMMATURE INFLORESCENCE

GLENN Y. ILAR, ELEANOR S. AVELLANOZA, and RHODORA R. ALDEMITA

*Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija*

The increasing population rate and shrinking area devoted to rice production in the Philippines pose a big challenge to plant breeders. Genetic engineering at PhilRice is being conducted to support the existing strategies to increase the yield potential of rice such as the improvement of pest resistance in the high yielding varieties, in the new plant type (NPT) elite lines, and in the cytoplasmic male sterile (CMS) lines used in hybrid rice breeding. The use of the natural vector *Agrobacterium tumefaciens* for gene delivery to Philippine-bred rice varieties necessitates the investigation of the suitable explant for susceptibility to infection. Early studies focused on the ability of different explants to produce embryogenic calli suitable for transformation experiments from 6 inbred lines, 9 NPT lines, and 6 CMS lines. The young inflorescence and mature embryos equally produced embryogenic calli, but not as good as the immature embryos sans contamination. *A. tumefaciens* strain EHAI O5 (pTOK233) harboring the reporter β -glucuronidase gene and the hygromycin resistance genes were tested on their infectivity to the different explants and genotypes. A few inbreds and CMS lines, and most of the NPT elite lines showed GUS activity as manifested by the blue precipitate present in the transformed cells after X-gluc staining. Regenerated plants from these transformed calli showed the presence of the GUS gene in PCR analysis. The efficiency in obtaining transgenic plants is relatively higher compared to the regeneration using calli derived from mature seeds.

Key words: genetic engineering, rice, *Oryza sativa*, young inflorescence, *Agrobacterium tumefaciens*, plant regeneration, calli



67. MOLECULAR ANALYSIS OF ON-FARM BIODIVERSITY IN THE PHILIPPINES

LEOCADIO S. SEBASTIAN, LORNA R. HIPOLITO, GUADA O. REDONDO,
ALICE N. BRIONES, GIRLIE NORA A. ABRIGO, CHERRYL B. CASIWAN,
and SERGIO R. FRANCISCO

*Philippine Rice Research Institute, Maligaya, Muñoz
3119 Nueva Ecija*

On-farm biodiversity of rice in the Philippines was analyzed using 1992 and 1997 survey data and 41 microsatellite markers to determine the popular varieties planted by farmers and their molecular diversity, respectively. Survey data showed that the use of modern varieties was widespread and more diverse in all regions. A total of 30 different varieties were planted in 1992 and 156 varieties in 1997. Among these varieties, ten most popular varieties were identified. These were released mostly between 1975 and 1999, and preferred by about 77% of the farmers. IR 64, a high-yielding variety with good eating quality, was the most widely used, suggesting the responsiveness of rice farmers to consumer preferences. Over time, the adoption pattern and relatedness of varieties changed. When the pattern of adoption was combined with molecular data in determining the genetic diversity (weighted), the diversity index decreased. The increased relatedness of the popular varieties planted in 1997 decreased the on-farm diversity. Among the regions in the Philippines, Mindanao region has the highest on-farm diversity. The pattern of adoption changed on-farm diversity substantially specially in areas where IR 64 was widely adopted like in the Visayas region where most farmers used it in 1992. Overall, the weighted on-farm diversity is lower than the genetic diversity based on molecular data alone (unweighted). Results show the impact of widespread use of a particular variety in the maintenance of biodiversity.

Key words: biodiversity, DNA marker, microsatellite, rice

68. TOWARDS MOLECULAR TAGGING OF TGMS GENES USING SSRs

LOIDA S. MORENO, APRIL JOY A. GOMES, IMELDA A. DELA CRUZ,
and EDIBELTOD. REDOÑA

*Plant Breeding and Biotechnology Division
Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija*

Thermo-sensitive genetic male sterility (TGMS) genes are unique DNA sequences in the rice genome that controls pollen fertility of a male-sterile rice line under different temperature regimes. Mapping these genes and the subsequent development of diagnostic DNA markers can facilitate the breeding of superior TGMS lines through marker-aided selection and, subsequently, of heterotic hybrid combinations. Simple sequence repeats (SSR) or microsatellite DNA sequences have been extensively used as markers in the construction of genetic linkage maps and tagging of specific genes. In this study, we generated six mapping populations to identify and locate three unknown TGMS genes from different sources. The TGMS gene donors, namely, PRT1 and PRT2 from Vietnam, and PRT4 from China, were crossed with two popular Philippine varieties, IR 64 and PSB Rc34 (Burdagol), to develop F₂ populations. A total of



108 SSR loci revealed monomorphic alleles and faint to no amplification, respectively. SSR markers polymorphic between any two parents shall be used to assay their corresponding F₂ population. Markers genetically linked to the TGMS trait can be used to facilitate the transfer of the TGMS gene to different genetic backgrounds of rice.

Key words: TGMS, SSR, rice, molecular mapping

69. IDENTIFICATION AND CHARACTERIZATION OF ACC SYNTHASE cDNAs EXPRESSED DURING SINTA PAPAYA (*Carica papaya*, L.) FRUIT RIPENING.

MARIE-SOL P. HIDALGO, ANTONIO C. LAURENA,
and EVELYN MAE TECSON-MENDOZA

*Institute of Plant Breeding, College of Agriculture
U. P. Los Baños, College, 4031 Laguna*

The cloning and characterization of cDNAs encoding ACC synthase from papaya hybrid Sinta is described. Total RNA from 80% ripe fruit was subjected to RT-PCR using primers specific for the ACC synthase gene. Five genes with different Eco RI restriction digest patterns and MW range of 1.1 to 1.4 kb were cloned. A cDNA of length 1,206 bp and coding for a 402-amino-acid polypeptide contained the highly conserved region shared by both ACC synthases and aminotransferases. Partial sequencing information indicate that all five genes are highly homologous to one another as well as to three other ripening-related ACC synthase cDNAs isolated from other papaya cultivars. Hybridization studies on northern and southern blots are currently being done to further characterize the five genes. Such information will help elucidate the ripening process undergone by hybrid papaya fruits.

Key words: cloning, cDNA, ACC synthase, *Carica papaya*, fruit ripening, RT-PCR, ethylene, southern blot, northern blot

70. MOLECULAR CLONING OF THE COAT PROTEIN GENE OF PAPAYA RINGSPOT VIRUS (PHILIPPINE ISOLATE)

PIERRIDEN A. PEREZ and VERMANDO M. AQUINO

*Institute of Plant Breeding, College of Agriculture
U. P. Los Baños, College, 4031 Laguna*

Development of constructs containing certain genomic sequences of viruses has been the basic technique used in the study of the organism's genetic organization. One of the strategies in developing disease resistant crops is pathogen-derived resistance against virus infections. An example of which is the production of a transgenic crop expressing the viral coat protein. Crude RNA from leaves infected with a local PRSV isolate was extracted. Complementary DNA (cDNA) was synthesized using reverse transcriptase and the coat protein (CP) gene sequence was amplified by PCR using specific primers. The fragment encoding the CP gene was inserted into a plasmid vector and transformed into *Escherichia coli* DH5 α . A gene construct containing a part of the CP gene of one isolate is already available for



sequencing and cloning on other isolates is still ongoing. The clones will be utilized in PRSV genetic variability studies and in the development of transgenic papaya resistant to ringspot disease.

Key words: papaya, papaya ringspot virus (PRSV), polymerase chain reaction (PCR), pathogen-derived resistance, complementary DNA (cDNA), reverse transcriptase, coat protein, cloning

71. CONTROL OF RIPENING IN PAPAYA BY GENETIC ENGINEERING

ANTONIO C. LAURENA¹, PABLITO M. MAGDALITA¹, BESSIE Y. PEREZ¹,
EVELYN MAE T. MENDOZA², VIOLETA N. VILLEGAS¹, and
JOSE RAMON BOTELLA²

*¹Institute of Plant Breeding, College of Agriculture
U. P. Los Baños, College, 4031 Laguna*

*²Plant Genetic Engineering Laboratory, Department of Botany
The University of Queensland, St. Lucia Campus, Queensland, Australia*

Papaya is an important fruit commodity in the Philippines and in other ASEAN countries. Its greater production and export potential are limited by the papaya ring spot virus (PRSV) problem and relatively short shelf life. This research addresses the latter problem with the objective of developing papaya varieties with delayed ripening trait, thus, longer shelf life.

In climacteric fruits such as papaya, ethylene controls the rate of ripening. One strategy to delay fruit ripening which has been employed in other fruits with success is the genetic manipulation of the plant genes involved in ethylene production during the ripening process.

In this project, we have cloned the ripening-related ACC synthase genes from the Davao Solo (yellow flesh) papaya variety and constructed an anti-sense transformation vector. We have transformed somatic embryos with this gene construct via the biolistic process. Putative transgenic tissues were selected and regenerated into plantlets. These plantlets will be grown in a BL2 greenhouse and their fruit will further be selected for the delayed ripening trait. The development of delayed ripening phenotypes via antisense technology will produce papaya varieties with better postharvest and transport characteristics that will be reflected in fruits of consistent superior quality and therefore better market prices.

Key words: papaya, ripening, transformation, ACC synthase, ethylene

72. HYBRID RICE RESEARCH AND DEVELOPMENT IN THE PHILIPPINES

SAMUELA. ORDOÑEZ, IMELDA A. DELA CRUZ, STELLA MARIE F. ABLAZA,
and EDILBERTO D. REDOÑA

*Plant Breeding and Biotechnology Division
Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija*



Hybrid rice technology can increase rice yields by 10-20% using the same input levels. Hence, in 1998, the Philippine government launched a hybrid rice program under the Department of Agriculture with hybrid rice breeding as a major component. Hybrid varietal development, however, is a long process that required a thorough understanding of genetic materials used in hybridization in order to achieve higher levels of efficiency. Since 1998, therefore, we studied various aspects of hybrid vigor or heterosis for important economic traits in rice using 1595 experimental hybrid combinations evaluated over two seasons (1998 DS and 1999 WS). Results of these experiments revealed a high relationship of yield heterosis with several agronomic traits. Distribution of heterosis was found to be normal for maturity and plant height and was bimodal for grain yield, number of productive tillers, panicle length, and spikelets number. The percentage of heterotic combinations has increased over time probably due to the continued improvement of parental materials and the increasing use of diverse germplasm. About 352 (22%) F₁ hybrids with more than 20% yield advantage over their male parents have been elevated to various yield traits. Since the establishment of the PhilRice breeding program, several promising hybrid combinations have been identified in these field trials. Five hybrid combinations have reached the national testing stage.

Key words: breeding, heterosis, hybridization, F₁

73. DEVELOPMENT OF VEGETABLE IPM PROGRAM IN RICE-BASED CROPPING SYSTEM

TEOTIMO M. AGANON¹, MARILYN G. PATRICIO¹
L. JOSE I. CALDERON², and JOSE S. SORIANO, Jr. ²

¹Research, Extension, and Training
Central Luzon State University
Muñoz, 3120 Nueva Ecija

²Novartis Agro Philippines, Inc., Crop Protection
3/F Asian Reinsurance Building,
Legaspi Village, 1229 Makati City

A study was conducted to identify the different insect pests and beneficials at different growth stages of eggplant and stringbeans and identify as well the critical growth stage(s) of the crops against insect infestation.

The occurrence of insect pests and beneficials relative to crop age was determined in both protected and unprotected plots. After mapping the insect pests and beneficials based on three cropping seasons, a strategic insecticide application was formulated and compared with farmers practice and untreated control.

A characteristic pattern of pest population of natural enemy attraction was recorded. In stringbeans, three peaks of infestation or critical periods (window) for crop growth seems attractive to early sucking pests such as leafhopper and aphid. The critical periods were 19-20, 53-54, and 65-75 days after emergence (DAE). In addition, 51-53 and 65-70 days, were critical periods so podborer damage. In eggplant, leafhopper and thrips predominated throughout the crop growth stage and their respective densities were highest at 20-25, 40-45, and 85-90 days after transplanting (DAT). Another significant observation is the apparent relationship of shootborer damage (highest at 67 DAT) and beneficials like



spider and coccinellid. The shootborer damage declined at 47 DAT and 81 DAT, the stage which coincided with the peak of spider and coccinellid populations indicating, among others, the probable role of beneficials in shootborer control.

The arthropod population dynamic data obtained were used to formulate a strategic insecticide application to optimize the effect of insecticides on insect pests while minimizing its impact on beneficials.

Efforts to demonstrate the judicious use of appropriate insecticide application based on insect occurrence and monitoring the critical windows showed that strategic applications in stringbeans and eggplant resulted in reduced spray application frequency. This strategy saved three applications in stringbean and six applications in eggplant compared to the farmers' practice.

While at times there were no significant quantitative yield differences between strategic insecticide application and farmers' practice plots, the savings in pesticide inputs and environmental safety cannot be ignored. It is apparent that the unprotected (unsprayed) plots in most cases yield is much lower than any of the other two treatments.

Further refinements in the strategies used including insecticide x parasitoid complementation are currently being studied. Initial data showed very promising results.

Key word: vegetable IPM

74. TRANSPLANTED IRRIGATED LOWLAND RICE PROGRAM AT PHILRICE

RODANTE E. TABIEN and LEOCADIO S. SEBASTIAN

*Philippine Rice Research Institute
Maligaya, Muñoz, 3110 Nueva Ecija*

Transplanting is still the predominant method of planting rice. Majority of the farmers in Luzon and Mindanao are transplanting rice in irrigated lowland fields, the most dependable source of rice in the country. Compared to direct seeding, transplanted rice has higher productivity but it is labor intensive. The average yield in irrigated lowland is 3.5 t/ha; but under the Gintong Ani Program, farmers yield averaged to 4.4 t/ha. With decreasing area devoted to rice and the global liberalization, research and development activities in transplanted regime have to be continued. The program aims to develop farming technologies that will improve and sustain yields in the transplanted irrigated lowland rice and to attain an average yield of 7.5 t/ha and 10 t/ha in multi-location trials by 2002 and 2005, respectively. Specifically, the research agenda will develop and promote location-specific nutrient and pest management technologies, improve and sustain yields of transplanted irrigated lowland rice; and implement technologies that are efficient, practical, and environment-friendly. Major accomplishments and current activities will be presented.

Key word: rice, transplanted rice, irrigated lowland, technology development



75. IMPROVEMENT OF IR64, C4-63G, PSB Rc 4, AND BPI-RI-10 FOR TRANSPLANTED IRRIGATED LOWLANDS

RODANTE E. TABIEN, MARLOU C. ABALOS, JOHNA R. CASAYURAN,
YOLANDA A. DIMAANO, and LEOCADIO S. SEBASTIAN

*Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija*

Four rice varieties, IR64, BPI Ri-10, PSB Rc 4, and C44-63G, are very popular in the Philippines. However, these are not resistant to bacterial leaf blight (BLB), one of the most serious diseases of rice in farmers' fields. With the identification of new genes like *Xa-21* that was not available during their development, these varieties can be improved through incorporation of new important traits like disease resistance. This study aims to improve BPI-Ri-10, IR64, C4-63G, IR546883, and PSB Rc4 through incorporation of *Xa-21* and *xa-5* for BLB resistance.

For four seasons, 146 advanced lines from the crosses involving these popular varieties were evaluated in replicated field trials together with the five high yielding parentals. The plants grown in 6 row plots with 11 hills were clip-inoculated with Maligaya strain of *Xanthomonas oryza* pv. *oryza* (Xoo) at maximum tillering and was scored 14 days after inoculation. All lines were found resistant indicating that they had the introduced *Xa-21* or *xa-5* gene. Across seasons, the highest yield of 7.02 t/ha was obtained from C4-63G/IRBB21 cross. This line has *Xa-21* gene good for almost all races of BLB in the Philippines. The IR64 progeny with *Xa-21* closely followed with 6.92t/ha, and PSB Rc4 with *xa-5* at 6.84 t/ha. Although BPI-Ri-10 progenies were not on the best ten lines, several lines from this cross have an average of 6 t/ha across four seasons. These elite lines are now in the replicated yield trails and will be forwarded for multi-location trials.

Key words: rice, bacterial leaf blight, disease resistance, *Xa-21* gene, high yield.

76. ANALYSIS OF TECHNICAL EFFICIENCY OF RICE PRODUCTION IN CAMARINES NORTE AND NUEVA ECIJA IN THE PRESENCE OF THE EL NIÑO PHENOMENON

FLORDELIZA C. HIDALGO¹, CHRISTIANNE EMMANUELLE V. FLORES¹, and
ALEJANDRO N. HERRIN²

¹*Philippine Rice Research Institute, Maligaya, Muñoz, 3119 Nueva Ecija*

²*School of Economics, U. P. Diliman, 1101 Quezon City*

This study deals mainly on the analysis of technical efficiency of rice farmers in Nueva Ecija and Camarines Norte as affected by weather abnormality such as the El Niño phenomenon. The technical efficiency of rice farmers was determined through a Maximum Likelihood Estimation of non-deterministic frontier production function. The resulting technical efficiency was then regressed with a dummy variable in order to measure the effect of the El Niño phenomenon. Furthermore, it was regressed against some socioeconomic characteristics of farmers to determine the factors affecting efficiency under such



circumstances. The production in each province was also regressed against the El Niño dummy variable to seek its effect on yield level. Results of the study showed that the El Niño phenomenon has no significant effect over the technical efficiency of rice farmers in the two provinces. This implies that farmers do not change their cultural and farm management practices even under the presence of the El Niño phenomenon. The results also revealed that socioeconomic characteristics such as age, education, trainings attended, and tenure status have no significant effect over technical efficiency. This is not due to inherent lack of relationship between the said variables but merely attributed to the relative homogeneity of the respondents. It was also found out that the El Niño phenomenon significantly increased the yield in Camarines Norte during the dry season while significantly reduced the production in both provinces during the wet season. The production enhancing effect was primarily accounted to the increased solar radiation during the dry season while yield-reducing effect was accredited the absence of normal rainfall that the two provinces usually received during such season. The study also determined the inputs significantly increasing production under such weather stress. These significant factors are water, fertilizer, and pesticide during dry season; and labor, fertilizer, and insecticide during the wet season. This implies that with the efficient use of such inputs, the farmers might minimize the yield reduction or maximize the production enhancing effect of the El Niño phenomenon. Finally, it was recommended that results of the study be verified using a more reliable proxy variable for El Niño such as rainfall data.

Key words: El Niño, dry season, wet season, Camarines Norte, Nueva Ecija, rainfall

77. RAPID DEVELOPMENT OF IMPROVED INDICA RICE VARIETY THROUGH ANTHR CULTURE TECHNOLOGY

NENITA V. DESAMERO, YOLANDA DIMAANO, CELIA L. DIAZ,
LEONILLO G. DOMINGO, EMILY R. CORPUZ, and RODANTE E. TABELIN

*Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija*

The major application of anther culture (AC) technology in rice breeding is to accelerate production of stable, homozygous breeding lines from genetically diverse, heterozygous genotypes. This results in the shortening of the time required for development of new varieties. The technology also offers the possibilities of introducing into plants variability that could be utilized for crop improvement. Anthers from IR64, a commercially released indica rice variety with premium grain and eating quality, were cultured in vitro. From a total of 57,549 anthers plated, we regenerated 45 green plants, of which, 19 are doubled haploids. These doubled haploid regenerants yielded a total of 147 doubled haploid breeding lines (DHL). A DHL is defined here as a tiller developed from an AC-derived doubled haploid regenerant. From these DHL, five were selected based on phenotypic acceptability, excellent kernel quality, moderate shatterability, and field resistance to diseases. The yield performance of three of the five lines was evaluated for two seasons, in 1999 dry and wet season, comparing them with the seed-derived (SD) IR64. At this point, the DHLs were at R₂ and R₃ generation, respectively. For two seasons, the AC-derived IR64 DHL matured earlier, and yielded better than the SD IR64. They produced more and comparable productive tillers in dry and wet season, respectively. The AC-derived IR64 plants were taller than the SD IR64 during the dry season, but shorter during the wet season. The data indicated that the SD IR64 elongated more during the wet season: trial. It can be inferred that SD IR64 is more sensitive to



solar radiation than the AC-derived IR64. This needs further study. Based on yield performance, one AC-derived IR64 was selected and elevated to the general yield trial (GYT). Conventionally, it will take at least six years for a breeding line to reach this stage. However, with the AC-derived IR64 selection, it took only three years. Thus, with anther culture technology, varietal improvement is expedited.

Key words: anther culture, doubled haploid line, yield performance, rice breeding

78. COMPARATIVE ANTHER CULTURE RESPONSE OF GENETICALLY DIVERSE AND HIGHLY HETEROZYGOUS INDICA RICE TO 2,4-D AND PAA-ENRICHED MEDIUM

WILHELMINA E. VILLALBA, MA. CORAZON N. JULATON, LAILA B. STA. MARIA,
LENIE P. ROMANO, MARTHA V. CHICO, SHARON S. MACABALE,
LEONILLO G. DOMINGO, and NENITA V. DESAMERO

*Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija*

Anthers from 18 genetically diverse and highly heterozygous F₁ crosses and two inbreds of rice were cultured in callus induction medium, supplemented with either 2,4-dichlorophenoxyacetic acid (2,4-D) or phenylacetic acid (PAA). Anthers from ten crosses formed more calli in 2,4D-enriched medium, eight in PAA-enriched medium, while two had comparable callus formation in both media. Percent callus formation ranged from 3.19 to 29.56 in 2,4-D-enriched medium, with a mean of 12.28 ± 7.91 . In medium supplemented with PAA, callus formation ranged from 2.95 to 32.85%, with a mean of 12.94 ± 8.41 %. Significant differences in callus formation were obtained for genotype, but not for callus induction medium, nor for the interaction between genotype and culture medium. Callus formation of at least 10% was observed more frequently in PAA-enriched medium. The callused anthers were transferred to various regeneration media to induce shoot and root formation. The green plant regeneration obtained for majority of the genotypes, was less than 1.0%, based on the total anthers plated. From our previous study with inbreds, we showed that PAA can induce direct regeneration in the same callus induction medium, without transfer of callused anthers into regeneration medium. This is one possible advantage of using PAA, as auxin for callus induction, over 2,4-D. We would like to exploit this advantage with our highly heterozygous breeding materials. This one-step anther culture protocol using PAA saves labor, time, laboratory supplies, and chemicals, as far as generating anther culture-derived breeding lines is concerned. Further study with other genotypes will be conducted to establish this point.

Key words: anther culture, indica rice, 2,4-D, PAA, callus induction, direct plant regeneration



79. IN VITRO RESPONSE OF ANTHHER CULTURE-DERIVED IR64 BREEDING LINES

MARTHA V. CHICO, SHARON S. MACABALE, and NENITA V. DESAMERO

*Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija*

Genotype is one of the major factors that determines the in vitro response of rice, and hence, the extent of utilization of in vitro culture in rice improvement. IR64 is one of the indica rice varieties recalcitrant to in vitro culture. In our anther culture (AC) work, we regenerated green plants from 0.08% of the total anthers (57,549 anthers) we cultured from the rice variety IR64. We advanced and evaluated these regenerants, and we selected some promising AC-derived IR64 breeding lines. This study was conducted to determine if the in vitro response was enhanced in the anther AC-derived IR64 breeding lines compared with seed-derived (SD) IR64. We used three explants, viz., young inflorescence, mature seed, and anther to establish the cultures. Our preliminary results indicated comparable callus formation from mature seeds of the AC-derived and SD IR64. Relatively more embryogenic calli were obtained from AC-derived lines. One of the three AC-derived lines regenerated more green plants than the SD IR64. With inflorescence culture, we used callus induction medium supplemented with either 2,4-D or PAA. In culture medium supplemented with PAA, more young spikelets regenerated shoots directly from AC-derived compared with the SD IR64. With 2,4-D, callus formation for AC-derived lines was not enhanced. However, one of the three AC-derived lines evaluated had enhanced green plant regeneration. With anther culture, better response was obtained from AC-derived lines, in terms of callus formation and green plant regeneration. Further studies will be conducted to establish the repeatability and stability of the in vitro responses observed.

Key words: anther culture, seed culture, inflorescence culture, variant

80. EFFECT OF DIFFERENT RATES OF GA₃ ON THE YIELD AND YIELD ATTRIBUTES OF PSB Rc72H (MESTIZO) IN A X R SEED PRODUCTION

ROEL R. SURALTA, DEXTER B. BASTADA, FRISCO M. MALABANAN
and EDILBERTO D. REDONA

*Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija*

The effect of different rates of gibberellic acid (GA₃) on improving the outcrossing characteristics of IR 58025A in A x R seed production was studied at PhilRice-CES during the 1999 dry season. The results indicated that increasing GA₃ dosage from 180 to 210 g/ha was the effective measure for improving the heading characteristics and panicle layer carriage of IR 58025A. Furthermore, spraying of GA₃ at these rates during 10% initial heading under the conditions of medium and high level population and growth uniformity of IR 58025A produced desirable effects on the yield, seed setting, and outcrossing rates of Mestizo. Integrating the optimum GA₃ application with other high-yielding techniques in hybrid rice seed production such as 2/4 to 3/4 flagleaf clipping, and supplementary pollination was more effective in increasing the yield of hybrid seed.

Key words: GA₃, IR 58025A, flagleaf clipping, supplementary pollination, Mestizo, hybrid seed, heading, outcrossing, panicle, seed setting



81. RICE VARIETIES AND GRAIN QUALITY ATTRIBUTES PREFERRED IN ADVERSE ENVIRONMENT

MARISSA V. ROMERO, JUMA NOVIE B. AYAP, ALICE M. BRIONES,
JESUSA M. CABLING, IRENE R. TANZO, and RENEE E. VALDEZ

*Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija*

A survey was conducted in adverse rice growing areas to determine farmer choice for varieties and consumer preference for grain quality. The provinces visited were Cagayan and Camarines Sur for saline-affected areas; Agusan del Norte and Nueva Vizcaya for zinc-deficient areas; and the province of Ifugao for cool-elevated areas. Five municipalities for each province were chosen and three barangays for each municipality were visited. The most popular variety was IR 66 in Cagayan, PSB Rc10 in Camarines Sur, PSB Rc18 in Agusan del Norte, BPI Ri10 in Nueva Vizcaya, and a native or traditional variety in Ifugao. All of the provinces surveyed showed that the major reasons for choosing the varieties was high yield, except in Ifugao where the highest premium was placed on grain quality. Asked about the grain quality attributes, the consumers indicated that taste was the most important. The other characteristics preferred were aroma, tenderness, and smoothness for cooked rice and maximum height increase and whiteness for raw rice. This information will provide the breeders and biotechnologists a guide in developing rice varieties with good grain quality for the adverse areas.

Key words: rice varieties, grain quality, adverse environment, saline, zinc deficiency, cool-elevated, raw rice, cooked rice, consumer preference, farmer choice

82. MASS SCREENING FOR SEEDLING SALT TOLERANCE AT PHILRICE

NOEMI S. DONES, JONATHAN M. NIONES, and PHILBERT S. BONILLA

*Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija*

A rapid screening method for rice seedling salt tolerance was established at the Philippine Rice Research Institute in June 1996 to identify and assess the degree of salt tolerance of different lines and varieties. The procedure is an integral component of the project on development of salt tolerant varieties whereby only lines rated tolerant and moderately tolerant in the observational nurseries are advanced to succeeding performance evaluation. The technique was a modification of the procedure being used at the International Rice Research Institute (IRRI) using Yoshida nutrient solution. Salt tolerance at electrical conductivity (EC) 12 mS/cm can be recognized after 21 d after sowing or 16 d after salinization.

Sources of materials for testing included the traditional rice variety collection, uniform lines from the breeding program of PhilRice, and introductions from collaborative breeding institutions. As of January 2000, a total of 5331 lines/varieties were screened in the different nurseries and trials. Out of those screened, 601 (10.9%) and 1536 (27.8%) were rated tolerant and moderately tolerant, respectively.

The procedure is presently being modified using seawater instead of adding NaCl to increase the EC. Seawater samples from four locations showed an average of 42.7 mS/cm EC and 1.85 ppm sodium content. The use of artificial seawater solution will simulate water conditions during salt intrusion where other salts are present.

Key words: electrical conductivity, mass screening, rice, salt tolerance, seawater



83. HUNTING THE RICE TUNGRO RESISTANCE GENE USING BACTERIAL ARTIFICIAL CHROMOSOMES AND RESISTANCE GENE ANALOGUES

GABRIEL O. ROMERO, VIVIAN A. PANES,
LEOCADIO S. SEBASTIAN, and VIOLETA TOLENTINO

*Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija*

As a step toward engineering resistance to tungro, the most destructive viral disease of rice in Southeast Asia, a map-based cloning approach was initiated to isolate a resistance gene against tungro spherical virus, the primary causal organism. Fine genetic mapping is underway to identify AFLP markers < 1.0 cM from the R locus. In parallel, physical mapping was carried out starting with RFLP and RAPD markers at ~ 1.0 cM. Four BAC clones were selected from libraries obtained from the International Rice Research Institute and the University of California, Davis using three anchor markers (C708, CDO456, and CDO783) at the resistance region. During chromosome walking from the anchor BAC clones, seventeen BAC ends were isolated by TAIL-PCR (thermal asymmetric interlaced polymerase chain reaction) that were used to identify 28 new candidate BAC clones in subsequent hybridizations. A contig of 14 clones at the C708 locus, a contig of 12 clones at the CDO456 locus, and another contig of 5 clones at the CDO783 locus were localized. Together with IRRI's screening, 36 BAC clones flanking the genes were identified at the target region. The size and arrangement of the tentative contig at the C708 locus were determined through pulse-field gel electrophoresis and cross hybridization. Gene hunting using PCR with RGA (resistance gene analogue) primers was also initiated on the 14 BAC clones. Clone 8P16 gave major PCR bands with primer pairs 1) ptokin1 and ptokin2, and 2) XLRR inverse 1 and inverse 2. Clone 16D8 also produced distinct PCR bands with the ptokin 1-ptokin 2 primer pair. Reamplification and subcloning of the most abundant bands are underway.

Key words: BAC, RGA, TAIL-PCR, RTSV, AFLP, RFLP, RAPD, physical mapping, chromosome walking, contig

84. PCR-BASED DNA FINGERPRINTING OF ANHER-CULTURE DERIVED INDICA RICE BREEDING LINES

SHARON S. MACABALE, MARTHA V. CHICO, and NENITA V. DESAMERO

*Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija*

Stable breeding lines were obtained from anther culture-derived variants from indica rice variety Wagwag and IR64. For some variants, differences in some agronomic traits were established. Other variants, however, are morphologically and agronomically similar. To genetically differentiate these variants, we subjected them to RAPD (randomly amplified polymorphic DNA) and SSR (simple sequence repeats) analysis. For RAPD analysis, we screened 37 primers. With Wagwag variants, 24 primers are polymorphic and four are monomorphic. The rest of the primers did not amplify. Only nine, those polymorphic



primers that amplify in all samples, were scored. With IR64, 11 primers are polymorphic, 4 are monomorphic. Only 10 polymorphic primers were scored. For SSR analysis, we screened 26 and 40 primers for Wagwag and IR64 variants, respectively. Twenty and 16 primers were scored for Wagwag and IR64, respectively. The results of the amplification reactions with the rest of the primers are not scorable. With the polymorphic molecular markers we were able to genetically differentiate the AC-derived variants from one another, and from the seed-derived parental genotype.

Key words: anther culture, RAPD, SSR, indica rice

85. GENETIC TRANSFORMATION OF RICE (*Oryza sativa* L) USING PIN2 AND GNA GENES FOR INSECT RESISTANCE

REYNALDO B. EVORA¹, VIOLETA N. VILLEGAS², MARIA TERESA B. PERALTA³,
VICTORIA P. CHAVEZ LAPITAN³, LEOCADIO S. SEBASTIAN⁴, MA. REGINA C. GARCIA¹,
JULIETA U. SAJISE¹, MARILOU R. CALAPARDO¹, PAUL CHRISTOU⁵, AND REY WU⁶

¹National Institute of Biology and Molecular Biotechnology,

²Institute of Plant Breeding, U. P. Los Baños, 4031 College Laguna

³Philrice-Los Baños, College, 4031 Laguna

⁴Philrice-Maligaya, Muñoz, Nueva Ecija

⁵John Innes Center, Colney Lane, Norwich

⁶Cornell University, Ithaca, N.Y.

Currently, insect pests are controlled mostly by chemical insecticides which also eliminate the beneficial insects and arthropods in the rice causing pest resurgence and more extensive damage. Introduction of Pin2 and GNA genes in rice is expected to confer tolerance/resistance to lepidopterans (stem borers, leaf folders, cutworms) and homopterans (brown planthopper, green leafhopper) pests, respectively.

Calli induced from sutella of mature seeds and immature embryos of IR72, PSBRc14, PSBRc 28, LX15, Taipei 309, and IR43 served as materials for transformation. Friable and embryogenic types of callus were shown to be excellent material for transformation as reported for japonica rice by Hiei et al. (1994). All the varieties being used produced the same kind of callus. On the other hand, among the varieties, Taipei 309, and LX15 had the highest callus induction rate while PSBRc14 had the lowest.

Embryogenic calli bombarded with pTWA and pubiGNA containing Pin2 and GNA genes, respectively, using the particle inflow gun apparatus were kept in the selection medium for at least one month or until the calli from the control treatment (not bombarded with Pin2 and GNA genes) died. Calli were then transferred into plant regeneration medium.

Plants were regenerated from BASTA[®] and hygromycin resistant calli induced from both mature seeds and immature embryos. Molecular analyses and physiological evaluation of the putatively transgenic are presently being undertaken. Preliminary PCR analysis showed positive results.

Key words: rice, transformation, particle bombardment, Pin2, GNA, insect resistance, embryogenic calli, BASTA, hygromycin



86. EFFECT OF MIST-POLISHING ON THE PHYSICOCHEMICAL AND SENSORY PROPERTIES OF RICE

JUMA NOVIE B. AYAPI¹, NANETTE V. ZULUETA¹, EVELYN M. HERRERA¹,
RENE E. VALDEZ¹, ESTRELLA G. ANTOLIN¹, TESSIE Q. RAMIREZ²,
and DANILO G. NATIVIDAD²

¹*Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija*

²*National Food Authority
E. Rodriguez Sr. Avenue, 1101 Quezon City*

The general impression on NFA rice is that it is of poor quality. One of the possible methods to eliminate this impression is through mist-polishing. Mist-polishing is a process wherein water, in the form of mist, is sprayed unto the grains during the polishing stage to remove excess dust, bran, and the aleurone layer remaining in the longitudinal groove. Physicochemical analysis and sensory evaluation were conducted using stocked NFA rice, remilled rice, and remilled-mist-polished rice to determine the effect of mist-polishing on rice grain quality. The most distinct difference among the three samples was seen in the physical properties of raw milled rice. The mist-polished sample was significantly superior over the remilled sample in color, gloss, translucency, and general acceptability. The remilled sample was, in turn, significantly superior over the original stock sample. However, in the cooked samples, remilled and mist-polished samples did not differ significantly in sensory and physicochemical properties and aerobic plate count. For these parameters, remilling was enough to improve the quality of the stock sample.

Key words: NFA rice, mist-polishing, remilling, grain quality, physicochemical properties, aerobic plate count, sensory evaluation, gloss translucency, color

87. PHYSICOCHEMICAL PROPERTIES OF IRON FORTIFIED RICE FLOUR

NANETTE V. ZULUETA¹ and MA. PATRICIA V. AZANZA²

¹*Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija*

²*College of Home Economics
U.P. Diliman, 1101 Quezon City*

Rice flour prepared from PSBRc10 rice variety intended for use in the production of traditional rice-based food products and noodles was fortified with iron by manual mixing for 30 min to 1h. The non-fortified rice flour contained $8.00-9.35 \pm 0.679$ mg Fe/100g rice flour while the treated sample had iron content ranging from 17.71 to 37.50 mg/100g. Analysis of variance (ANOVA) at 5% level of significance revealed that non-fortified rice flour was significantly whiter (75.27 whiteness values)



compared to those containing ferrous fumarate (FF) (74.20 whiteness values) and ferrous succinate (FS)(73.43 whiteness values) at concentrations of 30mg/100g. Bulk density of iron fortified rice flour was significantly higher compared to the control. Setback and breakdown viscosities slightly changed with the addition of FF. Ferrous succinate treated rice flour on the other hand showed slight decreases in their peak and final viscosities. Other important properties were not affected which indicates that iron fortified rice flour could find several applications in the rice-based food industry.

Keywords: rice flour, noodles, ferrous fumarate, ferrous succinate, whiteness, bulk density, setback, breakdown, peak viscosity, final viscosity

88. RICE NOODLE CHARACTERISTICS AS AFFECTED BY IRON

NANETTE V. ZULUETA¹ and MA. PATRICIA V. AZANZA²

*¹Philippine Rice Research Institute,
Maligaya, Muñoz, 3119 Nueva Ecija*

*²College of Home Economics
U.P. Diliman, 1101 Quezon City*

Noodles were prepared using rice flour fortified with 10, 20, and 30 mg/100 ferrous fumarate and ferrous succinate. The process involved soaking, steaming, kneading, extrusion, boiling, and drying. The rice flour (RFN) was characterized in terms of cooking and sensory qualities. The retention of iron at different stages of noodle production was also assessed. Cooking losses of non-fortified and fortified RFN were found to be not significantly different at the 5% level of significance. Overall appearance, overall flavor, smoothness, and chewiness of RFN were not affected with the addition of ferrous fumarate. No significant changes were also observed in the overall appearance, overall flavor, and overall texture of RFN enriched with ferrous succinate. A slight difference in the overall appearance of ferrous succinate-treated RFN were noted which was attributed to a slight change in color. Sensory qualities were most acceptable at fortification levels of 20 mg/100g.

Key words: noodles, rice flour, ferrous fumarate, ferrous succinate, cooking quality, sensory quality, cooking losses, overall flavor, overall appearance, overall texture

89. VARIABILITY IN RICE STEM BORER POPULATIONS AND ITS IMPLICATIONS IN THE DEVELOPMENT AND POSSIBLE RELEASE OF BT ENGINEERED RICE

CESAR G. DEMAYO

*Department of Biological Sciences
MSU Iligan Institute of Technology
Iligan City*

The Bt gene had been successfully engineered in several crops and it will not be long that its transfer and stable expression in rice will be realized. Engineering one very effective gene in rice does not mean



a successful, stable agriculture. There are so many unresolved issues and straightforward answers unanswered. Understanding the complexities in the interactions would mean a better chance in the deployment of the technology in a sustainable manner. To achieve this requires good evaluation for useful *Bt* genes; assessment of the potential for resistance in rice pests, and in this case the stem borer; transformation technology and gene expression; field tests of strategies to delay resistance; germplasm development and distribution. Thus there is a need to understand ecological and genetic interactions between *Bt* toxins, rice and rice pests and natural enemies. The results of this study provide some answers to these needs.

As to the search for the useful *Bt* gene, the result, of the study show that there are some *Bt* genes which could serve as candidates for introduction into the rice genome based on several criteria: lack of genetic homology with toxins of standard strains, high efficacy at killing specific stem borer pests, and unique mode of action. These are *CryIAc* for the striped stem borer and *CryIAc*, *CryIIA*, and *CryIC* for the yellow stem borer. The striped stem borer is very susceptible to *CryIAc* but not with the other two endotoxins, *CryIIA* and *CryIC* which were found to be as equally effective as *CryIA(c)* against yellow stem borer. Another important finding derived from this study is that those *Bt* endotoxins which has no "knockdown effects" are we effective not by killing but also by avoidance of the insects and inhibition of the growth of the larvae. This information is important to develop strategies in the proper development of the engineered rice.

An understanding of the pest movement based on genetic structure is essential for the logical development of resistance management strategies. The results of this study show geographical variation in response of different rice types and *Bt*-transgenic rice. This only indicates that any *Bt*-transgenic rice will not have the assurance of complete success when deployed in all the local fields where it will be planted. It was shown in this study that resistance to the very toxic *CryIAc* varied from population to population, thus there is a possibility that populations of these insects have the potential to overcome the effect of the *Bt* toxins expressed in rice. The problem will be compounded with large movements of these resistant insects to adjacent rice fields causing yield losses.

The practices of farmers of heavy pesticide use may contribute to the failure of the *Bt*-transgenic rice. It was found in a local survey of farmers management of rice pests that spraying with insecticides is done whether the rice variety is resistant or not. It is most likely that when *Bt*-rice will be deployed, this will be treated just like other varieties. Considerable effort should be exerted to help farmers realize the proper way of managing rice through education and participatory training in pest management.

Key words: *Bacillus thuringiensis*, pest management, variability

90. RESISTANCE SCREENING OF FARMERS' AND COMMERCIAL VARIETIES OF EGGPLANT AGAINST THE LEAFHOPPER, *Amrasca biguttula* (ISHIDA) AND THE EGGPLANT BORER, *Leucinodes orbonalis* BUENEE

MERDELYN CAASI-LIT¹, VICTOR P. GAPUD^{2,3}, CLARINDA PIL²
BELEN SANTIAGO², GINA BALAGOT², N. S. TALEKAR⁴, and EDWIN RAJOTTE⁵

¹Entomology Laboratory, Institute of Plant Breeding, College of Agriculture
Los Baños, College, 4031 Laguna

²Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija



³Department of Entomology, U. P. Los Baños
College, 4031 Laguna

⁴Asian Vegetable Research and Development Center

⁵Pennsylvania State University, U.S.A.

Eleven eggplant varieties were screened for resistance to the leafhopper *Amrasca biguttula* (Ishida) at the Central Experiment Station, PhilRice, Muñoz, Nueva Ecija in separate trials. Results in the first trial showed that the farmers' variety, Abar, was tolerant having higher yield than Dumaguete Long Purple (DLP), despite comparably the same number of leafhoppers as the susceptible variety. The relatively thicker leaves and more dense trichomes possibly conferred tolerance to Abar against the leafhopper.

In the second trial, antixenosis or non-preference (oviposition and feeding) was demonstrated by SRO2, a farmers' variety from Ilocos, at the early vegetative and reproductive stages of plant growth. The number of nymph and adult leafhopper was consistently low in all three leaf positions. Leafhoppers preferred to feed on DLP and Lon Violet throughout the sampling period. Damage ratings showed least leaf yellowing and, cupping for SRO2 but advanced damage for Long Violet and DLP. The mechanism of resistance of SRO2 should be further investigated in view of its possible use in eggplant varietal improvement. IPB GSI, an improved IPM leafhopper tolerant line, significantly yielded the highest, healthiest, and largest fruits in all four harvesting periods despite the number of leafhoppers present. IPB GSI is a good candidate for leafhopper tolerance. However, more breeding work should be conducted to further raise the level of tolerance.

Key words: eggplant borer, eggplant leafhopper, *Amrasca biguttula*, *Leucinodes orbonalis*, host plant resistance in eggplants

91. EFFECTS OF TEMPERATURE, pH, AND NITROGEN SOURCES ON THE GROWTH AND SPORULATION OF *FUSARIUM* CAUSING WILT AND ROOT ROT OF GARDEN PEA (*Pisum sativum* L.)

ASUNCION L. NAGPALA¹ and LINA L. ILAG²

¹Department of Plant Pathology, College of Agriculture
Benguet State University, La Trinidad, 2601 Benguet

²Department of Plant Pathology, College of Agriculture
U. P. Los Baños, College 4031 Laguna

The ability of *Fusarium oxysporum* f. sp. *Pisi*, Schlecht. Snyder and Hansen and *F. solani* f. sp. *Pisi*, Apell and Wollenweber to cause wilt and root rot on Garden Pea are influenced by temperature, pH, and nitrogen sources.

Both species of *Fusarium* grew under a temperature range of 10°C to 30°C in potato dextrose agar (PDA). Scanty mycelia was noted at 10°C. *F. oxysporum* reached the widest colony diameter of 80 mm and a spore count of 99/mL at 30°C, while 88 mm colony diameter and 86 spore count /ml was obtained at the same temperature after 1 week.



In terms of pH, both species of fungi grew at pH range of 3.0 to 8.0. However, the widest colony of 70 mm with the highest spore count of 250/mL of *F. oxysporum* was obtained at pH 5. The same trend was noted on the growth and sporulation of *F. solani*. The widest colony of 69 mm and a spore count of 395/mL were recorded at the same pH (5) after 1 week using potato dextrose agar (PDA). Growth and sporulation of the fungus declined as the pH was raised to neutral (7.0).

In relation to nitrogen sources, both species of *Fusarium* utilized different nitrogen sources: ammonium nitrate, ammonium sulfate, calcium nitrate, potassium nitrate, sodium nitrate, and urea. The heaviest mycelia weight of .17g of *F. oxysporum* was obtained in potassium and is comparable with oven dry weight of mycelia from the standard media potato dextrose agar (PDA), while the heaviest mycelia dry weight of 1.8 g of *F. solani* was obtained from ammonium nitrate. On the contrary, the highest spore count of 806/ mL was produced in calcium nitrate for *F. oxysporum* while 697 spores /mL was found in potassium nitrate for *F. solani*. Spore counts obtained from calcium nitrate and potassium nitrate were comparable with spores produced in potato dextrose agar after 1 week. Limited growth and sporulation was recorded in ammonium sulfate.

The results obtained from the laboratory experiments clearly demonstrated the effects of temperature, pH, and nitrogen sources on the growth and development of *Fusarium* wilt and root rot. These factors must be considered in any management scheme for the disease under natural conditions.

Key words: *Fusarium* wilt, root rot, garden pea, temperature, pH, nitrogen, management

92. MANAGEMENT STRATEGIES FOR COTTON FLOWER WEEVIL, *Amorphaidea lata* MOTSCHULSKY

TEODORO S. SOLSOLOY, MA. MAGDALENA C. DAMO,
RUSTICO G. DAVID, ESTRELITA O. DOMINGO, FREDOLIN P. JULIAN,
NENITA D. CACAYORIN, and BENITA U. BILGERA

*Cotton Development Administration
Research and Development Center
Batac, 2906 Ilocos Norte*

Flower weevil, *Amorphaidea lata* Motsch., is one of the major insect pests of cotton that provides difficulty among pest managers. Its behavioral characteristics render it unmanageable. The adult feeds and lays its eggs mainly on newly opened flowers. This causes a premature shedding of the young boll. It then spends all its larval stages inside until pupation. If left unchecked, cotton farmers experience yield loss of about 28-30 percent.

The management strategies for flower weevil, *Amorphaidea lata* Motsch., is an orchestration of the different researches done for a decade at the Cotton Development Administration Research and Operation Centers. The components of the management strategies are as follows: (1) dusting flower with ash supplemented by collection and burning of shed young bolls, (2) early planting during the months of August and September (3) wider row spacing of planting, (4) dense planting, i.e., 100,000 plants/ha, (5) close season planting, (6) planting of trap crop like okra, (7) irrigation management at critical stages of the pests, (8) releases of *Euborellia annulata*, and (9) use of granular systemic insecticides.

Various combinations of these components applied at the right time reduced flower weevil population



and subsequently change resulting in increased farmer's yield with income with the added benefits of reducing pollution to the environment.

Key words: *Amorphoidea lata*, dusting hower, young bolls, dense planting, close season, trap crops, *Euborellia annulata*

93. RICE HULL BURNING: A FARMER'S TECHNOLOGY FOR MANAGEMENT OF RICE ROOT-KNOT NEMATODE IN A RICE-ONION CROPPING SYSTEM

EVELYN B. GERGON¹, OSCAR OPINA², and SANTIAGO R. OBIEN²

¹*Philippine Rice Research Institute, Maligaya
Muñoz, 3119 Nueva Ecija*

¹*U.P. Los Baños, College, 4031 Laguna*

Rice hull burning (RHB) is a traditional cultural practice of many onion growers in San Jose City, Nueva Ecija, Philippines mainly for weed control and yield increase. The resulting carbonized rice hull is incorporated into the soil during land preparation before transplanting of onion. Studies to evaluate the effect of RHB on rice root-knot nematode, *Meloidogyne graminicola*, and onion yield were conducted in a farmer's field naturally infested by the pathogen. Fifteen cm-thick rice hull was sufficient to reduce the nematode population in the soil. The effect of heat from burning rice hull on the nematodes reached up to 30 cm deep. The effect of deep plowing on nematode population was insignificant in comparison with standard plowing. Increasing thickness of RHB gave a significant contribution to increase of onion yield and production of bulbs of export quality. Plots that received 30 cm-thick rice hull gave 27% more large bulbs than 15 cm-thick hull and 40% more than no RHB. Thirty 3 cm-thick rice hull gave a yield advantage of 31% over no RHB while 15 cm-thick hull gave a yield advantage of 11%.

Key words: root-knot, *Meloidogyne graminicola*, rice hull burning, management, rice-onion system

94. ARTHROPOD PESTS OF BAMBOOS: TAXONOMY, BIOLOGY, NATURAL ENEMIES, AND HOST PLANT RESISTANCE

IRENEO L. LIT, JR.¹, MERDELYN CAASI-LIT², and
MA. AMABEL A. CAPRICHIO²

¹*Entomology Section, Museum of Natural History
U.P. Los Baños, College, 4031 Laguna*

²*Entomology Laboratory, Institute of Plant Breeding, College of Agriculture
Los Baños, College, 4031 Laguna*

Sixty (60) species of bamboo arthropod pests (57 insects, 3 mites) were collected from several species of bamboos in nurseries, plantations, and natural stands around the Philippines. These were



identified to genus and/or species levels. These include the following: Bamboo node mealybug - *Antonina* sp. aff. *thaiensis* Takahashi; Bamboo shoot mealybug - *Palmicultor* sp. aff. *bambusum* Tang; Bamboo leaf mealbug *Paracoccus interceptus* Lit; Bamboo culm mealybug - *Chaetococcus bambusae* (Maskell); Bamboo planthopper—*Purohita* sp.; Bamboo green mites - *Schizotetranychus* sp.; Bamboo culm borer - *Chlorophorus* sp. and Bamboo leaf folder - *Pyrausta* sp. A rodent (*Rattus tanezumi*) and one snail were also observed but not collected. New species, whose descriptions are being prepared include: *Neoclavicoccus* sp. nov. (Pseudococcidae), from Makiling and Palawan, *Bambusaspis* sp. nov. (Asterolecaniidae) from Palawan, *Coccus* sp. nov. (Coccidae) from Palawan and Subic Bay Forest Reserve, *Greenaspis* sp. nov. (Diaspididae) from Mount Makiling, *Odonaspis* sp. nov. (Diaspididae) from Davao and *Kuwanaspis* sp. nov. (Diaspididae) from Laguna.

New records include: *Caltoris cahira* (Moore) and *Thosea* sp., as well as *Doleschallia bisaltide philippinensis*, *Melicodes tenebrosa tenebrosa*, *Protactia* sp., *Melamtis leda* new host records.

The list of bamboo pests from Gabriel's latest compendium was further updated by incorporating new findings in this project and results from further review of literature. The revised checklist records 110 species, which is 93% higher than Gabriel's 57. However, the inclusion of *Planococcus lilacinus* (Cockerell) in Gabriel's checklist is here regarded as doubtful and most probably constitutes a misidentification. It has never been recovered from any of the bamboo mealybugs collected from all over the country. The species being referred to is most probably *Paracoccus interceptus* Lit.

Key words: *bamboo pests, bamboo insects, arthropods*

95. CRITICAL PEST LEVEL FOR BOLLWORM, *Helicoverpa armigera* (HUBN.)

BENITA U. BILGERIA

*Cotton Development Administration
Batac, 2906 Ilocos Norte*

Cotton bollworm is one of the major pests of cotton and different control methods are used to control this pest. The use of insecticides is the most effective strategy but it should only be implemented when necessary, that is when the pest has reached the damaging level. In cotton, the critical pest level (CPL) is used as basis on whether to spray or not. Farmers claim that some of the recommended insecticides against bollworm are no longer effective. It is suspected that one of the possible reasons is the CPL currently used as basis in spraying. Hence, this study was conducted to determine the CPL for bollworm at vegetative, squaring, flowering, and bolling stages of cotton. It was done at the Research and Development Center, CODA, Batac, Ilocos Norte.

The cage technique was used in the experiment. Nylon mesh cloth cages were used to confine 20 hills of cotton with two plants per hill. Determination of the CPL was done at vegetative (22-42 DAP), squaring (43-63 DAP), flowering (64-84 DAP), and bolling (85-105 DAP) stages. Varying number of larvae were released inside each cage. These were: (a) 0; (b) 1; (c) 2; (d) 3; and (e) 4. Shed squares, flowers, and young bolls were collected and classified according to cause of shedding. The number of shed structures due to bollworm damage was recorded. Yield loss due to bollworm was computed based on the shed structures. Cost of control and yield loss were used as basis in determining the CPL for bollworm at different growth stages.



An increase in bollworm density meant an increase in the number of shed reproductive structures, resulting in a corresponding decrease in the number of harvested bolls and consequently, seedcotton yield. At vegetative (22-42 DAP) and squaring (43-63 DAP) stages, results showed that there is need to spray when the CPL of two bollworms/20 plants was reached. However, at flowering (64-84 DAP) and bolling (85-105 DAP) stages, spraying should be done at the CPL of three and two bollworms/20 plants, respectively.

Results imply that proper timing and judicious use of insecticides are important. It should only be done when the need arises or when the CPL is reached to avoid unnecessary expenses.

Key words: critical pest level, bollworm, growth stage, yield loss, control cost

96. INSECTICIDE AND FUNGICIDE EFFECTS OF BETEL, *Piper betle* L. VOLATILE OIL ON SELEGTED COTTON PESTS

AIDA D. SOLSOLOY, ESTRELITA O. DOMINGO, NENITA D. CACAYORIN and
MA. MAGDALENA C. DAMO

*Cotton Development Administration
Batac, 2906 Ilocos Norte*

The variety and versatility in the biological activity of indigenous plants in the Philippines warrant investigation as potential sources of pesticide materials. With an abundant source and ease in cultivation, these materials can possibly be tapped as substitutes or complements to chemical pesticides, the latter being a necessary evil in agricultural production. A common ingredient in the chewing of tobacco by old people, the betel, *Piper betle*, is one such plant worthy of investigation.

The volatile oil from betel, *Piper betle* L. leaves obtained by steam distillation, was yellowish brown with a strong peculiar aromatic odor. Through liquid-solid chromatography and successive elution with organic solvents, namely petroleum ether, and dichloromethane and methanol, the oil yielded three fractions.

Bioassay on selected cotton pests showed that the volatile oil and fractions isolated either by petroleum ether or dichloromethane effectively controlled sucking pests of cotton, notably, *Aphis gossypii* and *Amrasca biguttula*, and acted as ovicide against *Helicoverpa armigera* and *Pectinophora gossypiella*. The oil, however, stimulated *H. armigera* adults to deposit eggs and its larvae to feed on treated substrate, but deterred *P. gossypiella* and *Amorphoidea lata*. Interestingly, its fractions inhibited egg deposition of *H. armigera*, *P. gossypiella*, and *A. lata*, indicating a marked selectivity as well as synergism in insecticide action.

Similar trend in effectiveness as fusicide was observed for the oil and its two fractions against damping-off organisms, *Sclerotium rolfsii*, *Fusarium oxysporum*, and *Rhizoctonium solani*, in that order.

Using GC-El-MS, the fractions had six and three major components obtained by petroleum ether and dichloromethane, respectively. The components were generally terpenes and sesquiterpenes, notably allylphenol, caryophyllene, eugenol, betelphenol, cineol, cadinene, and menthone.

The pesticide action of *P. betle* volatile oil indicates potential as control agent for cotton pests, although, field evaluation is still necessary, in addition to determining its effect on the natural enemies. Also, with the oil being equally or more effective than its fractions, its prospect for formulation and application in agriculture seems viable, however, with its mammalian toxicity to be established yet.

Key words: insecticide, fungicide, *Piper betle*, volatile oil, *Aphis gossypii*, *Amrasca biguttula*, *Helicoverpa armigera*, *Pectinophora gossypiella*, damping-off organisms



97. *Argemone mexicana* L. (PAPAVERACEAE) PRICKLY POPPY: A NEW NON-QUARANTINE PEST RECORD IN THE PHILIPPINES

BONIFACIO F. CAYABYAB, EMMA M. ALFORJA
CARLOS L. PADILLA, JUANITA BARIUAN, ROLANDO G. BAYOT,
MELVIN D. EBUENGA, and ALICIA G. AQUINO

*Plant Quarantine Support Laboratory
National Crop Protection Center, College of Agriculture
U.P. Los Baños, College, 4031 Laguna*

Argemone mexicana L., commonly known as prickly poppy, is an exotic weed that was recently detected in onion growing areas of Bongabon, Nueva Ecija. Aside from competing with soil nutrients and sunlight with onions, the prickly poppy is also hazardous to farmer due to spines that can prick the legs and arms. This weed is not present during the rainy season; it emerges after rice harvest. Thus it can be surmised that it is dormant during the wet season. In fact this weed is common in drylands.

The description of this exotic weed and its field density are discussed.

Key words: onion, *Argemone mexicana*, prickly poppy, Bongabon, drylands, exotic weed, Nueva Ecija

98. DAMAGE ASSESSMENT OF LEPIDOPTEROUS PEST OF ONION IN NUEVA ECIJA

BONIFACIO F. CAYABYAB, CARLOS L. PADILLA, MELVIN D.
EBUENGA, ROLANDO G. BAYOT, JESSMYN R. ADORADA
FREDELINO PEÑALBA, EMMA P. PEREZ, and ALICIA G. AQUINO

*Plant Quarantine Support Laboratory
National Crop Protection Center, College of Agriculture
U. P. Los Baños, College, 4031 Laguna*

The lepidopterous pests, of onion which are leaf chewers were studied during the 1999 growing season. This pest group in Nueva Ecija includes cutworms, earworms, semi-loopers, and a new lepidopterous pest of onion. The cutworms are the dominant species.

Approximately 20% of red pinoy yield is reduced due to the damaged caused by these lepidopterous pests. The sampling protocols and details of the result are discussed.

Key words: lepidopterous pests, cutworms, damage assessment, onion, red pinoy, leaf chewers



99. INSECT PESTS AND NATURAL ENEMIES FROM STORED PRODUCTS IN JAPAN

MARISSA V. ROMERO¹ and KEIICHI TAKAHASHI²

¹Philippine Rice Research Institute
Maligaya, Muñoz 119 Nueva Ecija

²National Food Research Institute
Tsukuba, Japan

Severe infestation by insect pests on stored products shortens shelf life and leads to product deterioration. It is important therefore to identify these insect pests as well as their natural enemies as a step toward the development of control measures against them. Stored product samples such as cereal grains and animal feeds were collected from 15 sites in Kumamoto, Ibaraki, Okinawa, and Hokkaido prefectures in Japan. After isolating the insect pests, predators, and parasites from the samples, their identity was determined based on morphological characteristics. A total of 14 species of insect pests were identified from the samples and majority of them were beetles. *Tribolium castaneum* (red flour beetle) and *Stegobium paniceum* (drugstore beetle) were the most frequently occurring species in the samples. Among the various sources of the samples, Kumamoto Kikuchi Shokuryo and Kashima Forage Company had the most number of insect pest species. The predators found in the samples were *Gnathoncus nannetensis*, *Ar:isolabis maritime*, *Alleocranum biannulipes*, *Carcinops pumila*, pseudoscorpion, spider, beetle, and an unknown, while the parasites included two unknown species and *ventulia canescens*.

Key words: stored products, insect pests, predators, parasites, natural enemies, *Tribolium castaneum*, *Stegobium paniceum*, post-harvest, cereal grains, animal feeds

100. A SURVEY OF BUTTERFLIES AND SKIPPERS (LEPIDOPTERA: RHOPALOCERA) FROM MOUNT BANAHAO DE LUCBAN, QUEZON PROVINCE, PHILIPPINES

IRENEO L. LIT, JR., ORLANDO L. EUSEBIO, and
ARIEL R. LARONA

Entomology Section, Museum of Natural History
U.P. Los Baños, College, 4031 Laguna

A survey of the Rhopalocera of Mount Banahao de Lucban was conducted from July 1997 to December 1999. Four main sampling and observation sites were designated, namely, the Samil River area (700-1000 m asl), Manglit-Palola (750-900 m asl), Barod-Palola (700-1100 m asl), and Balicatan (900-1200 m asl). A total of 76 species were identified. These are distributed in nine families namely: Hesperidae, Papilionidae, Satyridae, Amathusiidae, Nymphalidae, Danaidae, Peiridae and Lycaenidae. The best represented family is Pieridae with 14 species. *Troides rhadamantus* Lucas which is included in Appendix II of CITES list can still be found in the mountain particularly around the Samil area, but was sighted only twice throughout the entire study period.

Keywords: butterflies, Rhopalocera, *Troides rhadamantus*, Mount Banahao de Lucban



101. GROWTH AND DEVELOPMENT OF RICE STEMBORER IN AN ARTIFICIAL DIET

AMELIA T. ANGELES and GENARO S. RILLON

*Crop Protection Division, Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija*

In searching for an alternative host for the yellow stem borer eggs for parasitoid studies, a corn borer diet was tested for growth and development of rice stem borer for pupa production and found suitable for rearing. Neonates of striped stem borer, *Chilo suppressalis* (Walker) were infested on the diet. Parameters such as larval/pupal weights, larval/pupal periods, adult survival, and fecundity were observed. Forty eight percent of the larvae survived, grew, and developed into adults on the corn borer diet. Development period ranged from 34 to 57 days with a mean of 44.34 ± 7.52 days. Mean larval period was 37.41 ± 7.05 days, mean pupal period 7.05 ± 1.54 days, and mean development period 44.34 ± 7.52 days. The peak of pupation occurred from 31 to 40 days while development period peaked at 36 to 45 days. Each female was able to lay an average of three egg masses with a mean egg count of 92.21 ± 55.17 eggs.

Key words: stem borer, *Chilo suppressalis*, larvae, corn borer diet, egg masses

102. MORPHOLOGY OF THE ANAL TUBERCLE AND DERMAL STRUCTURES OF LAC INSECTS (KERRIIDAE, COCCOIDAE, HEMIPTERA)

IRENEO L. LIT, JR.¹ and PENNY J. GULLAN²

¹*Entomology Section, Museum of Natural History
U. P. Los Baños, College, 4031 Laguna*

²*Department of Entomology, University of California, Davis;
formerly of the Division of Botany and Zoology
The Australian National University, Canberra, ACT 0200, Australia*

Specimens of *Austrotachardia acaciae* (Maskell), *Austrotachardia micropoda* (Lit and Gullan, *Kerria lacca* (Kerr), and *Paratarchardia decorella* (Maskell) were examined under the scanning electron microscope (SEM). SEM images were compared with light microscopy observations. The anal tubercles and dermal structures of each species are described and compared. The presence of what appears to be vestiges of an anal cleft in *Paratarchardia*, is interpreted as suggesting possible evolution of the lac insects from a lecanoid ancestor that possessed an anal cleft. The results provide easier interpretation of characters under the light microscope.

Key words: anal tubercle, dermal structures of scale insects, comparative morphology, lac insects, Kerriidae, SEM



103. BUTTERFLY MANURE: A NOVEL SOURCE OF BIO-ORGANIC FERTILIZER

BONIFACIO F. CAYABYAB¹, ROLANDO G. BAYOT¹
FREDELINO P. PEÑALBA¹, ALICIA G. AQUINO¹, and
FLORANTE F. CAYABYAB²

¹*Plant Quarantine Support Laboratory
National Crop Protection Center
U. P. Los Baños, College, 4031 Laguna*

²*#8 Romulo Boulevard, San Vicente
Tarlac City*

Butterfly manure from the larvae of *Danaus chrysippus* L., plain tiger, was collected from the Tarlac butterfly breeding site. The main host plant where these larvae feed is *Calotropis gigantea*. The larvae manure was air dried and analyzed at the Analytical Services and Soil/Plant Test Kit Project at the Department of Soil Science, U.P. Los Baños.

The nitrogen (N) content of butterfly manure at 1.19% approximates that of carabao (1.09% - 1.22% a.i.). Its potassium content at 2.14% is higher than that of cattle and almost equal to poultry. The other, chemical components of butterfly manure are discussed and compared with other sources of bio-organic fertilizers.

Key words: *Danaus chrysippus*, butterfly manure, bio-organic fertilizer, larvae, poultry, cattle, plain tiger, nitrogen, potassium

104. GRAFTED TOMATO FOR OFF-SEASON PRODUCTION

LUN G. MATEO TEOTIMO M. AGANON, JAMES R. BURLEIGH,
DENNIS R. CACHO, and ALEX S. CASPILLAN

*Central Luzon State University
Muñoz, 3120 Nueva Ecija*

An experiment was conducted to determine the efficacy of grafting Apollo and FM-TT-22 tomato plants onto eggplant rootstock using rain shelter and raised bed condition.

Growing tomatoes in the Philippines is usually done in lowland areas during the dry season. During the rainy season, (hot-wet months) particularly in Nueva Ecija, production of tomatoes is concentrated on very small hilly areas making the price almost unaffordable to consumers. This situation offers very high opportunity to off season production through grafting and planting tomatoes in the lowlands.

Grafting tomatoes onto eggplant rootstock may offer resistance to flooding during the rainy season. Upgrade tomatoes when flooded results in wilting and ultimately death of the plants.

One-month seedlings of Apollo and FM-TT-22 tomatoes were grafted to the same age of EG-203 eggplant rootstock. The rootstock and the scion were cut just above the first leaf to form a wedge and inserted into opposite ends of a rubber tube. Grafted seedlings were transferred to a chamber with approximately 80-90% relative humidity for one week and later on brought out from the chamber for hardening prior to transplanting.



Results of the experiment indicated that plant survival significantly increased in Apollo but not from FMTT-22. The percent survival from grafted Apollo was 74 percent higher than the non-grafted ones. In terms of the number of fruits, grafted Apollo had ten percent more fruits than the non-grafted plants.

Grafting likewise influenced significant weight of fruits per plant and computed yield per hectare. Grafted Apollo significantly produced higher fruit weight than the non-grafted plants. Furthermore, significantly higher yield was obtained from grafted Apollo plants, with mean yields of 15.48 tons per hectare from the grafted plants and 7.45 tons per hectare from the non-grafted. Grafting increased yield by 107 percent. For FMTT-22, yield for both grafted and non-grafted plants were the same.

Key words: grafted tomato, root stock, scion, rainshelter

105. BAMBOO SHOOTS AS SUBSTITUTE VEGETABLE DURING LA NIÑA

MERDELYN CAASI-LIT¹, ROY B. CANDELARIA¹, LINDA B. MABESA²,
and ROWENA P. URRIZA¹

¹Entomology Laboratory, Institute of Plant Breeding, College of Agriculture
U.P. Los Baños, College 4031 Laguna

²Institute of Food Science and Technology
U.P. Los Baños College, 4031 Laguna

Twenty-one (21) provinces were visited to survey several species of bamboo in natural stands and bamboo plantations. Bayog (*Dendrocalamus merrilianus*) is the predominant bamboo shoot species in Northern and Central Luzon, mostly kawawang tinik (*Bambusa blumeana*) and bolo or kawawang tsina (*Gigantochloa levis*) in Southern Luzon. Kiling (*Bambusa vulgaris* var. *vulgaris*) is predominant in the Bicol regions, giant bamboo (*Dendrocalamus asper*) in Central Mindanao and laak (*Bambusa philippinensis*) in Southern Mindanao.

The predominant bamboo species in an area is usually the one used as food and all bamboo shoots in the market are sold fresh. Each region has its own manner of processing bamboo shoots and Unique shoot delicacies. The presence or basence of bamboo shoots in an area's market place is a good indicator of the presence of absence of natural or cultivated bamboo strands.

Key words: bamboo shoots, La Niña phenomenon

106. FREEZE-DRYING CHARACTERISTICS OF MANGO (*Mangifera indica* L.) PUREE AT THREE LEVELS OF PRE-FREEZING TEMPERATURES

OFERO A. CAPARIÑO

Bureau of Postharvest Research and Extension (BPRE)
CLSU Compound, Muñoz, 3120 Nueva Ecija

The problem that besets the Philippine mango industry is the seasonality in production vis-a-vis unstable market situations characterized by a period of supply glut (February-June) resulting in low



prices, followed by a longer period of severe undersupply (July-January) with prices in the market rising to exorbitant levels. Although there are processed mangoes available in the market, development of new products such as freeze-dried mango powder, is still necessary in the food industry. Hence, it is important to establish technical information in the freeze drying of mango puree in order to produce high quality mango powder.

The study was conducted to establish the freezing and freeze-drying characteristics of mango puree at pre-freezing temperatures of -40°C and -65°C (using, an ultra-low temperature freezer) and -196°C (direct immersion in liquid nitrogen). Aseptically processed mango puree used in the study was pre-frozen at -40°C , -65°C , and -196°C . These samples were freeze-dried at 2 to 3 % moisture content (MC) wet basis at a vacuum pressure of 0.005 to 0.001 torr. Parameters studied included freezing behavior, freezing point, critical zone, rate of heat removal, freeze-drying duration, freeze drying rates, and percent powder recovery.

Results of the study showed that removal of sensible heat at -40°C , -65°C , and -196°C from the initial product temperature to below its freezing point required a time duration of 42, 35, and 2.87 minutes, respectively. Meanwhile, the time required to remove the latent heat from the sample product were 125, 9, and 6.58 minutes for the different temperatures applied. Using graphical analysis, the critical zone at -40°C , -65°C , and -196°C ranges from -0.05°C to -11.48°C .

The study that the freezing point for mango puree was -2.42°C . The heat removal rate below and above freezing at -40°C , -65°C , and -196°C were 60.7, 46.6, and 375 kJ/h, respectively. Direct immersion in liquid nitrogen (-196°C) during freezing yielded the shortest drying time of 16 has compared with freezing at -40°C and -65° which required 18 and 22.5 h of drying, respectively. This effect was attributed to an increase in surface area of sublimation caused by cracks that developed during freezing as a consequence of thermal shock. Freeze drying of mango puree at pre-freezing temperatures of -40°C , -65°C , and -196°C did not have any marked effect on powder yield. The technical information obtained in the freeze drying of mango puree added to the body of knowledge in the field of food processing. Such information can be applied in the commercial production of freeze-dried mango powder in a pilot scale to determine its economic viability.

Key word: freeze drying, mango puree, ultra-low temperature freezing, liquid nitrogen, aseptic processing, freezing point of mango puree, vacuum pressure, freeze-drying rate, freeze-dried mango powder, percent powder recovery

107. ANALYSES OF THE SHELF LIFE OF COMMERCIAL TEMPURA AND SAUCE IN CEBU CITY

RENISSA B. SARIO¹ and CORAZON P. MACACHOR²

*¹Cebu State College of Science and Technology
College of Agriculture
Lahug, Cebu City*

*²Cebu State College of Science and Technology
Colleg of Fisheries Technology
Carmen, 6005 Cebu*



This is a study on the shelf life of commercial tempura and sauce sold by street vendors in Cebu City based on its physicochemical, microbial, and sensory analyses observed under ambient and refrigerated conditions, packed and unpacked.

The newly processed tempura contained physicochemical parameters of 39.02 percent moisture; 8 percent fat; 11.05 percent protein; 3.31 percent ash; 38.62 percent carbohydrates; and water activity level (Aw) of 0.98. The bacterial count had reached 1.34×10^8 cfu/g higher than the standard count of 10^2 cfu/g by the Bureau of Food and Drugs (1990). Mold growth and *Staphylococcus aureus* were detected in the product. Based on sensory assessments, the shelf life of unpacked and packed tempura stored at ambient temperature lasted for only four days while samples stored at refrigerated temperatures were still acceptable after eight days of storage.

Tempura sauce had physicochemical parameters of 84.39 percent moisture; 0.2 percent fat; 0.81 percent protein; 2.6 percent ash; 12 percent carbohydrates; and 0.99 water activity (Aw) level. The mold growth was evident in the product and the bacterial count had reached to 4.20×10^3 cfu/g. Based on sensory assessments, the tempura sauce stored at ambient condition, unpacked and packed, lasted for only four days while those samples stored at refrigerated conditions were still acceptable by the panelists after eight days of storage.

There was a significant mean difference between the different treatments at a 0.05 level of significance using the analysis of variance (ANOVA) and least significant difference Test.

Key words: shelf life, tempura, tempura sauce, physicochemical analysis, microbial analysis, sensory analysis, refrigerated condition, ambient condition

108. CHANGES IN SOIL PROPERTIES ASSOCIATED WITH APPLICATION AND BURNING OF RICE HULLS IN PERI-URBAN VEGETABLE PRODUCTION AREAS IN CENTRAL LUZON

CLARITA P. AGANON¹ and ORLANDO RAMOS²

¹Research Office and ²Department of Soil Science

Central Luzon State University
Muñoz, 3120 Nueva Ecija

Peri-urban vegetable production is characterized as a highly intensive agriculture system. Large cities like Metropolitan Manila depends on such system for a year-round supply of vegetables. However, year-round vegetable production is beset with a wide range of constraints such as rains or floods, insects, diseases, weeds, and soil-related problems.

One of the major peri-urban areas in Central Luzon is found in San Leonardo, Nueva Ecija. In this site, the cost of weed control ranked next to the cost of insect control due to the prevalence of various weed species in succession. This condition prompted farmers to resort to the application and burning of rice hulls in their fields. Considering the negative effect of burning on the environment, a research study was conducted to identify the impacts of burning rice hulls both on soil and on pak-choi. Pak-choi, also known as pechay, is one of the most common peri-urban vegetables.

Rice hulls were applied at a thickness of one foot and one-half foot each in 16 one by four meter-plots. Four plots of the same dimensions were not applied with rice hulls for comparison. These thickness



were equivalent to a weight of 74 and 147 tons/ha of rice hulls, respectively. The rice hulls were burned until a carbonized rice hull (CRH) was left. After five days, when the CRH had cooled, it was incorporated into the soil through the use of a hand tractor.

Pak-choi seedlings were transplanted into the 20 plots. Plots without CRH were fertilized with 90-30-30 kg NPK/ha while four plots each from the 74 and 147 t/ha rice hulls, applied plots was fertilized with 90-30-30 kg NPK/ha and 45-30-30 kg NPK/ha. The field layout for the experiment was randomized complete block design.

Two consecutive cropping of pak-choi were done. During the second cropping, there was no application of rice hulls to evaluate any residual effect that could be detected in terms of weed control and yield. Soil samples were taken before planting and after harvest of the first and second crops for physical and chemical analysis of soil properties that were affected by CRH incorporation. Marketable yield of pak-choi and weed density was measured during the study.

A marked increase in soil organic, exchangeable potassium, and soil porosity was observed due to rice hull burning. The increase in porosity was attributed to the significant reduction in soil bulk density.

Burning of rice hull exerted a very positive effect on weed control during the first crop ranging from 180 percent in one-half foot thickness of application to 600 percent in one foot thickness of application. In the second crop weed control ranged from 100 to 1000 percent. Furthermore, a reduction in the amount of fertilizer to achieve the same yield was observed due to incorporation of CRH. This is applicable during the first and second cropping.

109. POTENTIAL OF LEP-118 (*Bacillus* sp.) AS BIOLOGICAL CONTROL AGENT AGAINST SOIL-BORNE PATHOGENS IN RICE-VEGETABLE SYSTEMS

RONALDO T. ALBERTO¹, MARIA SALOME V. DUCA¹,
and SALLY A. MILLER²

¹*Philippine Rice Research Institute
Maligaya, 3119 Muñoz, Nueva Ecija*

²*Department of Plant Pathology, OARDC
Ohio State University, Wooster, OH, USA*

The potential of LEP-118 (*Bacillus* sp.) as biocontrol agent and its system of delivery to the soil was tested against seven fungal soil-borne pathogens infecting Yellow Granex and Tanduyong varieties of onions in Nueva Ecija.

Laboratory tests showed high levels of antibiosis of LEP-118 against *Phoma terrestris*, three species of *Fusarium*, *Sclerotium rolfsii*, and *Rhizoctonia solani*. In a greenhouse study, the incidence of bulb rotting was significantly lower on both varieties with roots previously dipped in LEP-118 suspension than with plants grown in soil drenched with the suspension.

Key words: biological control, soil-borne, bulb rot, antibiosis, root dipping, soil drenching



110. REGIONAL ASSESSMENT AND COLLECTION OF AVAILABLE DYE-YIELDING PLANTS IN THE PHILIPPINES

ARSENIO B. ELLA, MARIO D.R. RAMOS, and EUSTAQUIO G. ARAGONES, JR.

*Forest Products Research and Development Institute
College, 4031 Laguna*

A total of 65 dye-yielding plant species in seven geographical regions of the Philippines were identified, collected, and documented. This discussion focuses on the collection, plant parts extracted, methods of dye extraction, dye-yield color, and uses and/or applications based on structured and unstructured interviews among local people.

The information gathered will serve as reference among people engaged in dye extraction and proprietors of small-scale industries, handicrafts, handloom weaving industries, fan and mat weaving, abaca weavers, fashion accessories, and costume jewelry available in the country. The information is suitable for local radio and TV interviews, and is an interesting subject matter among high school students especially those conducting investigatory work.

Key words: dye-yielding, extractive, natural forest, indigenous, resource survey, assessment

111. *Limnocharis flava* L. BUCH., and *Salvinia molesta* MITCHELL: POTENTIAL THREATS TO AQUATIC ECOSYSTEMS IN LUZON

EMMA M. ALFORJA, EMMA A. PEREZ, and JUANITO V. BARICAN

*National Crop Protection Center, College of Agriculture
U.P. Los Baños, College, 4031 Laguna*

Limnocharis flava L. Buch., locally known as "sandok-sandokan", belongs to family Butomaceae. Introduced from Tropical America, it was first collected in Java in 1870 and is now a native of Tropical Asia. *Salvinia molesta* Mitchell is a floating aquatic fern of South American origin. It has become a serious pest in parts of Asia, Africa, and Australia. Its presence in Iloilo was earlier reported and has spread to Luzon. Local folks call it "giant Azolla". Both weeds have infested lowland rice paddies, while the latter has started invading swampy areas, irrigation canals, and waterways in Lucban, Quezon, threatening nearby towns.

Limnocharis flava has a long triangular petiole crowding at the base of the stout rootstock. Leaves are large, the blade somewhat rounded with a peltate base. Flowers are in umbels with stout peduncles 3 sepals 3 yellow petals. Fruits are round capsules with 14-34 carpels, maturing in 21-24 days after flower opening. Each carpel has 22-123 small, brown to black seeds.

Salvinia molesta as fragile horizontal floating stems with difficult-to-wet hairy leaves. It produces numerous sporocarps, which contain the megasporangia and microsporangia. Growth is rapid and a means of dispersal is through fragmentation of the stem occurring rather easily.

The capacity of *Limnocharis* to produce tremendous numbers of small seeds and to reproduce vegetatively through offshoot production at the tip of the flower stalk make this plant potentially damaging.

Key words: *Limnocharis*, *Salvinia*, *Salvinia molesta*, *Limnocharis flava*



112. MANGROVE COMMUNITY STRUCTURE IN CARMEN, CEBU

CORAZON P. MACACHOR and SEVERINO R. ROMANO

*Cebu State College of Science and Technology
College of Fisheries Technology
Carmen, 6005 Cebu*

Coastal ecosystems are particularly important to the people as they provide both subsistence and cash-crop fisheries and other benefits, such as wood from mangrove forests. These ecosystems also contain a high biodiversity of animals and plants which can be a source of novel biochemical products and form a basis for valuable eco-tourism industry activities and discovery of new biochemical products. In Carmen, Cebu, mangrove communities are being utilized by the local coastal community into aquaculture farms or reclaimed for human settlements. Like any other coastal areas in the Philippines, these resources are being exploited without logical understanding of their ecology. This may eventually lead to depletion. Thus, the need for the residents of the community who are direct users of the resources to understand and rationalize their use. One objective of the CSCST-CFT, Carmen, Cebu Campus program is to assess the remaining valuable marine resources by conducting a study on the community structure and distribution of mangroves of the coastal areas of Carmen, Cebu. The result of the study will provide the community baseline information about the status of mangrove resources and guide them on how to utilize and maintain the remaining resources wisely.

Carmen, Cebu is located 41 km northeast of Cebu City. Five stations were established for the study namely: Dawis, Luyang, Puente, Cogon, and Poblacion. The mangrove vegetation structures of the five stations were analyzed from June to September 1999 by taking the following measurements: number of individuals per unit area, basal areas, and tree height. The number of individuals per species were counted from a 10 x 10 sq. meter-area; 20 to 50% of the trees of each species were measured for their circumference above the primary root using a calibrated tape. Tree height which is the vertical distance between the ground up to the tip of the crown was measured using a calibrated pole. Field testing and identification of other mangrove species outside of the quadrant were also done.

After four months of sampling, the most common mangrove species like *Sonnerati alba* (pagatpat), *Rhizophora stylosa* (bakauan-bankau), and *Avicennia marina* (bungalon) were found in the five stations of Carmen, Cebu. However, the diversity of mangrove species like *Sonneratia alba*, *S. caseolaris*, *Avicennia alba*, *A. lanata*, *marina*, *A. officianalis*, *Rhizophora stylosa*, and *Ceriops tagal* were found mostly in secondary growth in Luyang, Carmen, Cebu. The numerical dominance of *Rhizophora* species is due to its success in colonizing new areas. One of the reasons for this is attributed to the reproduction strategy of *Rhizophora* species. *Rhizophora* is oviparous, meaning, the propagules germinate and mature in the mother plant before they are released and dispersed. That is one of the reasons why *Rhizophora* species are widely used for mangrove reforestation. Propagules, when laid down in the mud, grow and take root quickly.



113. AN EVALUATION OF PRACTICAL DIETS FOR JUVENILE SEABASS

MYRNA A. SANTILICES

College of Agriculture and Fisheries, Catanduanes State Colleges
Virac, 4800 Catanduanes

Growth performance of juvenile seabass (initial mean bodyweight, 6.63 ± 0.24 g) fed with varying protein levels was determined using practical pelleted diets in a completely randomized experiment. Four diets with varying crude protein levels (35%, 40%, 45%, and 50%) were tested. The fish were reared for 26 days in 60 liters flow, through tanks with aeration in seawater at salinity of 31.57 ppt and at a temperature of 27.75°C .

Higher weight gain was observed in fish fed a diet containing 40% crude protein. Lowest specific growth rate was in fish fed with 45% crude protein. Survival was 100% in all treatments. The feed conversion ratio for fish fed with 40% protein was the best. Specific growth rate and weight gain did not differ in all treatments despite an increase in crude protein levels. Protein energy ration of feed containing 35% and 50% protein was significantly different from the other three diets. Fifty percent (50%) crude protein seems to be excessive for seabass. Based on this study, we recommend a protein level of 40% in practical diets.

Key words: seabass, *Lates calcarifer*

114. THE INFLUENCE OF BODY WEIGHT AND DIET ON THE AMMONIA EXCRETION OF THE AFRICAN CATFISH, *Clarias gariepinus*

RONELIE CHATO-SALVADOR¹ and LIBERATO V. LAURETA²

¹Fisheries Department, College of Agriculture
University of Eastern Philippines, Catarman
6400 Northern Samar

²Institute of Aquaculture, College of Fisheries
U. P. Visayas, Miag-ao
5023 Iloilo Province

Three size groups of African catfish, *Clarias gariepinus*, which mean weights were 124.5 g (adult size group), 5.4 g (juvenile size group), and 1.1 g (fingerling size) were given two types of diets (trash fish and floating pellets) to determine the influence of body weight and diet on ammonia excretion. Highest weight-specific excretion rate ($5.23 \text{ mg NH}_3\text{-N kg}^{-1} \text{ h}^{-1}$) was obtained from juveniles and fingerlings fed with trash fish and lowest ($0.24 \text{ mg NH}_3\text{-N kg}^{-1} \text{ h}^{-1}$) among adults fed with commercial pellets. Regardless of diet given, post-prandial excretion rates at 28°C were generally higher among fingerlings and lowest in adults. Within same size groups, excretion rate was 50-84% higher among test animals fed with trash fish. Significant differences in ammonia excretion in relation to diet stresses the dissimilarities



of the protein and amino acid requirements of the test groups. The hourly ammonia excretion rate obtained in this study can be used to determine the build-up of ammonia in ponds which could be exported to rivers and inland waters.

Key words: body weight, diet, ammonia excretion, *Clarias gariepinus*, trash fish, commercial pellets, weight specific excretion rates, pollution, water quality, post-prandial excretion rates

115. SEED QUALITY RESPONSE TO FUNGICIDE TREATMENT OF A LINE AND F₁ HYBRID SEEDS

SUSAN R. BRENA, FRISCO M. MALABANAN, and BONNIE M. VALIENTE

*Philippine Rice Research Institute
Maligaya, Muñoz, 3119 Nueva Ecija*

IR 58025 A (A line) and F₁ hybrid seeds harvested during the wet season 1999 at the PhilRice-Central Experiment Station were dipped in various concentrations of benomyl to control fungal growth during a germination test. Hybrid seeds were germinated in petri dishes lined with moistened filter paper then stored in a germination room with Temperature range of 28-32°C.

Washing and ten-minute dipping in 5 and 3% benomyl solution resulted in high germination percentage in A line and PSB Rc 27H (F₁) mestizo hybrid, respectively. Germination of hybrid seeds at these fungicide concentrations was characterized by minimal fungal infection.

Fungal growth in A line and PSB Rc 72H (F₁) hybrid seeds washed with tap water was not controlled. A line seeds washed then dipped into 3% benomyl solution exhibited minimal occurrence of fungal growth. Prolonged dipping seeds for 10 minutes in 3% solution significantly controlled fungal growth. On the other hand, five-minute dipping in 3% solution proved very effective in controlling fungal growth in PSB RC 72H (F₁) seed.

Keywords: hybrid, mestizo, A line, benomyl, germination, fungal growth, concentration, IR 58025A, PSB Rc 72H, F₁

116. PEDOLOGICAL CHARACTERIZATION AND AGRONOMIC POTENTIALS OF SOILS ASSOCIATED WITH KENNON LIMESTONE

CARLITO P. LAUREAN¹ and RODRIGO B. BADAYOS²

*¹Department of Soil Science, College of Agriculture
Benguet State University
La Trinidad, 2601 Benguet*

*²Department of Soil Science, College of Agriculture
U. P. Los Banos
College, 4031 Laguna*



The importance of understanding the characteristics of soils associated with limestone lies in their extensiveness. Limestone ranks third in extensiveness among the parent materials while soils associated with it comprise more than two million hectares (Fernandez and Clar de Jesus, 1980). Extensive research has not been conducted on soil-landscape relationships involving limestone in Benguet and in other parts of the country. Thus a study of Kennon limestone is necessary to set the limits of its properties in relation to soil formation and possibly serves as a tool in predicting properties of soils associated with other limestone formations that exhibit the same characteristics. Several reconnaissance trips were taken across areas where Kennon limestone formation was mapped. After the survey, sites for detailed soil description and sampling were selected. Thus, four landsurface units (interfluvial, fall face, transportation mid-slope and colluvial footslope) were described and sampled in La Trinidad, Benguet and Green Valley, Baguio City. At each land surface unit, a pit of approximately 1 square meter was excavated up to more or less 2 meters depth for description and sampling. Soil samples taken were prepared for laboratory analysis. Soil taxonomy is an effective tool in land use planning. It minimizes expensive conduct of site-specific trials for technology transfer since information on soil properties can be acquired from similar soils located in another area.

The morphological, physical, chemical and mineralogical properties of soils in four land surface units along the Kennon limestone formation indicated strong correspondence between landscape positions and soil properties. The land surface units studied in La Trinidad, Benguet are the interfluvial, fall face, transportation mid-slope and colluvial footslope. The same land surface units were replicated in Mt. Sto. Tomas, Green Valley, Baguio City. The soils were classified using the framework of Soil Taxonomy.

The stable nature of the interfluvial in both locations allowed the formations of deep and well-developed profiles. Classified as Typic Haplohumults, the soils show distinct development of umbric epipedons and thick argillic horizons. The soils formed in the fall face of La Trinidad and Green Valley have two different genetic pathways. In La Trinidad, the soil shows distinct umbric epipedon with cambic subsurface diagnostic horizon; hence it is classified as Typic Dystropepts. In Green Valley the presence of limestone outcrops, which somehow stabilizes the landscape unit, favors the development of mollic epipedon and argillic subsurface layer. The soils are therefore grouped as Typic Argiudolls.

The soil properties of the transportation mid-slope in La Trinidad are almost identical with those of Green Valley. In both sites, the soil profiles are deep and well developed. Both soils, identified as Typic Hapludalfs, have umbric epipedons and subsurface argillic horizons.

The soil in the colluvial footslope of La Trinidad is more developed than the soil in Green Valley. The soil in the former has a deep and well-developed profile. The surface soil is mollic epipedon and the subsurface horizon is argillic. The soil is Typic Argiudolls. The soil in the latter, on the other hand, has ochric epipedon and cambic horizon in the surface and subsurface layers, respectively. Thus, the soil is classified as Fluventic Dystropepts.

All soils observed in the different land surface units of La Trinidad and Green Valley, except those that are located in the fall face, are suitable for agricultural uses. The utilization of soils in the fall face is constrained by its steep location. Thus, the soils can be best utilized for forest trees and/or fruit-bearing trees.

Keywords: Kennon limestone, landsurface units, diagnostic horizons, epipedon, soil classification, soil taxonomy, agro-technology transfer, Haplohumults, Dystropepts, Argiudolls



117. GENETIC DIVERSITY ANALYSIS OF PHILIPPINE MAIZE INBRED LINES USING MICROSATELLITE MARKERS

NANCY B. CORONADO¹, ALEXANDER DAVID L. JOSUE¹,
PETER S. GUZMAN², and DESIREE M. HAUTEA¹

¹*Institute of Plant Breeding, College of Agriculture
U. P. Los Baños
College, 4031 Laguna*

²*Department of Agronomy, College of Agriculture
U. P. Los Baños
College, 4031 Laguna*

The success of a maize hybrid breeding program relies on the systematic evaluation and selection of inbred lines as parents based on their heterotic patterns. Heterotic patterns (HP) can be established using diallele analysis but the process is tedious, time-consuming, and costly, particularly if many lines or populations are involved. Fingerprinting and diversity analysis of inbred lines using molecular markers could reduce the number of lines required for testing and time needed to establish heterotic patterns. Inbred lines developed at IPB-CA-UPLB were analyzed using SSR or microsatellite markers. Sixty maize SSR primers were used to analyze the diversity of the 33 yellow and 47 white inbred lines. NTSYS analysis based on Nei's dissimilarity coefficient revealed clustering of very closely related inbred lines. The results of the study could provide maize breeders relevant information as a guide in selecting potential inbred lines as parents in a hybrid-breeding program.

Key words: maize, inbred line, hybrid, SSR, microsatellite, fingerprinting, heterotic

118. ASSESSMENT OF THE DIVERSITY OF MYCORRHIZAL FUNGI IN FOREST TREES OF PANTABANGAN, NUEVA ECIIJA

ANNIE MELINDA PAZ-ALBERTO¹, NELLY S. AGGANGAN², and
MARILOU H. BARRENO¹

¹*Central Luzon State University
Muñoz, 3120 Nueva Ecija*

²*National Institute of Biology and Molecular Biotechnology
U. P. Los Baños
College, 4031 Laguna*

A study of the diversity of mycorrhizal fungi in the forest trees of Pantabangan, Nueva Ecija was conducted to identify, classify, and assess the diversity of mycorrhizal fungi associated with the forest trees. Based on the results of the study, 21 species of vesicular-arbuscular mycorrhizal (VAM) fungal spores were identified and classified under three major genera. These are *Glomus*, *Acaulospora*, and *Gigaspora*. *Glomus geosporum* registered the highest frequency, density, and dominance. On the other hand, *Glomus* sp. 9, *Glomus* sp. 8, and *Acaulospora* sp. 1 recorded the lowest frequency, density, and dominance.



The diversity of mycorrhizal fungi is a biological indicator of environmental quality. However, results indicated that the computed species diversity of mycorrhizal fungi associated with the forest trees in Pantabangan is 0.3233 which was too small and considered not diverse. This could be attributed to the disturbed condition of the forest ecosystem of Pantabangan due to several human and animal activities that destroyed the ecosystem.

Results also revealed that out of fifty (50) tree species only twelve (12) trees were infected with VAM associated with their roots. *Casuarina equisetifolia* Forst. (agoho) got the highest VAM infection of 52.96% while *Semecarpus cuneiformis* Blanco (kamiring) registered the lowest VAM infection of 21.43%.

Key words: mycorrhizal fungi, vesicular-arbuscular mycorrhiza, endomycorrhiza, ectomycorrhiza, species diversity, forest ecosystem, frequency, density, dominance, VAM infection

119. SURVEY OF LICHENS IN THE FOREST ECOSYSTEM OF CARRANGLAN, NUEVA ECIJA

ANNIE MELINDA PAZ-ALBERTO AND PORTIA V. RECOMETA

*Central Luzon State University
Muñoz, 3120 Nueva Ecija*

A survey in the forest ecosystem of Carranglan, Nueva Ecija was conducted to identify the different species of lichens. Percent occurrence and percent cover were also determined.

Based on the results of the study, 19 species of lichens were identified and classified under four orders, five families, and nine genera. Results indicated that *Phaeographina cumingii* (Vain.) Redgr. occurred in the highest total number of trees (787) and highest percent cover of 5%. *Graphina* sp. had the least number of trees and least percent cover of 1%.

Nineteen species of lichens were found in alibangbang and acacia trees which showed the highest percentage occurrence of 100% while the least number of lichen species occurred in camias and pakak with 31.56%.

Results also revealed that 168 alibangbang trees were inhabited by lichens but there were no signs of growth in papaya and guava trees.

Lichens in the forest ecosystem play an important role as an indicator of air pollution. This means that the more lichens present in a certain ecosystem the less polluted that ecosystems. The result of the study showed that the forest ecosystem of Carranglan, Nueva Ecija is not polluted since different species of lichens are present and abundant.

Key words: Lichens, survey, percent occurrence, percent cover, air pollution, forest, ecosystem



120. MINERAL CONCENTRATION IN THE BLOOD OF GRAZING GOATS AND SOME FORAGES IN LAHAR-LADEN AREAS OF TARLAC, CENTRAL LUZON

EDGAR A. ORDEN¹, ALEXANDER B. SERRA¹, CLARITA P. AGANON¹,
EMILIO M. CRUZ¹, MA. EXCELSIS M. ORDEN¹, LIBERTADO C. CRUZ²,
and TSUTOMU FUJIHARA²

¹Central Luzon State University, Muñoz, 3120 Nueva Ecija

²Laboratory of Animal Science, Shimane University
Matsue 690-8504-Shimane, Japan

In 1998, about 5% of the country's goat population was raised in Tarlac, one of the provinces hard hit by the eruption of Mt. Pinatubo in 1991. Goats subsist mainly on forage species that grow predominantly or sporadically in lahar-laden areas characterized as sandy, dry, acidic with sulfur content 10 times more than the normal organic or mineral soils, and infertile because of organic carbon and nitrogen. In the absence of concentrate feeding, there is a high possibility that the mineral levels, particularly copper, selenium, and zinc, of the animals are below critical levels, as a result of insufficient minerals from the feedstuffs.

The study was conducted to determine the mineral status of 60 native goats and eight forage species, namely: *Cynodon plectostachyus*, *Pennisetum purpureum*, *Eleusine indica*, *Cynodon dactylon*, *Calopogonium muconoides*, *Centrosema pubescens*, *Leucaena leucocephala*, and *Mimosa pudica* in lahar-affected areas of Concepcion, Tarlac. Forage and blood samples were collected six times from December 1996 to September 1997, and analyzed for calcium, phosphorus, magnesium, sulfur, copper, iron, molybdenum, and zinc using an inductively coupled plasma emission spectrometer, and selenium using fluorometric detection of the 2,3-diaminonaphthalene.

Forage calcium and sulfur were non-limiting. Most forage species had low phosphorus, copper, and selenium, while some species had magnesium and zinc levels lower than the critical limit because of low mineral content and high percolation rate of lahar deposits. Iron and molybdenum were in excess.

The effect of the seasonal variation as well as the direct effect of the feedstuffs from the lahar-laden areas on the mineral status of the grazing goats was observed. More than 20% of the animals had low levels of calcium, copper, zinc, and selenium especially during the dry season possibly due to insufficient amount of these elements and excessive molybdenum and iron in most forages. While the percentage of the animals with low levels of Cu, Zn, and Se decreased during wet season, the percentage of the animals with low levels of Ca increased. The better growth of forage and higher concentration of Cu, Zn, and Se during the wet season could have contributed to this effect. Conversely, calcium in forage was high, but 47% of the animals had low plasma calcium concentration during the wet season possibly due to low availability of Ca in the forage.

Although no clinical signs of mineral deficiencies were observed, supplemental feeding would be important since the condition of the pasture in lahar-laden areas was not expected to improve in the next years. Intensified use of *L. leucocephala* with better mineral profile would be ideal in order to improve the mineral status of the grazing goats.

Key words: lahar-laden, minerals, goats, forage



121. SELENIUM SUPPLEMENTATION IN GRAZING GOATS: EFFECTS ON BLOOD AND MILK SELENIUM AND GROWTH PERFORMANCE OF KIDS BORN TO DOES RECEIVING SELENIUM-SOLUBLE GLASS-BOLUS

EDGAR A. ORDEN¹, EMLIO M. CRUZ¹,
MA. EXCELSIS M. ORDEN¹, and TSUTOMU FUJIHARA²

¹*Central Luzon State University, Muñoz, 3120 Nueva Ecija*

²*Laboratory of Animal Science, Shimane University
Matsue 690-8504-Shimane, Japan*

Philippine goats are traditionally raised under backyard level with negligible concentrate supplementation and feeding is primarily based on available fibrous crop residues or vegetation available in communal pastures. The mineral content of feed resources is generally low; thus, a high possibility that grazing animals suffer from known mineral deficiencies particularly in selenium.

The effectiveness of soluble glass boluses (SGB) to increase Se level has been known in sheep, but only limited literature is available on goats.

This study was conducted to determine the effects of SGB containing selenium on blood and milk Se levels, and growth performance of kids born to does receiving intraruminal SGB. A total of 50 grazing upgraded Philippine goats with mean body weight of 20 kg were evenly divided into two treatment groups; without SGB (Control) and with SGB (Treated). The animals grazed in a Se-deficient pasture in the experimental farm of the Central Luzon State University, without any concentrate supplementation, during the 12-month study. Two boluses in six months intervals were administered. Samples of goats' and kids' blood were collected monthly and analyzed for Se content using fluorometric detection of the 2-3 diamidonaphthalene following the procedure of Watkinson.

After three months of SGB administration, the treated group had higher blood and milk Se contents than the control. Blood Se levels among kids born to SGB-treated does reflected maternal treatments, i.e., a two-fold increase in Se level over the untreated group. Significant correlation was noted between blood and milk Se levels in does, and blood Se in kids. No positive response was observed in the birth weight and growth performance of kids suckling milk with relatively higher Se concentration. Results suggest that although SGB administration significantly increased blood as well as milk Se levels of does grazing in Se-deficient pastures, this did not improve birth weight and growth performance of their offspring.

Key words: selenium, Philippines, goats, SGB, blood, milk, growth performance



122. CYCLOSPORIN ANALYSIS IN BLOOD BY AUTOMATED REVERSED-PHASE HIGH PERFORMANCE LIQUID CHROMATOGRAPHIC METHOD COUPLED WITH SOLID PHASE EXTRACTION AND SPEED VACUUM EVAPORATION

MA. CRISTINA B. PORTILLA¹, MELCHOR V. CANTORIAS¹,
and CHERRIE B. PASCUAL^{1,2}

¹Research and Biotechnology Division, St. Luke's Medical Center
279 Cathedral Heights, E. Rodriguez Sr. Blvd, 102 Quezon City

²Institute of Chemistry, College of Science
U.P. Diliman, 1101 Quezon City

Cyclosporin A (CyA) is a cyclic undecapeptide drug used in combating tissue rejection after organ transplantation. High cyclosporin doses may lead to nephrotoxicity while a dose below the therapeutic level increases the probability of transplant rejection. A rapid HPLC analysis was developed for the estimation of cyclosporin in blood using a PC 1000 software and autosampler for routine analysis. The mobile phase consisted of acetonitrile: methanol: water (50:30:20) while the analytical column was a C₁₈ column maintained at 75°C with UV detection set at 214 nm. Whole blood samples, spiked with the internal standard cyclosporin D (CyD), was added with a protein precipitating agent, centrifuged, and applied to a disposable solid phase C₁₈ column to rapidly extract the CyA and CyD. The extracting solvent was removed by using a speed vacuum apparatus. Average retention times were 8.1 min for CyA and 10.0 min for CyD. Linear calibration curves were obtained from 0- 500 ng/mL with average correlation coefficient of 0.995. Calibration standards with increasing concentrations of CyA and fixed concentration of CyD were spiked in blood from healthy volunteers and subjected to the same preparation as CyA-containing blood samples. CyA concentrations in blood samples were determined using internal standard addition method (by area ratio of CyA to CyD) and the obtained calibration curve. This analytical technique is useful in monitoring cyclosporin level in transplant patients.

Key words: cyclosporin, high performance liquid chromatography, reversed-phase, solid phase extraction, speed vacuum, immunosuppressive drug, whole blood, chromatography, internal standard addition method



123. GROWTH PATTERNS AND INFECTIVITY OF A DENGUE-2 VIRUS STRAIN PROPAGATED IN THE HUMAN MYELOMONOCYTIC CELL LINE K562

CORAZON C. BUERANO^{1,2}, KOUICHI MORITA³, FUTOSHI HASEBE³, SHINGO INOUE², RONALD R. MATIAS^{1,2}, FILIPINAS F. NATIVIDAD^{1,2}, and AKIRA IGARASHI³

¹*Institute of Biology, College of Science
U.P. Diliman, 1101 Quezon City*

²*Research and Biotechnology Division, St. Luke's Medical Center
279 E. Rodriguez Sr. Blvd., 1102 Quezon City*

³*Department of Virology, Institute for Tropical Medicine
Nagasaki University, 1-12-4 Sakamoto-machi
Nagasaki, Japan*

Dengue virus is the causative agent of the disease dengue, which is manifested in different degrees of severity. There are 4 serotypes of the virus namely, Dengue 1, 2, 3 and 4. The genomic nucleotide sequences of representative strains of all 4 serotypes have been determined. Recently, Mangada and Igarashi (1998) reported the sequencing of the entire genome of three Dengue 2 virus strains from Thailand. These are ThNH-p11/93, ThNH-28/93 and ThNH-7/9, which were isolated from Thai patients exhibiting dengue fever, dengue haemorrhagic fever, and dengue shock syndrome, respectively. Differences in the secondary structure in the 3 non-coding region, as well as significant amino acid replacements, which could potentially alter the nature of the viral proteins, have been noted. In the present study, the growth patterns and infectivities of these three virus strains were compared. The viruses were initially propagated in the mosquito cell line, C6/36 *Aedes albopictus*, maintained in Eagle's minimal essential medium containing 2% fetal calf serum (FCS) and incubated at 28°C. After 1 week, the infected culture fluids (ICF) were collected and pre-incubated with or without enhancing antibodies. These 2 types of ICF's were then inoculated at the same multiplicity of infection into K562 human myelomonocytic cells. After two hours of viral adsorption, cells were cultured in 24-well plates at a concentration of 2×10^5 cells/ml per well in 2% FCS-supplemented RPMI at 37°C in a CO₂ incubator. Cells were harvested everyday for 7 days. Virus growth was quantified by focus formation unit assay in BHK. Percent of infected K562 cells was detected through, immunofluorescence test and correlated with severity of disease.

Key words: dengue virus, dengue fever, dengue haemorrhagic fever, dengue shock syndrome, *Aedes albopictus*, enhancing antibodies, myelomonocytic cell, K562 cells, immunofluorescence assay test, dengue-2 viruses



124. THE ANALGESIC ACTIVITY OF THE ALKALOIDS OF (*Ipomea Muricata*) Jacq. FAM. CONVULVULACEAE: A CORRELATION OF IN VIVO AND IN VITRO STUDIES

CHRISTINE DE VERA, CHARLES FELIX SIMBILLO, MARRISA F. VALENCIA,
and MAFEL C. YSRAEL

*Faculty of Pharmacy, University of Santo Tomas
España St., 1008 Manila*

The analgesic activity of the indolizidine alkaloids from the seeds of *Ipomoea muricata*, namely ipomine, ipalbidine, ipalbine, and ipalbinium were studied on mice using the hot-plate method. At a dose of 1 mg/kg BW, all alkaloids except ipalbine, elicited higher threshold to pain in mice than the 5 mg/kg-BW dose of indomethacin. The dose-activity relationship indicate that for all the alkaloids, 5 mg/kg-BW was observed as the dose that produced a time-course curve ideal of all analgesic agents. Based on the degree and nature of analgesic action, the alkaloids are arranged as follows: ipalbinium > ipalbidine > ipomine > ipalbine.

The alkaloids were assayed for their ability to inhibit prostaglandin synthesis in isolated rat leukocytes. Only ipalbadine showed significance inhibition of prostaglandin release at a concentration of 100 μ M. The results implicate the phenylindolizidine ring for the observed analgesic activity *m vivo*.

Key words: *Ipomoea muricata*, alkaloids, analgesic, ipomine, ipalbidine, ipalbinium, ipalbine

125. CERVICAL ADENOCARCINOMA IN FILIPINOS

ARSENIA A CASAUAY, EDNA A. AMPARADO, SONIA D. JACINTO,
ANNABELLE A. HERRERA, and RYAN C. FONTANILLA

*Institute of Biology, College of Science
U.P. Diliman, 1101 Quezon City*

Paraffin blocks of cervical adenocarcinoma tissues taken from 23 patients were processed by light microscopy and morphometry. Three different grades of cervical adenocarcinoma, namely well-differentiated, moderately-differentiated and poorly-differentiated were examined. Hyperplasia of glandular lining, cell and nuclear pleomorphism, stromal invasions, and lymphatic involvement were observed. Morphometry of transformed cells revealed that smaller cells predominate in the poorly differentiated stage. No notable differences in nuclear sizes were observed among the three histological grades. Measurements showed a direct relationship between nuclear-cytoplasmic ratios and degree of anaplasia, that is, the nuclear-cytoplasmic ratio increases as the cell becomes more anaplastic.

Key words: cervix, adenocarcinoma, histology, morphometry



126. CYTOGENETIC ABNORMALITIES IN FILIPINO COLON AND COLORECTAL CARCINOMA PATIENTS

MA. LUISA D. ENRIQUEZ^{1,2}, IRVING TAN³, RICARDO W. LO⁴
PIA DONNA N. LORENA¹, FILIPINAS F. NATIVIDAD^{1,5},
and THE SLMC COLON CANCER GROUP

¹Research and Biotechnology Division, St. Luke's Medical Center, 1102 Quezon City

²Departments of Physics/Biology, College of Science,
De La Salle University, 2401 Taft Avenue, 1004 Manila

³Department of Surgery, St. Luke's Medical Center, 1102 Quezon City

⁴Institute of Pathology, St. Luke's Medical Center, 1102 Quezon City

⁵Institute of Biology, U.P. Diliman, 1102 Quezon City

Cancer of the colon and rectum is a common and often fatal disease. It is one of the three leading causes of cancer mortality worldwide. There is a dearth of cytogenetic data on solid tumors such as colon and rectal cancer, primarily because of the inherent technical problems associated with these studies. Identification of tumor-specific chromosomal abnormalities, important in determining clinical remission or relapse, was conducted. Tumor tissues, all described as adenocarcinomas by histopathological examination, were surgically removed from one colorectal and 8 colon patients (7 males and 2 females). Primary cultures were prepared and chromosomes were stained using the Trypsin G-banding method. Structural aberrations included 3p and 5p deletions. Numerical aberrations such as hypodiploids, polyploids, absence of the Y chromosome, and presence of marker chromosomes were also observed. Cytogenetic findings were correlated with histopathological and flow cytometry data as well as cancer stage using the TNM and Duke's systems. Genetic abnormalities were confirmed by fluorescence in situ hybridization (FISH) and comparative genomic hybridization (CGH).

Key words: adenocarcinoma, cancer stage, colon cancer, colorectal cancer, cytogenetics, flow cytometry, histopathology, hypodiploid, malignancy, polyploid, trypsin G-banding

127. THE INDOLE ALKALOIDS FROM THE LEAVES OF *Alstonia scholaris* (L.) G. Don (APOCYNACEAE) - COMPARATIVE ANTIMYCOBACTERIAL ACTIVITY AND ANTICARCINOGENICITY AGAINST HUMAN ORAL EPIDERMOID CARCINOMA CELL-LINES

ALLAN PATRICK G. MACABEO¹, SCOTT G. FRANZBLAU²,
GEOFFREY A. CORDELL³, and MA. ALICIA M. AGUINALDO^{1,3}

¹Department of Chemistry, College of Science and ⁴Research Center for the
Natural Sciences, University of Santo Tomas
España Street, 1108 Manila



²National Hansen's Disease Center, Laboratory Research Branch
Louisiana State University, Baton Rouge, Louisiana, U.S.A.

³Department of Medicinal Chemistry and Pharmacognosy,
College of Pharmacy, University of Illinois at Chicago
833 South Wood Street, Illinois 60612-7231 U.S.A.

The indole alkaloids comprise the second largest single group of plant bases reputed for their pharmacological and therapeutic properties. In this study, the indole alkaloids from the air-dried leaves of *Alstonia scholaris* (L.) R. Brown and *Catharanthus roseus* (L.) G. Don (both from family Apocynaceae), were studied for their potential antitubercular activity and comparative anticarcinogenicity against human-oral epidermoid carcinoma cell lines (KB cells). Radiorespirometric assay of the crude alcohol leaf extracts and the crude alkaloids revealed a pronounced inhibition of *Mycobacterium tuberculosis* H₃₇Rv and *Mycobacterium avium*. However, only the *A. scholaris* crude alcohol extract the, and the crude alkaloids were active against both mycobacterial species. Sulforhodamine-B colorimetric assay of the crude *C. roseus* alcohol extracts and alkaloids showed broad spectrum cytotoxicity against the KB cancer cells at LC₅₀ (0.3 and 0.2 mcg/mL). Crude *A. scholaris* alcohol extracts exhibited a very slight cytotoxicity (18.8 mcg/mL) whereas its crude alkaloids did not demonstrate a significant cytotoxicity at LC₅₀ (>20).

Vacuum liquid chromatography of the crude *A. scholaris* and *C. roseus* alkaloid fractions resulted in several alkaloid-positive fractions. Radiorespirometric assay of the alkaloid fractions (first two for *A. scholaris*) indicated a higher inhibition for fraction As A and Cr B. Sequential gravity liquid column chromatography of the two bioactive fractions afforded a white amorphous solid (As-ISO) and a yellow solid (Cr-ISO). One-dimensional nuclear magnetic resonance analysis (¹H and ¹³C) of the isolates revealed the structure of As-ISO as akuammidine, a sampagine type (1) and Cr-ISO as vindoline, a plumeran type (2).

Key words: *Alstonia scholaris*, *Catharanthus roseus*, indole alkaloid, antimycobacterial, anticarcinogenicity, *Mycobacterium tuberculosis* H₃₇Rv, *Mycobacterium avium*, human oral epidermoid carcinoma cell lines, sampagine, plumeran

128. MOLECULAR DETECTION OF ENTEROVIRUSES ASSOCIATED WITH DILATED CARDIOMYOPATHY

JOYCE D. REYES¹, FABIO ENRIQUE B. POSAS², RONALD R. MATIAS^{1,3}
and FILIPINAS F. NATIVIDAD^{1,3}

¹Research and Biotechnology

²Heart Institute St. Luke's Medical Center, 1102 Quezon City

³Institute of Biology, College of Science
U.P. Diliman, 1101 Quezon City

Viral infections are the most common cause of inflammatory heart muscle disease aside from other known factors. Enteroviruses, particularly cocksackieviruses B (CVBs), have been implicated in the



pathogenesis of dilated cardiomyopathy (DCM). However, viral cultures of myocardial tissue are almost always negative, even when the clinical history or serological studies indicate viral infections. In this study, a right ventricular biopsy (5 mg wet weight) was performed in patients with clinically suspected DCM. The myocardial biopsies were used in the detection of enteroviral RNA by the Polymerase Chain Reaction (PCR). PCR is ideally suited for this study since it can detect low copy numbers of viral genome in small tissue samples. Two sets of primers (A/B and C/D) are from two different consensus sites in the enteroviral genome which allowed the detection of either CVB or poliovirus (PV). Primers A/B are most homologous to CVB3, whereas primers C/D are 100% homologous with six virus types (CVB1, CVB3, CVB4, PV 1, PV2, and PV3). Of the 28 patients enrolled in the study, 3 were positive for the first set of primers, while 11 were positive for the second set of primers. Two patients were found positive for both set of primers. Samples are also processed for electron microscopy but so far viral inclusion bodies or particles have not been detected. The results of this study indicate a link between viral infection and dilated cardiomyopathy in some patients.

Key words: enterovirus, cocksackie virus, poliovirus, endomyocardial biopsies, dilated cardiomyopathy, RNA, cDNA synthesis, PCR, electron microscopy, inclusion bodies

129. DETECTION OF *Helicobacter pylori* FROM FORMALIN-FIXED, PARAFFIN-EMBEDDED GASTRIC BIOPSY SPECIMENS: A STRATEGY FOR *vacA* GENOTYPING

BLANQUITA B. DE GUZMAN¹, LIZA P. FAUSTINO¹, MA. CORAZON B. PAREDES¹, FRANCISCO V. NARCISO¹, and FILIPINAS F. NATIVIDAD^{1,3}

¹Research and Biotechnology Division and ²Institute of Pathology
St. Luke's Medical Center
279 E. Rodriguez Sr. Blvd., Cathedral Heights
1102 Quezon City

³Institute of Biology, College of Science
U.P. Diliman, 1101 Quezon City

Helicobacter pylori is an important human pathogen, having been identified as the major causative agent of chronic gastritis. Although it is well-studied in the US, Europe, Latin America, Africa, and some Asian countries, i.e., Japan, Korea, and Thailand, there are no available data on its epidemiology in the Philippines. Due to the difficulty in culturing this bacterium, we established a method to detect *H. pylori* from formalin-fixed, paraffin-embedded gastric biopsy specimens. Forty-two samples from the Institute of Pathology of St. Luke's Medical Center were evaluated using polymerase chain reaction (PCR). The amplification targets are the genes for urease A (*ure A*), urease B (*ure B*) and urease C (*glmM*). Once a sample has been confirmed to be positive for *H. pylori*, the presence of the *vacA* gene was also evaluated. This gene encodes the vacuolating cytotoxin which induces the formation of intracellular vacuoles in epithelial cells. The signal region of the *vacA* gene occurs as either s1 or s2 allele, while the middle region is present as m1 or m2 allele. Different combinations of these alleles give rise to a specific *vacA* genotype and correlate with the severity of the disease. In this study, the PCR-based system



developed by Atherton (1999 *J Clin, Microb.* vol. 37: 9) was used to determine the *vacA* genotype of 42 gastric samples obtained from paraffin blocks.

Key words: *Helicobacter pylori*, PCR, *ureA*, *UreB*, *UreB*, *glmM*, vacuolating cytotoxin, *vacA*, signal region, middle region, gastric biopsy.

130. PRIMERS FOR CYSTEINE PROTEINASE GENE COULD DISTINGUISH PATHOGENIC *Entamoeba histolytica* FROM NON-PATHOGENIC *E. dispar*

RONALD R. MATIAS^{1,2}, PIA DONNA N. LORENA²,
ROCHE DE GUZMAN³, FILIPINAS F. NATIVIDAD^{1,2}
and GLORIAL. ENRIQUEZ¹

¹*Institute of Biology, College of Science
U. P. Diliman, 1101 Quezon City*

²*Research and Biotechnology Division
St. Luke's Medical Center, 1102 Quezon City*

³*Institute of Molecular Biology and Biotechnology
U.P. Diliman, 1101 Quezon City*

Cysteine proteinases and pore-forming peptides (amoebapores) have been found to be responsible for tissue lysis and cytopathic effects described in invasive amebiasis. A total of six distinct *Entamoeba histolytica* cysteine proteinase genes (*ehcp* 1 - *ehcp*6) have been identified and sequenced. Three of these genes, *ehcp*1, 2, and 5 are expressed at high levels in the pathogenic *E. histolytica*. In this study, an Oligo 4.0 software was used to design primer pairs WRG 1&2 and WRG 3&4 from consensus sequences of this gene. Amoebae were isolated from stool samples, cultured, and maintained in Robinson's medium. Genomic DNA was extracted using phenol-chloroform method. Polymerase Chain Reaction (PCR) using both primer sets could distinguish pathogenic *E. histolytica* from the non-pathogenic *E. dispar*. A 570-bp PCR amplicon was observed in 6 out of the 8 samples using WRG 1 &2, while a 755-bp product was obtained in 4 samples using WRG 3 & 4. These results were further compared with the PCR products generated by primers designed by Tachibana (1991) which also distinguish pathogenic from non-pathogenic *Entamoeba* species. Amplified products from the cysteine proteinase gene primers are currently being cloned for sequence analysis.

Key words: *Entamoeba histolytica*, *E. dispar*, PCR, cysteine proteinases, *E. histolytica* gene (*ehcp*1 - *ehcp* 6), amoebapores, Robinson's medium, genomic DNA extraction, cloning, gene sequencing.



131. POLYMERASE CHAIN REACTION-SEQUENCE SPECIFIC PRIMER (PCR-SSP) SYSTEM FOR BONE MARROW TYPING

LEONORA T.D. SALDA¹, JINGLE R. CANDELARIO¹, LUDOVICO TONOLETE²,
FILIPINAS F. NATIVIDAD^{1,3}, and RAYMUNDO W. LO²

*¹Research and Biotechnology Division and ²Institute of Pathology
St. Luke's Medical Center, Cathedral Heights, 1102 Quezon City*

*³Institute of Biology, College of Science
U.P. Diliman, 1101 Quezon City*

The Human Leukocyte Antigen (HLA) genes are highly polymorphic, co-dominantly expressed recognition genes that play an important role in determination of tissue compatibility for transplantation. Because of this, HLA compatibility between donor and recipient must be determined prior to transplantation. Although HLA types have been defined using serology for many years, the resolution capacity of this method is limited. The advent of DNA-based techniques has allowed the identification of DNA sequence variations which cannot be distinguished by serologic typing. Sequence-specific primer (SSP) typing is a DNA-based method that allows discrimination between the different alleles amplified by polymerase chain reaction (PCR). In this technique, PCR primers are designed to anneal only to a single or specific set of alleles. These primers contain sequences unique to the allele(s) and both primers must anneal to the DNA to get a positive amplification of the test sequence. The 96-well format for PCR allows simultaneous determination of 24 allelic groups in 4 samples belonging to potential donors and the recipient. Amplified DNA fragments are separated by agarose gel electrophoresis and visualized by staining with ethidium bromide and exposure to UV light. Interpretation of the results is based on the presence or absence of amplified DNA fragment corresponding to the specific primer set. Determination of HLA type is by analysis of the pattern of positive wells either using an Analysis Program software or a reaction pattern worksheet.

Key words: HLA, transplantation, tissue compatibility, bone marrow, polymerase chain reaction, sequence-specific primer, serologic typing, donor, alleles, tissue typing

132. DEVELOPMENT AND PROGRESS OF RESEARCH AND BIOTECHNOLOGY AT ST. LUKE'S MEDICAL CENTER

FILIPINAS F. NATIVIDAD

*Research and Biotechnology Division, St. Luke's Medical Center
279 E. Rodriguez, Sr. Blvd., 1102 Quezon City
and Institute of Biology, U. P. Diliman
1101 Quezon City*

Philippine biomedical science made a great advance when St. Luke's Medical Center, long a proponent of ultra-modernization and global initiatives in health care, established its Research and Biotechnology Division (RBD) in July 1995. Its mission is to promote the conduct of high quality research that will



propel the hospital to the realm of world-class excellence in total health care. Since then RBD has made several impressive strides towards achieving this vision. A high standard of scientific work has been made possible through its modern laboratories and state-of-the-art equipment for basic research, a program for intensive manpower development and recruitment, the presence of active national and international linkages, and full administrative support from St. Luke's Medical Center. Facilities at RBD include specialized laboratories for recombinant DNA technology, PCR, DNA sequencing, RNA analysis, protein analysis, molecular immunology, cell culture, chromosomal analyses, microbiology, analytical biochemistry, electron microscopy, and animal studies. These are equipped with several Class II and Class I biohazard cabinets, microscopes, microbiological and CO₂ incubators, thermocyclers, refrigerated microcentrifuges, various cold and ultra-cold storage facilities, ultracentrifuge, automated DNA sequencer, fluorescent microscope, ultrasonicator, UV-vis spectrophotometer, ELISA microplate reader, gel documentation and image analysis system, water ultrapurification apparatus, HPLC, GC-MS, transmission electron microscope, two darkrooms, two fully equipped animal operating rooms, and a network of Internet-capable computers, equipped with various software for database management, DNA sequence analyses and bioinformatics, gel documentation, spectral analysis, and chromatography analyses and libraries. The technical staff of RBD undergo a period of intensive training prior to their assignment as full-time staff. Their research skills are periodically upgraded by intensive training in new technologies here and abroad. Researchers at RBD enjoy the full support of St. Luke's administration in presentations of their research work at various national and international scientific fora. Majority of the studies conducted are on the elucidation of the molecular bases of genetic diseases, infectious diseases and viral diseases, cancers and other key ailments. Protocols for chromosomal analyses, mainly karyotyping and FISH, have been developed for the study of congenital disorders, genetic diseases, leukemias, solid tumors, and other population-based diagnostics. PCR-based procedures are extensively used in HLA-typing for matching transplant donors and recipients, colon cancer gene detection, breast cancer gene detection dystrophin gene analysis, detection and typing of dengue virus, hepatitis C virus, human papilloma virus, Epstein-Barr virus, coxsackie virus, poliovirus, herpes simplex viruses, *Helicobacter pylori*, *Mycobacterium tuberculosis*, and *Entamoeba histolytica*. Recombinant DNA technology, DNA sequencing, protein expression, immunochemistry, and mutagenesis studies are underway to elucidate the molecular basis of disease pathogenesis, to develop useful biotechnology products such as reagent antigens and enzyme conjugates for immunoassay, and to determine the molecular determinants of virulence, antigenicity, or oncogenicity of a pathogen. Various analytical chromatographic procedures involving TLC, HPLC, and GC-MS are being optimized for the analyses of various drugs and drug metabolites. Tissue pathology and cell ultrastructure studies are done at the Electron Microscope Facility. RBD's modern Animal Facility is a venue for a range of animal studies. Researches by St. Luke's clinicians, some as research fellows at RBD, are being conducted on the different aspects of leukemia, colon cancer, nasopharyngeal carcinoma, cervical cancer, stroke, cardiomyopathy, thalassemia, and dengue. RBD maintains intensive collaborations with research groups and medical institutions both within the Philippines and abroad, the latter including the Institute for Tropical Medicine in Nagasaki, Japan, and in the United States, the Mayo Clinic, Centers for Disease Control, Weis Center for Research at Penn State College of Medicine, Georgetown University, and LDS Hospital. The dedication and enthusiasm of the RBD staff enjoys the generous and full-hearted support of the St. Luke's leadership. There are very high expectations of RBD, however, with plans for a future in biotechnology ventures, clinical drug trials, medical genetics and gene therapy research, a metabolic disorders and pediatric neurology lab, and a research resource and bioinformatics center.

Key words: biomedical research, biotechnology, molecular biology, microbiology, cytogenetics, cell biology, virology, immunology, clinical trials, electron microscopy, analytical chromatography



Social Sciences

133. APPLICATION OF GEOGRAPHIC INFORMATION SYSTEMS (GIS) IN FARM MANAGEMENT ANALYSIS AND LAND USE PLANNING

ALICE M. BRIONES

*Senior Science Research Specialist, Socioeconomics Division
Philippine Rice Research Institute, Maligaya, Muñoz, 3119 Nueva Ecija*

The aim of this study was to demonstrate the application of Geographic Information Systems (GIS) in the analysis of farm management data and land use planning. Using barangay Maligaya as a case study, another objective was to determine the better utilization of farm resources and land use options on individual paddy farms of farmers in the area. Farm management and map data were used in the data analysis with the application of GIS software and correlation analysis. Results showed that other farmers in the area were not maximizing the utilization of their only land resource because of their inadequate information on how to make use of their land efficiently and productively. With the use of some criteria based on the correlation analysis results, land suitability analysis was also applied to assess and delineate areas suitable for vegetable cultivation. These areas were displayed in the thematic maps which can be used as crop options to farmers in increasing farm productivity and profitability. Moreover, it was found out that GIS is a powerful tool for (a) characterizing a specific farm location; (b) agricultural information developing decision support system; and (c) facilitating the process through a rapid and quick evaluation of the farm situation.

134. AN ANALYSIS OF THE SEASONAL MOVEMENTS OF PALAY PRICES AND INTERTEMPORAL PRICE EFFICIENCY

ALICE M. BRIONES

*Senior Science Research Specialist, Socioeconomics Division
Philippine Rice Research Institute, Maligaya, Muñoz, 3119 Nueva Ecija*

The study attempted to address the policy issue of how competitive or economically efficient the rice marketing systems are in terms of temporal price efficiency. That is, whether the incentive to carry inventory between two different time periods (from harvest to lean months) adequately covered costs of storage. Moreover, the seasonal price movements at the farm, wholesale, and retail levels were analyzed. Analyses were based on 1970 - 1995 price data series. Results showed that the seasonal price movements were largely due to the high seasonality of palay production. Between seasonal low and seasonal high price months, monthly seasonal price increase averaged at 3.4 percent, an incentive to induce traders to store excess stocks for the lean months. With the average costs of storage of 1.42 percent per month (in this case, it is the cost of working capital), the monthly seasonal price increase was adequate to cover the costs of storage. Although there were some years that the seasonal price increase were more



than enough to cover costs of working capital, these were being balanced by other years of very low returns. Thus, there could be a year-to-year offsetting of profits and losses that the trader does assume.

Key words: seasonality, seasonal price increase, storage costs, price behavior, intertemporal price, palay price, rice marketing

135. URBAN IMPACT OF THE QUALITY OF LIFE OF METRO MANILA RESIDENTS

DANIEL S. SANTOS

*College of Arts and Sciences, Pamantasan ng Lungsod ng Maynila
Intramuros, 1002 Manila*

Sociologists agree that urbanization affects the quality of life of residents both positively and negatively. Using the survey method, this researcher investigated the impact of urbanization of Metropolitan Manila on the quality of life of its residents. Questionnaires consisting of 39 questions were distributed to 416 PLM students (43% male and 57% female) enrolled in courses like engineering, nursing, physical therapy, business administration, and arts and sciences at the start of the second semester of school year 1999-2000.

Results of the study indicated that 64% of the respondents live in their own houses and that their residential area is adequate (85%), spacious (56%), while 37% answered crowded. Sixty-seven percent (67%) think that their residential area is satisfactory because it is quiet (22%), nice and orderly (33%), and that neighbors are friendly and good (29%). Forty-seven percent (47%) indicated that transportation is adequate and accessible (74%) but traffic is heavy sometimes (58%), therefore, noise and air pollution is a problem (73%). Transportation system is satisfactory (45%). Drinking water is safe (79%) and sufficient (53%), and that they get their drinking water (68%) and bathing/washing water (71%) from the MWSS. They get their electricity from MERALCO (94%) and that it is very adequate (56%). Sewerage is clean and running well (40%) or defective (33%), and garbage is collected daily (45%). Jobs are adequate (52%) from the private sector (42%), which give sufficient income for basic needs and luxury (67%). Hospitals and puericulture centers are very adequate and accessible (59%), medicines are always available (64%); 54% indicated they have their own comfort room and bathroom. Members of the family are mostly with education (85%). Leisure is always available and affordable (57%) in the form of megamalls (32%), movies (26%), parks (17%), and videos (17%). Malls and markets are available and accessible (93%), clean and nice (25%) where everything needed is available (35%) at affordable prices (25%). Peace and order is okay (74%); neighbors are friendly (35%), cooperative (22%), but sometimes become "tsismoso/a" (17%). However, 47% indicated that "bisyo" is minimal while 39% indicated that "bisyo" ay nagkalat". Summing up, 57% of the respondents think that life in the city is good and enjoyable; only 9% disagree.

Keywords: urban impact, quality of life, Metro Manila residents



21st Annual Scientific Meeting

The Academy held its 21st Annual Scientific Meeting (ASM) on 7-8 July 1999 at the Manila Hotel. DOST Secretary, Dr. Filemon A. Uriarte, Jr., stressed the theme of the ASM "Food, Population, and Environment". He noted its appropriateness, timeless, and responsiveness to President Estrada's national development program.

The ASM was co-organized with the Federation of Crop Science Societies of the Philippines, the Philippine Society of Animal Science, the Philippine Veterinary Medical Association, the Philippine Veterinary Drug Association, the Association of Professionals in Livestock Production, the Philippine Society of Animal Nutritionists, the Pest Management Council of the Philippines, and the University of the Philippines Los Baños.

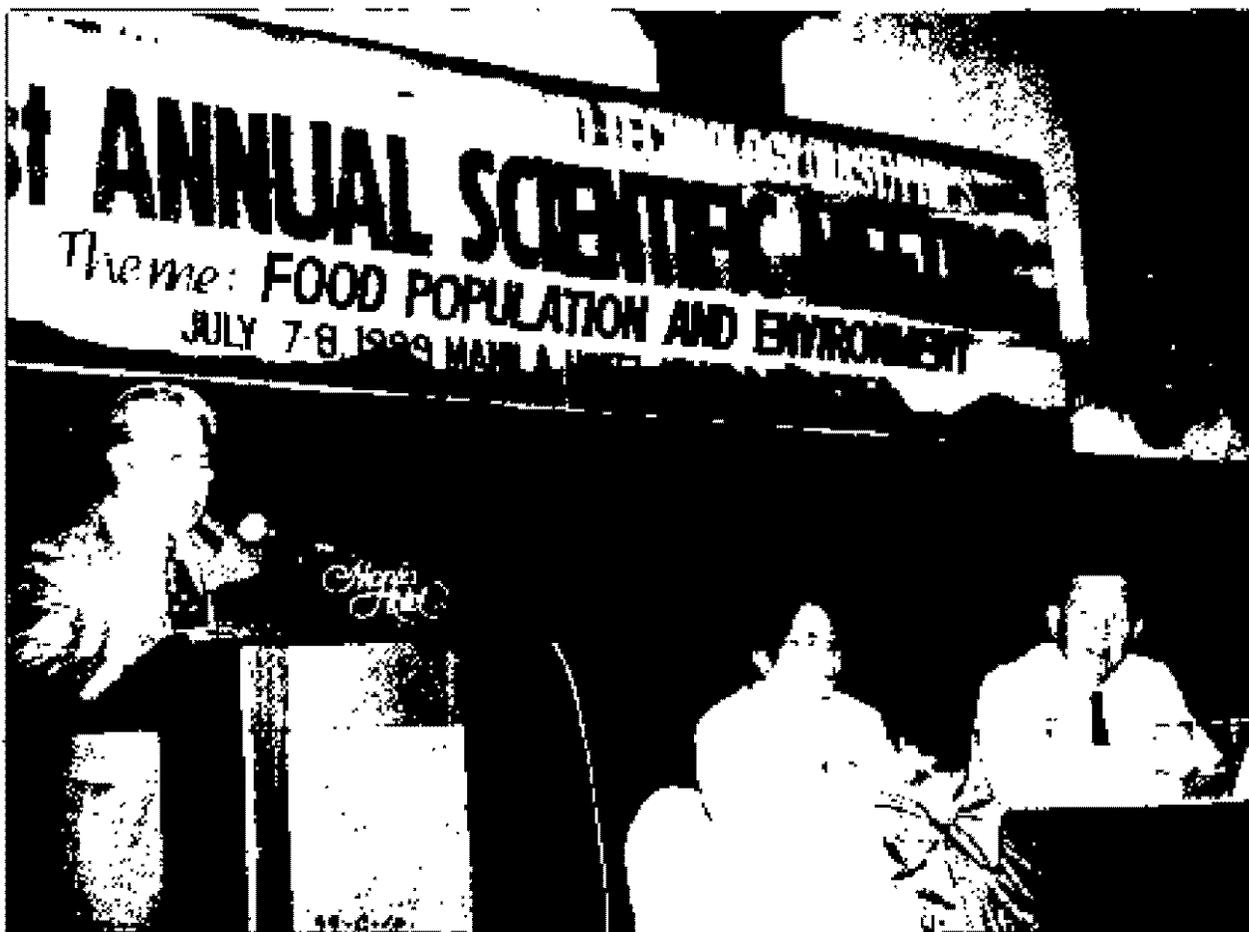
Congressman Angelito M. Sarmiento, Chairman of the House Committees on Agriculture and Food, was the Keynote Speaker.



From L-R: Academicians Jose O. Juliano and Bienvenido F. Nebres, S. J., Congressman Angelito M. Sarmiento, Academician Conrado S. Dayrit, and Academician Ruben L. Villareal.

Seven plenary papers, seventeen technical papers, and sixty-seven posters in different disciplines were presented during the two-day meet.

Seven plenary sessions were presented on the following topics: (1) "Carrying Capacity-Food Production: The Philippines and Selected Asian Countries" presented by Dr. Leonardo A. Gonzales; (2) "Safety of Novel Foods" presented by Dr. Estrella F. Alabastro; (3) "Major Issues/Policies/Strategies on the Animal Industry" presented by Dr. Libertado C. Cruz; (4) "Major Issues/Policies/Strategies on Major Crops" presented by Dr. William D. Dar; (5) "Major Issues/Policies/Strategies on Fisheries" presented by Mr. Nelson A. Lopez; (6) "Global Perspectives on Cereals/Rice" presented by Dr. Ronald P. Cantrell; and (7) "Global Perspectives on Pesticides" presented by Dr. Manfred Kern.



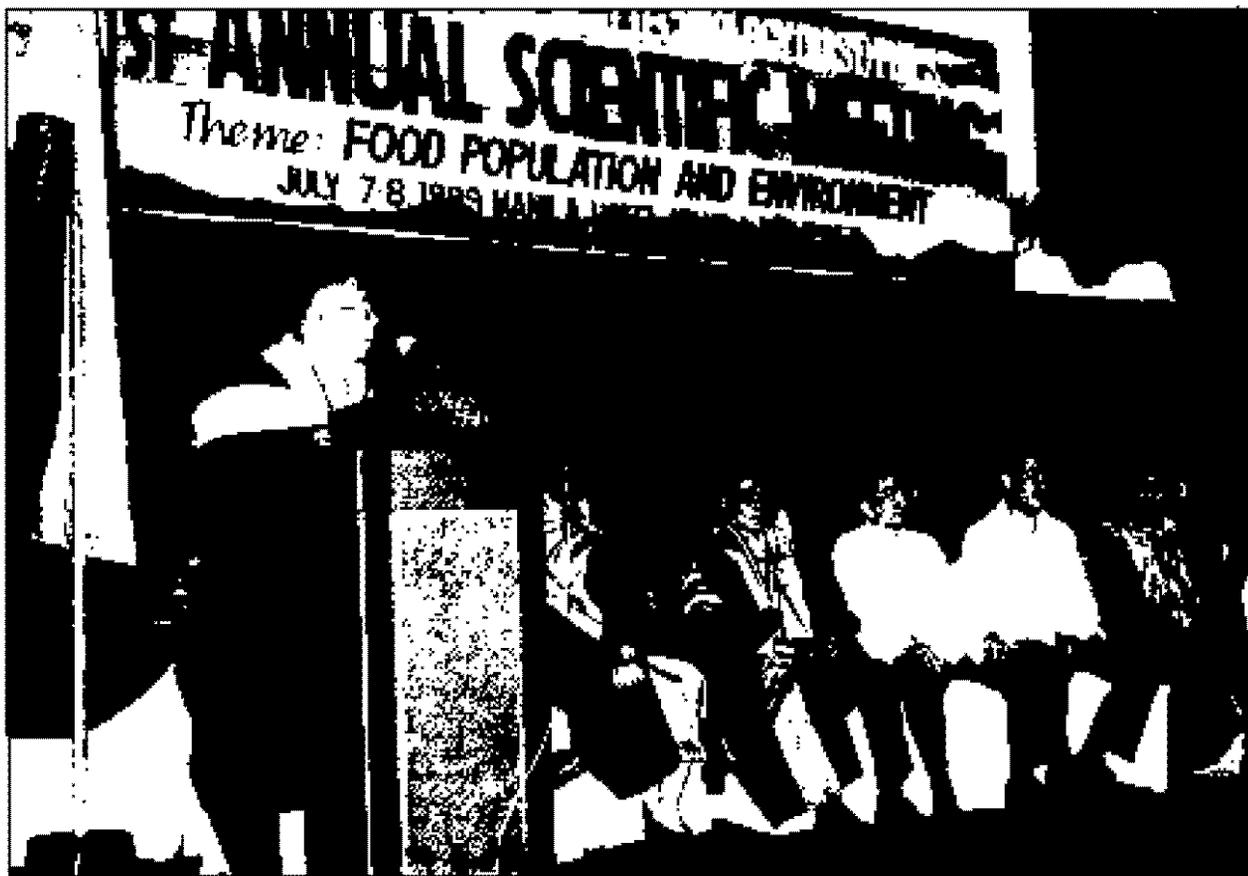
Dr. Santiago R. Obien, Executive Director of PhilRice was the discussant of Plenary Session VI: "Global Perspectives on Cereals/Rice". At the table were National Scientist Dolores A. Ramirez (moderator) and Dr. Ronald P. Cantrell, IRRI Director-General (Plenary Speaker).



The Board of Judges for the Best Poster Award chaired by Academician Quintin L. Kintanar selected the best posters according to Division:

- *Finite Invertible Loop of the Coset Product Type and Latin Square Composition of Factorable Groups and Loops* by Dr. Raoul E. Cawagas (Mathematical, Physical and Engineering Sciences)
- *Molecular Evolution of B-Glucanase in Cereals* by Dr. Gabirel O. Romero, et al. (Biological Sciences)
- *Benguet Farmers Adopt Aggie Technologies* by Wilfredo R. Estolas and C. C. Consolacion (Social Sciences)
- *Breeding Salt-Tolerant Rice Varieties in the Philippines* by Dr. Philbert S. Bonilla (Agricultural Sciences)
- *Detection of Mycobacterium tuberculosis by Polymerase Chain Reaction* by Jingle R. Candelario, et al. (Health Sciences)

Science Secretary Filemon A. Uriarte, Jr. and Assistant Secretary Segfredo R. Serrano of the Department of Agriculture graced the Awarding and Closing Ceremonies on 8 July. Academician Ricardo M. Lantican, Chairman of the Resolutions Committee, turned over the formulated recommendations to Secretary Uriarte and Asst. Secretary Serrano for their appropriate action or implementation.



From L-R: Academician Ricardo M. Lantican; National Scientist Dolores A. Ramirez; newly elected Academician, Dr. Onofre D. Corpuz; Secretary Filemon A. Uriarte, Jr.; Asst. Secretary Segfredo R. Serrano; and Academician Quintin L. Kintanar during the Closing Ceremonies.



PICTORIALS



 NAST 21ST ANNUAL SCIENTIFIC MEETING

PICTORIALS



NAST 22nd Annual Scientific Meeting (ASM) Committees

22nd ASM STEERING COMMITTEE

- Chair - Acd. Jose O. Juliano
Co-chair - Acd. Apolinario D. Nazarea
Acd. Lourdes J. Cruz
Acd. Bienvenido O. Juliano
Acd. Clara Y. Lim-Sylianco
Acd. Melecio S. Magno
Acd. Evelyn Mae T. Mendoza
Acd. Tito A. Mijares
Acd. Quirino O. Navarro
Acd. Bienvenido F. Nebres, S.J.
Acd. William G. Padolina

IN-CHARGE OF TECHNICAL AND POSTER SESSIONS

- Chair - Acd. Jose O. Juliano (MPESD)
Co-chair - Acd. Ruben L. Villareal (ASD)
Acd. Mercedes B. Concepcion (SSD)
Acd. Onofre D. Corpuz (SSD)
Acd. Ernesto O. Domingo (HSD)
Acd. Salcedo L. Eduardo (BSD)
Acd. Emil Q. Javier (BSD)
Acd. Evelyn Mae T. Mendoza (MPESD)
Acd. Dolores A. Ramirez (ASD)
Acd. Ramon F. Abarquez, Jr. (HSD)



BEST POSTER AWARD BOARD OF JUDGES

Chair - Acd. Quintin L. Kintanar (HSD)
Acd. Ramon F. Abarquez, Jr. (HSD)
Acd. Benjamin D. Cabrera (HSD)
Acd. Magdalena C. Cantoria (BSD)
Acd. Ledivina V. Cariño (SSD)
Acd. Leopoldo S. Castillo (ASD)
Acd. Mercedes B. Concepcion (SSD)
Acd. Salcedo L. Eduardo (BSD)
Acd. Edito G. Garcia (HSD)
Acd. Bienvenido O. Juliano (MPESD)
Acd. Alfredo V. Lagmay (SSD)
Acd. Ricardo M. Lantican (ASD)
Acd. Tito A. Mijares (MPESD)
Acd. Quirino O. Navarro (MPESD)
Acd. Faustino T. Orillo (ASD)
Acd. Joventino D. Soriano (BSD)

RESOLUTIONS COMMITTEE

Chair - Acd. Ruben L. Villareal (ASD)
Co-Chair - Acd. Lourdes J. Cruz (MPESD)
Acd. Solita F. Camara-Besa (HSD)
Acd. Veronica F. Chan (BSD)
Acd. Onofre D. Corpuz (SSD)
Acd. Ernesto O. Domingo (HSD)
Acd. Raul V. Fabella (SSD)
Acd. Edito G. Garcia (HSD)
Acd. Edgardo D. Gomez (BSD)
Acd. Rafael D. Guerrero III (ASD)
Acd. Clara Y. Lim-Sylianco (MPESD)
Acd. Prescillano M. Zamora (BSD)
Dr. Eliezer A. Albacea (OYS-MPESD)
Dr. Ann Inez N. Gironella (OYS-MPESD)



EXECUTIVE COUNCIL (1999-2002)

Academician Perla D. Santos Ocampo	-	President
Academician Ruben L. Villareal	-	Vice President
Academician Jose O. Juliano	-	Secretary
Academician Ledivina V. Cariño	-	Member
Academician Ernesto O. Domingo	-	Member
Academician Emil Q. Javier	-	Member
Academician Apolinario D. Nazarea	-	Member

SECRETARIAT

Miss. Luningning E. Samarita	-	Executive Director
Mr. Redocindo L. Santillan	-	Information Officer V
Miss Rosemarie S. Espino	-	Administrative Officer V
Mrs. Rowena V. Briones	-	Information Officer III
Mr. Carlo B. Castillo	-	Information Officer II
Mrs. Zenaida T. Mapua	-	Accountant III
Mrs. Chona S. Santos	-	Cashier III
Mr. Richard G. Apuyan	-	Stenographer II
Mr. Eliseo D. Raganit	-	Utility Worker I
Mr. Roberto N. Medina	-	Driver II
Mr. Ferdinand C. Gutay	-	Clerk II



Members of the National Academy of Science and Technology and Their Field of Specialization/s (1978-2000)

Name	Field of Specialization/s
1. Ramon F. Abarquez, Jr., M.D.	Cardiology
2. †Teodoro A. Agoncillo, Litt.D. (h.c.)*	Philippine History
3. Encarnación Alzona, Ph.D.*	Philippine History
4. Clare R. Baltazar, Ph.D.	Systematic Entomology
5. †Julian A. Banzon, Ph.D.*	Biophysical Chemistry
6. Benjamin D. Cabrera, M.D., M.P.H.	Medical Parasitology and Public Health
7. Solita F. Camara-Besa, M.D., M.S.	Biochemistry
8. Filomena F. Campos, Ph.D.	Plant Breeding and Cytogenetics
9. Paulo C. Campos, M.D.*	Nuclear Medicine
10. Magdalena C. Cantoria, Ph.D.	Botany
11. Ledivina V. Cariño, Ph.D.	Sociology
12. Gelia T. Castillo, Ph.D.*	Rural Sociology
13. Leopoldo S. Castillo, Ph.D.	Animal Science
14. Veronica F. Chan, Ph.D.	Microbiology
15. Mercedes B. Concepcion, Ph.D.	Demography
16. Onofre D. Corpuz, Ph.D.	Political Economics and Government
17. Lourdes J. Cruz, Ph.D.	Biochemistry
18. †Amando M. Dalisay, Ph.D.	Economics
19. Conrado S. Dayrit, M.D.	Pharmacology and Cardiology
20. †Emerita V. de Guzman, Ph.D.	Plant Physiology
21. †Geminiano T. de Ocampo, M.D.*	Ophthalmology
22. Fe del Mundo, M.D., M.A.*	Pediatrics
23. †Casimiro del Rosario, Ph.D.*	Physics, Astronomy and Metrology
24. Ernesto O. Domingo M.D.	Internal Medicine and Gastroenterology
25. Salcedo L. Eduardo, Ph.D.	Veterinary and Medical Parasitology
26. †José Encarnación, Jr., Ph.D.*	Economics
27. Pedro B. Escuro, Ph.D.*	Genetics and Plant Breeding
28. Raul V. Fabella, Ph.D.	Economics
29. †Raymundo A. Favila, Ph.D.	Mathematics
30. †Francisco M. Fronda, Ph.D.*	Animal Husbandry
31. Edito G. Garcia, M.D.	Medical Parasitology
32. Edgardo D. Gomez, Ph.D.	Marine Biology
33. Andrew Gonzalez, F.S.C., Ph.D.	Linguistics
34. Rafael D. Guerrero III, Ph.D.	Fisheries Management
35. Carmen Ll. Intengan, Ph.D.	Nutrition
36. Emil Q. Javier, Ph.D.	Plant Breeding and Genetics
37. Bienvenido O. Juliano, Ph.D.	Organic Chemistry
38. Jose O. Juliano, Ph.D.	Nuclear Chemistry and Physics
39. Quintin L. Kintanar, M.D., Ph.D.	Environmental Medicine



40. Alfredo V. Lagmay, Ph.D.*	Experimental Psychology
41. Ricardo M. Lántican, Ph.D.	Plant Breeding
42. †Hilario D. G. Lara, M.D., Dr. P.H.*	Public Health
43. Clara Y. Lim-Sylianco, Ph.D.*	Biochemistry and Organic Chemistry
44. †Cecilio F. Lopez, Dr. phil.	Philippine Linguistics and Oriental Studies
45. Melecio S. Magno, Ph.D.	Physics
46. Evelyn Mae T. Mendoza, Ph.D.	Biochemistry
47. Tito A. Mijares, Ph.D.	Statistics
48. Quirino O. Navarro, Ph.D.	Nuclear Chemistry
49. Apolinario D. Nazarea, Ph.D.	Biophysics
50. Bienvenido F. Nebres, S.J., Ph.D.	Mathematics
51. †Luz Oliveros-Belardo, Ph.D.*	Pharmaceutical Chemistry
52. Faustino T. Orillo, Ph.D.	Mycology
53. William G. Padolina, Ph.D.	Phytochemistry
54. †Eduardo A. Quisumbing, Ph.D.*	Plant Taxonomy, Systematics and Morphology
55. Dolores A. Ramirez, Ph.D.*	Biochemical Genetics
56. †Jose N. Rodriguez, M.D.	Leprology
57. †Juan S. Salcedo, Jr., M.D.*	Nutrition and Public Health
58. †Alfredo C. Santos, Dr. phil.*	Physical Chemistry
59. †Francisco O. Santos, Ph.D.*	Human Nutrition and Agricultural Chemistry
60. Perla D. Santos Ocampo, M.D.	Pediatrics
61. Joventino D. Soriano, Ph.D.	Cytogenetics and Mutation Research
62. Teodulo M. Topacio, Jr., Ph.D.	Veterinary Medicine
63. †Dioscoro L. Umali, Ph.D.*	Genetics and Plant Breeding
64. Jose R. Velasco, Ph.D.*	Plant Physiology
65. †Carmen C. Velasquez, Ph.D.*	Parasitology
66. †Gregorio T. Velasquez, Ph.D.*	Phycology
67. Benito S. Vergara, Ph.D.	Plant Physiology
68. Ruben L. Villareal, Ph.D.	Horticulture
69. †Gregorio F. Zaide, Ph.D.	History
70. Prescillano M. Zamora, Ph.D.	Plant Anatomy-Morphology
71. †Gregorio Y. Zara, D. Sc.*	Engineering and Inventions

Honorary Member

<i>Name</i>	<i>Field of Specialization/s</i>
Norman E. Borlaug, Ph.D. 1970 Nobel Peace Prize Laureate	Agronomy and Plant Breeding

Legend:

- * National Scientist
- + Deceased



Outstanding Young Scientists (1980-1999)

Name	Field of Specialization/s
1. EFREN F. ABAYA, Ph.D.	Electrical Engineering
2. ANTONIO L. ACEDO, JR., Ph.D.	Horticulture
3. JEZIE A. ACORDA, DVM	Veterinary Medicine
4. CANDIDA B. ADALLA, Ph.D.	Entomology
5. JOSEPHINE U. AGRAVANTE, Ph.D.	Postharvest Horticulture
6. ALICIA M. AGUINALDO, Ph.D.	Chemistry
7. ELIEZER A. ALBACEA, Ph.D.	Computer Science
8. RHODORA R. ALDEMITA, Ph.D.	Botany
9. AMBROSIO RAUL R. ALFILER, M.S.	Entomology
10. CARMELO A. ALFILER, M.D.	Pediatric Medicine
11. PORFIRIO ALEXANDER M. ALIÑO, Ph.D.	Marine Biology
12. RUPERTO P. ALONZO, M.A.	Economics
13. VICTOR B. AMOROSO, Ph.D.	Botany
14. VERMANDO M. AQUINO, Ph.D.	Plant Pathology
15. ANGELINA M. BACALA, Ph.D.	Physics
16. ABUNDIO A. BALGOS, M.D.	Pulmonary and Internal Medicine
17. ARSENIO M. BALISACAN, Ph.D.	Economics
18. JOSE MARIA P. BALMACEDA, Ph.D.	Mathematics
19. ADELINA A. BARRION, Ph.D.	Insect Genetics
20. ALBERTO T. BARRION, M.S.	Entomology
21. FRANCISCO M. BASUEL, Ph.D.	Animal Science
22. CHERRIE L. BUNAG-PASCUAL, Ph.D.	Chemistry
23. MA. CYNTHIA ROSE B. BAUTISTA, Ph.D.	Sociology
24. MA. SOCORRO G. BAUTISTA, Ph.D.	Economics
25. ROMEO M. BAUTISTA, Ph.D.	Economics
26. CARMELITA A. BELDA-BAILLIE, Ph.D.	Zoology
27. VICENTE Y. BELIZARIO, JR., M.D.	Tropical Medicine and Hygiene
28. EDWIN A. BENIGNO, Ph.D.	Entomology
29. ALLAN BENEDICT I. BERNARDO, Ph.D.	Cognitive Psychology
30. CHRISTOPHER C. BERNIDO, Ph.D.	Physics
31. ORVILLE L. BONDOC, Ph.D.	Animal Breeding and Genetics
32. PHILBERT S. BONILLA, Ph.D.	Plant Physiology
33. TERESITA H. BORROMEIO, M.S.	Plant Breeding
34. MERDELYN T. CAASI-LIT, Ph.D.	Plant Science and Entomology
35. RODOLFO P. CABANGBANG, Ph.D.	Agronomy
36. LEONORINA G. CADA, Ph.D.	Chemistry
37. DANTE B. CANLAS, Ph.D.	Economics
38. SERGIO R. CANOY, Ph.D.	Mathematics
39. SERGIO S. CAO, Ph.D.	Mathematics
40. SEVERINO S. CAPITAN, Ph.D.	Animal Physiology and Nutrition
41. WILLIAM T. CHUA, M.D.	Cardiovascular Medicine



42. MA. CECILIA G. CONACO, Ph.D.	Psychology
43. PACIENTE A. CORDERO, JR., Ph.D.	Marine Biology
44. ARMANDO C. CRISOSTOMO, M.D.	Colon and Rectal Surgery
45. LOURDES J. CRUZ, Ph.D. *	Biochemistry
46. VIRGINIA C. CUEVAS, Ph.D.	Botany
47. IDA F. DALMACIO, Ph.D.	Food Microbiology
48. ANTONIO MIGUEL L. DANS, M.D., M.S.	Clinical Epidemiology
49. WILLIAM D. DAR, Ph.D.	Agriculture
50. MANUEL M. DAYRIT, M.D.	Epidemiology and MPH
51. EMMANUEL S. DE DIOS, Ph.D.	Economics
52. ERNESTO J. DEL ROSARIO, Ph.D.	Chemistry
53. RHODORA A. DEL ROSARIO, M.D.	Health Science
54. REYNALDO E. DELA CRUZ, Ph.D.	Forestry
55. ALUMANDA M. DELA ROSA, Ph.D.	Radiation Chemistry
56. CESAR G. DEMAYO, Ph.D.	Entomology and Genetics
57. MARIBEL L. DIONISIO-SESE, DSc.	Plant Physiology
58. EMERENCIANA B. DURAN, Ph.D.	Biophysics
59. SALCEDO L. EDUARDO, Ph.D. *	Parasitology
60. MARK J. ENCARNACIÓN, Dr. techn.	Technical Mathematics
61. VIRGILIO G. ENRIQUEZ, Ph.D. +	Psychology
62. ELDA B. ESGUERRA, Ph.D.	Postharvest Horticulture
63. RENE P. FELIX, Ph.D.	Mathematics
64. EDWINO S. FERNANDO, M.S.	Plant Taxonomy
65. MARIO R. FESTIN, M.D.	Obstetrics and Gynecology
66. MIGUEL D. FORTES, Ph.D.	Marine Plant Ecology
67. ZENAIDA N. GANGA, Ph.D.	Plant Breeding
68. RUBEN M. GAPASIN, Ph.D.	Plant Pathology
69. SEVERINO V. GERVACIO, Ph.D.	Mathematics
70. ANN INEZ N. GIRONELLA, Ph.D.	Statistics
71. RAFAEL D. GUERRERO III, Ph.D. *	Fisheries Management
72. PONCIANO S.M. HALOS, Ph.D.	Plant Pathology
73. DESIREE M. HAUTEA, Ph.D.	Plant Genetics and Molecular Biology
74. RANDY A. HAUTEA, Ph.D.	Plant Breeding
75. JOSE E. HERNANDEZ, Ph.D.	Plant Breeding and Genetics
76. ALEJANDRO N. HERRIN, Ph.D.	Demographic Economics
77. RUFINO H. IBARRA, Ph.D.	Physics
78. ESPERANZA A. ICASAS-CABRAL, M.D.	Cardiology
79. GIL S. JACINTO, Ph.D.	Marine Chemistry
80. GERARDO C. JANAIRO, D. Nat. Sci.	Chemistry
81. RICARDO T. JOSE, Ph.D.	History and Area Studies
82. WILFREDO I. JOSE, Ph.D.	Chemical Engineering
83. TERCENCIO D. LACUESTA, Ph.D.	Physics
84. EMMANUEL M. LAGARE, Ph.D.	Mathematics
85. MARY ANN D. LANSANG, Ph.D.	Clinical Epidemiology
86. FELINO P. LANSIGAN, Ph.D.	Statistics
87. MANUEL M. LANTIN, Ph.D.	Plant Breeding



88. PORTIA G. LAPITAN, M.S.
89. DANILO B. LARGO, Ph.D.
90. RODEL D. LASCO, Ph.D.
91. ANTONIO C. LAURENA, Ph.D.
92. BERNADETTE D.L. LIBRANDA-RAMIREZ, Ph.D.
93. EDUARDO C. LIM, M.D.
94. JOSEPH ANTHONY Y. LIM, Ph.D.
95. MA. EMMA CONCEPCION D. LIWAG, Ph.D.
96. MA. CONCEPCION C. LIZADA, Ph.D.
97. MANUEL M. LOGROÑO, Ph.D.
98. ERNESTO P. LOZADA, Ph.D.
99. ERNESTO S. LUIS, Ph.D.
100. REYNALDO C. MABESA, Ph.D.
101. DAMASA B. MAGCALE-MACANDOG, Ph.D.
102. RODEL G. MAGHIRANG, M.S.
103. JOSE A. MAGPANTAY, Ph.D.
104. JOSE A. MARASIGAN, Ph.D.
105. RONALD R. MATIAS, Ph.D.
106. MANOLO G. MENA, Ph.D.
107. MERLYN S. MENDIORO, Ph.D.
108. EVELYN MAE T. MENDOZA, Ph.D. *
109. MARIE ANTONETTE J. MEÑEZ, Ph.D.
110. MANUEL F. MONTES, Ph.D.
111. JAIME C. MONTOYA, M.D.
112. FELIX P. MUGA II, Ph.D.
113. MANOLITO G. NATERA, Ph.D.
114. FIDELINA B. NATIVIDAD-CARLOS, Ph.D.
115. LUZ R. NOCHEFRANCA, Ph.D.
116. JOSE M. OCLARIT, Ph.D.
117. REMIGIO M. OLVEDA, M.D.
118. FLORIAN M. OREJANA-WARD, Ph.D.
119. ELY ANTHONY R. OUANO, Ph.D.
120. WILLIAM G. PADOLINA, Ph.D. *
121. ROBERT N. PADUA, Ph.D.
122. VICENTE B. PAQUEO, Ph.D.
123. LILIAN F. PATEÑA, M.S.
124. VALENTINO C. PERDIDO, M.S.
125. ERNESTO M. PERNIA, Ph.D.
126. GLORINA N. POCSIDIO, Ph.D.
127. LINDA S. POSADAS, Ph.D.
128. ROGER R. POSADAS, Ph.D.
129. ERIC R. PUNZALAN, Ph.D.
130. ROLANDO E. RAMOS, Ph.D.
131. BLESSILDA P. RAPOSA, Ph.D.
132. EUFEMIO T. RASCO, JR., Ph.D.
133. CORAZON M. RAYMUNDO, Ph.D.

Forest Biology
 Aquatic Environmental Science
 Forestry
 Agricultural Chemistry
 Immunology
 Immunology
 Economics
 Economics
 Biochemistry
 Plant Breeding and Genetics
 Agricultural Engineering
 Food Chemistry
 Food Science
 Botany
 Vegetable Breeding
 Physics
 Mathematics
 Zoology
 Metallurgy
 Genetics
 Biochemistry
 Marine Biology
 Economics
 Microbiology
 Mathematics
 Physics
 Economics
 Mathematics
 Applied Biochemistry
 Parasitic Diseases
 Fish Processing and Quality Control
 Environmental Engineering
 Phytochemistry
 Theoretical Statistics
 Human Resource Economics
 Plant Tissue Culture
 Crop Science
 Economic Demography
 Zoology
 Physics
 Physics
 Chemistry
 Mathematics
 Mathematics
 Plant Breeding
 Population Science



134. EDILBERTO D. REDOÑA, Ph.D.	Genetics
135. MA. JAMELA R. REVILLEZA, Ph.D.	Biochemistry
136. CECILIA P. REYES, Ph.D.	Entomology
137. LUZVISMINDA U. RIVERO, Ph.D.	Chemistry
138. JOSSIE M. ROGACION, M.D.	Pediatric Nutrition and Gastroenterology
139. ALBERTO G. ROMUALDEZ, JR., M.D.	Medicine
140. PERCY E. SAJISE, Ph.D.	Ecology
141. CAESAR A. SALOMA, Ph.D.	Applied Physics
142. MEDIADORA C. SANIEL, Ph.D.	Epidemiology
143. ROLAND V. SARMAGO, Ph.D.	Physics
144. LEOCADIO S. SEBASTIAN, Ph.D.	Plant Breeding
145. FLORENTINO C. SUMERA, Ph.D.	Chemistry
146. POLLY W. SY, Ph.D.	Mathematics
147. BENITO C. TAN, Ph.D.	Botany
148. BENITO L. TANHEHCO, Ph.D.	Biomedical Engineering
149. MANUEL FE H. TARROJA, Ph.D.	Physics
150. SHIRLEY R. TIONG-PALISOC, Ph.D.	Physics
151. WILFRED U. TIU, Ph.D.	Parasitology and Immunology
152. AMARYLLIS T. TORRES, Ph.D.	Psychology
153. TESSA T. TORRES-EDEJER, M.D.	Clinical Economics
154. THELMA E. TUPASI-RAMOS, M.D.	Infectious Diseases
155. FILEMON A. URIARTE, JR., Ph.D.	Chemical Engineering
156. VICTORA A. VICENTE-BECKETT, Ph.D.	Chemistry
157. CESAR A. VILLANOY, Ph.D.	Physical Oceanography
158. IRENE M. VILLASEÑOR, Ph.D.	Chemistry
159. VIOLETA N. VILLEGAS, Ph.D.	Fruit Breeding and Genetics
160. EDWARD H.M. WANG, M.D.	Orthopedics
161. DANILO M. YANGA, Ph.D.	Physics
162. HELEN T. YAP, Ph.D.	Marine Biology
163. GRACIANO P. YUMUL, JR., Ph.D.	Geology
164. ALFINETTA FERMINA B. ZAMORA, Ph.D.	Agronomy
165. REGALADO G. ZAMORA, Ph.D.	Animal Science

Legend:

* Also NAST Member