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ASTHRDP GRADUATE SCHOLARS CONFERENCE

Year 9

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

10 REDUCED INEQUALITIES

ASTHRDP:
Science, Technology and Innovation
Towards
Achieving
SUSTAINABLE DEVELOPMENT GOALS

7 AFFORDABLE AND CLEAN ENERGY

8 DECENT WORK AND ECONOMIC GROWTH

5 GENDER EQUALITY

6 CLEAN WATER AND SANITATION

November 26-27, 2020

3 GOOD HEALTH AND WELL-BEING

4 QUALITY EDUCATION

1 NO POVERTY

2 ZERO HUNGER

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DEPARTMENT OF SCIENCE AND TECHNOLOGY

OFFICE OF THE SECRETARY

My warmest greetings to the organizers and participants of the 2020 ASTHRDP Graduate Scholars Conference!

In our 9th year of this fruitful engagement of our Graduate Scholars and pool of experts, we invite to share their knowledge on the most pressing issues concerning the science community. This conference has always been an avenue for discussions on emerging trends in our respective fields, but with the current situation, we shall try to sustain the same impact while making sure that we prioritize our safety.

The science community has been contributing to several pillars of the Sustainable Development Goals (SDGs), and this conference ought to tackle this vision with our dearest scholars as we recognize the roles you can play in helping the country achieve the SDGs. With the theme "*ASTHRDP: Science, Technology and Innovation Towards Achieving SDGs,*" this year's conference clearly lays out that our strategy of pushing for science, technology, and innovation remains to be the best path to take towards sustainable development.

The 2020 ASTHRDP Graduate Scholars Conference is truly a fitting venue to engage you - our dear scholars, in tackling important issues even with our current situation. We call on you to maximize this opportunity and reap the benefits of technology in making an online conference that is just as impactful as our previous conferences.

Congratulations to all our participants and we look forward to a successful conference. *Mabuhay!*

FORTUNATO T. DE LA PEÑA
SECRETARY

SCIENCE EDUCATION INSTITUTE

OFFICE OF THE DIRECTOR

My warmest greetings to the participants of the 2020 ASTHRDP Graduate Scholars Conference.

Much have changed in the world in a span of less than a year due to the COVID-19 pandemic. While our strategies may have been altered, our macro and micro goals remain, and this is true with the global commitment, that is, the Sustainable Development Goals. The Philippines, as one of the 192 countries supporting the SDGs, has integrated these global goals in its National Development Framework. Since then, the country is staying true to this promise.

In this conference, we envision our Graduate Scholars as important players in achieving our SDGs. The theme, "ASTHRDP: Science, Technology and Innovation (STI) Towards Achieving SDGs," banners the mindset that just as STI drives national development, STI likewise propel us to sustain our growth and promote inclusivity in all our efforts. We know that for us to "leave no one behind", we need to utilize science and promote its all-encompassing benefits to our people.

To this, we realize our scholars' role in being ambassadors of STI as a strategy to achieve the SDGs. This conference, hence, aims to inspire science scholars to converge and learn from experts to identify avenues where among the 17 SDGs they can contribute. We are confident that the lineup of experts we have will facilitate these goals.

SEI affirms its support to the National Science Consortium for continuously finding means to develop our scholars into change-makers. I congratulate all our participants and look forward to a successful conference.

Thank you and *mabuhay tayong lahat!*

JOSETTE T. BIYO
DIRECTOR

ACCELERATED SCIENCE AND TECHNOLOGY HUMAN RESOURCE DEVELOPMENT PROGRAM

NATIONAL SCIENCE CONSORTIUM

To the ASTHRDP Community,

Greetings and a warm welcome to the 9th ASTHRDP Graduate Scholars Conference!

We are still in the midst of the COVID-19 pandemic and have just experienced severe disruptions brought about by typhoons and floods. Many of us have been talking about resilience in the abstract. This is the time to show resilience in our research activities and objectives.

The rationale for graduate research is two-fold: first, it is a training ground for research; and second, it is an opportunity to make new contributions to science and technology. We should then ask:

- How can graduate research itself become more resilient? How can we adjust our activities and the way we do things to keep graduate research going? How can we redesign some of our research activities and protocols to make them more resilient? The holding of this virtual conference is, in fact, an expression of a resilient response to the COVID-19 pandemic.

- How can graduate research respond to the objective of creating a more resilient Philippines? The economic set-backs due to the pandemic and the typhoons show how easily our progress can be reversed. How can we adjust our objectives so that the outcomes are more resilient and sustainable?

It is said that what you do is a reflection of who you are. This is the same with our research: if we apply resilience to our research, then we ourselves will become resilient.

Best wishes to our students, faculty, and staff!

FABIAN M. DAYRIT
CHAIRPERSON

ACCELERATED SCIENCE AND TECHNOLOGY HUMAN RESOURCE DEVELOPMENT PROGRAM

NATIONAL SCIENCE CONSORTIUM

It is a pleasure and a privilege to welcome participants in the 2020 ASTHRDP Graduate Scholars Conference.

The Department of Science and Technology, the Science Education Institute and the National Science Consortium have gone to great lengths to encourage students to seek further education in the sciences and to nurture and support the aspirations of those that choose to do so. It is a distinct honor for me to be given this chance to thank them and extend this message of support and our assurance for continued patronage of their activities.

This meeting with peers and professionals in your field and in other branches of learning gives you an opportunity to share your ideas and research findings, engage in discussions, establish collaborations, make valuable contacts through networking and help you plan future directions.

I hope conferences like this become more than just an exchange of papers and ideas but opportunities for all of us to learn from each other as we face challenges together.

Thank you all for dedicating your time and effort to a worthy cause

GLENN V. ALEA
CONFERENCE CHAIR

ATENEO DE MANILA UNIVERSITY

OFFICE OF THE PRESIDENT

The role of science and technology in the achievement of the Sustainable Development Goals (SDGs) cannot be overemphasized. Of the seventeen goals, the data and insights from science and technology research directly impacts at least eight, and one can easily argue that its input is necessary for all the remaining goals.

With only ten years to 2030, the year that the global community set as the target for the SDGs, it is reassuring that the National Science Consortium and Science Education Institute chose "Science, Technology and Innovation Towards Achieving SDGs" as the theme of the 2020 Accelerated Science and Technology Human Resource Development Program (ASTHRDP) Graduate Scholars' Conference. The results of your research and the insights of the experts that you have invited have the potential of accelerating our achievement of the SDGs.

The demands of sustainable development, however, reach beyond what science and technology can offer. If we hope to address the societal and environmental issues which the SDGs represent, then the scientific, economic, and sociopolitical communities need to work together. The United Nations General Assembly itself recognizes the multidisciplinary nature of the SDGs by the inclusion of the 17th goal, Partnership for the Goals. The need for multidisciplinary and multisectoral partnerships is also evident in the experiences of the conference's plenary speakers.

May this conference inspire you, our country's science and technology scholars, not only to advance and deepen your own knowledge and expertise but to cultivate the relationships necessary to advance sustainable development in our country and the world.

ROBERT C. YAP SJ
PRESIDENT

CENTRAL LUZON STATE UNIVERSITY

OFFICE OF THE PRESIDENT

The Central Luzon State University rejoices with the Science Education Institute and the National Science Consortium for successfully organizing and holding the year nine of the Accelerated Science and Technology Human Resource Development Program (ASTHRDP) Graduate Scholars Virtual Conference.

The Corona Virus (COVID-19) Disease worldwide dashboard of the World Health Organization ranked South-East Asia as the second highest region with over seven million confirmed cases. Philippines alone has more than 300,000 confirmed cases with 6,000 recorded deaths. Its reach is continuously growing while the social and economic state of most nations are declining and is highly affecting the overall well-being of the human population. True enough, this pandemic is an unprecedented wake-up call to all of us.

Good health and well-being is only one of the 17 Sustainable Development Goals (SDGs) that calls for immediate and sustainable action from member-states of the United Nations. When health is compromised by a crisis, the attainment of others will be hampered as the SDGs are all interrelated. Thus, this undertaking provides a timely platform that can facilitate awareness, common understanding, active participation, and forging of new partnership. Through the plenary sessions and research presentations, collective efforts may transpire towards planning for a coordinated and interconnected programs and projects that will significantly address our present concerns on food security, health, and environment.

The convening of researchers, scientists and scholars today is an indication that we understand and recognize the substantial role of science, technology and innovation (STI) in this most trying time. More important than ever, there is also a need to broaden our scope of interest as scientists, not limited to agriculture, aquatic and natural resources, but possibly encompassing all 17 sustainable development goals. Promoting prosperity through the conduct of responsive programs and projects, and innovation that does no harm to the planet is the challenge. With science and technology everything becomes possible, and by working together we can make progress and deliver positive results.

EDGAR A. ORDEN
PRESIDENT

DE LA SALLE UNIVERSITY

OFFICE OF THE PRESIDENT

Greetings!

With great pleasure I welcome and congratulate the participants in this year's ASTHRDP Graduate Scholars Conference.

This conference will give you an opportunity to share the results of your research, exchange ideas and engage in discussion with experts and with your fellow scholars. It's important to stay connected with your colleagues and be abreast with developments in your field as well as in other areas of study.

By choosing to seek further education in the sciences you will be active partners in the universal effort to find ways to cope with and address challenges that have become increasingly complex and difficult. Your roles as scientists, educators and future influencers will even be more vital now that we are in the midst of a pandemic that is triggering some drastic transformations in our day to day lives and disrupting global movements and economy.

I would also like to take this opportunity to extend my appreciation and gratitude to the Department of Science and Technology, through the Science Education Institute and the National Science Consortium for the initiatives you have instigated and the efforts you continue to take to encourage those who are able and help them realize their full potentials by supporting them through the journey and for giving them opportunities for knowledge exchange and networking.

I wish you all a successful and productive meeting.

RAYMUNDO B. SUPLIDO
PRESIDENT

MINDANAO STATE UNIVERSITY -
ILIGAN INSTITUTE OF TECHNOLOGY

OFFICE OF THE CHANCELLOR

My warmest greetings to the organizers and participants of the DOST -Science Education Institute's Accelerated Science and Technology Human Resource Development Program (ASTHRDP) National Science Consortium -Graduate Scholars Virtual Conference.

The ASTHRDP, since its inception, has been producing high caliber graduate scholars who excel academically here and abroad. With the conduct of this Graduate Scholars Virtual Conference, ASTHRDP shows that it is not allowing the challenges facing us today to postpone its mission.

I am optimistic that through this event, educators and researchers can discuss and share ideas on incorporating science and technology towards the achievement of the sustainable development goals (SDGs) and that it can empower research studies for national and global competitiveness.

I wish you great success in your conference!

SUKARNO D. TANGGOL
CHANCELLOR

UNIVERSITY OF THE PHILIPPINES - DILIMAN

OFFICE OF THE CHANCELLOR

Welcome, scholars, participants, and experts to "ASTHRDP: Science, Technology and Innovation Towards Achieving SDGs" organized by the DOST-Science Education Institute and National Science Consortium.

This two-day conference comes at a critical time when science and technology is playing a huge role amid a global pandemic. The move to an online format just proves that there are new approaches worth exploring as we collectively strengthen S&T in the Philippines. With support from DOST-SEI and ASTHRDP-NSC, scholars, faculty, and researchers can continue their studies and research work, especially to address our country's problems. This annual conference shows us just how valuable these scholarships are for stirring innovation in Biotechnology, Environmental Sciences, Mathematics, and other priority areas. Your individual and collaborative efforts in this conference and far beyond will help set the foundations for a better innovation and R&D community that will meet the challenges of the SDGs.

The theme of sustainable development allows everyone to address some of the most crucial issues that surround us today. I hope that the following talks, presentations, and discussions will motivate many others to contribute their knowledge and skills for the growth of science and technology in the country.

Congratulations to the participants!

FIDEL R. NEMENZO
CHANCELLOR

UNIVERSITY OF THE PHILIPPINES - LOS BANOS

OFFICE OF THE CHANCELLOR

I am pleased to welcome all guests, faculty members, and scholars to this year's Accelerated Science and Technology Human Resource Development Program-National Science Consortium (ASTHRDP-NSC) Graduate Scholars' Conference (Year 9). The conference for this year will be unique as it will be held via an online platform due to the pandemic.

The government and the NSC, through this conference, have established an environment conducive for innovation through the development of S and T human capital and a rich diversity of scientific talents. Our strengths in research and development will put the Philippine economy in good stead to compete globally for investments needed to open up new growth areas and create good jobs for our people.

The conference theme for this year, "ASTHRDP: Science, Technology and Innovation Towards Achieving SDGs" highlights the significant role that S and T innovation plays in realizing the UN-mandated sustainable development goals.

As a platform consolidating science and technology human resources, this conference will significantly contribute to the realization of the SDGs by opening bridges of collaboration among like-minded individuals and organizations.

Such collaborative efforts and cooperative measures are more important than ever especially in this time of pandemic. If we are to make the SDGs a reality, we must as scientists and scholars be united in supporting science- and evidence-based policies and policy-making processes.

I congratulate all our participants and look forward to a successful conference.

JOSE V. CAMACHO JR.
CHANCELLOR

UNIVERSITY OF THE PHILIPPINES - MANILA

OFFICE OF THE CHANCELLOR

Congratulations to the Department of Science and Technology-Science Education Institute (DOST-SEI) and the National Science Consortium (NSC) on the holding of the 2020 Accelerated Science and Technology Human Resource Development Program (ASTHRDP) Graduate Scholars' Conference which is now on its 9th year. We expect around 450 participants composed of plenary speakers from different scientific fields and DOST scholars and faculty members from NSC member universities.

The theme, "ASTHRDP: Science, Technology and Innovation Towards Achieving the SDGs" signifies the important role of science and technology in attaining the targets of the Sustainable Development Goals within the prescribed period. It recognizes that the extent to which developing countries can achieve progress and development in major SDG areas depends on their capacity to generate, harness, and apply science and technology within a conducive and facilitative environment.

The Philippines has for decades been grappling with low S and T budget and recognition, but in recent years has witnessed several initiatives and programs to fast track their advancement. The government, through the DOST and other research institutions, has implemented programs in human resource development through scholarships and dissertation grants, trainings, and Balik Scientist; development of a harmonized national S and T research and development agenda; increased funding for researches, policies and strategies; technology transfer through its Tuklas Lunas program; and facilities build up.

Today, Filipinos are benefitting from the technologies and innovations from such programs. Some recent innovations include the development of diagnostic kits, Biotek M. Aqua for dengue and Gen Amplify RT-PCR test for the Covid 19 virus, Medical Implant: Axis Knee System, vigormin which are organo minerals for treating wastewater and neutralizing odor from organic waste in landfill or material recovery facilities, and Biofertilizers and Plant Growth Enhancers.

The education sector plays a vital role in consolidating the gainsin S and T endeavors through continued nurturing and training of its students, faculty members, and research staff who are the main workforce for scientific projects and activities. The dynamic collaboration between the academe, exemplified by UP Manila as the Health Sciences Center, government, and industry remains a key aspect of success in S and T development and utilization.

This conference comes at a most opportune time while the country is still grappling with the adverse effects of this pandemic. It is a valuable occasion to present and disseminate the researches of the scholars and guest participants that will generate opportunities for their translation into usable forms.

Our commendations go to the SEI and NSC for continuing to provide platforms for our scientists to engage, interact, and network for more breaks and prospects towards furthering their scientific pursuitsthat will contribute to the achievement of the country's SDG goals and targets. May the Almighty continue to inspire, guide, and fortify all participants to pursue worthy goals for our country!

CARMENCITA D. PADILLA
CHANCELLOR

UNIVERSITY OF THE PHILIPPINES - VISAYAS

OFFICE OF THE CHANCELLOR

My warmest greetings to all participants tothe 9th ASTHRDP Graduate Scholars' Virtual Conference!

UP Visayas is proud to be part of the National Science Consortium (NSC), which is supported by the Accelerated Science & Technology Human Resource Development Program (ASTHRDP) – one of the country's leading programs in science and technology education.

This annual conference is dedicated to providing opportunities for many of the country's most promising minds. This year's theme, *Science, Technology, and Innovation Towards Achieving SDGs,* fits perfectly with the circumstances the country now finds itself in. 2020 is proving how vital it is to think innovatively, while ensuring that the systems we create can endure through time.

This year's virtual conference brings together 450 scholars from all over the country. Itis a rare opportunity for the scientific community to come together and to reinforce our scientific capacity and research culture. With the pandemic still very much upon us, I can think of no better way --- and indeed, no better time --- to renew our faith in science.

For it is to science that we must turn, for clarity in these for bidding times.

I am convinced that we will greatly benefit from the wealth of ideas that will come out of this conference. With an impressive agenda and a distinguished panel of presenters, this two-day conference promises to bestimulating.

Congratulations then to the organizers for their hard work and determined efforts. To the participants, I wish you all a productive and insightful conference!

CLEMENT C. CAMPOSANO
CHANCELLOR

UNIVERSITY OF SAN CARLOS

OFFICE OF THE PRESIDENT

Warm greetings to all!

I am honored to convey a message to the participants and organizers of ASTHRDP Graduate Scholars Virtual Conference. I suppose that, like many other conferences conducted online due to the pandemic, this conference is one for the books in the history of ASTHRDP. Congratulations therefore!

COVID-19 is a great disruptor and a game-changer. It has turned our way of life upside down, but it has also taught us many valuable lessons. Despite humanity's breakthrough discoveries, landmark advances and cutting-edge innovations in science and technology, we have been humbled by something as tiny and as basic as the virus. In a way, we have been educated.

The pandemic can be a watershed experience for us, a moment of realization that much still needs to be done, that although we can be out of our depth momentarily, but we can also wise up to do more and care more.

In education, the talk is about lifelong learning. With the pandemic, we might have to shift our conversation to life-learning. The former points to the enduring effort we put into learning and the timelessness of education. The latter, however, takes us to the profundity and meaning of what we need to know and why.

Science and technology need such input in the same manner that the medical experts working non-stop to develop COVID-19 vaccine have come to understand the importance of their work and why it matters.

May this conference make you ask the why of science and technology, not just the how or the what.

NARCISO CELLAN JR.
PRESIDENT

UNIVERSITY OF SANTO TOMAS

OFFICE OF THE RECTOR

Scientific research is an integral part of education since it contributes immensely to the development of society. It has made life better and easier via innovations and breakthroughs which continue to change the landscape of knowledge acquisition and knowledge production. Now, more than ever, in the time of the Covid-19 pandemic, science plays a very important role in addresing issues that affect humanity. This is a period in which scientists race against time to find a potential cure to those infected with the virus which has led to a staggering number of deaths worldwide. This is precisely the reason why scientists and academics convene on a regular basis through sminars, workshops, and conferences in order to provide an update on the latest scientific advances that will ultimately provide viable solutions to pressing concerns.

The Science Education Institute and the National Science Consortium will be holding the 9th Accelerated Science and Technology Human Resource Development Program (ASTHRDP) Graduate Scholars Virtual Conference on November 26-27, 2020. The theme for this conference is indeed very apt - ***ASTHRDP: Science, Technology, Innovation Towards Achieving SDGs,*** since it explores numerous possibilities and alternatives as well as examine new knowledge, current technology, and cutting-edge innovation that are said to be the shape of things to come. This caucus will bring together scientists, experts, academics, scholars, researchers, and students who will present various research projects through plenary talks, lectures, and in oral and poster presentations. On behalf of Rev. Fr. Richard G. Ang, O.P., Rector of the University of Santo Tomas, I would like to extend my heartfelt congratulations to the organizers and participants to this year's ASTHRDP Graduate Scholars Conference and may this gathering be both fruitful and meaningful as well as inspire graduate scholars to aspire for greater things.

ISAIS D. TIONGCO
VICE RECTOR

VISAYAS STATE UNIVERSITY

OFFICE OF THE PRESIDENT

Greetings from the Visayas State University!

It is a humbling opportunity to welcome the brilliant ASTHRDP Graduate scholars to this year's virtual conference.

The ASTHRDP program of the DOST has long been supporting the development of the country by giving opportunities to our deserving scholars to hone their capabilities and innovativeness in research and development.

We, in VSU, are grateful for the partnership and support given by ASTHRDP-NSC in enabling our faculty and staff developed their potentials.

This year we embark on the theme "ASTHRDP: Science, Technology, and Innovation towards Achieving SDGs." As the country and the rest of the world battles for various crisis and sustainability, may this conference shed light on the possible solutions as well as the important contribution of S&T and innovation in addressing these dire challenges.

To the ASTHRDP-NSC scholars and participants, may you be able to learn, engage, and take advantage of this conference. I am rooting for your success and I am looking forward to our encounters in leading country's development.

I offer my congratulations to the organizers of this event. It would indeed be a great pleasure to see the developments arising from this important gathering.

Mabuhay!

EDGARDO E. TULIN
PRESIDENT

About ASTHRDP

The Accelerated Science and Technology Human Resource Program is a graduate program being implemented by the Department of Science and Technology (DOST) through the Science Education Institute (SEI). The program offers scholarships for master's and doctoral degrees in priority S&T areas. The primary objective of the program is to improve the country's global competitiveness and capability to innovate through S&T and to accelerate the production of high-level human resources needed for Research and Development (R&D) in S&T.

About NSC

The National Science Consortium (NSC) is a consortium of eleven (11) Universities, namely, the Ateneo de Manila University (ADMU), Central Luzon State University (CLSU), De La Salle University (DLSU), Mindanao State University-Iligan Institute of Technology (MSU-IIT), University of the Philippines Diliman (UPD), University of the Philippines Los Baños (UPLB), University of the Philippines Manila (UPM), University of the Philippines Visayas (UPV), University of San Carlos (USC), University of Santo Tomas (UST), and Visayas State University (VSU).

The NSC was created to develop, support, and coordinate national programs for high quality science education through innovative alternative schemes. The DOST-SEI in collaboration with the NSC aims to:

- To accelerate the development of high-level human resources in basic, applied sciences and mathematics for the country's sustainability and competitiveness;
- To share resources and exchange information though collaborative academic and research activities to produce technically competent MS and PhD graduates;
- To develop and achieve national standards of technical competence of trained MS and PhD graduates in the basic and other applied sciences and mathematics; and
- To establish a dynamic system of sharing expertise, knowledge, facilities and other resources through collaborations, join conferences, and other innovative modes to strengthen partnerships among consortium member institutions.

NSC-STEERING COUNCIL

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- **DR. FABIAN M. DAYRIT**
  Ateneo De Manila University

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  University of San Carlos
- **DR. MARIBEL G. NONATO**
  University of Santo Tomas
- **DR. VICTOR B. ASIO**
  Visayas State University

IN RETROSPECT

Level Up to Level All: Science as Platform for Industry 4.0

ASTHRDP GRADUATE SCHOLARS CONFERENCE

Year 8

Department of Science and Technology
SCIENCE EDUCATION INSTITUTE

May 2-3, 2019
Philippine International Convention Center
Pasay City

ASTHRDP Graduate Scholars Conference - Year 8

Level Up to Level All: Science as Platform for Industry 4.0

10 PhD ASTHRDP scholars and finalists to the Fast-Talk competion together with the ASTHRDP-NSC Chair Dr. Fabian Dayrit, SEI Director Dr. Josette T. Biyo, and SEI Deputy Director Engr. Albert Mariño

In the increasing pace of technological change and globalization, the Accelerated Science and Technology Human Resource Development Program-National Science Consortium (ASTHRDP-NSC) conducted the 2019 Graduate Scholars' Conference Year 8 with a theme "Level Up to Level All: Science as Platform for Industry 4.0".

The scientific conference gave way the 442 MS and PhD scholar-graduates and faculty members from the consortium universities in the basic and applied sciences interaction with their co-scholars and mentors through oral and poster presentation.

ASTHRDP Graduate Scholars Conference - Year 8

Level Up to Level All: Science as Platform for Industry 4.0

Cutting of Ribbon and Opening of Poster Exhibit by DOST ASec. Leah Buendia, SEI Deputy Director Engr. Albert Mariño, DTI USec. Rafaelita Aldaba, and ASTHRDP-NSC Chair Dr. Fabian Dayrit, together with the ASTHRDP-NSC Project Leaders.

Dr. Rafaelita Aldaba, Undersecretary for Competitiveness and Innovation of the Department of Trade and Industry, Keynote Speaker of the conference, gave a presentation of the readiness of Philippine Industries for Industry 4.0, what are the gaps in the innovation and entrepreneurship ecosystems and what needs to be done to bridge the gaps.

Dr. Joseph Frohlich of the Austria Institute of Technology, one of the plenary speakers, talks about the 4.0 Policy Strategies and the Role of the Universities.

Dr. Johnson Ong Chee Bin, an AU-QA Expert, discussed the 4Cs Framework to Transform Higher Education Institution into an Innovation Producing Ecosystem.

Dr. Noor Amila Wan Abdullah Zawawi, Director, Institute of Self-Sustainable Building, Universiti Teknologi Petronas, Malaysia, gave her thoughts on Self-Sustainable Building.

Dr. Celia Reyes, President, Philippine Institute of Development Studies, gave a presentation on the Fourth Industrial Revolution and Implications on S&T Higher Education and Human Capital

The 2-day conference provided the participants access to current developments in science and technology from local and international experts on the use of enabling technology, in particular, information and communications technology or the internet-of-things (IoT).

ASTHRDP Scholars Conference Held Virtually

The new normal "class picture" of the participants and guests led by DOST Secretary Fortunato T. de la Peña of the 2020 ASTHRDP Graduate Scholars Conference

For the first time in its 9 years of implementation, the Accelerated Science and Technology Human Resource Development Program (ASTHRDP) Scholars' Conference was held virtually on November 26-27, 2020 via Zoom. Also for the first time, it was part of the National Science and Technology Week celebration.

To give emphasis to the global call for achieving sustainable development goals (SDGs), the theme of the 2020 ASTHRDP Graduate Scholars Conference – Year 9 titled "ASTHRDP: Science, Technology, and Innovation Towards Achieving SDGs" directed the graduate scholars' focus on using science, technology and innovation towards achieving the 17-point goals.

More than 500 ASTHRDP scholars and their research advisers gathered online to discuss and foster strategic ideas, and forge collaborations geared at achieving SDGs through their researches.

In his message to the scholars, DOST Secretary Fortunato T. de la Peña affirmed DOST's commitment to contribute to achieving the SDG goals through community empowerment with its programs like the Niche Centers in the Regions for R&D (NICER) program and its human resource development programs.

Secretary de la Peña highlighted 4 goals that are relevant to the S&T community: global competitiveness; improving the value chain particularly to help the regional industries and other productive sectors; developing world-class human resources; and promoting S&T in the creative arts as a way of inclusive development.

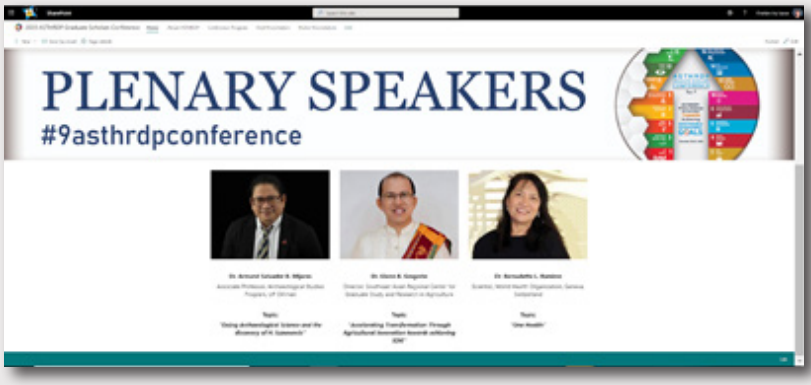
He invited the scholars to contribute to achieving the SDGs through their researches and that no contribution is small.

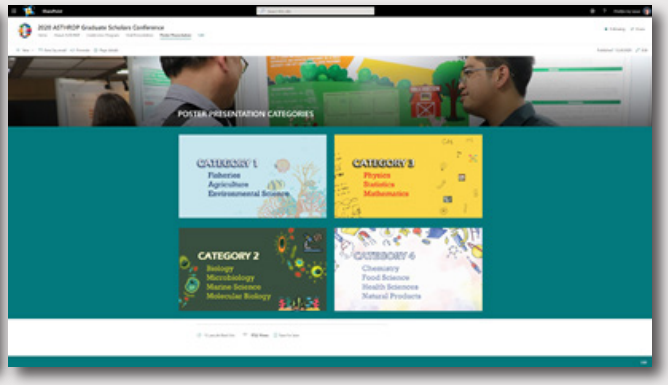
Dr. Armand Salvador B. Mijares, Associate Professor, Archaeological Studies Program at the University of the Philippines Diliman, talked on "Doing Archaeological Science and the Discovery of H. luzonensis."; Dr. Glenn B. Gregorio, Director of the Southeast Asian Regional Center for Graduate Study and Research in Agriculture, discussed about "Accelerating Transformation Through Agricultural Innovation"; and Dr. Bernadette L. Ramirez, a Scientist with the World Health Organization (WHO) in Geneva, Switzerland, shared about the various WHO programs through her talk on "One Health."

The morning session was highlighted with plenary talks by experts in the region and abroad along the areas of archaeology; agriculture, particularly in rice and crop breeding; and health sciences.

Sixty PhD and 264 MS scholars/scholar-graduates presented their researches in Parallel Oral Sessions and Poster Sessions, respectively, in the afternoon session of Day 1.

Top-Left: Dr. Renante Violanda, faculty from USC and moderator in the Parallel Session 5 introducing the scholar-presenters. Bottom-Left: Open Forum with Dr. Maribel Nonato, ASTHRDP-NSC Project Leader of UST and PhD scholar-presenter Ms. Rhanney Gonzales from DLSU. Right: Mr. Carlo Pelotenia, PhD scholar from DLSU presenting his research in one of the oral breakout sessions.

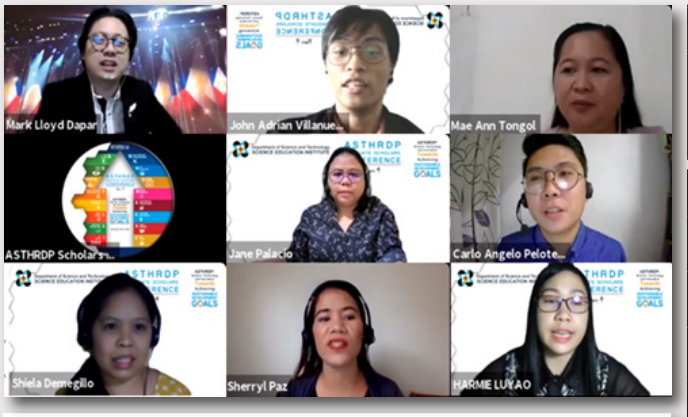




The first conference website was launched and served as the venue of the technical poster session. An instructional video was provided on how to access the website.

Day 2 of the conference featured the Elevator Pitch Competition. The top 9 oral presenters from the Oral Parallel Sessions gave 3-minute pitch of their researches in a plenary session.

The following scholar-participants were identified as best 3 presenters in the Elevator Pitch Competition and the best poster presenters in the four poster categories and were awarded Certificate of Achievement and cash prizes:



Top 9 Finalist of the Elevator Pitch Competition in order of presentation Top-Left to Bottom-Right Mr. Mark Lloyd Dapar-PhD Biology at UST, Mr. John Adrian Villanueva-PhD Physics at UPD, Ms. Mae Ann Tongol-PhD Animal Science at VSU, Mr. Khris June Callano-PhD Horticulture at UPLB, Ms. Jane Palacio-PhD Mathematics at UPD, Mr. Carlo Angelo Pelotenia-PhD Physics at DLSU, Ms. Sheila Demegillo-PhD Mathematics at MSUIIT, Ms. Sherryl Paz-PhD Environmental Science at UPLB, and Ms. Harmie Luyao-PhD Chemistry at MSUIIT.

Elevator Pitch Competition Best Presenters

1. Mr. Carlo Angelo Pelotenia - PhD Physics, DLSU
2. Ms. Harmie Luyao - PhD Chemistry, MSUIIT
3. John Adrian Villanueva - PhD, Physics, UP Diliman

Technical Poster Competition Winners

Category 1: Agriculture, Fisheries, Environmental Science	1st	**Mr. Marco Polo Ibañez** *MS Atmospheric Science, ADMU*
	2nd	**Ms. Diana Mae Calde** *MS Meteorology, UP Diliman*
	3rd	**Ms. Marlyn Entuna** *MS Soil Science, VSU*
Category 2: Biology, Marine Science, Microbiology, Molecular Biology	1st	**Mr. Lawrence Uy** *MS Molecular Bio. and Biotech., UP Los Baños*
	2nd	**Ms. Genea Nichole G. Corte** *MS Biology, UST*
	3rd	**Ms. Gela Myan S. Bueno** *MS Molecular Bio. and Biotech., UP Los Baños*
Category 3: Mathematics, Statistics, Physics	1st	**Mr. Rolex Teologia** *MS Mathematics, MSU-IIT*
	2nd	**Ms. Aixeen Fontanilla** *MS Applied Physics, UST*
	3rd	**Mr. Kurt Irvin Rojas** *MS Physics, DLSU*
Category 4: Chemistry, Natural Products, Food Science, Health Sciences	1st	**Mr. John Edward Zapater** *MS Agricultural Chemistry, UP Los Baños*
	2nd	**Ms. Kim Marie Sisican** *MS Materials Science and Engineering, UP Diliman*
	3rd	**Mr. Brandon Cyril Lira** *MS Chemistry, DLSU*

Dr. Glenn Alea, ASTHRDP-NSC Project Leader at DLSU and Conference Chair, closed the conference with a synthesis of the 2-day activities and a message of thanks to all the participants and working committees of the Conference.

PLENARY SPEAKERS

DR. ARMAND SALVADOR B. MIJARES

University of the Philippines - Diliman

PLENARY SPEAKER

DR. ARMAND SALVADOR B. MIJARES earned his Bachelor of Arts in Development Studies at the University of the Philippines in 1988. He later acquired his Master of Arts in Anthropology and a Diploma degree in Archaeology in the same university in 1995 and 1997, respectively.

Dr. Mijares was a recipient of various scholarships and awards. In 2016, he was recognized as the "Philippines Promising Star Awards" by the Thomson Reuters and Commission on Higher Education (CHED) for his world class research. And just recently, an International Publication Award for his paper titled "A New Species of Homo from the Late Pleistocene of the Philippines. Nature", and Centennial Faculty Grantee were both awarded to him by the University of the Philippines Diliman.

Dr. Mijares was a Fulbright-Hays Scholarship awardee for the pursuance of his MS in Anthropology major in Archaeology with distinction at the University of New Mexico in the USA in 2001. In 2006, he was also granted an International Post Graduate Research Scholarship and Australian University PhD University Scholarship at the Australian National University in Canberra, Australia where he finished his PhD in Archaeology and Paleoanthropology.

Since October 2019, Dr. Mijares has been a reviewer at the National Geographic Society Grant Proposals and became a Member Editorial Board for the World Archaeology Journal at the Routledge Publication in November 2019.

Dr. Mijares has mentored several MS and PhD students from the different universities in the country. He also made several publications in the International Refereed Journal (ISI) and Referred Local Journal Articles, and has released several International and Local Books both in single and joint authorships.

Currently, Dr. Mijares is a Professor at the Archaeological Studies Program and Head of the Plant and Sediment Laboratories and Ceramic Laboratory at the University of the Philippines. He is also a regular member of the National Research Council of the Philippines.

GLENN B. GREGORIO

Southeast Asian Regional Center for Graduate Study and Research in Agriculture

PLENARY SPEAKER

DR. GLENN B. GREGORIO obtained his Ph.D. in Genetics, minor in Statistics and MS in Plant Breeding at UPLB. He was born and educated at Central Mindanao University, Musuan, Bukidnon for this Elementary and High School. His career was developed at the International Rice Research Institute (IRRI) as researcher, where he later served as Post-Doctoral Fellow and assumed various research positions, including International Research Fellow, Scientist, Senior Scientist, and Deputy Division Head of IRRI's Plant Breeding Genetics and Biotechnology Division. At IRRI, he worked on rice breeding for tolerance to saline-prone and problem soils, and as Coordinator for varietal development pipeline cross-cutting R&D. He also had a three-year stint as crop breeding manager for corn at East-West Seed Company. Currently, he is a professor at the Institute of Crop Science, College of Agriculture and Food Science at UPLB and the Director of the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA). He has been recently appointed as Chairperson of the Technical Panel for Agriculture, Commission of Higher Education (CHED), and steering committee member of the Philippines Department of Agriculture Biotechnology Program.

Dr. Gregorio has published 107 peer-reviewed journals, 14 book chapters/manuals/policy papers, and proceedings. with an H-Index of 43 and 7,541 citations. His numerous awards include the following: Ten Outstanding Youth Scientists of the Philippines (TOYS 1980); Outstanding Young Scientist (OYS 2004) in the field of Genetics; Crop Science Society of the Philippines Achievement Award for Crop Science Research (2004); Honorary Foreign Scientist of the Rural Development Administration (RDA) Award of Korea (2002-2005); The Outstanding Young Men (TOYM 2004) Philippines; Ho Chi Minh Medal for "Having Great Contribution to the Cause of Agriculture and Rural Development of Vietnam" (2012); Crop Science Achievement Award in Research Management (2014); and Crop Science of the Philippines Honorary Fellow in 2019. Dr. Gregorio was also conferred the rank of Academician of NAST-Philippines in 2018. Most recently, he was awarded as 2020 UPLB College of Agriculture and Food Science Distinguished Alumnus for Rice Chemistry and Food Science Research.

DR. BERNADETTE L. RAMIREZ

World Health Organization, Geneva, Switzerland

PLENARY SPEAKER

DR. BERNADETTE L. RAMIREZ is based at WHO Headquarters in Geneva, Switzerland. She coordinates and manages TDR's work in the area of vector-borne diseases in the context of the changing environment, including climate change. TDR's current efforts are focused on research capacity building for operationalizing One Health in 5 countries in Africa (Cote d'Ivoire, Kenya, Mauritania, South Africa and Tanzania). She also manages TDR's research portfolio on health and environment in South East Asia and Western Pacific Regions.

Bernadette did her PhD research in Molecular Immunology at the Programme in Cell, Molecular and Developmental Biology, College of Medicine, Brown University, Providence, Rhode Island, USA under the US Fulbright Programme. She received her BS and Masters degrees in Biological Science from the University of the Philippines and the University of Santo Tomas, respectively.

Prior to joining WHO in 2007, she was the Director of the Institute for Biotechnology and Molecular Biology, National Institutes of Health, University of the Philippines-Manila (UPM). She was also Professor and Vice-Chair (for Research) at the Department of Biochemistry & Molecular Biology, College of Medicine, UPM; and Adjunct Professor, Institute of International Health, Michigan State University, East Lansing, Michigan, USA.

ABSTRACTS

ORAL PRESENTATIONS

TIME	SESSION NO.	NAME	TITLE	SCHOOL
BIOLOGY/GENETICS				
1:30 - 1:45	PS1-1	Llara M. Siglos	Assemblages of Freshwater Snails (Mollusca: Gastropoda) from Selected Rivers in Zamboanga City and Isabela City, Basilan	ADMU
1:45 - 2:00	PS1-2	Nickel Jean S. Lagare	Resolving the Mysterious Freshwater Crab Isolapotamon Bott, 1968 (Decapoda, Brachyura, Potamidae) from Mindanao, with Notes on the Philippine Isolapotamon Species	MSU-IIT
2:00 - 2:15	PS1-3	Dulce Marie P. Nisperos	Stomach Content Analysis and Molecular Identification of Prey Species of the Rice Paddy Eel, Monopterus Albus in Luzon, Philippines	DLSU
2:15- 2:30	PS1-4	Adriano R. Melendres Jr.	Integrated Culture of Commercially Important Seaweed *Eucheuma denticulatum* and *Bivalves Perna viridis* and *Crassostrea* Sp. besides Commercial Fish Farm using IMTA Approach in Carcar Bay, Cebu, Philippines	USC
2:30 - 2:45	PS1-5	Mark Lloyd G. Dapar	Quantitative Ethnopharmacological Documentation and Molecular Confirmation of Medicinal Plants Used by the Manobo Tribe of Agusan Del Sur, Philippines	UST
2:45 - 3:00	PS1-6	Priscilla Hope P. Swann	Determination of Pesticide Use and Perceptions of Farmers in Laguna, Philippines	DLSU
3:00 - 3:15	PS1-7	Cecilia Diana O. Calapit-Palao	Characterization and Development of Microsatellite Markers From RNA-SEQ Data of Abaca (*Musa textilis* Nee) cv. Abuab	UPLB
3:15 - 3:30	PS1-8	Derick Erl P. Sumalapao	Polymeric Compositions of Medical Devices Account for the Variations in *Candida albicans* Biofilm Structural Morphology	UPM
CHEMISTRY/FOOD SCIENCE				
1:30 - 1:45	PS2-1	Yusoph C. Manalundong II	Bioactive Ceramide Derivatives from the Philippine Marine Sponge *Stelodoryx procera* Topsent 1904	MSU-IIT
1:45 - 2:00	PS2-2	Aldrin P. Bonto	Spatial Distribution of Iron in Ultrasonic-Treated Fortified Rice Using Synchrotron X-ray Fluorescence Microscopy	DLSU
2:00 - 2:15	PS2-3	Remmer L. Salas	Design and Synthesis of a New Group of Histidine-Based Peptidomimetics with Potent Antibacterial Activity	UPD
2:15- 2:30	PS2-4	Eiza S. Florentino	Experimental Manifestation of π-d Interaction in Axially-Ligated Metallophthalocyanine Magnetic Conducting Molecular System via M(Pc)Br_2(M = Fe, Ru) Radical Solution Spectra	DLSU
2:30 - 2:45	PS2-5	Roeve Ann Mae C. Mazo	Scalardysin B And β-Sitosterol from Philippine Marine Sponge Biemna *sp.*	MSU-IIT
2:45 - 3:00	PS2-6	Rhanney L. Gonzales	Sterols from *Echinopsis oxygona (Link) Zucc. Ex Pfeiff*	DLSU

TIME	SESSION NO.	NAME	TITLE	SCHOOL
CHEMISTRY/FOOD SCIENCE				
3:00 - 3:15	PS2-7	Criselda B. Inot	Physico-Chemical Characterization, Bioactive Compounds and Antioxidant Activity of Water Apple [*Syzygium aqueum* (Burm.F.) Alston] Fruit	UPLB
3:15 - 3:30	PS2-8	Harmie N. Luyao	Discovery of Cytotoxic Natural Products from the Philippine Marine Sponge *Paratetilla* sp.	MSU-IIT
ANIMAL SCIENCE/FISHERIES/ENTOMOLOGY				
3:30 - 3:45	PS2-9	Manuel D. Gacutan Jr.	Feeding Evaluation of Yellow Corn Sprouts as Supplement for Dairy Buffaloes in Transition Period to Peak Lactation	UPLB
3:45 - 4:00	PS2-10	Liberty N. Espectato	Knowledge, Attitude and Practices (KAP) of the Community on the Role of the Inter-Local Government Unit Alliance in Coastal Resource Management	UPV
4:00 - 4:15	PS2-11	Angie R. Poliquit	Genetic Parameters of Production Traits in Japanese Quail (*Coturnix japonica* Temminck & Schlegel, 1849)	UPLB
4:15 - 4:30	PS2-12	Mae Ann S. Tongol	Intake and *In Vivo* Digestibility of Fortified Sugarcane Tops-Based Pellets Supplemented with Concentrates and *Arachis pintoi* (Krap. & Greg.) at Varying Ratios in Goats	VSU
4:30 - 4:45	PS2-13	Gina D. Balleras	Establishment of *Beauveria bassiana* and *Metarhizium anisopliae* as Endophytic Entomopathogens in Rice and It's Effects on Plant Biomass and Brown Planthopper Mortality Rate	UPLB
MATHEMATICS				
1:30 - 1:45	PS3-1	Jimboy R. Albaracin	On Inverse Limit of BE-Algebras	MSU-IIT
1:45 - 2:00	PS3-2	John Rafael M. Antalan	On Computation of Some Distance-Based Topological Indices for Multiplicative Circulant Networks	DLSU
2:00 - 2:15	PS3-3	Bryan S. Hernandez	Multistationarity of Power-Law Kinetic Systems and Fundamental Decompositions of Chemical Reaction Networks	UPD
2:15 - 2:30	PS3-4	Rohaima M. Amairanto	Hyper Homomorphisms and Hyper Product of Hyper Up-Algebras	MSU-IIT
2:30 - 2:45	PS3-5	Lauro L. Fontanil	Decomposition of Chemical Reaction Networks	DLSU
2:45 - 3:00	PS3-6	Jane D. Palacio	Coverability of Bi-Infinite Sequences and Subshifts	UPD
3:00 - 3:15	PS3-7	Michelle T. Panganduyon	A Topology on a Hyper BCI-Algebra via Left Application of a Hyper Order	MSU-IIT
3:15 - 3:30	PS3-8	Daryl M. Magpantay	S-Invariant Termwise Addition of Reactions (STAR) Tansformations of Chemical Kinetic Systems	DLSU
3:30 - 3:45	PS3-9	Mark Lexter D. De Lara	Ambient Automorphisms of Knotted Subgroups	UPD

TIME	SESSION NO.	NAME	TITLE	SCHOOL
MATHEMATICS				
3:45 - 4:00	PS3-10	Ricky F. Rulete	Backwards ITÔ-Henstock Integral for the Hilbert-Schmidt-Valued Stochastic Process	MSU-IIT
4:00 - 4:15	PS3-11	Shiela S. Demegillo	Tilings and Numeration System Induced by Four-Fold Rotational Beta Transformation in Two Dimensions	UPD
4:15 - 4:30	PS3-12	Daven S. Sevilleno	On Independent Transversal Domination in the Join Corona and Composition of Graphs	MSU-IIT
ENVIRONMENTAL SCIENCE				
1:30 - 1:45	PS4-1	Emerson L. Bergonio	Socioecological Analysis of *Otolithes ruber* Fishery Under Varying Institutional Arrangements in San Miguel Bay, Philippines	UPLB
1:45 - 2:00	PS4-2	Joseph Paul T. Abad	Soil Quality Evaluation on Selected Agricultural Lands of Tarlac Province	CLSU
2:00 - 2:15	PS4-3	Mheda G. Garcia	Towards the Development of a Holistic Instrument for Evaluating EIA Systems	UPLB
2:15- 2:30	PS4-4	David Y. Fomegas	Potential Nanoremediation of Some Heavy Metals Using Synthesized Zeolite-Chitosan-Silica Nanocomposite	CLSU
2:30 - 2:45	PS4-5	Maria Kristina O. Paler	Microplastics occurrence in *Siganus spp.* from Eastern Tañon Strait, Central Philippines and its Histopathological Effects on the Juvenile *Siganus guttatus* (*Bloch*, 1787)	UPLB
2:45 - 3:00	PS4-6	Marilou M. Sarong	Nanophytoremediation of Heavy Metal Polluted Soil Utilizing Biochar-Nanocomposite	CLSU
3:00 - 3:15	PS4-7	Sherryl L. Paz	Drivers and Patterns of Wildlife Hunting and Trade in Two Selected Protected Areas in Caraga Region, Mindanao Island, Philippines	UPLB
HORTICULTURE/PLANT BREEDING/AGRONOMY				
3:15 - 3:30	PS4-8	Richielda R. Sumalinog	Physicochemical Characteristics of Cut Chrysanthemum (*Chrysanthemum morifolium ramat*) Flowers as Influenced by Hydration during Transport and Floral Preservatives	VSU
3:30 - 3:45	PS4-9	Khris June L. Callano	Cytogenetics of *Solanum aethiopicum* L., *S. Melongena* L. and their F_1 Hybrids and the Mechanism of Hybrid Breakdown	UPLB
3:45 - 4:00	PS4-10	Alvin D. Palanog	Important Genomic Regions for Zinc, Grain Yield, and Agronomic Traits in Rice (*Oryza sativa* L.) Unveild Using Connected Populations	UPLB

TIME	SESSION NO.	NAME	TITLE	SCHOOL
ENVIRONMENTAL SCIENCE				
4:00 - 4:15	PS4-11	Leif Marvin R. Gonzales	Physico-Chemical, Biochemical, and Physiological Properties of Eggplant (*Solanum melongena* L.) Fruits as Influenced by Alginate-Based Edible Coating Enriched with Essential Oils	VSU
4:15 - 4:30	PS4-12	Jerry B. Sanguillosa	Agro-Morphological Characterization of Selected Philippine Traditional Maize (*Zea mays* L.) Populations	UPLB
4:30 - 4:45	PS4-13	Minerva L. Gaurana-Nuñez	Physiological, Biochemical and Molecular Characterization of Selected Rainfed Lowland Rice (*Oryza sativa* L.) Genotypes Under Drought Condition	UPLB
PHYSICS/MATERIALS SCIENCE AND ENGINEERING				
1:30 - 1:45	PS5-1	Al Otayde Advincula	Morphology and Conductivity of Electropolymerized Polypyrrole/Low-Density Silver-Coated Spherical Granular Matter Composite Films	ADMU
1:45 - 2:00	PS5-2	Jessalyn C. Grumo	Effects of Nanocellulose on the Anticorrosion Properties of Epoxy Coating	MSU-IIT
2:00 - 2:15	PS5-3	Gene M. Itable	Gap Stability in Translationally Invariant Lattice Spin Systems	UPD
2:15- 2:30	PS5-4	Dominic P. Guaña	Computational Model of Bessel Beam Created from an Elliptical Slit Aperture	ADMU
2:30 - 2:45	PS5-5	Ricardo A. Narandan	AB Initio Calculations of Nonequilibrium Spin Magnetization Dynamics in Mettlatic Layers	USC
2:45 - 3:00	PS5-6	Mary Joyce O. Hernal	Indentations on Layered Granular Packings	ADMU
3:00 - 3:15	PS5-7	Carlo Angelo A. Pelotenia	Porphyrin Tapes as Molecular Electronic Devices: A First Principles Study	DLSU
3:15 - 3:30	PS5-8	Lady Jaharah Y. Jabber	Cellulose Fibers Reinforced Polyurethane Foams	MSU-IIT
3:30 - 3:45	PS5-9	John Adrian N. Villanueva	Black Hole Inspirals in an Expanding Universe	UPD
3:45 - 4:00	PS5-10	Lotis R. Racines	Low Cost Supercapacitor Electrode Based on Cacao Pods	DLSU
4:00 - 4:15	PS5-11	Arven I. Café	Development of Porous Silicon Based Distributed Bragg Reflector as Optical Filter for Hyperspectral Imaging	UPD
4:15 - 4:30	PS5-12	Key T. Simfroso	Transport Coefficients of Ar+H_2 Plasma Working Gases in the Presence of TiO_2 Solution Precursors	MSU-IIT

TIME	SESSION NO.	NAME	TITLE	SCHOOL
PHYSICS/MATERIALS SCIENCE AND ENGINEERING				
4:30 - 4:45	PS5-13	Jenny Lou B. Sagisi	Temporal Modification of Laser Source Term in Two-Temperature Model Simulations of Pulsed Laser Ablation of Metals	UPD
4:45 - 5:00	PS5-14	Luce Vida Sayson	Fabrication of Copper Oxide Film via Spray Pyrolysis Method for Supercapacitor Application	UPD

ASSEMBLAGES OF FRESHWATER SNAILS (MOLLUSCA: GASTROPODA) FROM SELECTED RIVERS IN ZAMBOANGA CITY AND ISABELA CITY, BASILAN

Llara M. Siglos and Crisanto M. Lopez, Dr. rer. nat.
PhD Biology/Ateneo De Manila University
Department of Biology, School of Science and Engineering,
Ateneo de Manila University, Quezon City 1108, Philippines

A study was conducted to improve the limited knowledge on the taxonomy of freshwater invertebrates of Zamboanga Peninsula. Samples of freshwater snails were collected from nine rivers in Zamboanga City and Isabela City, Basilan. The samples were preliminarily identified by morphological characteristics, and their mitochondrial COI gene was amplified, sequenced, and analyzed. Species from seven families (Ampullariidae, Lymnaeidae, Neritidae, Physidae, Planorbidae, Thiaridae, Viviparidae) were recorded. This study is the first documentation on the identification of freshwater snails in Zamboanga Peninsula using morphological and molecular biology techniques.

RESOLVING THE MYSTERIOUS FRESHWATER CRAB *ISOLAPOTAMON* BOTT, 1968 (DECAPODA, BRACHYURA, POTAMIDAE)FROM MINDANAO, WITH NOTES ON THE PHILIPPINE *ISOLAPOTAMON* SPECIES

Nickel Jean S. Lagare, Olga M. Nuñeza*, and Jose Christopher E. Mendoza*
PhD Biology/ Mindanao State University-Iligan Institute of Technology
Department of Biological Sciences, College of Science and Mathematics,
MSU-IIT, Andres Bonifacio Avenue, Tibanga, Iligan City 9200
Lee Kong Chian Natural History Museum, National University of Singapore,
21 Lower Kent Ridge Road, Singapore 119077

The genus *Isolapotamon* Bott, 1968 is represented in the Philippines by five poorly known species of freshwater crabs from a handful of areas in Mindanao with very limited number of specimens. In the present study, unprecedented increase of number of specimens collected from all over the island provides wider scope and clearer view of its taxonomy and distribution. A total of 32 localities from Mindanao were sampled. Morphology, molecular, and biogeography serve as underlying evidences to understand the taxonomy of *Isolapotamon* from Mindanao. Species were morphologically examined and noted according to the available types deposited in LKCNH Museum and in literature. Haplotype network and uncorrected pairwise distances were obtained from 190 specimens with COI gene (313bp). Mindanao major river basins map was utilized to better understand the dispersion and distribution of this genus. The questions on the unknown type locality of *I.sinautifrons* and *I.mindanaoense* were further explained based on morphological, molecular, and biogeographical evidences. Remarks on the taxonomy and an update on the distribution of *I.spatha* are provided. Distribution of *I.danielae* remains unknown since no samples were collected from the type locality and nearby areas. New records of *I. maranao* outside from the type locality are noted. Two potential new species are also described here. This study serves as a bigger step in understanding the alpha taxonomy and systematics of freshwater crabs in the Philippines. Extensive sampling on the unexplored freshwater systems in Mindanao may increase the recorded number of described freshwater crab fauna and the discovery of new taxa.

STOMACH CONTENT ANALYSIS AND MOLECULAR IDENTIFICATION OF PREY SPECIES OF THE RICE PADDY EEL, *MONOPTERUS* ALBUS IN LUZON PHILIPPINES

Dulce Marie P. Nisperos, Ma.Carmen A. Lagman*, and Jose Santos Carandang VI*
PhD in Biology / De la Salle University, Manila
Department of Biology, College of Science, 2410 Taft Avenue, Malate, Manila

An important key aspect in understanding the establishment and survival of an introduced species in an ecosystem is to investigate on its feeding habits. This study was conducted to examine the diet composition and dietary importance of prey items of *Monopterus albus*. Gut analysis was applied and a DNA barcoding was adapted as well. A total of 65 samples of *M. albus* were collected from 3 sites in Luzon. Morphology and parts of the prey in the stomach were examined. DNA prey tissue samples were extracted and mitochondrial cytochrome oxidase I gene (CO1) was amplified using a primers C_FishF2_t1/C_FishR2_t1 (Ivanova et al. 2007) for fish and HCO2198_t1/ LCO1490_t1 (Folmer et. al 1994) for invertebrate. The percent frequency occurrence of the prey items found was dominated by the gastropod (43.24%) followed by oligochate, (21.62%), juvenile teleost (18.92%), insects (13.51%) and crustacean (2.70%). In terms of the total length (TL) of individual rice paddy eel measured, the results of the percentage frequency of occurrence of the prey items in the stomach suggest that the small-sized individuals (TL = 39cm and below) are passive predators, the medium- sized (TL = 40 – 49 cm) are generally non-selective and the large-sized ones (TL = 50 and above) are active predators. DNA barcoding revealed the prey species identity and this includes the *Pomacea canaliculata, Methaphire houletti* and *Channa striata*. The findings of this study may contribute to the assessment of the ecological role of the rice paddy eels for better management strategies.

INTEGRATED CULTURE OF COMMERCIALLY IMPORTANT SEAWEED *EUCHEUMA DENTICULATUM* AND BIVALVES *PERNA VIRIDIS* AND *CRASSOSTREA* SP. BESIDES COMMERCIAL FISH FARM USING IMTA APPROACH IN CARCAR BAY, CEBU, PHILIPPINES

Adriano R. Melendres Jr., Dr. Danilo B. Largo*
PhD Bioscience Track B: Marine Biology/University of San Carlos
Nasipit, Talamban, Cebu City

The study was carried to assess potential growth of IMTA species; *Eucheuma denticulatum, Perna viridis*, and *Crassotrea* sp. together with its responses to nutrients in Carcar Bay, Cebu, Philippines. Two sampling sites (573 m apart) were selected, one representing the square floating cage with pompano and juvenile milkfish and breeders near coastal waters and the other representing the modern INCA floating circular cages in deeper area. Biomass yield of *E. denticulatum* and growth rate of the two bivalves, along with measurements of physico-chemical parameters, were monitored at monthly intervals for the study period. Results showed that the bivalves and seaweed at the study area were influenced by weather conditions and predation. Further, slower growth of oysters over 7 months relied heavily on site-specific factors and culture technique employed in the study. However, overall growth observed was good for the green mussel and the seaweed. Physico-chemical parameters differed between two sites, except for salinities which closely stable at 35, respectively, at all depths. On the other

hand, growth rate of *E. denticulatum* was influenced more by water movement, nutrients such as ammonia and phosphate, and weather conditions. Heavy rains, predation by herbivores, and strong waves decreased the biomass production. The use of IMTA concept in experimental finfish cage contributed to a decrease in nutrients, keeping the water quality within optimal range.

QUANTITATIVE ETHNOPHARMACOLOGICAL DOCUMENTATION AND MOLECULAR CONFIRMATION OF MEDICINAL PLANTS USED BY THE *MANOBO* TRIBE OF AGUSAN DEL SUR, PHILIPPINES

Mark Lloyd G. Dapar and Grecebio Jonathan D. Alejandro*
Ph.D. in Biological Sciences/University of Santo Tomas

The ethnopharmacological knowledge held by indigenous peoples like the *Manobo* tribe in the Philippines is an important resource that should be documented and preserved. This study aims to document the traditional practices, medicinal plants use, and knowledge; to quantify the relative importance, consensus, and the extent of all medicinal plants used; and to integrate molecular confirmation of uncertain species used by the *Agusan Manobo*. Quantitative ethnopharmacological data were obtained from semi-structured interviews, group discussions, field observations, and guided field walks with a total of 335 key informants. The key informants' medicinal plant use knowledge was statistically analyzed using descriptive and inferential statistics. This study documented a total of 122 medicinal plant species belonging to 108 genera and 51 families classified in 16 use categories. Integrative molecular approach confirmed 24 species with confusing species identity using multiple universal markers (ITS, *mat*K, *psb*A-*trn*H, and *trn*L-F). The highest number of species (88) was being used as treatment for the category of abnormal signs and symptoms (ASS). The correlations of the basic variables and indices (UR, UC, UV, CIV, and UD) were significant ($r_s \geq 0.69$, $p<0.001$), some being stronger than others. Statistically, the medicinal plant use knowledge among respondents was significantly different ($p<0.001$) when grouped according to education, gender, social position, occupation, civil status, and age but not significant ($p=0.379$) according to location. This study recorded the first quantitative ethnopharmacological documentation coupled with molecular confirmation of medicinal plants in Mindanao, Philippines with novel medicinal uses and ethnopharmacological information to date.

DETERMINATION OF PESTICIDE USE AND PERCEPTIONS OF FARMERS IN LAGUNA, PHILIPPINES

Priscilla Hope P. Swann and Divina M. Amalin*
PhD Biology/De La Salle University – Manila
2401 Taft Avenue, Malate, Manila, Metro Manila

Previous studies about the perception of Philippines farmers regarding pesticides have been very location-specific, such as the multiple studies of Lu in Benguet, Perez et al. (2015) in Mindanao, Warburton (1995) in Nueva Ecija, and Heong (1991) in Leyte. Performing a study with similar objectives in another location, with farmers that grow different kinds of crops and pesticides would be able to add information to paint a more coherent picture of Philippine agriculture and

**Adviser*

its relationship with pesticides. The unsafe use and mishandling of pesticides can possibly be attributed to the wrong or incomplete information gathered by the practitioners (Pingali and Palis, 1995). If farmers perceive that their practices are unsafe because pesticide exposure is unsafe, their habits and practices change (Warburton, 1995). Additionally, it has been found that farmers with experience and education, among other things, has a significantly positive effect on their technical efficiency (Koirala et al., 2016). The researcher determined the demographics of farmers using pesticides in farming communities in three municipalities of Laguna as well as their perceptions regarding the use of pesticides and generate information from this study that may be integrated in the training programs of the local government units of the areas being studied.

CHARACTERIZATION AND DEVELOPMENT OF MICROSATELLITE MARKERS FROM RNA-SEQ DATA OF ABACA (*Musa textilis* NEE) CV. ABUAB

Cecilia Diana O. Calapit-Palao, Ma. Genaleen Q. Diaz*, Rita P. Laude*,
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To develop novel simple sequence repeat (SSR) markers in abaca (*Musa textilis* Nee), inner leaf sheath transcriptome sequencing and *de novo* assembly of *M. textilis* cv. 'Abuab', *M. balbisiana* cv. 'Pacol', and merged Abuab × Pacol backcross progenies (BC_1, BC_2, and BC_3) were performed. Using a modified bioinformatics pipeline for *in silico* SSR mining, a total of 17,827 non-redundant SSRs (6.23%) were discovered from RNA-Seq data. Trinucleotide SSRs (37.17%) were most abundant, followed by dinucleotides (32.91%). AG/CT repeat motif (77.32%) was most prevalent among dinucleotides while AGG/CCT was the most common trinucleotide SSR motif (23.36 %). A total of 12,076 primer pairs were designed where a random set of 50 SSR markers was chosen for validation. Twenty-four polymorphic SSRs were identified and successfully cross-amplified in different abaca varieties. The average number of alleles per locus, observed heterozygosity, Shannon's information index, and polymorphic information content were 6.11, 0.449, 2.21, and 0.738, respectively. Pairwise analysis of banding patterns and hierarchical clustering revealed distinct grouping of Pacol and backcross progenies from Abuab. Twenty-five percent of the identified polymorphic SSR markers targeted unique sequences when compared to published sequences in NCBI while 66.67% revealed highly significant alignment with *M. acuminata* subsp. *malaccensis* and *G. hirsutum* characterized proteins, including expansin, a fiber-quality gene. Identified SSR markers were also able to discriminate between Abuab accessions, thus, are recommended for use in future abaca screening work.

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POLYMERIC COMPOSITIONS OF MEDICAL DEVICES ACCOUNT FOR THE VARIATIONS IN *Candida albicans* BIOFILM STRUCTURAL MORPHOLOGY

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The increase in the number of fungal infections has been associated with the prevalent use of medical devices. This study assessed the morphological structure of *Candida albicans* biofilms on the surfaces of medical devices using scanning electron microscopy and characterized the polymeric compositions of these medical devices using infrared spectroscopic study. Biofilms on the surfaces of these medical devices exhibited variations in morphological topographies ranging from the presence of ellipsoid and spherical yeast cells joining end to end, to the growth of pseudohyphae and hyphae formation with chains of cylindrical cells, and the formation of several microcolonies entrenched in a polymeric matrix. The differences in the spectroscopic profiles of the medical devices accounted for the variations in the structural morphology of these biofilms. Spectral studies on polyvinyl chloride endotracheal tube revealed sp^3-CH stretching frequencies at 2959, 2926, and 2858 cm^{-1} with CCl stretching frequencies at 636 cm^{-1} and 693 cm^{-1}. Silicone polymer containing medical devices had SiOSi and SiC stretching frequencies identified at 1096 cm^{-1} and 804 cm^{-1} for the silicone urinary catheter, while the stretching frequencies were identified at 1005 cm^{-1} and 862 cm^{-1} for the silicone nasogastric tube, respectively. Given the information on the variations in the morphological appearance of the biofilms on medical device surfaces, these differences on the polymeric compositions of the medical devices can provide explanations on the adhesion potential, biofilm formation, structural morphology, and subsequent susceptibility pattern of the sessile organism to antifungal drugs.

BIOACTIVE CERAMIDE DERIVATIVES FROM THE PHILIPPINE MARINE SPONGE *STELODORYX PROCERA* TOPSENT 1904

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Ceramide and its derivatives have become important compounds due to their bioactivity and diversified structures. In this study, two ceramide derivatives have been isolated from the sponge *Stelodoryx procera* Topsent 1904, collected off the coast of Zamboanga City, Philippines. This is the first report on the presence of ceramides in *S. procera*. The structures of the compounds were elucidated by NMR and mass spectrometry, coupled with analysis of chemical degradation products. After acid hydrolysis, the sphingosine and fatty acid portion were separated, which further defined the structure of the compounds. MTT assay also revealed moderate bioactivity of the isolated compounds against colon cancer cell line, HCT116.

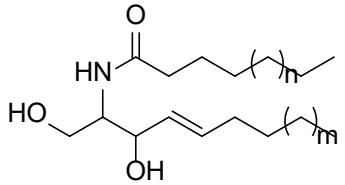

Figure 1. Structure of Ceramide from *S. procera*

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SPATIAL DISTRIBUTION OF IRON IN ULTRASONIC-TREATED FORTIFIED RICE USING SYNCHROTRON X-RAY FLUORESCENCE MICROSCOPY

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Nutritional iron content in milled rice is generally lost as a result of milling due to removal of aleurone layer. Iron fortification in milled rice is recommended to regain the lost nutrients and address the malnutrition issues. This work investigates the uptake of iron and its diffusion into the kernel on ultrasonic-treated milled rice. Rice samples were subjected to ultrasonic waves resulting in the formation of microporous surfaces and the creation of fissures in the milled rice. Sonication followed by soaking in aqueous iron solution resulted in the uptake of 321 ± 13.43 mg of iron /kg of rice, a 28-fold increase compared to the endogenous iron content of milled rice with retention of 82.9% upon washing and cooking. Cross-section mapping (μ-XRF) of the concentration of the fortificant into the uncooked grains showed inward diffusion at different rates reaching into the kernel core. Results also show that sonication decreased the amount of water-soluble phosphorus in rice suggesting the removal of potentially anti-nutrient phytic acid. Rheological and textural analysis of ultrasonic-treated iron-fortified rice premix revealed favorable properties that can be advantageous for its consumer acceptability.

DESIGN AND SYNTHESIS OF A NEW GROUP OF HISTIDINE-BASED PEPTIDOMIMETICS WITH POTENT ANTIBACTERIAL ACTIVITY

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Antimicrobial resistance is rapidly increasing in global scale while the antibiotic pipeline is declining in the past three decades. This urgent need of novel antibiotics leads to the renewed interest in antimicrobial drug discovery in recent years. Antimicrobial peptidomimetic is a promising alternative due to its multifunctionality and ease of synthesis. Histidine-based peptidomimetics are a recently described family of potent and less toxic antimicrobials. However, they have low selectivity.

Hence, this study primarily aimed to improve its selectivity. Myristic acid was conjugated at the *N*-terminus as it has been reported to have optimum hydrophobicity. To enhance its selectivity, a second positively charge amino acid was coupled to histidine. Moreover, derivatives of lysine such as Orn, Dab and Dap were used to determine the optimum length of the side chain for cation-pi interaction and to improve its stability to proteases.

Consequently, six His-based peptidomimetics were synthesized via Fmoc solid phase peptide synthesis namely: Myr-His-His-NH_2, Myr-Arg-His-NH_2, Myr-Lys-His-NH_2, Myr-Orn-His-NH_2, Myr-Dab-His-NH_2, Myr-Dap-His-NH_2. With such simple modification we produced

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potent antimicrobials with some having an MIC < 5 μM. Moreover, all of them are salt resistant. Structure-activity relationship study on Lys and its derivatives shows that the optimum length for side chain is three carbons. The MIC of Myr-Orn-His-NH_2 is the same with Myr-Arg-His-NH_2. Only these two were soluble in NH_4HCO_3 buffer pH 8.2 used in protease stability study. As expected, only Myr-Orn-His-NH_2 is resistant to degradation by trypsin. As these new His-based peptidomimetics are potent, they are promising drug candidate for further development.

EXPERIMENTAL MANIFESTATION OF π-d INTERACTION IN AXIALLY-LIGATED METALLOPHTHALOCYANINE MAGNETIC CONDUCTING MOLECULAR SYSTEM VIA M(Pc)Br_2 (M = Fe, Ru) RADICAL SOLUTION SPECTRA

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The giant negative magnetoresistance (GNMR) behavior in partially oxidized salts of axially-ligated iron (III) phthalocyanine [Fe^{III}(Pc)L_2] complexes (L = CN, Br) stems from the inherent intramolecular π-d interaction between Pc-π conducting electron and Fe-d electron (S =1/2). Oxidation of Pc ring to form the radical complex effectively demonstrates an open-shell system to describe both the conducting electron localization/delocalization and π-d interaction within the system through its electronic solution spectra. Analysis of [Ru^{III}(Pc)Br_2] spectra reveal a blue-shifted Q band that indicates lowering of the Pc-π orbital (HOMO), while the red-shifted charge-transfer band indicates increase in Ru-d orbital (next HOMOs); demonstrating smaller orbital energy gap, Δε, between between Pc-π and Ru-d orbitals, thus greater π-d interaction. Furthermore, the absence of charge-transfer bands at 400 and 540 nm (exhibited in the L=CN species) in [Ru^{III}(Pc)Br_2] indicates unhampered electron transport within the Pc moiety. [Ru^{III}(Pc)Br_2] has strong π-d interaction and high electron delocalization, which proves the design of a highly conducting molecular conductor with GNMR.

SCALARDYSIN B AND β-SITOSTEROL FROM PHILIPPINE MARINE SPONGE BIEMNA *sp.*

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Many researches today work on discovering new bioactive substances from natural sources like marine sponges that can be used to design and produce compounds that are useful for the prevention, treatment or cure of human and animal diseases. Isolation of Scalardysin B and β-sitosterol from the nonpolar extract of marine demosponge Biemna *sp.* (**AN45 NP**) collected off the coast of Agusan del Norte was confirmed by spectroscopic measurements. **AN45 NP** at 100 μg/mL concentration exhibited low percent cell viability in the *in vitro* Cell Proliferation Assay using MTT and is cytotoxic against HCT116 (colon) (% Viability = 4.427 ± 0.006), HepG2 (liver) (% Viability = 12.648 ± 0.158) and MCF7 (breast) (% Viability = 25.979 ± 0.095) cancer cell lines.

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STEROLS FROM *ECHINOPSIS OXYGONA (LINK) ZUCC. EX PFEIFF*

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Echinopsis oxygona (Link) zucc. ex Pfeiff, commonly known as easter lily cactus and sea urchin cactus, is grown as an ornamental plant in the Philippines. Chemical investigation of the dichloromethane extracts of *E. oxygona* has led to the isolation of ostreasterol (**1**), ostreasteryl fatty acid esters (**2**) and ergosterol peroxide (**3**) from the flowers and a mixture of β-sitosterol (**4**) and stigmasterol (**5**) in about 2:1 ratio from the stems. Compounds 3-5 were reported to exhibit anti-cancer properties. This is the first report on the chemical constituents of *E. oxygona.*

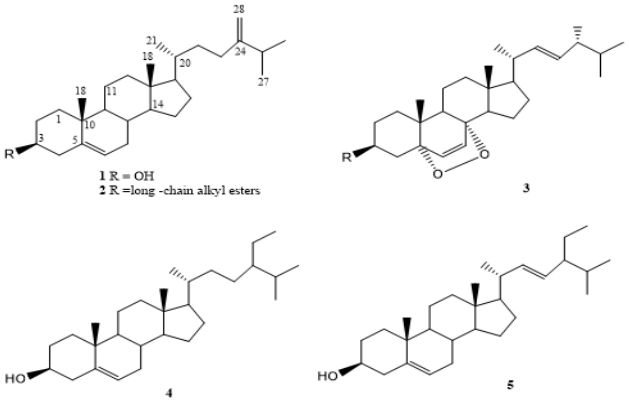

Figure 2. Chemical Structures of Compound 1-5

PHYSICO-CHEMICAL CHARACTERIZATION, BIOACTIVE COMPOUNDS AND ANTIOXIDANT ACTIVITY OF WATER APPLE [*Syzygium aqueum* (Burm.f.) Alston] FRUIT

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Water apple ("*tambis*") is a neglected and underutilized fruit in the Philippines. The study aimed to determine the component and functional properties of the fruit from pink, green, maroon and red varieties harvested in Baybay City from the province of Leyte.

Fruit width, length, weight, shape, pH, TSS, %TA, moisture content, crude protein, ash, ether extract, starch, sugar, total anthocyanin, phenols, flavonoids and antioxidant (DPPH and FRAP) activity from each of the variety were determined and compared.

Results revealed that maroon and red varieties significantly differ from pink and green. Maroon and red has a total anthocyanin of 10.966 and 16.079 mg CGE/g, total flavonoids of 1.588 and 1.761 mg QE/g, total phenolics of 7.132 and 8.286mg GAE/g, DPPH scavenging activity of 46.13 and 49.04 %, and FRAP of 51.61 and 37.11 Fe2+/g, respectively. Lower values were obtained from the pink and green varieties.

This study highlights the potential health benefits of water apple ("*tambis*") fruit in human diet.

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DISCOVERY OF CYTOTOXIC NATURAL PRODUCTS FROM THE PHILIPPINE MARINE SPONGE *PARATETILLA* SP

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The nonpolar extract (50%MeOH: 50%Ethyl acetate) of *Paratetilla* sp which was collected from Surigao City was evaluated for cytotoxic activity via MTT assay. The said extract was partitioned with methanol (L04NPa), ethyl acetate (L04NPea), hexane (L04NPh) and dichloromethane (L04NPd). L04NPa was the most active against HCT116 colon cancer cells based on MTT results and fractionated further using the Isolera system loaded with SNAP C_{18} 12g to yield seven fractions. Promising activities were detected in fractions of 80% aqueous MeOH and 100% MeOH. The latter was subjected to HPLC to provide one active compound. Structure determination and the purification of the other active fractions are currently in progress.

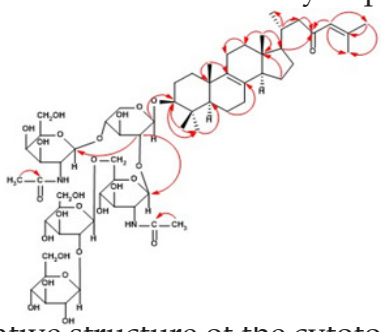

Figure 3. Tentative structure of the cytotoxic compound

FEEDING EVALUATION OF YELLOW CORN SPROUTS AS SUPPLEMENT FOR DAIRY BUFFALOES IN TRANSITION PERIOD TO PEAK LACTATION

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The transition period covers 3 weeks before and 3 weeks after calving in dairy ruminants. Typical of this period are the rapid fetal development, increased rate of mammogenesis, and reduced feed intake which likely results to the so-called negative energy balance (NEB). As a consequence, there is expected low milk yield and metabolic imbalance among others. A total of 15 transition dairy buffaloes were blocked based on parity and were laid out in RCBD. Each cow per block were randomly assigned a specific diet comprising Diet A = Basal diet (BD) alone; Diet B = BD + 4kgs dairy concentrate/day; and Diet C = BD + 0.75%DM based on BW corn sprouts. Adjustment period was done during the dry period prior to actual feeding of the assigned diets which lasted for a total of 6 weeks under the transition period. Milk yield (MY) and dry matter (DM) intake were obtained on daily basis. On the other hand, blood serum and body weight were collected on a weekly basis while milk composition were analyzed once a month. Data were analyzed using one-way ANOVA and declared significant at $p \leq 0.05$. Tukey's HSD was used to compare differences among treatment means. The study aimed to determine the nutritive value of yellow corn sprouts, its immediate and carry-over effects on transition cow to peak lactation and its digestibility using a rumen cannulated dairy buffalo.

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Results showed a nearly 3-fold increase in fresh harvest yield of corn sprouts with highest increase from 9d-15d of germination. In terms of DM, there was a notable decrease over time whereas GE and CP had increased from 1d and 15d. Moreover, as the sprouts grow older, NDF as well as ADF continous to increase which can be explained by accumulation of structural carbohydrates. Despite this, degradability estimates were still high at about 70-85% as early as 3h to 9h *in situ* implying that the corn sprouts were highly degradable and apparently absorbed and utilized by the animal. Cows under the Diet A and Diet B had a peak yield in 5 weeks post-partum which was relatively earlier compared to those in Diet C with peak yield at 7 weeks. Furthermore, highest MY was observed in cows with Diet C nd least in Diet B. The average daily MY for 2 months post-partum were 9.47li, 8.79li, and 10.08li in cows given Diet A Diet B, and Diet C, respectively. This can be explained by relatively higher lactose content and higher concentration of propionic acid compared to other treatments which partly elucidate the possible increase in lactose concentration, an osmole regulator in milk synthesis. However, cows with Diet B had higher composition of milk fat and total solid compared to other cows. Nevertheless, its milk protein and solid non-fat were comparable across treatments. Finally, the SCC in milk was found least in cows having Diet C and highest when Diet A was fed.

KNOWLEDGE, ATTITUDE AND PRACTICES (KAP) OF THE COMMUNITY ON THE ROLE OF THE INTER-LOCAL GOVERNMENT UNIT ALLIANCE IN COASTAL RESOURCE MANAGEMENT

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This paper will present the case of Banate-Barotac Bay Coastal Resource Management Council, Inc. (BBBRMCI), an alliance composed of four municipalities (Anilao, Banate, Barotac Nuevo, and Barotac Viejo) in northern Iloilo, Philippines. It was organized in 1997 with the goal of managing their common coastal resource, the Banate Bay.

A study was implemented to assess the knowledge, attitude, and practices (KAP) of the member-municipalities of BBBRMCI and to identify factors that influenced their KAP towards the alliance. A face-to-face interview of 474 randomly selected respondents from the four municipalities was conducted using a pre-tested survey instrument. The results were validated through key informant interview and focused group discussion.

Results show that majority of the respondents across the four municipalities knew about the alliance, with the highest percentage in Barotac Viejo (96%). Statistical test reveal that awareness is associated with the municipality (p-value = .000, significant at $\alpha = 0.01$). Generally, respondents have positive attitude towards the alliance and this is associated with the frequency of their participation in the BBBRMCI activities (p-value = .000, significant at $\alpha = 0.01$). Sixty-nine percent believed that the alliance has attained its protection and conservation goals. Suggested strategies to improve KAP of stakeholders include social marketing to address misconceptions about the alliance, dialogues to encourage participation of inactive members, and transparency and accountability of the officers in handling financial matters.

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GENETIC PARAMETERS OF PRODUCTION TRAITS IN JAPANESE QUAIL (*Coturnix japonica* TEMMINCK & SCHLEGEL, 1849)

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Restricted maximum likelihood (REML) software was used to estimate the variance components, heritability (h2) and genetic correlation (r) for production traits of Japanese quail. Heritability estimates were: body weight at first egg (BWFE) = 0.65 ± 0.65, weight of first egg (WFE) = 0.31 ± 0.26, age at first egg (AFE) = 0.74 ± 0.74, egg number (EN) = 0.504 ± 0.52 and egg weight (EW) = 0.39 ± 0.39. The moderate to high heritability estimates for production traits suggest that selection for these traits in Japanese quail may lead to substantial response to selection. Negative genetic correlations were found between AFE and EN (r = - 0.32) and of EW with WFE (r = -0.68), AFE (r = -0.56) and EN (r = -0.13). The significant positive genetic correlations of BWFE with EN (r = 0.0.36) and EW (r = 0.25), WFE with AFE (r = 0.30) are expected to bring correlated responses in the other traits.

INTAKE AND IN VIVO DIGESTIBILITY OF FORTIFIED SUGARCANE TOPS-BASED PELLETS SUPPLEMENTED WITH CONCENTRATES AND *Arachis pintoi* (KRAP. & GREG.) AT VARYING RATIOS IN GOATS

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An *in vivo* digestibility trial was conducted to assess the nutrient intake and digestibility of fortified sugarcane top-based pellets supplemented with concentrates and *Arachis pintoi* at varying ratios, with th following treatments: T1- concentrate at 1.25% of BW, T2- concentrate at 1.00 % of BW and *A. pintoi* at 0.25% of BW, T3- concentrate 0.75% of BW and *A. pintoi* at 0.50% of BW, T4- concentrate at 0.50% of BW and *A. pintoi* at 0.75% of BW, T5- concentrate at 0.25% of BW + *A. pintoi* at 1.00% of BW and T6- *A. pintoi* at 1.25% of BW, all in dry matter (DM) basis. Data on feed intake and fecal output were recorded and samples were analyzed for DM, organic matter (OM), crude protein (CP) and neutral detergent fiber (NDF). Results show that supplementation of *A. pintoi* at 1.25% of BW got a higher DM, OM, CP and NDF, followed by T2 group (1.00% of BW concentrate and 0.25% of BW A. pintoi leaf meal). It is concluded that the ratio of concentrate and *A. pintoi* at 1.00:0.25 and 0.75:0.50 % of BW, DM basis significantly increased DM, OM and CP digestibility, therefore, highly recommended to maximize intake and digestibility of fortified sugarcane top-based pellets in goats.

Keywords: sugarcane top-based pellets, in vivo digestibility, goats

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ESTABLISHMENT OF *Beauveria bassiana* AND *Metarhizium anisopliae* AS ENDOPHYTIC ENTOMOPATHOGENS IN RICE AND IT'S EFFECTS ON PLANT BIOMASS AND BROWN PLANTHOPPER MORTALITY RATE

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Endophytes are fungi that colonized plant tissues without inducing apparent symptoms in their hosts. Several studies have reported that infected plants contained several toxic alkaloids, and that endophyte-crop association can be beneficial by increasing their host's tolerance to biotic and abiotic stress factors. In rice (*Oryza sativa L.*) studies involving endophytic entomopathogens (EEP) may give rise to plant-endophyte-insect pest interactions as one component of integrated pest management programs. This study has developed a protocol to establish identified entomopathogens *Beauveria bassiana* and *Metarhizium anisopliae* as endophytes in rice to mitigate brown planthopper (BPH) (*Nilaparvarta lugens Stal.*) infestation. Analysis of SEM-generated images showed that both the EEP tested have colonized the rice plant as indicated by hyphal growth and appressoria inside leaf sheath and culm tissues. Furthermore, DNA sequence data showed that B. bassiana and M. anisopliae isolates extracted from 21-day old inoculated rice plants were similar to original fungal isolates indicating the successful establishment of *B. bassiana* and *M. anisopliae* as endophytes. The higher mortality of BPH recorded 30 days after exposure in 21-day old *B. bassiana*- (87±2.5%; N=100) and *M. anisopliae*-inoculated (76±4%; N=100) rice plants relative to control (0%; N=100) was attributed EEP alkaloid toxicity as reported in other crop species. Infested rice plants were able to recover from BPH damage and continued to grow and develop until grain maturity stage without exhibiting visible symptoms while the control exhibited stunted growth and poor survival rate. The above results showed that both *B. bassiana* and *M. anisopliae* may provide biological protection against BPH and other insect herbivores in rice.

Key words: Beauveria bassiana, Metarhizium anisopliae, endophyte, entomopathogen, brown planthopper, rice

ON INVERSE LIMIT OF BE-ALGEBRAS

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This study covers the notion of the inverse limit of the inverse system of BE-algebras and investigates some of its properties. In particular, it is shown that the inverse limit of the inverse system of BE-algebras exists and is unique up to isomorphism. Furthermore, the structure of the inverse limit of the inverse system of the subalgebras (filters and ideals) of BE-algebras, quotient BE-algebras and direct product of BE-algebras are examined.

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ON COMPUTATION OF SOME DISTANCE-BASED TOPOLOGICAL INDICES FOR MULTIPLICATIVE CIRCULANT NETWORKS

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In chemical graph theory, a topological index is a real number that is calculated based on the molecular graph of a chemical compound. It is a type of molecular descriptor, hence a topological index quantitatively describes the physical and chemical information of a molecule. They may be classified based on the graph's structural parameter in which they are being calculated. Some of the major classes of topological indices are distance-based indices, degree-based indices, indices based on counting specific sets and indices associated with matrices and their spectra.

A large number of graph-distance-based as well as graph-degree-based topological indices in various families of graphs and networks have been computed. However, for the family of circulant networks, only few results were known.

In this presentation, we compute for the exact values of some well-known distance based and distance-degree based topological indices for multiplicative circulant networks using recurrence relations and generating functions. In particular, we compute the Wiener index, hyper-Wiener index, Schultz molecular topological index, Harary index, additively weighted Harary index, and multiplicatively weighted Harary index for multiplicative circulant networks of order power of two and three.

MULTISTATIONARITY OF POWER-LAW KINETIC SYSTEMS AND FUNDAMENTAL DECOMPOSITIONS OF CHEMICAL REACTION NETWORKS

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This paper presents an algorithm to determine if a chemical reaction network (CRN) endowed with power-law kinetics has the capacity for multistationarity, i.e., whether there exist positive rate constants such that the corresponding differential equations admit multiple positive steady states within a stoichiometric class. We illustrate the algorithm by establishing the multistationarity of a global carbon cycle model with climate engineering in the generalized mass action format of biochemical systems theory. On the other hand, the fundamental decomposition of a CRN is the set of subnetworks generated by the partition of its set of reactions into what we call fundamental classes. We explore some of the important properties of the fundamental decomposition, in particular, its independence, i.e., the network's stoichiometric subspace is the direct sum of the subnetworks' stoichiometric subspaces. Feinberg established the essential relationship between independent decompositions and the set of positive equilibria of a network, which we call the Feinberg Decomposition Theorem. It is one of the reasons why we study independent fundamental decompositions. We also provide examples of CRNs with independent fundamental decompositions existing in literature.

****Adviser***

HYPER HOMOMORPHISMS AND HYPER PRODUCT OF HYPER UP-ALGEBRAS

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A hyper UP-algebra is a set H with constant 0 and hyperoperation ∗ satisfying the following axioms, for all x, y, z H: (HUP1) [(x ∈ ∗ ∗ y) (x ∗ z)] « y ∗ z, (HUP2) 0 ∗ x = {x}, (HUP3) x ∗ 0 = {0}, (HUP4) x « y and y « x imply x = y, where x « y is defined by 0 y ∈ ∗ x and for every A, B subsets of H, A « B is defined by: for all a A, there exists b B∈ ∈ such that a « b. In such case, we call "«" the hyperorder in H. Let (H; ∗, 0) and (K; ∗′, 0′) be hyper UP-algebras. A mapping f: H → K is called a hyper homomorphism if for all x, y H: (HH1) f(0) = 0′, (HH2) f(x ∈ ∗ y) = f(x) ∗′ f(y).

In this paper, we investigate some properties of hyper homomorphisms on hyper UP-algebras and formulate some hyper homomorphism theorems on hyper UP-algebras. We also investigate the notion of hyper product of hyper UP-algebras.

DECOMPOSITION OF CHEMICAL REACTION NETWORKS

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Investigating a phenomenon modeled using a chemical reaction network (CRN) has become more efficient due to the advancements in the field of chemical reaction network theory (CRNT). In fact, many are now choosing to analyze the chemical reaction network model instead of doing some costly and time-consuming experimental procedures in studying some chemical phenomenon since, oftentimes, the earlier is as equally effective but requires fewer amount of time and resources. However, some very large networks are still challenging to handle that the only way to examine them is to look into their smaller but critical parts. With this, the decomposition theory of CRNT, which focuses with the smaller components of a network, could be a practical option when it comes dealing with such networks. In this presentation, we will discuss how to decompose a CRN. Some fundamental results on decomposition theory will also be given. Finally, some questions leading to some possible research directions on this particular topic of CRNT will be tackled.

*Adviser

COVERABILITY OF BI-INFINITE SEQUENCES AND SUBSHIFTS

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A word w over a finite alphabet A is said to be coverable if w has a proper subword u such that every position in w falls under some occurrence of u in w. We say that u is a cover of w. We first illustrate the relationship of coverability with other notions of regularities in words such as periodicity and recurrence. We then investigate the properties of the set X_u of all bi-infinite words covered by a finite word u. In particular, we show that X_u is an irreducible shift of finite type with memory $2|u|-2$. Moreover, we provide necessary and sufficient conditions for X_u to be finite as well as conditions for X_u to be topologically mixing. We show that given a u-coverable sequence w, any element of the subshift $X(w)=\overline{\{S^n(w): n \in Z\}}$ generated by w is also u-coverable. We introduce the notion of coverability of subshifts and define a subshift X to be coverable if there are some coverable bi-infinite sequence w such that $X=X(w)$. Specifically, we are interested in the coverability of subshifts arising from substitutions over a finite alphabet. Lastly, we show that a special type of coverability is invariant under conjugacy.

A TOPOLOGY ON A HYPER BCI-ALGEBRA VIA LEFT APPLICATION OF A HYPER ORDER

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This paper investigates some important properties and characterizations involving a topology on a hyper BCI-algebra via left application of a hyper order.

S-INVARIANT TERMWISE ADDITION OF REACTIONS (STAR) TRANSFORMATIONS OF CHEMICAL KINETIC SYSTEMS

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The paper of Veloz et al., proposed to analyze the dynamics of Evolutionary Game Theory models using Chemical Reaction Network Theory (CRNT) in the form of polynomial kinetics. This leads to the exploration of chemical reaction networks with poly-PL kinetics (PYK), i.e. positive linear combinations of power law kinetics Since poly-PL Kinetics (PYK) systems is yet to be explored, transforming a network from PYK to power law kinetics (PLK) will give us ways to use the established properties and concepts on PLK in describing our original network. Hence, this paper will introduce transformation from PYK to PLK by constructing a chemical reaction network using additional complexes and reactions.

STAR (S-invariant Termwise Addition of Reactions) is a network structure-oriented approach to poly-PL Kinetics based on the following basic observation: if K(x) is a poly-

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PL kinetics for a reaction $y \rightarrow y'$ and $K(x)=\sum a_j P_j, j=1,\ldots T$, where the a_j are positive and the P_j are power law functions, then the term (summand) in the SFRF for the reaction is $K(y'-y)=(\sum a_j P_j)(y'-y)=\sum(a_j P_j (y'-y))$. Each summand in the last sum can be viewed as a reaction with a power law kinetics P_j and the positive coefficient can be lumped to the rate constant.

Two STAR transformation approaches will be discussed. The first is by using reaction vector multiple (STAR-RVM) and the other is by via maximal stoichiometric coefficient (STAR-MSC).

AMBIENT AUTOMORPHISMS OF KNOTTED SUBGROUPS

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Matrix Lie groups serve as nice examples of topological manifolds endowed with differential structure. This enabled us to define knotted subgroups of matrix Lie groups. We have shown that there is a one-to-one correspondence between the set of all knotted subgroups of a matrix Lie group and the set of all non-trivial, non-injective one-parameter subgroups of the matrix Lie group. Using these and the relationships between a matrix Lie group and its Lie algebra, we have defined ambient automorphism between knotted subgroups of matrix Lie groups. Examples of ambient automorphisms on low-dimensional classical matrix Lie groups were also provided.

BACKWARDS ITÔ-HENSTOCK INTEGRALFOR THE HILBERT-SCHMIDT-VALUED STOCHASTIC PROCESS

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In this paper, a definition of backwards Itô-Henstock integral for the Hilbert-Schmidt-valued stochastic process with respect to a Hilbert space-valued Wiener process is introduced. Let U and V be separable Hilbert spaces, Q be a symmetric nonnegative definite trace class operator from U to itself, and $f:[0,T]\times\Omega\rightarrow L_2(U_Q,V)$ be an adapted process on a backward filtered probability space $(\Omega, \mathcal{G}, \{\mathcal{G}_t\}, \mathbb{P})$, where $U_Q := Q^{\frac{1}{2}}U$ is a separable Hilbert space which is a subspace of U, and $L_2(U_Q,V)$ is the class of all Hilbert-Schmidt operators from U_Q to V. Then f is said to be *backwards Itô-Henstock integrable,* or $\mathcal{IH}_B$ on $[0,T]$ with respect to a U-valued Q-Weiner process W if there exists $A \in L^2(\Omega,V)$ such that for every $\varepsilon > 0$, there is a positive function δ on (0,T] and a positive number η such that for any backwards (δ,η)-fine partial division $D=\{(u_i,\xi_i],\xi_i\}_{i=1}^n$ of [0,T], we have

$$\mathbb{E}[\|S(f,D,\delta,\eta)-A\|_V^2] < \varepsilon$$

where

$$S(f,D,\delta,\eta) := (D)\sum f_\xi(W_\xi - W_u) := \sum_{i=1}^n f_{\xi_i}(W_{\xi_i} - W_{u_i}).$$

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In this case, f is $\mathcal{IH}_B$-integrable to A on $[0,T]$ and A is called the $\mathcal{IH}_B$-integral of f.

In this paper, we establish some standard properties for this integral. Also, we provide an equivalent definition for this integral using the concept of AC^2 $[0,T]$-property, a version of absolute continuity.

TILINGS AND NUMERATION SYSTEM INDUCED BY FOUR-FOLD ROTATIONAL BETA TRANSFORMATION IN TWO DIMENSIONS

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We construct a family of substitution tilings arising from rotational beta transformations with fundamental domains $[0,1)^2$ and $[-1/2,1/2)^2$ where the rotational component is a four-fold counter-clockwise rotation about the origin. We do this for any real number beta that is also a quadratic Pisot number.

Based on the rotational beta transformation and by imposing certain conditions, we obtain a numeration system with countably many real number bases. Letting B be a sequence containing these bases, we call these number representations the *beta Cantor series expansion* or simply *B-expansion* which generalizes the classical positive and negative beta expansion by allowing non-integer bases in the Q-Cantor series expansion. Finally, in the case when B is purely periodic sequence of periodicity two, we give a characterization of the pre-periodic points in the fundamental domain with respect to the B-expansion.

ON INDEPENDENT TRANSVERSAL DOMINATION IN THE JOIN CORONA AND COMPOSITION OF GRAPHS

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A subset D of a vertex set $V(G)$ of a graph G is an independent transversal dominating set of G if S intersects every maximum independent set of G. The independent transversal domination number of G is the minimum cardinality $\gamma_{it}(G)$ of an independent transversal dominating set of G. In this paper, we investigate the independent transversal dominating sets of graphs resulting from the join, corona and composition.

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SOCIOECOLOGICAL ANALYSIS OF OTOLITHES RUBER FISHERY UNDER VARYING INSTITUTIONAL ARRANGEMENTS IN SAN MIGUEL BAY, PHILIPPINES

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Croaker *Otolithes ruber* (Bloch & Schneider, 1801) is native to San Miguel Bay. *Otolithes ruber* is one of the major fish catch in the Bay, with the corresponding high market price, and fish processing is a seasonal livelihood among coastal villages. The Bay is being challenged by a multitude of interconnected problems, issues, and concerns. Thus, using a socioecological approach, this study investigated and characterized *O. ruber* fishery at the present condition of San Miguel Bay and particularly under prevailing institutional arrangements, considering that the entire Bay has been declared as part of municipal waters by the seven local government units (LGUs).

Fishing trips from September 10 to November 19, 2018 showed that *O. ruber* was commonly caught from the middle to the mouth of the Bay off Mercedes and Siruma, using bottom-set gill nets. Fisherfolks also employed different methods, i.e., the "*timbog*" ("*tupak*") method was commonly practiced as this was considered effective, although large catches were recorded when the "*patalang*" method was employed. Fishing for *O. ruber* typically involved two to three fisherfolks together out at sea for up to 7 hours, and fresh catch were either brought immediately to nearby fish ports for local auction ("*bulungan*") or sold directly to middlemen or fish vendors. The analysis of 434 composite *O. ruber* samples bought from the fishing trips identified 222 and 212 female and male fish individuals with mean total length (TL) of 19.14 ± 0.11 cm (range 11.0 to 30.2 cm) and body weight of 70.76 ± 1.46 g (range 20 to 315 g). The majority were already mature to spawning stages; histopathological analysis of gonads revealed that *O. ruber* was in normal condition, i.e. gonads had no apparent lesions and the population's reproductive capacity is healthy as evidenced by numerous spermatocytes or oocytes.

Otolithes ruber occurred year-round and were found abundant from January to May, based on landed catch data from 2015 thru 2017. The increased fishing effort and presence of fish ports may probably justify the high landed catches recorded in the municipalities of Calabanga, Tinambac, and Cabusao. The species contributed less than 3% to the total landed catch and to the catch from gill nets and trawls. Time series analysis revealed ~2% decrease in catch every year when projected from 2018 to 2022. Dry processing of *O. ruber* seemed to offer a potential source for additional income, employment, and livelihood to fisherfolks because of increasing demand and high market price especially of from dried split and "*biti*" (swimbladder).

San Miguel Bay is under lateral institutional arrangements as agreed upon by the seven Local Government Units and Municipal Fisheries and Aquatic Resources Management Councils, which are being assisted by several social groups. The San Miguel Bay Integrated Fisheries and Aquatic Resources Management Council serves as the venue for inter-municipality and multi-stakeholders collaborations and tackles bay-wide issues and management. However, a unified ordinance and concrete management actions still need to be drafted, in order to address the decline in fish stocks and catch in San Miguel Bay, including *O. ruber*. The uncoordinated

initiatives and weak regulatory measures among LGUs have led to the prevalence of illegal and destructive fishing activities and inequalities and conflicts between and among resource users. Multi-stakeholder engagements and fisherfolks' participation would be vital to enhance and strengthen the presently applied fisheries management and policies

Keywords: Catch, Institutional Arrangements, Fishing Practices, Otolithes ruber, Socioecological

SOIL QUALITY EVALUATION ON SELECTED AGRICULTURAL LANDS OF TARLAC PROVINCE

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Soil quality assessment is an effective way to emphasize appreciation and perception of how important it is to maintain healthy soils, and the significance of fundamental soil processes. This study was intended to document cropping system, management history, and other parameters related to soil quality; and evaluate selected soil quality indicators necessary to determine an effective approach to select practices and techniques to maintain soil health. A total of 54 sampling sites were selected to represent different agricultural land features of Tarlac Province. Soil quality index was determined using the NRCS-USDA Soil Quality Assessment Guide.

In general, most areas have moderate soil quality index (SQI). The contributing factors that affected the SQI are OM, infiltration class, %WSA, soil stability, pH, and EC. Provided that most of the identified limiting factors were improved and increased by 20% of the actual SQI rating, mainly all areas had upgraded SQI rating. Low coefficient of improvement (CI) varying from 1.11 to 1.43 suggests that the areas assessed do not have much possibility for increase of the soil quality and of the productivity. However, potential yields increased up to 11% to 42%. Meanwhile, there was no significant relationship between the potential rice yield and the improved SQI. However, significant relationships between the corn yield and the SQI were noted similarly with the improved SQI relationships and the potential corn yield (0.38).

The need for tools to assess soil quality must be established and development of soil quality multi-factor assessment protocols crafted based on Philippine soil situation.

**Adviser*

TOWARDS THE DEVELOPMENT OF A HOLISTIC INSTRUMENT FOR EVALUATING EIA SYSTEMS

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The Philippine Environmental Impact Statement System (PEISS) is one of the oldest environmental impact assessment (EIA) systems in the world. The Philippines adopted the approach in 1978 after it was first introduced in the United States of America in 1969. As there is no existing standard instrument to evaluate EIA systems, the performance of the PEISS was examined using a holistic questionnaire developed based on the criteria of Ahmad and Wood (2002). Considering the practitioners' evaluation of the performance of the PEISS, the underlying dimensions of the instrument with 28 items were examined through data reduction and regression techniques. The results show that the instrument has six underlying dimensions that explained 84% of the total variance. These are i) EIA review, ii) decision making on environmental compliance certificate (ECC), iii) screening and public participation, iv) impact mitigation and environmental management plan, v) EIA practitioners and industry sector, and vi) appeal on ECC and coordination among agencies. It was concluded that the experiences of EIA practitioners can be an important data source in analyzing the performance of EIA systems. Administrators could use the feedback to develop quality management rating and to make longitudinal comparisons of an EIA system or comparisons between EIA systems. The evaluation criteria have been used in evaluating EIA systems worldwide, but there is no evidence of their application by quantifying the opinions of practitioners. This paper makes a contribution by exploring their underlying dimensions using empirical data.

POTENTIAL NANOREMEDIATION OF SOME HEAVY METALS USING SYNTHESIZED ZEOLITE-CHITOSAN-SILICA NANOCOMPOSITE

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This study was conducted to determine the potential nanoremediation of some chicken litter-associated heavy metals using synthesized zeolite-chitosan-silica nanocomposite material. The zeolite-chitosan-silica nanocomposite material was synthesized at the nanotechnology laboratory of Central Luzon State University and subjected to nanoparticle size, UV-vis, and FTIR analyses.

Nanoremediation potential test of the synthesized zeolite-chitosan-silica nanocomposite revealed the tendency of Zn to hyperaccumulate in pechay (*Brassica napus* var. *chinensis* cv. Black behi) above the maximum residue limit (MRL) in plants despite the significant reduction (Fisher's LSD at 5%) of bioaccumulated Zn in pechay due to application of the nanocomposite material. The nanocomposite material and chicken litter showed potential in effectively remediating or reducing Zn availability in the soil (Fisher's LSD at 1%), thereby reducing its bioavailability. Either the application of nanocomposite material or chicken litter can significantly reduce the level of soil As but not to a level lower than the permissible limit for agricultural soils. The nanocomposite did not significantly reduce soil Cu and bioaccumulated Cu in pechay, but chicken litter application showed significant increase of bioaccumulated Cu in pechay.

MICROPLASTICS OCCURRENCE IN *Siganus* SPP. FROM EASTERN TAÑON STRAIT, CENTRAL PHILIPPINES AND ITS HISTOPATHOLOGICAL EFFECTS ON THE JUVENILE *Siganus guttatus* (*Bloch*, 1787)

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The minuteness and ubiquity of microplastics (MP) such as polyethylene (PE) in the marine ecosystem has become a global issue. They may be ingested by fishes, and thus pose a threat to their health. This study determined MP occurrence in the rabbitfishes from Tañon Strait, the country's largest marine protected area. Its histopathological effects on the intestine and liver of juveniles *Siganus guttatus* were determined. Rabbitfishes namely *S.canaliculatus* (n= 65), *S. spinus* (n=17), *S. guttatus* (n=5) and *S. virgatus* (n=8) were sampled from Badian, Moalboal, Tabuelan and San Remigio. MPs were extracted using density separation and filtration. All isolated particles were examined microscopically and identified using Attenuated Total Reflectance-Fourier Transform Infrared (ATR-FTIR) spectroscopy. Siganus guttatus juveniles (N=150) were subchronically exposed to PE suspensions of 0, 0.01, 0.1, 1.0, 10ppm. The MP abundance in the rabbitfishes in this study ranged from 0-7 particles per fish (*S. guttatus* > *S. virgatus* > *S. spinus* > *S. canaliculatus*). The most common MP in the rabbitfishes' gut were polyamide and polyethylene. There was a direct relationship (R^2=0.97, $p<0.05$) between species size and MP incidence rate. Majority of MPs isolated were fragments, <1mm and colored white. There was no significant difference in the CF of the fishes exposed to varying concentrations of PE suspensions. However, fishes exposed to the highest concentration of PE suspension exhibited a higher proximal, distal, liver and total organ index as compared with the control ($p<0.05$). The histological changes in the intestine were hyperemia, necrosis, goblet cells hyperplasia, widening of the space between the lamina propria and the muscularis, and flattening of the villi. In the liver, hyperemia of the blood vessels and cellular vacuolization were observed. This study serves as a warning that if current plastic use and improper disposal continue, commercially important fish species in the area will be threatened.

Keywords: Microplastics, ATR-FTIR, polymer typology, Siganus, histopathological

Adviser

NANOPHYTOREMEDIATION OF HEAVY METAL POLLUTED SOIL UTILIZING BIOCHAR-NANOCOMPOSITE

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Nanotechnology and phytoremediation both have potential for soil decontamination. Removal efficiency can be enhanced by combining both technologies. Enhanced phytoextraction technologies have been proposed as an effective approach to decontamination of heavy metal in soils. This study was conducted to synthesize, characterize and evaluate the potential of nano silica, nano calcium, nano chitosan and nanocomposite to promote growth and enhance phytoremediation of vetiver grass (*Vetiveria zezanioides*). Characterization through Dynamic Light Scattering (DLS) revealed that the particle size of synthesized nano silica, nano chitosan, nano calcium, and its nano composite were in nano-sized. Fourier-transform infrared (FTIR) spectroscopy confirmed the purity of the four nanomaterials. X-ray diffraction (XRD) spectroscopy revealed that all the four materials were amorphous and considered non-toxic. More Cr and Ni were accumulated in the vetiver roots compared to the shoots. Application of biochar + nano silica have the highest biomass yield and found to be the most efficient in terms of overall heavy metal plant uptake (both Cr and Ni). The study provided insights about the danger of heavy metal translocation on harvestable parts of the plant. For successful phytoremediation, the first requisite is high production of plant biomass which is exhibited by vetiver plant. Moreover, the application of biochar-nanocomposite improved its phytoremediation efficiency. Long term studies are therefore recommended to fully understand the fate of synthesized nanocomposite materials in heavy metal polluted soil.

DRIVERS AND PATTERNS OF WILDLIFE HUNTING AND TRADE IN TWO SELECTED PROTECTED AREAS IN CARAGA REGION, MINDANAO ISLAND, PHILIPPINES

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Wildlife hunting and trading are still rampant in Agusan Marsh Wildlife Sanctuary (AMWS) and Siargao Islands Protected Landscape and Seascape (SIPLAS) despite of Wildlife Act (RA 9147). In this study, demographic, socio-economic, and cultural profile of the hunters and traders through snowballing and semi-structured interviews showed that most of the respondents were farmers with low educational attainment, low income and lack awareness on Wildlife Act and on threatened species in two PAs. Most of the hunters in both PAs resorted to subsistence hunting using traditional and modern but harmful hunting techniques. Local trading of threatened wildlife was also rampant for quick cash. Structural Equation Modeling results showed that hunter's knowledge and awareness on Wildlife Act and on conservation-related activities positively influenced hunting regulation attitude which in turn reduced hunting footprint in AMWS. Surprisingly, awareness on threatened species and on conservation-related activities negatively influenced hunting regulation attitude of hunters in SIPLAS. However, awareness on Wildlife Act positively influenced hunting regulation attitude and monitoring frequency reduced hunting footprint. Generally, poverty, low conservation awareness and poor

enforcement influenced hunting and trade in two PAs. This suggests that to reduce hunting footprint, raising conservation awareness, improving monitoring and enforcement, community engagement, sustainable livelihood and more hunting sustainability research must be done. materials in heavy metal polluted soil.

Keywords: hunting, trade, wildlife, hunting footprint, protected areas

PHYSICOCHEMICAL CHARACTERISTICS OF CUT CHRYSANTHEMUM (*CHRYSANTHEMUM MORIFOLIUM* RAMAT) FLOWERS AS INFLUENCED BY HYDRATION DURING TRANSPORT AND FLORAL PRESERVATIVES

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Cut chrysanthemum flowers are one of the highly valued cut flowers worldwide due to its diverse floral types and colors. Prolonging its vase life is very important to consider for better profit in the business. Immediate hydration after harvest and during transport and application of floral preservatives are thought to extend vase life of cut flowers, however, it was seldom observed in the market chain. This study was conducted to evaluate the physicochemical qualities of chrysanthemum as influenced by hydration during transport and different floral preservatives and to identify the best floral preservatives. This study was laid out in factorial design arranged in RCBD and replicated four times with the following treatments: hydration during transport- with water and without water; and kind of floral preservatives- tap water, flower food, sucrose, citric acid, salicylic acid, asunting leaf extract + distilled water, asunting leaf extract + carbonated drink, and distilled water alone. The results of the study revealed that hydration during transport had no significant effect on visual quality at day 5 until termination, weight loss and chlorophyll content of cut chrysanthemum flowers, however, kind of floral preservatives significantly affected all parameters. Significant interactions were observed on flower diameter decrement, visual quality at day 1 and day 9, stalk browning at day 5 until day 9, solution uptake, vase life, and pH of vase solution at termination. Among the floral preservatives used, 0.2% asunting leaf extract combined with carbonated drink exhibited lower pH, lower weight loss and longest vase life (13 days).

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CYTOGENETICS OF *Solanum aethiopicum* L., *S. melongena* L. AND THEIR F_1 HYBRIDS AND THE MECHANISM OF HYBRID BREAKDOWN

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Cytogenetic studies can elaborate the genetic affinity of the parents in the interspecific hybrids. Chromosomal evaluation of *Solanum aethiopicum* (Acc. 8971), *S. melongena* (var. DLP and Acc. 3305) and their F_1 hybrids was done using iron-acetocarmine technique to elucidate the cytogenetic relationships between the wild species *(S. aethiopicum)* and the cultivated species *(S. melongena)*. Fluorescence micrsocopy was used to determine pre-fertilization barriers in the interspecific hybrids. *S. aethiopicum* and *S. melongena* were found to be diploid species (2n=24). Meiosis in the studied species including their F_1 hybrids was normal (12II). Pre-fertilization barrier in the form of inhibited pollen tube growth was noted in the interspecific hybrids.

IMPORTANT GENOMIC REGIONS FOR ZINC, GRAIN YIELD, AND AGRONOMIC TRAITS IN RICE (*Oryza sativa L.*) UNVEILD USING CONNECTED POPULATIONS

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Micronutrient malnutrition is a serious nutritional problem that affects billions of people around the world. Breeding for rice varieties with increased micronutrient content is one of the sustainable approaches to address micronutrient malnutrition. Hence, developing rice with high Zn and Fe content along with desirable agronomic characters are the main targets in biofortification breeding. In this study, we tested four connected recombinant inbred populations derived from the crosses of Kaliboro (donor parent) with IR14M141, IR14M110, IR14M125, and IR95044:8-B-5-22-19-GBS (recipient parents) to detect QTL affecting grain Zn content, Fe content, grain yield, and agronomic traits. The multi-cross QTL analysis effectively identified 156 QTL with two major QTL (plant height and grain Zn content) for agronomic and biofortification traits distributed in all 12 chromosomes with some overlapping genomic regions. Fourteen and 27 QTL were detected for grain Fe and grain Zn, respectively that were located across 12 chromosomes. A major QTL ($qZn_{5.1}$) for grain Zn content that accounted for 13% of phenotypic variation was detected using MC-QTL analysis and was verified by genome wide association analysis mapping in multiple populations and inclusive interval mapping of individual populations. Genomic region of $qZn_{5.1}$ was studied through *in-silico* candidate gene analysis, gene prediction, and *cis*-regulatory analysis. Several metal transporters and binding genes including primary putative genes *OsZIP5, OsZIP9*, and *LOC_OS50G40490* were found harboring this genomic region. *OsZIP5, OsZIP9, LOC_OS50G40490* showed also functional SNP polymorphisms when the genome of the parents were compared. These predicted genes where further analyzed for cis-regulatory elements revealed a robust number of regulatory elements involve in seed storage, photoperiodism, light-regulation, alpha-amylase expression and disease resistance in their promoter and coding regions.. Findings suggest the possible association

of genes involve in Zn uptake and transport with other physiological functions. The genetic information on $qZn_{5.1}$ can provide basis useful in marker-aided breeding for rice with high Zn.

PHYSICO-CHEMICAL, BIOCHEMICAL, AND PHYSIOLOGICAL PROPERTIES OF EGGPLANT (*Solanum melongena* L.) FRUITS AS INFLUENCED BY ALGINATE-BASED EDIBLE COATING ENRICHED WITH ESSENTIAL OILS

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Edible coating formulations have been formulated to enhance quality and increase shelf-life of most horticultural commodities. However, little information is available regarding the incorporation of essential oils particularly citral and eugenol into alginate-based edible coatings of vegetables. This study was aimed to determine the effect of alginate-based edible coating formulation enriched with essential oil on the physico-chemical, biochemical, and physiological properties of eggplant fruits. The experiment was laid out in a Completely Randomized Design with seven treatments and three replications. Sodium alginate (AL) was tested at 2% (w/v) with the incorporation of eugenol (Eug) and citral (Cit) at 0.1%, 0.2%, and 0.3% concentration. On days 0, 3, 6, 9 and 12, samples were taken to perform physicochemical, biochemical, and physiological analysis (weight loss, firmness, shriveling, color (L*, a*, b*), visual quality rating (VQR), pH, total soluble solids (TSS), titratable acidity (TA), vitamin C, oxidation-reduction potential (ORP), total dissolved solids (TDS), electrical conductivity (EC), free radical scavenging capacity (FRSA), total sugar content, respiration rate, ethylene production and microbial growth). Results showed that fruits with alginate coating enriched with essential oil (citral and eugenol) got the highest performance in improving the quality of eggplant fruit as compared to the control (without essential oil) added. The use 0.2% eugenol and 0.2% and 0.3% citral showed lower weight loss. Fruits with 0.3% eugenol shriveled less and got the best VQR which is comparable to 0.3% citral. A similar pattern of effect was observed on TSS and TA were 0.3% eugenol and citral was the best. All coatings were best in reducing the microbial load. However, control treatment was statistically lowest in respiration rate and sometimes comparable to other coatings. Citral and eugenol at 0.3% were effective essential oils when added to alginate.

Keywords: eggplant, sodium alginate, essential oils, citral, eugenol

AGRO-MORPHOLOGICAL CHARACTERIZATION OF SELECTED PHILIPPINE TRADITIONAL MAIZE (*Zea mays* L.) POPULATIONS

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One key problem and remains a major bottleneck in any breeding program is the presence of a very narrow genetic base which limits the potential of producing inbred or hybrid with desirable

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traits, most importantly improve yield. Thus, there is a need to identify the extent of variation present in the germplasm by employing genetic diversity analysis which is an important pre-breeding activity in inbred line development and hybrid breeding program.

In the current study, a total of 88 locally collected maize genotypes were characterized for 69 agronomic and morphological traits. These traits were comprised of 40 qualitative and 29 quantitative variables which were recorded using standard descriptors designed by the National Plant Genetic Resources Laboratory of the Institute of Plant Breeding, UPLB. Descriptive statistical analysis showed maximum variability observed in unshelled weight (828.05), followed by shelled weight (599.87), ear height (321.525), plant height (257.59), and % grain shedding (162.06). The results suggested the potential of the traditional corn populations in employing in breeding selection for quantitative traits. The selected maize germplasm collections were distributed into 4 main clusters and a singleton through cluster analysis at a 0.25 dissimilarity coefficient indicating the presence of considerable genetic diversity. Based on the clustering analysis, none of the genotypes collected from the same province or region grouped altogether thus, the distribution of the maize genotypes is independent of their geographical background. The identification of the extent of genetic diversity in the current study could be utilized for further varietal improvement in maize breeding.

PHYSIOLOGICAL, BIOCHEMICAL AND MOLECULAR CHARACTERIZATION OF SELECTED RAINFED LOWLAND RICE (*Oryza Sativa* L.) GENOTYPES UNDER DROUGHT CONDITION

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Edible coating formulations have been formulated to enhance quality and increase shelf-life of most horticultural commodities. However, little information is available regarding the incorporation of essential oils particularly citral and eugenol into alginate-based edible coatings of vegetables. This study was aimed to determine the effect of alginate-based edible coating formulation enriched with essential oil on the physico-chemical, biochemical, and physiological properties of eggplant fruits. The experiment was laid out in a Completely Randomized Design with seven treatments and three replications. Sodium alginate (AL) was tested at 2% (w/v) with the incorporation of eugenol (Eug) and citral (Cit) at 0.1%, 0.2%, and 0.3% concentration. On days 0, 3, 6, 9 and 12, samples were taken to perform physicochemical, biochemical, and physiological analysis (weight loss, firmness, shriveling, color (L*, a*, b*), visual quality rating (VQR), pH, total soluble solids (TSS), titratable acidity (TA), vitamin C, oxidation-reduction potential (ORP), total dissolved solids (TDS), electrical conductivity (EC), free radical scavenging capacity (FRSA), total sugar content, respiration rate, ethylene production and microbial growth). Results showed that fruits with alginate coating enriched with essential oil (citral and eugenol) got the highest performance in improving the quality of eggplant fruit as compared to the control (without essential oil) added. The use 0.2% eugenol and 0.2% and 0.3% citral showed lower weight loss. Fruits with 0.3% eugenol shriveled less and got the best VQR which is comparable to 0.3% citral. A similar pattern of effect was observed on TSS and TA were 0.3% eugenol and citral was the best. All coatings were best in reducing the microbial load. However, control treatment was statistically lowest in respiration rate and sometimes comparable to other coatings. Citral and eugenol at 0.3% were effective essential oils when added to alginate.

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MORPHOLOGY AND CONDUCTIVITY OF ELECTROPOLYMERIZED POLYPYRROLE/LOW-DENSITY SILVER-COATED SPHERICAL GRANULAR MATTER COMPOSITE FILMS

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Polypyrrole (PPy)-based composite films were electrochemically polymerized at varying synthesis time in the presence of low-density conductive spherical granular matter (CSGM). Scanning electron microscopy revealed more ordered and diverse structures with thicker composite films compared to parent films. Energy dispersive X-ray confirmed the existence of elemental compositions of PPy and conductive microspheres while FTIR analyses verified the presence of bonding associated with the dopant molecules. Four-point probe resistivity measurements showed non-linear IV characteristic curves for all fabricated films and displayed large percentage increase in conductivities for composite films. Possible mechanisms for the deposition CSGM onto the PPy complexes as well as configuration for improved charge transports are proposed in this investigation.

EFFECTS OF NANOCELLULOSE ON THE ANTICORROSION PROPERTIES OF EPOXY COATING

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Epoxy resin has been widely used as a coating material to protect steel because of its outstanding processability, excellent chemical resistance and strong adhesion to heterogeneous substrates. However, due to their hydrophilic surface, additional filler is needed to enhance the anticorrosion and barrier properties of the polymer coating. Nanocellulose (NC) is an attractive reinforcing agent that can be incorporated into protective coatings because it offers unique properties such as great mechanical properties, surface chemistry and biological properties. In this work, various amount of nanocellulose were added to epoxy resin and applied on steel substrates. The corrosion protection performance of coated steel was analyzed using potentiodynamic polarization. The compositional characterization of nanocomposite coating was carried out using Fourier transform infrared (FTIR) spectroscopy.

Electrochemical result revealed that the protective performance of epoxy coating was significantly enhanced by the addition of nanocellulose. The corrosion protection efficiency of nanocomposite coating was improved by more than 96%. Furthermore, FTIR spectra revealed that the absorbance of the vibrational mode corresponding to the interaction of nanocellulose and epoxy matrices significantly increase as the nanocellulose loading ratio increased. This further confirmed the crosslinking of NC with epoxide group.

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GAP STABILITY IN TRANSLATIONALLY INVARIANT LATTICE SPIN SYSTEMS

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The task of theoretical condensed matter physics is to provide models that best describe observed properties and predict new realistic properties of condensed matter systems. In studies of magnetic materials at zero and very low temperatures, the relevant models are lattice spin systems. The spectral gap, the finite energy separating the ground state with the excited states, is an important quantity to calculate in these systems. Many studies reported that the presence and absence of a gap dictate the correlations within the system. For models to better represent real materials, the infinite-size or thermodynamic limit must be approached. However, such a case is difficult to handle analytically and computationally. Hence, the objective is to infer the gap in the thermodynamic limit from relatively smaller sizes. In this work, we aim to develop a notion of gap stability. The gap is stable if it is certainly greater than some lower bound beyond a critical size. We derived sufficient conditions for the gaps of translationally invariant lattice spin systems to be stable. These models have a mathematical structure that is simpler than general models in the context of increasing system sizes. Hence, we studied the gap stability in random minimal one-dimensional models belonging to this family. We then discussed the conditions in connection to the gap stability of these random models.

COMPUTATIONAL MODEL OF BESSEL BEAM CREATED FROM AN ELLIPTICAL SLIT APERTURE

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A computational model of the generation of Bessel beam from an elliptical slit is presented in this study. The model is obtained from the Maxwell's electromagnetic theory, then a computational approach is used to generate the Bessel beam. Solutions show that the z-dependence of electromagnetic beam vanishes when the product of electric field and its conjugate was obtained. Calculations demonstrate that the generated Bessel beam acquires an elliptical shape that is oriented perpendicular to the elongation of the elliptical aperture. Computations are in good agreement with what is found in the experimentations for large propagation distances. The results obtained in this study can help shed light in understanding other forms of Bessel beams for applications in atom optics, data encryption and quantum communications.

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AB INITIO CALCULATIONS OF NONEQUILIBRIUM SPIN MAGNETIZATION DYNAMICS IN METTLATIC LAYERS

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We executed an ab initio numerical calculation of the Buot-Loberternos-Otadoy spin magnetization quantum transport equations (BLO SMQTE) without the spin dependent terms for simple magnetic and non-magnetic metallic layers. The initial simulations for the time evolution of the magnetization was done with the assumption that the applied effective field is constant and that the internal field is uniform. There is also no gradient of magnetization in the momentum space thus the velocity associated to the introduced spin polarized current is constant. It is also taken to be and that there is no damping or scattering considered yet. Thus, only prevalent terms of the original BLO SMQTE are considered in the numerical simulations. Results show that at early times the spin magnetization exhibits perturbation and then relaxes back to the usual rotation due to the presence of external field. Since there is no damping present, the oscillations of the components of magnetization were not observed to die out as in the case of Landau-Lifshitz-Gilbert (LLG) simulations. The resulting magnetic field lines also show magnetic domain formations along the *z*-axis or *xy*-plane and strong magnetic anisotropy is observed to be present along *xz*- and *yz*-planes.

INDENTATIONS ON LAYERED GRANULAR PACKINGS

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An investigation is conducted on the geometry of the indentations created due to impact loading on different layered granular packings. These packings are composed of partially cohesive granular matter and dry and loose granular materials. The upper layer of the two-layer granular packings is composed of kinetic sand (synthetic sand with polymer polydimethylsiloxane) while the bottom layer is a pack of one of the following: glass marbles, glass beads, mung beans, and pumice stones. The crater's geometric properties namely the depth (*h*), diameter (*D*), and mouth area (*A*) are measured to obtain their relationships with the total drop height H and the indenter's impact velocity v. Results reveal that: (i) craters are wider and deeper in a two-layer granular packing, (ii) the penetration depth scales with ~1/2 power of the total drop height, (iii) the crater diameter varies ~1/4 power of the total drop height, and (4) a Hertzian impact, neither nor a pseudo-Hertzian impact, is not possible. However, when layers of marbles are placed 1 cm below the kinetic sand, craters formed are narrower and shallower as compared to the two-layer granular packings and pure kinetic sand. The penetration depth scales with ~ 0.859 power of the drop height, an exponent that is only 7% higher than that obtained in a Hertzian impact.

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PORPHYRIN TAPES AS MOLECULAR ELECTRONIC DEVICES: A FIRST PRINCIPLES STUDY

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The miniaturization trend of the microelectronic circuit components continues to seek for faster and cheaper materials. Thus, pushing scientific studies to design materials for electronic devices in a molecular level. Manipulations through the addition of adsorbates, impurities and dopants to functionalize molecules as the material itself. With this interest, this paper investigated the changes on the structural and electronic properties of porphyrin tape due to different transition metal (M) atom cores (M= V, Cr, Fe, Mn, Co, Ni, Cu and Zn) using first principles calculations based on density functional theory. The results show that all M-porphyrin tapes (MPp's) are stable with binding energies affected by the the number of unpaired electrons of the cores. Moreover, MPp's with cores that have more unpaired electrons tend to be metallic and those with less unpaired electrons are semiconducting. Thus, porphyrin tapes with cores V, Cr, Mn and Fe can be used as molecular connectors while those with Co, Ni, Cu and Zn cores are possible molecular switch components. Further investigation on the functionalities of semiconducting porphyrin tapes can lead to the realization of molecular electronics that can replaced the existing silicon-based devices.

CELLULOSE FIBERS REINFORCED POLYURETHANE FOAMS

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The rigid polyurethane foam (RPUF) has been widely used for industrial and light weight engineering applications due to its promising properties. Latterly, utilization of bioresources for RPUF has attracted attentions because of the increasing concerns about environmental problems. Enhancing RPUF has been and continues to be of interest. A lot of strategies in reinforcing RPUFs, several reports utilized fillers or additives incorporated during the foam process. In this work, RPUFs were reinforced with cellulose fibers extracted from pineapple (*Ananas comosus*) leaves as fillers. The pineapple leaves undergo surface treatment to enhance the fiber-matrix adhesion of the fiber. RPUF composites were done by mixing varied amount of cellulose fibers with polyols, catalyst, surfactants and blowing agents. It was then mixed with the isocyanate to complete the reaction of the polyols and isocyanate.

The experimental result shows the successful production of RPUF composites as revealed in the Scanning Electron Microscopy (SEM) images. It showed that the cell structure is significantly

affected by the cellulose fibers which resulted in inhomogeneous, irregular and larger cell structures and further decrease the densities of the RPUFs. Fourier Transform Infrared (FTIR) spectra also revealed that cellulose fibers was attached to the matrix of the PUFs. Mechanical results suggest that the compressive strength and thermal conductivity of RPUFs decreases as fiber content increase. Furthermore, the thermal degradation shows enhancement on the thermal stability of the reinforced RPUFs due to the presence of cellulose that degrades at higher temperature which gives promising results for insulation applications.

BLACK HOLE INSPIRALS IN AN EXPANDING UNIVERSE

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General relativity predicts that bound orbits will undergo a slow process of orbital decay, or separation decrease, due to binding energy being released through gravitational waves. This process is called an inspiral, and will be most noticeable for compact objects (CO) orbiting near a black hole (BH). Aside from energy, gravitational waves, or disturbances in space-time, also liberate angular momentum from a bound orbit, which then circularizes initially elliptical orbits. Furthermore, the surroundings of the CO-BH binary affect the rate of production of gravitational waves and will be important to consider in modelling realistic astrophysical black hole binaries. In this work, we produced simulations of the orbital trajectory around the central black hole as it circularizes and inspirals to the point of the last stable orbit, where it will be plunging to the black hole. In addition, we consider the binary to exist inside an expanding space-time, which will physically affect the inspiral. The expansion of the universe adds an extra pull, a repulsive "force" that counteracts gravitational attraction, described most simply by the cosmological constant in Einstein's equations. Although an expanding universe is the cosmological model most widely accepted, current literature discards the effect of the cosmological constant in binaries as its effects would be best felt at cosmological distances, or distances very far away from a central black hole. However, the cosmological constant directly affects the rate of gravitational radiation and will therefore affect the orbital trajectory in small length scales by modifying time scales in dissipative processes like the inspiral and the circularization, as well as in conservative processes like the pericenter advance. We produced visual plots of the effect of this “pull" by the cosmological constant in a generic elliptical orbit to draw qualitative conclusions on the deviations in the orbit. We found that the cosmological constant severely affects highly elliptical orbits, with one of its effects as an increased rate in the pericenter advance.

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LOW COST SUPERCAPACITOR ELECTRODE BASED ON CACAO PODS

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Activated carbon was obtained from cacao pods using ZnCl2 as the activating agent. The prepared activated carbon was characterized using XRD and SEM-EDX. The XRD result showed the amorphous structure of the activated carbon with a graphitic phase resemblance suggesting the presence of micropores. A significant decrease in the pore size from micro to nanoscale diameter was observed and is attributed to the decomposition of cellulosic and lignin content of cacao pods to carbon. The SEM-EDX result confirms the presence of micro- and mesopores on the produced activated carbon with pore diameter of less than 42 nm. The supercapacitor electrode was fabricated by adding polyvinylidene fluoride and N-methylpyrrolidone to the activated carbon to form a slurry and was cast onto a nickel foam. The capacitance of the fabricated electrodes was determined using a potentiostat. A Cyclic Voltammetry (CV) was performed at various scan rates in a 3 M KOH electrolyte. The voltammograms showed faradaic reactions of the electrode at around 0.4 V and 0.7 V in a potential window of 0 V to 2.0 V with a scan rate of 50 mV/s to 600 mV/s. This is attributed to the low concentration and dispersion of electrolyte ions resulting to the formation of less layering of electrolyte ions. From the CV results, the specific capacitance of a 1-cm2 supercapacitor electrode was found to be approximately 100 F/g. Parameters of the electrode and electrolyte are further investigated to optimize the electrode for supercapacitor application.

DEVELOPMENT OF POROUS SILICON BASED DISTRIBUTED BRAGG REFLECTOR AS OPTICAL FILTER FOR HYPERSPECTRAL IMAGING

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Porous silicon (PSi) is a sponge-like nanostructure derived from a bulk silicon via electrochemical etching process. Its noble optical and structural properties such as tunable refractive index and variable porosity made this material popular in applications such as waveguide and anti-reflecting coating. By creating multilayers of alternating refractive index and thicknesses, the optical reflection and transmission of the PSi can be optimized or tuned into a desired spectral region. The produced multilayered structure which provide a reflectivity at selected wavelength is called Distributed Bragg reflector (DBR). In this study, we developed a wide-range optical filter by combining multiple narrow-band DBR's tuned at different wavelength for hyperspectral imaging application.

The DBR based on PSi thin-film were synthesized on a cleaned and oxide freed p-doped silicon substrate via electrochemical etching. The Si substrates were cut into a dimension 1.5cm x 1.5cm to fit into a bottom cell anodization cell setup made of Teflon with silver anode connected to a programmable current source. The analyte solution used was consisted of 1:1 ratio of absolute ethanol and 48% hydrofluoric acid. The supplied current for high refractive index layers I_h=15mA and I_l=100mA for low refractive index layers. The circular exposed surface area for the

electrochemical process is approximately 1.0cm in diameter wherein the 40 layers PSi structure is going to form. The DBR's were theoretically tuned to be highly reflecting at 500, 550, 600, 650nm and 700nm respectively. The resulting reflection spectra of the optical filters matches the calculated spectra using transfer matrix method (TMM), having only 5-10nm deviation from the central-wavelength of the fabricated filter with 100nm optical bandwidth.

TRANSPORT COEFFICIENTS OF Ar+H_2 PLASMA WORKING GASES IN THE PRESENCE OF TiO_2 SOLUTION PRECURSORS

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One way to obtain a TiO_2 coating is via solution precursor plasma spraying (SPPS) which uses liquid precursors injected into the plasma jet to form solid deposits onto a substrate. The solution droplets undergoing physical and chemical transformations depend on the transport properties of the plasma jet. Hence, a numerical investigation using T&TWinner software was conducted to understand the thermal transport properties of argon (primary gas) and H_2 (secondary) plasma working gases in the presence of different TiO_2 precursors: titanium nitride (TiN), titanium isopropoxide (TIP), and titanium butoxide (TB).

Thermal conductivity of Ar+H_2 plasma working gas mixture is observed to increase when the different TiO_2 solution precursors were added to it. The viscosity of the plasma jet is affected and lowered by the presence of solution which is due to the vapors coming from the solvent and other chemical species produced from the solution precursor-plasma interaction. These properties also were greatly influenced by the solution injection rate and concentration. The higher the injection rate and concentration, the higher the thermal conductivity, the lower the viscosity. The modified ability of heating factor of the plasma working gases, i.e. the ratio of the averages of the two transport properties, is also studied. The modified AHF when the precursors are present displayed 3 times greater compared to that of the pure Ar+H_2 plasma.

TEMPORAL MOD IFICATION OF LASER SOURCE TERM IN TWO-TEMPERATURE MODEL SIMULATIONS OF PULSED LASER ABLATION OF METALS

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Femtosecond pulsed laser ablation (fs-PLA) is a complex phenomenon which highly depends on material and laser properties. In many simulations including two- temperature model, the temporal profile of the laser source term is always assumed to have a Gaussian form. While this assumption is valid spatially and supported by many studies, the other forms ot temporal shape has not given much concern because of the difficulty demonstrating the pulse profile with time. Since femtosecond (fs) laser pulses find applications ln many different fields, accurate depiction of its nature is important, especially when modelling different laser- matter interactions.

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In this study, we demonstrate the effect of having a non-Gaussian temporal profile laser source term on metal ablation. Using copper as the model material, we calculated the temporal evolution of the electron and lattice temperatures, and the depth and radius of the crater formed from a single shot fs laser with Gaussian, Lorentzian, and hyperbolic secant temporal profiles. Our simulation results show that for a single shot pulse, there is a small difference in the electron and lattice temperatures achieved by the different temporal profiles. Calculations of crater parameters revealed that different temporal pulses form identical crater profiles for a single-shot laser pulse.

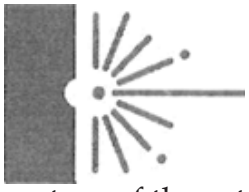

Figure 3. Tentative structure of the cytotoxic compound

FABRICATION OF COPPER OXIDE FILM VIA SPRAY PYROLYSIS METHOD FOR SUPERCAPACITOR APPLICATION

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Supercapacitor, also known as ultracapacitors or electrochemical capacitors, utilize high surface area electrode materials and thin electrolytic dielectrics to achieve capacitances several orders of magnitude larger than conventional capacitors. Since supercapacitors store energy on the surface of active material, the charging-discharging occurs at faster rates which results in high power densities and high cycling stability. This kind of energy storage have the potential to offset the intermittency problem of renewable energy sources by storing the generated intermittent energy and then making it accessible upon demand.

In this work, Copper oxide (CuxO) thin films were deposited on stainless steel by spray pyrolysis method. To study the annealing effects on the specific capacitance of CuxO, the films were subsequently annealed for two hours at varying temperatures 160°C, 250°C, and 400°C. The monoclinic phase of CuO was confirmed using X-ray diffractometry (XRD) and Raman spectroscopy. The calculations based from the XRD results revealed narrower full width half maximum (FWHM) of the diffraction peaks which is attributed to reduction of stress in crystal as the annealing temperature increases which resulted to increase in grain size. Surface morphology was examined by Scanning Electron Microscope (SEM) which revealed the smooth surface for as-grown films and presence of surface cracks with a maximum of length and width of 4.6μm and 0.32 μm respectively upon annealing due to the tensile stress developed in the films. The supercapacitive properties of the electrodes were evaluated in a three-electrode configuration in aqueous electrolyte, sodium sulphate (Na2SO4), employing cyclic voltammetry (CV) and charge–discharge cycling (CDC). The highest specific capacitance of 81.6 F/g at 10 mV/s with a columbic efficiency of 77% was achieved for CuO thin films annealed at 400°C. The obtained results show that CuO has a promising potential as an electrode for supercapacitor application.

ABSTRACTS

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1	Russel D. Bañoc	Field Performance and Grain Quality of Four Rice Types (*Oryza sativa* L.) as Influenced by Time of Planting Under Rainfed Lowland Conditions	VSU
2	Joven T. Sermona	Physicochemical And Sensory Quality of Bingawan Black Rice (*Oryza sativa* L.) Grown Under Various Production Systems	VSU
3	Zedrikke Cliphorde R. Fabella	*In Vitro* Digestibility and Gas Production of Upland Fodder Trees and Shrubs in Goats (*Capra hircus* L.) Fed Grass Diets With or Without Concentrates	VSU
4	Jean Karla D. Julian	Laying Performance of Itik-Pinas Ducks (*Anas platyrynchos*) as Influenced by Production Systems and Probiotics Supplementation	CLSU
5	Joe B. Poblete	Effect of Dietary Tannin on Growth Performance, Rumen Fermentation Characteristics and Nutrient Digestibility in Growing Holstein-Friesian X Sahiwal Bulls Fed with Low and High Energy Rations	UPLB
6	Cresini Inna B. Rañeses	Physico-Chemical, Micbiological, and Sensory Quality of Soft White Cheese Supplemented with Probiotics and Prebiotic	UPLB
7	Ronel B. Geromo	Genetic Characterizatics of Native Pigs (*Sus scrofa domesticus* L.) in Bohol Island, Philippines	VSU
8	Maria Karissa C. Lanza	Semen Quality and Reproductive Efficiency of Red Jungle Fowl (*Gallus gallus* L.) and SOEM Locally Available Native Roster (*Gallus gallus domesticus* L.)	VSU
9	Sance J. Secondez	Rumen Microbial Population and Digestibility Responses of Grower Goats (*Capra hircus* Linn) Fed with Varying Levels of Corn Stover Silage on a Napier Grass-Based Diet	VSU
10	Jean Marie L. Diego	Feeding Programs for Itik Pinas (*Anas platyrhynchos*) during the Development Phase and their Influence on the Subsequent Egg Production Period	CLSU
11	Xyrra Jeremiah C. Mazo	Aquashade Technology and its Impact on the Water Quality and Reproductive Indices of Nile Tilapia (*Oreochromis niloticus* L.)	CLSU
12	Angelica V. Tarampi	Morphometric and Molecular Identification of Two Genetically Improved Philippine Strains of Tilapia (*Oreochromis* Spp.)	CLSU
13	Imee G. Delos Reyes	Characterization of the Spatial and Temporal Distribution of Fine Particulate Pollution in the Surface Layer of a Monsoon Asia Megacity: An Assessment of Personal Exposure of a High-Risk Occupational Group in Metro Manila, Philippines	ADMU
14	Marco Polo A. Ibañez	Investigation of the Monsoonal Variation of Microphysical Characteristics of Rainfall Over Metro Manila Using a Parsivel^2 Disdrometer	ADMU
15	Paola Angela V. Bañaga	Long-Term and Seasonal Trends of Omi-Derived Tropospheric Column NO2 in Southeast Asia: Urban Emissions, Seasonal Burning, and the Influence of Meteorology	ADMU

Poster Presentation

POSTER NO.	NAME	TITLE	SCHOOL
AGRICULTURE/FISHERIES/ENVIRONMENTAL SCIENCE			
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17	Larry Ger B. Aragon	Surface Microphysical Characteristics of Stratiform and Convective Rains in Metro Manila, Philippines	ADMU
18	Lyka C. Abayon	QTL Detection and Estimation of Resistance Genes in Us-2/ Malay-2 BC_1F_2 and BC_1F_5 Population Using Standard Differential System	CLSU
19	Symon Louie E. Andoy	Evaluation of Nano-Structured Cashew (Anacardium Occidentale L.) Nut Shell Oil Against Banana Aphid (Pentalonia nigronervosa Coq.)	CLSU
20	Luis L. Calama	Collembolan in the Arabica Coffee Agroforestry System in the Highlands of Benguet Province	CLSU
21	Ma. Michele P. Felisan	Black Soldier Fly, Hermetia Illuscens Larvae and Substrates Analyses	CLSU
22	Alona H. Grospe	Surveillance, Detection and Mapping of Anthracnose-Twister Disease of Onion in Guimba, Nueva Ecija Using Remote Sensing Technology	CLSU
23	Anna Marie S. Irang	Evaluation of Inoculation Methods for Characterizing the Resistance of Rice Genotypes to Panicle Blast	CLSU
24	Airene T. Otanes	Surveillance, Detection and Mapping of Anthracnose-Twister Disease of Onion in Cuyapo, Nueva Ecija Using Remote Sensing Technology	CLSU
25	Princess M. Perez	Development of Integrated Disease Management Program Against Anthracnose-Twister (Colletotrichum gloeosporioides Penzig and Sacc.)-Gibberella moniliformis Wineland Disease of Onion (Allium Cepa L.)	CLSU
26	Vince Jethro B. Alba	In Vitro Control of Fusarium Oxysporum F.Sp. Cubense Race 2 Using Different Treatments of Sewage Sludge-Derived Compost Tea	ADMU
27	Audie Melbert L. de Asis	Antibiotic Resistant Screening of Enterococcus Spp. in Iloilo River Impacted by Land Use	ADMU
28	Cristine P. Dulfo	Speciation of Nickel and Chromium in Paddy Soils of Masinloc, Candelaria, and Sta. Cruz, Zambales, Philippines	ADMU
29	Jessica R. Francisco	In Vitro Assessment of the Inhibitory Effect of Sludge Against Fusarium Oxysporum F. Sp. Cubense (Smith) Snyder Et Hansen	ADMU
30	Lara R. Mendoza	Establishing Mollusc-Vegetation-Sediment Relationships in Mangrove-Recolonization in Abandoned Fishponds: Implications on Mangrove Restoration	ADMU

Poster Presentation

POSTER NO.	NAME	TITLE	SCHOOL
AGRICULTURE/FISHERIES/ENVIRONMENTAL SCIENCE			
31	Manuel Anthony P. Jondonero	Cost-Benefit Analysis of Mangrove Ecological Services and Commercial Aquaculture Industries in Selected Sites Along Panguil Bay, Mindanao, Philippines	MSU-IIT
32	Psyche Karren Ann S. Osing	Aboveground Carbon Stock of the Selected Natural and Reforested Mangrove Forests in Panguil Bay, Mindanao, Philippines	MSU-IIT
33	Ria Jhoanna C. Ducusin	Vulnerability Assessment to Climate Change Impacts of a Globally Important Heritage System (GIAHS) in the Philippines: The Case of Batad Rice Terraces, Banaue, Ifugao, Philippines	UPLB
34	Kimbhierly M. Ludovice	Chemical Speciation, Spatial Distribution and Risk Assessment of Trace Metals in the Sediments of Laguna De Bay, Philippines	UPLB
35	Francis Jhun T. Macalam	Groundwater Vulnerability Assessment Using Modified Hydrological Drastic Model in Meycauayan City, Bulacan, Philippines	UPLB
36	Joseph J. Magdalera	Drinking Water Treatment Using Hybrid Biosand Filter with Locally Produced Coconut Shell Carbon for Brgy. San Juan, Kalayaan, Laguna, Philippines.	UPLB
37	Angelica T. Magpantay	Rainfall Pattern and Land Use and Land Cover (LULC) Changes Impact Assessment on the Surface Runoff Responses of Santa Cruz Watershed, Philippines	UPLB
38	Maria Shiela M. Muros	Hedonic Analysis of Flood Prone Risk in Batangas City, Philippines	UPLB
39	Andreah Kate M. Orlina	Analysis of Soil Microbial Diversity and Gross Primary Productivity of Magabuyo (*Celtis luzonica* Warb.) - Dominated Area and Corn (*Zea mays* L.) - Planted Area in Mt. Makiling	UPLB
40	Unice Faith A. Roa	Rainwater as Water Source: The Case of Sitio Pulot-Bae, Kalayaan, Laguna, Philippines	UPLB
41	John Darby W. Taguiam	Efficacy and Production Cost of *Trichoderma* Microbial Inoculant (TMI) and Citronella Essential Oil as Pest and Disease Control Methods in Hot Pepper (*Capsicum annuum* L.) Cultivation	UPLB
42	Aries C. Tibar	Sustainable Environmental Performance of Spring Onion (*Allium fistulosum* L.) Production in Pangil and Mabitac, Laguna, Philippines	UPLB
43	Geri Mae A. Tolentino	Environmental Conceptions, Awareness and Attitudes of Kindergarten Children and Teachers in Selected Schools in Calauan, Laguna	UPLB
44	Laarlyn N. Abalos	Mapping Ambient Water pH and Temperature Using an Unmanned Aerial Vehicle: A Case Study in Guinabasan River, Asturias, Cebu, Philippines	USC
45	Katrene Cerna	Sedimentation Rate in the Reef Area Off Barangay Maribago and Barangay Punta Engaño, Lapu-Lapu City, Mactan Island, Cebu, Phillipines	USC

Poster Presentation

POSTER NO.	NAME	TITLE	SCHOOL
AGRICULTURE/FISHERIES/ENVIRONMENTAL SCIENCE			
46	Anthea Maliz V. Cortes	Microplastic Occurrence in Lake Mainit and Plastic Awareness of Residents in Mainit, Surigao Del Norte, Philippines	USC
47	Therese Elaine B. Enad	Forest Fragmentation Assessment using Landsat 8 Imagery from the Year 2015 and 2019 in Siargao Mainland, Surigao Del Norte, Philippines	USC
48	July B. Arinez	Transcriptome Analysis Provides Molecular Bases for the Selection of a Superior Asian Catfish *Clarias macrocephalus* Günther 1864 Strain Intended for Reintroduction	UPV
49	Welmen B. Carcellar	Some Aspects of Ecology and Biology of the Mangrove Clam, *Anadontia edentula* in Tarangnan, Samar	UPV
50	Ryan V. Fabay	Effects Of Dietary pH on Growth and Feed Efficiency of the Nile Tilapia *Oreochromis niloticus*	UPV
51	Honey Lyn R. Gomez	In Silico and In Vitro Assessment of Portuguese Oyster (*Crassostrea angulata*) Protein as Precursur of Bioactive Peptides	UPV
52	Amel G. Nudalo	Evaluation of Dietary Benfotiamine on Growth and Immune Respone of *Penaeus monodon* Post Larvae	UPV
53	Janine Kaysee R. Soriano	Assessment of Endomycorrhizal Fungi Diversity and Gall Rust Disease of *Falcataria moluccana* (Miq.) Barneby & J.W. Grimes Trees in Laguna, Philippines	UPLB
54	John Emmanuel S. Fungo	Gold-Bearing Liswanites in a Young Island Arc: A Case Study in the Malabeg Prospect, Zambales, Philippines	UPD
55	Joy C. Codog	Flowering Response and Postharvest Quality of Tissue Culture-Derived Chrysanthemum (*Chrysanthemum morifolium* Ramat.) Applied with Different Organic Soil Amendments Under Two Types of Cultivation System	VSU
56	Warren L. Obeda	Growth, Yield and Physico-Chemical Qualities of Sweet Pepper (*Capsicum annuum* L.) Under Protected Cultivation System as Influenced by Wood Vinegar Application	VSU
57	Jonessa G. Vigo	Effect of Exogenous Application of Salicylic Acid on Growth and Yield of Tomato (*Solanum lycopersicum* L.)	VSU
58	Ma. Cecilia S. Alaban	Growth Effects, Accumulation, and Localization of Lead in Ulasimang-Bato [*Peperomia pellucida* (L.) H.B.K.]	UPLB
59	Rizza Mae L. Cantalejo	Growth, Phytochemical Content and Yield of Vegetable Fern, *Diplazium esculentum* (Retz.) Sw., as Influenced by Compost and Inorganic Fertilizer	UPLB
60	Eddie P. Gacasan	Effectivity of Grafting and Trap Cropping on Increasing Yield of Ampatola [A Graft Between Ampalaya (*Momordica charantia* L.) and Patola (*Luffa acutangula* L.)] Grown Under Protected Cultivation System	VSU

Poster Presentation

POSTER NO.	NAME	TITLE	SCHOOL
AGRICULTURE/FISHERIES/ENVIRONMENTAL SCIENCE			
61	Lyn A. Jardio	Effect of Anti-Browning Agents and Edible Based Coating on Quality and Shelf Life of Sliced Ripe Jackfruit Var Eviarc Sweet	VSU
62	Jina May B. Morales	Effect of Precooling and Hot Water Treatment on Postharvest Quality and Shelflife of Mango (*Mangifera indica* L.) cv. Carabao	VSU
63	Charmae B. Tapayan	In Vitro Culture of Two Varieties of Ornamental Bamboo (*Bambusa* Sp.) Using Nodal Explants	VSU
64	Alyssa Dawn Castillo	Atmosphere and Ocean Response of Tropical Cyclone Hato (Isang) And Pakhar (Jolina) as Observed and Simulated by Coupled Model.	UPD
65	Diana Mae T. Calde	Storm Surge Analysis in the Eastern Region of the Philippines	UPD
66	Kevin Christopher B. Cordoviz	Influence of the West Pacific Subtropical High on Landfalling Winter Tropical Cyclones in the Philippines	UPD
67	Jan Leandro L. Acedera	Morpho-Agronomic and Molecular Characterization of Locally Collected Sugarcane (*Saccharum officinarum* L.)	UPLB
68	Mari Neila P. Seco	Phenotypic Reaction and Gene Expression of Wheat-Durable Resistance Gene *Lr67* in Rice (*Oryza sativa* L.) Against Fungal Pathogens	UPLB
69	Mark Anthony M. Barbadillo	Reformulation of Organic Fertilizer and Efficacy Test on Corn (*Zea mays* L.) at Early Stage of Growth	VSU
70	Jeam D. Catague	Characterization of Lahar and Black Sand Laden Soils of Botolan, Zambales Towards Improving Soil Productivity	CLSU
71	Catherine May A. Mercado	Tempo-Spatial Variability of Glyphosate Residue on Corn Growing Areas in Brgy. Colubot, San Manuel, Tarlac	CLSU
72	Virginia Isabelle G. Mapa	Potentials of Nano-ZnO as a Zinc Source for Correcting Zinc Deficiency and for Zinc Biofortification in Rice	UPLB
73	Adela Maria A. Reynoso	Morphology and Phosphate Retention Capacity of Soils Affected by Volcanic Ejecta And Lahar	UPLB
74	Marlyn C. Entuna	Properties, Genesis, Fertility Status, and Classification of Soils Mapped as Faraon Series in Leyte and Samar	VSU
75	Mark Vincent G. Latras	Effects of Combined Application of Uncharred and Charred Poultry Litter, and Beneficial Microorganisms on the Microbial Activity and Fertility of a Strongly Acid Soil	VSU
76	Warren Kim Siarot	Physico-Chemical Properties and Heavy Metal Contents of Soil Organic Amendments Produced in the Visayas Region	VSU
77	Al John C. Cabanas	Occurrence and Distribution of Philippine Warty Pig (*Sus philippensis*, Nehring 1886) in Mt. Banahaw De Tayabas	UPLB

Poster Presentation

POSTER NO.	NAME	TITLE	SCHOOL
BIOLOGY/MARINE SCIENCE/MICROBIOLOGY/MOLECULAR BIOLOGY			
78	Kenneth Xavier O. Sanchez	Parasitic Nematodes & Oligochaetes of Invasive Alien Species (IAS) of Amphibians in Paoay Lake, Ilocos Norte Province	UST
79	Michael A. Tabug	Intraspecific Variation in Foraging Ecology and Diet of the Philippine Spotted Flying Lizard, *Draco spilopterus* (Wiegmann, 1834), in Luzon Biogeographic Region	UST
80	Loel B. Dalan	From Free-Living to Parasitic: A Potential Ephemeral Parasitism Activity of *Caenorhabditis brenneri* on a Tropical Slug	MSU-IIT
81	Erl Phian T. Maglangit	Amphibians and Reptiles of Limestone Karst Habitat of Unib Island: Its Diversity Microhabitats and Current Conservation Status in Dinagat Islands, Northeastern Mindanao, Philippines	MSU-IIT
82	Noel John Ian Feben S. Maguate	Antibacterial Activity of *Sargassum crassifolium* (Aragan) and *Kappaphycus striatum* (Guso) Crude Methalonic Extract against Isolated Vibrio Species from Infected Seahorses	MSU-IIT
83	Jalanie S. Marohomsalic	Association of Parasitic *Hexathrombium* Mites (Acari: Microtrombidiidae) and Tiger Beetle *Calomera Angulata Angulata* in Lanao Del Sur, Philippines	MSU-IIT
84	Regina T. Sangcopan	Isolation and Identification of Entomopathogenic Nematodes from Digos, Davao Del Sur	MSU-IIT
85	Angeleth U. Taotao	Microhabitats of Land Snails (Mollusca: Gastropoda) in Selected Areas in Northern Mindanao, Philippines	MSU-IIT
86	Marlon S. Dela Cruz	Identification and Validation of Stress Response Genes in the Mature Seeds of *Moringa oleifera* Lam. Transcriptome Using Quantitative Real Time PCR	ADMU
87	Ralph Allen C. Geronimo	Microbiological Evaluation of Virgin Coconut Oil (VCO) Production in the Philippines	ADMU
88	Maria Kenosis Emmanuelle G. Lachica	Establishment of a Potential Microbial Consortium with Screened Biofilm-Forming Bacteria for Bioaugmentation	ADMU
89	Arthien Lovell Pelinge	Three New Species and One New Record of *Neoperla* Needham, 1905 (Plecoptera, Perlidae) from the Philippines Using Integrative Taxonomy	ADMU
90	Janice S. Aguilar	Diversity and Pharmacological Potential of Sea Cucumber in Casiguran, Aurora	CLSU
91	Rose Anne C. Bognot	Growth Stimulation and Phyto-Nanoremediation of Lead Using Chitosan/Zeolite/Silica Nanocomposite in Water Spinach (*Ipomoea aquatica* Forsk.)	CLSU
92	Don T. Dumale	Direct-Seeded Rice Genotype Selection Based on Lodging Resistance and Anaerobic Germination for Optimization on Mechanized Farming	CLSU

Poster Presentation

POSTER NO.	NAME	TITLE	SCHOOL
BIOLOGY/MARINE SCIENCE/MICROBIOLOGY/MOLECULAR BIOLOGY			
93	Gian Carlo S. Gaetos	Root Responses of Rice Genotypes to Drought Stress	CLSU
94	Maureen B. Gajeton	Carotenoid Uptake in Red Nile Tilapia (*Oreochromis niloticus*) Tissues as Affected by Carotenoid-Rich Diet	CLSU
95	Ann Jhudeil C. Santos	Potential Sources of Novel Tungro Resistance Genes from Philippine Traditional Rice Varieties	CLSU
96	Roselyn J. Uy	Pharmacological Potential of Crude Extract from Mango (*Mangifera indica* L.) Leaves (*Carabao* Var.)	CLSU
97	Shad Natthew S. Arce	Diversity and Taxonomic Keys of the Pest and Beneficial Arthropods of Potato in La Trinidad, Benguet Across Two Growing Seasons	DLSU
98	Yokimiko C. David	Volatile Organic Compound Profiling of *Capsicum annuum* Var. *longum* Grown Under Different Concentrations of Nitrogen	DLSU
99	Maria Criselda V. Dela Cruz	Attraction of Cacao Mirid Bug (*Helopeltis bakeri* Poppius) to Feeding Attractant β-Caryophyllene Using Wind Tunnel Behavioral Bioassay	DLSU
100	Phoebe R. Diez	Detection of *Wolbachia* Sp. in *Aedes* Spp. Mosquitoes (Diptera: Culicidae) in Selected Barangays of General Trias City, Cavite and Metro Manila	DLSU
101	John Paul Domingo	To Eat or Not to Eat: Cadmium and Lead Concentrations in the Dorsal Muscles of Spotted Knifefish (*Chitala ornata*, Gray 1831) from Laguna De Bay, Philippines	DLSU
102	Helenar A. Gonzales	Identification of Gastrointestinal Helminths in a Small-Scale Poultry Farm	DLSU
103	Meril Kate K. Mariano	Surface Morphology and Wetting Behavior of the *Aspidiotus* Spp. Scale Covers	DLSU
104	John Martin S. Mondragon	Decellularization of Kidney using a Sonication-Assisted Treatment for Renal Tissue Engineering Applications	DLSU
105	Daisy R. Sucaldito	Detection of *Wolbachia* Sp. in *Aedes aegypti* Mosquitoes (Diptera: Culicidae) in Three (3) Selected Barangays of Lucena City, Quezon Province	DLSU
106	Jhoyel B. Ylagan	Histological and Behavioral Response of *Cyprinus carpio* in Response to Different Environmental Stress Factors	DLSU
107	Pamela Angel D. Zamora	Cytotoxic Activity of *Terminalia microcarpa* Decne Fruit Extract on Human Cancer and Normal Cell Lines and the Effect on Expression of Early Apoptotic *CFOS* and *CJUN* Genes And Proinflammatory Cytokine *Interleukin-1β* and *Tumor Necrosis Factor* -α (TNF-α) Genes	DLSU

Poster Presentation

POSTER NO.	NAME	TITLE	SCHOOL
BIOLOGY/MARINE SCIENCE/MICROBIOLOGY/MOLECULAR BIOLOGY			
108	Gerard Clinton L. Que	Mitochondrial DNA Haplotype Analysis of the Critically Endangered Philippine Cockatoo (*Cacatua haematuropygia* P.L.S. Müller, 1776)	UPD
109	Maria Theresa T. Tengco	Assessment of Blue Swimming Crabs *Portunus pelagicus* (Linnaeus, 1758) Populations in the Philippines Using Mitochondrial DNA Markers	UPD
110	Genea Nichole G. Cortez	Floral Diversity Assessment of Del Carmen Mangrove Forest in Siargao Island, Philippines	UST
111	Justine R. de Leon	Lake Depth and Productivity as Predictive Parameters on the Widespread Invasion of *Arctodiaptomus dorsalis* (Marsh, 1907) (Copepoda: Calanoida) in Tropical Lakes	UST
112	Yfiigo Luis C. del Prado	Investigating the Potential Cryptic Diversity of the Philippine Pitviper *Trimeresurus flavomaculatus* (Viperidae: Crotalinae) in the Luzon Biogeograpic Region	UST
113	Ma. Marivic C. Pepino	Abundance and Composition of Macrobenthic Invertebrates Collected from Six Seagrass Sites Along Guimaras Strait and Panay Gulf, Philippines	UPV
114	Christine Claire Arcenal-Piloton	Metabolic Responses of the Philippine Cupped Oyster *Crassotrea iredalei* to Environmental Change	UPV
115	Mary Ann Cielo L. Malingin	Faunal Assemblages in Mangrove Fringes in Southern Guimaras, Philippines	UPV
116	Jan Michael P. Chan	Status of Schistosomiasis in the Philippines: Prevalence, Control and Innovative Methods for Detection and Elimination	DLSU
117	Grapesy Pink M. Alsonado	Microhabitats of Jumping Spiders (Araneae: Salticidae) in Selected Areas of Northern Mindanao, Philippines	MSU-IIT
118	Von Carlo P. Dela Torre	Species Diversity, Distribution, and Microhabitats of Anurans on Mt. Kalo-kalo of the Mt. Kalatugan Range Natural Park, Bukidnon, Philippines	MSU-IIT
119	Michelle Anne B. Diano	First Report of *Caenorhabditis brenneri* Isolated from Giant African Land Snail *Achatina fulica,* and its Bacterial Associates	MSU-IIT
120	Rogel Victor D. Mendoza	Reasons for Breaking-Up? The Use of Mitochondrial Genes and Population Genetics in Determining the Genetic Differentiation of *Rousettus amplexicaudatus*	UPD
121	Rose Chinly Mae H. Ortega	A Call for Seahorse Conservation: 16S rRNA Metabarcoding Analysis of Microbial Communities Associated with *Hippocampus Barbouri*	MSU-IIT
122	Chinee S. Padasas	A Tool for Seahorse Conservation: Metabarcoding Using 16S rRNA Gene of Bacterial Communities Detected from the Skin Mucus of *Hippocampus comes*	MSU-IIT

Poster Presentation

POSTER NO.	NAME	TITLE	SCHOOL
BIOLOGY/MARINE SCIENCE/MICROBIOLOGY/MOLECULAR BIOLOGY			
123	Jeanette Mara P. Tan	Petiole Anatomy Characters Delimiting Eupolypods I Families *Sensu* PPG	UPLB
124	Ted Dominique S. Belonias	Lead Tolerance and Antioxidant Activity of *Andrographis paniculata* (Burm.F.) Nees	UPLB
125	Jeremaiah L. Estrada	Morphometric Analyses of Sea Grapes (*Caulerpa Spp*.) in Selected Regions in the Philippines	UPLB
126	Grace B. Vinarao	Morphological Characterization and SSR-Based DNA Fingerprinting of Cassava (*Manihot esculenta* Crantz) Varieties Released by the National Seed Industry Council (NSIC)	UPLB
127	Darlyne L. Bugtong	Diversity, Abundance and Spatial Distribution of Mollusks Along the Intertidal Zones of Illana Bay, Philippines	MSU-IIT
128	Ann Clowee J. Hurboda	Green Synthesis of Carbon Quantum Dots Using Lambda-like Carrageenan from the Marine Red Alga *Halymenia durvillei* Bory De Saint-Vincent	USC
129	Bienson Ceasar V. Narvarte	Inorganic Carbon Utilization of Tropical Calcifying Macroalgae and Survival of the *Rhodolith sporolithon* Sp. (Sporolithales: Rhodophyta) under Long-Term Low-pH Conditions	UPD
130	Christine Baran	Reproductive Output and Sex Ratio of the Soft Coral *Lobophytum* Sp. (Octocorallia: Alcyonacea) in Bolinao-Anda Reef Complex, Pangasinan	UPD
131	Christine Marie C. Florece	Transcriptomic Analysis of Three Vermivorous Cone Snails (Subgenus *Rhizoconus*, Gastrpopoda, Mollusca): Insights to Therapeutic Application	UPD
132	Jay B. Estrella	The Use of Bayesian Belief Networks (BBNS) in Predicting Alexandrium and Skeletonema Blooms in Bolinao Pangasinan Philippines	UPD
133	Joana Andrea C. Maningas	Influence of Shallow-Water Vents on Survival of Various Coral Species in Mabini Batangas	UPD
134	Paolo Carlo Calalang	Effects of CO_2-Induced Acidification on the Growth and Physiology of *Alexandrium minutum* and *Chaetoceros calcitrans* in Laboratory Cultures	UPD
135	Tracey Antaeus D. Gutierrez	Phylogeny of Aeromonad Bacteriophages	UST
136	Noel R. Bangquiao	Impact of Madden-Julian Oscillation on Philippine Rainfall During Boreal Winter	UPD
137	Reneelyn E. Danganan	Identification and Polyphasic Characterization of a Red Halophilic Archaeon from a Solar Saltern	UST

Poster Presentation

POSTER NO.	NAME	TITLE	SCHOOL
BIOLOGY/MARINE SCIENCE/MICROBIOLOGY/MOLECULAR BIOLOGY			
138	Angelbert D. Cortes	Taxonomic Microbiome Profiling and Abundance Patterns in the Cacao (*Theobroma cacao* L.) Rhizosphere Treated with Biochar and Arbuscular Mycorrhizal Fungi	UPLB
139	Jonathan E. Wong	Transcriptomic Complexity of the Venom Repertoire in Closely Related Piscivorous Cone Snail Species	UPD
140	Lindsay Clare D.L. Carandang	Genomic Analysis of Putative AHPND-Causing *Vibrio parahaemolyticus* Isolates from Shrimp Aquaculture Farms in Mindanao Island	UPD
141	Gela Myan S. Bueno	Suitability of Rice Thioredoxin h (OsTRXh) Promoter in Improving the Iron and Zinc Content in Rice Endosperm	UPLB
142	Krystal M. Hate	Evaluation of Single Nucleotide Polymorphism (SNP) Markers Associated with Waterlogging Tolerance in Corn (*Zea mays* L.)	UPLB
143	Jerice R. Monge	Molecular Characterization and SSR Marker Development of KASII and KASIII Oil Genes in Coconut (*Cocos nucifera* L.)	UPLB
144	Nadine Janelle E. Sinco	Development of DNA Markers for Sex Determination in Pili (*Canarium ovatum* Engl.)	UPLB
145	Lawrence Yves Uy	*TGW6* Targeted Knock-Down via CRISPR-Cpf1 System Enhances Grain Weight in Elite Rice Varieties	UPLB
146	Moses Edric G. Abadilla	Transmission Dynamics of *Toxocara canis* in Mayondon, Los Baños, Laguna: Seroprevalence, Environmental Reservoirs, and Risk Factors	UPLB
147	Junard A. Catabay	Philometrid Nematode Infecting the Ovaries of Japanese Threadfin Bream *Nemipterus japonicus* (Bloch, 1791): Prevalence, Intensity, and Effect on Reproductive Potential	UPLB
MATHEMATICS/STATISTICS/PHYSICS			
148	Angelie R. Ferrolino	Optimal Location of Sensors for Early Detection of Tsunami Waves	UPD
149	Cristeta Jamilla	Solutions of Neutral Delay Differential Equations Using a Generalized Lambert *W* Function	UPD
150	Gertrude Thea Marie S. Reyes	On the Computation of a Bank's Minimum Capital Requirement for Operational Risk Using Advanced Measurement Approach	UPD
151	Jayrah Bena E. Riñon	A Mathematical Model on the Transmission of Schistosomiasis in the Philippines	UPD
152	Rey Audie S. Escosio	A Perturbed Accelerated Gradient Descent Algorithm Using an n-Dimensional Golden Section Search Method	UPD

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POSTER NO.	NAME	TITLE	SCHOOL
MATHEMATICS/STATISTICS/PHYSICS			
153	Leah Mei Charisse G. Manongas	Modified Hierarchical Shelter Location Allocation Models	UPD
154	Aixeen M. Fontanilla	Evaluation of the Neutron Spectra in a Linear Accelerator Facility Using a Modified Bonner Sphere Spectrometer (mBSS)	UST
155	Mark Anthony C. Burgonio	Image Quality Evaluation of a Hybrid Iterative Reconstruction Algorithm in the Multi-Slice Computed Tomography Scanner for the Pediatric Head Diagnostic Procedure	UST
156	Abigail R. Espina	Medium Chain Triglyceride and Cerebral Ketone Body Metabolism	DLSU
157	Joven Paolo D. Angeles	Predicting the Surface Plasmon Resonance of Fe_3O_4-Au Spherical Nanoparticles for SERS Applications	UPD
158	Giovanni Benito Escolano	Combinatorial and Topological Properties of a Family of Random Substitutions	ADMU
159	Gerone Russel J. Eugenio	The Set Chromatic Numbers of the Middle Graph of Graphs	ADMU
160	Patrick John M. Fernandez	On Point-Color-Symmetric Graphs and Groups with Point-Color-Symmetric Picture Representation	ADMU
161	James Efraim M. Tamargo	N_2-Vertex Coloring of Some Families of Graphs and Graph Operations	ADMU
162	Dhenmar E. Chua	On Efficient Zero Ring Labeling of Some Classes of Trees	DLSU
163	Jehan R. Abbas	Uncertainty Principle in a Seperable Hilbert Space	UPD
164	Emman C. Ahmad	Fault-Tolerant Location-Domination of Some Graphs	MSU-IIT
165	Irene Mae Y. Antabo	A One Dimensional Parametrized Test Functions Space of Entire Functions	MSU-IIT
166	Mark Anthony G. Bacang	Coding Theory and Hyper BCI-Algebras	MSU-IIT
167	Vergel T. Bilar	Minimum Dominating Maximum Degree Energy of Graphs Obtained from Some Graph Operations	MSU-IIT
168	Maria Andrea O. Bonsocan	On Chromatic Transversal Domatic Number of Graphs under some Sgraph Binary Operations	MSU-IIT
169	Mark L. Caay	Analysis of a Mathematical Model of HIV Transmission Based and its Control Strategies	MSU-IIT
170	Kenneth John E. Duhaylungsod	Partially Ordered Multiplicative Hyperring	MSU-IIT

Poster Presentation

POSTER NO.	NAME	TITLE	SCHOOL
MATHEMATICS/STATISTICS/PHYSICS			
171	Ronelo A. Fajardo	Local Stability Analysys: Predator-Prey System with Harvesting	MSU-IIT
172	Ang Elyn P. Gumanoy	Calculation of Transition Probabilities in the Birth and Death Markov Process in the Epidemic Model	MSU-IIT
173	Javier A. Hassan	θ_s - Open Sets and other Variations of Topological Concepts	MSU-IIT
174	Ronaldson J. Jamesolamin	On a Generalization of Feedback Vertex Sets: Theory and Algorithm	MSU-IIT
175	Angelica Mae L. Mahistrado	The Complexity of Some Graphs	MSU-IIT
176	Rodolfo E. Maza	On the Φ-Strong Luzin Integral in Locally Convex Topological Vector Spaces	MSU-IIT
177	Marivir M. Ortega	Semitotal κ-Fair Domination in Graphs	MSU-IIT
178	Jill Maegan B. Pamplona	On the Planarity of a Directed Pathos Total Digraph of Some Special Arborescence Graphs	MSU-IIT
179	Chrisley Jade C. Saromines	Interior Perfect Hop Domination in Graphs Under Some Binary Operations	MSU-IIT
180	Jan Alejandro C. Sasam	On θ_{sw}-Open Sets and Its Corresponding Topological Concepts	MSU-IIT
181	Efieme B. Sumilhig	Generalized Topology of Intuitionistic Fuzzy Sets via Neighbourhood Systems	MSU-IIT
182	Mary Anne L. Tabigue	On Topological G-Algebras	MSU-IIT
183	Rolex B. Teologia	Epidemiological Modelling of the Population Dynamics of Bee Colonies	MSU-IIT
184	Jam Benneth G. Wong	The Essential Self-Adjointness of the Bender-Dunne Basis Operators	UPD
185	Prudence Peace V. Bustamante	Magnetic and Semiconducting Hydrogen-Functionalized Di-Vacancy Graphene: A DFT Study	MSU-IIT
186	Diamond C. Domato	DFT Calculations of the Electronic Properties of Metal-Adsorbed Pristine and Defective (7,0) Swcnt	MSU-IIT
187	Mariel A. Escobal	Surface Analysis on the Effects of Zinc Ions to SPPS-Hydroxyapatite Coatings via X-Ray Photoelectron Spectroscopy	MSU-IIT
188	Jeremiah D. Juevesano	Study of $\frac{B(B^o \to J/\Psi(\mu^-\mu^+)\eta'(\eta\pi^-\pi^+))}{B(B_s^o \to J/\Psi(\mu^-\mu^+)\eta(\pi^0\pi^-\pi^+))}$ Using Partial Reconstruction Technique at a Future High Luminosity Z Factory	MSU-IIT

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POSTER NO.	NAME	TITLE	SCHOOL
MATHEMATICS/STATISTICS/PHYSICS			
189	Alfredo Q. Liboon Jr.	Effect of Transition Metals Co-Doping of TiO_2 on Its Photocatalytic Properties	MSU-IIT
190	Kim S. Ponce	Electronic Properties of Hydrogen-Adsorbed Divacancy (6,0) Single-Walled Carbon Nanotube via Density Functional Theory	MSU-IIT
191	Jumar G. Cadondon	Excitation-Emission Fluorescence Characterization of Algal Organic Matter and Pigments Towards the Development of a Portable LED Fluorescence Lidar System	DLSU
192	Martin Guillermo C. Fernandez	Functionalization of Polyaniline on Woven Abaca Fibers	DLSU
193	Alyssa Marie V. Llanes	A Characterization of Electrochemically-Polymerized Polypyrrole (PPY) Doped with Na-pTS And K-HQS	DLSU
194	Audrey Rillera	Mechanical Properties of B/C/N/Mg/Ca/K-Decorated Aluminene: A First Principle Study	DLSU
195	Kurt Irvin M. Rojas	Water Stability of HB Sheets	DLSU
196	Cephas Olivier V. Cabatit	Prisoner's Dilemma Game Dynamics on Complex Networks via a Modified Radiation Model of Migration	UPD
197	Cleofe Dennielle P. Ayang-ang	Quantum Critical Phenomena and Finite Scaling Analysis in a Kitaev Chain with Variable-Range Interactions	UPD
198	Jhon Delo L. Procurato	Redshift Function for Photons in a Spherically Symmetric Black Hole Spacetime	UPD
199	Kenneth Jhon M. Remo	Representation of the Finite Part Integral and its Application in Term by Term Integration	UPD
200	Ralph Adrian E. Farrales	Solutions to the Time Kernel Equation	UPD
201	Mark Adones P. Lingaro	Resonant Tunneling Diode (RTD) as Computer Memory Storage	USC
202	Mary Diane A. Pilapil	Osteosarcoma Cellular and Nuclear Adaptation on a Nanopatterned Substrate	USC
203	Jeric Villanueva	DFT Study of the Electronic Properties and the Stability of Ge Doped $Ch_3Nh_3SNI_3$	USC
204	Remalyn Fajardo	Pyroelectric Properties of Zirconium-Doped $BaTiO_3$ Solid Solutions using Electron Diffraction and First-Principle Calculations	USC
205	Betz S. Hayag	Superfield Liouvillian versus Hierarchy Equations of Motion Scattering Formalisms in Nonequilibrium Quantum Transport	USC
206	Anthony Val Camposano	1D DFT + LWW Quantum Transport Modeling	USC

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POSTER NO.	NAME	TITLE	SCHOOL
MATHEMATICS/STATISTICS/PHYSICS			
207	Jacob Alberto S. Garcia	A Geospatial Analysis of the Spatial Patterns Present within Puj-Attributed Particulate Matter	DLSU
208	Joseph P. Abordo	A Multivariate Cace-Based Approach for Longitudinal Data	MSU-IIT
209	Trixia May D. Belga	Latent Dirichlet Allocation Using a Dirichlet Type II Prior	MSU-IIT
210	Idzhar A. Lakibul	On the T-Standard U-Quadratic Exponentiated Generalized (Tsuexg)-Generated Family of Distributions	MSU-IIT
211	Rey E. Lampawog	A Blessing of High Dimensionality: Modified Feature Clustering Based on Some Data Reduction Techniques	MSU-IIT
212	Azman A. Nads	Robust Estimation in Functional Missing Data Analysis	MSU-IIT
213	Mercedita M. Platino	Bayesian Estimation of Zero-Inflated Negative Binomial INGARCHX Model	MSU-IIT
214	Glend Ford B. Rodriguez	On The Reliability Theory of Aging of Nematods	MSU-IIT
215	Daniel R. Sanson	Bayesian Zero and K Inflated Negative Binomial Spatio-Temporal (BZKINB S-T) Model	MSU-IIT
CHEMISTRY/NATURAL PRODUCTS/FOOD SCIENCE/HEALTH SCIENCES			
216	Adonis A. Yanos	Beta-Mannanase from *Bifidobacterium adolescentis* DSM 20083: Biochemical Characterization and Manno-Oligosaccharides Production Using Copra Meal and Makapuno Galactomannan	UPLB
217	John Edward I. Zapater	Invasion Gene-Specific Electrochemical Nanobiosensor as an Efficient Detection Tool for *Salmonella enterica*	UPLB
218	Luster May N. Serrano	Compositional Glycoanalysis of Biopsy Tissue Samples from Filipino Non-Small Cell Lung Cancer (NSCLC) Patients	UPLB
219	Judith Clarisse G. Jose	Cytotoxicity of Extracts of *Crescentia cujete* L. Fruit on Human Cancer Cell Lines and their Effect on the Expression of Early Apoptotic Genes and Proinflammatory Cytokine Genes	DLSU
220	Rod Vincent L. Borromeo	Antiproliferative, Anti-Oxidant and Anti-Angiogenic Property of *Artocarpus blancoi (Elmer) merr.* Leaf Extract	MSU-IIT
221	Landmark M. Estopa	One-pot Multicomponent Approach for Accessing 4,6-Diarylpyrimidin-2(*1H*)-Ones and their in Silico Evaluation as Potential Antimicrobial, Antihypertensive and Anti-Inflammatory Agents	MSU-IIT
222	James Phil D. Flores	A Theoretical Investigation of the Formation of $[(Ru(cyclam)Cl)_2(\mu\text{-}N_2)]^{2+}$ from $[Ru(cyclam)(No)Cl]^{2+}$	MSU-IIT

Poster Presentation

POSTER NO.	NAME	TITLE	SCHOOL
CHEMISTRY/NATURAL PRODUCTS/FOOD SCIENCE/HEALTH SCIENCES			
223	Lareno L. Villones Jr.	Assessment of the Anticlastogenicity and Nephroprotective Activities of *Peperomia pellucida* (L.) HBK Decoction on Cisplatin-Induced Clastogenicity and Kidney Injury in Male Albino Mice (*Mus musculus* Lin.)	MSU-IIT
224	Erin N. Bondoc	Fenton-like Degradation of Organic Pollutants from Aqueous Solution by Bimetallic Hierarchical Zeolite FeCu-HZSM-5	ADMU
225	Ma. Graciele E. Placido	Preparation and Characterization of OTMA-HDTMA Modified Zeolite Y for the Removal if AS(V) in Aqueous Solution	ADMU
226	Danica Mae V. Sta. Teresa	Functionalization of Cellulose Nanocrystals from Abaca Fiber for Natural Rubber Latex Reinforcement	ADMU
227	Angelica A. Tabamo	Quercetin Grafted Starch/Polylactic Acid (PLA) Composite Film for Active Food Packaging Applications	ADMU
228	Addie Rish O. Albano	Modulation of Thiol-Induced Olefinic Protons Lability in Some Molecular Switches: Determining the Potential of these Switches as Chemical Exchange Saturation Transfer Agents	DLSU
229	Carmelo Miguel H. Ebreo	Characterization of the Surface of Kappa-Carrageenan Hydrochar with Molybdenum Disulfide	DLSU
230	Tricia Jan Marie C. Fajardo	Encapsulation and Characterization of Quercetin in Metal Alginate Hydrogels for Drug Delivery System	DLSU
231	Adrian Go	Degradation of Rhodamine B Using Semiconductor Photocatalysts	DLSU
232	Faith Chalice M. Isla	Metabolomic and Stable Isotope Profiling of Cacao Beans in the Philippines by GC-MS and IRMS	DLSU
233	Jessa C. Leuterio	Film-Based Carbon Nanodots from Carrageenan for Degradation of Toxic Dyes	DLSU
234	Brandon Cyril S. Lira	Coal Fly Ash-based Geopolymer Spheres Coated with Amoxicillin and Nanosilver Potential Antibacterial Applications	DLSU
235	Miguel D. Mansilungan	Gold-Nanoparticle/Nickel Hexacyanoferrate Composite-Modified Glassy Carbon Electrode for Histamine Detection Using Electrochemical Impedance Spectroscopy	DLSU
236	Pamela Ruth G. Mateo	Fortification of Rice Grains with Vitamin A	DLSU
237	Cybele Riesse L. Santos	Sulfonated Graphene Oxide as a Heterogeneous Carbocatalyst in the Synthesis of Dihydrotriazolopyramidinones	DLSU
238	Mariel G. Tecson	Structural Investigation of Degraded Kappa Carrageenan	DLSU
239	Abigail Ruth F. Velasquez	Association of *MTHFR* 677C>T and *MTR* 2756A>G Single Nucleotide Polymorphisms and the Risk of Breast Cancer in Selected Filipino Population	UST

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POSTER NO.	NAME	TITLE	SCHOOL
CHEMISTRY/NATURAL PRODUCTS/FOOD SCIENCE/HEALTH SCIENCES			
240	Kent Caesar C. Gervacio	Association of *RRP1B* and *SIPA1* 545 C>T Single Nucleotide Polymorphisms with Breast Cancer Incidence in a Selected Filipino Population	UST
241	Mary Ailenn T. Baculpo	Silver Nanocomposites with Cellulose from Cyperus Alternifolius: Imaging and Antimicrobial Properties	USC
242	Princess Rosery H. Cabotaje	Isolation, Purification, and Characterization of **α**-Glucosidase Inhibitors from PC-DB19	USC
243	Seagal P. Asjali	Total Synthesis of Ficusnotin-E Analogs	MSU-IIT
244	Daisy Shane L. Atayan	Microwave-Assisted Synthesis of 4-Arylcoumarin Derivatives	MSU-IIT
245	Jan Mart T. Daluz	Anti-Inflammatory and Antiproliferative Activities of Selected Philippine Marine Sponges Collected Off Poblacion, Kauswagan, Lanao del Norte	MSU-IIT
246	Lorenz Mae L. Lugo	Evaluation of Isorhamnetin as Metal Chelator to Inhibit Metal-Aβ Induced Aggregation in Alzheimer's Disease: A Molecular Docking and Multispectroscopic Study	MSU-IIT
247	Jibe Labenz L. Nebato	Evaluation of the Antioxidant, Anticancer and Anti-Inflammatory Properties of Traditional Medicinal Plants Used by the Mamanwa Indigenous People of Mindanao	MSU-IIT
248	Joshua Andrew P. Nillama	A Simple Protocol for the Synthesis of 4-Hydroxyquinolin-2(*1H*)-One and its Olefination with Substituted Benzaldehydes	MSU-IIT
249	Rachele G. Tura	Molecular Docking Study, Microwave-Assisted Synthesis and Antioxidant Property Evaluation of Naphthoflavonol Analogs	MSU-IIT
250	Nesteve John B. Agosto	Antioxidant, Anti-Inflammatory and Anticancer Activities of Selected Traditional Medicinal Plants Utilized by the Mamanwa Indigenous People of Agusan and Surigao Provinces	MSU-IIT
251	Christine Ann S. Tila	Phytochemical Analysis Of Crude "Tabon-Tabon" (*Atuna racemosa* Raf.) Fruit Extract and Its Potential as Biofungicide and Antibacterial Wash for Green Ice Lettuce (*Lactuca sativa* var. Crispa)	UPLB
252	Omar D. Alo	Physico-Chemical, Proximate and Functional Properties of Composite Flour From Banana (*Musa acuminata x balbisiana* var Cardaba C.) Sweetpotato (*Ipomoea batatas* Lam) and Glutinous Rice (*Oryza Sativa* var glutinosa L.) Fermented with *Lactobacillus plantarum* (Orlan-Jensin)-Biotech 1223	VSU
253	Anastacio T.Cagabhion III	Quality Evaluation and Shelf-Life Study of Vacuum Fried Chicken (*Gallus gallus domesticus* L.) "Isaw" through Moisture Sorption Isotherm (MSI) and Accelerated Shelf-Life Testing (ASLT)	VSU
254	Kevin B. Gasatan	Microbial Quality and Sensory Quality Evaluation of Minimally Processed Unripe Jackfruit (*Artocarpus hterophyllus* Lam) as Affected by Levels of Ascorbic Acid, Sodium Metabisulfite and Sodium Benzoate and Storage Condition	VSU

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CHEMISTRY/NATURAL PRODUCTS/FOOD SCIENCE/HEALTH SCIENCES			
255	Gil Felicisimo S. Cabrera	Synthesis and Characterization of Gold-Graphene Oxide Nanostructures	UPD
256	Kim Marie D. Sisican	Pvp-Mediated Synthesis and Surface Functionalization of Iron(III)-Based Metal-Organic Framework Nanoparticles	UPD
257	Adrien Kyle M. Jacinto	*In-Vitro* 5-Lox And Cox Inhibition of the Isolates from *Eleusine indica* Linn Gaertner (Poaceae) Aerial Shoot Fraction	UPM
258	Allyanna Mae D. Agustin	Activity-Guided Isolation and Characterization of In-Vitro Xanthine Oxidase Inhibitors From *DDHP_1587* Leaves	UPM
259	Xenia Elika N. Bucao	Bioassay-Guided Isolation and Characterization of α-Glucosidase Inhibitor from MASE Peel	UPM
260	Daniel G. Salunga	A Study on the Awareness, Knowledge, Attitudes and Practices (AKAP) of Barangay Nutrition Scholars (BNS) on the 2012 Operation Timbang Plus (OTP Plus) Implementing Guidelines in Malabon City, Philippines	UPM
261	Niña Marie T. Caballero	Food Waste Generation and Management of Selected Barangays in Quezon City: A Case Study	UPM
262	Denniese C. Sy	Perceptions on Nutrition Labels and Factors Affecting Its Use Among Adults in Selected Communities in Los Baños, Laguna	UPM
263	Bienvenido S. Cabaro III	Analysis of Timing of First Pregnancy from First Sexual Intercourse Among Filipino Women Using Survival Analysis	UPM
264	Ann Rose D. Payumo	Development and Validation of a Semi-quantitative Food Frequency Questionnaire (SFFQ) as an Assessment Tool for Iron Intake of Filipino Women of Reproductive Age (WRA)	UPM

FIELD PERFORMANCE AND GRAIN QUALITY OF FOUR RICE TYPES (*Oryza sativa* L.) AS INFLUENCED BY TIME OF PLANTING UNDER RAINFED LOWLAND CONDITIONS

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One way of improving rice production and productivity albeit climate change situation is through identification of rice types that can adapt the changing environmental conditions. Appropriate rice types should be taken into consideration since these are sowing time responsive. Hence, this study sought to determine the growth and yield performance and evaluate the grain quality of four rice types as influenced by time of planting under rainfed lowland conditions. The experiment was laid out in split plot arranged in Randomized Complete Block Design with three replications. Planting time (November 2018, December 2018, and January 2019) was designated as main plot while rice types as subplot (PSB Rc18, NSIC Rc192, Heirloom Red Rice and Caimpas). Results revealed significant interaction between planting time and rice types on number of days from sowing to heading and maturity, LAI, fresh straw yield, productive tillers, filled grains, panicle weight and grain yield. Heirloom Red Rice obtained significantly higher productive tillers in January planting. PSB Rc18 and Caimpas yielded higher in any planting time due to more filled grains and panicle weight. PSB Rc18 and Caimpas can be planted anytime while all rice types evaluated are productive in December planting. Nutritional analysis in December planting showed slightly higher ash, crude fat, sugar and starch contents but November planting revealed slightly higher nitrogen. This research proved that favourable planting time has significant influence on grain yield and its components. Thus, desirable planting date and suitable cultivars are important for proper growth, yield improvement and prevention from damage.

Keywords: Climate, Heirloom, Nutrition, Planting time, Rice types

PHYSICOCHEMICAL AND SENSORY QUALITY OF BINGAWAN BLACK RICE (*Oryza sativa* L.) GROWN UNDER VARIOUS PRODUCTION SYSTEMS

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Production systems affect the physicochemical properties and sensory attributes of cooked rice. To evaluate the effects of different production systems on physicochemical characteristics and sensory quality of Bingawan black rice, a study laid out in Randomized Complete Block Design (RCBD) with 4 replications was conducted with 3 treatments, namely; T_1 = UPLB organic production system, T_2 = optimized organic production system in Leyte and T_3 = conventional production system in Leyte. Length, breadth and bulk density of milled Bingawan black rice grains were statistically the same in all production systems. Grains produced from all production systems were classified as long grains. Breadth of grains from organic production systems (T_1 and T_2) were classified medium while the conventional production system (T_3) produced slender grains. Milling recovery was statistically comparable among production

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systems. Total phenolic content and free radical scavenging activity of Bingawan black rice were significantly influenced by various production systems. Grains from UPLB organic production system (T_1) had higher total phenolic content and high percentage free radical scavenging activity. Optimized organic production system in Leyte (T_2) had lower total phenolic content and free radical scavenging activity while total flavonoid was statistically similar in all production systems. Sensory quality attributes and acceptability of cooked Bingawan black rice did not differ significantly with production systems. General acceptability ratings of freshly cooked and 3 hours after cooking of Bingawan black rice varies with production systems. Cooked rice from UPLB organic production system (T_1) had highest general acceptability ratings but comparable to the conventional production system in Leyte (T_3).

Keywords: Black rice, physicochemical properties, production systems and sensory quality

IN VITRO DIGESTIBILITY AND GAS PRODUCTION OF UPLAND FODDER TREES AND SHRUBS IN GOATS (*Capra hircus* L.) FED GRASS DIETS WITH OR WITHOUT CONCENTRATES

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This study was conducted to evaluate the nutrient composition, *in vitro* digestibility and *in vitro* gas production of foliages from selected upland fodder trees and shrubs using rumen fluid of goats fed an all-forage diet. Eleven (11) mature foliages from marginal upland fodder trees and shrubs were evaluated and three (3) male, crossbred Anglo-Nubian goats were used as rumen fluid donors. The *in vitro* trial was set up using three (3) canisters containing the three (3) rumen fluids harvested from the three (3) goats representing three (3) blocks or replicates, and the foliages were incubated for 24hrs. in a randomized complete block experimental set-up. Results showed significant differences in *in vitro* digestibility among the foliages (p<0.001). Dry matter (DM), organic matter (OM), crude protein (CP), and neutral detergent fiber (NDF) where highest in *Hibiscus rosa-sinensis* at 75.44%, 73.59%, 83.85%, and 56.82%, respectively. The legume fodder trees and shrubs generally had high values of nutrient composition but have relatively low digestibility values except for *Gliricidia sepium* with DM, OM, CP, and NDF digestibility at 56.23%, 57.59%, 74.14%, and 51.36%, respectively. *In vitro* gas production indicated significant differences (p<0.001) and were directly related to the digestibility of the forages. Among the forages tested, *H. rosa-sinensis*, had the highest total gas production at 22.00ml followed by *M. alba* and *G. sepium* at 18.00ml and 11.33ml, respectively.

Keywords: In vitro digestibility, in vitro gas production, upland foliages, goat, all-forage diet

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LAYING PERFORMANCE OF ITIK-PINAS DUCKS (*Anas platyrynchos*) AS INFLUENCED BY PRODUCTION SYSTEMS AND PROBIOTICS SUPPLEMENTATION

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The study was conducted to determine the influence of production systems and probiotics supplementation on laying performance of IP-ducks. A split-plot design was used where the main plot was production systems (Intensive Production System or IPS and Semi-intensive Production System or SIPS) and the subplot was probiotic supplementation (Control, Commercial, and Beneficial Indigenous Microorganism or BIM) through the drinking water. Each treatment was composed of five replicates with 8 ducks and 1 drake. Data on feed-intake, hen-day production, feed conversion ratio/kg egg, livability, egg quality evaluation, egg classification, and fertility rate were collected. Analysis of data was done using the General Linear Model of STATISTICA version 7. Significant difference of means was carried out using Tukey's HSD.

Results indicated that ducks raised under SIPS showed higher livability ($P<0.01$) than those in IPS. Hen-day egg production was lower under SIPS compared to IPS. Egg quality evaluation showed that ducks under SIPS produced heavier eggs and albumen weight with darker yolk coloration than eggs laid ($P<0.01$) by ducks in IPS. Conversely, Haugh unit was found to be significantly higher ($P <0.01$) in eggs produced by ducks raised in IPS than those in SIPS. Ducks under SIPS produce more Medium and Large-sized eggs and had a higher fertility rate also. Moreover, the interaction of production systems and probiotics supplementation showed that ducks under an intensive system with BIM supplementation resulted to highest feed intake ($P<0.01$) and production of more eggs ($P>0.01$). Overall, no other interaction was observed between production systems and probiotics supplementation. With the inclusion of either commercial probiotics or BIM, economic benefit was reduced.

EFFECT OF DIETARY TANNIN ON GROWTH PERFORMANCE, RUMEN FERMENTATION CHARACTERISTICS AND NUTRIENT DIGESTIBILITY IN GROWING HOLSTEIN-FRIESIAN X SAHIWAL BULLS FED WITH LOW AND HIGH ENERGY RATIONS

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This study was conducted to determine the effect of dietary tannin on growth performance, rumen fluid characteristics, and apparent total-tract digestibility in growing Holstein-Friesian x Sahiwal bulls fed low and high energy rations. Eighteen growing bulls with initial body weight

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(BW) of 162.8±12.7 kg at 15±0.80 months were used in an unbalanced randomized complete block design set-up in a 2x2 factorial arrangement. The experimental animals were blocked by their respective BW. Animals were fed with concentrates containing metabolizable energy (ME) at 2.47 and 2.72 Mcal/kg without or with 20g/kg tannin in dry matter basis. At the final week of the trial, rumen fluid and fecal samples were collected for the rumen fluid characteristics and apparent total-tract digestibility analyses. No differences ($p>0.05$) were observed between the growth performance, rumen gas production, volatile fatty acids as well as organic matter, crude protein, and energy digestibility. High energy concentrates had higher ($p<0.05$) dry matter and neutral detergent fiber digestibility than low energy concentrates. Low energy concentrates without tannin had cheaper ($p<0.001$) total feed cost but feed cost per kilogram BW gain was similar ($p>0.05$) across treatments. Feed savings costs of Php 910.00 per animal were attained in feeding low energy concentrates without tannin. Therefore, feeding concentrates containing 2.47 Mcal/kg ME without additional tannin can still be fed economically to growing cattle without any adverse effect on growth, ruminal fermentation characteristics, and apparent total-tract digestibility.

PHYSICO-CHEMICAL, MICBIOLOGICAL, AND SENSORY QUALITY OF SOFT WHITE CHEESE SUPPLEMENTED WITH PROBIOTICS AND PREBIOTIC

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The aim of the study was to evaluate the physico-chemical, microstructural, microbiological and sensory characteristics of soft white cheese with prebiotic (T1), probiotic (T2) and synbiotic (T3). The treatments were analyzed on the 1st and 7th day at 4-10°C. No significant difference was observed on protein and fat. T2 has the highest moisture content. High scores on texture were rated on T2 and T3 while high scores on firmness were rated on CT (Control) and T1. Microstructural properties using scanning electron microscopy, T1 and T3 were observed with needle-like crystals and dense disposition of protein matrix. T3 showed minimal reduction of probiotic viable count as compared to T2. Despite the losses, T2 and T3 remain on the suggested dose of 10^6 cfu/g probiotic count. The pH value of T3 was lower compared to T2 with high titratable acidity which was also manifested in the sourness detected by the panelists in T2 and T3. The yield of T2 and T3 has a tendency to have a significant difference. All treatments produced were rated acceptable by the panelists at the end of its shelf-life. The results suggested that soft white cheese was an adequate food matrix for supplementation of probiotics and prebiotic.

Keywords: Kesong Puti, Prebiotic, Probiotic, Soft White Cheese, Synbiotic

GENETIC CHARACTERIZATICS OF NATIVE PIGS (*Sus scrofa domesticus* L.) IN BOHOL ISLAND, PHILIPPINES

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This study was conducted to evaluate the matrilineal phylogeny, genetic diversity, distance, and evolutionary relationships of native pigs in Bohol Island, Philippines in comparison with other established species/subspecies of the genus *Sus* using complete sequence of mtDNA D-loop region. A total of 72 individuals belonging to 10 sampling sites and one wild pig were obtained. Standard protocols for sample storage, DNA extraction, isolation, quantification, amplification and purification were followed. The PCR products were cleaned and purified using Exonuclease 1 (Exo1) and Shrimp Alkaline Phosphatase (SAP), and samples were sent to FASMAC Corporation, 5-1-3 Midorigaoka, Atsugi-shi, Kanagawa, Japan for direct DNA sequencing and fragment analysis. Results revealed a distinctive nucleotide diversity (0.1097 ± 0.0087) among native pigs in Bohol Island, Philippines which conforms with results in the global pig population diversity. Phylogenetic and network analyses revealed 19 haplotypes, clustered mainly to haplogroup D, A, and E. Results also showed that 8 out of 19 identified haplotypes of native pigs in Bohol (Haplotype 1, 2, 6, 7, 10, 11, 14, and 17) were not clustered under any of the haplogroup classification recommended by Wu *et al.*, (2007) implying a unique genetic characteristic distinct and peculiar only to native pigs of Bohol Island, Philippines. The genetic distance analysis of native pig haplotypes was distantly (76%) close to the *Sus verrucosus* in Southeast Asia.

SEMEN QUALITY AND REPRODUCTIVE EFFICIENCY OF RED JUNGLE FOWL (*Gallus gallus* L.) AND SOEM LOCALLY AVAILABLE NATIVE ROOSTER (*Gallus gallus domesticus* L.)

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A study was conducted to evaluate the reproductive efficiency of Red Jungle Fowl, Basilan and Local Native roosters. A total of 15 sexually matured cocks and 15 commercial layers were used in the study. Fresh semen ejaculates from 5 roosters per strain were collected using a 1 cc Tuberculin syringe, and transferred to a test tube, pooled and mixed immediately and inseminated to assigned commercial layers (0.1 ml of the fresh semen). All eggs laid were collected, marked and stored under room temperature, and artificially incubated at day 7. Result disclosed decreasing trend on egg fertility and hatchability from Week1 to Week4 across all strains. Meanwhile, egg hatchability was significant (P<0.01) on Week2 showing higher number of eggs hatched on RJF (75.00) compared with the extremely low hatchability in LN (8.89) and BS (6.00). Furthermore result on egg weight revealed significantly (P<0.01) heaviest egg weight on BS (67.38 g) followed by LN (62.12 g) and RJF (61.43 g). Data indicated a strong (P<0.01) and positive correlation between fertility and hatchability, mass activity and motility, as well as sperm concentration and mass activity. Also, significant (P<0.05) correlation coefficient were noted on mass activity and sperm color, as well as sperm concentration and motility. Generally, results revealed no significant relationship between rooster strain on fertility and hatchability of eggs.

Keywords: efficiency, Red Jungle Fowl, Basilan, Local Native, commercial layers

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RUMEN MICROBIAL POPULATION AND DIGESTIBILITY RESPONSES OF GROWER GOATS (*Capra hircus* Linn) FED WITH VARYING LEVELS OF CORN STOVER SILAGE ON A NAPIER GRASS-BASED DIET

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Ruminants create a synergistic relationship with rumen microorganism by which the animal provide nutrients and optimal environment conditions for the fermentation of feeds, while the microorganisms degrade fiber and synthesize microbial protein as protein supply for the animal. This study aimed to assess the potential of corn stover silage on a napier grass-based diet in the digestion and rumen microbial population of grower goats. The experiments were set up in a Complete Randomized Design (CRD) with three replicates using fifteen goats distributed under five dietary treatments: T0-100% Napier grass, T_1-75% Napier grass + 25% Corn stover silage, T_2- 50% Napier grass + 50% Corn stover silage, T_3- 75% Corn stover silage + 25% Napier grass, T_4-100% Corn stover silage at 3% body weight. Data gathered were subjected to one-way Analysis of Variance (ANOVA) while comparison of treatment means was done using Kruskal-Wallis Test with Statistical Package for Social Science (SPSS) version 22.0 software. Results showed that the rumen microbial population of goats was not significantly affected by the varying levels of corn stover silage although the combined diets in T_2exhibited their effects to rumen protozoa by causing swelling and consequent rupture of protozoa cells. Furthermore, varying levels of corn stover silage did not significantly affect the DM intake, Neutral Detergent Fiber Intake (NDFI) and Neutral Detergent Fiber Digestibility (NDFD) but it significantly affected its CP intake and CP Digestibility. led no significant relationship between rooster strain on fertility and hatchability of eggs.

Keywords: Corn stover silage, rumen microbial population, neutral detergent fiber intake, crude protein intake, digestibility

FEEDING PROGRAMS FOR ITIK PINAS (*Anas platyrhynchos*) DURING THE DEVELOPMENT PHASE AND THEIR INFLUENCE ON THE SUBSEQUENT EGG PRODUCTION PERIOD

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A total of 300 (12-week old) *Itik Pinas* (IP) ducks were used in the study to evaluate the influence of different feeding programs on their growth parameters and subsequently, on their egg productivity, egg quality and reproductive capacity during the first 12 weeks of laying. Income over feed cost (IOFC) was also computed. The ducks were randomly assigned to the pens using randomized complete block design (RCBD) with bodyweight and paddock location as blocking factors. There were 10 ducks (9 female: 1 male) per pen with 10 replications for each treatment. The feeding programs were: developer feeding program (12-18 weeks of age); pre-lay feeding program (developer diet 12-15 weeks of age and pre-lay diet 16-18 weeks of age) and layer feeding program (developer diet 12-15 weeks of age and layer diet 16-18 weeks of age). All ducks were fed layer diet during laying period (19-30 weeks of age).

Results revealed that production and economic performance during growing stage were not influenced (P>0.05) by the feeding programs. However, the bodyweight uniformity of ducks under layer feeding program tended (P=0.10) to be higher than their counterparts. For the laying period, production and reproductive performance, egg quality parameters, egg classification, shank and keel length were also not influenced (P>0.05) by the feeding programs during the growing period. Eggshell weight of ducks fed layer diet starting at 16 weeks of age was heavier (P<0.05) than those in the other programs. IOFC was numerically highest from ducks fed pre-lay diet at 16 weeks of age due to their higher egg production. The findings indicated benefits of feeding growing IP ducks pre-lay diet at 16 weeks of age and shifting to layer diet at point of lay or feeding layer diet starting at 16 weeks of age.

AQUASHADE TECHNOLOGY AND ITS IMPACT ON THE WATER QUALITY AND REPRODUCTIVE INDICES OF NILE TILAPIA (*Oreochromis niloticus* L.)

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One of the major challenges facing the tilapia farming industry is the production of sufficient amount of quality seeds during warm seasons. The effect of extreme and unusual increase in water temperature on the reproductive biology of fish must be studied while technologies that might address this problem must also be evaluated. Hence, this study assessed the effect of aquashade technology on the water temperature and reproductive indices of Nile tilapia by investigating the effectiveness of different shading capacities of nets (T2- 40%S, T3- 60%S and T4- 80%S) as top cover of breeding ponds. Gonadosomatic index, sperm density, proportion of active sperm and sperm motility were used to evaluate the reproductive indices of the breeders. The breeding performance was assessed through the spawning rate and seed production. Data on the water temperature and dissolved oxygen were also gathered. Results of the study revealed that shading of pond can help reduce the water temperature by 1-2°C at 0700h and 3-6°C at 1100h to 1500h. The parameters tested for the evaluation of the reproductive indices and breeding performance showed no significant difference among the shaded treatments (T2, T3, T4), but were significantly higher than the unshaded treatment (T1) (P<0.01). Results of the analysis showed that the use of aquashade decreased the water temperature and favored faster gonadal development, increased sperm density, higher proportion of active sperm and higher sperm motility score. It is therefore concluded that aquashade technology is effective in improving the breeding performance of Nile tilapia during warm months.

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MORPHOMETRIC AND MOLECULAR IDENTIFICATION OF TWO GENETICALLY IMPROVED PHILIPPINE STRAINS OF TILAPIA (*Oreochromis spp.*)

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This study focused on the morphometric and molecular identification of two genetically improved Philippine strains of tilapia iEXCEL and iBEST. A total of 150 samples were morphometrically described and analysed. A ratio of (28) males and (47) females for iEXCEL and (36) males and (39) females for iBEST samples were subjected to morphometric characterization. Morphometric characters were categorized into three region parts of the fish, the head, body, and tail. Statistical analysis using independent-sample T-test showed that there was a significant difference between iEXCEL and iBEST samples among all the morphometric characters examined. Males have relatively higher growth compared to females including other morphological characters examined.

Molecular identification was also conducted using 50 genomic DNA of iEXCEL and iBEST samples. Analyses including BLAST on the identification of similar sequences from the genebank and generation of phylogenetic tree to determine the maximum likelihood of samples were conducted to understand the relatedness of the two strains within population. Composition of BLAST results for iEXCEL samples showed that there are 3 and 7 for iBEST of nile tilapia strains from genebank producing significant alignments and sequences. Phylogenetic analysis showing the maximum likehood and relatedness of iEXCEL and iBEST to other *Oreochromis* sp. had a 99-100% bootstrap value while the combined phylogenetic tree of the two strains versus the outgroup (*Sarotherodon* sp.) AJ844999 presented a 99% bootstrap value among samples revealing that iEXCEL and iBEST tilapia improved stains developed in the Philippines came from the same lineage and ancestry.

CHARACTERIZATION OF THE SPATIAL AND TEMPORAL DISTRIBUTION OF FINE PARTICULATE POLLUTION IN THE SURFACE LAYER OF A MONSOON ASIA MEGACITY: AN ASSESSMENT OF PERSONAL EXPOSURE OF A HIGH-RISK OCCUPATIONAL GROUP IN METRO MANILA, PHILIPPINES

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The public utility jeepney (PUJ) is the most popular mode of transportation in Metro Manila, Philippines, a megacity in monsoon Asia with $PM_{2.5}$ concentrations greater than guideline values. PUJ drivers ply their routes for long hours; exposing them to high levels of fine particulate pollution. Thus, field measurements were conducted for five weeks from November-December 2018 in a high-traffic key site in Metro Manila to estimate the personal exposure of PUJ drivers to fine particulate pollution. Real-time $PM_{2.5}$ exposure levels of 31 drivers plying a 10-km route were recorded continuously for 12 hours each sampling day (total of 1061 circuits). Results showed that the mean $PM_{2.5}$ exposure concentration for all runs was 41μgm^{-3}, a factor of four greater than

the mean annual $PM_{2.5}$ guideline value (10μgm^{-3}) set by the World Health Organization. Spatial averaging of $PM_{2.5}$ concentrations revealed transportation microenvironments (TMEs) with elevated levels of $PM_{2.5}$. Multiple linear regression analysis used to calculate the incremental contribution (β values) of each TME to the personal exposure of PUJ drivers indicated that the shopping mall had the highest contribution (β=33.2μgm^{-3}), a factor of ~40 greater than the baseline value (β=0.8μgm^{-3}). To ascertain the accuracy of field measurements, the portable $PM_{2.5}$ samplers used were collocated with a Beta Attenuation Monitor for 16 days (N=368), showing strong linear relationship (R^2=0.83-0.85). The results of this study will offer quantitative evidence that is needed by the Public Utility Vehicle Modernization Plan (PUVMP), a policy program that aims to replace old PUJs with a more eco-friendly version.

INVESTIGATION OF THE MONSOONAL VARIATION OF MICROPHYSICAL CHARACTERISTICS OF RAINFALL OVER METRO MANILA USING PARSIVEL2 DISDROMETER

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The seasonal variability of Raindrop size distribution (RSD) and integral parameters of rainfall over Metro Manila during the Northeast Monsoon (NEM) (November 2018 – February 2019), Transition (March – May 2019), and Southwest Monsoon (SWM) (June – September 2019) seasons are studied by using 1 year of PARSIVEL2 Disdrometer data. Satellite and re-analysis data sets are used to determine the possible dynamic and microphysical processes that affects the RSD during the three different seasons. Results show that NEM has the highest number concentration of small raindrops *(D < 1 mm)* while SWM season rainfall has more presence of large rain drops *(D ≥ 3 mm)* among the three seasons. In terms of rain intensity, convective rainfall (RI ≥ 10 mm hr^{-1}) exhibits a broader RSD compared to stratiform rainfall (RI < 10 mm hr^{-1}) for all the seasons. This implies that the presence of (small) large raindrops during (NEM) SWM season is due to the (low) high frequency of occurrence of convective rainfall. It was found that during SWM season, high values of convective available potential energy (CAPE) extend clouds further above the freezing layer (~ 5 km) resulting to cold-rain process. This promotes aggregation and riming of ice particles which will eventually melt during its descend and produce large raindrops at the surface. This study contributes in the further understanding of rainfall microphysics in the Philippines by: (1) providing information for the improvement of rainfall estimation in weather radars and (2) giving insights for cloud microphysics parameterization in numerical models.

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LONG-TERM AND SEASONAL TRENDS OF OMI-DERIVED TROPOSPHERIC COLUMN NO_2 IN SOUTHEAST ASIA: URBAN EMISSIONS, SEASONAL BURNING, AND THE INFLUENCE OF METEOROLOGY

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As the Southeast Asia (SEA) region hosts a number of developing countries, several of which practice agricultural burning, understanding both urban and burning-related sources of NO_2 is essential for pollution mitigation strategies in these countries. This study utilizes tropospheric NO_2 column values from the Ozone Monitoring Instrument (OMI) to identify long-term, seasonal, and spatial trends at selected cities across the SEA region for the period January 2005 to December 2016. Regional hotspots of NO_2 column values were observed over Bangkok, Singapore, and Jakarta; however, considerable values were also observed from burning sites. Long-term analysis showed varied relative trends such as +4.5% year-1 in Hanoi and -5.1% $year^{-1}$ in Jakarta. The correlation analysis with meteorology shows that rainfall, boundary layer height, and surface solar radiation were the most influential environmental factors overall, showing strong correlations with statistical significance at the $p = 0.05$ level across multiple cities; however, slight variations in the most important environmental factors per city were observed. Strong correlations with fire radiative power and fire count existed in cities near burning sites, indicating the important NO_2 contribution of local- to regional-scale burning, while other cities showed weak correlations with nearly all environmental variables, indicating the dominant role of their own urban emissions. Both wind speed and wind direction were found to be important in modulating NO_2 columns which highlights the role of long-range transport in the advection of emissions across SEA from burning areas to cities, and vice-versa. Further work will extend the analysis until December 2019.

CHARACTERIZATION OF PARTICULATE MATTER ($PM_{2.5}$) IN SELECTED URBAN BACKGROUND AND TRAFFIC SITES IN METRO MANILA

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Metro Manila, the national capital region of the Philippines, is one of the most rapidly urbanizing cities in the Southeast Asian region that suffer from high emissions of fine particulate matter (PM) that often exceed the WHO guideline value. In 2015, a short-term intensive measurement campaign was undertaken at an urban background (MO UB) and two roadside (TAFT and KAT RS) sites during the Metro Manila Aerosol Characterization Experiment (MACE) experiment. $PM_{2.5}$ filter samples were analyzed for mass, organic carbon (OC), elemental carbon (EC), water-soluble inorganic ions, and elemental and trace species. Mass closure between the gravimetric mass and chemical composition was performed. We found that the bulk $PM_{2.5}$ mass was dominated by carbonaceous materials (OC and EC), followed by secondary inorganic aerosols and crustal matter. The average OC/EC ratio at the RS sites suggest that a major fraction of the aerosol's particle mass at these sites derives from traffic sources, while the OC/EC ratio at the UB

site is indicative of a more aged sampled air mass. Considering all the sites combined, chemical mass closure showed an excellent agreement between the gravimetric and the chemically-derived mass (Slope: 1.02, $R^2 = 0.94$). In addition, the monthly and weekday/weekend profile of $PM_{2.5}$ were investigated from the long-term measurement at the MO UB site (January-December 2015). PM sources and their contributions were identified using positive matrix factorization (PMF) and the likely direction of the PMF-resolved factors were analyzed using conditional probability function.

SURFACE MICROPHYSICAL CHARACTERISTICS OF STRATIFORM AND CONVECTIVE RAINS IN METRO MANILA, PHILIPPINES

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The study investigates the surface microphysical characteristics of stratiform and convective rains in Metro Manila, Philippines using the second–generation Particle Size Velocity (PARSIVEL^2) disdrometer located at the Manila Observatory (14.64°N, 121.08°E), Quezon City, Philippines. The dataset from September 2018 to September 2019 is used to derive the raindrop size distributions (DSDs) and integral rain parameters for stratiform and convective regimes. For the categorized rains, stratiform types show higher frequency of occurrence but are dominated by convective types in terms of accumulated rainfall amount. The total concentration (N_t), radar reflectivity factor (Z) and liquid water content (LWC) are shown to increase as rain rate (R) intensifies from stratiform to convective regimes. The scatterplot of mass–weighted mean diameter (D_m) and normalized intercept parameter ($\log_{10}N_w$) further reveals that convective rains in Metro Manila are described as more maritime than continental in nature. Likewise, the N_w values obtained are closest to N_w values in the West Western Pacific region, higher than those in the maritime continent regions, and lower than those in the South Eastern China regions including Taiwan. Notably, the PARSIVEL^2 disdrometer–derived Z–R relations in this study can serve as reference in calibrating the polarimetric weather radars in the Philippines. This study is also anchored in the Cloud, Aerosol and Monsoon Processes Philippines Experiment (CAMP^{2}Ex): a collaborative campaign led by the National Aeronautics and Space Administration (NASA), US Naval Research Laboratory (NRL) and local research institutions including Manila Observatory which seeks to understand the microphysical and dynamical interactions between aerosols and meteorology in the Philippine vicinity.

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QTL DETECTION AND ESTIMATION OF RESISTANCE GENES IN US-2/MALAY-2 BC_1F_2 AND BC_1F_5 POPULATION USING STANDARD DIFFERENTIAL SYSTEM

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Rice blast (*Magnaporthe grisea*) reduced rice production for both temperate and tropical regions. Using host resistance is one of the most efficient, economical and environmental friendly control methods to this disease. In this study, 128 BC_1F_2 and 50 BC_1F_5 Recombinant Inbred Lines (RILs) derived from the crosses of resistant variety (Malay-2) and universal susceptible variety (US-2) were evaluated against 20 differential blast isolates. Rice Blast Differential System was used for major resistance (R) genes estimation. DNA extraction was done using CTAB method and the Quantitative Trait Loci (QTL) was analysed using 99 Simple Sequence Repeats (SSR) markers. Eight estimated R genes present in BC_1F_2 RILs were *(Pi1, Pik, Pi7(t), Pik-m, Pik-p, Pik-h, Pita* and *Pita-2)* against blast isolates PO6-6 and IK81-25. Ten estimated R genes present in BC_1F_5 RILs were *(Pi20(t), Pita, Pik, Pita-2, Pi9(t) , Piz-5, Pi1, Pi7(t), Pia* and *Pit)* against 20 blast isolates. A total of 44 putative QTLs were identified in both BC_1F_2 and BC_1F_5 RILs mapping population located in all chromosomes aside from chromosome 5. The *qIK81-25.9* was identified common and consistent QTL identified in the BC_1F_2 and BC_1F_5 RILs mapping population. This QTL was located at chromosome 9 in flanking markers RM410-RM24843 with LOD value of 3.07. This QTL accounted for 28.5% of phenotypic variance with the effect of Malay-2 allele. Thirteen RILs carrying the R genes *(Pita-2, Pi9(t)* and *Pita)* with the effect from introgressed segment of Malay-2, demonstrated broad spectrum resistance to twenty differential blast isolates.

EVALUATION OF NANO-STRUCTURED CASHEW (*Anacardium occidentale* L.) NUT SHELL OIL AGAINST BANANA APHID (*Pentalonia nigronervosa* Coq.)

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The insecticidal property of cashew nut shell oil as plain extract and as nano-structure was evaluated against banana aphids (*Pentalonia nigronervosa*). *In vitro* testing consisting of six treatments replicated three times revealed that CNSO treatments could be an excellent source of biopesticide that could be used to combat infestation of banana aphids. Pure cashew nut shell extract and encapsulated CNSO with nano-silica treatments showed comparable results to commercial insecticide in terms of percent repellency and percent mortality after one hour and 24 hours observation, respectively. It was determined that 2.0% was the lowest concentration (LD50) to cause 50% mortality on the population of banana aphids. Morphologically, aphids treated with pure cashew nut shell extract and CNSO treatments had distorted antennae and legs, appeared dried or desiccated with oily bodies, and have browned and busted abdomen.

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COLLEMBOLAN IN THE ARABICA COFFEE AGROFORESTRY SYSTEM IN THE HIGHLANDS OF BENGUET PROVINCE

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The study was conducted in an Arabica coffee plantation at La Trinidad, Benguet, Philippines (16°26'42" N; 120°34'02" E) in October to December 2018. In the study, there were two coffee production systems determined. First was the Agroforestry Coffee System (ACS) and second was Lone Coffee System (LCS) where the coffee grows with no shade trees. The objectives were to determine the (1) effect of ACS on the soil-litter collembolan community structure; (2) relationship of soil-litter collembolans with soil fertility maintenance; and (3) impact of ACS interface interaction to the major insect pests of coffee.

Data gathered were collembolan population and diversity indices [Margalef's species richness (Dmg), Shannon-Wiener diversity (H'), and Simpson diversity (D') indices.], soil microclimate [soil moisture content (SMC) and soil temperature (ST)], soil fertility [soil pH, soil organic matter (SOM), cation exchange capacity (CEC)], coffee major insect pests populations, and micro environmental data [atmospheric temperature (AT) and relative humidity (RH)].

Results showed that the AFS had a higher diversity and species richness, better microclimate and higher soil fertility than the LCS. Linear regression analysis showed that collembolan diversity and species richness affected ST and SMC. Likewise, in soil fertility, soil pH affected the diversity and species richness. SOM affected the collembolan community structure.

The only major insect pest of coffee collected was the coffee berry borer (CBB) *Hypothenemus hampei*. AFS had lower CBB population, and better microenvironment. Linear regression analysis showed that CBB population was affected by AT and RH.

BLACK SOLDIER FLY, *Hermetia illuscens* FLY LARVAE AND SUBSTRATES ANALYSES

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The emerging problems on the use of synthetic farm inputs led to the development of sustainable organic farming. One way towards achieving sustainable organic farming is the use of insect-based farm inputs. One of the potential insects that can be used is the Black Soldier Fly (*Hermetia illucens*) larvae (BSFL). This can be utilized as feedstuff to fresh-water fish and the larval rearing substrates as organic fertilizer. This study aimed to analyze the BSFL chemical components from different substrates and the compositions of the substrates wherein a high-crude protein-containing larvae can be preferably reared for feedstuff; and identify the substrate compositions that could be used as organic fertilizer. The experiment was laid out using completely randomized design with six treatments and three replicates. BSF larvae were reared in six different substrates for 15 days, subsequently, the larval composite samples from different substrates were air dried

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and brought to the laboratory for analysis.

Results revealed that among the substrates used, 50% decomposed materials + 50% chicken manure (Treatment 4) is the best substrate to be used in order to produce a high crude protein containing larvae which is 40.35%, and also this substrate has the appropriate amount of total N, P_2O_5, K_2O (6.63%) that is within the range of the required amount of total N, P_2O_5, K_2O which is 5 to 7% that could be considered as organic fertilizer according to the Philippine National Standard for Organic Agriculture. Based on the results, the substrate is potential organic fertilizer.

SURVEILLANCE, DETECTION AND MAPPING OF ANTHRACNOSE-TWISTER DISEASE OF ONION IN GUIMBA, NUEVA ECIJA USING REMOTE SENSING TECHNOLOGY

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Advanced technologies such as GIS and remote sensing technology provide essential mechanism of detection and thus enable determination of the spatial distribution of disease which has potential in control management strategies and forecasting capabilities. Using these innovative tools, the anthracnose-twister disease was surveyed, detected and mapped in Guimba, Nueva Ecija. The occurrence of anthracnose-twister disease was first detected in Barangay Manacsac. Disease incidences were also detected in neighboring barangays of Caballero, Galvan, Pacac, Pasong Intsik, San Miguel, San Rafael and Triala.

Disease spread which is a critical factor for possible disease outbreak revealed that Barangay Manacsac, obtained an average spread rate of 3.49 m/w (12.18 m^2/week), Barangay Caballero with an average spread rate 2.19 m/w (4.80 m^2/week) and average spread rate of 3.48 meters per week (12.11 m^2/week) in Barangay Pacac. Furthermore, hot spot analysis revealed that the hot spot areas of anthracnose-twister disease were detected in Barangay Manacsac and Barangay Caballero with moderate scale of infestation and considered as the highest endemic clustered areas recorded throughout the cropping season. Environmental factors such as relative humidity, temperature and rainfall revealed to be the prevailing factors which influenced disease development and severity specifically at the early stage of cropping season. Given the prevailing environmental condition, disease incidence in Barangay Manacsac and Barangay Caballero is influenced by RH ranging from 66.69% to 80.33%, temperature ranging from 21.89°C to 23.27°C and rainfall ranging from 0.016 mm to >13 mm. Moreover, spectral reflectance and image analysis showed the successful differentiation and classification of healthy and infected onion leaves in both handheld spectroradiometer and UAV. Using this approach in monitoring plant health and early detection of disease is essential to employ appropriate management practices thereby minimize the use of chemicals and reduce the spread of disease.

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EVALUATION OF INOCULATION METHODS FOR CHARACTERIZING THE RESISTANCE OF RICE GENOTYPES TO PANICLE BLAST

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Three inoculation methods (injection, cotton balls saturated with conidial suspension and spraying) were evaluated for their effectiveness in screening plant materials for panicle blast resistance. Two rice blast differential varieties, IRBLkh-k3 (for *Pik-h* gene) and IRBLta-k1 (for *Pita* gene) and leaf blast susceptible LTH were inoculated with differential blast isolates 43 and M101-1-2-9-1 following the Randomized Complete Block Design (RCBD). The three inoculation methods were compared in terms of panicle blast infection, reliability and ease of application. Results showed that spraying was the most effective as this method provided a consistent reaction in test varieties and produced sufficiently high levels of disease to discriminate between susceptible and resistant rice genotypes. Also, it was found to be practical, rapid and reliable that made it feasible for mass screening for panicle blast resistance.

In screening rice genotypes for resistance to panicle blast, 20 leaf blast resistant traditional rice varieties (TRVs) along with blast differential variety IRBLsh-b (for *Pish* gene) and rice blast susceptible variety CO39 were evaluated through spraying of differential blast isolates 43 and M101-1-2-9-1 following Completely Randomized Design (CRD). Disease Severity Index (DSI) and Disease Incidence (DI) were observed at 21 days after inoculation (DAI). Results showed that TRV Handurayan exhibited panicle blast resistant reaction to the two differential blast isolates. TRVs Abilash and Malay 2 were resistant to differential blast isolate M101-1-2-9-1 while Putan Lansong was resistant to differential blast isolate 43. The variation observed in the reaction of some traditional varieties was due to the difference in the panicle axis base length based on the Pearson correlation analysis. The length of panicle axis base affected the panicle blast severity rating of test rice varieties. And most of the leaf blast resistant traditional varieties evaluated were found to be susceptible to panicle blast, concluding that the level of resistance between leaf blast and panicle blast differed. The identified panicle blast resistant traditional rice variety can be utilized as potential source of resistance genes for panicle blast.

Keywords: inoculation methods; screening; panicle blast; resistance; traditional varieties

SURVEILLANCE, DETECTION AND MAPPING OF ANTHRACNOSE-TWISTER DISEASE OF ONION IN CUYAPO, NUEVA ECIJAUSING REMOTE SENSING TECHNOLOGY

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This study was conducted to detect, monitor, and map anthracnose-twister disease of onion in Cuyapo, Nueva Ecija using Geographic Information Systems (GIS) and remote sensing technology. Onion areas in Barangay Calancuasan Sur, Malbeg-Patalan and Ungab were infested with anthracnose-twister disease and the rate of spread of the disease was also calculated.

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The rate of disease spread in Barangay Calancuasan Sur was calculated as 5.94 m/week (35.28 m^2 /week), whereas, 2.31 m/week (5.34 m^2/week) was in Barangay Malbeg-Patalan and 0.55 m/week (0.31 m^2/week) was calculated in Barangay Ungab.

The generated maps showed the spatial distribution, areas affected, health status and the extent of damage in onion areas. The overall status of the disease was found to be in moderate scale in incidence and severity. Spectral signatures of infected leaves of onion showed an upward reflectance from the visible to near infrared region. On the other hand, healthy leaves of onion and grass showed low reflectance in the visible region and rapid reflectance in near infrared region. The hot spot analysis tool used in the study is the Gi* statistics and this method proved to be effective in delineating hot spot areas of onion infected with anthracnose-twister. The onion areas in Barangay Calancuasan Sur, Malbeg-Patalan and Ungab fall under high hot spot areas of disease infestation.

Meteorological factors prevailing in the area were found to have an influence in the occurrence and development of anthracnose-twister disease in Cuyapo. It was found also that the prevailing relative humidity was the most influencing factor on the incidence and severity of disease throughout the onion cropping season followed by optimum temperature ranging from 22 °C to 28 °C which enhanced the occurrence and development of anthracnose-twister disease in the area.

DEVELOPMENT OF INTEGRATED DISEASE MANAGEMENT PROGRAM AGAINST ANTHRACNOSE-TWISTER (*Colletotrichum gloeosporioides* PENZIG AND SACC.)-(*Gibberella moniliformis* WINELAND) DISEASE OF ONION (*Allium cepa* L.)

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Anthracnose-Twister disease caused by *Colletotrichum gloeosporioides* and *Gibberella moniliformis* has always been the major problem of onion growers every onion season due to absence of efficient and cost effective management system, thus, this study was conceptualized by integrating all the available management approaches to put the disease at bay. Specifically, this study was conducted to; (a) develop an integrated disease management program for the anthracnose-twister disease of onion; (b) evaluate the effectiveness of different combination of approaches that will result into an effective management program (c) determine the prevailing environmental conditions in the area that contribute to the occurrence of the disease, and (d) determine which among the management programs is the most cost effective that can be recommended to the farmers.

Among the different management programs, the lowest % disease incidence and severity were found in T3 (Benomyl-Propineb-Difenoconazole~Propiconazole(DP)-Difenoconazole-Carbendazim-Mancozeb-*Trichoderma* sp.) and the ideal size of the marketable bulbs, highest number and heaviest weight of the marketable bulbs were also obtained. This also proved to be the most cost effective management program. Moreover, results showed that application of protectant fungicide during the early part of the season followed by systemic fungicide application can bring down the disease incidence and severity as adequate protection to the

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plants were provided. Furthermore, late transplanting date as well as using 15x15cm spacing between hills and rows and 5-day irrigation interval contributed against the occurrence of anthracnose-twister disease. The weather factors prevailing in the area were found to have an influence in the occurrence and progress of the disease in all the treated plots as well as in the control plots (T9). Among the management programs tested, the highest net income was obtained in the T3.

IN VITRO CONTROL OF *FUSARIUM OXYSPORUM* F.SP. *CUBENSE* RACE 2 USING DIFFERENT TREATMENTS OF SEWAGE SLUDGE-DERIVED COMPOST TEA

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Compost tea is the filtered product of compost fermented in water. It has long been used as a soil and foliar spray for delivering essential nutrients for crops and as a natural alternative to pesticides due to its ability to suppress plant diseases. In this study, one-week and two-week aerated compost tea (ACT) was produced from compost made using sewage sludge as a primary feedstock. Three concentrations (1%, 5, and 10%) of raw, pasteurized, and heat-sterilized ACT were tested against *Fusarium oxysporum* f.sp. *cubense* Race 2 (*Foc* R2), which affects important banana cultivars in the Philippines. Raw and pasteurized ACT were shown to strongly inhibit *Foc* R2, effectively reducing mycelial growth at least by 50% using all concentrations tested. We infer that competition for space and nutrients by compost tea-inhabiting microorganisms were the main cause of inhibition using raw ACT, while the activity of heat-stable antifungals may have contributed to the inhibition noted using pasteurized ACT. Brewing duration showed no significant effect on inhibitory effect except on the 10% heat-sterilized ACT. All treatments contained siderophores but not significant enough to affect *Foc* R2 growth. Proteases were also present but were eliminated after heat-sterilization. The siderophore and protease detection assays suggest alternative antagonistic mechanisms against *Foc* R2. In summary, sludge-derived ACT is a potential control for *Foc* R2 in plant production systems. Further investigation on other mechanisms involved in pathogen inhibition is necessary to improve its efficiency as a biocontrol agent.

ANTIBIOTIC RESISTANT SCREENING OF *ENTEROCOCCUS* SPP. IN ILOILO RIVER IMPACTED BY LAND USE

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The study aims to assess the level of antibiotic resistant *Enterococcus* spp. in Iloilo River and its correlation with land use. Water samples were filtered in a membrane filter and cultured in a media supplemented with vancomycin (6µg/mL). Isolates were identified to species level using physiological and biochemical testing. Multiple antibiotic resistant (MAR) index was evaluated using disk diffusion against four antibiotics. Isolates with high MAR index were identified

using 16S rRNA sequence analysis. The populations of antibiotic resistant *Enterococcus* spp. significantly varied with land use ($P < 0.005$; ANOVA test) and was highest near commercial site. Out of the 49 isolates, 55% exhibit resistance to multiple antibiotics. Most of the isolates were resistant to tetracycline, doxycycline, ciprofloxacin and levofloxacin. Two isolates of *E. faecalis* and one isolate of *E. camelliae* exhibit resistance to all four antibiotics. However, high MAR index was recorded at the downstream part of the river (88%). Our results indicate that commercial areas are major sources of antibiotic resistance in Iloilo River and the isolates from downstream area manifest resistance to different antibiotics.

SPECIATION OF NICKEL AND CHROMIUM IN PADDY SOILS OF MASINLOC, CANDELARIA, AND STA. CRUZ, ZAMBALES, PHILIPPINES

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While the natural abundance of Ni and Cr in serpentine soils are well known, very few studies related the presence of reactive iron on the dynamics of Ni and Cr in paddy soils. The objective of this study is to elucidate the role of reactive iron in the stabilization of Ni and Cr in serpentine derived paddy soils in the Philippines. Surface soil (0-20 cm) samples were collected and characterized across three paddy areas (a total of 60 surface soil samples) in Luzon Island, Philippines. A citrate-bicarbonate- dithionite reduction procedure was employed to extract reactive iron from the soil and the concentrations of total Ni and Cr were quantified using the aqua regia method. In addition, Ni and Cr fractions (exchangeable, reducible, oxidizable, residual) in paddy soils were determined and quantified. The results revealed that: (1) Ni and Cr concentrations in paddy soils were significantly ($p<0.05$) higher in Sta Cruz compared to Candelaria and Masinloc; (2) Ni ($R2=0.54$; $p<0.0001$) and Cr ($R2=0.44$; $p<0.0001$) concentration increases with increasing reactive iron concentration; and (3) reactive iron is directly correlated ($p<0.001$) to the different Ni fractions, whereas the reactive iron is not ($p>0.05$) significantly correlated with exchangeable and oxidizable Cr. Despite exceeding agricultural guidelines of Ni and Cr concentrations, with up to 57 folds for Ni and 9 folds in Cr, they have low availability since they are mostly bound to mineral structures, suggesting that reactive iron acts as giant rusty sponge for Ni and Cr in serpentine paddy soils.

IN VITRO ASSESSMENT OF THE INHIBITORY EFFECT OF SLUDGE AGAINST *FUSARIUM OXYSPORUM* F. SP. *CUBENSE* (SMITH) SNYDER ET HANSEN

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One challenge resulting from wastewater treatment is the formation of sludge from the sedimentation of solids in the treatment process. Consequently, the global generation of sludge is continuously increasing and is estimated to exceed 10,000 tons per day. Such amount produced can become a challenge in terms of its treatment costs and disposal management. Recent literature

has shown that sludge may elicit inhibitory response against soil-borne pathogens, which may be valuable in managing soil infections. However, there is a need to conduct more research to understand the mechanisms of sludge's inhibitory properties, primarily in the local setting. The study determined the physico-chemical characteristics of sludge and assessed its inhibitory activity against *Fusarium oxysporum*. Each sludge extracts produced from different air-drying time were tested for inhibitory response using *In vitro* setup. Identification of organisms with inhibitory properties was also done and correlational analysis was also conducted. The highest Relative Inhibition Zone Diameter (RIZD) ($p<0.05$) is 78.30% in sludge extract from two months of drying, which also showed an increased amount of humic acid (10.29 C-mg/2mL), Total N (2.83 ±0.09 %) and microbial respiration (8.51 C-mg/mL). The co-relational analysis revealed that total bacterial count, total N, K, and microbial respiration contribute to the highest positive correlation among the parameters. Despite showing high inhibitory, its concluded that sludge must still undergo other treatment processes to produce mature sludge that passes the local regulatory standard. Moreover, it's also found out that the biotic component positively affects the inhibition of sludge against *F. oxysporum*.

ESTABLISHING MOLLUSC-VEGETATION-SEDIMENT RELATIONSHIPS IN MANGROVE-RECOLONIZATION IN ABANDONED FISHPONDS: IMPLICATIONS ON MANGROVE RESTORATION

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Most fishponds in the Philippines are former mangrove areas but are abandoned after exhausting its productive use (ca. 25 years). The abandoned fishponds provide spaces for mangrove vegetation and sediments to re-develop. However, it is not clear if faunal diversity will follow the vegetation and sediment recovery patterns. In this study, we assessed mollusc assemblages in mangrove-recolonized fishponds composed of four-yr (4y) and 20-yr (20y) stands and compared with the natural stands. The mollusc (composed of arboreal and epifaunal assemblages) were also tested for correlation with vegetation and sediment parameters. A total of 4,491 molluscs from nine families and 16 species were collected. Our results showed that both arboreal and epifaunal assemblages (in terms of diversity) gradually increased with age of the stands and were comparable with the natural stands (68 % and 77 %, respectively). Different species from different assemblages dominated the different stands. The species *Littorina scabra* and *Terebralia sulcata* were common across stands although the former had increasing dominance with age of the stands in the arboreal and the latter in the epifaunal assemblages, respectively. Both assemblages were significantly correlated to vegetation (arboreal, $\rho = 0.65$; epifauna, $\rho = 0.69$) and sediments (arboreal, $\rho = 0.63$; epifauna, $\rho = 0.61$). Our results indicate that while natural mollusc recolonization in abandoned fishponds is possible (although will take longer period), it can be further enhanced with a more proactive assisted mangrove restoration.

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COST-BENEFIT ANALYSIS OF MANGROVE ECOLOGICAL SERVICES AND COMMERCIAL AQUACULTURE INDUSTRIES IN SELECTED SITES ALONG PANGUIL BAY, MINDANAO, PHILIPPINES

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Mangroves are recognized globally for their ecological, economic, social, and cultural importance because of the variety of goods and services they provide. Since their value is not fully recognized, they have been converted to other land uses which offer more economic benefits. To protect them from further degradation, there is a need to showcase their relevance in terms of economic value. The study revealed that the Total Economic Value (TEV) of mangroves per hectare exceeds the TEV of aquaculture farms (both shrimp and milkfish production). Furthermore, the Cost-Benefit Analysis (CBA) between mangrove reforestation projects and aquaculture farms revealed that mangrove reforestation has higher Internal Rate of Return (IRR) than aquaculture production showing a positive Net Present Values in all prevalent discount rates in the area (10%, 15%, and 20%, respectively). In contrast, the NPV of an aquaculture enterprise showed negative NPV in all discount rates (except for shrimp farming at 10% discount rate). In addition, if aquaculture industries were to internalize and pay the environmental costs incurred during their operation, they cannot sustain their operations. Thus, conservation and protection of mangrove forests are more economically feasible than conversion to aquaculture production.

ABOVEGROUND CARBON STOCK OF THE SELECTED NATURAL AND REFORESTED MANGROVE FORESTS IN PANGUIL BAY, MINDANAO, PHILIPPINES

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To justify the role of mangroves in mitigating the impacts of climate change, it becomes necessary to quantify the carbon pools in the different compartments of these ecosystems as well as to understand the factors that control them. Using the guidelines established by Howard *et al.* (2014), this study was conducted in the selected natural and reforested mangrove forests in Panguil Bay, Mindanao, Philippines. The results revealed that the reforested mangrove forest has higher carbon stored of 58.31 MgC/Ha compared to the natural mangrove forest with 36.66 MgC/Ha. The lower carbon density of the natural mangrove forest could be affected with the abundance of *Nypa fruticans* in the area which contributes to only about 12.13% of the total aboveground carbon stock. The leaf litter component also represents a minimal portion of the total aboveground carbon stock in both natural (0.40%) and reforested (0.34%) mangrove forest. Moreover, it was observed from the result that carbon stock in the aboveground biomass tends to increase and sequestration tends to decrease linearly with age. The 15-year old natural mangrove forest has higher carbon sequestration rate of 2.79 MgC/Ha/Year but has lower carbon stock of 36.66 MgC/Ha compared to the 30-years old reforested mangrove forest with carbon sequestration rate of 1.95 MgC/Ha/Year and aboveground carbon stock of 58.31 MgC/

ha. With this results, to further improve this study the following are recommended; use of other allometric equations in obtaining the biomass and conduct further study on the role of leaf litter in the mangrove forest.

VULNERABILITY ASSESSMENT TO CLIMATE CHANGE IMPACTS OF A GLOBALLY IMPORTANT HERITAGE SYSTEM (GIAHS) IN THE PHILIPPINES: THE CASE OF BATAD RICE TERRACES, BANAUE, IFUGAO, PHILIPPINES

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Batad Rice Terraces of Ifugao, Philippines is declared as a Globally Important Agricultural Heritage System due its traditional system characterized with a synergy of goals of biodiversity conservation, sustainable productivity and strengthening of traditions and culture. It is also inscribed as a World Heritage Site by the UNESCO. However, in spite the fact that it is considered a living sustainable agricultural system, it is hypothesized that the rice terraces is not immune to the impacts brought by climate change. This study aimed to determine the level of vulnerability of Batad Rice Terraces to climate change impacts. To do this, the study examined the vulnerability as a function of exposure (E), sensitivity (S), and adaptive capacity (AC). The study used 28 indicators: 5 for exposure, 12 for sensitivity, and 11 for adaptive capacity. A total of 114 respondents were interviewed and focus group discussions were conducted in July-August 2017. Results of the study showed that the vulnerability rating for the study was 0.51 (E = 0.40; S = 0.65; and AC = 0.51) which indicated that Batad Rice Terraces is moderately vulnerable to climate change impacts. Of the 28 indicators, the key vulnerability indices are from sensitivity and adaptive capacity components. Under sensitivity, these include acidic soil pH, soil potassium deficiency, perceived increase in presence of pests, high dependence on irrigation, agricultural unsuitability, and food import dependency; whilst adaptive capacity indicators include declining practice of key traditions and low number of farmers per household.

CHEMICAL SPECIATION, SPATIAL DISTRIBUTION AND RISK ASSESSMENT OF TRACE METALS IN THE SEDIMENTS OF LAGUNA DE BAY, PHILIPPINES

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Laguna de Bay is a dynamic urban lake resource within an active volcanic field in the Philippines. The continuous uncontrolled economic development in its watershed has resulted to sedimentation and trace metal pollution in the lake. Trace metals can be deposited to the sediments and can still be remobilized into the water at certain physicochemical conditions. The goal of the study is to assess the sediment quality at the South Bay by characterizing the trace metal species through ultrasonic-assisted sequential extraction, principal component analysis, and ecological risk assessment. Increased total trace metal concentrations were found in sites nearest the coastal lake areas of Calamba and Los Baños. The trace metals at the South Bay were 17.48 ppm chromium, 15.51 ppm nickel, 123.94 ppm zinc, 109.49 ppm copper, 0.22 ppm

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cadmium, and 18.20 ppm lead, which have increased in over a decade, especially for copper and zinc. Cadmium had a high-risk level for potential ecological toxicity and primarily a by-product of human activities. Chromium and nickel were mostly bound within the minerals and primarily released through natural weathering, while the presence of copper, zinc, and lead were influenced by both lithogenic and anthropogenic processes. South Bay sediments had a moderate to considerable level for trace metal contamination.

GROUNDWATER VULNERABILITY ASSESSMENT USING MODIFIED HYDROLOGICAL DRASTIC MODEL IN MEYCAUAYAN CITY, BULACAN, PHILIPPINES

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DRASTIC System coupled with a geologic software was used in this study to determine the location of potential areas in Meycauayan City were groundwater is susceptible to pollution. The state of groundwater pollution is a critical issue with increasing population and industrial development in Meycauayan City. The main objective of the study was to show areas of highest potential for groundwater pollution based on hydro-geological condition and human impacts. Eight major hydro-geological factors (Depth to water table, net Recharge, Aquifer media, Soil media, Topography, Impact to Vadose zone and hydraulic Conductivity) adding Land Cover as the last parameter incorporated into modified DRASTIC model and geographical information system (GIS) to create a groundwater vulnerability map by overlaying the available hydro-geological data. The result showed that the groundwater resources of Meycauayan City were found to be high potential vulnerable to contamination having vulnerability index of 254 using DRASTIC MODEL. For groundwater management, the generated maps could be used as a tool for decision making in by the Local Government units (LGU) in their Comprehensive Land Use Plan (CLUP) where they can identify where the development will take place. This could be used to assist in the formulation of policiesrelated to groundwater resource management and protection in Meycauayan City.

Keywords: Groundwater Vulnerability Assessment,Meycauayan City, DRASTIC

DRINKING WATER TREATMENT USING HYBRID BIOSAND FILTER WITH LOCALLY PRODUCED COCONUT SHELL CARBON FOR BRGY. SAN JUAN, KALAYAAN, LAGUNA, PHILIPPINES

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The community in Brgy. San Juan, Kalayaan, Laguna consumes water from unprotected sources. Treatment of drinking water is necessary to prevent the spread of water-borne diseases like diarrhea. The Hybrid Biosand Filter (HBF) was designed and fabricated for this purpose. Evaluation of four filter systems revealed that the filter with 75% v/v sand and 25% v/v carbon

was the best version which removed 100% of thermotolerant coliform, 100% of turbidity, and 92% to 95% of color from the untreated water. The carbon in HBF was soaked with 50% NaCl solution improving its characteristics and adsorptive capacity. The social acceptability of the community for the use, fabrication, and maintenance of the HBF for treatment of the community's drinking water was also determined. The survey on the respondents revealed that 66% of them would accept using the HBF and majority are willing to fabricate and maintain their own HBF. Through logistic regression, it was found that the respondents' willingness to pay for drinking water treatment is Php 0.77 per liter of water filtered. The payback period of the recommended HBF was computed at 11.91 months. Based on the results, it is recommended that the community could use the HBF for drinking water quality improvement.

RAINFALL PATTERN AND LAND USE AND LAND COVER (LULC) CHANGES IMPACT ASSESSMENT ON THE SURFACE RUNOFF RESPONSES OF SANTA CRUZ WATERSHED, PHILIPPINES

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Among the wide range of ecosystem services provided by watersheds are quantity, distribution and timing of water supply. Water resources is affected, among others, by rainfall and LULC changes. With Philippines being prone to hydro-meteorological hazards, continuous population increase and economic development; it is vital to conduct a research pertaining to its hydrological impacts. This study aimed to detect and project the impact of these changes on the surface runoff responses of Santa Cruz Watershed during a typhoon event. The study was able to identify several General Circulation Models (GCMs) under two storylines of Representative Concentration Pathways (RCP) including RCP 4.5 and RCP 8.5 to account for the future impact of change in rainfall whereas LULC modeling was executed using the Markov chain method in Terrset™ to project LULC 2040 for change in LULC. Outputs were used to simulate their separate and combined impacts using event-based HEC-HMS model. For separate impact, results revealed that there is a higher probability of increase in discharge volume, peak, and earlier time of peak under RCP 8.5 than RCP 4.5 while LULC change displayed similar trend as compared with the baseline. In terms of combined impacts, there is a certainty that peak discharge and total volume will increase, and time of peak will be earlier in comparison with the baseline model for both RCP 4.5 and RCP 8.5 scenarios. Output of the study can serve as additional baseline information in the formulation of DRRM and watershed management plans among others.

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HEDONIC ANALYSIS OF FLOOD PRONE RISK IN BATANGAS CITY, PHILIPPINES

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The study examined the price people are willing to pay to reduce the risk of experiencing the impacts of flooding through the hedonic pricing method as revealed in land prices in Batangas City. Five regression models were used to estimate the implicit prices of factors that influence residential land prices using market and zonal values. Using zonal values, it revealed that a 1% increase in flood risk using flood risk index (FRI) would decrease land value by 0.07%. Utilizing the 'distance from the river' variable in place of FRI, it showed that a 1% increase in distance away from the river would decrease land price by 0.15%. This is contrary to the notion that lands located near the river have lower prices due to expected water-related risk. This result could be attributed to the confounding effect of proximity to water-related amenities. The potential risks computed though significant have little impact on price. Further, it can be argued that the model which utilized 'distance from the river' variable is the best fitting model and distance is a better predictor of price compared to FRI. The resulting implicit prices could be used by decision makers in estimating benefits of flood-related projects.

ANALYSIS OF SOIL MICROBIAL DIVERSITY AND GROSS PRIMARY PRODUCTIVITY OF MAGABUYO (*CELTIS LUZONICA* WARB.)-DOMINATED AREA AND CORN (*ZEA MAYS* L.)-PLANTED AREA IN MT. MAKILING

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Soil microorganisms play an important role in an ecosystem. Anthropogenic activities affect the soil microbial population that inflict an effect in the ecological role that these organisms perform. The study aims to compare the physicochemical properties, soil microbial community and GPP of a Magabuyo-dominated forest area (F_{1-3}) and Corn-planted agricultural area (C_{1-3}) situated in Mt. Makiling to compare the changes brought about by change in the land use. The soil in both areas were dominantly clay loam in texture. F_{1-3} had a lower pH and EC and had a higher moisture content, OM and nutrient content compared with C_{1-3}. Actinobacteria and Proteobacteria are the dominant phylum in C_{1-3} and F_{1-3}, respectively. F1-3 had a more diverse microbial community compared with C_{1-3} but indicated no significant difference. TG model was used in estimating the GPP of the two land uses. F_{1-3} had a higher average daily GPP compared with C_{1-3} for both dry or wet season ($F_{1-3\ wet}$= 9.55g C/m^{-2}/year, $F_{1-3\ dry}$= 11.01g C/m^{-2}/year; $C_{1-3\ wet}$= 9.29 g C/m^{-2}/year, $C_{1-3\ dry}$= 9.72 g C/m^{-2}/year). The correlation between the physicochemical properties and microbial diversity and GPP and soil microbial diversity of the two land uses had no statistical significance.

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RAINWATER AS WATER SOURCE: THE CASE OF SITIO PULOT-BAE, KALAYAAN, LAGUNA, PHILIPPINES

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Sitio Pulot-Bae is a rural community located in Bgy. San Antonio, Kalayaan, Laguna with a total population of 419 as of 2018. The man-made lake and natural springs are the sources of water for drinking and domestic uses. The community has insufficient supply of clean water which affect the health and livelihoods. Thus, the study assessed the rainwater quantity and quality as potential water supply. One-year monitoring of local rainfall was done using improvised rain gauge. The recorded total annual rainfall is 1,928.36 millimeters. It showed that rainwater could be harvested to supply the community. Rainwater quality assessment was conducted during wet and dry. The local people observed good rainwater quality in terms odor, color and volume during rainy seasons, but yellowish color was noted during dry months due to rusty roofs and gutters. The collected rainwater samples met the Philippines water quality standards for temperature, chloride and nitrate values, however, low pH (5.89) and high turbidity (5.3 NTU) concentrations were recorded. Further, the water samples are positively contaminated by thermotolerant coliform and *E. coli* during wet season sampling. The contaminations usually occur due to atmospheric deposition of pollutants, chemical and physical reactions of rainwater with the system's materials and from deposited feces of birds and other animals. Rainwater is a good water source with appropriate treatments such as boiling to avoid waterborne diseases especially among children.

Keywords: rainwater, spring; man-made lake; water quality; water supply; physic-chemical parameters; microbiological parameters; Philippine water quality standards

EFFICACY AND PRODUCTION COST OF *TRICHODERMA* MICROBIAL INOCULANT (TMI) AND CITRONELLA ESSENTIAL OIL AS PEST AND DISEASE CONTROL METHODS IN HOT PEPPER (*Capsicum annuum* L.) CULTIVATION

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The potential of *Trichoderma* Microbial Inoculant (TMI) and citronella essential oil as alternative pest and disease control method to chemical pesticides in hot pepper cultivation were investigated. The major plant disease observed is chili anthracnose (*Colletotrichum* spp.) while major insect pests are aphids (*Myzus persicae* Sulzer) and whiteflies (*Aleurodicus dispersus* Russell). Combination of TMI and citronella essential oil (T3) significantly decreased the incidence of anthracnose (9.37%) whereas TMI (T1), citronella essential oil (T2) and its combination (T3) significantly decreased the severity of anthracnose. There was a significant decrease in the mean population of insects in T0, T1, T2 and T3. In terms of financial analysis, T1 incurred the cheapest

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production cost (PhP 670/50 m^2) while current farmers practice (T0) incurred the highest net income among all treatments (PhP 2,141.60/50 m^2). Both TMI and citronella essential oil were found to be effective against the identified major pests and disease of hot pepper. Thus, can be recommended as potential alternative to chemical pesticides in controlling the identified pests and diseases of hot pepper.

SUSTAINABLE ENVIRONMENTAL PERFORMANCE OF SPRING ONION (*Allium fistulosum* L.) PRODUCTION IN PANGIL AND MABITAC, LAGUNA, PHILIPPINES

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The sustainable environmental performance of spring onion production system in Pangil and Mabitac, Laguna was evaluated to inspect the hotspots of every activities across the life cycle of spring onion from land preparation to harvesting and to assess the spring onion farmers' management performance. The life cycle sustainability assessment was used to identify the environment, social and economic impacts of spring onion production while the environmental performance evaluation determined the management performance of spring onion farmers.

Impact categories for environmental life cycle impact assessment such as global warming potential (2.7E – 03 kg CO2 eq) and acidification potential (4.60E-07 kg SO2 eq) occurred during land preparation with the use of diesel. High level amount of human ecotoxity potential (7.27E+05 kg 1,4 DCB eq) and terrestrial ecotoxicity potential (8.24E+05 kg 1,4 DCB eq) occurred during the growing period with the application of agrochemicals. Health risks of both spring onion farmers and farm workers due to agrochemicals application, child labor during harvesting and unhygienic cleaning practices of newly harvested of spring onion are among the identified social hotspots. The economic impact of spring onion production generated high amount of net income per kg of spring onion during wet season (Php 66.07). Spring onion farmers have good production performance but poor in management performance. Good agricultural practices were recommended to improve the sustainability of spring onion production.

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ENVIRONMENTAL CONCEPTIONS, AWARENESS AND ATTITUDES OF KINDERGARTEN CHILDREN AND TEACHERS IN SELECTED SCHOOLS IN CALAUAN, LAGUNA

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Early childhood education, which focuses on inculcating basic environmental science principles could be one of the most efficient strategies to achieve sustainable development since sensitivity to, concern for and positive attitude toward the environment is developed through time and should be instilled to people early in life. Hence, this study investigated on the environmental conceptions, awareness and concern of 59 kindergarten children and 40 kindergarten teachers from public and private schools in Calauan, Laguna, an agro-industrial municipality south of Manila experiencing some environmental problems. Through drawing sessions and interviews, it was found out that children view the environment as having more natural elements. There is not much evidence of environmental issues awareness in their drawings. Through interviews the students reported positive environmental attitude towards consumption patterns, recycling-reusing and environmental protection. Negative environmental attitude were found in their living habits—playground and residential preferences. Teachers, who are proposed to be models of positive environmental attitude for children, had a more anthropocentric concept of the environment. Nevertheless, they are conscious of the existence of both global and local issues and have also reported positive environmental attitudes toward consumption patterns, recycling-reusing, environmental protection and education.

MAPPING AMBIENT WATER PH AND TEMPERATURE USING AN UNMANNED AERIAL VEHICLE: A CASE STUDY IN GUINABASAN RIVER, ASTURIAS, CEBU, PHILIPPINES

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This study developed a low cost wireless pH and temperature *in-situ* prototype sensor using an unmanned aerial vehicle (UAV) to provide real-time *in-situ* measurements and map ambient water quality parameters of waterbodies. Compared to the traditional *in-situ* monitoring (TISM) using handheld device, the use of an UAV with wireless network sensing (WNS) data measurements provide comparable and reliable real-time data. Moreover, the integration of remote sensing (RS), WNS and *in-situ* commercial electrodes attached to an UAV compared to the traditional *in-situ* monitoring using handheld device proved to be better in terms of efficiency, performance, usability and adaptability. There was a positive feedback from the end-users on the use of remote sensing and geo-informatics during the conduct of water quality monitoring and assessment. The current UAV with WNS configuration as described in this thesis study can reduce the limitations and challenges in the conduct of field monitoring as well as the issues attached to the use of RS and geo-informatics. The set-up can be incorporated in the current water quality monitoring and assessment in the near future as the Philippines is passed to become a developed economy in the fourth industrial revolution.

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SEDIMENTATION RATE IN THE REEF AREA OFF BARANGAY MARIBAGO AND BARANGAY PUNTA ENGAÑO, LAPU-LAPU CITY, MACTAN ISLAND, CEBU, PHILLIPINES

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This study aimed to compare the sedimentation rate of the four selected reef sites between dry and wet seasons at 5– and 8-meters depth, of which, two sites were located in Brgy. Maribago and two sites were in Brgy. Punta Engaño. Sedmentation rate was then correlated to total suspended solid and discussed the relationship between surface current and sedimentation rate. Determined the particle size from the sediment traps. And determined the status of the reef based on Gomez (1979) and Shannon-Weiner Diversity Index and correlated it to sedimentation rate. Resulted showed that the mean sedimentation rate ranged from 0.04759 $mg/cm^{-2}/day^{-1}$ to 0.11348 $mg/cm^{-2}/day^{-1}$during dry season. Whereas, during wet season mean sedimentation rate ranged from 0.02012 $mg/cm^{-2}/day^{-1}$ to 0.12392 $mg/cm^{-2}/day^{-1}$. Multi-way ANOVA revealed that that the sedimentation rate was significantly ($p < 0.05$) influenced by depth, site, and season as-well-as their interactions. In terms of total suspended solids and current velocity, sedimentation rate tends to be higher when current speed is low because some suspended solids has the opportunity to settle down at the bottom. Also, the sediment composition from the fallout were terrigenous and biogenic in origin. The coral community condition ($r^2 = 0.1052$) and macro-benthic invertebrates diversity ($r^2 = 0.0946$) showed no correlation with sedimentation rate. Thus, sedimentation rate in these sites were relatively low and had no effect yet, and that there are other factors affecting the coral condition and the diversity of macro-inverts.

MICROPLASTIC OCCURRENCE IN LAKE MAINIT AND PLASTIC AWARENESS OF RESIDENTS IN MAINIT, SURIGAO DEL NORTE, PHILIPPINES

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Microplastic (MP) has become an ubiquitous emergent pollutant in aquatic environments. Studies are more common in marine environments, however, freshwater lakes have also been identified as sinks of microplastics. The current study investigated the occurrence of MPs in the sediment and water in the northern inlet and southern outlet of Lake Mainit, a large inland lake in the Philippines, and in the gut of *Glossogobius giuris*, a native fish in the lake. Sediment samples contained the most MP-like particles containing 35 items in total, and 10% of these were subjected to FT-IR. The particles were noted to contain polyethelene and polypropylene compounds. The awareness survey revealed that although local residents are mostly aware of plastics, majority of them were not aware or have only heard of MPs. Education level is positively correlated with knowledge scores. There is, however, no correlation between knowledge and the residents' perception or willingness implying an overall environmental concern even without prior knowledge. The Driver-Pressure-State-Impact-Response (DPSIR) framework was used to describe relationships between community and plastic & MP pollution and identify areas for management.

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FOREST FRAGMENTATION ASSESSMENT USING LANDSAT 8 IMAGERY FROM THE YEAR 2015 AND 2019 IN SIARGAO MAINLAND, SURIGAO DEL NORTE, PHILIPPINES

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Land use land cover change remains to be the leading driver of biodiversity loss worldwide. The lack of sufficient data on the extent of land conversion in Siargao Island pose as a major challenge in developing successful conservation strategies, hence, this paper aims to assess and compare the morphological changes of its landscape, specifically on forest fragmentation, for the year 2015 and 2019. Comparison between the two years showed that economic development has improved as evident from the increased built-up land use class from the year 2015. Moreover, forest fragmentation from both years shows no significant difference in terms of its morphology and total land area cover, however, results from FRAGSTATS v4.2 suggests high fragmentation in the island which can be attributed from the observed illegal anthropogenic activities in the area such as slash and burn practices, illegal logging, and land conversion into agricultural lands. The findings of this study suggest that in order to minimize the negative implications of a highly fragmented forest, strict implementation of laws and improved management systems are needed.

TRANSCRIPTOME ANALYSIS PROVIDES MOLECULAR BASES FOR THE SELECTION OF A SUPERIOR ASIAN CATFISH *Clarias macrocephalus* GÜNTHER 1864 STRAIN INTENDED FOR REINTRODUCTION

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The selection of physiologically-superior strains constitutes one of the most important factors that predicts the success of stock enhancement programs. In this study, a comparative transcriptome analysis between two remaining *Clarias macrocephalus* populations from Cagayan (CmC) and Agusan del Sur (CmA), Philippines was conducted to profile and compare the expression patterns of various fitness-related hepatic genes and identify a potent strain for reintroduction. By using RNA sequencing, a total of 58,877,141 clean reads were generated and were *de novo* assembled into 86,011 unigenes (Table 1). Functional annotation of the transcripts showed that 43,368 and 36,976 unigenes were successfully annotated in NCBI non-redundant (NR) and Swiss-Prot protein databases, respectively. Expression analysis of these annotated unigenes also revealed that 19,087 genes were co-expressed in the liver of both catfish strains while 176 and 106 genes exhibited specific expression only in CmA and CmC tissues, respectively. By conducting Gene Ontology analysis, the identified differentially expressed genes were also found to be involved in hydrolase activity, immune system processes and lipid metabolic processes. Comparison of overexpressed DEGs also highlighted the significant upregulation of numerous reproduction-, immunity- and growth-related genes including *PGR, CTLD, TFRP*-like, *GS03, LPL*-like and *ALT2* genes in CmA relative to CmC. Interestingly, most of these genes belonged to the pool of genes that were only specifically expressed in CmA samples. Our study demonstrated that RNA-seq

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can be used to identify strain-specific DEGs which could impart valuable information for the selection of a catfish strain that is ideal for breeding and reintroduction.

SAMPLE	RAW READS	CLEAN READS	READS MAPPED TO TRANSCRIPTOME	MAPPING RATE
CmA	31,608,848	31,193,690	24,029,543	77.03%
CmC	28,057,443	27,683,451	20,926,875	75.59%

Table 1. Statistics of the assembled reads generated from the hepatic tissues of juvenile *Clarias macrocephalus*

SOME ASPECTS OF ECOLOGY AND BIOLOGY OF THE MANGROVE CLAM, *Anodontia edentula* IN TARANGNAN, SAMAR

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The mangrove clam *Anodontia edentula* is a source of food and income for gleaners. This clam is highly prized in the Philippines for its flavor and large size. The exploitation of *A. edentula* had been prominent since the 1960s which resulted in resource depletion due to the poor understanding of its ecology and biology, thus hindered the management of this resource. This study characterized the habitat, estimated population density, and investigated the feeding biology of *A. edentula*. Results showed that *A. edentula* inhabits muddy substrate in the mangrove areas and are buried into the mud at 20-60 cm deep in the mud and they are found in waters with the following parameters water temperature at 29-34 °C, salinity at 28.84-32.00 ppt, dissolved oxygen at 4.04-6.05 mgL^{-1} and pH at 7.00-7.23. Sediment grain size analysis showed that the preferred substrate of *A. edentula* is between medium sand with 34.24% (0.85 mm) and fine sand with 9.68% (0.250 mm) and a total of 95.82% to 2.16 % finer ranging from a mixture of sand, mud, and gravel. A total of 123 individual clams were gleaned per 10 m^2 in December, 2019 and 163 individual clams in February, 2020 with a total mangrove area of 5000 m^2 and showed twelve dominant co-inhabitants of *A. edentula* (66.67% relative abundance), and Simpson diversity index, D=0.465 that indicates infinite diversity in the mangrove mudflat. The mangrove clam relied mainly on phytoplankton as food, primarily on diatoms. For a sustainable supply of this resource, efficient and effective management strategies are required, thus improve its present condition. Therefore, the present study serves as baseline information which may support the development of policies for sustainable management of the resource.

Keywords: mangrove clam, mata, mudflat, physicochemical, plankton

EFFECTS OF DIETARY pH ON GROWTH AND FEED EFFICIENCY OF THE NILE TILAPIA *Oreochromis niloticus*

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Two feeding trials were conducted to investigate the effects of pH level (pH 2.5, pH 3.7, pH 4.6, pH 5.7-control, pH 7.0, pH 8.0) and different acids (acetic acid, citric acid, hydrochloric acid and control-no acid) on growth, feed utilization and survival of tilapia. In experiments 1 and 2, the attractability of the diet were assessed. Results of the experiments are shown below.

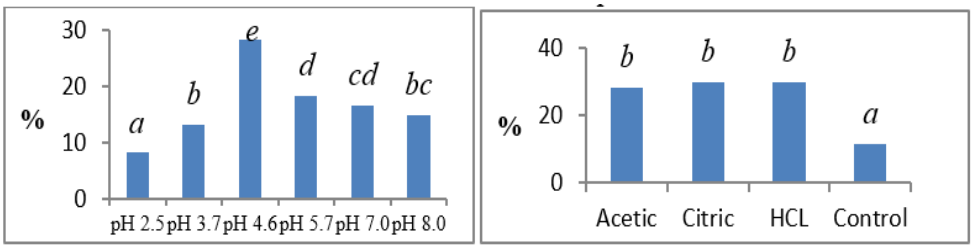

Figure 4. Attractability test of the basal diet and of test diet in experiment 1 and 2 after 3 minutes of feed placement

pH level	IABW	ABW	FI	WG	SGR	FCR	PER	SR
2.5	0.2	1.0±0.1^{a}	2.7±0.1	0.8±0.1^{a}	1.5±0.1^{a}	3.6±0.3^{c}	0.3±0.1^{a}	86.7±2.7^{a}
3.7	0.2	1.9±0.0^{b}	3.2±0.1	1.7±0.0^{bc}	3.3±0.1^{bc}	1.8±0.0^{b}	0.8±0.0^{b}	100.0±0.0^{c}
4.6	0.2	2.7±0.2^{c}	3.4±0.2	2.6±0.2^{d}	4.9±0.3^{d}	1.3±0.0^{a}	1.3±0.0^{c}	100.0±0.0^{c}
5.7	0.2	2.1±0.0^{b}	3.3±0.0	1.9±0.0^{c}	3.7±0.1^{c}	1.8±0.0^{b}	0.9±0.0^{b}	100.0±0.0^{c}
7.0	0.2	2.0±0.1^{b}	3.2±0.1	1.8±0.1^{bc}	3.5±0.1^{bc}	1.8±0.1^{b}	0.9±0.0^{b}	100.0±0.0^{c}
8.0	0.2	1.9±0.1^{b}	3.1±0.1	1.6±0.0^{b}	3.3±0.2^{b}	1.9±0.0^{b}	0.8±0.1^{b}	92.0±2.3^{b}

Table 2. Growth efficiency and survival of tilapia fry after 56 days of feeding at various dietary pH

Acids	IABW	ABW	FI	WG	SGR	FCR	PER	SR
Acetic	0.1	2.7±0.1^{b}	3.8±0.1	2.6±0.0^{b}	4.7±0.1^{b}	1.5±0.3^{a}	1.5±0.0^{b}	100.0±0.0
Citric	0.1	2.7±0.1^{b}	3.8±0.1	2.6±0.0^{b}	4.7±0.1^{b}	1.5±0.0^{a}	1.5±0.0^{b}	100.0±0.0
Hydrochloric	0.1	2.7±0.1^{b}	3.8±0.1	2.6±0.0^{b}	4.8±0.2^{b}	1.4±0.0^{a}	1.5±0.0^{b}	100.0±0.0
Control	0.1	2.1±0.1^{a}	3.5±0.1	2.0±0.1^{a}	3.6±0.2^{a}	1.8±0.1^{b}	1.2±0.0^{a}	100.0±0.0

Table 3. Growth efficiency and survival of tilapia fry after 56 days of feeding at various dietary acid

Initial average body weight (IABW), average body weight (ABW), weight gain (WG), specific growth rate (SGR), feed conversion ratio (FCR), feed intake (FI), protein efficiency ratio (PER) and survival rate (SR). Means in the same column sharing the same superscript are not significantly different (p>0.05).

The experimental diet at pH 4.6 resulted in significantly the best growth and feed utilization. Results showed that addition of any acid in the diet (hydrochloric, citric and acetic acid) resulted in better growth than that of the control group. This study demonstrated that pH and not actually the kind of acid diet promoted growth and efficiency in the Nile Tilapia fry.

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IN SILICO AND IN VITRO ASSESSMENT OF PORTUGUESE OYSTER (*Crassostrea angulata*) PROTEINS AS PRECURSOR OF BIOACTIVE PEPTIDES

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In this study, the potential bioactivities of Portuguese oyster (*Crassostrea angulata*) proteins were predicted through *in silico* analyses and confirmed by in vitro tests. *C. angulata* proteins were characterized by sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE) and identified by proteomics techniques. Hydrolysis simulation by BIOPEP-UWM database revealed that pepsin (pH>2) can theoretically release greatest amount of bioactive peptides from *C. angulata* proteins, predominantly angiotensin I-converting enzyme (ACE) and dipeptidyl peptidase IV (DPP-IV) inhibitory peptides, followed by stem bromelain and papain. Hydrolysates produced by pepsin, bromelain and papain have shown ACE and DPP-IV inhibitory activities *in vitro*, with pepsin hydrolysate (PEH) having the strongest activity of 78.18% and 44.34% at 2 mg/mL, respectively. Bioactivity assays of PEH fractions showed that low molecular weight (MW) fractions possessed stronger inhibitory activity than crude hydrolysate. Overall, *in vitro* analysis results corresponded with *in silico* predictions. Current findings suggest that *in silico* analysis is a rapid method to predict bioactive peptides in food proteins and determine suitable enzymes for hydrolysis. Moreover, *C. angulata* proteins can be a potential source of peptides with pharmaceutical and nutraceutical application.

EVALUATION OF DIETARY BENFOTIAMINE ON GROWTH AND IMMUNE RESPONSE OF *Penaeus monodon* POST LARVAE

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Normally, shrimps are not well adapted to high amounts of dietary carbohydrate and results in poor growth performance. Thiamine (vitamin B1) plays a key role in the conversion of carbohydrates into energy. Benfotiamine is a lipid-soluble derivative of thiamine and is absorbed up to 3.6 times more than the water-soluble forms of the vitamin. The present study aims to evaluate the effects of high carbohydrate diet alone or supplemented with benfotiamine on growth and immune response of *Penaeus monodon* post larvae.

An attractability test and two feeding trials were conducted- the first feeding trial aimed to compare the effects of a normal dietary carbohydrate level (C) with those of a high carbohydrate diet (HC) and with those of a high carbohydrate diet supplemented with 0.02 g/kg benfotiamine (HCB). At the termination of the feeding trial, the shrimps were subjected to sublethal ammonia

toxicity test to determine the effects of the diets on the immune response of the experimental shrimps. The second feeding trial aimed to determine the optimum inclusion level of benfotiamine at 0.02, 0.04, 0.06 and 0.08 g/kg.

Table 1. Composition of experimental diets to determine the effects of high carbohydrates supplemented with benfotiamine .

Feed Ingredients	Control (g)	HC (g)	HCB (g)
Shrimp (Acetes) meal	200.0	200.0	200.0
Soybean meal	200.0	200.0	200.0
Corn/wheat starch	130.0	200.0	200.0
Cod liver oil	40.0	40.0	40.0
CMC	104.8	34.8	34.78
Lecithin – Soy (70%)	5.0	5.0	5.0
Trace mineral premix	10.0	10.0	10.0
Vitamin premix	10.0	10.0	10.0
Peruvian Fishmeal	300.0	300	300
BHT	0.2	0.2	0.2
Benfotiamine	0.0	0.0	0.02
TOTAL	1000.0	1000.0	1000.0

Table 2. Determined proximate composition (dry weight basis)

	C (%)	HC (%)	HCB (%)
Moisture	7.44	6.71	6.67
Crude Protein	47.50	47.09	46.30
Crude Lipid	8.31	9.80	9.43
Crude Fiber	2.52	2.28	
Ash	13.18	14.75	

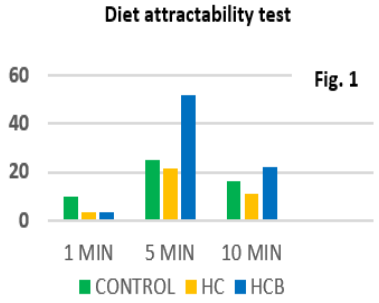

Fig. 1

Fig.1 showed that the HCB diet elicited significantly the highest attractability after 5 min of feed placement in the chamber.

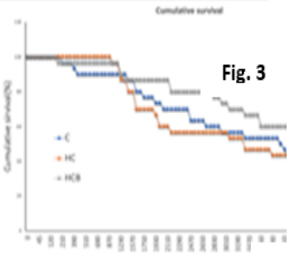
Fig. 3

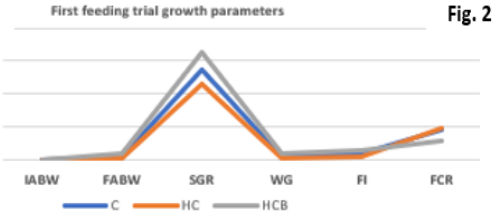

Fig. 2

Fig. 3 **showed the results of the 3 days ammonia challenge 0f 50 ppm. The shrimp fed with diet HCB exhibited significantly the highest survival rate of 60% while those fed with diet C and HC exhibited lower survival rates of 33% and 40%, respectively and were not significantly different from each other.**

Fig. 2. **For the first feeding trial that lasted for 60 days, results showed that shrimps fed with HCB 0.02 g/kg exhibited significantly the highest growth among all groups in terms of final average body weight, weight gain, and specific growth rate and feed intake.**

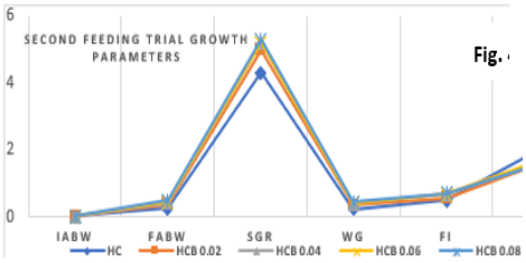

Fig.

Fig. 4 **showed the result of the second feeding trial. The diet containing 0.04 g/kg benfotiamine exhibited significantly higher final average body weight, weight gain, specific growth rate and feed intake than those fed the diet containing 0.02 g/kg but was not significantly different from those fed diets at 0.06 or 0.08 g/kg.**

In conclusion, benfotiamine enhances growth performance and immune response at an optimum inclusion of 0.04 g/kg.

ASSESSMENT OF ENDOMYCORRHIZAL FUNGI DIVERSITY AND GALL RUST DISEASE OF *Falcataria moluccana* (Miq.) BARNEBY & J.W. GRIMES TREES IN LAGUNA, PHILIPPINES

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Falcataria moluccana is an economically- important tree species for the wood industry but it is a host to a destructive gall rust disease caused by *Uromycladium falcatarium*. Studies have shown that mycorrhizas induce host plant resistance against pathogens. Thus, this study investigated the relationship of endomycorrhizal fungi diversity and gall rust disease severity in *F. moluccana*

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trees. The study was conducted in a 50-year old *F. moluccana* plantation in Siniloan, Laguna, Philippines. Three transects were established to serve as sampling sites for soil collection and tree surveys. Soil samples were collected in triplicate for endomycorrhizal assessment following the wet sieving and decanting method. Endomycorrhizal spores were individually counted to calculate diversity parameters. Tree survey results showed that the plantation have a 100% disease incidence with moderate infection (DSI= 30- 44) on mature trees. Height, diameter and basal area were significant at 5% level among all sampling sites. Indigenous endomycorrhizas were isolated, assessed, and identified, resulting to 13 morphospecies, 3 orders, 4 families and 4 genera per 100g dry weight of soil. Shannon Index (H') was significant in all sites ($F(2,31) = 7.46$, $p = 0.002$) in which Site 2 have the highest endomycorrhizal diversity ($H' = 2.660$). Correlation analyses showed that diversity have strong negative correlation with tree biometrics, while weak relationship was observed between health score and diversity, implying indirect effect of endomycorrhizas to disease by contributing to overall growth of *F. moluccana* trees. The study provides implications to establishment and sustainability of *F. moluccana* tree farms by including endomycorrhizal fungi in gall rust disease management operations.

Keywords: Falcataria moluccana, gall rust, endomycorrhiza, biodiversity, Uromycladium

GOLD-BEARING LISTWANITES IN A YOUNG ISLAND ARC: A CASE STUDY IN THE MALABEG PROSPECT, ZAMBALES, PHILIPPINES

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Listwanites are silica-carbonate alteration of serpentinized ultramafic rocks in faults and shear zones. They are common in geologically older continental belts that underwent significant metamorphism. However, gold-bearing listwanites were also found within the Philippine Mobile Belt, a young island arc in the Western Pacific. These were found in the Malabeg Prospect in Cabangan, Zambales. Two phases of listwanitization were identified through petrography, ore microscopy and mineral chemistry. Phase I listwanites are made up of talc-carbonate veins that occur in shear zones and contacts between diabase and serpentinized peridotite. Sulfide assemblage includes arsenopyrite + rutile. Phase II listwanites consist of quartz veins and minor chalcedony between carbonatized ultramafic rocks. They represent the mineralized stage of the deposit and have sulfide assemblages of pyrrhotite + sphalerite + galena + chalcopyrite + gersdorffite + pentlandite and chalcopyrite + galena + sphalerite + electrum. Mineralization sequence between the two phases of listwanites is reflected by carbonate rims (Phase I) of veins being more silica-dominant towards the core (Phase II). A shift from a reduced to a slightly oxidizing environment has been documented by the Fe-S mole percent of sphalerite grains, which indicates that fluids were initially buffered by ferromagnesian minerals comprising the host rocks.

Pliocene-Holocene magmatic centers of the Bataan Volcanic Arc Complex may have driven the circulation of hydrothermal fluids within the Cabangan Massif. These resulted to listwanitization and leaching of gold from the ultramafic units. Ultimately, the Malabeg Prospect suggests potential for other ophiolites within similar settings.

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FLOWERING RESPONSE AND POSTHARVEST QUALITY OF TISSUE CULTURE-DERIVED CHRYSANTHEMUM (*Chrysanthemum morifolium* RAMAT.) APPLIED WITH DIFFERENT ORGANIC SOIL AMENDMENTS UNDER TWO TYPES OF CULTIVATION SYSTEM

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In the Philippines, chrysanthemum is one of the most in demand and high valued cut flowers. Due to increasing demand, high valued ornamentals are grown under protective structure for increased production. Thus, this study was conducted to evaluate and assess the flowering performance, profitability and postharvest quality of tissue culture-derived chrysanthemum applied with different organic soil amendments under two types of cultivation system. This was carried out in split-plot arranged in randomized complete block design with three replications. The type of cultivation system (low tunnel structure and open field) served as main plot and organic soil amendments (wokozim, carbonized rice hull, NaturComplet®-G and IMO_6) as sub plot factor.

Results showed that horticultural characteristics, flowering and yield components of tissue culture-derived chrysanthemums were not significantly affected by the types of cultivation system. The different organic soil amended plants were comparable to each other but showed superiority over the control. Heaviest yield was obtained in NaturComplet®-G and carbonized rice hull but similar to inorganic fertilizer, wokozim and IMO_6. Gross margin analysis showed that application of carbonized rice hull generated the highest net income for both cultivation system. On the other hand, longer vase life was observed under low tunnel structure with reduced number of stomates. Chrysanthemums in unamended control obtained the lowest values in all parameters considered.

Keywords: low tunnel Wokozim, NaturComplet®-G, IMO_6, carbonized rice hull, vase life

GROWTH, YIELD AND PHYSICO-CHEMICAL QUALITIES OF SWEET PEPPER (*Capsicum annuum* L.) UNDER PROTECTED CULTIVATION SYSTEM AS INFLUENCED BY WOOD VINEGAR APPLICATION

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Sweet pepper (*Capsicum annuum* L.) is one of the most important vegetable crops grown extensively throughout the world. The hazards to health and environment from the use of pesticides must be minimized and the dependence on chemical control needs to be reduced without compromising the growth of sweet pepper and its volume of production. Thus, this study was conducted to evaluate the growth, yield, and physico-chemical qualities of sweet pepper as affected by methods of application and the dilution rates of bamboo wood vinegar (WV) applied; determine the most effective method of application and dilution rate; assess its effect on the pest incidence and fruit disorders; and evaluate the interaction effects of the methods

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of applications and the dilution rates on the aforementioned parameters. The experiment was laid out in split-plot design arranged in RCBD with three replications. The methods of WV application (drenching and foliar application) served as the main plot and the different dilution rates (tap water, 750x, 500x and 250x dilution rate) as the sub-plot factor.

Results showed that the methods of application and the dilution rates of WV significantly improved the growth, yield and yield parameters. The lowest dilution rate (250x) when applied through drenching produced the largest and greatest number of sweet peppers which resulted to significant increase in the total yield. Significant reduction on fruit fly damaged fruits and broad mite infestation were observed on plants applied with diluted WV through foliar spraying while drenching reduced blossom-end rot disorder on fruits. Most of the chemical characteristics of freshly harvested fruits and after six days of storage were significantly improved by the different dilution rates of wood vinegar.

Keywords: dilution rate, Capsicum annuum L., broad mite, blossom end rot, vitamin C

EFFECT OF EXOGENOUS APPLICATION OF SALICYLIC ACID ON GROWTH AND YIELD OF TOMATO (*Solanum lycopersicum* L.)

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Tomato is one of the most popular and widely vegetable grown in the Philippines. However, production of this vegetable crop under VSU's condition was affected by soil borne disease specifically bacterial wilt. Thus, this study was designed to evaluate the effects of different concentrations of salicylic acid in improving yield and suppression of the disease. The experiment was laid out in a single factor experiment design and arranged in a Randomized Complete Block Design with three replications. The concentrations were based on the standard amount of a 138mg L^{-1} salicylic acid. Lower and higher concentrations were included in the study.

Results revealed that concentrations of salicylic acid significantly affected the flowering, some of horticultural characteristics and yield and yield components of tomato. Early flowering was observed on plants applied with 14mg L^{-1} with comparable effects to untreated plants, and plants applied with 69mg L^{-1}, 138mg L^{-1}, and 207mg L^{-1}. Early harvest was observed on plants applied with 138mg L^{-1}. However, the increasing concentrations of 2mM or 276mg L^{-1} resulted to corresponding delay in flowering and fruit setting of tomato. In addition, the number and weight of both marketable and total yield were highest and heaviest at concentration 138mg L^{-1} or 1mM. Moreover, lower and higher salicylic acid concentrations showed a declining trend in marketable and total yield. Higher bacterial wilt incidence was significantly higher on untreated plants thus; lower percentage of plant survival was recorded. The use of 138mg L^{-1} concentration of salicylic acid is recommended in areas heavily infected by *Ralstonia solanacearum*.

Keywords: tomato, salicylic acid, Ralstonia solanacearum

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GROWTH EFFECTS, ACCUMULATION, AND LOCALIZATION OF LEAD IN ULASIMANG-BATO [*Peperomia pellucida* (L.) H.B.K.]

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The effects on growth, accumulation, and localization of lead (Pb) in *Peperomia pellucida* (L.) H.B.K. were investigated. The potential of different organic amendments [coconut coir dust, carbonized rice hull (CRH), leaf compost] as soil ameliorant in the Pb uptake and growth of *P. pellucida* were also evaluated. Increasing levels of Pb (50, 100, 250, and 500 mg kg-1) caused progressive reduction of plant height but had no effect on other vegetative and reproductive growth parameters measured. Pb accumulated in the roots, stem, and leaves of *P. pellucida*. The Pb concentration in each plant part increased with increasing concentration of Pb applied in the planting medium. Pb content was highest in the roots (87.0%) followed by the stem (9.5%) and leaves (3.5%). Values of translocation and bioaccumulation factors ranged from 0.14 – 0.28 and 0.02 – 0.06, respectively, categorizing *P. pellucida* as a Pb excluder.

The use of coir dust and leaf compost as soil organic amendments resulted in the growth of *P. pellucida* with reduced height. Application of Pb in coir dust further reduced plant height. Leaf compost enhanced leaf development, increased plant biomass, and reduced Pb shoot uptake of *P. pellucida* by 55%. Histochemical rhodizonate analysis showed that Pb localized in the stem and root of *P. pellucida*. Qualitative analysis exhibited that more Pb was present in the roots compared with the stem. This agreed with the result of the quantitative analysis where highest Pb concentration was detected in the roots.

GROWTH, PHYTOCHEMICAL CONTENT AND YIELD OF VEGETABLE FERN, *Diplazium esculentum* (Retz.) Sw., AS INFLUENCED BY COMPOST AND INORGANIC FERTILIZER

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The growth, phytochemical content and yield of *Diplazium esculentum* (Retz.) Sw. or "pako", an indigenous edible fern, were evaluated as a function of the type and rate of compost and inorganic fertilizer. Composts used were composted chicken manure (CM), vermicompost (VC) and leaf compost (LM) which were applied at 100% (1X) and 150% (1.5X) of the recommended rate of 0.30 g complete fertilizer (14-14-14) or 0.042 g of N, P_2O_5 and K_2O per kg soil. N, P and K fertilizers were applied using urea, solophos and muriate of potash, respectively, with one element varying at rates of 50% (0.5X) and 1.5X of the recommended rate while maintaining the original rate for the other two elements. Treatments with complete fertilizer at recommended rate and unfertilized control were included for comparison. The highest growth and plant biomass of plants supplemented with compost were obtained from VC1.5X and in N1.5X for inorganically fertilized plants. Phytochemical analysis of harvestable young fronds of CM1.5X had the highest total phenolics (57.71 GAE g^{-1}), flavonoid (60.70 mg QE g^{-1}) and vitamin A content (4.57 mg 100 g^{-1}) among compost treatments. N1.5X, which caused the greatest increase

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in most growth parameters, had the lowest total phenolics, flavonoid, vitamin C and antioxidant capacity among inorganic treatments, while the application of P1.5X had a positive effect on all phytochemical parameters tested. Young frond yield, however, was not influenced by the application of both compost and inorganic fertilizer.

EFFECTIVITY OF GRAFTING AND TRAP CROPPING ON INCREASING YIELD OF AMPATOLA [A GRAFT BETWEEN AMPALAYA (*Momordica charantia* L.) AND PATOLA (*Luffa acutangula* L.)] GROWN UNDER PROTECTED CULTIVATION SYSTEM

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Ampalaya is considered as one of the major vegetables in the Philippines. However, its production is affected by various soil-borne diseases like bacterial wilt and root-knot nematodes. Thus, this study was designed to evaluate the effects of grafting ampalaya to patola and the use of varieties of *Impatiens balsamina* as trap crops for root-knot nematodes. The experiment was laid out in a split plot design arranged in a Randomized Complete Block Design with three replications.

The type of planting material either grafted and non-grafted served as the main plot and the varieties of *Impatiens balsamina* which include the control, pink, red, violet and white as the subplot factor. Results revealed that the types of planting materials had significant effect on the reproductive parameters of ampalaya in which grafted ampalaya produced flowers and fruits earlier compared to non-grafted. In terms of yield and yield components, grafted plants have greater number and weight of marketable fruits, and total yield. Moreover, incorporating different varieties *I. balsamina* in ampalaya or ampatola production produced earlier flower compared to without trap crops.

Keywords: root-knot nematodes, Impatiens balsamina, ampalaya, patola, trap crops, root galls

EFFECT OF ANTI-BROWNING AGENTS AND EDIBLE BASED COATING ON QUALITY AND SHELF LIFE OF SLICED RIPE JACKFRUIT VAR EVIARC SWEET

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This study was conducted to: (a) evaluate the effect of different anti-browning agents on postharvest characteristics of sliced ripe jackfruit var 'EVIARC sweet'; (b) determine the effect of different edible based coating on quality and shelf life of sliced ripe jackfruit and determine the most appropriate anti browning agents and edible coating that will improve quality and shelf life of sliced ripe jackfruit. Commercially matured jackfruit was procured at a farm in

Brgy. Dayhagan, Ormoc City, Leyte and brought to the Postharvest Technology Laboratory, Department of Horticulture, Visayas State University, Visca, Baybay City, Leyte Minimally sliced ripe jackfruit were treated with HWT 45° C, Citric acid , Potassium meta bisulfite and Ascorbic acid with cassava starch and corn starch coating. Different Anti-browning agents and edible based coating had a significant interaction effect on the degree of browning, percent weight loss, visual quality rating, shriveling, softening , shelf life color (b*) , total soluble solids and titratable acidity. Potassium meta bisulfite alone and Potassium metabisulfite with corn starch coating was found to be effective; in reducing weight loss that can decrease the quality and also can control the rapid browning, retard softening and shriveling, retain and prolong the shelf life of minimally processed jackfruit.

Figure 5. Minimally processed sliced ripe jackfruit influenced by different anti-browning agents and edible based coating treatment

EFFECT OF PRECOOLING AND HOT WATER TREATMENT ON POSTHARVEST QUALITY AND SHELFLIFE OF MANGO (*Mangifera indica* L.) CV. CARABAO

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Mango is a climacteric and ripens rapidly after harvest. Thus, a study was conducted to: (a) evaluate the effect of precooling as influenced by different dipping time on the quality and shelflife of carabao mango; (b) determine the effect of hot water treatment as affected by different dipping time on the quality and shelflife of carabao mango and (c) determine the optimum dipping time of precooling and hot water treatment on the quality and shelflife of carabao mango. The study was laid out in 4 x 5 factorial in Completely Randomized Design (CRD). The treatments were designated as follows: Factor A- Precooling with different dipping time: Fa_0- No treatment (control), Fa_1- 8°C for 6 hours, Fa_2- 8°C for 8 hours and Fa_3- 8°C for 10 hours; Factor B- Hot water treatments with different dipping time: Fb_0- No treatment (control), Fb_1- 53°C for 2 minute, Fb_2- 53°C for 5 minutes, Fb_3- 53°C for 8 minutes and Fb_4- 53°C for 10 minutes. Precooling and hot water treatments with different dipping time significantly affected the postharvest quality and shelflife of carabao mango. Interaction between precooling and hot water treatment significantly reduced percent weight loss, higher visual quality rating, reduced softening and delay yellowing and prolonged the shelflife of mango fruits. Fruits precooled at 8°C for 10 hours and subjected to 53°C hot water treatment for 10 minutes significantly maintained the quality and extended the shelflife of mango after 14 days of storage.

Keywords: Precooling, mango, postharvest, hot water treatment, shelflife

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IN VITRO CULTURE OF TWO VARIETIES OF ORNAMENTAL BAMBOO (*Bambusa* SP.) USING NODAL EXPLANTS

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Bamboo (*Bambusa* sp.) is one of the most economically important crops that can be considered as climate resilient. The production of true-to-type bamboo through tissue culture is of high importance especially in large scale production. This study was conducted to determine the most suitable surface sterilization procedure and effects of different growth regulators on the growth and development of various explants of *B. suberecta* and *B. multiplex* (Lour.) cv. 'Silverstripe'. Young and mature nodal segments were used as explants with four different sterilization techniques. The results indicated that mature nodal tissues are more prone to fungal contamination while the younger tissues exhibited more bacterial contaminants. Based on the percent surviving explants, the lowest concentration of NaOCl (1%) and soaking period of 20 minutes was identified as the most suitable for disinfecting young nodal tissues with 54.03% survival for *B. suberecta* and 48.18% for *B. multiplex* (Lour.) cv. 'Silverstripe'. On the other hand, for mature nodal tissues, reduction of contamination is effective for both varieties at 2.0% NaOCl 20 minutes soaking. Highest percent survival of 54.03% and 53.70% was obtained for *B. suberecta* and for *B. multiplex* (Lour.) cv. 'Silverstripe' respectively. Although differences in response to treatments were observed between varieties, the highest percentage survival was about 50% for both young and mature tissues. Surface sterilization procedures using 1.0% NaOCl for 20 minutes for young nodal explants and 2.0% NaOCl for 20 minutes for mature nodes of *B. suberecta* and *B. multiplex* (Lour.) cv. 'Silverstripe' was done prior to inoculation to specific culture medium formulation. Based on the results obtained, only mature nodal tissues produced shoot. MS basal medium supplemented with 1.0mg/L BAP had the highest percentage shoot initiation of up to 36.67% in B. suberecta and 25.00% in *B. multiplex* (Lour.) cv. 'Silverstripe'. However PGR supplementation could also improve shoot growth percentage with the combined treatments of 1.0 mg/L BAP and 0.5 mg/L NAA (T2) and 2 mg/L Ki (T11).

Keywords: Explant, NaOCl, Phytohormones, B. suberecta and B. multiplex (Lour) cv. 'Silverstripe'

ATMOSPHERE AND OCEAN RESPONSE OF TROPICAL CYCLONE HATO (ISANG) AND PAKHAR (JOLINA) AS OBSERVED AND SIMULATED BY COUPLED MODEL

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Recent studies increasingly highlight the importance of air-sea coupled models in better representing weather and climate systems. However, forecasts from coupled ocean-atmosphere models remain underutilized, particularly in the Philippines. In August of 2017, Hato and Pakhar passed near the vicinity of Northwest Luzon, where a University of Philippines oceanographic cruise was being conducted west of Luzon to survey the Northwest Luzon Currents. The response of the ocean and atmosphere due to TC passage as it passed the vicinity of the study area was thus examined using *in situ*, satellite and Naval Research Laboratory's Coupled Ocean/Atmosphere

Mesoscale Prediction System for Tropical Cyclone (COAMPS-TC) model which uses the Navy Coastal Ocean Model (NCOM) for its ocean component. The sensitivity of COAMPS-TC's initial ocean conditions with and without Hato forcing on the Typhoon Pakhar forecast is validated with cruise, Argo and satellite data. Results show a cold wake is formed north of Luzon after the passage of Hato, but the wake has no effect to the intensity of Pakhar as Pakhar's track is south of the wake. Using a different NCOM initial condition that has the Hato forcing, produced less intense winds and warmer ocean, thus better representing *in situ* and satellite observed values. Model run with Hato forcing also has a forecast TC track closer to the observed track than model run without Hato forcing.

STORM SURGE ANALYSIS IN THE EASTERN REGION OF THE PHILIPPINES

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Tropical cyclones (TCs) rank the deadliest amongst the natural hazards in the world, mainly because of the associated storm surges. Coastal areas in the eastern Philippines are said to be the most vulnerable but actual records have been sparse. Data from five tide gauge stations in the eastern Bicol, Samar, and Leyte (Jose Panganiban, Virac, Catbalogan, Tacloban, and Guiuan) were analyzed to identify occurrence and magnitude of storm surge during the passage of TCs Nock-Ten, Tokage, Sarika, and Nida. Meteorological data from synoptic stations and satellite data were also examined to determine the TC parameters that contributed to the surge. Water level abnormally above the predicted astronomical tides, defined as storm surge, were observed for TC Nock-Ten for stations closest and at the north of the TC track. Nock-Ten induced a 1.05 m surge at Virac, highest among the tropical cyclones due to intensified wind towards the coast (40 m/s). Tokage, Sarika, and Nida generated winds weaker than Nock-Ten and produced surges less than 0.5 m. Interestingly, a 0.36 m surge was recorded at Virac station a day after Tokage's landfall. The cyclone's winds interacted with the northeast monsoon, intensifying the easterly component of the wind as the eye of Tokage was 269 km from the station. For the subset of TCs studied, it is thus found that high velocity winds towards the coast are crucial for storm surge to occur and that intensification of perpendicularly-directed winds toward the coast may also induce elevated water levels even when the TC is way past the station location.

INFLUENCE OF THE WEST PACIFIC SUBTROPICAL HIGH ON LANDFALLING WINTER TROPICAL CYCLONES IN THE PHILIPPINES

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Impacts of the long-term changes of the Western Pacific Subtropical High (WPSH) on tropical cyclone (TC) in the Philippine Area of Responsibility (PAR) during the months of November to January for the years 1958 to 2017 was investigated. Changes in TC tracks passing through the PAR were observed. There was an increase in TC landfall frequency in Visayas and Mindanao regions from 10 TCs making landfall during the 1950s, to about 19 that made landfall during the

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2010s. The increase was due to the intensification and southwestward propagation of the WPSH over the decades. The decadal mean of the 5870 gpm contour line's westernmost tip moved from 19°N, 150°E to 14°N, 97°E in the last six decades. Areal gpm means which depicts the WPSH were calculated from the JRA55 reanalysis data. They show link between WPSH strength and likelihood of TC landfall in the Philippines.

Correlation maps were then used to analyze the trend and variability of WPSH. Results show that WPSH behavior is significantly correlated with SSTs of the East Indian Ocean (r=0.81), and the South China Sea (SCS; r=0.81). Correlation maps also show a positive correlation to the El Niño Southern Oscillation (ENSO) tongue. Time series analysis for WPSH and SST areal means also showed upward trends over the years indicating a positive relationship between SST, and WPSH intensity, which then coincide with the increase in TCs making landfall in Visayas, and Mindanao.

MORPHO-AGRONOMIC AND MOLECULAR CHARACTERIZATION OF LOCALLY COLLECTED SUGARCANE (*Saccharum officinarum* L.)

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Selection of parents for hybridization relies on the erudite information of their genetic relationship and diversity which are essential in any breeding program. Sugarcane, being propagated asexually, has narrow gene pool which is disadvantageous in varietal development. The study was conducted to determine the diversity of the 76 sugarcane accessions from seven (7) regions in the Philippines using phenotypic traits and genotypic markers. Germplasm diversity was assessed using 57 morpho-agronomic characters – 46 qualitative and 11 quantitative traits – resulting in an average diversity index of 0.72. Out of the 46 qualitative characters, no variation was observed in prominence of bud hair trait (H'=0) while the bud base position was equally distributed throughout the population (H'=1.0). Moreover, quantitative traits ranged from 0.64 to 0.91 diversity index, an indication of high variability, with bud length giving the highest variability across the samples. Variations of the evaluated agronomic traits within the population were found to be significant except for the stalk length trait. Out of 50 markers used, 41 (82%) were found to be highly informative (PIC ≥ 0.50). The cluster analysis of both morpho-agronomic and molecular data generated five and six clusters respectively. The phenotypic and genotypic characterization of the assessed population has led to grouping of accessions that are similar to each other. These results serve as a baseline for future breeding efforts and expedite the breeding processes in the selection of promising parents to meet market demands for sugar and it's by-products.

Keywords: Sugarcane, SSR, Germplasm, Genetic Diversity, morpho-agronomic characters

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PHENOTYPIC REACTION AND GENE EXPRESSION OF WHEAT-DURABLE RESISTANCE GENE *Lr67* IN RICE (*Oryza sativa* L.) AGAINST FUNGAL PATHOGENS

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Occurrence of rice fungal diseases are major constraints in rice production causing significant yield loss and breeding for effective and durable disease resistance is one strategy to manage the problem. *Lr67*, a broad-spectrum, multipathogen resistance gene from wheat conferred partial resistance to three rust pathogens and powdery mildew and was reported to be transferrable to close relatives of wheat. This research generated transgenic rice via *Agrobacterium tumefaciens*-mediated transformation and validated the presence of *Lr67*res in indica rice cv. IR64, showed the segregation pattern and identified homozygous lines used in evaluation of resistance against blast, brown spot, sheath blight, and false smut diseases. Expression of *Lr67*res was analyzed and correlated with phenotypic reaction of transgenic plants against fungal pathogens. Three independent transgenic events were confirmed to contain the gene and segregation analysis revealed single insertion in all events. Transgenic plants showed partial resistance to leaf and panicle blast, brown spot, sheath blight, and false smut where effectiveness of resistance against each pathogen correlated with level of transgene expression. One transgenic event was effective at seedling stage while the other transgenic event was effective at mature stage. Leaf tip necrosis was absent in two transgenic events due to no difference in expression of senescence-related gene in transgenic and wild type statistically. This study showed that Lr67res was functionally transferrable to other cereal species such as rice.

REFORMULATION OF ORGANIC FERTILIZER AND EFFICACY TEST ON CORN (*Zea mays* L.) AT EARLY STAGE OF GROWTH

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Occurrence of rice fungal diseases are major constraints in rice production causing significant yield loss and breeding for effective and durable disease resistance is one strategy to manage the problem. *Lr67*, a broad-spectrum, multipathogen resistance gene from wheat conferred partial resistance to three rust pathogens and powdery mildew and was reported to be transferrable to close relatives of wheat. This research generated transgenic rice via *Agrobacterium tumefaciens*-mediated transformation and validated the presence of *Lr67*res in indica rice cv. IR64, showed the segregation pattern and identified homozygous lines used in evaluation of resistance against blast, brown spot, sheath blight, and false smut diseases. Expression of *Lr67*res was analyzed and correlated with phenotypic reaction of transgenic plants against fungal pathogens. Three independent transgenic events were confirmed to contain the gene and segregation analysis revealed single insertion in all events. Transgenic plants showed partial resistance to leaf and panicle blast, brown spot, sheath blight, and false smut where effectiveness of resistance against each pathogen correlated with level of transgene expression. One transgenic event was effective at seedling stage while the other transgenic event was effective at mature stage. Leaf tip necrosis

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was absent in two transgenic events due to no difference in expression of senescence-related gene in transgenic and wild type statistically. This study showed that Lr67res was functionally transferrable to other cereal species such as rice.

CHARACTERIZATION OF LAHAR AND BLACK SAND LADEN SOILS OF BOTOLAN, ZAMBALES TOWARDS IMPROVING SOIL PRODUCTIVITY

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The objectives of the study were: to characterize the socio-demographic profile of farmer; to describe morphologically the soil profile in the affected areas and estimate land productivity index; to describe the physico-chemical and biological characteristics of surface soil; to determine crop suitability rating and limitation; and to develop doable recommendations based on identified limitation and availability of resources.

It was determined that real income dropped an average of Php 81,496.00 per annum. Farming profit also decreased after the eruption, and rice lost an average of Php 2,283.15 per hectare.

The soil condition falls into two land mapping units: class VIII and II with common characteristics of excessive drainage or doughtiness and limitations on coarse textured or excess gravel. Percent of gravel is high, texture is very coarse, and has low water holding capacity. The average OM content was very low, soil pH ranged from neutral to very strongly acidic, electric conductivity and cation exchange capacity were low, and NPK amount was insufficient.

Crop suitability evaluation of most plant were found not suitable. Limitations shown were primarily stoniness. In addition, sandy areas were very severe limitations, while areas with solum layer, attained moderate limitation.

Keywords: crop suitability; land productivity index; Mt Pinatubo; lahar; sand

TEMPO-SPATIAL VARIABILITY OF GLYPHOSATE RESIDUE ON CORN GROWING AREAS IN BRGY. COLUBOT, SAN MANUEL, TARLAC

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This study has the following objectives: to identify areas that are devoted for glyphosate-ready corn; to determine the glyphosate residue in soil before application at 1, 15, 30 and 90 days after application of herbicide and to correlate herbicide residue with the different soil physical and chemical properties.

The level of glyphosate residue in corn growing areas in Brgy. Colubot, San Manuel, Tarlac is 0.01 mg/kg of soil which is less than the critical residue level for glyphosate of 0.1 mg/kg of

soil. Analysis of glyphosate residue at 0, 30 and 90 days showed that glyphosate in the soil is <0.01 mg/kg. Narrowing the monitoring period to 1, 15 and 30 days showed a rapid decrease in glyphosate residue in soil from 0.854 mg/kg to <0.01 mg/kg for LMU 1 and 0.82 mg/kg to <0.01 mg/kg for LMU 2. Furthermore, soils containing medium amount of organic matter, high cation exchange capacity, slightly alkaline and clay in texture showed higher glyphosate residue than soil with low organic matter and cation exchange capacity, very slightly acidic and clay loam in texture.

Degradation of glyphosate with time is represented by the equation y= -0.0329x + 0.8488 with a coefficient of determination value of 0.8391 at LMU 1 while an equation of y=-0.0324x +0.8299 having a coefficient of determination value of 0.8254 was obtained from soils at LMU 2. The negative correlation of glyphosate within 30 days period shows that glyphosate does not persist in the soil for a long period of time.

POTENTIALS OF NANO-ZNO AS A ZINC SOURCE FOR CORRECTING ZINC DEFICIENCY AND FOR ZINC BIOFORTIFICATION IN RICE

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Zinc deficiency in human population is highly correlated to zinc deficiency in soils and in staples including rice. One way to correct zinc deficiency and increase grain zinc is to apply zinc fertilizers. This study aimed to establish the potentials of nano-ZnO and bulk ZnO, compared to $ZnSO_4$ as zinc fertilizer applied through soil, foliar and combined soil-foliar application. An optimization experiment for nano-ZnO was conducted and established 1% as the best concentration of nano-ZnO foliar spray. Comparison among treatments revealed that nano-ZnO resulted in a higher grain yield when applied as foliar spray than bulk ZnO and $ZnSO_4$. In terms of grain and total Zn uptake, nano-ZnO was fared as well as $ZnSO_4$ and better than bulk ZnO when application was done by foliar or combined soil+foliar application, but not when soil-applied due to reactions in the soil. The benefits of nano-ZnO were also shown to be supported by an indirect effect of P uptake which showed a significant positive correlation with grain yield. The most effective method to correct zinc deficiency and increase grain zinc in rice using nano-ZnO is foliar application alone or in combination with soil application.

Keywords: zinc deficiency, biofortification, nanofertilizer, zinc oxide

MORPHOLOGY AND PHOSPHATE RETENTION CAPACITY OF SOILS AFFECTED BY VOLCANIC EJECTA AND LAHAR

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Among the world's most fertile soils are developed from volcanic materials brought to the surface of the Earth by the most violent phenomena. Twelve soils developed from different volcanic deposits, majority of which were ash-affected, and now under various land uses were

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characterized and their phosphate retention capacity determined. Mount Pinatubo's 1991 plinian eruption deposited layers of ash and lahar on different municipalities in Pampanga Province, which produced new soils with low organic matter content and low phosphate retention capacity. Mayon Volcano's intermittent eruptions throughout the centuries continuously rejuvenates the soils of Albay Province, resulting in high organic matter content and high phosphate retention capacity. These surface soils with high phosphate retention capacity were observed to have pHNaF values greater than 9.5 indicative of Andic properties given the abundance of allophane. Taal Volcano's past activities are evident from the productive lands that originated from past ash deposits, leaving the nearby municipality of San Nicolas with soils having medium organic matter content and medium phosphate retention capacity, as expected from developed soils. Farmers from affected lands found ash deposits to be more advantageous than lahar in terms of the quality of the soil and the effects on their crop.

PROPERTIES, GENESIS, FERTILITY STATUS, AND CLASSIFICATION OF SOILS MAPPED AS FARAON SERIES IN LEYTE AND SAMAR

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Soil series, the most specific unit of classification system, provides relevant scientific information including morpho-physical and chemical characteristics to serve as basis for proper soil management practices. This study evaluated the soil properties, genesis, fertility status and classification of the Faraon series in Leyte and Samar. A total of ten (10) soil profiles were examined in Eastern Samar, North Western Leyte and Southern Leyte.

The findings show a wide range in morphological, physical and chemical properties. Most of the soils have shallow solum (<50 cm depth), have low to high OM ranging from 0.36% to 14.72% and total N ranging from 0.01% to 0.72% variable amounts of exchangeable bases (Ca, Mg, K, Na) and pH values above 7.5 (alkaline) causing low available P (<5 ppm). These results imply that the soils have different potentials and fertility constraints that would require different site-specific soil management strategies for sustainable crop production.

The Faraon series in Eastern Samar are classified as Calcaric Phaeozems (Clayic) (P1) and Calcaric Cambisol (P2 and 3) while in Leyte are Rendzic Phaeozems (P9), Hypercalcic Regosol (P4), Calcic Luvisol (P8), Calcic Epileptic Luvisol (P7), Endocalcic Luvisol (P6), Calcaric Luvisol (Clayic) (P5) and Endocalcic Luvisol (Differentic). It also revealed a great variation in the degree of soil development ranging from poorly developed soils (P9) to welldeveloped (P2) based on the values of the Chemical Index of Alteration.

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EFFECTS OF COMBINED APPLICATION OF UNCHARRED AND CHARREDPOULTRY LITTER, AND BENEFICIAL MICROORGANISMS ON THE MICROBIAL ACTIVITY AND FERTILITY OF A STRONGLY ACID SOIL

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Growing evidence indicates that poultry litter char (PLC) addition to degraded soils improve crop yield and soil quality. An incubation experiment and pot experiment using strongly acidic soil was conducted to evaluate the interaction effects of PLC, effective microorganism (EM) and indigenous microorganism (IMO_6) on early growth, N and P uptake of corn grown and soil quality. Microbial biomass increased linearly with increasing rates of PLC levels and resulted in consistent increase in pH, OC, total N and total P of soil taken after incubation experiment. Similarly, increasing rates of PLC resulted in consistent increase in pH, OC, total N and total P of soil taken after harvest. Application of 50 g PLC $500g^{-1}$ soil significantly increased extractable P but increasing the rate to 100 g PLC $500g^{-1}$ soil, resulted in an increase, which did not significantly differ, from that of 50 g PLC 500 g^{-1}. Similar trend was observed in the plant height at three weeks after sowing, total plant biomass and P uptake. Combined application of PLC with IMO_6 and EM resulted in significantly higher root biomass than those plants inoculated with sole EM and IMO_6. Tissue P concentration of plants with sole application of IMO_6 and EM were significantly ($P < 0.001$) different from P of the plants with combined PLC with IMO_6 and EM. Significant interaction effects between PLC and types of beneficial microorganism was noted on plant N concentration. Interaction between application of 100 g PLC 500 g^{-1} soil in combination with IMO_6 or EM significantly increased plant N concentration. Although optimum rate of PHC had not been reached, results demonstrate that PLC is good ameliorant for strongly acid soil planted to peanut. However, further studies are needed to establish the optimum rate when used with IMO_6 and EM.

Keywords: Acid soil, beneficial microorganisms, poultry litter char, inoculation

PHYSICO-CHEMICAL PROPERTIES AND HEAVY METAL CONTENTS OF SOIL ORGANIC AMENDMENTS PRODUCED IN THE VISAYAS REGION

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Organic farming have gained more attention since it provides a healthy food from the use of organic materials in crop production. The use of soil organic amendments have been used through the years and, in fact, many farmers have developed their own to address the increasing demand for food production and some have potential in restoring the fertility status of the soil. This study was conducted to: (a) to characterized the physico-chemical properties and to classify them into organic fertilizer or soil conditioner and (b) to determine the heavy metal contents (Cr, Cd, Zn, Fe and Cu) of the different soil organic amendments produced in the Visayas Region in order to provide information needed whether if it is safe to use for farming. Soil organic

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amendments were collected from different farms from regions 6, 7, & 8 (Visayas Region). Heavy metal analysis was conducted using AAS (Shimadzu AA-7000) in the Philippine Nuclear Research Institute, Total N & K was analyzed in the Central Analytical Service Laboratory while Total P was conducted in National Abaca Research Center. Results revealed that majority of the soil organic amendments have brown to black in color and a moisture content ranging from 10-35%. Soil organic amendments from BACCFA Balangkayan, E.Samar Montesuerte, Carmen, Bohol and Provincial Office, Dumaguete, Negros Oriental were the only samples that has passed the criteria set by PNS (2016) with a total value for N, P_2O_5 and K_2O on an average of 7.29, 5.53, and 5.25 respectively, where they can be classified as organic fertilizers. Iron and Zinc were found out to have the highest metal concentration in all samples meanwhile Chromium, Cadmium and Copper have low level concentration based on the criteria set by PNS (2016).

Keywords: soil organic amendment/organic fertilizer/soil conditioner, heavy metal, physico-chemical properties and Visayas Region, Philippines

OCCURRENCE AND DISTRIBUTION OF PHILIPPINE WARTY PIG (*Sus philippensis*, NEHRING 1886) IN MT. BANAHAW DE TAYABAS

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There has not been much effort to establish baseline information to address knowledge gaps relating to the occurrence and distribution of *Sus philippensis* in the Philippines, specifically in Mt. Banahaw. Ten camera traps were deployed for 17 days in different elevations to determine the occurrence and distribution of Philippine Warty pigs in Mt. Banahaw de Tayabas. Species distribution models (BIOCLIM, DOMAIN, MAXENT) were constructed to determine the potential distribution of the species in the area. This study presented that the Philippine Warty-pig prefers secondary growth forest (600-800masl) based on the model average. The most reliable model which predicted the distribution of the species is MAXENT. *Sus philippensis* also prefers plantations and areas near water sources such as streams. Camera trapping confirms the occurrence of the species in the area with several species captured at 700 meter above sea level. Modelling predicts that Philippine Warty-pigs occur throughout Mt. Banahaw de Tayabas although sparsely in the extreme southern and northern portions of the mountain.

PARASITIC NEMATODES & OLIGOCHAETES OF INVASIVE ALIEN SPECIES (IAS) OF AMPHIBIANS IN PAOAY LAKE, ILOCOS NORTE PROVINCE

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Endoparasites of amphibians are heavily neglected in the Philippines, especially those parasitizing invasive alien species (IAS). Parasites of IAS play a great role in development and emergence of wildlife diseases that affect both man and native fauna. The presence of exotic species of parasites, as well as competence of invasive frogs as hosts, has dire implications

to the health and demographics of native taxa. Unfortunately, the identity of parasites from alien frogs currently established in the Philippines is yet to be known. Frogs were retrieved from Paoay Lake during November 2018 and were examined for internal helminthiases. The study collected metazoan endoparasites found in the alimentary canal of three major IAS in the Philippines namely the giant cane toad *Rhinella marina* (Linnaeus 1758), Chinese bullfrog *Hoplobatrachus rugulosus* (Wiegmann 1834) and Asian painted frog *Kaloula pulchra* Gray 1831; along with descriptive measures of their infrapopulations. Specimens were initially identified as cosmocercid nematodes (Nematoda: Cosmocercidae), and an oligochaete parasite of genus *Dero* Oken, 1815. Among 33 inspected individuals, the study found *K. pulchra* has highest prevalence of nematode infection (88%; 7 of 8 individuals infected), followed by *H. rugulosus* (29%; 2 of 7) and *Rhinella marina* (17%; 3 of 18). A mean worm burden of 3, 11 and 76 worms (accounting for 2 hyper-parasitized individuals) were found for the three IAS frogs respectively. The survey is expected to contribute novel knowledge on indigenous endoparasites, as it contributes to the baseline information for IAS parasites present for the Northern Philippine region. It is also expected to augment future biodiversity studies, invasion management policies, and general awareness for probable zoonoses that can be spread by IAS.

INTRASPECIFIC VARIATION IN FORAGING ECOLOGY AND DIET OF THE PHILIPPINE SPOTTED FLYING LIZARD, *DRACO SPILOPTERUS* (WIEGMANN, 1834), IN LUZON BIOGEOGRAPHIC REGION

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The foraging ecology and diet of the Philippine Spotted Flying Lizard *Draco spilopterus* were studied through a combination of *in-situ* field observation and examination of preserved museum specimens of lizards and prey items. We determined the extent of variation in morphology, diet, and foraging behavior of four *Draco* populations across the Luzon, namely, in forested areas in Ilocos, Laguna, Cavite, and Bicol. Results show these lizards feed mainly on ants (Formicidae). All samples of lizards from the study populations preyed on a relatively high proportion of ants (96% of all samples), which strongly implies that *Draco* lizards are specialist predators and sit-and-wait foragers. However, we found significant differences in diet composition, with those from Ilocos feeding mostly on Formicidae, Languriidae and Pseudococcidae, those from Laguna specializing on Pyralidae, Asiomorpha and Coleoptera, those from Cavite consumed mostly on Formicidae, Isoptera and Pyralidae, and those from Bicol consumed Formicidae, Isoptera and Araneae. The head morphology of flying lizards is a sexual dimorphic feature and we found significant variation among populations. Although this lizard is diurnal, feeding behavior slightly differs among populations. Lizards from Ilocos actively forage from 0830–1600 hr, Laguna population is active from 0815–1545 hr, Cavite population is active from 0715 –1658 hr, and lizards from Bicol are active from 0645–1630 hr. Foraging activity decreases during mid-day. There are also differences between perch height ($P < 0.05$) and perch diameter ($P < 0.05$). The observed inter-population variation in foraging habit, diet, and head morphology is likely to be correlated with vegetation structure and composition. The results of this study may be combined with morphological and molecular data to identify the presence of cryptic populations of this species.

**Adviser*

FROM FREE-LIVING TO PARASITIC: A POTENTIAL EPHEMERAL PARASITISM ACTIVITY OF *Caenorhabditis brenneri* ON A TROPICAL SLUG

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Caenorhabditis brenneri is a free-living, bacterivorous nematode found in soil and decaying matter. Previous studies reported that several invertebrate taxa specifically isopods, millipedes, snails, and slugs were found to harbor three *Caenorhabditis* species by evolving adaptions in order to enter and endure conditions in the gut system of slugs, which potentially signified the onset towards parasitism. Parasitism of various nematode species leads to host death by proliferation and release of the associated bacteria into the body system. In this study, live tropical slugs from Little Baguio, Imelda, Zamboanga Sibugay were collected, washed and placed into sterile containers and fed daily until death. Cadavers were washed prior to dissection and nematodes were isolated to determine the potential ephemeral parasitism of the free-living *Caenorhabditis* species. Cadavers were dissected, nematodes were isolated and pure culture was obtained through series of sub culturing using gravid females into culture media seeded with bacteria from the cadaver. Through DNA barcoding using the D2D3 of 28S rRNA and 18S rRNA regions, it was identified as *C. brenneri*. Moreover, using the 16S rRNA, three bacterial isolates; *Proteus mirabilis, Alcaligenes faecalis,* and *Alcaligenes* sp. were identified, contributing to the parasitic activity of *C. brenneri* by releasing these bacteria into the host's body once it hitches a ride on a passing organism such as slugs. This showed that *C. brenneri* can now and then exhibit an ephemeral parasitic lifestyle from being a free-living nematode. Herein we report the first record of *C. brenneri* infesting slugs.

AMPHIBIANS AND REPTILES OF LIMESTONE KARST HABITAT OF UNIB ISLAND: ITS DIVERSITY MICROHABITATS AND CURRENT CONSERVATION STATUS IN DINAGAT ISLANDS, NORTHEASTERN MINDANAO, PHILIPPINES

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A study on amphibians and reptiles in two different ecotypes consisting of mature secondary forest (MSF) and mixed agricultural area (MAA) in limestone karst habitat of Unib Island in Dinagat Province of northeastern Mindanao was conducted on 4-14 September 2019. A total of a 1-hectare area was surveyed using a combination of strip transect, audio-visual encounter, and trapping methods. Twenty-seven species of amphibians and reptiles (n=130 individuals) belonging to nine families were recorded of which 12 species (44.44%) are confirmed historical species and 11 species (40.74%) are endemic to Mindanao Pleistocene Aggregate Island Complexes. A new island record of three herpetofaunal species was documented of which two are threatened species: IUCN Endangered Botel Gecko *Gekko kikuchii* and IUCN Vulnerable

Mindanao Bush Frog *Philautus leitensis*. There are nine species that are Not Evaluated by IUCN, one Data Deficient, and two unknown species of frog in the genus *Platymantis*. Shannon-Weiner index of diversity showed that mature secondary forest had a higher herpetofaunal diversity (H'=2.489) than mixed agricultural area (H'=2.278). The *Platymantis* sp. (limestone bush frog) is the most abundant (n=35; RA=23.1%) frog species and *Cyrtodactylus mamanwa* is the most abundant reptile (n=26; RA=20.0%). Tree trunk and leaf litter are dominant microhabitats utilized by limestone karst- dwelling amphibians and reptiles. Protection and conservation of the island is highly recommended since it is one of the remaining limestone karst forest frontiers of Dinagat and northeastern Mindanao which is home to endemic, threatened, and undescribed herpetofaunal species.

ANTI-BACTERIAL ACTIVITY OF *Sargassum crassifolium* (ARAGAN) AND *Kappaphycus striatum* (GUSO) CRUDE METHANOLIC EXTRACTAGAINST ISOLATED VIBRIO SPECIES FROM INFECTED SEAHORSES

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The yellow seahorse (*Hippocampus kuda*) is commonly harvested in the Philippines, for its therapeutic claims in Traditional Chinese Medicine (TCM) and in most cases often infected by certain diseases leading to mortality. The purpose of this study is to identify the bacteria present in epithelial surface of deceased seahorses in light of their therapeutic claims and possible cause of mortality for conservation and effective management. A total of six samples of infected and deceased yellow seahorses (3 males and 3 females) were collected from Tubod, Lanao del Norte and utilized. A total of eighty-one (81) bacterial isolates were identified based on cultural characterization and DNA barcoding using 16s rDNA unidirectional gene sequencing. Polymerase Chain Reaction (PCR) amplification was done using universal primers and was carried out within the standard PCR conditions. Results yielded, 80 bacterial species belonging to class Gammaproteobacteria and Bacilli. The microbial flora belonged to genera Vibrio and Bacillus which could be pathogenic and also has potential in the field of biomedicine. Bacterial groups present may explained mortality and also support the therapeutic claims. However, one isolated bacteria was not identified based on existing database online, which may indicate possibly a new species. In addition, bacteria present were found from other sources mainly in the habitats of seahorses hence, may alleviate pressure on seahorses itself if further utilized for biomedical purposes. Thus, this study served as a baseline data for bacterial species found in the epithelial surface of H. kuda for effective improvement of captive population and conservation.

Adviser

ASSOCIATION OF PARASITIC *HEXATHROMBIUM* MITES (ACARI: MICROTROMBIDIIDAE) AND TIGER BEETLE *CALOMERA ANGULATA ANGULATA* IN LANAO DEL SUR, PHILIPPINES

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Mites and insects share complex and diverse interactions but these associations are poorly understood in most cases. This study aimed to investigate the association of mites and tiger beetles inhabiting selected areas of Lanao del Sur province, Philippines. Six species of tiger beetles comprising 289 individuals belonging to four genera were examined. Based on the number of individuals, 12 tiger beetle *Calomera angulata angulata* which constituted 4.2% of the total sampled tiger beetles were found parasitized by mites confirming the first record of association between *Hexathrombium* mites and tiger beetles in Lanao del Sur. Result showed that *C. angulata angulata* found in sandy riverine areas may be vulnerable to mite association although there was no strong evidence presented. In addition, thorax was the most parasitized body part suggesting that this body region was the most preferred by mites for attachment. Although there is no apparent evidence on sex preferences of mites, results disclosed that 75% of the studied mites were observed in the male *C. angulata angulata.*

ISOLATION AND IDENTIFICATION OF ENTOMOPATHOGENIC NEMATODES FROM DIGOS, DAVAO DEL SUR

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Entomopathogenic nematodes have the ability to kill target insects through its bacterial symbionts of the genera *Xenorhabdus* and *Photorhabdus* via direct infection or toxin action. EPNs of the families Steinernematidae and Heterorhabditidae are used as biological control agents of several insect pest in lieu of harmful synthethic pesticides. In the Philippines, despite being a megadiverse country, only limited studies on EPN diversity are conducted and reported. Therefore, this study aimed to isolate and identify EPNs from Digos, Davao del Sur as a starting point. EPNs were recovered from the soil using the *Zophobas morio* as the bait insect. Out of the 20 samples, only 3 soil samples were EPN-positive with a recovery rate of 15%. Preliminary identification using morphological approach grouped these 3 EPN isolates genera *Steinernema* (2 isolates) and *Heterorhabditis* (1 isolate). All EPN isolates are still subject to molecular identification and virulence testing as this study is still on going.

Adviser

MICROHABITATS OF LAND SNAILS (MOLLUSCA: GASTROPODA) IN SELECTED AREAS IN NORTHERN MINDANAO, PHILIPPINES

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Habitat association is one of the important determining factors that may provide insights and understanding on the coexistence of species in an ecosystem. However, studies on some faunal indicator groups such as land snails and their microhabitats are often neglected. Thus, this study was conducted to contribute to knowledge on land snail microhabitat in selected areas in Northern Mindanao. To determine the microhabitats of land snails, live individuals were collected using a combination of opportunistic sampling, visual survey, and hand picking methods. Six microhabitats, namely: ground, leaf litter, rock, plants and dead tree, and rotten log were identified from 21 live land snail species with 82 individuals documented. Plant was observed to be the most preferred microhabitat where 14 land snail species were recorded. Among the land snail species that preferred plant microhabitat, four species were found on the plant *Schismatoglottis* sp. The land snail species, *Sulfurina amaliae* occurred on the widest range of plant species while *Obba marginata f. kochiana* was found in all identified microhabitats except rotten logs. The result implies that different species of land snails inhabit different microhabitat types. Some snail species were found to be associated to a specific type of microhabitat. The structure of microhabitat which may serve as shelter, food source, and moisture appears to influence the presence or existence of land snails in a particular area.

IDENTIFICATION AND VALIDATION OF STRESS RESPONSE GENES IN THE MATURE SEEDS OF *MORINGA OLEIFERA* LAM. TRANSCRIPTOME USING QUANTITATIVE REAL TIME PCR

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Moringa oleifera Lam. is important in agriculture because it is resistant to climate change and pathogens. In spite of the fact that *M. oleifera* is a resilient plant that can withstand various environmental stresses, there is a dearth of information on its stress response genes. The main objective of this study is to identify and validate the stress response genes in the transcriptome of *M. oleifera* Lam. Identification of stress response genes were done using COG functional annotation from NCBI Non-Redundant protein database for Trinity, Oases and SOAP transcriptome assemblers. Gene identification using BLAST2GO for Trinity and Oases was also performed. A total of 1,358 sequences in Trinity, 1420 in Oases and 1,899 in SOAP transcriptome assemblers involved in stress response were identified. Additionally, a total of 3,571 sequences in Oases and 4,997 sequences in Trinity transcriptome assemblers were found to possess the GO term "response to stress". The five (5) top-ranking stress response genes identified in the *M. oleifera* transcriptome were *PER42, PIP1-3, HSP80, UBC10* and *TH14*. Comparison of the levels of expression of the stress response genes using transcriptome data and qPCR analysis showed minimal differences in gene expression levels between the two groups, which imply that levels of gene expression are affected by various environmental stresses in the region where the seeds

have been obtained. Results of sequencing of the qPCR validated genes in comparison with transcriptome data showed 100% homology which signify the presence of the five top-ranking stress response genes in *M. oleifera* Lam.

MICROBIOLOGICAL EVALUATION OF VIRGIN COCONUT OIL (VCO) PRODUCTION IN THE PHILIPPINES

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Virgin Coconut Oil (VCO) is gaining popularity in recent years because of its beneficial properties that have several applications in food, cosmetics, and medicine. The Philippines is one of the leading exporters of VCO in the world. Some of the most common VCO production techniques in the industry are centrifugation, high-pressure expeller method, and natural fermentation method. To date, there is a lack of studies regarding the microbiology of VCO production. This research aims to determine the microbial quality and safety of virgin coconut oil.

Samples were collected from each production step from two production runs from nine VCO producers. Samples were analyzed for Aerobic Plate Count (APC), Yeast and Mold Count (YMC), Total, Fecal/Thermotolerant Coliform, *Escherichia coli, Staphylococcus aureus, Salmonella species,* and *Listeria monocytogenes.*

Microbial counts were very high at the start of the production (eg. grated coconut meat, coconut milk) with APC up to >5.9 x106 CFU/mL. After several processing steps, APC, YMC and coliforms were drastically reduced. Pathogenic bacteria such as *Salmonella, E. coli, S. aureus*, coliforms were detected in some samples collected from various steps of the production. However, all finished VCO products tested negative for these bacteria. No sample was positive for *L. monocytogenes*. However, only three out of 18 finished VCO products passed the Philippine National Standard (PNS) for VCO; all others failed in either or both the APC and YMC standards. Producers should follow good manufacturing practices to ensure production of high quality VCO with microbial counts that pass the PNS for VCO.

ESTABLISHMENT OF A POTENTIAL MICROBIAL CONSORTIUM WITH SCREENED BIOFILM-FORMING BACTERIA FOR BIOAUGMENTATION

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Biofilms are complex structures of microbial cells adhered to a surface enclosed in a matrix of extracellular polymeric substances and triggered by unfavorable external conditions. This leads to gene expression modification that increases survival of bacterial cells. Biofilm-mediated bioaugmentation is the use of microorganisms to enhance the removal of nutrients, complex

carbons, and/or toxic compounds from the water phase. Biological nitrogen removal is done by nitrification involving ammonia oxidizing bacteria (AOB) and nitrite-oxidizing bacteria (NOB) and denitrification, via denitrifying bacteria. Using the positive controls *Bacillus subtilis* and *Pseudomonas putida*, a quantifiable biofilm formation protocol was developed. Tryptic soy broth (TSB) was most suitable for *B. subtilis* and *P. putida* biofilm formation, with highest absorbance values under 30-36 h static incubation at 30°C. Twenty-three bacterial species that exhibited significant biofilm formation using the optimized protocol were co-cultured with *Nitrosomonas europaea* and *Nitrobacter winogradskyi*. Biofilm formation of the 23 species did not significantly change in co-cultures. Nitrification activity of the co-cultures were measured for eight days using $(NH_4)_2SO_4$ and $NaNO_2$ supplemented TSB. Co-cultures with biofilm formers *Bacillus pumilus* and *Acinetobacter radioresistens* showed highest NH_4^+ to NO_2^- conversion after eight days. Highest NO_2- to NO_3- conversion was exhibited by co-cultures with *Morganella morganii, Micrococcus luteus, Alcaligenes faecalis, Staphylococcus aureus, Brevibacterium linens, Hafnia alvei, A. calcoaceticus, B. pumilus, P. chlororaphis,* and *Delftia tsuruhatensis*. Utilizing a co-culture of biofilm-forming microbes with fastidious AOB *N. europaea* and NOB *N. winogradskyi*, a potential microbial consortium for partial nitrogen waste removal in water may be established.

THREE NEW SPECIES AND ONE NEW RECORD OF *NEOPERLA* NEEDHAM, 1905 (PLECOPTERA, PERLIDAE) FROM THE PHILIPPINES USING INTEGRATIVE TAXONOMY

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One of the Sustainable Development Goals of the United Nations is to conserve and protect freshwater-related ecosystems such as rivers, lakes, aquifers, and wetlands while at the same time improving its water quality (SDG 6). Plecoptera (stoneflies) is a group of aquatic insects known for its intolerance to organic pollution and their presence and abundance are important in rapid assessments of water quality in rivers and streams. However, stonefly research in the Philippines dealing with their taxonomy and ecology is scarce. In this study, we present three new putative species of perlid stoneflies which are *Neoperla* sp. A (Mindoro), *Neoperla* sp. B (Palawan), and *Neoperla* sp. C (Mindanao) while *Neoperla atripennis* was newly recorded in Camiguin. Four other species namely *N. recta* (Mindanao), *N. oculata* (Mindanao), *N. sabang* (Palawan), and *N. salakot* (Palawan) were also recorded from additional localities in Mindanao and Palawan. Morphological examination of diagnostic characters such as aedeagus and eggs were done by the use of compound and scanning electron microscopes (SEM). For the first time, a new set of primers (LCO1490_mod and HCO2198_mod) were used to successfully amplify COI mtDNA sequences serving as DNA barcodes. A TCS haplotype network and a Kimura-2-parameter genetic divergence analysis were performed to distinguish each species and to associate nymphs and adults. It is recommended that additional efforts are done in collection and identification of stoneflies using integrative taxonomy to further advance the knowledge on their systematics, zoogeography, and ecology.

Adviser

DIVERSITY AND PHARMACOLOGICAL POTENTIAL OF SEA CUCUMBER IN CASIGURAN, AURORA

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Sea cucumber is a marine invertebrate that occurs in almost every marine environment (Kerr et al., 2005). They play crucial roles and serve as keystone species; their absence can affect the survival of other species that are part of the same ecosystem (Lampe, 2013). Presently, there is a strong interest of discovering new drugs from sea cucumbers due to the number of novel bioactive compounds isolated from them which were proven to possess various pharmacological potential. The diversity of sea cucumber in Casiguran, Aurora was assessed using belt transect method. Three sites were surveyed; namely: Barangay Cozo, Barangay San Ildefonzo and Barangay Culat. Antimicrobial, antioxidant and total phenolic content, embrotoxicity, teratogenicity, cytotoxicity and the secondary metebolites of *Holothuria atra, Holothuria leucospilota* and *Holothuria scabra* body wall chloroform, hexane, ethanol, and methanol extracts were evaluated. Sea cucumber in the area was not diverse with only seven species observed. All the extracts have antioxidant potentials while there were no antimicrobial effect against *E. coli, S. aureus,* and *C. albicans*. High concentrations are toxic to zebrafish embryos and the teratogenic effect of the extracts delayed growth. The extracts contain phenols, steroids, anthrones tannins, alkaloids, flavonoids, anthraquinones, and coumarins.

Keywords: diversity; secondary metabolites; antioxidant activity; sea cucumber

GROWTH STIMULATION AND PHYTO-NANOREMEDIATION OF LEAD USING CHITOSAN/ZEOLITE/SILICA NANOCOMPOSITE IN WATER SPINACH (*Ipomoea aquatica* FORSK.)

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The potential of chitosan/zeolite/silica nanocomposite to promote growth and enhance Pb phytoremediation of water spinach was evaluated. The synthesized nanocomposite was characterized with a mean particle size of 62 nm and functional groups with absorption peaks of 3273.89 cm^{-1} (-OH bonds) and 1056 cm^{-1} (Si-OH bonds). SEM images showed rough and irregular grain surfaces, in addition with non-uniform particle sizes.

Nanocomposite at 100, 200 and 400 ppm concentrations did not produce significant effects on water spinach's growth and Pb remediation; possibly due to agglomeration and insufficient dispersion of the nanoparticles. Early stages of growth showed that nanocomposite at higher concentrations could slightly inhibit plant growth. However, on the 30^{th} day, treatments applied with the nanocomposite showed better performance compared to the control. Phytoremediation indexes suggested that the nanocomposite was not able to facilitate water spinach's Pb uptake. The alkalinity of the soil was assumed to have interfered with Pb ions mobility. Higher concentrations exhibited lower Pb extraction rates because of the adsorptive property of the

nanocomposite due to presence of silica.

Despite the low remediation rates of the nanocomposite, Pb absorbed in water spinach's shoots reached beyond the maximum allowable limit (2 ppm) set by FAO and WHO. This study further proved the importance of heavy metal screening for both plant prior to marketing and using soil for agricultural purposes.

DIRECT-SEEDED RICE GENOTYPE SELECTION BASED ON LODGING RESISTANCE AND ANAEROBIC GERMINATION FOR OPTIMIZATION ON MECHANIZED FARMING

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Selection of rice genotypes intended for mechanized direct seeded system of farming was done by evaluating and assessing the yield, lodging resistance and anaerobic germination tolerance of 44 advanced rice genotypes. The correlation between different morphological and anatomical traits to push resistance was also evaluated. Anaerobic germination trial and the determination of the presence of the putative QTL qAG-9-2 were done to evaluate the ability of the test genotypes to germinate in anoxic environment.

Seedling height and the number of adaxial vascular bundles were the only traits found to be significantly correlated to increased push resistance. One genotype PR 48633-6-3-1-B was found to have a significantly higher push resistance than the lodging resistant check NSIC Rc396. The estimated yield of almost all test genotypes were statistically comparable to the check NSIC Rc 396 which are therefore all potentially high yielding. Twenty-one genotypes had comparable push resistance to the check NSIC Rc 396 while two genotypes (PR 48633-6-3-1-B and PR 47862-4-1-2-1-B) had significantly higher thus have a potential high resistance to lodging during maturity and better candidate for genotype for mechanized farming. Anaerobic germination trial was not able to differentiate the ability of the test genotypes to germinate in anoxic condition. Marker RM105 was able to identify the presence and absence of QTL qAG-9-2 for anaerobic germination in inbred lines. Eight genotypes were selected to be good candidates for successive breeding for mechanized system since they are potentially high yielding, lodging resistant and anaerobic germination tolerant.

**Adviser*

ROOT RESPONSES OF RICE GENOTYPES TO DROUGHT STRESS ON MECHANIZED FARMING

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The increasing threats of climate change to food security necessitates the evaluation of rice varieties in response to changing environmental conditions to achieve sustainable rice production. Drought stress brought about by water scarcity lowers rice production by altering morpho-physiological status, metabolic activities, and other related processes concerning growth and development. Thus, this study compared the root responses of rice genotypes to drought stress in terms of morpho-physiological regulation. Three rice genotypes, IR 64, NSIC Rc 416, and PSB Rc 68, were subjected to drought and non-drought conditions within 39 days after sowing (DAS). Comparing the three rice genotypes, significant changes in morpho-physiological development of shoot and root cell structure in response to drought stress were observed in plant height, root and leaf development and biomass production. The significant reduction of SDW (shoot dry weight) maybe attributed to fewer roots and shoots development and dry matter production. Based on the result of the study, it was apparent that PSB Rc 68 was more tolerant to drought compared to NSIC Rc 416. The drought tolerance ability of PSB Rc 68 was related to its ability to promote lateral root production (plasticity). The lateral root plasticity increased soil water uptake and thus dry matter production was also increased under drought. Future works can be done by assessing the PSB Rc 68 in irrigated lowland rice areas with occasional drought.

CAROTENOID UPTAKE IN RED NILE TILAPIA (*Oreochromis niloticus*) TISSUES AS AFFECTED BY CAROTENOID-RICH DIET

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Red tilapia is a product of subsequent interbreeding and genetic enhancements in the aquaculture industry. Since consumers are inclined to select fish on the basis of appearance, particularly bright pigmentation, and tend to equate quality, flavor and nutritive value with color, researches are now geared towards improving coloration in red tilapia to enhance market acceptability and

profitability. In this study, fish were fed with carotenoid-rich diet from *Daucus carota, Ipomoea aquatica,* and *Moringa oleifera*. RNA were extracted and gene expression in relation to carotenoid intake in red tilapia were analyzed using the *csf1ra, bcdo2b* and *StAR* genes in muscle, skin, and dorsal fin. Results showed that after feeding there was a significant improvement on the coloration of red tilapia wherein fin displayed the brightest color among tissue observed. To confirm the phenotypic evaluation, measurement of carotenoid level was done and it was found out that it conforms to the outcome of phenotypic evaluation. Molecular affirmation was also conducted. *Csf1ra* was found to be up-regulated among treatments while the *Bcdo2b* was down-regulated in diets with *M. oleifera*. *StAR* was also found to be down regulated in diets with *I. aquatica* and *M. oleifera*. The study concluded that extracts from the plant used as a potential source of locally-available beta-carotene could enhance the coloration of red tilapia. Results can be used as initial findings for the genetic improvement of red tilapia in terms of marketability, profitability, and acceptability.

POTENTIAL SOURCES OF NOVEL TUNGRO RESISTANCE GENES FROM PHILIPPINE TRADITIONAL RICE VARIETIES

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Philippine traditional rice varieties (PTRVs) are sought because of their potential as rich sources of genes useful in improving rice resistance against diseases. In this study, PTRVs pre-observed with apparent tungro resistance under natural field conditions were further evaluated for reactions to RTSV under screenhouse condition. Test plants were forced-inoculated with RTSV and virus accumulation was assessed by enzyme-linked immunosorbent assay (ELISA). Representative plants were also screened for presence of genes associated with rice resistance against RTSV, the *tsv1* and *eIF4G*. Results showed that PTRVs Gunadara, Kabugna, Sugbo-anon and Hinumay contain the resistant tsv1 allele based on PCR-based amplification with reported SSR markers. Based on ELISA, these PTRVs were detected with very low RTSV accumulation at 21 days post inoculation. Though these PTRVs were identified as promising alternative sources of the resistant *tsv1* allele, the sequence analysis of their *eIF4G* gene exon 9 region showed similarity with the TN1 susceptible SNP type. Meanwhile, PTRVs Ginandora, Red Rice, Pilit 2, Calatrava, Mukol and Minerva, which also showed notable RTSV resistance were identified as potential sources of tungro resistance genes other than *tsv1* and *eIF4G*. These are recommended for further evaluation for reactions to the insect vector, green leaf hopper. If these PTRVs will be verified as GLH-susceptible but RTSV-resistant, they will serve as promising materials for mapping of potentially novel tungro resistance genes. The eventual development of molecular markers useful for marker-assisted selection can help hasten the development of tungro-resistant rice varieties while promoting increased utilization of PTRVs in the rice breeding programs.

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PHARMACOLOGICAL POTENTIAL OF CRUDE EXTRACT FROM MANGO (*Mangifera indica* L.) LEAVES (*Carabao* var.)

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The pharmacological potential of crude extract from mango leaves was evaluated in this study. Methanol was used to extract the bioactive compounds. The crude extract was screened for phytochemical, antioxidant, total phenolic content, antimicrobial and cytotoxic activities. Moisture content of the leaves decreased to 6.93% and prevented growth of microbes and made the secondary metabolites more stable. Essential oils, phenols, triterpenes, steroids, fatty acids, sugars, anthraquinones, coumarins, anthrones, tannins, flavonoids, alkaloids and amino acid were present in the crude extract. It also exhibited comparable radical scavenging activity of 61.42% with catechin and total phenolics of 43.58mg/g GAE. Intermediate and susceptible antimicrobial activity of the crude extract was assessed against *Staphylococcus aureus* and *Candida albicans* with 12.20 *mm* and 16.99 *mm* zone of inhibition, respectively, inactive against *Escherichia coli*. The crude extract was non-toxic with LC_{50}=198.9.

Keywords: Mangifera indica L.; radical scavenging activity; antimicrobial; total henolics

DIVERSITY AND TAXONOMIC KEYS OF THE PEST AND BENEFICIAL ARTHROPODS OF POTATO IN LA TRINIDAD, BENGUET ACROSS TWO GROWING SEASONS

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Determining the arthropod diversity on croplands is significant in developing safe protocols for Integrated Pest Management (IPM). Surveys on diversity provide insights on potential pests and its severity, presence of viable biological controls, and ecological interaction between arthropods and vegetation. At present, there is lack of documentation on the definite pest and beneficial arthropods present in potato fields in the Philippines; hence, this study aims to create a compendium of pests and beneficial arthropods that exist in a potato field in La Trinidad, Benguet, Philippines, where insecticides have not been applied. A field survey, to assess the diversity and abundance of pest and beneficial arthropod species present, has been conducted for the first growing season in August to October 2019 and another survey will be conducted for the second growing season from March to May 2020, in the same sampling site in La Trinidad, Benguet. Arthropod sampling was done using different techniques: sweeping, light trapping, pitfall trapping, and Malaise trapping. Collected arthropods were identified. Data on the survey wil be used to compute for the diversity indices from each growing. Taxonomic keys (dichotomous keys and Lucid keys) will be generated based on the identified arthropod species. The resulting taxonomic keys will be used to construct a compendium guide of beneficial and pest arthropods.

VOLATILE ORGANIC COMPOUND PROFILING OF *Capsicum annuum var. longum* GROWN UNDER DIFFERENT CONCENTRATIONS OF NITROGEN

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Biotic and abiotic factors, such as environmental stress, herbivory, diseases, and nutrient deficiency, can elicit plants' defense mechanism through emission of volatile organic compounds (VOCs). For instance, excessive or limited supply of nitrogen can weaken their stability and immunity making them vulnerable to different types of diseases and infestations. As a response, plants release VOCs to relieve internal stress, to signal its neighboring plant and to attract herbivore predators.

In this study, we exposed *Capsicum annuum* var. *longum* at various concentrations of nitrogen (i.e. 1.8 g/L, 4.5 g/L and 9 g/L Urea). The extraction of VOCs was conducted using a 100 µm Solid Phase Micro-Extraction Fiber (SPME) coated with Polydimethylsiloxane (PDMS) followed by an analysis using Gas Chromatography-Mass Spectroscopy (GCMS) on Electron Impact Mode.

Butanoic acid, 3-hexenyl ester; (E)-, Butanoic acid, hexyl ester; Hexanoic acid, 3-hexenyl ester, (Z)-; Hexanoic acid, 4-hexen-1-yl ester; cis-3-Hexenyl cis-3-hexenoate and 4-Pentenoic acid 2-methyl-, hexyl ester were only detected from leaves of plants exposed to nitrogen. Similarly, green leaf volatiles 3-Hexenal and 2-Hexen-1-ol, (E) were only detected from N-treated plants. In addition, an increase in peak areas of 2-Hexenal; 3-Hexen-1-ol, (Z)- and 1-Hexanol were observed from nitrogen treated plants. These findings could aid in understanding how *C. annuum* var. *longum* responds to nitrogen stress.

ATTRACTION OF CACAO MIRID BUG (*Helopeltis bakeri* POPPIUS) TO FEEDING ATTRACTANT β-CARYOPHYLLENEUSING WIND TUNNEL BEHAVIORAL BIOASSAY

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Theobroma cacao L. produces cocoa, the main ingredient for the production of chocolates. It is a high value agricultural crop recognized for various health benefits and due to this, the demand continues to increase. Cacao is an equatorial crop, making the Philippine climate and topography suitable for cultivating cacao and could be advantageous for local farmers to profit and participate in the supply deficit of the global market. However, farmers continuously deal with the decreasing supply mainly due to pest infestations. Cacao mirid bug (CMB) is one of the emerging pests of cacao and it feeds and oviposit on the pods, causing lesions that renders cacao unmarketable. The use of semiochemicals is a program of IPM applied to confuse, attract, and trap pests in a biologically-based way. This study aimed to evaluate the attraction of CMB

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towards the feeding attractant β-Caryophyllene, determine the optimum concentration and assessed different trap designs using wind tunnel behavioral bioassays. Results showed that among treatments (45µg, 65µg, 90µg and 180µg β-caryophyllene), 90µg attracted the highest number of CMB (75.05%) in standard delta trap prototype and was highly significant ($p<0.0001$) from the control and other concentrations tested. Among the tested trap designs, the rectangular trap has the most catch (50%) and was significantly different from the pyramid trap and bottle trap except from the green sticky board. Therefore, there was a positive attraction behavior of CMB, confirming the potential of β-caryophyllene as an attractant to CMB. The data obtained in this study serves as a baseline data to be used in future field assays and further aid in reducing infestations to T. cacao and boost local production.

DETECTION OF *WOLBACHIA* SP. IN *AEDES* SPP. MOSQUITOES (DIPTERA: CULICIDAE) IN SELECTED BARANGAYS OF GENERAL TRIAS CITY, CAVITE AND METRO MANILA

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The high number of recorded dengue cases in General Trias City, Cavite significantly emphasizes the need for alternative vector control strategy. *Wolbachia* are endosymbiotic bacteria potentially capable of controlling mosquito population by altering host reproduction and reducing the ability of disease transmission. *Aedes* spp. eggs were collected using modified ovitraps from General Trias City, Cavite and Metropolitan Manila. A total of 6 *Ae. albopictus* and 357 *Ae. aegypti* reared F1 adult individuals from the collected eggs were screened for the presence of *Wolbachia* using wsp gene through Polymerase Chain Reaction. Six individuals of *Aedes albopictus* (N=6) and one individual of *Aedes aegypti* (N=189) from Metro Manila tested positive for *Wolbachia.* All screened *Ae. aegypti* individuals (N=168) from General Trias City tested negative for *Wolbachia*. The overall prevalence of *Wolbachia* in F1 *Ae. albopictus* in Metro Manila is 100%. Meanwhile, the overall prevalence of *Wolbachia* in F1 *Ae. aegypti* in General Trias City, Cavite and Metropolitan Manila is 0.25% (1/357). None of the reared F2 *Ae. aegypti* individuals (N=92) from Metro Manila and General Trias City, Cavite tested positive for *Wolbachia.* The result of the study seems to suggest that *Wolbachia* is common in *Ae. albopictus* and rare in *Ae. aegypti.* Further research is recommended in *Wolbachia* detection including quantifying of bacterial density from field-collected eggs, using other molecular markers that target *Wolbachia* and exploiting other molecular methods to determine the infection status and transmission rate of *Wolbachia* in the target *Ae. aegypti* population.

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TO EAT OR NOT TO EAT: CADMIUM AND LEAD CONCENTRATIONS IN THE DORSAL MUSCLES OF SPOTTED KNIFEFISH (*Chitala ornata*, GRAY 1831) FROM LAGUNA DE BAY, PHILIPPINES

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Laguna de Bay is the largest freshwater lake in the Philippines that became a major source of agricultural food supply because it houses 33 fish species. Previous studies revealed that fishes in the lake are greatly affected by pollution such as heavy metals which can cause harmful effects to humans when consumed. Spotted knifefishes were randomly collected from Binangonan (n=21), Cardona (n=20), and Sta. Rosa (n=20) which represent the West Bay, Central Bay, and South West Bay of Laguna de Bay, respectively. The length and weight of the samples were first measured before obtaining the dorsal muscle from each fish. Afterwards, the muscles were oven-dried, furnaced, and dissolved in concentrated nitric acid and deionized water before subjecting to cadmium and lead analysis using AA-6300 Atomic Absorption Spectrophotometer (AAS). Spotted knifefish samples from Binangonan, Cardona, and Sta. Rosa sites had similar ($P>0.05$) mean cadmium concentrations of 0.2961, 0.2871, and 0.2962 mg/kg, respectively, which all exceeded maximum cadmium level for human consumption set by international standards. The mean concentration of lead in samples collected from Binangonan, Cardona, and Sta. Rosa were 0.3221 mg/kg, 0.4892 mg/kg, and 0.7640 mg/kg, respectively, all being significantly different ($P<0.05$). The cadmium and lead levels from Binangonan were similar ($P>0.05$), while the lead levels from Carmona and Sta. Rosa were higher than the cadmium levels ($P<0.05$). All lead levels exceeded maximum permissible limits of all international standard standards. There was no significant correlation between all sites' cadmium concentrations with body weight and length ($P>0.05$). Also, there was no significant correlation between lead levels from Binangonan and Cardona sites with body weight and length ($P>0.05$). There was significant correlation between lead levels from Sta. Rosa with body weight and length ($P<0.05$). The levels of cadmium and of lead, are significantly high to be a potential human health hazard in Laguna de Bay fish. Knifefish is also a potentially useful as a bioindicator of heavy metal contamination in aquatic systems.

IDENTIFICATION OF GASTROINTESTINAL HELMINTHS IN A SMALL-SCALE POULTRY FARM

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Poultry is one of the fastest growing industry in the Philippines as a result of high demand for poultry meat and egg products by consumers. A decrease in poultry production was recorded due to malpractices in poultry farming and range of food pellets fed on to the local chicken that may harbor infective stages of parasites thereby prompting them to acquire gastrointestinal infections. These gastrointestinal (GIT) helminths compromise the health of the chickens and are known to be one of the leading causes of high mortality in the poultry industry. This study

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aimed to identify the gastrointestinal parasites in chickens from a small-scale poultry farm in Muntinlupa City, Philippines. Stool samples were examined using Formol-Ether concentration technique followed by microscopy. *Coccidia, Fasciola* spp. and *Toxocara eggs* and nematode larvae were observed in the stool samples. The result of the study suggests that chickens reared in poultry farms are vulnerable to parasitic infections. It is therefore recommended that management practices in small-scale poultry farms should be reviewed and that poultry owners be educated regarding proper waste management and poultry farming practices to reduce the risk of infection and mortality among chickens.

Keywords: Gastrointestinal helminths, chicken, poultry, helminths, Formol-Ether

SURFACE MORPHOLOGY AND WETTING BEHAVIOR OF THE ASPIDIOTUS SPP. SCALE COVERS

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The scale insects *Aspidiotus destructor* and *Aspidiotus rigidus* exhibit notable scale covers made of wax which provide protection against water loss and are capable to resist wetting, thus making them a desirable model for biomimetic designs. Their waxy covers enable them to infest mainly leaves of coconut trees despite the harsh environmental conditions. This study aims to describe and compare the micro-morphological characters on the surfaces of their scale covers consequently, how these ultrastructures affect their wetting properties. Scanning electron microscope (SEM) was used for the surface characterization while an optical contact angle meter was employed in the wetting measurement. The measured contact angle (CA) was used to compute for the rate of wettability, drop asymmetry (DA) and surface free energy (SFE). The study found that scale cover of *A. destructor* is composed of multiple outwardly stacked layers of wax forming a conspicuous concentric pattern while that of *A. rigidus* showed a less conspicuous concentric pattern. Furthermore, the wax protrusions' height and density of *A. destructor* were not significantly different to those of *A. rigidus.* The arrangement of the wax protrusion of the scale cover may have affected the SFE. Principal component analysis using the wetting properties used for both *Aspidiotus* spp. showed separation between the two species, suggesting that the characters used and the surface ultrastructure could differentiate the two species from one another as a form of nano-taxonomy.

DECELLULARIZATION OF KIDNEY USING A SONICATION-ASSISTED TREATMENT FOR RENAL TISSUE ENGINEERING APPLICATIONS

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Decellularization is a tissue engineering process which aims to remove the cells of a native tissue to reduce the risk of immunogenicity. The most preferred decellularization method which is chemical perfusion, however, require long processing times and excessive chemical usage

to produce safe and viable tissue replacements. The present study evaluated the effect of the addition of sonication (150, 200 and 250 W) on the decellularization process. Treatment duration, amount of chemical usage, efficiency of cell removal and preservation of microarchitectural integrity of the product kidney bioscaffolds were evaluated. Initially, cells of the native porcine kidney were removed by the perfusion of Sodium dodecyl sulfate through the renal artery until it appeared translucent white. Histological staining and imaging confirmed the complete removal of cells and the preservation of the microarchitectural integrity of the native kidney. Renal structures such as glomerulus, tubules and its vasculature remained intact following decellularization except for the kidney bioscaffolds produced from decellularization with 250 W sonication where minimal disruption of the glomerular basement membranes and thinning of blood vessels were observed. Results revealed that decellularization with sonication using 150 W, 200 W and 250 W required a treatment time of 24 h, 16 h, and 12 h respectively compared to the 28 h treatment time of decellularization without sonication. This shortened processing times also led to the reduction in the amount of chemicals used. Therefore, it can be concluded that the addition of sonication in the decellularization process can reduce processing time and chemical usage while completely removing the cells and retaining the microarchitectural integrity of the native kidney tissue.

DETECTION OF *Wolbachia* sp. IN *Aedes aegypti* MOSQUITOES (DIPTERA: CULICIDAE) IN THREE SELECTED BARANGAYS OF LUCENA CITY, QUEZON PROVINCE

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One of the hotspots of dengue cases is Lucena City, Quezon Province. Current record showed high prevalence of dengue cases in this municipality, which needs immediate action, particularly on the vector control. *Aedes aegypti* is the vector of dengue virus. The use of biological control to manage the population of *Ae. aegypti* is becoming popular as an alternative to insecticides. *Wolbachia* sp. are natural intracellular bacteria which is a candidate beneficial microbe to manage the population of *Ae. Aegypti*. It has the ability to manipulate the reproduction of its hosts to facilitate invasion of carriers, and to modify host responses to viral infections. In this study, eggs of *Aedes* mosquitoes were collected using modified ovipositional traps in three (3) selected barangays in Lucena City, Quezon Province and three (3) selected cities in Metropolitan Manila. The eggs were reared in the laboratory to obtain adult mosquitoes for the detection of Wolbachia. A total of 347 reared eggs of *Aedes aegypti* (290 individuals from F1 generation and 57 individuals from F2 generation) were tested for the presence of *Wolbachia* sp. using Polymerase Chain Reaction and Gel Electrophoresis. Out of 290 adult mosquito samples from F1 generation only 2 samples were tested positive for *Wolbachia*, wherein one came from Lucena City, Quezon Province and the other one came from Metropolitan Manila. No Wolbachia was detected from the F2 generation. This preliminary results suggests very low prevalence of Wolbachia. However, the sample size is relatively low. Thus, wider sampling both temporal and spatial should be done to further study the transmission of Wolbachia in *Ae. Aegypti* and test for its biological control potential.

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HISTOLOGICAL AND BEHAVIORAL RESPONSE OF *Cyprinus carpio* IN RESPONSE TO DIFFERENT ENVIRONMENTAL STRESS FACTORS

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Stressors can be initiated by endogenous and exogenous factors that greatly affect the physiological, biological and behavioral responses of an organism. In this study, *Cyprinus carpio* were exposed to the different environmental stress parameters such as starvation and overcrowding, their behavioral and histological changes were evaluated. Behavioral responses in swimming pattern, appetite and jumping reactions were observed.

The organs identified for histopathology were kidney, liver, muscle tissue, intestine, gills and heart wherein stress response can be highly detected. Necrotic changes were observed in kidney, liver, muscles tissues and intestine with an evident swelling of hepatocytes that can lead to hepatocellular carcinoma, liver dysfunction and macrophages which triggers inflammatory response of the fish due to stress. While the gills and the hearts were all normal after the extent of the study.

Further investigations are essential to accurately describe the role of stress in the analysis of fish research results. A thorough hematology, bacteriological and virology analysis is highly recommended for a clear analysis of pathological changes.

CYTOTOXIC ACTIVITY OF *TERMINALIA MICROCARPA* DECNE FRUIT EXTRACT ON HUMAN CANCER AND NORMAL CELL LINES AND THE EFFECT ON EXPRESSION OF EARLY APOPTOTIC *CFOS* AND *CJUN* GENESAND PROINFLAMMATORY CYTOKINE *INTERLEUKIN-1β* AND *TUMOR NECROSIS FACTOR -a GENES FACTOR -a (TNF-a) GENES*

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Terminalia microcarpa D., locally known as Kalumpit, is widely used in traditional medicine. It has been reported that it contains several biological activities including anti-cancer and anti-inflammatory activities. This study aimed to investigate the phytochemical components of crude dichloromethane (DCM) extract isolated from the fruit pulp using GC-MS analysis and their cytotoxic and anti-inflammatory activities on human cancer and normal cell lines. It also determined the mechanisms of these activities. Crude DCM extract exhibited cytotoxic effect against the MCF-7 breast cancer cells, HeLa cervical cancer cells, H69PR lung cancer cells, and VCaP prostate cancer cells, but not to THP-1 acute monocytic leukemia cells and normal HDFn human dermal fibroblasts ($IC_{50} \geq 100$ µg/mL). Following PrestoBlue® reasurin assay, the crude DCM extract showed IC50 values of 2.385, 3.228, 3.732, 8.373 µg/mL for MCF-7, HeLa, H69PR and VCaP cell lines, respectively. Treatment exposure to crude DCM extract of MCF-7 cells induced

upregulation of early apoptotic genes *cfos* and *cjun* transcripts. Moreover, downregulation of proinflammatory cytokines *IL-1β* and *TNF-a* transcripts was observed in lipopolysaccharide (LPS)-treated phorbol myristate acetate (PMA)-induced macrophage after treatment with crude DCM extract. This study provides evidence that the crude DCm extract from *T. microcarpa* was cytotoxic to the cancer cell lines but not to the normal cell line tested. This study also provides strong evidence that crude DCM extract has an anti-inflammatory effect against LPS-induced macrophages.

MITOCHONDRIAL DNA HAPLOTYPE ANALYSIS OF THE CRITICALLY ENDANGERED PHILIPPINE COCKATOO (*CACATUA HAEMATUROPYGIA* P.L.S. MÜLLER, 1776)

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The Philippine Cockatoo or Katala (*Cacatua haematuropygia*) is a Critically Endangered parrot species endemic to the Philippines with an estimated wild population of up to 1,120 individuals. Threats to its continued existence include habitat destruction and poaching for the pet trade. While protected populations exist in Palawan under the care of the Katala Foundation Inc., no previous genetic studies aimed at quantifying genetic diversity in the protected populations has been done. This study examines two mitochondrial genes of over 100 individuals in protected populations of the Katala. Results show that very few haplotypes are present for both *nd2* and *cox1* and a possible reduction of genetic diversity over time. The nuclear gene *tgfb2* was also examined for a few individuals and is highly similar in sequence for 31 individuals, further supporting the hypothesis of genetic bottleneck. Future conservation work for the species should account for possible consequences of reduced genetic diversity.

ASSESSMENT OF BLUE SWIMMING CRABS *Portunus pelagicus* (Linnaeus, 1758) POPULATIONS IN THE PHILIPPINES USING MITOCHONDRIAL DNA MARKERS

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Philippines is one of the biggest exporters in the crab industry which is massively contributed by the blue swimming crabs or *Portunus pelagicus*. However, the annual catch of blue crabs continues to decline due to overexploitation and insufficient implementation of regulatory policies in using destructive fishing methods and establishing closed seasons. Assessment of various blue swimming crab stocks in the Philippines is necessary for appropriate management actions and policies. This research focuses on both genetic and morphological analysis of the different crab landings in the Philippines. *P. pelagicus* samples from four different fishing grounds across the archipelago were collected. Sequences of cytochrome c oxidase subunit I (COI), cytochrome b, and control region genes were analyzed. For the morphometrics, morphological measurements and ratios were noted. High genetic diversity was observed based on COI, cytochrome b and control region haplotypes, suggesting stable population. Morphological differentiation

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across sites using these morphometric ratios was observed to be only true for females. It is recommended for further analyses to use nuclear genes, along with mitochondrial DNA, for studying population structure.

FLORAL DIVERSITY ASSESSMENT OF DEL CARMEN MANGROVE FOREST IN SIARGAO ISLAND, PHILIPPINES

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The Del Carmen Mangrove Forest covering 4,295 hectares is perceived to be the largest contiguous mangrove stand in the Philippines. However, knowledge regarding its floral diversity is very limited and outdated. Field surveys were conducted in 11 barangays last July and August 2019. For each barangay, plant species were surveyed in 5 quadrats (10m x 10m) with an interval of 400 m distance along the total transect line of 2 km. Trees were recorded using 10m x 10m quadrats, 5m x 5m quadrats for shrubs, vines, and epiphytes while 1m x 1m quadrat for small herbaceous plants. Noteworthy species were molecularly analyzed. Plant diversity was assessed through total number of species (S), Margalef species richness (d'), Shannon diversity (H'), Pielou's evenness (J), Simpson's dominance index (D) and Sorensen coefficient of similarity (Ss). The study reported approximately 1,898 individuals from 51 families, 70 genera, and 110 species. There were at least 17 true mangrove species from 7 families. The most dominant species were from the family Rhizophoraceae. Overall, the Del Carmen Mangrove Forest had significantly high floral diversity *(S= 110, d'= 13.12, H'=3.11, J=0.68, D= 0.12, S_s= 1)*. The diversity of the mangroves in the areas surveyed in all barangays varied. Brgy. Del Carmen yielded highest in both species richness *(S=35)* and Margalef species richness *(d'=5.43)*. The highest evenness was accounted to Brgy. Katipunan *(J=0.64)*. Brgy. Mabuhay resulted to have the highest dominance *(D=0.39)*. The highly diverse Del Carmen Mangrove forest with its ecological and economic importance requires effective conservation.

LAKE DEPTH AND PRODUCTIVITY AS PREDICTIVE PARAMETERS ON THE WIDESPREAD INVASION OF *ARCTODIAPTOMUS DORSALIS* (MARSH, 1907) (COPEPODA: CALANOIDA) IN TROPICAL LAKES

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The massive invasion of the Neotropical calanoid copepod *Arctodiaptomus dorsalis* (Marsh, 1907) in the Philippines has already been reported in various studies. Experimental results involving the said species revealed the dependency of fecundity on food concentration. In contrast, increasing temperature appear to have detrimental effects on its hatching success rate

and survivorship. However, predictive measures are yet to be identified as possible parameters in the successful integration and propagation of this invasive species. In this study, spatial analysis of morphometry and reproductive capacity – proxied by its clutch size (CS) – of different populations of *A. dorsalis* obtained from 11 tropical lakes in the Philippines was done. Correlation analysis of the morphometry and reproductive capacity with select water quality parameters was also conducted. Collection of copepod samples, water quality parameters, and chlorophyll-a readings were conducted from December 2018 to April 2019. Statistical analysis show that the morphometry of *A. dorsalis* populations exhibited significant differences across all borders ($p = <0.001$). Correlation analysis revealed that the growth of adult male and female, represented by its total length (TL), and CS of ovigerous female have an inverse relationship with lake depth ($R = 0.571$, $p = <0.001$; $R = 0.524$, $p = <0.001$; and $R = 0.538$, $p = <0.001$). This shows that shallower lakes, which are more homogenous in terms of nutrient distribution throughout the water column, provide a more suitable habitat for *A. dorsalis.* This explains the widespread occurrence and abundance of *A. dorsalis* in more eutrophied shallower lakes in the Philippines.

INVESTIGATING THE POTENTIAL CRYPTIC DIVERSITY OF THE PHILIPPINE PITVIPER *Trimeresurus flavomaculatus* (Viperidae: Crotalinae) IN THE LUZON BIOGEOGRAPHIC REGION

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Pitvipers of the genus *Trimeresurus* are among the most widespread and commonly-encountered venomous snakes in forests of tropical Asia. This group is known to have a high prevalence of cryptic diversity and the taxonomy of many known species remains problematic. The endemic Philippine pitviper, *Trimeresurus flavomaculatus,* is considered taxonomically complex due to its wide distribution, conservative morphology, extreme polymorphisms, and problematic lineage.

The unresolved phylogeny and potential cryptic speciation in this group leaves fundamental problems with regards to species conservation and snakebite management. With the aim to assess for cryptic speciation in the *T. flavomaculatus* complex, this study provides an initial phylogenetic inference for Philippine pitvipers using four mitochondrial DNA markers (12S, 16S, *Cytb*, and ND4).

Our phylogenetic reconstruction centered on different populations of *T. flavomaculatus* from the islands of Luzon and Mindoro, which are two of the seven distinct biogeographic regions known in the Philippines. Included in the analysis are *Trimeresurus mcgregori* from the island of Batanes and a sample of *T. flavomaculatus* from Mindanao Island. Our study revealed a paraphyly in the species complex, the separation of Luzon and Mindanao populations suggesting the need to reevaluate the *T. flavomaculatus* and *T. mcgregori*. Additionally, examination of museum specimens, live specimens from the field, and published photographs put forward at least three different color and pattern morphotypes among the populations of Luzon Island.

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ABUNDANCE AND COMPOSITION OF MACROBENTHIC INVERTEBRATES COLLECTED FROM SIX SEAGRASS SITES ALONG GUIMARAS STRAIT AND PANAY GULF, PHILIPPINES

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Coastal areas are getting particularly vulnerable to rapid expansion of human population. Not only for residential uses, coastal areas, especially sandy beaches, have long been an attraction for tourists. These areas are therefore subjected to intense stress coming from increasing coastal infrastructure, the development of shoreline armoring, beach nourishment, resource exploitation, and pollution. Primarily affected by these stressors are the benthic invertebrates because of their close association with the sediment. These organisms live attached to or move on or in the bottom substrate, thus they serve as good indicators of stress and pollution. Benthic community studies have been traditionally known to provide baseline information on the habitat status of several aquatic systems, and insights on the interactions between biotic and abiotic components of the community. Thus, this study was undertaken. Six seagrass beds, subject to different stress were studied, specifically the abundance and composition of macrobenthic invertebrates. The sites include: Banate Bay, Iloilo; Cauayan, Negros Occidental; Sibunag, Guimaras; Bulubadiangan Is., Concepcion, Iloilo; Lakawon Is., Cadiz, Negros Occidental; and Nogas Is., Antique. The overall macrobenthic density was 6,875.28 ind•m-2 and the total number of species identified was 179. Nogas Is. is consistently the highest in terms of abundance and composition, while Banate Bay is constantly lowest. Mean densities and species composition of macrobenthic invertebrates between sites were significantly different. Relationship with environmental factors were also examined. These data can be used as a tool to manage these coastal areas, especially those with the productive fishery.

METABOLIC RESPONSES OF THE PHILIPPINE CUPPED OYSTER *Crassostrea iredalei* TO ENVIRONMENTAL CHANGE

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Climate change threatens the survival of many species, particularly in tropical areas where the current average temperature is close to critical levels. This compromises how the animal will consume oxygen to maintain bodily functions and stay alive. In this study, the metabolic response of the Philippine cupped oyster *Crassostrea iredalei* was assessed to understand how these tropical species function in the face of climate change. This is a first attempt to look closely at the whole-animal metabolic rate of *C.iredalei* using the intermittent-flow respirometry technique, measuring VO_2 (mg O_2 ind^{-1} hr^{-1}). The metabolic rate of oysters was observed in the laboratory by exposing individuals to different temperature and salinity combinations. Moreover, the metabolic rates of routine activities such as feeding and spawning were assessed according to the natural habitat (25°C; 35 p.p.t.) conditions during collection. For temperature and salinity experiment, the animals were exposed to temperatures of 25, 30, and 35°C with salinities of

10, 20, 30, and 40 p.p.t. VO_2 remained low at low salinity of 10-20ppt despite an increase in temperature. At higher salinities of 30-40 p.p.t., VO_2 significantly increased with temperature. On the other hand, VO_2 significantly increased for 6 hrs after feeding before gradually returning to the basal rate. Moreover, under the absence of food, VO_2 declined slightly and eventually stabilized at standard values. Meanwhile, VO_2 on spawned oysters increased significantly compared to unspawned oysters. These findings can be considered as supporting knowledge to improve the oyster culture in the country.

FAUNAL ASSEMBLAGES IN MANGROVE FRINGES IN SOUTHERN GUIMARAS, PHILIPPINES

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The function of mangroves in nursery role, providing food and protection to many fish and invertebrates species is well accepted. These fauna, many of which are commercially important species, utilize mangrove habitat differently, as well as interacting in complex ways in the adjacent habitats. As such, the role of the mangroves can be inferred from the characteristics of the faunal assemblages that move in and out of them. In this study, weekly samples of catches from several fish corrals set close to the mangrove fringe in the vicinity of Taklong Island National Reserve (TINMAR), Southern Guimaras were monitored along with daily records of total catch from each of 4-6 corrals during the same period to examine daily, monthly and seasonal variability in catches from March 2011 to September 2013. A total of 354 species from 96 families were recorded during the study period, more than 90% caught were fishes but with significant monthly percentage contribution of invertebrates such as squids and shrimps were observed. Cluster analysis revealed major groups, those assemblages that were pronounced during Southwest to early Northeast monsoon, and Northeast to summer months while autocorrelation and spectral analysis revealed some dominant species apparent use of mangrove habitat concurring with their reproductive activities. Further analysis in terms of occurrence, size, trophic structure and composition of several species were also examined. Imperative insights on the apparent patterns were also discussed in relation to the relative importance of the mangrove habitat in the areas of the marine reserve and its proximity.

STATUS OF SCHISTOSOMIASIS IN THE PHILIPPINES: PREVALENCE, CONTROL AND INNOVATIVE METHODS FOR DETECTION AND ELIMINATION

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Schistosomiasis, also known as bilharzia is recognized by the World Health Organization as one of the neglected tropical diseases globally. It is caused by parasitic blood flukes under the genus *Schistosoma*. Among the seven known zoonotic *Schistosoma* species, *S. japonicum* is reported to be the most pathogenic in which an estimate of 280 million people are infected worldwide. In the Philippines, *S. japonicum* is endemic in 28 provinces and remains as one of the major public

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health concern. At present, the national prevalence of Schistosomiasis is recorded at 4.68% with 435 out of 1,599 endemic barangays with prevalence of >5%. Due to the country's topography, rapid transmission of the disease from exposure of humans and animals to cercarial infested waters during domestic and agricultural activities are highly observed. Mammals such as water buffaloes (carabaos), cattle, dogs and rats contribute to the transmission of the disease. Other high-risk factors including the play habits of children, lack of proper sanitation and hygiene have increased the vulnerability of individuals in acquiring the infection. Moreover, various cases of anemia, malnutrition, growth retardation, poor cognitive function and mortality associated with *S. japonicum* infection were also recorded. To date, detection of Schistosomiasis using techniques with higher sensitivity and specificity such as by ultrasound, Polymerase Chain Reaction, Circum-oval Precipitin Test and Enzyme-Linked Immunosorbent Assay have been utilized. Moreover, detection of eDNA contribute to the surveillance of the disease in endemic areas.

Keywords: Schistosomiasis, S. japonicum, prevalence, control, elimination

MICROHABITATS OF JUMPING SPIDERS (ARANEAE: SALTICIDAE) IN SELECTED AREAS OF NORTHERN MINDANAO, PHILIPPINES

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Microhabitat selection is one of the important factors in the diversity, abundance, and distribution of spider fauna. This study was conducted to assess the microhabitats of salticid spiders in selected areas of Northern Mindanao, Philippines. Opportunistic sampling was conducted from November 10, 2018 to October 10, 2019 for 5 days per site using beat-netting and vial-tapping methods. All possible microhabitats were searched and examined. Nine microhabitats were found to be associated with the salticid spiders. Salticid spider species are well distributed in shrubs, understory tree leaves, and ground (ground plants, leaf litter, rocks, dry twigs, and rotten logs) microhabitats. Species richness was high on understory shrubs while a high degree of complementarity (C=100%) with a total distinctness of 53% of the total number of paired microhabitats was recorded. This implies that salticid spiders are widespread in varying microhabitats in selected sampling areas in Northern Mindanao.

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SPECIES DIVERSITY, DISTRIBUTION, AND MICROHABITATS OF ANURANS ON MT. KALO-KALO OF THE MT. KALATUNGAN RANGE NATURAL PARK, BUKIDNON, PHILIPPINES

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Anurans are considered good indicators of habitat quality due to their dual life mode, limited dispersal abilities, and sensitivity to environmental changes brought about by habitat fragmentation. Accounts of high anuran species diversity and their important function as ecological indicators, along with continued threats to Mount Kalatungan provide basis for this study. This study aimed to determine species diversity and distribution of anurans in the lower (1000-1400 masl) and upper (1400-1600 masl) montane forests in Mount Kalatungan employing the cruising technique. A total of 251 individuals of anurans representing 13 species were recorded during the study period. The upper montane forest has higher diversity index (H'= 1.276) than the lower montane forest (H' = 0.871). *Ansonia muelleri* was the most abundant which constituted 73% of the total number of anurans. Most of the species prefer terrestrial and aquatic microhabitats, specifically in the rocks and bank substrates along the rivers and streams. Three species of anurans *(Philautus acutirostris, Philautus poecilius, and Rhacophorus bimaculatus)* were strictly found in the arboreal microhabitat. *Limnonectes magnus* and *Ansonia muelleri* species have overlapping microhabitats. Even with the low diversity indices, the level of endemism of anurans was 69% where nine of the recorded species are Mindanao faunal region endemic and two species are Philippine endemic. Results indicate that the forests of Mount Kalatungan continue to support substantial endemic anuran species richness both in lower and upper montane forests, suggesting that conservation efforts continue to be a priority in this unique protected area.

FIRST REPORT OF *Caenorhabditis brenneri* ISOLATED FROM GIANT AFRICAN LAND SNAIL *Achatina fulica*, AND ITS BACTERIAL ASSOCIATES

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Gastropods are extremely diverse taxa with nearly 60,000 species of which *Achatina fulica* (Giant African Land Snail) and *Pomacea canaliculata (*Golden Apple Snail) are well-known members and are invasive. They serve as vectors and hosts for several free-living and parasitic nematodes. However, these snails are alternative hosts of parasitic and pathogenic nematodes infecting human and other higher vertebrates, making studies on the diversity of nematodes isolated from gastropods be more emphasized. This study aimed to isolate and identify nematodes from the two invasive gastropod species and their bacterial associates. Samples of *A. fulica* and *P. canaliculata* were collected from six different locations (i.e. Bukidnon, North Cotabato, Zamboanga Sibugay, Zamboanga City, Davao del Sur, Kapatagan, and Maigo, Lanao del Norte) of Mindanao island, Philippines. Gastropod samples from 5 areas were positive for the presence of nematodes – four of which were from *A. fulica* and one from *P. canaliculata*. Only one species of nematodes amongst many others was thoroughly identified and confirmed through

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morphological and morphometrical data, and analysis of the D2D3 of 28S rRNA and 18S rRNA regions – the *Caenorhabditis brenneri*. This nematode species found inside the dissected snail cadaver, to our knowledge is the first report. Additionally, analysis on the 16S rRNA gene, four species of bacteria were identified that formed association with *C. brenneri viz Bacillus cereus, Providencia rettgeri*, and two *Bacillus* sp. *Caenorhabditis brenneri* is not yet widely studied even though it is closely related to *Caenorhabditis elegans*, the model organism. Other samples that were positive for the presence of nematodes were not yet identified since the study is still on-going. Herein we also report that there was no nematode species identified so far that are pathogenic to humans.

REASONS FOR BREAKING-UP? THE USE OF MITOCHONDRIAL GENES AND POPULATION GENETICS IN DETERMINING THE GENETIC DIFFERENTIATION OF *ROUSETTUS AMPLEXICAUDATUS*

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Recent studies show the high genetic divergence of Philippine fruit bats from other Southeast Asian specimens based on their cytochrome oxidase subunit I (COI) gene, posing the questions of whether (1) species in the Philippines belong to a species of their own and (2) whether populations classified as one species in the Philippines represent different species. In this study, we elaborate the extent of the genetic differentiation of Philippine fruit bats by examining the case of the Southeast Asian endemic *Rousettus amplexicaudatus* (Geoffroy's Rousette).

First, we barcoded 13 samples of *R. amplexicaudatus* sampled in different locations in the Philippines and compared them with other populations found outside the Philippines using BLAST (Basic Local Alignment Search Tool) and constructing a neighbor-joining tree. Second, we determined the genetic differentiation of the species in other gene regions by extracting individual genes from the assembled whole mitochondrial genome of *R. amplexicaudatus* and subjecting each individual gene to BLAST. Lastly, we compared the genetic differentiation of *R. amplexicaudatus* in Luzon and Mindanao populations by using 10 microsatellite markers.

We found that Philippine samples clustered separately from populations found outside the Philippines (Malaysia, Vietnam, and Laos) when using the COI gene region. Comparison of individual gene regions with the genetic database show low genetic divergence (2-3%) of Philippine specimens with Papua New Guinea using the 16S (97.33%) and 12S (98.35%) rRNA genes and high genetic differentiation (>6%) with other Philippine specimens using the control region. However, there were no significant genetic differentiation (Fst<0.05) between populations of *R. amplexicaudatus* found in the Philippines based on 10 microsatellite markers.

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A CALL FOR SEAHORSE CONSERVATION: 16S rRNA METABARCODING ANALYSIS OF MICROBIAL COMMUNITIES ASSOCIATED WITH *Hippocampus barbouri*:

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Seahorse (*Hippocampus spp.*) are popular among traditional medicine for its therapeutic claims. Seahorse' demand became high and the population is threatened due to overexploitation, incidental by-catch and degradation of habitats. Among various species of seahorse, *Hippocampus barbouri* is one that is currently listed on the Appendix II of CITES and on the IUCN Red List of Threatened Species. Such status paved way to conduct studies in understanding the microbial community of seahorse to provide useful information about seahorse husbandry, health management and conservation measures. Henceforth, this study was designed to evaluate the bacterial composition associated with *Hippocampus barbouri* including the water and sediments of its natural habitat. Samples were collected from Cantiasay Island in Surigao del Norte, Philippines. DNA of the bacterial communities from the skin and gut of *Hippocampus barbouri*, the water, and the sediments were extracted and identified through 16S-based metagenomics analysis. Result shows that there were 929,803 amplicon sequence reads representing all the samples with corresponding 711 total operational taxonomic units. P*hyla Proteobacteria, Firmicutes, Bacteroidetes, Actinobacteria, Planctomycetes, Cyanobacteria*, and *Chloroflexi* were the most prominent phylum observed with 38 classes, 85 orders, 157 family and 318 genera. These bacterial communities obtained from *H. barbouri* are greatly influenced by the host environment while few were exclusive. Findings on bacterial communities present may shed light on the therapeutic claims of seahorses and help in conservation of the species.

A TOOL FOR SEAHORSE CONSERVATION: METABARCODING USING 16s rRNA GENE OF BACTERIAL COMMUNITIES DETECTED FROM THE SKIN MUCUS OF *Hippocampus comes*

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This study classified and identified the bacterial composition of *Hippocampus comes* and its surrounding water obtained from Hanigad Island, Surigao del Norte, Mindanao, Philippines. DNA was extracted and the bacterial community associated on the skin mucus, gut content as well as the carriage water were classified up to family level using the 16s rRNA-based metabarcoding analysis. A total of 739, 236 amplicon sequence reads corresponding to 676 total operational taxonomic units were obtained from the three metabarcoding libraries in this study. Proteobacteria is significantly the most dominant bacterial phyla in all samples followed by Fermicutes. A total of 36 different classes and 139 families were identified, 14 of which had shared presence in all samples while others were exclusive to different sample. This study revealed some bacterial families associated on *H. comes* and its carriage water with important medicinal properties which may have contributed to the healing properties of seahorses. The baseline data gathered on this study served as a source of inspiration for biomedical research and drug discovery for treating diseases relevant to the use of seahorses in traditional medicine.

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Furthermore, future test on the bacterial families with medicinal properties is needed in order to confirm its importance thus, help alleviate pressure on wild seahorse and aid in conservation.

PETIOLE ANATOMY CHARACTERS DELIMITING EUPOLYPODS I FAMILIES *SENSU* PPG

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The families within eupolypods I has been a subject of taxonomic controversies which needs to be addressed. This study investigated the functionality of petiole anatomy characters to 21 selected species of eupolypods I. Field work was conducted and the petiole of the samples were processed in the laboratory, following standard fixation and dehydration procedures. Anatomical characters were utilized for cluster analysis using Gower of Paleontological Statistics (PAST) software and generated five clusters (Cluster 1 - S-shaped xylem, Cluster II - C-shaped xylem, Cluster III - Hook-shaped xylem, Cluster IV - Arc-shaped xylem, U and V-shaped vascular bundles, and Cluster V - arc-shaped xylem, semi-circle vascular bundles). Also, the dendrogram grouped the species within their respective families, except for Dryopteridaceae. The important characters that delineate and classify species of eupolypods I are the xylem shape, vascular bundle shape, and number. The study demonstrated that petiole anatomy is a valuable tool in the taxonomy of eupolypods I.

LEAD TOLERANCE AND ANTIOXIDANT ACTIVITY OF *Andrographis paniculata* (Burm.f.) Nees

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Andrographis paniculata, commonly called "Sinta" is a common medicinal plant in the Philippines. However, there are reports that some medicinal plant species absorb and accumulate large amounts of heavy metals in their tissues, thereby posing risk to human health. This study aimed to assess the ability of *A. paniculata* to absorb and accumulate increasing levels of lead in the soil and determine the effects of these different concentrations on the chlorophyll content, total phenolic content and antioxidant activity of *A. paniculata*. In this study, it was shown that *A. paniculata* is tolerant to high levels of Pb in the soil. The plants showed no visual symptoms of lead toxicity even at the highest concentration of 1000 ppm Pb added to the soil. Almost three-fourths of the total Pb absorbed by the plant accumulated in the roots and only small amounts were translocated to the stems and leaves. Phenolic content of the leaves increased when 200 mg/L lead was applied to the soil compared to the control. However, when the concentration was increased to 400, 600, 800 and 1000 mg/L, phenolic content remained unchanged. Antioxidant activity (% FRSA) significantly increased with increasing concentration of lead with the highest antioxidant activity in plants applied with 1000 mg/L lead.

MORPHOMETRIC ANALYSES OF SEA GRAPES (*Caulerpa spp.*) IN SELECTED REGIONS IN THE PHILIPPINES

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Sea grapes or locally known in the Philippines as "lato" or "ar-arusip" are economically important macroalgae belonging to the edible species of the genus *Caulerpa*. This study characterized and compared morphologically distinct populations of sea grapes and described the influence of physico-chemical parameters of seawater on their morphology from selected regions in the Philippines. Morphometric, cluster and principal component analyses showed that morphological plasticity exist in sea grapes species (*Caulerpa lentillifera and Caulerpa racemosa*) found in different sites in the Philippines. These are evident in morphometric parameters namely, assimilator height, space between assimilators, ramuli diameter and number of rhizoids on stolon wherein significant differences were found. This evident morphological plasticity was analyzed in relation to physico-chemical parameters of the seawater. Assimilator height of *C. racemosa* is significantly associated and directly influenced by water depth, temperature, salinity and dissolved oxygen whereas in *C. lentillifera* it is affected by depth and salinity. Highest assimilator height of sea grapes was found in Coron and Culion in Palawan due to higher salinity and temperature while in Mactan, Cebu, it is primarily attributed to lower depth and higher salinity values.

MORPHOLOGICAL CHARACTERIZATION AND SSR-BASED DNA FINGERPRINTING OF CASSAVA (*Manihot esculenta* Crantz) VARIETIES RELEASED BY THE NATIONAL SEED INDUSTRY COUNCIL (NSIC)

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The genetic variability of 47 cassava varieties released by NSIC was evaluated through morphological characterization and DNA fingerprinting using Simple Sequence Repeat (SSR) markers. Phenotypic similarities based on 34 morphological descriptors were observed in varieties sharing a common parent. Fifty polymorphic SSR markers were used to construct DNA fingerprints. A total of 648 polymorphic alleles and 764 unique banding patterns were observed among the 47 varieties. The polymorphism information content (PIC) values ranged from 0.46 to 0.95, with an average of 0.83. Each variety had a unique banding profile indicating that SSR markers were useful in distinguishing cassava varieties. A wider genetic diversity of cassava varieties was detected in SSR data (70%) compared to morphological data (50%) showing that SSR markers are more effective in determining the extent of variation between genotypes. The DNA fingerprints of cassava varieties have been successfully generated which can be used as a benchmark for varietal identification and authentication of released cassava varieties.

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DIVERSITY, ABUNDANCE AND SPATIAL DISTRIBUTION OF MOLLUSKS ALONG THE INTERTIDAL ZONES OF ILLANA BAY, PHILIPPINES

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Being one of the major fishing grounds in the country, Illana Bay is of particular interest for surveying intertidal mollusks. Nowadays, these are declining due to human disturbances. In this paper, molluskan composition, diversity and distribution were determined in eight (8) sampling stations. All live molluscan species encountered were properly counted and recorded. A hierarchical cluster analysis was performed to determine similarity between and among groups. Analysis of variance (ANOVA) was used to compare the diversity variables according to sampling sites. A total of 51 intertidal mollusk species representing 11 species of bivalves and 40 species of gastropods were obtained. The bivalve recorded was from 5 families while the gastropod recorded was from 14 families. Based on percent similarity of species composition, four main clusters were formed. The first cluster (similarity at 25%) was formed by 3 sampling stations (Dumalinao, San Pablo and Tabina). A second group, at 20% similarity, was formed in Pagadian while the 3rd and 4th cluster were formed below 15% similarity (formed in Labangan and Tukuran and Dinas and Dimataling repectively). The results of the analysis undertaken in the present study showed that the grouping of stations appeared to be are due to habitat structure, length of the intertidal area, presence of vegetation and human disturbance. Meanwhile, mollusks diversity and abundance have close connection with vegetation (seaweed and seagrass presence) and substrate composition. It is expected that this study may provide insights to future research on molluskan status in Illana bay.

GREEN SYNTHESIS OF CARBON QUANTUM DOTS USING LAMBDA-LIKE CARRAGEENAN FROM THE MARINE RED ALGA *Halymenia duryvillei* BORY DE SAINT-VINCENT

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Carbon quantum dots (CQDs) designate a novel class of carbon nanomaterials comprised of quasispherical nanoparticles with sizes<10nm. Their small size, strong fluorescence, intrinsic biocompatibility, and chemically inert structure render them useful for applications in drug delivery and bioimaging, among many others. This study used the red alga Halymenia durvillei, which possesses high amounts of lambda-like carrageenan, as a carbo precursor. CQDs were synthesized from both algal biomass and lambda-like carrageenan via one-step hydrothermal treatment and characterized by UV-visible, Fourier transform infrared sprectroscopy (FT-IR), and transmission electron microscopy (TEM). CQD stability was also observed using PL intensity vs time. The synthesized CQDs from the algal biomass and carrageenan are well dispersed in water and showed bright blue fluorescence under the UV-light (λ_{cx}=365 nm) which can last for months. The results of this study will help establish H. durvillei and its carrageenan constituent in nanomaterials research. Ultimately, it will expand the limited knowledge on marine algae as CQD precursors, and support efforts aiming to synthesize and characterize low-cost, clean, and non-toxic CQDs with potential biotechnological applications from diverse green resources.

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INORGANIC CARBON UTILIZATION OF TROPICAL CALCIFYING MACROALGAE AND SURVIVAL OF THE *RHODOLITH SPOROLITHON* SP. (SPOROLITHALES: RHODOPHYTA) UNDER LONG-TERM LOW-PH CONDITIONS

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The increasing atmospheric CO_2 has led to the increased level of dissolved CO_2 in the ocean. The concomitant reduction in pH is known as ocean acidification (OA). Such changes in seawater carbonate chemistry have several impacts on marine life. The physiological response of tropical calcifying macroalgae to this global stressor have ecological implications because of their functional roles as shelters, reef-builders and primary producers in tropical marine ecosystems. This study investigated the long-term effects (40 days) of OA on the physiology, calcification and skeletal integrity of a molecularly identified rhodolith *Sporolithon* sp. Samples were collected from Bolinao, Pangasinan and were incubated under two pH treatments (pH 7.9 = ambient and pH 7.5 = OA) in a temperature-controlled (26 ± 0.02 °C) room provided with saturating light intensity (114.42 ± 7.5 µmol photons m^{-2} s^{-1}). After the experimental treatment period, growth rate, calcification rate, nutrient uptake rate, moisture, organic and inorganic content, pigments, and tissue C, N and P of Sporolithon samples were compared. OA significantly reduced the growth rate, calcification rate and skeletal $CaCO_3$ content by 65%, 66% and 22%, respectively. On the other hand, nutrient uptake rates, organic matter, pigments and tissue C, N and P were not affected by the low pH treatments. The results suggest that the rhodolith *Sporolithon* sp. is susceptible to the negative effects of OA. Under future OA conditions, the survival of tropical calcifying macroalgae, particularly the rhodoliths, may be compromised with knock-on effects due to their functional roles in coral reef ecosystems.

REPRODUCTIVE OUPUT AND SEX RATIO OF THE SOFT CORAL *LOBOPHYTUM* SP. (OCTOCORALLIA: ALCYONACEA) IN BOLINAO-ANDAREEF COMPLEX, PANGASINAN

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Many regions have reported declining coral populations and communities due to natural and human-induced disturbances including the Philippines. Soft corals may proliferate and serve as stabilizing agent to some degraded reef community when hard corals' population collapse. Thus, understanding the early life history of corals can help understand coral recruitment and recovery on the reef. The soft coral *Lobophytum* sp. is a dimorphic encrusting alcyonacean commonly found in Bolinao-Anda reef complex, Pangasinan. Here, we quantify the production of oocytes and spermaries per polyp of *Lobophytum* sp. from random colonies (n=73 colonies) ranging from 6.5 to 48.5 cm average colony diameter. Tissue samples were dissected and examined histologically to confirm the sexes of colonies. Our results showed that *Lobophytum* sp. is a gonochoric broadcast spawner with 1:1.1 female to male sex ratio (n=221 colonies) in the population. The balanced sex ratio and distance between males and females ranged from 1 to few meters may permit successful fertilization. Female colonies produced two size

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classes of oocytes (small and large) occurring simultaneously in each polyp. Average number of immature (<250 μm) and mature (>300 μm) oocyte per polyp (±SD) was 8.5 (±3.9) and 6.7 (±3.9), respectively. While mean immature and mature oocyte size (±SD) was 110.72 μm (±14.74) and 386.04 μm (±40.02), respectively. Average spermaries per polyp for male colonies was 39.2 (±22.48). Thus, these reproductive traits seen in Lobophytum sp. may provide valuable insights to their successful distribution and abundance in the study site.

TRANSCRIPTOMIC ANALYSIS OF THREE VERMIVOROUS CONE SNAILS (SUBGENUS *RHIZOCONUS*, GASTRPOPODA, MOLLUSCA): INSIGHTS TO THERAPEUTIC APPLICATION

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Cone snails constitute one of the most diverse taxonomic groups of predatory marine invertebrates with over 750 species. Each species synthesizes ~100-400 peptide toxins, called conotoxins or conopeptides, which are the primary constituents of its venom. Conotoxins have been established as agonists or antagonists of human ligand- or voltage-gated ion channels and have thus gained popularity as potential peptide-based drugs. A conotoxin isolated from *Conus magus* has in fact been successfully developed as an anti-pain drug known as Ziconotide (Prialt). This resulted in the surge of researches involving conotoxin mining using next generation sequencing and omics approach.

Although extensive research has been carried out on *Conus,* conopeptide diversity in worm hunting species of the subgenus *Rhizoconus* remains poorly understood. Several studies on worm hunting cone snails have already resulted in identification of vertebrate-targeted conotoxins, suggesting that other vermivorous cone snails may also serve as potential sources of conopeptides with therapeutic applications.

This study aims to profile the conopeptides and nonconopeptides present in the venom gland transcriptomes of the three vermivorous cone snails *Conus capitaneus, Conus miles,* and *Conus mustelinus*, all in the *Rhizoconus* clade. Using bioinformatic tools, the transcriptome assemblies were evaluated for quality and completeness, mined for conotoxins using BLAST and HMMER, followed by classification of the predicted conotoxins into gene superfamilies, cysteine frameworks, and predicted pharmacological activity. This study provides insights into the potential of worm-hunting cone snail venom peptides as marine natural product candidates for drug discovery. Further studies involving proteomics and bioassays are suggested to characterize and identify the potential pharmacological targets of these candidate conotoxins.

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THE USE OF BAYESIAN BELIEF NETWORKS (BBNS) IN PREDICTING *ALEXANDRIUM* AND *SKELETONEMA* BLOOMS IN BOLINAO PANGASINAN, PHILIPPINES

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Harmful Algal Blooms (HABs) cover a heterogeneous set of events by phytoplankton species with negative impacts on health, environment, as well as causing economic losses to aquaculture, fisheries, and tourism. Bolinao had previously been affected by these events with PSP (Paralytic Shellfish Poisoning) caused by *Alexandrium* sp. in 2003 and *Skeletonema* sp. blooms documented in 2005 & 2010 where fish kills occurred. As most HABs are monospecific events, understanding its autecology and physicochemical requirements becomes crucial in the identifying the factors that drive these complex events. To determine the most significant physicochemical parameters causing individual blooms of these two species, a relatively new technique that combines machine learning and traditional statistics called Boosted Regression Trees (BRT) was used. Then, Bayesian Belief Networks (BBNs) which are probabilistic and acyclic graphical representation of variables' cause-effect relationship were then developed. BBN models were built to assess combined influence of climate, nutrient conditions, and physical oceanographic processes that trigger *Alexandrium* and *Skeletonema* blooms. Historical data (2002-2014) from MSI (biological and physicochemical), PAGASA (climatological), and satellite images (SST and PAR) were used for the said models to ultimately determine the environmental factors these species are most sensitive to, determine their probability of occurrence, and predict future trends as influential environmental variables fluctuate.

INFLUENCE OF SHALLOW-WATER VENTS ON SURVIVAL OF VARIOUS CORAL SPECIES IN MABINI, BATANGAS

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Submarine groundwater discharge (SGD) are any flow of water often an overlooked contributor to the nutrient exchange from land to ocean. The prominence of shallow-water vents in Mabini, Batangas has been recognized to emit springs with CO2 bubbles resulting in an acidic environment, a feature of coastal acidification. This threatens the structural complexity of coral reef ecosystems, particularly on calcification of reef-building corals, which may lead to lower ecosystem goods and ecological services. Field-based experiments are important to advance our knowledge on local stressors of coral communities as well as their physiological responses in areas which mimics the predicted seawater conditions by the year 2100. Selected colonies of *Porites* sp. and *Platygyra* sp. were fragmented to 5 cm^2 and attached to 7 x 7 cm tiles, acclimatized in a coral nursery with ambient seawater conditions, then deployed and attached on the substrate of the Non-Vent (Control) and Vent (SGD) sites. These fragments were deployed for observation after 3 months. Ninety coral nubbins for the *Porites* sp. were deployed for each site, and in addition 30 coral nubbins from *Platygyra* sp. Based on preliminary investigation a month after, a number of *Porites* sp. nubbins that were deployed in the Vent site were bleached especially those that were near the vent conduits while the *Platygyra* sp. did not have those observable changes. Nubbins that were left in the Non-Vent site remained undisturbed. Further observation should be done to establish the effect of the Vent site on the deployed nubbins.

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EFFECTS OF CO_2-INDUCED ACIDIFICATION ON THE GROWTH AND PHYSIOLOGY OF *Alexandrium minutum* AND *Chaetoceros calcitrans* IN LABORATORY CULTURES

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Increasing CO2 leads to a consequent decrease in seawater pH in a process called ocean acidification (OA). Under these changing conditions, studies have shown a potential shift in the dominant phytoplankton species within a community. For this study, *Alexandrium minutum* represents a harmful algal bloom (HAB) dinoflagellate species that was seen to dominate in conditions with low pH, while *Chaetoceros calcitrans* represents a non-toxic diatom that has been found to be more abundant in conditions with relatively ambient pH. The study was done in a temperature and light controlled environment for a duration of 4 weeks with pH manipulation achieved through the use of a mass flow controller unit (MFCU). Daily cell counts were collected for analysis of growth rates while toxin analysis was accomplished on a weekly basis to show how each species will respond to the CO_2–induced decrease in pH. Growth rates from both *A. minutum* and *C. calcitrans* showed negative initial responses due to acidification, but recovered in the later weeks. For toxin production, *A. minutum* exhibited increased toxin production in acidified conditions during week 1 and 2 but decreased for all treatments in the later weeks. The results showed that both species adjusted during the first two weeks of exposure to lowered pH but eventually adjusted to the change in conditions towards the end of the experiment.

PHYLOGENY OF AEROMONAD BACTERIOPHAGES

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Bacteriophages ¬are considered vital in the microbial ecosystems for their role in bacterial mortality and evolution. However, there are limited studies about phages in the country which hinder further understanding of the nature of these viruses. This study employs a polyphasic approach in classifying bacteriophages through determination of phenotypic characteristics, including stability of phages in different environmental conditions (pH, temperature, saline concentrations), and genotypic properties using signature genes *g23, phoH, terL*, and *g37*. Twenty-seven (27) previously isolated *Aeromonas hydrophila* phages were acquired from the UST-Bacteriophage Ecology, Aquaculture, Taxonomy, and Systematics (BEATS) Reference Collection and was initially propagated using the host bacterium, *A. hydrophila* PNCM 10089. Subsequent stability tests were performed by exposure of phages in different pH, temperature and salinity ranges to determine breadth of phage infection. Similarity between the phenotypic characteristics of phages were analyzed according to source samples. Sewage and Lake phages were stable and

produced substantial to complete clearing at wide range of pH and temperature, with optimal bacterial lysis at pH 7 and 40°C. Phages from river and pond samples produced optimal clearing when maintained at pH 7 and resulted to a substantial clearing at the temperature range of 25-30°C. Host range using 5 *A. hydrophila* Bacteriophage Insensitive Mutants (BIMs) were done, resulting to substantial to no clearing, indicating that the optimal infection of phages maybe limited to the original host strain. Phages showed a decrease in titer (PFU/mL), with 70 to 80% reduction of plaques formed when exposed to high saline concentrations (20% NaCl w/v).

Keywords: Bioinformatics, Marker Genes, Phage Stability, Phage Ecology

IMPACT OF MADDEN-JULIAN OSCILLATION ON PHILIPPINE RAINFALL DURING BOREAL WINTER

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Intraseasonal variability in the tropics is modulated by Madden-Julian oscillation (MJO), a large-scale convective disturbance which propagates eastward across the equatorial Indian Ocean and western-central Pacific at a rate of 5 ms^{-1}. Impact of MJO on Philippine rainfall during boreal winter of 1987-2017 was studied using composite analysis of rainfall, convective and circulation anomalies. MJO events have been defined using the RMM index. Compositing analysis used strong MJO events (amplitude greater than 1) to obtain the mean for each MJO phase. Normally, Philippines experiences a northeasterly wind with convection mostly occurring in the Eastern Philippines. High amount of rainfall is experienced in the windward direction while places in the leeward direction receive no or less rainfall. However, rainfall was found to deviate from normal winter values coherent with the MJO phases, with generally negative anomalies during phases 1,2,3,7 and 8 (MJO convective center in Indian Ocean and western Hemisphere) and positive anomalies during phases 4-6 (MJO convective center in Maritime Continent and Western Pacific). The greatest impact of MJO occurred in type I and III climate regions (dry climate during boreal winter) which experienced enhanced (suppressed) rainfall during rainy (dry) phases of MJO. MJO's influence on rainfall can be explained not just by the direct influence of tropical convective anomalies but also by the result of enhancement (suppression) of the winter monsoon, induced anomalous low (high) sea level pressure, rising (sinking) air and troughs (ridges). "Active" (days of strong MJO events with positive rainfall anomaly in conjunction with MJO rainy phases) and "break" (days of strong MJO events with negative rainfall anomaly in conjunction with MJO dry phases) during strong ENSO years have also been studied. There was observed higher number of breaks during El Nino, normal years and 1988-1989 and 2007-2008 La Nina while active days were dominant during 1998-1999 and 1999-2000 La Nina. Several non-typhoon associated floods coincided with MJO rainy events during 1988-1989 and 2007-2008 La Nina. The dominance of breaks during La Nina 1988-1989 and 2007-2008 and MJO associated flooding was hypothesized to be due to strong MJO amplitudes.

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IDENTIFICATION AND POLYPHASIC CHARACTERIZATION OF A RED HALOPHILIC ARCHAEON FROM A SOLAR SALTERN

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Halophilic archaea have huge potential in the industrial and biotechnological applications. The Philippines, being an archipelago with more than 7,000 islands, is one of the countries with the highest coastline-area ratio. This high coastline to area ratio possibly implies mor e habitats for halophiles. In spite of this, only a few studies have been done on haloarchaea in the Philippines. Thus, it is the aim of this study to carry out a polyphasic characterization on a previously isolated red halobacterium, Strain RHB-CT, based on the proposed minimal standards for description of new taxa in the Order *Halobacteriales*. Cells of strain RHB-C^T were pleomorphic and Gram-negative. Growth occurred at pH 6.5-8.5 and 10-30% NaCl concentration with optimal growth at pH 7.0-7.5 and 25% NaCl. Magnesium was not required for growth; however, optimal growth was observed at 0.2-0.4M $MgCl_2$ concentration. The following substrates were utilized for growth as sole sources of carbon and energy: glucose, sucrose, fructose, maltose and galactose. Sensitivity to different antimicrobial agents were tested. RHB-C^T was found susceptible to trimethoprim/sulphamethoxazole, bacitracin, novobiocin, rifampin and penicillin and resistant to chloramphenicol, gentamicin, ciprofloxacin, neomycin, erythromycin, ampicillin/sulbactam, tetracycline and ampicillin. Phylogenetic analysis was done based on 16S rRNA and rpoB' gene markers. 16S rRNA gene sequence similarity analysis indicated that the strain belonged to the genus *Halorubrum* and was closely related to *Halorubrum xinjiangense* (99.04%), *Halorubrum sodomense* (98.77%), *Halorubrum coriense* (98.77%), *Halorubrum litoreum* (98.77%), *Halorubrum trapanicum* (98.42%) and *Halorubrum distributum* (98.08%). Phylogenetic analysis based on the rpoB' gene sequences showed that strain RHB-C^T was closely related to strain *Halorubrum xinjiangense (*96.89%), *Halorubrum sodomense* (96.07%), *Halorubrum coriense* (96.28%), *Halorubrum litoreum* (96.78%), *Halorubrum trapanicum* (96.17%), and *Halorubrum distributum* (96.89%). The DNA G+C content of the strain was found to be 68.69 mol%. The phenotypic, chemotaxonomic and phylogenetic properties suggested that strain RHB-C^T represents a novel species of the genus *Halorubrum*.

TAXONOMIC MICROBIOME PROFILING AND ABUNDANCE PATTERNS IN THE CACAO (*Theobroma cacao* L.) RHIZOSPHERE TREATED WITH BIOCHAR AND ARBUSCULAR MYCORRHIZAL FUNGI

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Biochar and arbuscular mycorrhizal fungi (AMF) are two agricultural interventions being adapted by farmers in improving the growth of crops in nutrient-deficient acidic soil. These interventions have been previously observed to enhance agricultural production and nutrient cycling by influencing the physicochemical and biological properties of the rhizosphere. Biochar

may serve as a refuge for colonizing microbial communities and influences mycorrhizal activities by altering biological processes that affect mycorrhizae. This greenhouse study investigated the changes in prokaryotic diversity in the rhizosphere of cacao plants grown in acidic soil with arbuscular mycorrhizal fungi (AMF) and bamboo biochar (BB) for 15 months under nursery conditions. Metagenomic analysis of the V3-V4 region of 16S rRNA gene of the rhizosphere with AMF, 15% BB, and AMF+15% BB revealed that the diversity within sample was reduced by addition of AMF and BB. Of all Operational Taxonomic Units (OTUs) recovered, the top three abundant phyla in the treated soils were: *Proteobacteria, Acidobacteria* and *Actinobacteria*. The relative abundances of *Proteobacteria* and *Acidobacteria* increased with the treatments, whereas that of Actinobacteria was decreased. In addition, biochar greatly increased the unclassified genera under order *Acidobacteriales* and *Chromatiales* whereas AMF strongly increased the abundance of unclassified genus under order *Xanthomonadales*. Moreover, the genus *Rhodoplanes* was the most dominant in AMF+15% BB-treated soil with a relative abundance of 9.4%, whereas *Bacillus* (7.7%) was the most abundant in untreated soil. Based on its beta diversity, Principal Coordinate Analysis (PCoA) revealed that the microbial communities across samples were separated and distinct from each other. The samples shared only 4.9% of the total OTUs, whereas 1475, 610, 593, and 439 unique OTUs were observed in the control, +AMF, 15% BB, and AMF+15% BB, respectively. Most of the increased genera has been reported to play important roles in nitrogen cycling, which may contribute in cacao growth promotion.

TRANSCRIPTOMIC COMPLEXITY OF THE VENOM REPERTOIRE IN CLOSELY RELATED PISCIVOROUS CONE SNAIL SPECIES

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The genus *Conus* is a highly diverse group of venomous marine gastropods, each expressing a complex mixture of bioactive peptides, called conopeptides, in its venom for various biological interactions. Despite the plethora of conopeptides available in nature, only a small fraction has been reported and characterized thus far. Here, the venom composition in three sister species of the fish-hunting *Pionoconus* clade, *Conus magus, Conus stercusmuscarum* and *Conus striolatus*, was characterized by venom gland transcriptomics. A total of 160, 77 and 104 unique putative toxin peptides representing 33 known and 12 potentially novel conopeptide gene superfamilies were identified in the three *Pionoconus* species. The predicted conopeptides display a diverse set of cysteine frameworks in their mature regions, as well as a wide array of possible molecular targets within their prey. Only a few toxin gene superfamilies dominate the transcriptomes in terms of peptide diversity and expression, suggesting a crucial role in their predation and defense. Overall, this study describes the remarkable complexity of the venom repertoire in individual *Conus* species, even among closely related species. Our findings present great insights into the fish-hunting strategies of piscivorous cone snails together with findings from previous behavioral studies, as well as future opportunities on drug discovery and development.

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GENOMIC ANALYSIS OF PUTATIVE AHPND-CAUSING VIBRIO PARAHAEMOLYTICUS ISOLATES FROM SHRIMP AQUACULTURE FARMS IN MINDANAO ISLAND

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Shrimp is a major Philippine fishing product, contributing 45.9 million U.S.D. to the total fisheries exports in 2018. However, the country's shrimp farms suffer from destructive diseases, one of which is Acute Hepatopancreatic Necrosis Disease (AHPND) caused by a virulent strain of *Vibrio parahaemolyticus*, a well-documented marine shrimp pathogen. The AHPND-causing *V. parahaemolyticus* strain possesses a virulence plasmid, pVA1, harboring genes that encode the binary toxins $PirA^{VP}$ and $PirB^{VP}$ that cause sloughing of the hepatopancreatic tubule cells of infected shrimp, leading to early pond-wide mortality. To gain insight on their pathogenicity, genomes of putative AHPND-causing *Vibrio* spp. from shrimp aquaculture farms in Mindanao Island were analyzed through a functional genomics bioinformatics workflow. Illumina MiSeq reads from shrimp-associated bacterial isolates were pre-processed in FastP prior to *de novo* assembly via SPAdes, assessment using Quast, species assignment with pyANI, and annotation with Prokka. The draft genomes of confirmed *V. parahaemolyticus* isolates were probed to detect the presence of virulence factors (VFs), antibiotic resistance genes (ARGs), virulence plasmid sequences, and AHPND toxin genes. The isolates' sequence types (STs) were also determined through *in silico* multi-locus sequence typing (MLST). A total of thirteen bacterial genomes were analyzed, seven of which were confirmed *V. parahaemolyticus* belonging to six STs. Sequence type 415 was found to be most common and the type III secretion system 1 (T3SS1) is the common VF detected. The obtained genetic and genomic profiles can inform preventive measures and disease management interventions to mitigate economic losses from the country's shrimp aquaculture industry.

SUITABILITY OF RICE THIOREDOXIN h (OsTRXh) PROMOTER IN IMPROVING THE IRON AND ZINC CONTENT IN RICE ENDOSPERM

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Iron (Fe) deficiency is a highly prevalent micronutrient deficiency and is the most common cause of anemia. Rice biofortification is one approach to help alleviate Fe deficiency. In this study, rice thioredoxin h1 (OsTRXh1) promoter was evaluated for its tissue-specific expression by driving *β-glucoronidase* (GUS) reporter gene and its ability to increase Fe and Zn in polished grains without affecting agronomic performance by driving *rice nicotianamine synthase 2 (OsNAS2)*. OsNAS2 is an enzyme which synthesizes nicotianamine (NA), a chelator and precursor to deoxymugineic acid (DMA). NA and DMA are both involved in Fe as well as zinc (Zn) uptake. The expression analysis OsTRXh1 promoter showed strong expression particularly in vascular tissues. OsTRXh1 promoter may be useful to drive expression in vascular tissues. *OsTRXh1::OsNAS2* event, IRS441-271, obtained the highest increase of 9.5 mg/kg Fe and 34 mg/kg Zn in polished rice

with no significant difference in agronomic performance compared to wild type (WT). OsTRXh1 promoter was effective in driving *OsNAS2* and consequently increasing Fe and Zn content in polished grains. The use of rice genes to increase Fe and Zn content in polished rice grains shows that cisgenic plants can be developed and may help improve consumer acceptance for future product development.

EVALUATION OF SINGLE NUCLEOTIDE POLYMORPHISM (SNP) MARKERS ASSOCIATED WITH WATERLOGGING TOLERANCE IN CORN (*Zea mays* L.)

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None of the assessed SNP-containing QTLs overlapped with the biosynthesis of ethylene and alcohol dehydrogenase which are essential genes for the waterlogging tolerance. However, this study revealed that 2 SNPs from these QTLs overlapped with Flavonoid 3'-monooxygenase gene *(CYP75B1)* and Very-long- chain (3R)-3-hydroxyacyl-CoA dehydratase gene *(PAS2)*, and were predicted to activate deleterious missense variant (PZE09123105094) and splice donor variant (PZE0814653797), respectively. However, unlike what was predicted by the bioinformatics tool SIFT, mutant CYP75B1 protein due to the SNP PZE09123105094 may not actually manifest a drastic effect since the alternative amino acids P369 and L369 are both very non-reactive and not involved in protein function. Both amino acids are hardly located within protein active and binding site. Moreover, an aberrant PAS2 protein may emerge due to SNP PZE0814653797 leading to exon deletion and premature stop codon omitting its active site. It was challenging to generate a single band during PCR amplification using wild type and mutant allele-specific primers based on the target SNPs. Both primers were still able to amplify the target sequences. Expression analysis and functional studies of CYP75B1 and PAS2 are recommended to assess their actual role in waterlogging tolerance in maize. Presence of SNPs or mutations within these genes might not have correlation with waterlogging tolerance in maize alone but could impose negative consequence even in normal condition.

MOLECULAR CHARACTERIZATION AND SSR MARKER DEVELOPMENT OF KASII AND KASIII OIL GENES IN COCONUT (*Cocos nucifera* L.)

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Coconut oil, a major product derived from coconut, is rich in medium chain fatty acid, particularly lauric acid (C12), which is of economic importance in the oleochemical and food industry. Developing new approaches in manipulating fatty acid composition in coconut oil can be achieved by understanding the roles of genes responsible for oil production, specifically the β-ketoacyl ACP synthases (KAS) II and III, which are involved in the condensation and elongation of fatty acids. This study reports the first characterization of *KASII* and *KASIII* genes isolated from 10-11 month coconut Catigan Dwarf (CATD) endosperm cDNA. The candidate sequences were used to validate the predicted sequences of coconut *KASII* and *KASIII* genes

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found in the published genome. The predicted *KASII* was validated while the *KASIII* had an unexpected unmapped exon region. *KASII* and *KASII*I were mapped to genome contigs 35 and 13, respectively and were predicted to have open reading frame (ORF) with 561 and 409 amino acids, respectively.

SSR markers MK299, MK317, MK832, and MK853 were designed and used to genotype a genetic mapping population. MK299 and MK317 exhibited Mendelian inheritance while MK832 and MK853 exhibited segregation distortion. The physical and genetic linkage of these SSR markers were also validated. The findings from this study can be used to annotate the mapped oil genes based on the published CATD genome assembly. Furthermore, the designed SSRs can be used as immediate markers for genetic linkage analysis and quantitative trait loci (QTL) mapping for high yield and outstanding quality of copra oil.

DEVELOPMENT OF DNA MARKERS FOR SEX DETERMINATION IN PILI (*Canarium ovatum* Engl.)

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Pili (*Canarium ovatum* Engl.) is an indigenous fruit species in the Philippines and is widely cultivated in the Bicol region. Recently, pili has gained importance in the international market due to its nutritional and industrial uses. It is dioecious, but only 1:25 male to female ratio is needed to have profitable yield. Sex of dioecious plants is difficult to identify at the seedling stage, thus, this study aimed to develop DNA markers for sex determination in pili using sex-specific primers and optimum polymerase chain reaction (PCR) conditions. Using the *Bgl16* primer, a DNA marker with 553 bp at 42 ^{o}C annealing temperature and was obtained in female individuals only. A new primer pair was designed based on the nucleotide sequence of this female DNA marker. Moreover, *SRY* primers showed a unique banding pattern for hermaphroditic individuals showing a 900 bp amplicon at 40.3^{o}C annealing temperature. Hence, the *SRY* primers could be used to determine hermaphrodites in pili. Analysis of the morphological characteristics suggested that hermaphrodites did not differ in growth habit, ability to bear fruit and leaf morphology with male and female trees. However, the floral morphology varied among them. Male and hermaphrodite flowers had stamen and a vestigial ovary while the female flower showed a distinct pistil, enlarged ovary and a non-functional stamen. The size of the fruits (33.92 g, 7.18 cm long) of the female trees was significantly larger than that of the hermaphrodite trees (24.38 g, 4.59 cm long). The study has developed a DNA marker for female and hermaphrodite individuals and the first report of DNA markers for sex determination in pili.

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TGW6 TARGETED KNOCKDOWN VIA CRISPR-CPF1 SYSTEM ENHANCES GRAIN WEIGHT IN ELITE RICE VARIETIES

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An estimate of 3.5 billion people depends on rice as their staple food. Increasing its production is a major challenge. One approach in tackling this is through genome engineering of yield-related genes in elite rice varieties. THOUSAND GRAIN WEIGHT 6 is known to influence grain weight. In this study, *TGW6* was knocked down in IR64 and Samba Mahsuri (SM) using Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR)-Cpf1 system. CRISPR Cpf1 vector construct (IRS-1466) was assembled to target TGW6 in both IR64 and Samba Mahsuri. Transgenic IR64 and Samba Mahsuri were analyzed for sequence variation in the promoter region. The analysis revealed high cutting efficiency for CRISPR-CPf1. SM-1RS1466 had 81.7% while IR64-IRS1466 displayed 94.34% cutting efficiency. Phenotypic data showed significant increase in grain number and total grain weight of SM-IRS1466 and IR64-IRS1466 compared to the wild type controls. The thousand-grain weight of SM-IRS1466-285 increased by 26% while the total grain weight of SM-IRS1466-26 increased by 33.5%. On the other hand, thousand grain weight of IR64-IRS1466-145 increased by 16.27%. while the total grain weight of IR64-IRS1466-02 increased by 105.11% (more than double compared to the control). These results reveal that targeted knockdown of TGW6 increases grain weight and consequently yield.

TRANSMISSION DYNAMICS OF *Toxocara canis* IN MAYONDON,LOS BAÑOS, LAGUNA: SEROPREVALENCE, ENVIRONMENTAL RESERVOIRS, AND RISK FACTORS

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Few studies have been conducted in the Philippines to quantify the potential risks associated with toxocariasis. This study was conducted to determine the factors that contribute to the transmission dynamics of toxocariasis via seroprevalence, and identification of environmental reservoirs and risk factors from the environment in Barangay Mayondon, Los Baños, Laguna. Serum samples from 50 public school children (ages 8-13) were tested using a *Toxocara canis* IgG ELISA kit. In addition, 60 randomly selected households were sampled for the presence of *Toxocara* eggs in their pet dogs and soil using fecalysis and modified sucrose flotation, respectively. Survey questionnaires were given per household to determine potential risk factors. Results of the ELISA test showed that 60% of the public school children were positive for toxocariasis, while *Toxocara* ova were detected in 38.3% of the soil samples and 28% of the fecal samples collected. Deworming and socio-economic level of the owners were significantly correlated to the risk factors ($p < 0.05$). Results show of the study highlights the potential risks of toxocariasis infection of residents in Barangay Mayondon. Strict implementation of ordinances related to responsible pet ownership and proper sanitation may help mitigate the transmission of toxocariasis in the area.

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PHILOMETRID NEMATODE INFECTING THE OVARIES OF JAPANESE THREADFIN BREAM *Nemipterus Japonicus* (BLOCH, 1791): PREVALENCE, INTENSITY, AND EFFECT ON REPRODUCTIVE POTENTIAL

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The parasitic nematode, *Philometra nemipteri,* has long been observed in the ovaries of Japanese threadfin bream (*Nemipterus japonicus*) locally known as "*bisugo*" in Manila Bay, Philippines. However, there are no studies regarding the extent of the effects of this parasite on the health and reproductive biology of the host, and the taxonomic identification of the parasite remains poorly investigated. In this study, *P. nemipteri* was described through microscopy, SEM, and molecular characterization. Its prevalence in female *N. japonicus* and effects on host fecundity were then evaluated. Among the 817 female *N. japonicus* sampled between August (2018) and January (2019), overall prevalence of infection in the ovary was 56.1% (458/817) and intensity of infection ranges from 1 to 14 worms per host. Histopathology revealed infected ovaries showing live and dead worms, follicle displacement, tissue fibrosis, tissue necrosis, granuloma, macrophages and lymphocytic infiltration. The mean fecundity was found to be significantly higher in uninfected individuals [121,490.81 (± 9442.58) eggs per ovary] than infected ones [73,818.58 (± 3456.40) eggs per ovary]. Thus, *P. nemipteri* infection in *N. japonicus* adversely affects the fish reproductive potential. In countries wherein the fisheries industry contributes to large portion of the economy, such effects on fish production pose threats to food security.

Keywords: Nemipterus japonicus, Philometra nemipteri, fecundity, histopathology, Manila Bay

OPTIMAL LOCATION OF SENSORS FOR EARLY DETECTION OF TSUNAMI WAVES

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Tsunami early detection systems are of great importance as they provide time to prepare for a tsunami and mitigate its impact. In this paper, we proposed a way in determining the optimal location of a given number of sensors to report a tsunami as early as possible. We used three population-based algorithms namely genetic algorithm with multi-parent crossover, particle swarm optimization algorithm and rainfall optimization algorithm, to solve the optimization problem. Computation of wave travel times were done using two methods: by recreating wave propagation using an approximation of wave velocity, and by solving the 2D nonlinear shallow water equations.

SOLUTIONS OF NEUTRAL DELAY DIFFERENTIAL EQUATIONS USING A GENERALIZED LAMBERT W FUNCTION

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The Lambert *W* function is defined by $W(a)e^{W(a)} - a = 0$. One of the many applications of the Lambert *W* function is in solving delay differential equations (DDEs). In 2003, Asl and Ulsoy provided a solution of some DDEs in terms of the Lambert *W* functions. However, the solutions are limited to differential equations with delay in the state variable. T.C. Scott et.al in 2006 introduced a generalized Lambert function which was further studied by Mezo and Baricz in 2017. In our work, we show that this generalization of the Lambert *W* function provides an analytical solution to neutral delay differential equations (NDDEs). NDDEs are DDEs with time delay not only in the state variables but also in the derivative terms. Furthermore, we present a numerical method to solve NDDEs using the generalized Lambert *W* function. We implement our method to examples with known solutions.

ON THE COMPUTATION OF A BANK'S MINIMUM CAPITAL REQUIREMENT FOR OPERATIONAL RISK USING ADVANCED MEASUREMENT APPROACH

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In this paper, we present the use of Advanced Measurement Approach (AMA) on the computation of minimum capital requirement of a bank for operational risk under Basel II guidelines. Loss Distribution Approach is used as the specific method under AMA for the calculation. An example is shown using sample internal data for loss frequency and loss severity as well as expert opinions to be able to use Bayesian analysis under LDA. Loss frequency and loss severity are modelled under discrete and continuous distributions, respectively. Parameters are estimated using the maximum likelihood estimation and the models are validated using different goodness-of-fit tests like QQ plot, Kolmogorov-Smirnov Test, Anderson-Darling Test, and Chi-Squared Test. Monte Carlo simulation method is then used to compute for the value-at-risk at 99.9^{th} percentile, giving us the minimum capital requirement of the bank for operational risk. The result is then compared to the expert opinions in order to be verified. This provides us one of the main factors in reducing the chance of severe operational losses for the following reporting year.

**Adviser*

A MATHEMATICAL MODEL ON THE TRANSMISSION OF SCHISTOSOMIASIS IN THE PHILIPPINES

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Schistosomiasis, a parasitic disease caused by *Schistosoma japonicum*, is one of the neglected tropical diseases and remains endemic in the Philippines covering 28 provinces in 12 regions. Unlike other species of *Schistosoma, Schistosoma japonicum* is a zoonotic parasite which infects other mammalian hosts aside from humans. With that nature of the parasite, we construct a mathematical model to study the transmission dynamics of schistosomiasis in the Philippines. Here, we consider humans and carabaos as definitive hosts, and snails as intermediate hosts. We conduct stability analysis on the proposed model, and calculate for the basic reproduction number, R_0. We also perform sensitivity analysis using the partial rank correlation coefficient (PRCC) technique to investigate how the model output is affected by the changes in model parameters. Using the available Philippine schistosomiasis data from the Department of Health (DOH), we estimate some model parameters in our proposed model.

A PERTURBED ACCELERATED GRADIENT DESCENT ALGORITHM USING AN n-DIMENSIONAL GOLDEN SECTION SEARCH METHOD

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Gradient descent has been widely studied specifically on its limitations in escaping saddle points, determining global optima, and solving ill-conditioned problems. Previous researches perturb the iterations using stochastic methods. We propose a deterministic alternative that employs the accelerated gradient descent as the global search and the n-dimensional golden section search as the local search.

The n-dimensional golden section search is a novel generalized technique for optimization of convex problems by subsequently enclosing the optimum until convergence. The n-spherical coordinate system is used to adjust the search space as an equidistant ball centered on the iterate. Partitioning can also be implemented in the algorithm for multimodal problems.

The algorithm is tested using benchmark functions with different characteristics e.g. steepness, presence of several local minima, and convex properties. In comparison with other gradient-based methods such as the conjugate gradient and the steepest descent, the hybridized global-local search escapes saddle points and converges to global minimum even on ill-conditioned problems.
Furthermore, the algorithm is applied to: (1) parameter estimation of the Fitzhugh-Nagumo model, a system of differential equations on neuronal dynamics, (2) restoration of blurry and noisy signals using the Tikhonov-TV regularization, and (3) a single-layer artificial neural network applied on dataset classification.

MODIFIED HIERARCHICAL SHELTER LOCATION-ALLOCATION MODELS

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In calamity-prone countries such as the Philippines, provision of temporary shelters to affected communities are of invaluable importance. However, identifying standard-based shelters to minimize the victims' evacuation time without carefully planning the location and number of shelters to be built may cause inefficient relief distribution and larger transportation and maintenance cost. Indeed, studies have shown the impact of shelter location on the efficiency of evacuation. There are several shelter location-allocation models present in literature particularly on hierarchical shelters, or shelters catering to time-varying levels of victims' needs. These models aim to select the position of minimal number of temporary shelters that will optimize evacuation time as well as construction and maintenance cost.

This paper presents four novel hierarchical shelter location-allocation models that modify transfer ability and distance minimization objective of the existing ones. The first model allows the allocation of victims to any level of shelter while permitting the transfer of lower-level shelters to higher-level shelters. The second model requires the victims to be allocated to lower-level shelters before transferring to higher-level shelters. The third model allocates the victims to only one level of shelter without any transfer. Finally, the fourth model selects the location and allocates the victims to shelters closest to their communities and workplace. The existing and modified models are applied to a test problem using particle swarm optimization.

EVALUATION OF THE NEUTRON SPECTRA IN A LINEAR ACCELERATOR FACILITY USING A MODIFIED BONNER SPHERE SPECTROMETER (mBSS)

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Radiotherapy using linear accelerators (LINACs) plays an unparalleled role in the management of cancer due to its capability to deliver localized dose to ill tissues. LINACs operating above 10 MV are more advantageous in certain treatment plans, however, neutrons are generated as a byproduct through the photonuclear interactions between the high-energy photons and high-Z materials in the accelerator head and room structures, as well as interaction with patients. Neutrons may contaminate the therapeutic photon dose; hence, the measurement of neutron doses is important in radiation protection. Neutron spectrometry covers a wide neutron energy range for a more accurate assessment of the neutron dose.

Lung Center of the Philippines has a 15 MV Varian Clinac Cx LINAC for radiation therapy. The neutron energy spectra generated by the said LINAC were evaluated at three locations using the modified Bonner Sphere Spectrometer developed by PNRI. The mBSS system consists of several high-density polyethylene shells with an indium foil central detector. Indium foil exploits the detection reaction $^{115}\text{In}(n,\gamma)^{116m}\text{In}$, emitting gamma rays from ^{116m}In which were

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then counted using an NaI(Tl) scintillator. From the obtained gamma spectrum, the neutron flux and the saturation activity at each point were calculated. The highest neutron flux and saturation activity were both obtained in the isocenter, the point closest to the radiation source. The neutron spectra were derived using the Frascati Unfolding Interactive Tool. This study aspires to give information of the neutron spectra to help in evaluating the radiation protection protocols against neutron contamination and shielding.

IMAGE QUALITY EVALUATION OF A HYBRID ITERATIVE RECONSTRUCTION ALGORITHM IN THE MULTI-SLICE COMPUTED TOMOGRAPHY SCANNER FOR THE PEDIATRIC HEAD DIAGNOSTIC PROCEDURE

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Despite high radiation doses from computed tomography (CT), pediatric head CT procedures have increased. Dose reduction protocols – such as the iterative reconstruction (IR) algorithm – have been developed. Dose reduction is essential, especially for children. However, it is also necessary to ensure that the implementation of a dose reduction CT protocol does not degrade CT image quality. This study focused on the image quality evaluation and dose reduction capabilities of the hybrid IR 'iDose^4' algorithm in the 256-slice CT scanner for the pediatric head diagnostic procedure. The ACR CT phantom was used for image quality evaluation. The displayed $CTDI_{vol}$ values were used for dose reduction assessment. For the image quality evaluation, the calculated objective metric parameters were the contrast-to-noise ratio (CNR), signal-to-noise ratio (SNR), standard deviation (SD), noise power spectrum (NPS), modulation transfer function (MTF), and task transfer function (TTF). Three different pediatric age groups were considered. The parameters were determined from the images produced at the tube current-time product (mAs) and the filtered backprojection algorithm currently used. The mAs values were then reduced and the different level settings of the iDose4 were applied. The CNR and SNR increased, the SD and NPSr peak curve amplitude decreased, and the spatial resolution (TTF) improved for the images reconstructed using the iDose4. The noise texture appearance of images reconstructed at different level setting became smoother and less grainy when compared to the FBP images. The iDose^4 also showed a CTDIvol reduction of 8.42% to 26.19% without degrading image quality. Moreover, it has been shown that reduced mAs values matched with specific iDose4 reconstruction levels for each age group could be utilized for a dose-reduced pediatric brain plain CT protocol.

MEDIUM CHAIN TRIGLYCERIDE AND CEREBRAL KETONE BODY METABOLISM

Abigail R. Espina and Angelyn R. Lao*

Alzheimer's disease (AD) still remains as one of the world's incurable progressive neurodegenerative disorder that causes drastic structural brain atrophy and affects multiple brain functions. Cerebral glucose metabolism, which is responsible for ATP production, gradually slows down due to advanced aging where notably a healthy adult brain experiences an 8% lower cerebral metabolic rate (CMR) as compared to a huge decline of 20-40% CMR

in AD patients. Also, cerebral glucose hypometabolism, which is also associated with senile plaque density, is a presymptomatic feature of AD and significantly contributes to AD's future development and progression. With these, several converging researches suggest that ketone bodies (KB) can augment the normal glucose supply of the brain and can repair vulnerable cells to increase mitochondrial efficiency. Moreover, numerous studies suggest that a ketogenic intervention such as an Medium-Chain Triglyceride (MCT)-induced intervention can increase the brain's energy availability and might delay further cognitive decline in AD patients. In this presentation, I will discuss different models (both biological and mathematical) related to ketone body metabolism and its connection to the brain. I will also present the initial model that I built to study the effect(s) of MCT on KB and brain metabolism.

PREDICTING THE SURFACE PLASMON RESONANCE OF FE_3O_4-Au SPHERICAL NANOPARTICLES FOR SERS APPLICATIONS

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Surface-Enhanced Raman Scattering (SERS) has been used in different fields due to its advantages such as recognition capabilities, non-destructive analysis, and minimal sample preparation. SERS provides high signal enhancements especially at nanostructured metallic surfaces. It is generally accepted for spherical nanoparticles that, if the surface plasmon resonance of a SERS nanoparticle matches with the laser wavelength used in Raman spectroscopy, higher signal enhancements can be achieved.

In this study, the Surface plasmon resonances and SERS enhancement factor were investigated for Fe_3O_4-Au core-shell nanoparticles with increasing gold coating thickness using the Finite Element Method. Numerical simulations were done to solve the Maxwell's equation in the Electromagnetic waves, Frequency Domain interface available in COMSOL Multiphysics®. The model calculates the scattering of a plane wave of light off of a core-shell nanoparticle. Calculations were also done using the DDSCAT Fortran code that applies discrete dipole approximations to compute the extinction spectra on the nanoparticle. The plasmonic resonance was observed through extinction spectrum as well as the localized electric field in the nanoparticle. Results show that as the gold thickens, the surface plasmon resonance blue shifted. In addition, the maximum SERS enhancement factor was found to decrease. These results would provide useful indications for monitoring the synthesis of the magnetic core-shelled nanoparticle, as well as for the development of coupling magnetic nanoparticles to a noble metal for surface enhanced Raman spectroscopy applications.

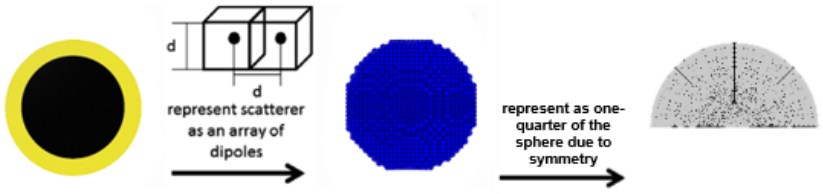

Figure 6. Iron Oxide – Gold Nanoparticle Model for DDA and FEM

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COMBINATORIAL AND TOPOLOGICAL PROPERTIES OF A FAMILY OF RANDOM SUBSTITUTIONS

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The combinatorial and topological properties of a large class of substitutions called the random noble Pisa substitutions are studied. It is shown that each member of this family is a primitive irreducible Pisot substitution. Moreover, these substitutions are random generalisations of the deterministic Fibonacci substitution known to be non-recognisable. Using a specialised construction, it is established that a random noble Pisa substitution admits recognisable words at all levels. It is proven that random noble Pisa substitutions are not topologically mixing. Noted in the end is a weaker mixing property and the possibility of this family satisfying the said property.

Keywords: Pisot substitution, random substitution, semi-mixing, topological mixing.

THE SET CHROMATIC NUMBERS OF THE MIDDLE GRAPH OF GRAPHS

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In the area of graph colorings, much research has been done on the topic of neighbor-distinguishing colorings and the effects of graph operations on the chromatic numbers associated with these colorings. First introduced by Chartrand, Okamoto, Rasmussen, and Zhang in 2009, one example of a neighbor-distinguishing coloring is called the set coloring, which is defined as follows: For a simple connected graph *G, let c:V(G)→N* be a vertex coloring of G, where adjacent vertices may be colored the same. The *neighborhood color set of a vertex v,* denoted by NC(v), is the set of colors of the neighbors of *v*. The coloring c is called a *set coloring* provided that *NC(u)≠NC(v)* for every adjacent pair of vertices *u* and *v*. The minimum number of colors needed for a set coloring of *G* is referred to as the *set chromatic number of G* and is denoted by χ_s *(G)*. In the literature, the set chromatic number has been studied with respect to some graph operations such as join, corona, and comb product. In this work, the set chromatic number of graphs is studied in relation to three other well-studied graph operations: middle graph, total graph, and central graph. Our results include the exact set chromatic number of the middle, total, or central graphs of some families of graphs and some bounds on the set chromatic number of general graphs obtained using these operations.

ON POINT-COLOR-SYMMETRIC GRAPHS AND GROUPS WITH POINT-COLOR-SYMMETRIC PICTURE REPRESENTATION

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In 1979, Chen and Teh introduced the concept of point-color-symmetric (PCS) graphs, combining point symmetry (i.e., vertex transitivity) and an analogous concept we can call "color symmetry," and determined a necessary and sufficient condition for a graph to be PCS. Extending this, Marcelo et al. in 1994 defined conditions for a PCS graph to be a PCS picture representation (PPR) for a group and also determined a necessary and sufficient condition for a group to have a PPR. However, the determination of all groups with a PPR is not yet complete. This paper investigates and proves the existence or non-existence of a PCS edge coloring for some families of graphs (e.g., circulant graphs, hypercube graphs) and the existence or non-existence of a PPR for certain families of groups (e.g., dihedral groups, alternating groups, some finite Coxeter groups, direct products of some groups).

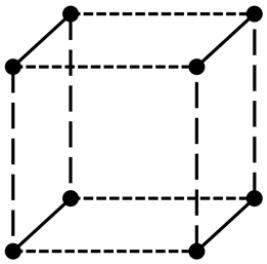

Figure 7. A PCS graph: the hypercube graph Q_3, formed by the vertices and edges of the 3-dimensional cube, is a PPR for the group $\mathbb{Z}_2^3$. In general, the n-dimensional hypercube graph Q_n is a PPR for the group $\mathbb{Z}_2^n$.

N_2-VERTEX COLORING OF SOME FAMILIES OF GRAPHS AND GRAPH OPERATIONS

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Let G be a graph. A vertex coloring ψ of G is called N_2-vertex coloring if $|\psi(v)| \leq 2$ for every vertex v of G, where $\psi(v)$ is the set of colors of vertices adjacent to v. Let $t_2(G)$ be the maximum number of colors used in an N_2-vertex coloring of G. We determine the $t_2(G)$ for some families of graphs and graph operations. We also provide some upper and lower bounds for the $t_2(G)$. Also, we obtain the condition where $t_2(G)_{=n}$ and some conditions where $t_2(G)=2$.

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ON EFFICIENT ZERO RING LABELING OF SOME CLASSES OF TREES

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A zero ring is a ring in which the product of any two elements is zero, which is the additive identity. A zero ring labeling of a graph is an assignment of distinct elements of a zero ring to the vertices of the graph such that the sum of the labels of any two adjacent vertices is not the zero element in the ring. Given a zero ring labeling of a graph, if the cardinality of the set of distinct sums obtained from all adjacent vertices is equal to the maximum degree of the graph, then the zero ring labeling is *efficient*. In this paper, we showed the existence of an efficient zero ring labeling for some classes of trees and their disjoint union. In particular, we showed that an efficient zero ring labeling exists for some families of the following classes of trees: path graphs, star graphs, bistars, centipede graphs, caterpillars, spiders, lobsters, and rooted trees.

UNCERTAINTY PRINCIPLE IN A SEPARABLE HILBERT SPACE

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Let *X, Y* be Hilbert spaces over $\mathbb{R}$, $T: X \to Y$ be a bounded linear transformation, and denote the range of T by R(T). Suppose $y \in Y \setminus R(T)$ and $\{x_n\}_{n=1}^{\infty} \subseteq X$ such that $Tx_n \to y$. Then approximate solutions $\{x_n\}_{n=1}^{\infty}$ blow up, i.e., $||x_n|| \to +\infty$. Consequently, $Tx=y$ has no solution but has approximate solution, i.e., $y \in \overline{\mathcal{R}(T)} \setminus \mathcal{R}(T)$. We construct an explicit example of a function $\varphi:(0,+\infty)\to(0,+\infty)$ which depends on y such that φ is increasing and the limit of $\varphi(s)$ as s approaches 0 from the right is 0. Finally, we obtain an uncertainty principle inequality of the form $\varphi(||Tx - y||)||x|| \geq c$ for some constant c.

**Adviser*

FAULT-TOLERANT LOCATION-DOMINATION OF SOME GRAPHS

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This study focuses mainly on the concept of fault-tolerant location-domination in graphs. It intends to characterize the fault-tolerant LD-sets of some special graphs and some graphs resulting from some binary operations and determine the fault-tolerant location-domination number of these graphs. Main results generated in this study include the following: (i.) characterize the fault-tolerant locating-dominating sets of some special graphs; (ii.) characterize the fault-tolerant locating-dominating sets of some graphs resulting from some binary operations of graph; (iii.) determine bounds and exact value for the fault-tolerant location-domination number of some special graphs; and (iv.) determine bounds and exact value for the fault-tolerant location-domination number of some graphs resulting from some binary operations of graph.

A ONE DIMENSIONAL PARAMETRIZED TEST FUNCTIONS SPACE OF ENTIRE FUNCTIONS

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Inspired by the construction of Kondratiev test functions in infinite dimensional analysis, this paper obtains the nuclear space of entire test functions. More precisely, for parameter $0 \leq \beta \leq 1$ and $p = 0,1,2,\ldots$, the inner product $(f,g)_{p,\beta} = \sum_{n=0}^{\infty} a_n \overline{b_n}\, e^{pn}(n!)^{1+\beta}$ defines a countable system of nondecreasing Hilbertian norms and constructs a family of Hilbert spaces $\{\mathcal{H}_p^{\beta}\}_{p=0}^{+\infty}$ of entire functions. The functions in $\mathcal{H}_p^{\beta}$ are entire of at most $\frac{2}{1+\beta}$ order growth and type not more than $\frac{(1+\beta)}{2}e^{\frac{-p}{1+\beta}}$. Moreover, the linear space $\mathcal{E} = \cap_p H_p^{\beta}$ is countably Hilbert and Fréchet space. Also, $\mathcal{E}$ is a nuclear space of entire functions of order growth at most $\frac{2}{1+\beta}$ and of minimal type, endowed with the projective limit topology.

**Adviser*

CODING THEORY AND HYPER BCI-ALGEBRAS

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The notion of a hyper BCI-valued function on a set is introduced, and related properties has been investigated as A.T. Surdive , N. Slestin and L. Clestin have done for a hyper BCK-algebras. We constructed the codes generated by a hyper BCI-valued function. Moreover, we will provide an algorithm which allow to find a hyper BCI-algebra starting from a given binary block code.

MINIMUM DOMINATING MAXIMUM DEGREE ENERGY OF GRAPHS OBTAINED FROM SOME GRAPH OPERATIONS

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In the study of spectral graph theory, the adjacency matrix, the Laplacian matrix, and other related matrices were essential in obtaining the spectra of certain matrix associated with some graphs and with the spectra of these matrices, we can find some useful information about graphs. The energy of a graph was first defined by I. Gutman in 1978 and its concept came from theoretical chemistry. Let G be a simple graph of order n with vertex set V(G)={$v_1, v_2, \ldots, v_n$} and edge set $E(G)$. A subset S of $V(G)=V$ is called a dominating set of G if every vertex of $V \setminus S$ is adjacent to some vertex in S. Any dominating set with minimum cardinality is called a minimum dominating set and the cardinality of such dominating set is the domination number of the graph G denoted by $\gamma(G)$. A dominating set D with $|D|=\gamma(G)$ is called the γ-set of G. The minimum dominating maximum degree matrix of G is the $n \times n$ matrix defined by $A_{DM}(G)=(a_{ij})$ where

$$a_{ij} = \begin{cases} \max\{d(v_i), d(v_j)\}, & if\ v_i v_j \in E(G) \\ 1, & if\ i = j\ and\ v_i \in D \\ 0, & otherwise \end{cases}$$

and its characteristic polynomial is denoted by $f_n(G,\lambda) = det(\lambda I - A_{DM}(G))$. The eigenvalues of the graph G are the eigenvalues of $A_{DM}(G)$ and the minimum dominating maximum degree energy of G is defined as $E_{DM}(G)= \sum_{i=1}^{n} |\lambda_i|$. In this paper, we establish results for the minimum dominating maximum degree energy of graphs resulting from some graph operations and also, construct an upper bound for r-regular graph, path (P_n) and cycle (C_n).

ON CHROMATIC TRANSVERSAL DOMATIC NUMBER OF GRAPHS UNDER SOME SGRAPH BINARY OPERATIONS

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This study deals with the chromatic transversal domatic number of some graphs, another graph invariant introduced by L. Benedict Michael Raj, S. K. Ayyaswamy, and I. Sahul Hamid which uses the concept of coloring and domination. A dominating set S of G is called a chromatic transversal domination set (*ctd*-set) if S has non-empty intersection with every color class of every λ-partition of G. The minimum order of a *ctd*-set of G is the chromatic transversal domination number of G and is denoted by $\gamma_{ct}(G)$. The chromatic transversal domatic number of a graph G is the maximum order of a partition of V into *ctd*-sets of G and is denoted by $d_{ct}(G)$. In this paper, the chromatic transversal domatic number of graphs like the cocktail-party graph, windmill graph, dutch-t-windmill graph, helm graph, the join of graphs G and H where either G or H are complete or both are noncomplete, the Cartesian product of graphs, and the corona of graphs are determined. Furthermore, we will find a graph in which $d_{ct}(G)=a$ and $d(G)=b$ for a given two positive integers a and b, where $a \leq b$.

ANALYSIS OF A MATHEMATICAL MODEL OF HIV TRANSMISSION BASED AND ITS CONTROL STRATEGIES

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The Department of Health (DOH) of the Philippines keeps a record of the number of reported HIV positive individuals and it is available online. In the reports, the predominant mode of transmission is by sexual contact, which is divided into three categories, namely, male-female sex, male-male sex, and female-female sex. In this study, we propose a mathematical model that represents the dynamics of the transmission of HIV considering these various sexual preferences. Stability analysis is performed on the equilibrium points of the system and the reproductive number R_0 are estimated on each equilibrium points. Intervention strategies that can be incorporated in the model are investigated and real-life implications are studied.

**Adviser*

PARTIALLY ORDERED MULTIPLICATIVE HYPERRING

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In this study, we introduce the notion of multipicative hyperring , $(R, +, \otimes)$ besides a binary relation $\leq$, where $\leq$ is a partial order that satisfies the conditions: (1) If $a \leq b$ then $a+c \leq b+c$, that is for any x in a+c then there exists a y in b+c such that $x \leq y$. (2) If $a \leq b$ then $a \otimes c \leq b \otimes c$, that is for any x in aCc there exists a y in $b \otimes c$ such that $x \leq y$. This structure is called the ordered multiplicative hyperring. Furthermore, we present several examples of ordered multiplicative hyperring and prove some results in this respect. By using the notion of pseudoorder on an odered multiplicative hyperring $(R, +, \otimes)$ we obtain an ordered ring. Moreover, we study some properties of pseudoorder on an ordered multiplicative hyperring.

LOCAL STABILITY ANALYSIS: PREDATOR-PREY SYSTEM WITH HARVESTING

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The effect of constant-rate harvesting has been investigated by many authors that there are very rich and interesting behaviours in the dynamics of the predator-prey system. This paper studies the effect of harvesting on the predator-prey model of N.H.Mohammad. It is assumed in this study that the prey outside the refuge and predator are harvested with constant rates. The stability of the system when prey inside the refuge is growing exponentially is analyzed explicitly. Bifurcation point has been computed and numerical simulations are made in this paper. Moreover, the stability analysis is also studied when the time delay is considered on the predator's functional response term.

CALCULATION OF TRANSITION PROBABILITIES IN THE BIRTH AND DEATH MARKOV PROCESS IN THE EPIDEMIC MODEL

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Birth and death processes are important tools in epidemiologic studies. They are used to model the number of particles in a system in which the jumps of a particle from a particular state are only allowed to neighboring states. A jump to the right represents birth with an increase by one of the number of particles in a system, and a jump to the left represents death with a decrease by one of the number of particles. Any change of state is called a transition. In this study, we consider birth and death processes that are continuous-time Markov processes on the state space of non-negative integers. In the general birth and death process with k particles, a birth occurs with instantaneous rate λ_k and a death with instantaneous rate μ_k. The process is characterized by a tri-diagonal transition rate matrix. This Markov process is reasonably applied

to an epidemic modeling of the spread of disease in a community, which determines the number of infected individuals after time *t*. In particular, the transition probabilities are used to obtain the number of infected individuals in birth and death epidemic modeling. In view of this, this paper calculated the transition probabilities in the general birth and death Markov process applied to the epidemic model using matrix method with constants birth and death rates. Specifically, a compact form of the characteristic polynomial corresponding to the transition rate matrix is given. Moreover, an algorithm for computing these transition probabilities is developed.

θ_s- OPEN SETS AND OTHER VARIATIONS OF TOPOLOGICAL CONCEPTS

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This study introduces the concept of θ_s-open set and describe its connection to some other well-known concepts such as the classical open, θ-open, ω -open, ω_θ -open and the semi-open sets. It will be shown that the collection of all θ_s -open sets in a topological space X forms a topology on X.

This paper also introduces the concepts of θ_s -open and θ_s -closed functions and θ_s -continuous function from an arbitrary topological space into the product space. Moreover, the concept of θ_s-connectedness will be defined and characterized.

ON A GENERALIZATION OF FEEDBACK VERTEX SETS: THEORY AND ALGORITHM

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A feedback vertex set (FVS) of a graph is a set of vertices whose removal leaves a graph without cycles. It is an NP-complete problem in computational complexity theory. FVS has already been widely applied to operating systems, database systems, and in chip designs. Currently, it has been emerging as an important tool in mathematical tool in mathematical formulations for understanding biological and chemical systems. In this work, we define a generalization of the FVS, namely, the k-FVS, which is the set of vertices whose removal leaves a graph with at most k cycles. With this definition, the classical FVS is just the 0-FVS. Moreover, one can then define the corresponding generalizations of variants of FVS such as connected k-FVS and independent k-FVS of some simple connected graphs, formulated the k-FVS problem's corresponding integer linear program, and develop some algorithms for special classes of graphs.

Adviser

THE COMPLEXITY OF SOME GRAPHS

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A spanning tree of a graph G is a spanning subgraph of G that is a tree. The number of spanning trees of G is the complexity of G and is denoted by $\tau(G)$. In this paper, the complexity of edge-chain $\mathscr{C}_m$ of graphs C_4 and prism graph R_n are determined using deletion and contraction method.

ON THE Φ-STRONG LUZIN INTEGRAL IN LOCALLY CONVEX TOPOLOGICAL VECTOR SPACES

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In this paper, we introduced the Φ-Strong Luzin condition for functions with values in a locally convex topological vector space. Using these condition, we define the Φ-Strong Luzin (Φ-SL) integral. Moreover, we show the equivalence of Φ-SL and SH1 integrals.

SEMITOTAL *k*-FAIR DOMINATION IN GRAPHS

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Let G be a graph without isolated vertices. For an integer k ≥1, a *k-fair dominating set (kfd-set)* is a dominating set S ⊆ V(G) such that $|N_G(u) \cap S| = k$ for every $u \in V(G)\setminus S$. A set $S \subseteq V(G)$ is a *semitotal k-fair dominating set* in G if S is a k-fair dominating set in G and for every x ∈ S, there exists $y \in S\setminus\{x\}$ such that $d(x,y) \leq 2$. The *semitotal k-fair domination number* of G, denoted by $\gamma_{kf}^{t2}(G)$, is the minimum cardinality of a semitotal k-fair dominating set. In this paper, we introduce and investigate the concept of semitotal k-fair domination and determine $\gamma_{kf}^{t2}(G)$ for some special graphs G. We also characterize the semitotal k-fair dominating sets in the join, corona, lexicographic product and Cartesian product of graphs and determine the exact value or sharp bounds of the corresponding semitotal k-fair domination number.

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ON THE PLANARITY OF A DIRECTED PATHOS TOTAL DIGRAPH OF SOME SPECIAL ARBORESCENCE GRAPHS

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An arborescence graph is a directed graph in which, for a vertex u called the root, and any other vertex v, there is exactly one directed path from u to v. The directed pathos of an arborescence A_r is defined as a collection of minimum number of arc disjoint open directed paths whose union is A_r. For an arborescence A_r, a directed pathos total digraph $Q=DPT(A_r)$ has vertex set $(Q)=V(A_r)\cup A(A_r)\cup P(A_r)$, where $V(A_r)$ is the vertex set, $A(A_r)$ is the arc set, and $P(A_r)$ is a directed pathos set of A_r. The arc set $A(Q)$ consists of the following arcs:

- ab such that $a,b \in A(A_r)$ and the head of a coincides with the tail of b;
- uv such that $u,v \in V(A_r)$ and u is adjacent to v;
- au (ua) such that $a \in A()$ and $u \in V(A_r)$ and the head (tail) of a is u;
- Pa such that $a \in A(A_r)$ and $P \in P(A_r)$ and the arc a lies on the directed path P;
- $P_i P_j$ such that $P_i P_j \in P(A_r)$ and it is possible to reach the head of P_j from the tail of P_i through a common vertex, and it is also possible to reach the head of P_i from the tail of P_j.

In this study, the concepts on planarity, outerplanarity, maximal outerplanarity, minimally nonouterplanarity, and crossing number being applied to $DPT(A_r)$ are discussed. The problem of reconstructing a directed pathos total digraph from an arborescence graph is presented. Further, planarity, outerplanarity, internal vertices of these directed pathos total digraph of A_r are also discussed.

INTERIOR PERFECT HOP DOMINATION IN GRAPHS UNDER SOME BINARY OPERATIONS

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Let $G = (V(G), E(G))$ be a simple graph. A subset S of $V(G)$ is an interior perfect hop dominating set of G if S is a subset of the interior set of G, $Int(G)$ and for every u in $V(G)\setminus S$ there exists a unique vertex v in S such that $dg(u,v) = 2$. The smallest cardinality of an interior perfect hop dominating set of G, denoted by γ_{Iph}, is the interior perfect hop domination number of G. This study characterizes the interior perfect hop dominating set of graphs resulting from the lexicographic product and Cartesian product of two graphs

**Adviser*

ON θ_{sw}-OPEN SETS AND ITS CORRESPONDING TOPOLOGICAL CONCEPTS

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This study introduces the concepts of θ_{sw}-open and describe its relationship to the other well-known concepts such as θ-open, ω_θ-open, ω-open, *somewhat*-open, and the classical open sets. Moreover, the concepts θ_{sw}-open and θ_{sw}-closed functions between topological spaces will also be defined and characterized. Related concepts such as θ_{sw}-connected space and θ_{sw}-continuous functions from an arbitrary topological space into product space will also be introduced and characterized.

GENERALIZED TOPOLOGY OF INTUITIONISTIC FUZZY SETS VIA NEIGHBOURHOOD SYSTEMS

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Let X be a nonempty set. A collection γ of an intuitionistic fuzzy sets in X is an intuitionistic fuzzy generalized topology if $0_{\sim} = (\bar{0}, \bar{1}) \in \gamma$and γ is closed under countable union where $\bar{0}$ and $\bar{1}$ are fuzzy sets in X defined by $\bar{0}(x) = 0$ and $\bar{1}(x) = 1$ for all $x \in X$.

This paper introduces the concept of a generalized neighbourhood systems on the set of an intuitionistic fuzzy points in a nonempty set X. Also, we construct an intuitionistic fuzzy generalized topological space using the concept of a generalized neighbourhood systems. Moreover, the notion of continuity of two intuitionistic fuzzy generalized topological spaces are introduced and investigated.

ON TOPOLOGICAL G-ALGEBRAS

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This paper introduces the concept of topological G-algebra. The notions of G-algebra topological space and topological G-algebra are defined. Some properties of topological G-algebras and a characterization of topological G-algebra with respect to neighborhoods are proved. Moreover, the separation axioms for topological G-algebra are investigated. The relative topology induced by a topological G-algebra on a subalgebra of a G-algebra is also discussed.

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EPIDEMIOLOGICAL MODELLING OF THE POPULATION DYNAMICS OF BEE COLONIES

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Bees are increasingly in demand as pollinators for various key agricultural food crops, but globally are in decline which leads to increase of bee colony failure rates. This scenario highlights a need to understand the conditions in which colonies flourish and in which colonies fail. In lieu of this, a model which combines the infection dynamics within a bee colony with the demographic dynamics of the colony incorporating time delay to determine the success or collapse of the colony under different scenarios is proposed in this paper. Qualitative analysis, including sensitivity analysis, and quantitative analysis and/or numerical simulations on the effects of infection on bee population dynamics were performed. The model suggests that the key factors in the survival or collapse of a bee colony in the face of an infection are the rate of transmission of the infection and the disease-induced death rate. Moreover, the study shows a clear distinction between an exposure of a bee colony to an environmental hazard and an exposure to an infectious disease. Incorporating time delay in the system suggests that there is a significant difference on the severity of the mortality rate compared to the normal demographic dynamics of the bee colony that will determine the survival or collapse of a bee colony.

THE ESSENTIAL SELF-ADJOINTNESS OF THE BENDER-DUNNE BASIS OPERATORS

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The Bender-Dunne operators, given by

$$T_{-m,n} = 2^{-n} \sum_{k=0}^{n} \binom{n}{k} q^k p^m q^{n-k}$$

where q and p are the position and momentum operators, respectively, are densely defined operators on the Hilbert space of square integrable functions which form a basis for constructing time of arrival operators. We consider the self-adjoint properties of the operators $T_{-m,n}$. We solve for its deficiency indices to investigate its essential self-adjointness.

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MAGNETIC AND SEMICONDUCTING HYDROGEN-FUNCTIONALIZED DI-VACANCY GRAPHENE: A DFT STUDY

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Graphene are of great interest for both theoretical and experimental investigations due to its tunable electronic and magnetic properties making graphene a potential candidate for wide variety of applications in electronic devices and in spintronics. It has been reported that through vacancy and functionalization the electronic and magnetic properties of graphene can be altered from conducting to semiconducting as well as from non-magnetic to magnetic. However, preparing graphene for spin transistor application is not easily achieved because it requires making graphene a magnetic semiconducting material. On top of that it has been observed in previous studies that a magnetic state of graphene is mostly observed when graphene is made conducting. And non-magnetic state of graphene is mostly observed when it is in a semiconducting state. In this study, it is shown that it is possible to make graphene a magnetic semiconducting material for spin transistor application using di-vacancy combined with hydrogen functionalization. Investigation of the electronic and magnetic properties of defected graphene are done using density functional theory.

DFT CALCULATIONS OF THE ELECTRONIC PROPERTIES OF METAL-ADSORBED PRISTINE AND DEFECTIVE (7,0) SWCNT

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Carbon nanotubes (CNTs) usually suffer from various types of topological defect during their growth. A great amount of experiments and theory has demonstrated that the existence of defects such as vacancies in the carbon nanostructures produce a significant influence on their electronic properties, exhibiting to be useful for achieving some desired functionalities. CNTs exhibit even better properties when interacted with metal atoms. It is suggested that these stable CNT-metal systems could become promising engineering materials in many fields such as CNT devices for various spintronics applications and CNT metal–matrix composites.

Adsorption of heavy metals Ag and Au onto pristine and divacancy-defected (7,0) zigzag single-walled carbon nanotube (SWCNT) was investigated using density functional theory (DFT) based on plane wave pseudopotential method with generalized gradient approximation (GGA). Metals were adsorbed exohedrally on the SWCNT and their structural and electronic properties [band structure and density of states (DOS)] were calculated and compared. Electronic structures of pristine and divacant SWCNTs showed band gap, E_g, near the Fermi level, E_F, indicating their semiconducting behavior. Ag and Au adsorption on pristine SWCNT changed the system from semiconducting to metallic. In addition, electronic properties of the system were significantly enhanced if vacancies were presented.

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SURFACE ANALYSIS ON THE EFFECTS OF ZINC IONS TO SPPS-HYDROXYAPATITE COATINGS VIA X-RAY PHOTOELECTRON SPECTROSCOPY

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Development and advanced microstructural researches were previously conducted on varying zinc concentrations (0mol%, 5mol%, 10mol%, 15mol%) doped into hydroxyapatite coatings (Zn-HA) via SPPS. In this work, X-ray photoelectron spectroscopy (XPS) was used to elaborate the effects of zinc ion addition to the surface morphology and microstructure of the obtained coatings. XPS surface survey spectra confirmed the presence of calcium, phosphorous, oxygen, and zinc as the major elements which indicated that the synthesized HA coatings were successfully incorporated with zinc. The binding energy of Ca2p was observed to change significantly upon the addition of zinc into the HA structure, i.e from 348.8eV to 346.8eV, which indicated a chemical state change attributed to the formation of CaO due to the decomposition of calcium phosphate. Moreover, the binding energy of $Zn2p_{3/2}$ found at ~1022eV, associated to the formation of ZnO, further confirmed the interaction of zinc ions with the oxygen atoms of HA. On the other hand, no significant changes on the BE of O1s and P2p was observed indicating no changes on their chemical states. In addition, %at composition analysis at 5mol% of ZnHA showed a decrease in the amount of both calcium and phosphorous consequently increasing the Ca/P and (Ca+Zn)/P ratio. However, for higher concentrations of zinc, an increase in the amount of phosphorous was observed while calcium ions showed an inverse proportionality. As a result, Ca/P and (Ca+Zn)/P ratio was observed to decrease. Literature suggests that the decrease in Ca/P is caused by the reduction of Ca^{2+} in crystal lattice of HA with the increase of Zn^{2+} ions.

STUDY OF $\frac{B\,(B^o \to J/\Psi(\mu^-\mu^+)\eta'(\eta\pi^-\pi^+))}{B\,(B_s^o \to J/\Psi(\mu^-\mu^+)\eta(\pi^0\pi^-\pi^+))}$ USING PARTIAL RECONSTRUCTION TECHNIQUE AT A FUTURE HIGH LUMINOSITY Z FACTORY

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The transition of a particle into a given decay mode is quantified by a parameter in particle physics called branching fraction. This branching fraction is sensitive and important in investigating possible New Physics (NP) and precision measurement (PM). One of the decay modes that could be probed for NP or PM is the $B^o \to J/\Psi\,(\mu^-\mu^+)\,\eta'(\eta\pi^-\pi^+)$. However, due to the presence of a neutral particle, i.e. η, in its final decay, reconstruction efficiency. A technique called partial reconstruction is applied to reconstruct m_{B^o} by parameterizing the missing variable using measurable quantities of a charged particles.

In pursuit for NP and better PM, the European Organization for Nuclear Research spearheaded a multidisciplinary project to construct Future Circular Colliders (FCC) that will greatly push the energy and intensity frontiers of particle colliders. This will expectedly increase the $B^o \to J/\Psi\,(\mu^-\mu^+)\,\eta'(\eta\pi^-\pi^+)$ signal which might improve its branching fraction measurement.

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In this study, the $(B^o \rightarrow J/\Psi\ (\mu^-\mu^+)\ \eta'(\eta\pi^-\pi^+)$ and $B_s^o \rightarrow J/\Psi\ (\mu^-\mu^+)\ \eta(\pi^0\pi^-\pi^+)$ are stimulated using FCC Generator s.t. possible FCC-ee tracking environment is incorporated by applying vertex and momentum resolutions given by International Linear Detector (ILD). Stimulated events are then partially reconstructed to measure the branching ratio $\frac{B(B^o \rightarrow J/\Psi(\mu^-\mu^+)\eta'(\eta\pi^-\pi^+))}{B(B_s^o \rightarrow J/\Psi(\mu^-\mu^+)\eta(\pi^0\pi^-\pi^+))}$. Measurement of $\frac{B(B^o \rightarrow J/\Psi(\mu^-\mu^+)\eta'(\eta\pi^-\pi^+))}{B(B_s^o \rightarrow J/\Psi(\mu^-\mu^+)\eta(\pi^0\pi^-\pi^+))}$ were then analyzed as a function of improved ILD resolutions.

EFFECT OF TRANSITION METALS CO-DOPING OF TiO_2 ON ITS PHOTOCATALYTIC PROPERTIES

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Titanium dioxide (TiO_2) has been extensively used as a photocatalyst and is often employed in water splitting, solar-assisted hydrogen production, and water treatment. However, the efficiency and absorption ability of TiO_2 alone over a wide spectrum of solar energy is low due to its wide band gap and high rate of photo-generated electron-hole (e^--h^+) pair recombination. Several studies have shown that the incorporation of one and/or two transition metals, at certain concentrations, onto TiO_2 simultaneously reduced both of its bandgap and the e^--h^+ pair recombination rate, thereby enhances its photocatalytic activity at the visible region of light. This work focused on the development of TiO_2-based coatings added with two transition metals (Co-La and Fe-La) at different concentrations. The XRD, SEM, UV-Vis and Photoluminescence spectroscopies were the techniques used to characterize the samples.

The experimental results showed that the samples added with two dopants have shifted the absorption edge of TiO_2 to higher wavelength which implies a lower band gap, and have reduced its recombination rate lower as compared with that TiO_2 alone and with those added only with one dopant. These improvements of the photocatalytic properties of TiO_2were attributed to the synergistic effect of the dopants. Furthermore, the morphology of TiO_2 was also changed upon the addition of the dopants with an indication of anatase and rutile phases of TiO_2.

*Adviser

ELECTRONIC PROPERTIES OF HYDROGEN-ADSORBED DIVACANCY (6,0) SINGLE-WALLED CARBON NANOTUBE VIA DENSITY FUNCTIONAL THEORY

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Single-walled carbon nanotubes (SWCNTs) have been one of the heavily researched materials in the field of nanoscience in the last decades due to its special properties applicable in a vast number of technologies such as sensing, electronics, biomedicine and the most recent, hydrogen storing. In this study, (6,0) divacancy SWCNT and hydrogen-adsorbed divacancy (6,0) SWCNT were assembled using Virtual Nanolab (VNL) builder. The divacancy was implemented at a selected location along the zigzag path of the nanotubes while the adsorption site is located around the divacancy exactly at the center between one of the removed C atoms and the C atom opposite. The electronic band structure and density of states (DOS) were determined using density functional theory (DFT) calculations via Quantum ESPRESSO (QE) package.

The band structure of the divacancy SWCNT showed contact of the lowest points of the conduction band and the highest points of the valence band around the Fermi level while the band structure of the H-adsorbed divacancy SWCNT revealed overlapping of bands near the said region. This implies that the adsorption improved the metallic character of the divacancy SWCNT. Furthermore, the density of states increased after adsorbing H in the divacancy SWCNT. These observations confirm that adding H alter the electronic properties of divacancy SWCNT.

EXCITATION-EMISSION FLUORESCENCE CHARACTERIZATION OF ALGAL ORGANIC MATTER AND PIGMENTS TOWARDS THE DEVELOPMENT OF A PORTABLE LED FLUORESCENCE LIDAR SYSTEM

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We have developed a portable pulsed Led fluorescence LIDAR system based on the preliminary algal organic matter and pigment excitation emission matrix (EEM) of commercialized AZTEC Spirulina powder at varying concentrations. For the EEM measurements, the excitation spectra range from 250- to 450-nm and the emission (fluorescence) spectra ranges from 350- to 600-nm for algal organic matter and 600- to 800-nm for algal pigments. It was observed that there is significant information on spectral peaks as the concentration varies. Using this information, a fluorescence LED LIDAR with a wavelength of 385-nm, pulse bandwidth of 10.92 ns, and repetition frequency of 475 kHz was constructed for chlorophyll detection at 700-nm. Range-resolved fluorescence lidar signal showed high correlation with the information from pigment EEMs, chemical analysis on chlorophyll-a concentration, and absorbance measurements.

**Adviser*

FUNCTIONALIZATION OF POLYANILINE ON WOVEN ABACA FIBERS

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Polyaniline (PAni) is a conducting polymer extensively studied for its facile synthesis, environmental stability, adhesion to substrates, and tunable electrical conductivity. Its tunability has led to PAni's extensive research in protective coatings, sensors, electrode materials and, electromagnetic interference shielding (among others). Its adhesive property allows for PAni's functionalization unto various fibers, giving flexion and reinforced strength to the polymer. This preliminary study presents the functionalization of Polyaniline onto Abaca (*Musa textilis*) for a strong, flexible and, conducting composite material for lightweight and heavy-duty applications.

A CHARACTERIZATION OF ELECTROCHEMICALLY-POLYMERIZED POLYPYRROLE (PPY) DOPED WITH Na-pTS AND K-HQS

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Conducting polymers (CPs) are known to be cheap, flexible, and corrosion resistant, giving them an advantage towards their inorganic counterparts. Polypyrrole is a type of CP commonly used in fabricating organic solar cells, batteries, sensors, and Thermoelectric Generators (TEGs). By itself, polymers are insulators, and unlike the common doping process of inorganic semiconductors, CPs are doped through a redox process. In this study, Polypyrrole (PPy) doped with Sodium p- toluenesulfonate (Na-pTS) and Hydroquinone monosulfate potassium salt (K-HQS) was electrochemically polymerized, and the optical, electrical, and surface properties of the samples were observed. The polymerization of PPy samples were carried out with a dopant concentration of 0.1M and 0.12M, and a constant current density of 5mA/cm2. The optical bandgap of the PPy samples were observed through UV-VIS spectrometry. The Na-pTS doped samples with a dopant concentration of 0.1M and 0.12, yielded a bandgap of 2.05eV and 1.98eV respectively. On the other hand, the K-HQS doped sample, with a dopant concentration of 0.1M, yielded a bandgap of 1.86eV. The electrical conductivity of each sample was also acquired using the van der Pauw technique. The resulting electrical conductivity of the samples ranged from 105 to 151 Ω-1cm-1. It was observed that the electrical conductivity is proportional to the dopant concentration, while the optical bandgap is inversely proportional to the dopant concentration. The surface morphology of the PPy samples were also acquired using scanning electron microscopy. At 100% duty cycle, the samples were observed to have a low packing density of 2.124 g/cm3, indicating the rough, loose, and porous nature of the sample.

MECHANICAL PROPERTIES OF B/C/N/Mg/Ca/K-DECORATED ALUMINENE: A FIRST PRINCIPLE STUDY

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Since the successful synthesis of graphene in 2004, research on two-dimensional materials have gained a lot of interests. Being light, yet strong, these materials with excellent electronic properties are advantageous on various applications such as nano-devices, flexible sensors, and potential replacements for conventional semiconductors. Motivated by the huge application potential inherent from its bulk counterpart, we study the mechanical properties of two-dimensional aluminum (aluminene) using density functional theory. The effect on the elastic modulus of the material upon the introduction of atomic decorations was also considered. Calculations were carried out using Vienna ab initio simulation package (VASP) using the Perdew-Burke-Erzernhof (PBE) generalized gradient approximation exchange correlation functional. The sampling of the first Brillouin zone was restricted to $8 \times 8 \times 1$ k-point mesh size, and the projected augmented wave method was set with a cut-off energy of *450 eV*. Non-metal atoms (Boron, Carbon, and Nitrogen), and metal atoms (Manganese, Calcium, and Potassium) were used as decorations at three crystallographic sites, namely, the Top (T), the Bride (B), and the Hollow (H). Results show that all the decorations except the Nitrogen prefer the H site for adsorption where the latter prefer the B site. Stretching and compressing the material, done by nudge elastic band calculations, yielded stress-strain curves for different decorations at three different sites. The elastic modulus of aluminene was found to be *146.89 GPa.* Deviations from this value were observed upon the introduction of decorations. These decorations can tune the elasticity of aluminene for different applications.

WATER STABILITY OF HB SHEETS

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The Hydrogen Boride (HB) sheet is a newly synthesized material that consist of a honeycomb boron sheet stabilized by hydrogen. Due to its novelty, much of its basic properties are unexplored. In this study, the water stability of HB sheets was investigated for the purpose of opening water-based applications to HB sheets. To measure the stability/reactivity of HB sheets, the reaction between HB sheet and a water molecule was simulated. The interaction was investigated where we looked for indication of chemical reactivity, particularly a strong initial bond that is typically an onset of hydrolysis reactions. The adsorption energy, lack of atomic orbital hybridization and preservation of water HOMO shows that no chemical reaction indicator was present in the interaction. Furthermore, by investigating the charge gain & loss, the apparent interaction is of a weak electrostatic attraction due to the dipoles induced on water and HB sheet. This means that HB sheets are stable in water and could be used in water-based applications.

**Adviser*

PRISONER'S DILEMMA GAME DYNAMICS ON COMPLEX NETWORKS VIA A MODIFIED RADIATION MODEL OF MIGRATION

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The steady-state dynamics of a homogenous population spreading over a network of settlements is investigated using a modified model for human migration based on radiation emission. The original migration model ("Radiation Model") utilizes a probability to migrate proportional to the population size of the settlement sites. It was observed that for this model, the steady-state population of sites with low clustering coefficient, sites that are not interconnected with each other, are higher than sites with high clustering coefficient.

Neoclassical economics conceives migration as an individual decision for income maximization. Here, we modify the Radiation Model to use a probability based on the Prisoner's Dilemma (PD) game pay-off to realize the notion of a selfish population. Certain network motifs, which are network patterns that appear repeatedly in a network, were observed to reach similar transient patterns. These motifs could also be used to demonstrate steady-state behavior of networks with varying distances.

The population distribution using the modified model were observed to move towards sites with low clustering coefficient and high betweenness centrality and node degree, which are the hubs of the network. The modified model was also found to be independent of the PD parameters.

The previous and modified models yielded similar results throughout the simulations which implies that the incorporation of Prisoner's Dilemma into the model had no effect to the overall dynamics of the population distribution. This shows that migration is more dependent on the network structure. The results of this work also imply that modifying the network structure could be used to influence migration patterns.

QUANTUM CRITICAL PHENOMENA AND FINITE SCALING ANALYSIS IN A KITAEV CHAIN WITH VARIABLE-RANGED INTERACTIONS

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The quantum phases were determined for the exactly solvable Hamiltonian of a one-dimensional chain of spinless fermions with tunable interactions. From the diagonalized Hamiltonian, the expectation value of the parameter Schmidt gap (i.e. algebraic difference of the first two largest eigenvalues of the reduced density matrix) was used to define these phases and their

corresponding critical points. Near criticality, the continuous transition of the Schmidt gap was analyzed using a finite scaling ansatz to extract the numerical values of its critical exponents. Initial results show that the scaling function holds for phase transitions in the region where interactions are short range. Critical exponents for long range interactions show non-converging values which can indicate the scaling ansatz is longer be consistent in this region.

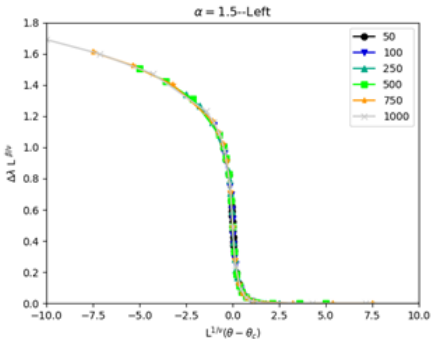

Figure 7. The curve collapse for the scaling of the Schmidt gap for interactions decay rate α=1.5

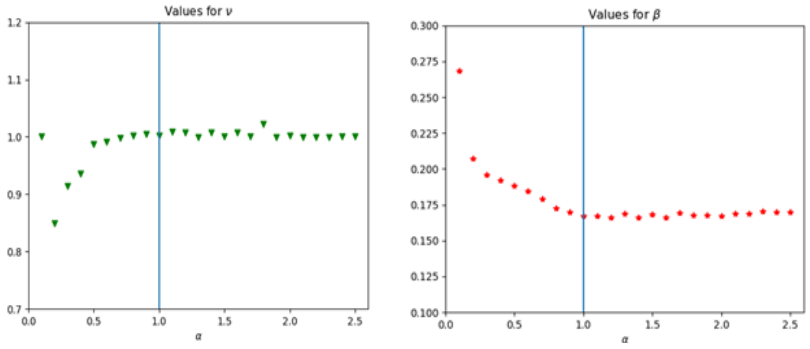

Figure 8. Numerical values for the critical exponents ν and β for different α values

REDSHIFT FUNCTION FOR PHOTONS IN A SPHERICALLY SYMMETRIC BLACK HOLE SPACETIME

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The radiation emitted by a charged particle moving in a spherically symmetric spacetime is examined in this work. Describing the emitted radiation's trajectory can be done by solving the geodesic equation for null rays. In this work, we characterize the charged particle's emitted radiation that reaches an observer at infinity by calculating its redshift, which quantifies the energy of photons that reaches the observer's device at infinity to see clearly how photon's energy is influenced as it propagates in the presence of a spherically symmetric black hole in addition to the Doppler effect generated from the particle's motion. In this work, we present redshifts as maps on a two-sphere, in order to show their dependence on the relative angular directions of emitter and observer and we also present the relationship between the maximum and minimum values of redshift in terms of the orbital radius. We found out that the redshift is dependent on the particle's motion dictated by the quantity Ω which is the orbital angular velocity and the angle φ which describes the emitter's position relative to the observer at infinity. We also found out that for a large orbital radius (i.e. the radius of orbit approaches infinity), the redshift that was registered by an observer at infinity approaches to unity, this means that the emitted frequency of the charged particle approaches the same value as the observed frequency by an observer at infinity.

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REPRESENTATION OF THE FINITE PART INTEGRAL AND ITS APPLICATION IN TERM BY TERM INTEGRATION

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Divergent integral has wide spectrum of values making it difficult to deal with. Luckily, there are existing method of extracting meaningful values from a divergent integral and one of them is by using finite part integral. The finite part of a divergent integral can be calculated along the real axis and it involves limiting and expansion processes. However, it was later found out that the finite part integral can be extended in the complex plane by representing it as contour integrals and the representation will depend on the nature of the function involve whether we have a pole or branch point singularity. Exploring the complex definition of the finite part, we have obtained new contour integral representations. We were able to generalize the contour representation by considering arbitrary contour. These results show that the complex extension of the finite part is not unique in the sense that it can be represented in many ways, if certain analyticity conditions are satisfied. We applied the results in obtaining the term by term integration of the incomplete Stieltjes transform. It was found out that the new contour integral representations were able to reproduce the existing results. The proposed representations in this study serves as an alternative way of dealing with finite part integral in the complex regime and is not superior compared to the other existing representations.

SOLUTIONS TO THE TIME KERNEL EQUATION

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The time kernel equation can be used to obtain the kernel of the time of arrival operator. Previously, this was solved using Frobenius method for various potentials. Here, we propose using eigenfunction expansion as another method of solving the time kernel equation. We shall also investigate the solution space of the time kernel equation, since the time of arrival kernel is just one specific solution dictated by its corresponding boundary conditions. Different boundary conditions must then correspond to different types of time kernel solutions.

RESONANT TUNNELING DIODE (RTD) AS COMPUTER MEMORY STORAGE

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Resonant tunneling diodes or RTDs are one of the most common quantum devices in Physics and material science. RTDs are double barrier quantum well structures that exhibit quantum tunneling behavior. For this study, we utilized the Lattice Weyl-Wigner (LWW) Many-body Quantum Transport Formalism to numerically investigate an RTD with an unconventional structure. The RTD used in this study has an n-n+n- spacer layer as opposed to an n- only spacer layer. It was observed experimentally that this structure exhibits memory-like behavior at zero bias which raises the possibility for computer memory storage applications. For this paper, we are using transport equations derived from LWW formalism to simulate the electronic properties of this RTD. From our numerical calculations, we found only two charge states exist at zero bias. The current-voltage characteristic calculations show that RTDs with n-n+n- spacer layer exhibit similar characteristics to that of conventional RTDs where only one jv-curve exists. Our jv-curve calculations lead us to believe that the memory-like behavior may be caused by external factors such as a capacitive breakdown.

OSTEOSARCOMA CELLULAR AND NUCLEAR ADAPTATION ON A NANOPATTERNED SUBSTRATE

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The biophysical nature of cells are mainly governed by its mechanical properties, which includes cell shape and cell size. These are commonly investigated using customized chambers that undergo sophisticated processes. This study, therefore, aims to characterize cellular and nuclear morphological adaptation of osteosarcoma (U-2Os) cell lines, with MC3T3-E1 pre-osteoblast as the control, as they attach on a functionalized low-cost micro-patterned Polydimethylsiloxane (PDMS) chamber. This study further aims to establish a single-cell model and measure stress distributions on the cell under various morphological state using finite element analysis.

Quantitative orientation analysis and morphometric measurements were conducted using ImageJ. The normalized distributions of orientation vectors show that both cell lines have no dominant orientation at short-time incubation (24 hours). However, at longer incubation time (4 days) U-2Os cells show a significant orientation that corresponds to that of the micro-grating in contrast to MC3T3-E1. The morphology of U-2Os cells indicates a decrease in the average cell area, a decrease in the average circularity, and an increase in the average elongation.

Finite-element modeling reveals that there is a higher degree of mechanical stress along the grooves of the micro-grating. This, therefore, induces the cell to deform and align along the pattern. Hence, micro-gratings with a width about 13% of the average diameter of the nucleus and a height of about 3% of the height of the nucleus, can induce large deformations on cancer cells.

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DFT STUDY OF THE ELECTRONIC PROPERTIES AND THE STABILITY OF Ge DOPED $CH_3NH_3SNI_3$

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For the past decade, there has been an unending quest in finding an alternative for lead based perovskite solar cells due to its environmental implications. However, lead – free perovskites such as tin based perovskite solar cells suffer from low efficiency and low stability. Recent studies have shown that Germanium (Ge) is a potential dopant to increase the efficiency of lead-free perovskites. In this study, Methylammonium Tin Iodide ($CH_3NH_3SnI_3$) has been doped with different concentrations of Germanium. The cubic primitive cell of $CH_3NH_3SnI_3$has been transformed into a 2 x 2 x 2 supercell in order to simulate the doping of Ge atoms into the perovskite. The electronic properties and the formation energy of the perovskite were analyzed to describe the efficiency and the stability of the lead-free perovskite. For the electronic properties, the density of states and the band structure are calculated by employing first principle calculations based on the density functional theory.

The initial results show that the density of states of the material shows that there is a strong hybridization between the d orbitals of Sn and Ge with the p orbital of I. This implies that there is covalent bonding between the atoms. The formation energy of the material was calculated at different concentrations of Ge. This energy is used in determining the Ge doping concentration which would give the most stable structure of the material. Further calculations will be done to deeply investigate how the Ge concentration affects the electronic properties and stability of $CH_3NH_3SnI_3$.

PYROELECTRIC PROPERTIES OF ZIRCONIUM-DOPED $BaTiO_3$ SOLID SOLUTIONS USING ELECTRON DIFFRACTION AND FIRST-PRINCIPLE CALCULATIONS

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Barium titanate (BTO) is one of the important lead-free ferroelectric materials with good electrical properties. Recent studies shown that Zr-doped BTO, (BZT), solid solutions exhibit superior pyroelectric properties compared to many other lead-free materials which is very vital for pyroelectric-based devices such as thermal detectors. In this work, 10-20% BZT ceramics has been considered to understand the key factors influencing its pyroelectric properties. The material's crystal strain and Born effective charges (BECs) are analyzed to quantify its pyroelectric coefficient. Here, the crystal strain is calculated from the X-ray diffraction(XRD) data while the BECs are calculated by employing first-principles calculations based on the density functional theory (DFT). XRD results showed that BZT has predominantly single-phase pseudo cubic perovskite structure which was verified by Rietveld refinement. Investigation of the lattice parameters reveals discontinuities at 90°C and 170°C which can be attributed to the shrinkage

of the unit cell and the phase transition from its polar to non-polar phase. DFT results reveal a substantial difference between the calculated BEC values and the nominal charges for the titanium, zirconium and oxygen which is related to the ferroelectric instability of the material. This anomalous deviations of the BEC values from the nominal charges is due to the increase in the interactions between the O-*2p* orbitals and the unoccupied cation *d* states. It is supported by the strong hybridization between the Ti-*3d* and Zr-*4d* states with the O-*2p* states. This study reveals that the combinatory role of BECs induced by these orbital hybridizations and crystal strain is very vital to quantify the pyroelectric properties.

SUPERFIELD LIOUVILLIAN VERSUS HIERARCHY EQUATIONS OF MOTION SCATTERING FORMALISMS IN NONEQUILIBRIUM QUANTUM TRANSPORT

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Nanodevices like resonant tunneling diodes (RTDs) and emerging fields like quantum computing can be studied more accurately with exact non-perturbative formalisms in nonequilibrium quantum transport. Two of these are Buot's superfield Liouvillian (SL) which is based on nonequilibrium Green's function method and R. Kubo and Y. Tanimura's hierarchy equations of motion (HEOM) which is based on differentiating reduced density matrix elements defined by path integral. A study of these two formalisms is done to determine similarities and differences. It has been found that both formalism are in complete agreement with each other. The terms describing the particles' motion are the same while the scattering terms differ due its treatment. SL accounts all scattering processes (phonon, zero order optical, polar optical, piezoelectric, and ionized impurity) using relaxation-time approximation while HEOM only accounts phonon scattering but treats it more accurately and more exactly. Since the two formalisms are in complete agreement, we can borrow the scattering term result of HEOM and add or replace it to the scattering term in SL to determine the extent of how much electron-phonon scattering affects electron transport in RTDs.

1D DFT + LWW QUANTUM TRANSPORT MODELING

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Our study aims to implement density functional theory (DFT) in combination with lattice Weyl-Wigner (LWW) formulation in the quantum transport equation, derived using Superfield theory. The way we can incorporate the molecular system's properties is through its potential contribution to the Hamiltonian. From the potential of the system, we can calculate the Wigner function using the LWW transport equation. The observables, electron density and current density, can easily be computed from the Wigner function. For the electron-electron interaction, Poisson's equation was solved self-consistently. The simplest case we can consider for a molecular transport equation is a single-level model often referred to as the resonant-tunnelling model. To test the validity of our model, we applied the developed numerical algorithm of

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the transport equation to a 1D resonant tunnelling diode (RTD) using Python programming language. DFT+LWW is a new technique we hope would help model the molecular system and compute the transport properties accurately and efficiently.

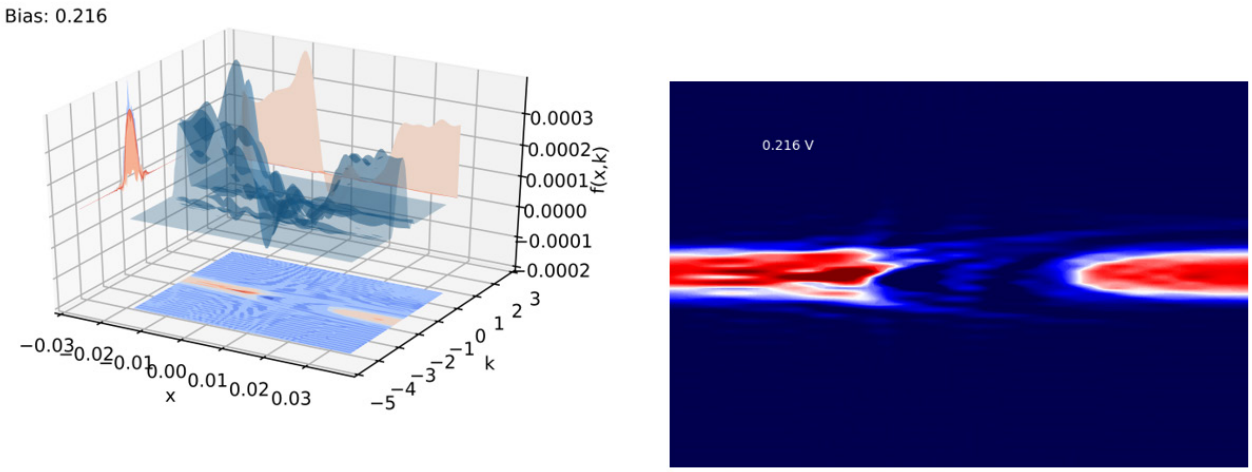

Figure 9. Wigner function at 0.216 V with its different projection (right), and contour of the Wigner function with visible oscillation on the channels (left)

A GEOSPATIAL ANALYSIS OF THE SPATIAL PATTERNS PRESENT WITHIN PUJ-ATTRIBUTED PARTICULATE MATTER

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Particulate matter pollution is a serious threat to populations under high exposure. Areas such as Metro Manila are situated in a highly urbanized location. With this, a great concern of environmentalists is the amount of particulate matter in the region. Due to the high demand for transportation in the area, public utility jeepneys are widely used by many Filipinos. These jeepneys are configured with outdated engines that release toxic substances –of many, particulate matter poses a serious threat. These fine particles were found to cause many premature deaths; hence, it is important to derive future abatement strategies through numerical weather modeling. The Weather Research and Forecasting model coupled with chemistry was used to numerically describe future policy scenarios and their corresponding health and monetized benefit. Further analysis was then undertaken to determine clusters of high pollutant concentrations through the implementation of the global and local spatial autocorrelation statistics. Primary findings noted a cluster of increased pollutant levels along central Metro Manila. Moreover, the authors found an unexpected cluster of high pollutant concentrations within a neighborhood of low values in the north-eastern quadrant of Metro Manila. In contrast, future emission scenarios returned favorable emission levels, where the most significant decrease in pollutant levels was observed for areas within the route network. Thus, the authors conclude that the densely spaced route networks played a significant role in determining the spatial variability of pollutant concentration within the domain, which was also intensified by decreased atmospheric flow during the north-east monsoonal period.

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A MULTIVARIATE CACE-BASED APPROACH FOR LONGITUDINAL DATA

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Longitudinal studies involve human participants where data are often complicated by subjects that do not comply with their treatment assignment (noncompliance) or do not provide complete data, and thus, the occurrence of missing data. Treatment noncompliance is a common issue in *randomized controlled trials* (RCTs) that may plague the randomization settings and bias the treatment effect estimation in a model.

The *Complier Average Causal Effect* (CACE) or the Multiple Univariate CACE model has become popular in estimating the impact of an intervention among treatment even when there is noncompliance. In 2018, Yue Ma introduces the Multivariate CACE (MCACE) analysis and shows that the methodology outperformed the classical CACE methodology.

In this paper, the MCACE model is investigated to handle missing data in addition to noncompliance, and a baseline covariates is included in the model. The proposed methodology focuses on setting some crucial assumptions on the model, and results are evaluated with respect to its statistical power via simulation study.

Results show that the proposed methodology provides more accurate analysis results since it included baseline characteristics and component for missing data in the model.

LATENT DIRICHLET ALLOCATION USING A DIRICHLET TYPE II PRIOR

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Digitalization led to a crisis in storing and retrieving information. Resolving this paved way to information retrieval systems. Topic modelling is a technique developed to acquire information from different sources. One of the widely used topic modelling method is Latent Dirichlet Allocation (LDA).

LDA in a handful of researches uses a Dirichlet Type I prior. Aside from the relatively little work in machine learning on the structure of the prior distributions used in LDA, the use of a Dirichlet Type I prior is criticized since most of its application uses the symmetric Dirichlet. Symmetric Dirichlet prior against asymmetric Dirichlet prior shows weaker perfomance compared to the latter due to the fact that asymmetric Dirichlet prior captures popularity bias of topics in generation process.

This paper proposes to use the Dirichlet Type II as the prior for an LDA process. The Dirichlet Type II, also known as the inverted Dirichlet distribution, is known for its usefulness in practical settings specifically on its flexibility to approximate many shapes. This proposed LDA process using the Dirichlet Type II is applied to some Wikipedia articles. Model evaluation is patterned

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from the work of Tong and Zhang (2016) on a document exploring system based on Wikipedia artices to explore LDA's performance. The Dirichlet Type II's ability to permit multiple symmetric and asymmetric modes will serve as an advantage in model evaluation on document clustering, finding similar documents, and exploring corpus.

ON THE T- STANDARD U- QUADRATIC EXPONENTIATED GENERALIZED (TSUEXG)-GENERATED FAMILY OF DISTRIBUTIONS

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Statistical distribution plays a vital role in many research areas. It is important for modelling and describing the behaviour of the data. Statistical models are useful in predicting real-world phenomena. Now a days, due to the complexity of the data, the classical distribution will not be enough to describe the real phenomenon of the data. Because of that, many researchers develop methods for extending the classical distribution by adding parameter(s) to it. Let $F(x) = \int_0^{G(x)} r(t)dt$ where $r(t)$ is a probability distribution function of a random variable T define on the interval and is any cumulative distribution of . This paper proposes a new generated family of distributions called "T-Standard U - Quadratic Exponentiated Generalized - G Family of Distributions" labelled as TSUEXG family. This new generated family of distributions uses the properties of the U-Quadratic distribution, the Exponentiated Generalized Class of distributions and the transformed transformer family of distributions in its derivation. It can be shown that the cumulative distribution function of the TSUEXG generated family of distributions will have the form $F(x) = \int_0^{J(x)} f(t)dt$ with $f(t) = 12(t - \frac{1}{2})^2, J(x) = (1 - (1 - G(x))^a)^b, a, b > 0$. This paper also derives some mathematical properties of the TSUEXG- Genarated family like the infinite mixture representation of the cumulative and probability distribution functions, moments, order statistics and the moment generating function. In addition, a special model of the TSUEXG family is derived by specifying a baseline distribution and its corresponding mean, variance, skewness and kurtosis are computed.

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A BLESSING OF HIGH DIMENSIONALITY: MODIFIED FEATURE CLUSTERING BASED ON SOME DATA REDUCTION TECHNIQUES

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With hundreds or more features in high dimensional data, computational workload is challenging. Clustering high dimensional data is usually a difficult task. In fact, most traditional clustering algorithms tend to break down when applied to high dimensional feature spaces. When doing clustering, we really have to reduce data. Therefore the aim of this paper is to decrease the computation load by reducing the size of high dimensional data by feature clustering. A good percentage of subsets of features, which well-represent all features in the data set, is selected and used, and then the result is comparable to when the entire set of variables is used. Hence the process is three-fold; (1) discarding irrelevant data, (2) choosing one feature that representing a number of redundant features by forward feature selection, and (3) selecting one variable among the relevant variables to be analyzed first for a systematic feature clustering. That is, (1) and (2) perform a dimensionality reduction before (3) which is the clustering process. In this study, a modified feature clustering based on some data reduction techniques is proposed. This research answers the optimum percentage of how much reduction we have to do in order to cluster high dimensional data with its relevant features.

ROBUST ESTIMATION IN FUNCTIONAL MISSING DATA ANALYSIS

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Missing data are unobserved values that would be meaningful for analyses if observed; in other words, a missing value hides a meaningful value. In almost all research, missing data can reduce the statistical power of a study and can produce biased estimates, leading to invalid conclusions. This paper exposes on the problems and three categories of missing data mechanisms consisting of *missing completely at random* (MCAR), *missing at random* (MAR), and *missing not at random* (MNAR), along with the techniques for handling missing data. The mechanisms by which missing data occur are illustrated, and the methods for handling the missing data are discussed and illustrated. This paper uses longitudinal data with dropout and fully observed covariates. Non- and semi-parametric techniques will be used to reduce assumptions when analyzing incomplete data. An extended simulation study is carried out to evaluate the estimation accuracy of the methods in handling missing data. This study concludes with recommendations for handling missing data.

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BAYESIAN ESTIMATION OF ZERO-INFLATED NEGATIVE BINOMIAL INGARCHX MODEL

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Dengue fever is an infectious disease caused by a family of viruses that are transmitted through the bite of infected female mosquitoes and it is the most rapidly spreading mosquito-borne viral infection affecting human. A severe form of dengue fever called dengue hemorrhagic fever (DHF) can cause severe bleeding, a sudden drop in blood pressure and death. In 2019, Philippines declared a national dengue epidemic which causes an economic burden in the country. Recently, mathematical or statistical models for dengue scenario are being developed and studied. For example, Chen et al.(2019) introduced two nonlinear negative binomial integer-valued GARCHX (NB-INGARCHX) models using Bayesian approach to model weekly dengue fever cases in Thailand associated with two meteorological covariates, namely: cumulative rainfall and average maximum temperature. However, none of the models has able to address the problem of the DHF data having excessive zeros.

This study proposes an INGARCHX model with Zero-Inflated Negative Binomial (ZINB) distribution. The paper aims to model the DHF cases in some areas of the Philippines to include other variables aside from cumulative rainfall and average maximum temperature. The parameters of the models are estimated using Bayesian approach through MCMC method. Results shows that the ZINB-INGARCHX model perform better than the NB-INGARCHX model when there are excessive zeros in the data.

ON THE RELIABILITY THEORY OF AGING OF NEMATODES

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Extensive studies of phenomena related to aging, especially among technical/mechanical systems, have produced many diverse findings. As demonstrated by the success of evolutionary theories of aging, quite general theoretical considerations can be very useful when applied to research on aging. In this study, we attempt to gain insight into aging, specifically of a biological system – nematodes, by applying a general theory of systems failure known as reliability theory. Considerations of this theory, and some naturally – occurring biological laws such as the Gompertz Law, lead to the following expected results: (i) Life span or lifetime of nematodes is solely determined by local environmental factors (e.g. temperature and species – sensitive chemical elements) and can therefore be bound by these parameters. (ii) Redundancy of nematodal functions in a group plays an important role in the population dynamics of such group. In particular, (iii) the number of nematodes still deteriorate or age even if they are composed of some "old as good as new" component functions – unimpaired functions throughout life span due to redundancy. Finally, this study is concluded with some simulations to verify results and some recommendations for future endeavors.

BAYESIAN ZERO AND K INFLATED NEGATIVE BINOMIAL SPATIO-TEMPORAL (BZKINB S-T) MODEL

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Dengue virus has four serotypes and according to the Department of Health, Philippines, first infection with one of the four serotypes usually is non-severe or asymptotic, while the second infection with one of the other serotypes may cause severe dengue. Bayesian modelling can be used to analyze an epidemiological risk as spatially and temporally varying, like in the case of Dengue Hemorrhagic Fever (DHF) data. A DHF data is known to be a zero inflated data and when the number of zeros exceeds the amount expected, the zero inflated Poisson model is appropriate; thus, the formulation of the Bayesian Zero Inflated Poisson Spatio-Temporal (BZIP S-T) model by Mukhsar et.al (2016). However, DHF data with too many zeros are commonly an over-dispersed data. To account for overdispersion, the Bayesian Zero Inflated Generalized Poisson Spatio-Temporal (BZIGP S-T) model was later modified by the same author in 2017. Both models were used by Mukhsar to real data and both models show that rainfall and population density are significant predictors to DHF cases. Further, the results of the modified model of Mukhsar (2017) shows that BZIGP S-T model performed better than BZIP S-T model.

The Bayesian Zero and K Inflated Negative Binomial Spatio-Temporal (BZ*K*INB S-T) model is proposed to cater not just the repeated zeros of the DHF data but also the occurrence and re-occurrence of a DHF case. The proposed model accommodates local environmental character as predictor. The proposed model is implemented using DHF monthly data in some endemic area in the Philippines. The BZKINB S-T model serves as a modification or alternative to BZIP S-T and BZIGP S-T models in modeling DHF Data. MCMC method is used to estimate the parameters of the three models.

BETA-MANNANASE FROM *BIFIDOBACTERIUM ADOLESCENTIS* DSM 20083: BIOCHEMICAL CHARACTERIZATION AND MANNO-OLIGOSACCHARIDES PRODUCTION USING COPRA MEAL AND MAKAPUNO GALACTOMANNAN

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The study of β-mannanase has gained so much interest recently due to its ability to degrade mannan polymers and produce high value products such as manno-oligosaccharides (MOS). This enzyme can be obtained from various microorganisms including bacteria. In this study, a recombinant β-mannanase (BaMan101K) from *Bifidobacterium adolescentis* was used to produce potential prebiotic MOS using mannan-rich agricultural substrates such as copra meal and makapuno. The recombinant β-mannanase was purified by a one-step purification technique using Ni-immobilized metal ion affinity chromatography column and then biochemically characterized. The specific activity of the purified enzyme was 66.10 U_{man}/mg. SDS-PAGE analysis showed that the enzyme was homogeneous and had a molecular weight of approximately 110 kDa. The optimum temperature and pH obtained was 37 °C and pH 5.3, respectively. It was

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relatively stable at 30 °C after 24 h incubation. The purified enzyme successfully hydrolyzed various substrates including locust bean gum, guar gum, konjac glucomannan, defatted copra meal and makapuno galactomannan. The major products obtained from defatted copra meal were mannobiose and mannotriose. While for makapuno galactomannan, the major products were 6^1-α-D-galactopyranosyl-*β*-1,4-mannobiose and 6^1-α-D-galactopyranosyl-*β*-1,4-mannotriose. These results showed that *β*-mannanase from *Bifidobacterium adolescentis* can be used to produce potential prebiotic MOS.

INVASION GENE-SPECIFIC ELECTROCHEMICAL NANOBIOSENSOR AS AN EFFICIENT DETECTION TOOL FOR *Salmonella enterica*

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Globally, *Salmonella enterica* continues to be one of the most important human foodborne pathogens. This study assessed the ability of an invasion gene-based electrochemical nanobiosensor for rapid, sensitive and selective detection of *S. enterica* through double hybridization of target gene with proprietary 50-base pair (bp) DNA detector probe conjugated with polyaniline coated magnetic nanoparticles and 50- (bp) DNA capture probe followed by electrochemical detection via cyclic voltammetry. Biosensor sensitivity was evaluated against 7 genomic DNA (gDNA) concentrations (0, 0.1, 0.3, 0.7, 1, 15 and 30 ng/µL) while selectivity is tested against 30 ng/µL of two target *S. enterica serovars* (Enteritidis and Typhimurium) and two non-target pathogens (*Escherichia coli* O157:H7 and *Shigella flexneri*). The biosensor is selective to *S. enterica* with anodic peak current responses of S. Enteritidis (6.57 ± 0.40 µA) and S. Typhimurium (3.41 ± 0.10 µA) significantly different against blank (0.86 ± 0.62 µA) at +0.550 V. On the other hand, *E. coli* O157:H7 and *S. flexneri* have non-significantly different responses of 0.54 ± 0.20 and 1.30 ± 0.14 µA, respectively against blank in the same potential. Nanobiosensor sensitivity was determined to be as low as 0.3 ng/µL with electrochemical signal of 1.74 ± 0.04 µA. With rapid analysis time (5.5 hrs + 6 hr sample processing) as compared with standardized culture-based methods (~5 days), and polymerase chain reaction (~28 hr with enrichment) high sensitivity and selectivity, DNA-based electrochemical nanobiosensor has a potential to replace current lengthy and costly detection methods in the Philippines.

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COMPOSITIONAL GLYCOANALYSIS OF BIOPSY TISSUE SAMPLES FROM FILIPINO NON-SMALL CELL LUNG CANCER (NSCLC) PATIENTS

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A dense layer of sugar moieties (glycans) cover the surface of most cells. These glycans are involved in a variety of biological processes such as cell to cell signaling, adhesion, and communication and are also implicated in disease progression such as cancer. Thus, these glycans are gaining considerable interests for its role in the discovery of disease biomarkers. This study reports the compositional glycan profile of tumor biopsy samples from Filipino NSCLC patients using high-throughput tandem mass spectrometry-based methods (nano-ESI LC-MS/MS). The results showed that 39 out of the 55 glycans identified were decorated with fucose and sialic acid residues. Specifically, the glycans that were found in higher relative abundances in cancer cases were: $Hex_5HexNac_3Fuc_1Sia_0$, $Hex_8HexNAc_7Fuc_1Sia_0$, $Hex_7HexNAc_6Fuc_1Sia_0$, $Hex_6HexNAc_5Fuc_0Sia_1$, $Hex_4HexNAc_5Fuc_1Sia_1$. These glycans and its associated proteins can serve as potential biomarkers that reflect the differences in pathological states between Filipino cancer patients and healthy individuals.

CYTOTOXICITY OF EXTRACTS OF *Crescentia cujete* L. FRUIT ON HUMAN CANCER CELL LINES AND THEIR EFFECT ON THE EXPRESSION OF EARLY APOPTOTIC GENES AND PROINFLAMMATORY CYTOKINE GENES

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Crescentia cujete L. is widely used in traditional medicine. It has been reported that it possesses several biological activities including anti-cancer and anti-inflammatory activities. This study aimed to investigate the phytochemical components of the crude MeOH extract and to isolate and characterize the *trans*-cinnamic acid (TCA) from the fruit pulp using GC-MS analysis. It also determined the cytotoxic, genotoxic and anti-inflammatory activities of the extracts on human normal and cancer cell lines and the mechanisms of these activities. Results showed that both crude MeOH extract and TCA were cytotoxic against HCT-116, H69PR and MCF-7 but not to THP-1 and HDFn. Crude MeOH extract showed IC50 values of 26.60, 6.662, 3.945 µg/mL, while TCA showed 5.108, 5.119 and 4.555 µg/mL for MCF-7, H69PR and HCT-116, respectively. Moreover, COMET assay afforded significant DNA damage resulting to apoptosis in TCA-treated HCT-116 shown by high tail length, % DNA in tail, and tail moment compared to untreated cells. This is supported by the significantly upregulated early apoptotic *cfos* and *cjun* transcripts in TCA-treated HCT-116 compared to untreated levels. Meanwhile, downregulation of proinflammatory cytokines *IL-1β* and *TNF-a* transcripts was observed in lipopolysaccharide

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(LPS)-treated phorbol myristate acetate (PMA)-induced macrophage after TCA treatment. However, crude MeOH extract upregulated the expression of both pro-inflammatory genes in LPS-induced macrophages. This study provides evidences that the crude MeOH extract and TCA from *C. cujete* fruit were cytotoxic to the cancer cell lines but not to the normal cell line tested and that TCA has an anti-inflammatory effect against LPS-induced macrophages.

ANTI-PROLIFERATIVE, ANTI-OXIDANT AND ANTI-ANGIOGENIC PROPERTY OF *Artocarpus blancoi (Elmer) merr.* LEAF EXTRACT

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The presence and degree of abundance of bioactive compounds in medicinal plants are now widely being studied for its pharmacological potential in investigating its effect on cell proliferative and cell cycle activity. Thus, this study aims to determine whether, the Philippines endemic, *Artocarpus blancoi (Elmer) merr,* leaf extracts can inhibit MCF-7 cancer cell line proliferation and induce apoptosis. Phytochemical analyses revealed the presence of alkaloids, anthraquinones, flavonoids, steroids, and tannins from the leaves of *A. blancoi*. Cytotoxicity results showed that, after 72 hours, among all leaf extracts of *A. blancoi,* ethyl acetate extract significantly decreased cell viability to (18.18±0.014) > 50% at 100 µg /ml, and (50.57±0.36) at 50 µg/ml concentration. The IC_{50} value of ethyl acetate extract was established at 46.30 µg/ml, indicating it as moderately active, based on US-NCI criteria. Further, immunofluorescence staining showed a decrease in the activity of ki-67, proliferation marker at 12.5µg/ml concentration, implying that they are metabolically active but not mitotically dividing. Interestingly, some cells exhibited an increase of positive p53 protein suggesting the restoration of its function as tumor suppressor and the possibility that it, might lead to senescence or apoptosis. Elucidating and understanding the effect of bioactive compounds in cancer cells provides knowledge to create a strategic pathway for the optimization of drug development.

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ONE-POT MULTICOMPONENT APPROACH FOR ACCESSING 4,6-DIARYLPYRIMIDIN-2*(1H)*-ONES AND THEIR *IN SILICO* EVALUATION AS POTENTIAL ANTIMICROBIAL, ANTIHYPERTENSIVE AND ANTI-INFLAMMATORY AGENTS

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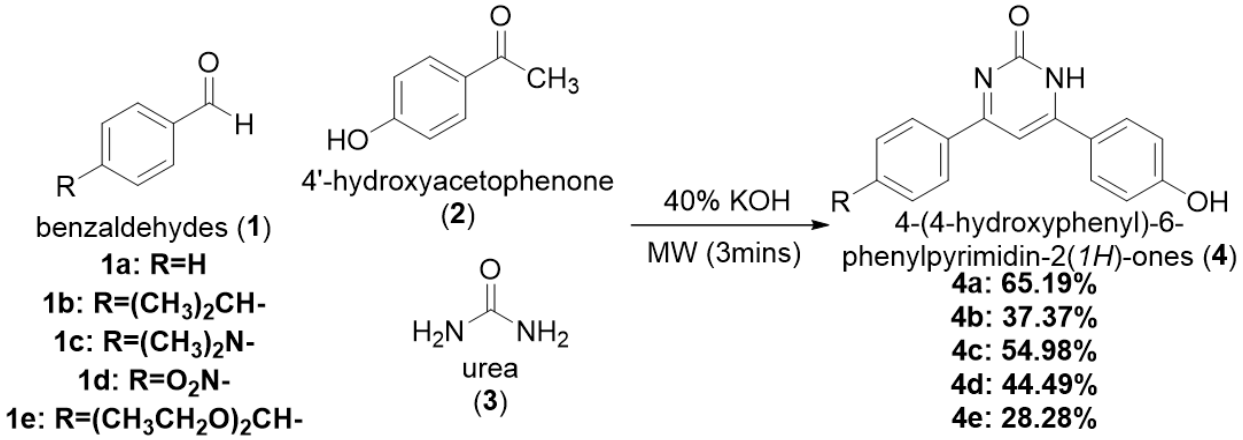
This account presents a method for a facile and straightforward synthesis of 4,6-diarylpyrimidin-2(*1H*)-one and its analogues from different benzaldehydes, 4'-hydroxyacetophenone and urea by employing a devised one-pot protocol using 40% KOH as catalyst producing considerably good yields. The synthesized 4,6-diarylpyrimidin-2(*1H*)-ones were assessed *in silico* by molecular docking studies and showed promising results towards chaperone Hsp70 for antimicrobial potentials, L-type voltage-gated Calcium-ion channel for antihypertensive potentials and Cyclooxygenase-2 for anti-inflammatory potentials.



A THEORETICAL INVESTIGATION OF THE FORMATION OF $[(Ru(cyclam)Cl)_2(\mu\text{-}N_2)]^{2+}$ FROM $[Ru(cyclam)(NO)Cl]^{2+}$

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Ruthenium nitrosyl complexes are believed to release nitric oxide (NO) catalytically involving one-electron reduction, followed by aquation, substitution with NO_2, and reaction with water regenerating the initial complex. However, experimental results by Jorolan (2014) dispute this mechanism. Using $[Ru(cyclam)(NO)Cl]^{2+}$, chemiluminescence and spectroscopic detection of NO release showed no signal and cyclic voltammetry revealed two-electron transfer process. Moreover, X-ray crystallography of the reduction product reveals formation of the dimeric structure, $[(Ru(cyclam)Cl)_2(\mu\text{-}N_2)]^{2+}$. With these inconsistencies, this work presents a theoretical investigation on the formation of $[(Ru(cyclam)Cl)_2(\mu\text{-}N_2)]^{2+}$ from $[Ru(cyclam)(NO)Cl]^{2+}$.

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The first part of this study was focused on determining the most appropriate theoretical method by evaluating the reproducibility of the experimental results and computational cost. Using polarizable continuum model, calculations were made in an aqueous environment. Among the computational methods tested using $[Ru(cyclam)(NO)Cl]^{2+}$, B3LYP, B3PW91 and B3P86 showed good results. For the basis set for the ruthenium atom, LANL2DZ showed the best outcome. For the basis sets of other atoms other than ruthenium, cc-pVTZ showed the best result but, the computational cost was so high that 6-311+G* was used instead. With these preliminary results, three methods were tested for the dimer product, $[(Ru(cyclam)Cl)_2(\mu\text{-}N_2)]^{2+}$ (M1 = B3LYP/LANL2DZ/6-311+G*, M2 = B3P86/LANL2DZ/6-311+G*, M3 = B3PW91/LANL2DZ/6-311+G*). From these three methods, M2 was evaluated as the most suitable method. The investigation on the mechanism of the formation of $[(Ru(cyclam)Cl)_2(\mu\text{-}N_2)]^{2+}$ using M2 is still ongoing.

ASSESSMENT OF THE ANTICLASTOGENICITY AND NEPHROPROTECTIVE ACTIVITIES OF *Peperomia pellucida* (L.) HBK DECOCTION ON CISPLATIN-INDUCED CLASTOGENICITY AND KIDNEY INJURY IN MALE ALBINO MICE (*Mus musculus Lin.*)

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In clinical setting, the use of Cisplatin (CP) as antitumor drug is significantly restricted due to its nephrotoxicity. In this study, the clastogenicity/anticlastogenicity and nephrotoxicity/nephroprotective activities of *Peperomia pellucida* (L) HBK decoction on the optimized CP-induced clastogenicity and kidney damage animal model were assessed. The results showed that treatments of 12.5 - 50.0 mg/kg *P. pellucida* (L) HBK decoction for 3 consecutive days/week for four weeks did not cause significant increase on the levels of micronucleated polychromatic erythrocytes (MNPCEs), blood urea nitrogen (BUN) and serum creatinine (SCr) levels, and renal tissue morphology similar to that of the negative control. This suggest that *P. pellucida* (L) HBK decoction is nonclastogenic and non-nephrotoxic at all concentrations tested. On the other hand, 7.5 mg/kg CP treatment once a week for four weeks in mice have caused significant elevation of MNPCEs, BUN and SCr levels and led to loss of normal renal histology. Posttreatments of *P. pellucida* (L) HBK decoction have ameliorated the increase of MNPCEs, BUN and SCr induced by CP, with up to 50% reduction, and showed improved kidney tissue morphology. These observations reveal that *P. pellucida* (L) HBK decoction treatment prevents CP-induced genotoxicity and nephrotoxicity which can be attributed to the synergistic effects of the diuretic, anti-inflammatory, analgesic, anticancer and antitumor compounds present in the plant. Kidney tissue protein profiling unveiled the presence of pro-apoptotic enzymes involved CP-induced kidney injury. Unfortunately, further purification steps and experimentations are needed to elucidate the molecular mechanism of the nephroprotective activity of the plant.

FENTON-LIKE DEGRADATION OF ORGANIC POLLUTANTS FROM AQUEOUS SOLUTION BY BIMETALLIC HIERARCHICAL ZEOLITE FeCu-HZSM-5

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Fenton reaction is an advance oxidation process that yields hydroxyl radicals from ferrous ion and hydrogen peroxide to degrade organic compounds. This oxidation process has attracted popularity due to its efficiency, low cost, use of non-toxic reagents, and simplicity of the operation. However, the reaction is limited to acidic conditions and is prone to iron leaching.

In this study, hierarchical zeolite ZSM-5 (HZSM-5) was synthesized by microwave-assisted synthesis using hexadecyltrimethylammonium bromide (CTAB) as the templating agent. Iron and copper metals were incorporated in the HZSM-5 through incipient wetness impregnation. As evidenced by the X-ray diffraction analysis, iron and copper oxides were present inside the pore volume of the zeolite sample. Furthermore, degradation of the organic pollutant was accomplished by the bimetallic catalyst FeCu-HZSM-5 and H2O2 as the hydroxyl radical source. The FeCu-HZSM-5 catalyst exhibited its catalytic activity due to the ease of transport and access of the reactants and products to the zeolite channels and the small metal oxide particles.

PREPARATION AND CHARACTERIZATION OF OTMA-HDTMA MODIFIED ZEOLITE Y FOR THE REMOVAL OF AS(V) IN AQUEOUS SOLUTION

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Exposure to water contaminated with higher levels of arsenate, As(V), may brought several human health problems, therefore removal of this contaminant is crucial. At present, adsorption technique was identified as a simple and effective technique for the elimination of arsenate in water and the success of arsenate removal via this technique depends largely on the development of effective sorbent materials. In this study, surfactant modified zeolite Y was synthesized and characterized and this will be used for the removal of As(V) in aqueous solutions.

X-ray diffraction analysis of the sample confirms that the synthesized product is probably a Y-type zeolite and its crystalline structure had been retained upon surfactant modification. As(V) was then adsorbed using OTMA-HDTMA modified zeolite Y. Isotherm data observed fitted well to Freunlich isotherm model. The OTMA-HDTMA modified zeolite Y exhibited high adsorption capacity for As(V) because surfactant modification allows the formation of a bilayer-

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like structure on zeolite surface thus altering its surface charge (from negative to positive) therefore providing sites for sorption of anions such as arsenate for which untreated zeolites have little affinity.

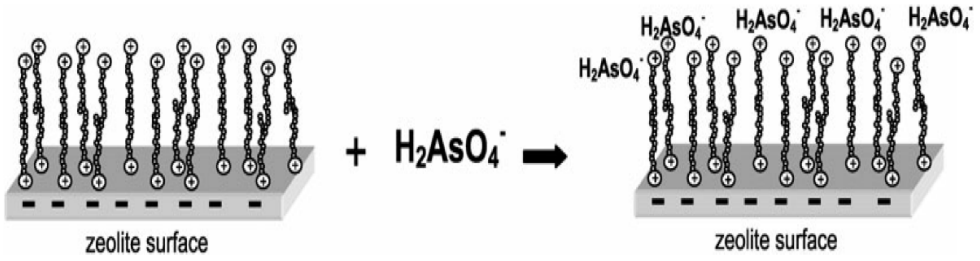

Figure 10. Schematic illustration of the adsorption of As(V) on the anionic site of surfactant modified zeolite

FUNCTIONALIZATION OF CELLULOSE NANOCRYSTALS FROM ABACA FIBER FOR NATURAL RUBBER LATEX REINFORCEMENT

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The search for a sustainable and low cost reinforcing agent for polymers with high commercial importance such as natural rubber has attracted many researchers on developing bio-based nanofillers. Nanocellulose contributes much on this type of research owing to its wide availability and promising properties.

Although bionanofillers have shown many advantages over the conventional filler, the dilemma faced by many researchers is the low compatibility of hydrophilic nature of nanocellulose and hydrophobic natural rubber. Over time, several studies have dwelled on counteracting the drawbacks of these biofillers. Functionalization of nanocellulose has been the major solution to improve the filler-matrix interaction and one of the functionalization technique is through fatty acid modification. In this study, cellulose nanocrystal (CNC) was isolated from abaca fiber by acid hydrolysis using 64% H_2SO_4 at 45° C for 40 min as the optimum conditions. The nanocellulose was characterized using Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscope (SEM) and X-ray Diffraction (XRD). The CNC was functionalized using oleic acid to improve its hydrophobicity and the FTIR spectra of the modified and the unmodified CNC showed that the modification was successful at peak 1745 cm^{-1} which was attributed to the formation of ester bonds. The Modified CNC was used as reinforcing agent to prepare nanocomposite films of natural rubber latex by casting method. The thermal, mechanical and morphological properties of the nanocomposite were also investigated.

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QUERCETIN GRAFTED STARCH/POLYLACTIC ACID (PLA) COMPOSITE FILM FOR ACTIVE FOOD PACKAGING APPLICATIONS

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Due to environmental concerns, researchers made efforts to study biopolymers which can potentially replace petroleum-based plastics in the market. Starch is one of these biopolymers. Starch alone, however, is inadequate to form materials with desirable mechanical properties so it is usually blended with other polymers like Polylactic acid (PLA). Aside from increased biodegradability, plastic packaging is being developed to help improve the shelf-life of food. These type of packaging materials is known as "Active packaging". In this study, an active packaging material was fabricated using quercetin-g-starch and PLA blend.

Fourier Transform Infrared Spectroscopy (FTIR) and Nuclear Magnetic Resonance (NMR) were done to verify the presence of quercetin in the conjugate. The amount of quercetin grafted to starch is 42 mg QE/g dry polymer. The thermal and tensile properties of the films were studied using Thermal Gravimetric Analysis (TGA) and Universal Testing Machine (UTM), respectively. The antioxidant property of the composite material fabricated was verified using ABTS analysis. The researcher was able to fabricate a bio-based active packaging material with good antioxidant property. This material can further be developed to cater the needs of the food packaging industry.

MODULATION OF THIOL-INDUCED OLEFINIC PROTONS LABILITY IN SOME MOLECULAR SWITCHES: DETERMINING THE POTENTIAL OF THESE SWITCHES AS CHEMICAL EXCHANGE SATURATION TRANSFER AGENTS

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The development of stimuli-responsive small molecules for probing biologically active antioxidants such as glutathione (GSH) has important ramification in the detection of oxidative stress. An ideal sensor for biological applications should be sensitive, selective, and reversible. Designing a suitable sensor thus requires a detailed understanding of activation properties and mechanism of action. In this project, antioxidant sensing of spiropyrans and the thiol-induced lability of the olefinic protons in spiropyrans will be investigated using NMR spectroscopy. Understanding the sensing mechanism of spiropyrans will facilitate the design of more effective sensors for detection of antioxidants in vivo.

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CHARACTERIZATION OF THE SURFACE OF KAPPA-CARRAGEENAN HYDROCHAR WITH MOLYBDENUM DISULFIDE

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Kappa-carrageenan is an abundant form of sustainable biomass source and has many practical applications. It can be transformed and functionalized into other useful forms through hydrothermal carbonization (HTC). Hydrothermal carbonization is a green and an energy-efficient way to convert carbonaceous biomass into amorphous carbon polymer with many oxygen functionalities. In this study, we aim to characterize the surface of kappa-carrageenan hydrochar with molybdenum disulfide via one-pot hydrothermal synthesis. The chemical functionalities on the surface of hydrochar samples were analysed by XPS and EDX, while the particle size and morphology were approximated using FESEM technique. The study confirmed the presence of KC hydrochar particles in the dimension of microns. FESEM images showed the successful synthesis of cabbage-like features of molybdenum disulfide distributed on the hydrochar matrix. Using XPS, the chemical forms of carbon, oxygen, molybdenum, and sulphur were determined. The XPS data were complimented by the elemental analysis using EDX. Overall, the characterization of surface of the KC hydrochar gave insights on how molybdenum disulfide was incorporated during the one-pot HTC.

ENCAPSULATION AND CHARACTERIZATION OF QUERCETIN IN METAL ALGINATE HYDROGELS FOR DRUG DELIVERY SYSTEM

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Quercetin is vital in our body. It exhibits various pharmacologic effects including anti-inflammatory and antiviral activities as well as its high potential in treating cardiovascular diseases. Importantly, quercetin is well studied for its antioxidant and anti-cancer properties. However, its insolubility, low bioavailability, short biological half-life and instability poses a problem in delivering it to the body. To improve its bioavailability, quercetin will be explored by encapsulating in metal alginate for a site specific and controlled release. Characterization using various techniques including FT-IR, TGA, DSC, SEM-EDX, XRD will be used to better understand the changes happening with different metal alginate compositions and some additives. The drug release profile in physiological pH conditions will also be investigated to describe release mechanism.

DEGRADATION OF RHODAMINE B USING SEMICONDUCTOR PHOTOCATALYSTS

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Photocatalytic degradation is one of the popular effective strategies to degrade organic pollutants in water. Two different semiconductor photocatalysts, silverphosphate (Ag3PO4) and Hydroxyapatite nanorods (HAp) were investigated via degradation of a recalcitrant pollutant, Rhodamine B. Both semiconductors photocatalysts were synthesized via precipitation method (size controlled for Ag_3PO_4 and mussel shell -derived for HAp). Particle size, morphology and compositions of the photocatalyst were analyzed using SEM-EDX. Degradation of Rhodamine B using the desired photocatalyst was performed in a fabricated photoreactor with constant stirring under visible light illumation for Ag3PO4 and UV light for HAp. Concentration was monitored using UV-Vis spectroscopy at 553nm. It was observed that the rate of Rhodamine B degradation is faster using the Ag3PO4 with larger particle size with a degradation efficiency of 99.9 after 1hr. On the other hand, HAp nanorods derived from mussel shells gave a degradation efficiency of 86.8% after 5 hr/s. Both photocatalysts are viable for future applications in photocatalytic degradation. Our team is currently investigating on the potential reason for the observed effect of Ag_3PO_4 particle size on its degradation rate. In addition, we are also exploring on optimizing the synthesis to improve the degradation rate of both photocatalysts.

METABOLOMIC AND STABLE ISOTOPE PROFILING OF CACAO BEANS IN THE PHILIPPINES BY GC-MS AND IRMS

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Cocoa beans have an important economic significance since it is the key ingredient in the production of chocolate and can also be found in pharmaceuticals, cosmetics and toiletries. Philippines is one of the countries that has geographical advantages on growing cacao trees. Food authentication and geographical origin has an important role since mislabeling and food fraud has reached a critical attention.

With the increasing demand on cocoa and the growing awareness of the consumers for food quality and food fraud, the researcher found it worthy to investigate and determine the metabolic and stable isotope profile of different species of cocoa beans from different farms in the Philippines. The study would also give way for farmers to fingerprint their crops for further authentication purposes. Also, the study aims to provide a scientific information which can promote the said agricultural crops and introduce this method to farmers.

The study will include the determination of metabolic profile of different species of cocoa from participating farms in the Philippines using GC-MS and the stable isotope profile will include Hydrogen, Carbon, Oxygen and Nitrogen isotopes using IRMS. Group trends and outliers will be visualized using multivariate analysis by PCA. Partial least squares discriminant analysis (PLS-DA) will be used to develop a determination method for origin mapping for cocoa.

**Adviser*

FILM-BASED CARBON NANODOTS FROM CARRAGEENAN FOR DEGRADATION OF TOXIC DYES

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Carbon nanodots (CNDs) is one of the new excellent carbon nanomaterials, which received a significant interest due to its excellent high fluorescence properties. This study explored the potential of carrageenan (κ-, ι-, λ-) as a carbon source for CNDs and its application in sensing and degradation of toxic dyes. UV-Vis Spectrophotometer was used in acquiring UV-Vis absorption spectra, Fluorescence Spectrophotometer for fluorescence spectra, Field Emission Scanning Electron Microscope (FESEM) equipped with EDS was done to measure the size and morphology of the CNDs and elemental analysis, Fourier Transform- Infrared Spectroscopy (FT-IR) was measured to analyze the functional groups, Nuclear Magnetic Resonance and Dynamic Light Scattering (DLS) was performed for the analysis of the hydrodynamic size and zeta potential of the CNDs. This study was a contribution to the environment and society on finding valuable use of carrageenan and new applications outside the food industry.

COAL FLY ASH-BASED GEOPOLYMER SPHERES COATED WITH AMOXICILLIN AND NANOSILVER FOR POTENTIAL ANTIBACTERIAL APPLICATIONS

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Geopolymers are emerging "green" materials for its low embodied energy and carbon footprint, and its potential to valorize wastes, such as coal fly ash. It is an inorganic cementitious material formed from the polymerization of aluminosilicates in an activating solution such as that of alkali hydroxides or silicates. Their superior mechanical properties, including heat and fire resistance make them an excellent material for diverse applications. Recent studies have also exploited the tunable open porosity and adsorbing properties of geopolymers. Our work thus explores the potential of porous geopolymer spheres for antibacterial applications. These spheres were synthesized using coal fly ash as the geopolymer precursor and the porous surface is coated with either amoxicillin or silver nanoparticles (AgNPs) adsorbed in the matrix. For the AgNP geopolymer spheres, SEM images show spherical nanostructures when using ascorbic acid as a reducing agent, while spherical, cubical, and wire structures were observed when reduced using NaBH4. Indication from UV-Vis results also suggest the gradual release of both amoxicillin and AgNPs in the solution from the functionalized geopolymer spheres. Using *E. Coli* as the test organism for a modified disk diffusion assay, both showed zones of inhibition against the bacteria. Further tests on antibacterial application of AgNP geopolymer spheres show their effectiveness to kill at least 95% of the *E. coli* in a water sample initially containing 105 cfu/mL in just 30 minutes.

GOLD-NANOPARTICLE/NICKEL HEXACYANOFERRATE COMPOSITE-MODIFIED GLASSY CARBON ELECTRODE FOR HISTAMINE DETECTION USING ELECTROCHEMICAL IMPEDANCE SPECTROSCOPY

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Histamine, which is produced during bacterial degradation of seafoods, is an indicator of food spoilage. Allergic reactions to histamine especially in seafood products are real threats to most people. Determination of the levels of histamine has been confined to the laboratories requiring advanced instrumentation and specialized training. There is a need to develop a simple and rapid method to detect histamine in fishes. The aim of this study is to develop a system to detect histamine in fish samples using electrochemical impedance spectroscopy (EIS). To improve the sensitivity of EIS to histamine detection, a working electrode composed of gold nanoparticle (AuNPs)/nickel hexacyanoferratemodified glassy carbon, will be fabricated. The morphology and composition of the modified electrode will be characterized by scanning electron microscopy and EDS, while its electrochemical behavior will be determined by cyclic voltammetry and EIS. The impedance of the system towards histamine will be determined by measuring the current when a potential at different frequencies (0.1 Hz-100kHz) is applied throughout the electrochemical cell using a three-electrode system. Using the optimized frequency, the impedance will be correlated to increasing concentration of standard histamine, which will be represented by the Nyquist plot (real Z vs imaginary Z) and the Bode plot (log Z vs frequency) of the system. The detection parameters such as limits of detection, sensitivity, and selectivity will be determined. The method will be validated using standard HPLC technique for determining levels of histamine.

FORTIFICATION OF RICE GRAINS WITH VITAMIN A

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Vitamin A is a fat-soluble vitamin that plays a major role in normal growth, vision, and reproduction. Vitamin A deficiency is the leading cause of preventable blindness among children in developing countries. Rice, which is a staple food, can be used as a vehicle of vitamins to address nutrient deficiencies. In a new rice fortification technique developed in our laboratory, the protocol involves surface modification and absorption of vitamins or minerals. However, the technique is limited only to water-soluble nutrients. This proposal will embark on developing a protocol for fat soluble vitamins using Vitamin A as the model vitamin. Three techniques will be explored in combination with rice surface modification. The rice grains will first be modified by ultrasonication to increase its absorption capacity. The sonicated rice grains will be subjected to three different methods of fortifications. The first method will utilize the water/ethanol-dispersable Vitamin A acetate where the sonicated rice will be soaked. The second method will use the non-polar form of Vitamin A, which will be dissolved in coconut oil where the sonicated rice grains will be soaked. The third method will involve supercritical CO_2 to dissolve the vitamin A powder using variable pressures. The Vitamin A uptake will then be quantified using HPLC-UV. The physiochemical, sensory, thermal, and cooking properties will also be analyzed.

**Adviser*

SULFONATED GRAPHENE OXIDE AS A HETEROGENEOUS CARBOCATALYST IN THE SYNTHESIS OF DIHYDROTRIAZOLOPYRAMIDINONES

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Graphene oxide, as a heterogeneous carbocatalyst, has been reported to be efficient in different organic reactions, aside from its other applications in the material and electrochemical field. In this study, the efficiency of graphene oxide after sulfonation was explored in multicomponent reactions. Sulfonated graphene oxide was prepared through a simple chemical approach using concentrated sulfuric acid. The catalyst was characterized by scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FT-IR), X-ray diffraction spectroscopy (XRD), X-ray photoelectron spectroscopy (XPS), elemental analysis, and acid–base titration. Its potential catalytic activity is being examined in the synthesis of dihydrotriazolopyramidinones.

STRUCTURAL INVESTIGATION OF DEGRADED KAPPA CARRAGEENAN

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The decrease in molecular weight of carrageenan due to various depolymerization techniques reveals new properties that is different from its polysaccharide counterpart, such properties include antioxidant, antitumor, antiviral, and antibacterial and plant growth promoting activity. The application of low molecular weight (LMW) oligosaccharides for agricultural purposes have produced promising results such as increase in product yield, protection against pathogens, stronger stem and increase of product size. All polymers degrade and the susceptibility of a polymer to undergo degradation process depends on its chemical structure, morphology, molecular size and the conditions to which it is subjected. The processes by which polymers can experience degradation are hydrolytic, mechanical, ultrasonication, chemical, thermal, biological, photolytic, and radiolytic. The studies about plant defense and growth mechanism established a relationship between molecular weight and the observed effect, indicating that as the molecular weight decreases the plant growth effect becomes more significant.

Carrageenan molecules are composed of D-galactose units and 3,6-abnhydrogalactose linked alternately with α-1,4 and β-1,3 linkages. The κ-carrageenan was selected in this study because of its high degradation yield which can be measured using Charlesby-Pinner equation and its molecular structure can be seen in figure 1.0. The initial results obtained from UV-VIS, FT-IR and 1H NMR suggests a change in the molecular structure of oligo-carrageenan kappa. The aim of this study is to separate various fragments of degraded κ-carrageenan using semipreparative GPC technique and determine its chemical structure by conducting 2D NMR techniques and elemental analysis to the degraded κ-carrageenan products.

ASSOCIATION OF *MTHFR* 677C>T AND *MTR* 2756A>G SINGLE NUCLEOTIDE POLYMORPHISMS AND THE RISK OF BREASTCANCER IN SELECTED FILIPINO POPULATION

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Single nucleotide polymorphisms (SNP) can change the functionality of enzymes involved in folate metabolism, such as methylenetetrahydrofolate reductase (MTHFR) and methionine synthase (MTR). Dysfunction in these enzymes could affect DNA synthesis and methylation resulting to cancer development, such as breast cancer. Several studies suggest that *MTHFR* and *MTR* SNPs are associated with breast cancer risk particularly among Asian populations. Thus, this study aims to determine the association of MTHFR 677C>T and MTR 2756A>G SNPs with the breast cancer risk in selected Filipinos seen at the University of Santo Tomas Hospital, Manila. DNA samples from patients (n=100) and healthy controls (n=100) were analyzed using PCR-RFLP analysis to evaluate the case-control differences in the genotypic and allelic distributions of these SNPs. The results showed that the MTHFR CT genotype (OR: 0.775, 95% CI: 0.35-1.71, P=0.528) and T allele (OR: 0.703, 95% CI: 0.34-1.48, P=0.352) were not associated with breast cancer risk. Likewise, no breast cancer association was observed in the MTR AG genotype (OR: 0.493, 95% CI: 0.23-1.04, P=0.064), GG genotype (OR: 0.436, 95% CI: 0.04-4.91, P=0.502) and G allele (OR: 0.520, 95% CI: 0.27-1.01, P=0.0503). Although both SNPs had no association, there were higher frequency values of their heterozygous genotype, homozygous mutant and mutant allele among cases compared with controls. Since this study involved relatively small number of participants, increasing the number of samples is recommended for a more conclusive MTHFR and MTR association with breast cancer risk.

ASSOCIATION OF *RRP1B* 1307 T>CAND *SIPA1* 545 C>T SINGLE NUCLEOTIDE POLYMORPHISMS WITH BREAST CANCER INCIDENCE IN A SELECTED FILIPINO POPULATION

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Ribosomal rRNA-processing protein homolog 1B (RRP1B) and signal-induced proliferation associated protein 1 (SIPA1) are two metastasis-linked proteins involved in cell proliferation, growth, and adhesion. Single nucleotide polymorphisms (SNPs) on the genes of these proteins, specifically *RRP1B* 1307 T > C and *SIPA1* 545 C > T, are found to be associated with increased breast cancer susceptibility in some populations. However, there are currently no studies on the association of these SNPs with breast cancer that involves a Filipino population. In this study, the *RRP1B* 1307 T > C and *SIPA1* 545 C > T SNPs were investigated for its association with breast cancer incidence in a Filipino population via a case-control study. Furthermore, a T-ARMS PCR protocol for genotyping *SIPA1* 545 C > T was designed and optimized since there is no available literature for this method. Based on the gathered results, there is no significant association between the *RRP1B* 1307 T > C (p = 0.386; OR for T/C = 0.81, 95% CI = 0.44-1.47;

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OR for T/T = 2.42, 95% CI = 0.45-12.95) and *SIPA1* 545 C>T (p = 0.670; OR for C/T = 0.78, 95% CI = 0.44-1.40, OR for T/T = 1.14, 95% CI = 0.29-4.48) SNPs and breast cancer incidence in the population involved. Furthermore, there are no association between *RRP1B* 1307 T > C and breast cancer type (p = 0.919), tumor grade (p = 0.673), lymph node involvement (p = 0.248), and distant metastasis (p = 0.626). Similarly, there are no association between SIPA1 545 C > T and breast cancer type (p = 0.464), tumor grade (p = 0.250), lymph node involvement (p = 0.118), and distant metastasis (p = 0.600).

SILVER NANOCOMPOSITES WITH CELLULOSE FROM CYPERUS ALTERNIFOLIUS: IMAGING AND ANTIMICROBIAL PROPERTIES

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Preparation of antimicrobial nanocomposite materials have gained significant interest for medical applications. Natural fibers which are readily available, biocompatible and biodegradable are much preferred rather than synthetic materials. This study aims to prepare Ag nanoparticles on cellulose fiber extracted from *Cyperus alternifolius* and investigate their morphology and antimicrobial properties. Silver concentrations of 0.1 mM, 0.4 mM, and 1.0 mM were used to prepare for cellulose fiber – Ag nanoparticles. A range of pale yellow color to golden yellow colors were observed on the cellulose fibers after Ag treatment. The spatial distribution of silver nanoparticles on the fibrous surface was studied using field emission scanning electron microscope (FESEM). The prepared cellulose fiber – Ag nanoparticles were found to have a good antibacterial activity against the different bacterial species, *E. coli, K. pneumonia, S. aureus, B. subtilis* and fungus, *C. albicans.* The prepared cellulose fiber – Ag nanoparticles could be developed as antibacterial textiles for medical and hygienic products.

ISOLATION, PURIFICATION, AND CHARACTERIZATION OF α-GLUCOSIDASE INHIBITORS FROM PC-DB19

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The inhibition of intestinal α-glucosidase can suppress glucose absorption, and reduce postprandial hyperglycemia, making it a significant approach in the management of type 2 diabetes. Potential α-glucosidase inhibitors (AGIs) derived from **PC-DB19** extracts were isolated through a bioassay-guided method that involved the use of reverse-phase high-performance liquid chromatography (HPLC) system equipped with a diode array detector. The developed method was regarded as a simple, rapid, easy to perform, and useful method for the purification

of AGIs from **PC-DB19**. Initially, the leaves were extracted using *n*-hexane, ethyl acetate, ethanol, methanol, and water. Inhibitory potential of the extracts against α-glucosidase was assessed *in vitro*. The most potent inhibition was exhibited by aqueous extracts with a half-maximal inhibitory concentration (IC_{50}) that is lower than acarbose to a large extent. An optimized chromatogram enabled the separation of major constituents in the complex matrices of the aqueous extract. Results from the bioassay of the isolates revealed that the significant inhibitory potency of the extract could be attributed to the synergistic effect of two AGIs, Fraction **X** and Fraction **Y**. UV spectra of the isolates showed a λ_{max} at 278 nm, a typical spectral characteristic of proanthocyanidins, while dominant FT-IR peaks corresponded to O–H, C–H, C=C, and C–O vibration modes, with spectral patterning characteristic to ketone-less flavonoids and proanthocyanidins, which were confirmed to be present in the fractions through phytochemical screening tests. **PC-DB19** can act as a promising standardized herbal medicine and as a source of AGI candidates for the next stages of antidiabetic drug development.

TOTAL SYNTHESIS OF FICUSNOTIN-E ANALOGS

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A new strategy for the total synthesis of Ficusnotin-E is described. Key features of the synthesis include the construction of precursor intermediate via one-pot copper (I)-activated tandem Grignard addition-hydrolysis sequence, followed by a base-catalyzed aldol condensation with different substituted benzaldehdyes and chemoselective hydrogenation using aqueous Raney Nickel.

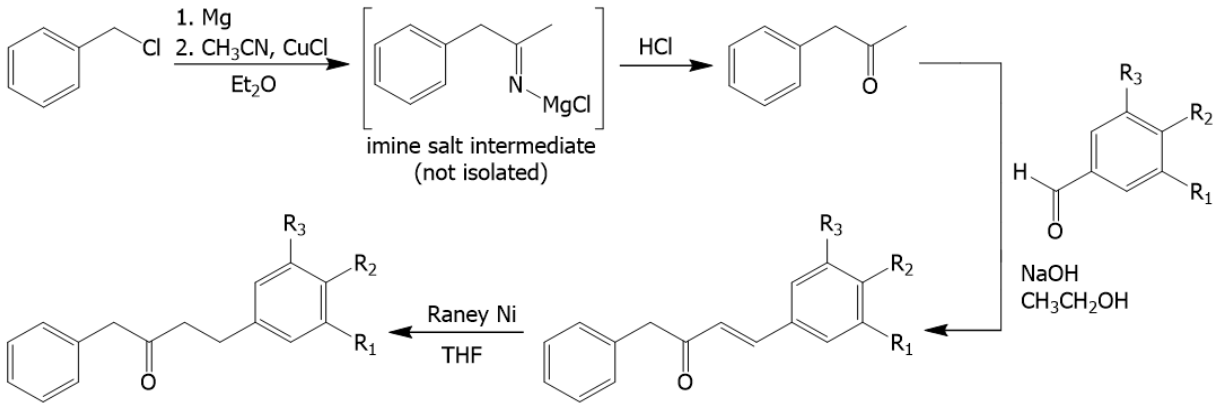

Figure 11. General reaction for the synthesis of Ficusnotin-E analogs

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MICROWAVE-ASSISTED SYNTHESIS OF 4-ARYLCOUMARIN DERIVATIVES

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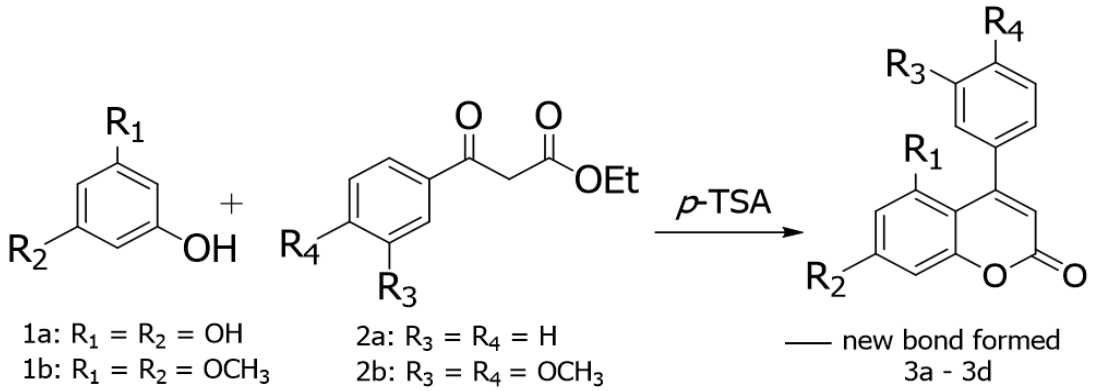
Pechmann condensation is a simple and useful methodology for coumarin synthesis that proceeds in three steps: electrophilic aromatic substitution, transesterification, and dehydration. Conventional protocols, however, involve harsh reaction conditions. Using microwave irradiation, a one-pot, one-step protocol for Pechmann condensation of various β-keto esters and phenols provides a greener route in the production of target 4-arylcoumarin derivatives. Optimization of the reaction conditions, reaction time and microwave power, and the addition of p-TSA as catalyst ensured the production of 4-phenyl 2H-chromen-2-one derivatives in significant yields.



ANTI-INFLAMMATORY AND ANTIPROLIFERATIVE ACTIVITIES OF SELECTED PHILIPPINE MARINE SPONGES COLLECTED OFF POBLACION, KAUSWAGAN, LANAO DEL NORTE

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With countries like the Philippines, a nation which has long been recognized by its large archipelagic nature, there is a need for exploration of untapped potentials for anticancer and anti-inflammatory drugs.

In this study, nonpolar and polar extracts were prepared from five marine sponges collected off Poblacion, Kauswagan Lanao del Norte. In the anti-inflammatory assay, almost all the extracts yielded anti-inflammatory properties but only to a mild extent against HCT116 cancer cell line with PKSS03NP (48.35%) as the highest. When tested for their antiproliferative potential, PKSS02NP, PKSS03NP, PKSS07NP and PKSS07P crude sponge extracts revealed cytotoxic effects from moderate to mild (41.44%-58.66%). Considering their activities in the secondary and orthogonal assays, two active extracts, PKSS07P and PKSS02NP, were respectively partitioned into organic and aqueous fractions and subjected to another round of MTT assay against HCT116. The organic and aqueous extracts of both PKSS07P and PKSS02NP exhibited comparable mild cytotoxic effects with cell viability values of 82.87%-89.23% and 64.51%-97.39%, respectively.

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EVALUATION OF ISORHAMNETIN AS METAL CHELATOR TO INHIBIT METAL-Aβ INDUCED AGGREGATION IN ALZHEIMER'S DISEASE: A MOLECULAR DOCKING AND MULTISPECTROSCOPIC STUDY

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Alzheimer's disease (AD) is a form of neurodegenerative disease characterized by the aggregation of amyloid-β (Aβ) peptides in the brain and excessive generation of reactive oxygen species that leads oxidative damage of neurons. Studies showed that the aggregation rate is hastened by the presence of metal in the protein folds. To prevent Aβ from further aggregation at the onset of AD, metal protein attenuating compounds (MPACs) are introduced to chelate the metal in the metal-induced Aβ aggregation. Isorhamnetin, a flavonoid and known antioxidant, is evaluated towards Pb(II)-Aβ(1-42) induced aggregation through molecular docking simulation, UV-Vis, fluorescence and FTIR spectroscopic studies. Affinity of Pb towards Aβ(1-42) and isorhamnetin towards Pb(II)-Aβ(1-42) were evaluated at the theoretical level through molecular docking studies. Results of molecular docking studies showed that Pb produces non-bond interactions such as charge repulsion and metal repulsion on His 6, 13 and 14 residues of Aβ(1-42) (Figure 12). Upon the addition of isorhamnetin on the Aβ(1-42)-Pb(II) aggregate, these interactions were absent and instead, electrostatic interactions of isorhamnetin on Aβ(1-42) were observed. UV-Vis spectra show isorhamnetin interaction with Pb(II) and a potential chelator in the Aβ(1-42)-Pb(II) to inhibit aggregation. Fluorescence intensity of Aβ(1-42)-Pb(II) aggregate decreased upon addition of isorhamnetin suggestive of the isorhamnetin's chelation property with Pb(II) and/ or inhibition on the Aβ(1-42) aggregation. Further, FTIR studies will show confirmation on these observed interactions and the use of plant extracts as natural source of MPACs for evaluation.

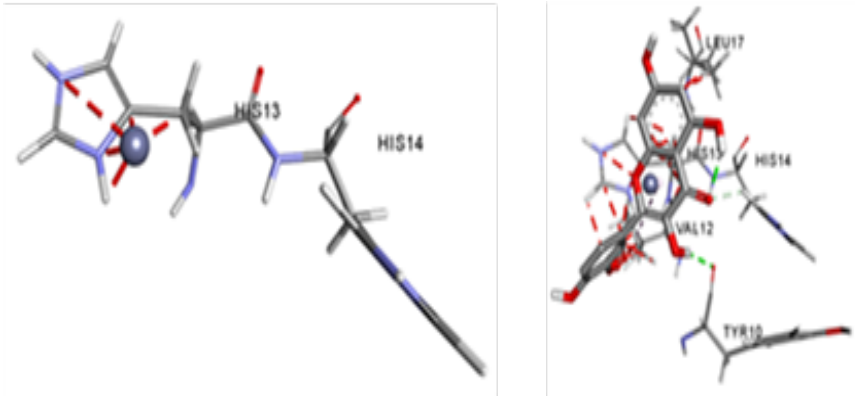

Figure 12. Pb binding on His 13 residue of Aβ without and with isorhamnetin

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EVALUATION OF THE ANTIOXIDANT, ANTICANCER AND ANTI-INFLAMMATORY PROPERTIES OF TRADITIONAL MEDICINAL PLANTS USED BY THE MAMANWA INDIGENOUS PEOPLE OF MINDANAO

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This study evaluated the antioxidant, anticancer and anti-inflammatory properties of the decoction and ethanolic extracts of selected traditional medicinal plants used by the Mamanwa Indigenous People of Mindanao namely "Baklid" and "Panamog". Antioxidant potentials were assessed using the DPPH Radical Scavenging Assay, the Total Phenolics Content Assay and the Total Flavonoid Content assay based on the Folin-Ciocalteu and Aluminium Chloride colorimetric methods, respectively. EC_{50} values for DPPH radical scavenging activity ranged from 75.07-192.12 µg/ml, with the decoction of "Baklid" having the lowest value and thus the most potent. The ethanolic extract of "Panamog" showed the highest content of total flavonoids (101.73±4.18 mg/g QE), while the decoction of "Baklid" exhibited the highest total phenolics content (93.08±4.18 GAE/g). Cell viabilities were determined using the MTT assay. Almost all samples showed mild cytotoxicity (65.60±0.08-161.49±1.40% viability of cells) against breast (MCF-7), lung (A549), and colon (HCT116) cancer cells. The anti-inflammatory activity of the plant extracts was evaluated by measuring the activity of the caspase-1 using a luminogenic caspase-1 substrate, Z-WEHD-aminoluciferin. The plant samples showed only mild inhibitory effect with the ethanolic extract of "Panamog" having the highest inhibition of 32.98±3.54%.

A SIMPLE PROTOCOL FOR THE SYNTHESIS OF 4-HYDROXYQUINOLIN-2(1H)-ONE AND ITS OLEFINATION WITH SUBSTITUTED BENZALDEHYDES

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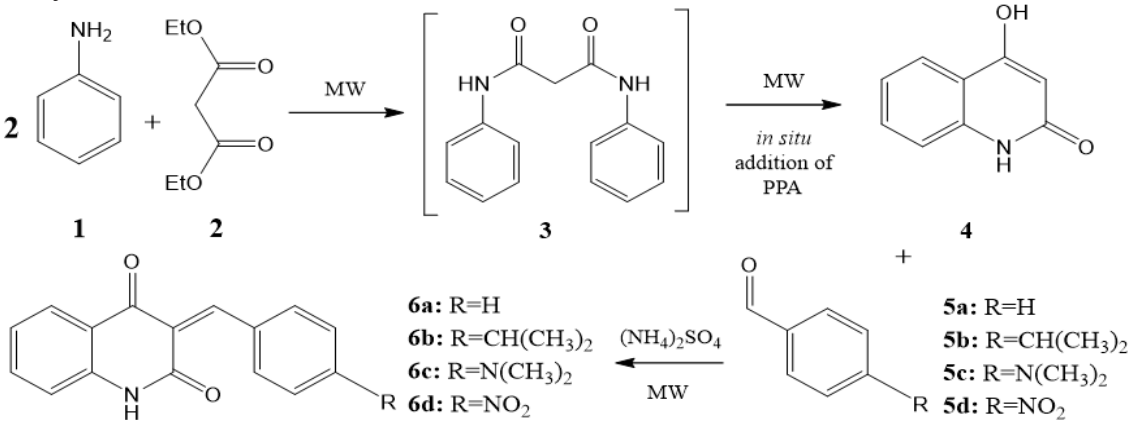
A simple one-pot, two-step approach was developed for the synthesis of 4-hydroxyquinolin-2*(1H)*-one by employing microwave irradiation. Using the one-pot protocol, the necessity of intermediate isolation was eliminated, thereby reducing the overall workup procedure as well as waste production. In addition, derivatization of the hydroxyquinolone framework with substituted benzaldehydes was also carried out. Incorporation of microwaves in the reaction and ammonium sulfate as catalyst produced 3-benzylidenequinolin-2,4(*1H,3H*)-diones in reasonable yields.



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MOLECULAR DOCKING STUDY, MICROWAVE-ASSISTED SYNTHESIS AND ANTIOXIDANT PROPERTY EVALUATION OF NAPHTHOFLAVONOL ANALOGS

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Several novel *beta*-naphthoflavonol analogs were designed using computational techniques, and the drug-likeness properties, pharmacokinetics and pharmacodynamics of the analogs were predicted using Swiss ADME, Swiss target prediction and molecular docking. A microwave-assisted one-pot, two-step approach was developed using Claisen-Schmidt condensation and Algar-Flynn Oyamada oxidative cyclization reaction to synthesize analogs **3a, 3b** and **3c.** Based on the results, the analogs were proven to have good drug-protein interactions with the selected target proteins, tyrosinase and proline-rich tyrosine kinase (PYK2). All synthesized compounds were characterized using Rf values, melting points, UV-Vis spectroscopy, and FT-IR. The antioxidant activity was assessed using DPPH assay and product **3b** is the most active among the three compounds synthesized.

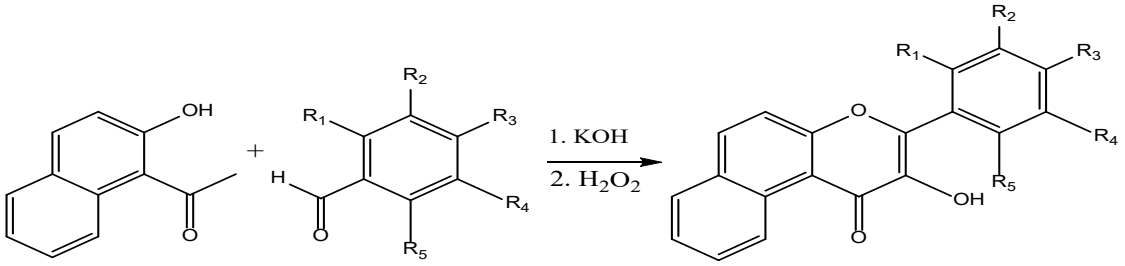

Figure 13. General scheme for the synthesis of beta-naphthoflavonol

ANTIOXIDANT, ANTI-INFLAMMATORY AND ANTICANCER ACTIVITIES OF SELECTED TRADITIONAL MEDICINAL PLANTS UTILIZED BY THE MAMANWA INDIGENOUS PEOPLE OF AGUSAN AND SURIGAO PROVINCES

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"Dayakit" and "Buka-buka" are traditional medicinal plants utilized by the Mamanwa indigenous people of Agusan and Surigao Provinces. In the present study, antioxidant, anti-inflammatory and anticancer activities of the decoction and ethanolic leaf extracts of "Dayakit" and "Buka-buka" as well as their total phenolics content (TPC) and total flavonoids content (TFC) were investigated. Their antioxidant activities were evaluated using 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging assay. TPC and TFC were estimated based on the Folin-Ciocalteu and aluminium chloride colorimetric methods. Their anti-inflammatory activities were determined on the basis of their ability to inhibit caspase-1 in monosodium urate-induced HCT116 cells. Anticancer activity was determined using 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) cell viability assay. Results showed that the decoction leaf extract of "Dayakit" had the highest level of total phenolics and the most potent antioxidant activity. On the other

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hand, the ethanolic leaf extract of "Dayakit" showed the highest level of total flavonoids and a weak anti-inflammatory activity. Moreover, all extracts showed weak anticancer activities against A549 lung cancer and HCT116 colon cancer cells. Strong correlations were found between TPC and antioxidant activity and between TFC and anti-inflammatory activity. These results suggest that phenolic compounds and flavonoids present in these medicinal plants play a significant role in their antioxidant and anti-inflammatory activities.

PHYTOCHEMICAL ANALYSIS OF CRUDE "TABON-TABON" (*Atuna racemosa* Raf.) FRUIT EXTRACT AND ITS POTENTIAL AS BIOFUNGICIDE AND ANTIBACTERIAL WASH FOR GREEN ICE LETTUCE (*Lactuca sativa* var. Crispa)

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The increasing trend on vegetable consumption signals the need to assess the safety of ready to eat, minimally processed fresh produce. Aside from this, post-harvest losses brought by fungal diseases poses a major problem in the agriculture industry. With the aim to address these issues, the potential use of the aqueous fruit extracts (AFE) of the underutilized *tabon-tabon* plant as a biofungicide and as a vegetable wash for Green Ice leaf lettuce was examined by determining its phytochemical and antimicrobial properties.

Plant material subjected to air-drying (AD), oven-drying (OD) and freeze-drying (FD) revealed significantly higher ($p<0.05$) levels of Alkaloids and Tannins compared to Coumarins, Saponins and Terpenoids. Highest Alkaloid content (16.25±1) was obtained using OD while highest Tannin content was obtained using FD (11.32±0.91). Among the drying techniques employed, OD was found to have the highest extraction yield. Hence, it was used for antimicrobial analyses. *In vitro* antifungal activity of OD AFE was evaluated at concentrations 20, 40 and 60 mg/ml which exhibited positive antifungal activity against the isolated *Cercospora* sp. strain. Moreover, the antifungal activity was found to be concentration dependent. Highest Percent Inhibition of Radial Growth (PIRG) value (32.54%) was observed from the highest concentration. AFE were also tested (*In vivo*) as an antimicrobial wash on Green Ice lettuce artificially inoculated with *E. coli.* 200 ppm chlorine and water were also tested alongside at 2 min and 5 min contact time for 8 days. Microbiological analyses showed no treatment x time interaction. As such, the treatments were independently found to have significant effects at days 0, 4 and 6. The least antibacterial effect was observed using water, followed by chlorine. Lastly, AFE was found to be the most effective wash in reducing bacterial load in green ice lettuce. However, determination of optimum concentration for application of plant extract is recommended since it induced surface discoloration at prolonged storage period.

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PHYSICO-CHEMICAL, PROXIMATE AND FUNCTIONAL PROPERTIES OF COMPOSITE FLOUR FROM BANANA (*Musa acuminata x balbisiana var Cardaba* C.) SWEETPOTATO (*Ipomoea batatas* Lam) AND GLUTINOUS RICE (*Oryza sativa var glutinosa* L.) FERMENTED WITH *Lactobacillus plantarum* (ORLAN-JENSIN)-BIOTECH 1223

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Composite flour is advantageous in countries where wheat cultivation is not possible like Philippines. Hence, locally available crops, banana, sweetpotato, and glutinous rice were processed to flour as a means of reducing the dependence on wheat. Also, with the application of lactic acid bacteria fermentation, to modify the quality of the native flour which can further improve its range of application. Thus, the study was conducted to evaluate the quality of the *Lactobacillus plantarum* fermented composite flour from banana, sweetpotato, and glutinous rice flour on the physico-chemical (pH, total soluble solids, titratable acidity), proximate composition (moisture content, crude protein, fat, and ash) and functional properties (water absorption capacity, oil absorption capacity, bulk density, swelling capacity, and gelation). Using Augmented Simplex Lattice Design, 10 treatments were generated with different levels of the three independent variables. Response Surface Regression Analysis revealed that linear and quadratic effect of fermented banana, sweetpotato, and glutinous rice flour were found to significantly influenced the total soluble solids and titratable acidity. Proximate composition analysis revealed that the linear and special cubic effect of the fermented banana, sweetpotato, and glutinous rice significantly influence the moisture content. On the other hand, linear effect of the three independent variables significantly affected the ash content. Functional analysis showed linear effect of fermented banana, sweetpotato, and glutinous rice significantly influenced the water absorption capacity, bulk density, and swelling capacity. Moreover, quadratic effect also significantly influenced the bulk density and special cubic effect influenced water absorption capacity and gelation properties.

Keywords: Augmented Simplex Lattice Design, Fermented Composite Flour, physico-chemical properties, proximate composition, functional properties

QUALITY EVALUATION AND SHELF-LIFE STUDY OF VACUUM FRIED CHICKEN (*Gallus gallus domesticus* L.) "ISAW" THROUGH MOISTURE SORPTION ISOTHERM (MSI) AND ACCELERATED SHELF-LIFE TESTING (ASLT)

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Chicken "isaw" which is a very common street food in the Philippines is prepared by conventional frying and is observed to have poor shelf-life and keeping qualities. Hence, a new product was developed employing vacuum frying technology to minimize undesirable changes and provide longer shelf-life as the conditions under vacuum frying involves the use of low temperature and minimal exposure to oxygen. However, data on its quality and shelf-life are not yet

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available since the product is new. Thus, development of sorption isotherms, understanding of isosteric heat of sorption and application of accelerated shelf-life testing to the newly developed product is essential for the quantitative approach to predicting stability, quality changes during packaging and storage, and predicting its shelf-life. Isotherms of vacuum fried chicken "isaw" were measured at 20°C, 30°C and 40°C by the static gravimetric method over a range of relative humidity from 7 to 75%. BET (up to 43% Aw), Smith, Kuhn, Oswin, Karel and Peleg were the mathematical models used in fitting the experimental sorption data. Corresponding to BET, the monolayer moisture content revealed that the vacuum fried chicken "isaw" must have a moisture content of 3.7946%, 1.9858% and 1.9691% at 20°C, 30°C and 40°C, respectively to prevent auto-oxidation and to enhance product stability of vacuum fried chicken "isaw" during storage. The net isosteric heat was calculated using the Clausius-Clapeyron equation and was observed that as moisture content is decreased, isosteric heat of sorption increases. Meanwhile, shelf-life of vacuum fried chicken "isaw" was determined through accelerated shelf-life testing through water activity, moisture content and microbial count (TPC) determination per week. Results revealed that even until the sixth week of storage, Aw of the product stored under 20°C, 30°C and 40°C was still below the set standard (0.300). Moisture content of the product was found to increase as storage week is lengthened but was observed to be below the set standard (3%) even until the sixth week of storage. Microbial count of the vacuum fried chicken "isaw" stored under three different storage temperatures (20°C, 30°C & 40°C) was also found to be below the given standard (105 CFU/g) even until its sixth week of storage. Results revealed using the Q_{10} that product's shelf-life is estimated to be 20.1360 weeks when stored at 20°C.

MICROBIAL QUALITY AND SENSORY QUALITY EVALUATION OF MINIMALLY PROCESSED UNRIPE JACKFRUIT (*Artocarpus heterophyllus* Lam) AS AFFECTED BY LEVELS OF ASCORBIC ACID, SODIUM METABISULFITE AND SODIUM BENZOATE AND STORAGE CONDITION

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The study was conducted to determine the effects of ascorbic acid (1.0% and 1.5% w/v), sodium metabisulfite (0.02% and 0.1% w/v) and sodium benzoate (0.02 % and 0.1% w/v) levels as pretreatment solution to the microbial quality and visual sensory properties of minimally processed unripe jackfruit. The samples were evaluated on both storage days namely: ambient storage and chilling storage across 8 days of storage period.

Microbial effect estimates on both ambient and chilled temperature shows that both ascorbic acid and sodium benzoate as well as their interaction effects gave negative significant effect which means that the increase in the levels of these two pretreatment solution would result a lower microbial count. Microbial analysis also reveals that the control treatment is only microbiologically acceptable at day 1 and up to day 4 on ambient storage and chilled storage

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respectively while treated samples are microbiologically acceptable until day 2 and day 6 of ambient storage and chilled storage, respectively. Treatment 7 ((Ascorbic Acid (1.5 w/v), Sodium Metabisulfite (0.1 w/v) and Sodium Benzoate (0.02 w/v)) in particular, is microbiologically acceptable until the last days of storage.

Results in sensory evaluation reveal that ascorbic acid mainly affects most of the sensory attribute such color, texture and general acceptability. Aroma acceptability was only affected by levels of sodium metabisulfite on day 1 of storage at ambient storage. Based, on the sensory evaluation parameters, Treatment 6 (Ascorbic Acid (1.5 w/v), Sodium Metabisulfite (0.02 w/v) and Sodium Benzoate (0.1 w/v)) is generally the most acceptable among all treatments.

Keywords: Microbial quality, sensory quality evaluation, dipping solutions, storage days.

SYNTHESIS AND CHARACTERIZATION OF GOLD-GRAPHENE OXIDE NANOSTRUCTURES

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Gold Nanoparticles has been extensively exploited due to its unique optical properties and biocompatibility. Gold-based nanostructures are commonly used as a nanosensor. Gold's ability to exhibit a localized surface plasmon resonance is the reason why it has been integrated as a substrate in Surface-enhanced Raman Spectroscopy (SERS). Tuning the shape of the gold nanoparticles from spherical to rod-like or star-like is one way to further enhance the Raman signal. By integrating graphene oxide (GO) to SERS, Raman signal can also be enhanced via π-π stacking. Also, GO is a good molecular anchor because of its affinity to organic compounds. The need for a better substrate for SERS is vital when developing SERS based nanosensors.

In this work, different gold-GO nanostructures such as spheres and stars were synthesized by modifying the Turkevich method and seed-mediated method, respectively. UV-Vis spectroscopy was employed to examine the absorbance spectra of the synthesized nanostructures while scanning electron microscope (SEM) was used to determine the size and morphology. SEM micrograph shows well defined spherical particles for structures synthesized using the modified Turkevich method. Nanoparticles synthesized using the modified seed-mediated method exhibit star-like morphology. Synthesized nanostructures are well embedded on the graphene oxide sheet. UV-vis spectra showed that spherical particles has an absorbance at around 520nm while stars were at around 650nm. The peak at 270nm can be attributed to GO. The synthesized nanostructures are therefore good candidates as SERS substrates for the detection of organic molecules due to the synergistic effect of incorporating GO into gold.

**Adviser*

PVP-MEDIATED SYNTHESIS AND SURFACE FUNCTIONALIZATION OF IRON(III)-BASED METAL-ORGANIC FRAMEWORK NANOPARTICLES

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Metal-organic framework nanoparticles (MOF NPs) often have novel and enhanced size-dependent properties which are not present in their bulk counterparts, such as accelerated adsorption/desorption kinetics, increased external surface-area-to-volume ratio, and improved bioavailability. Iron(III)-based MOF NPs with the formula Fe(III)(OH)(1,4-BDC) was synthesized via coordination modulation method to produce highly uniformed and monodispersed nanoparticles with different crystal morphologies. The effect of the nature and concentration of polyvinylpyrrolidone (PVP) as modulator on the crystal growth was also investigated. The crystallinity of the synthesized iron(III)-based MOF NPs was analyzed using X-ray diffraction (XRD) while the surface morphology of the nanoparticles was characterized using scanning electron microscopy (SEM). The particle size distribution was also measured using dynamic light scattering (DLS) technique. Nanoparticles are also known to exhibit undesirable surface properties which causes aggregation in solutions. Thus, post-synthetic functionalization on the external surface using PVP was performed to improve colloidal stability. The nature of polymer binding during surface functionalization was further analyzed using Fourier transform infrared spectroscopy (FTIR). This research aims to develop new facile strategies in fabricating iron(III)-based MOF NPs with desirable functionalities and characterize these materials for their potential applications in versatile research areas.

IN-VITRO 5-LOX AND COX INHIBITION OF THE ISOLATES FROM *Eleusine Indica* Linn Gaertner (Poaceae) AERIAL SHOOT FRACTION

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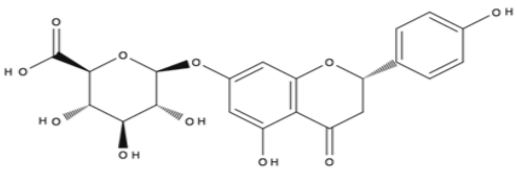
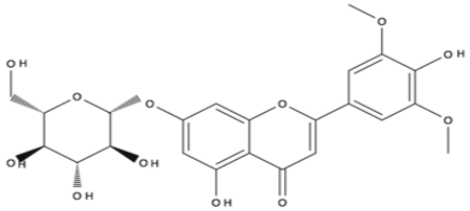
Goose grass (*Eleusine indica*) is a locally abundant weed traditionally used as an herbal medicine. Recent studies supported its use in inflammatory processes as evidenced by the reduction of Lipopolysaccharide-induced inflammation *in vitro* and *in vivo.* (De Melo et. al., 2005) This research aims to evaluate the anti-inflammatory of *E. indica* in the context of cyclooxygenase (COX-1 & COX-2) and lipoxygenase (5-LOX) inhibition *per se*. Drugs able to act as dual inhibitors of arachidonic acid pathways is of pharmacological interest as it possesses a wide range of anti-inflammatory activity with no ulcerogenic risk, and could be a promising treatment for cancer and seizure-induced neurovascular leakage. (Leval et al., 2002; Sokola, B.S., 2018). Additionally, cytotoxicity screening using HepG2 and HK-2 cells and characterization of the most active isolate were also performed.

Preliminary screening of the crude methanolic extract and its fractions revealed significant dual 5-LOX/COX inhibition, with no significant difference among the treatment groups ($p<0.05$). Ethyl acetate fraction, the most active dual inhibitor found to be rich in phenolic compounds after TLC derivatization, were considered for further purification and screening at 50µg.mL^{-1}. Among the 9 isolates, isolate 6 was regarded as the most active sample with moderately hepatotoxic and nephrotoxic profile. Its IC_{50} was found to be 16.47 µg.mL^{-1} for 5-LOX, 19.64 µg.mL^{-1} for COX-1, and 22.26 µg.mL^{-1} for COX-2 respectively. Two compounds namely Naringenin-7-O-β-D-glucuronide and Tricin-7-O-β-D-glucopyranoside (see Figure 14) were tentatively identified after mass spectral analysis. These compounds, along with seven other compounds identified from isolate 6, were responsible for the dual anti-inflammatory activity of E. indica.



(A) Naringenin 7-O-β-D-glucuronide



(B) Tricin-7-O-β-D-glucopyranoside

Figure 14. Tentative Chemical Structure of Compounds Identified in Isolate 6

ACTIVITY-GUIDED ISOLATION AND CHARACTERIZATION OF IN-VITRO XANTHINE OXIDASE INHIBITORS FROM *DDHP_1587* LEAVES

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DDHP_1587 is a plant widely cultivated in the Philippines and other Southeast Asian countries. Its leaves are noted to possess high therapeutic value and was previously reported to inhibit xanthine oxidase (XO) activity. The present study isolated and characterized its bioactive compounds guided by the XO enzyme inhibitory activity measured through a spectrophotometric assay based on the conversion of xanthine to uric acid. Powdered *DDHP_1587* leaves were successively extracted with different solvents. Preliminary screening of these crude extracts revealed the CE3 to have the highest activity at 25 ppm (46.99%±5.93%). The crude extract was subjected to solvent partitioning yielding three fractions wherein the SF2 demonstrated the highest activity of 57.33% (±6.67%) at 25 ppm. Column chromatography was then done for further separation, which afforded eight subfractions with F1 showing the greatest activity at 55.63% (±6.26%) at 25 ppm. This fraction was then subjected to Preparative Layer chromatography for isolation where a semi-purified sample showed a 44.77% (±2.12%) XO enzyme inhibition. This was further separated and afforded a partially purified sample with a significant activity of 61.67% (±2.00%) at 25 ppm and an IC50 value of 57.80µg/ml. Furthermore, phytochemical tests and mass spectrum analysis revealed the consistent presence of flavonoids as one of the putative bioactive compounds.

**Adviser*

BIOASSAY-GUIDED ISOLATION AND CHARACTERIZATION OF α-GLUCOSIDASE INHIBITOR FROM *MASE* PEEL

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Diabetes is a severe chronic disease that affects 422 million adults worldwide in 2014. It was the sixth leading cause of mortality in the Philippines in 2016. The primary cause of death of diabetic patients is due to cardiovascular disease. α-Glucosidase inhibitors (AGIs) are known for their cardiovascular benefits because they prevent the postprandial glucose level from increasing which plays a significant role in the development of cardiovascular diseases. AGIs are expensive, and not all can take these medications due to financial constraints. Therefore there's a need to discover AGI from plants since they are more accessible to the community especially to those who are in remote areas who use plants as their primary treatment. Thus, this study aims to isolate and characterize α-glucosidase inhibitor from *MASE* peel. A preliminary test will be done to assess the α-glucosidase inhibitory activity of four different crude extracts of *MASE* peel. The crude extract with the highest α-glucosidase inhibitory activity will be subjected to bioassay-guided isolation until a pure compound is obtained using flash column chromatography and preparative TLC. Acarbose will be used as the positive control. All tests will be performed in triplicate. Percentage inhibition will be calculated from the absorbance results at the end of the assay. The IC50 values will be determined from plots of percentage inhibition versus log inhibitor concentration and will be calculated by non-linear regression analysis from the mean inhibitory values. The purified α-glucosidase inhibitor/s will be characterized using FTIR and HPLC-MS.

A STUDY ON THE AWARENESS, KNOWLEDGE, ATTITUDES AND PRACTICES (AKAP) OF BARANGAY NUTRITION SCHOLARS (BNS) ON THE 2012 OPERATION TIMBANG PLUS (OPT PLUS) IMPLEMENTING GUIDELINES IN MALABON CITY, PHILIPPINES

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[2]*Open University, University of the Philippines Los Baños, Laguna, Philippines 4031*
[3]*Institute of Human Nutrition and Food, University of the Philippines Los Baños, Laguna, Philippines 4031*
[4]*National Nutrition Council, 2332 Chino Roces Ave. Ext. Taguig City, Philippines 1630*
[5]*Food and Nutrition Research Institute, DOST Compound General Santos Ave, Taguig City, Philippines 1630*

Background and Objectives: Malnutrition in the Philippines remains a serious problem. High quality data are prerequisite for better information, decision-making and population health and are essential to tracking Sustainable Development Goals' progress, specifically zero hunger and good health and wellbeing. Generating nutrition data of all under-five children, Philippines uses Operation Timbang Plus (OPT-Plus), an annual activity conducted by Barangay Nutrition Scholars (BNS) or volunteer nutrition workers in the villages. OPT-Plus is the only mechanism available for local nutrition planning. Such evaluation is needed to determine not just OPT-Plus usefulness but also its adaptiveness to users.

Adviser

Methods: This mixed-method study determined the awareness, knowledge, attitudes and practices (AKAP) of BNS in one of the highly-urbanized-city of the Philippines on the 2012 OPT-Plus Implementing Guidelines and explored underlying factors in the successful conduct of the activity. Information was drawn from validated and pretested questionnaires and interview schedule for quantitative and qualitative methods.

Results: Study showed majority of village nutrition workers were not aware of the implementing guidelines but were knowledgeable and showed positive attitude towards OPT-Plus, however most of them have poor practices in the conduct of the activity. It appears that AKAP is interrelated to each other. It was concluded that recurring themes, such as enabling and cooperative environment, work and life balance, information and dissemination strategies, data quality, innovation on measuring tools, training and supervision and dedication to work, are factors that underly a successful implementation of the OPT-Plus.

Conclusion: The study provided evidence to the undocumented information and insights on the AKAP of BNS on OPT-Plus, and factors that affect its conduct. The results of the study will be used in planning for strategies that will improve the conduct of OPT-Plus and will jump-start the nationwide data quality review as part of the Philippines' first nutrition research agenda and updated surveillance system.

FOOD WASTE GENERATION AND MANAGEMENT OF SELECTED BARANGAYS IN QUEZON CITY: A CASE STUDY

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This paper aimed to measure the proportion of household with avoidable food waste and the average generation of avoidable food waste in selected barangays in Quezon City as well as its management at the barangay level. This study was a case study of one city using a mixed method specifically concurrent triangulation design. This also included a survey of household avoidable food waste using household food inventory list and key informant interviews of barangay officials and staffs involved on food waste management. Three barangays in Quezon City were pre-selected as study areas. A total of 228 household respondents and 4 key informant interviews of barangays officials and staffs were obtained. Estimation for population proportion and population mean were employed. Content analysis was utilized to analyze the key informant interviews.

The proportion of households with avoidable food waste was 0.7 with 95% CI of 0.64- 0.76 while the average household avoidable food waste was 127.50 grams ±13.70 grams and 95% CI of 100.50- 154.50. The most common strategy present at the barangay level was the collection and segregation of food waste as well as informational campaign. Among the three areas, only one had on-going program on food waste which was composting. The most prominent challenge of the barangays in reducing food waste was the behavior of their residents since most of them lack the commitment and participation on the implementation of programs. None of the three barangays has achieved successes on reducing food waste. These results could be used as baseline data for future research on food waste specifically in Philippines.

**Adviser*

PERCEPTIONS ON NUTRITION LABELS AND FACTORS AFFECTING ITS USE AMONG ADULTS IN SELECTED COMMUNITIES IN LOS BANOS, LAGUNA

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Non-communicable diseases (NCDs) are the leading cause of death around the world. In terms of unhealthy diet as a risk factor, nutrition labelling is one of the recommendations to increase awareness and promote healthy diets through the provision of sufficient nutrition information.

In this analytic cross-sectional study, the prevalence of nutrition label use, perceptions, and the factors associated with the use of nutrition label were determined among 440 adults in selected communities in Los Baños, Laguna, using the Theory of Planned Behavior as the study model.

Study findings revealed that the prevalence of nutrition label use among the adults in the selected communities was 87.73%. With regards to perceptions, 61.36% among the adults perceived nutrition facts table (NFT) as easy to understand and 68.86% for multiple traffic light label (MTL). While in terms of adequacy of information, 76.82% perceived NFT as having enough information and 72.95% for MTL.

Among socio-demographics, health-related factors, lifestyle factors and other factors, only the following were found to be associated with nutrition label use, namely: 1) intention to use nutrition label (OR: 4.37; 95% CI: 1.77 – 10.82), 2) enough perceived time-spent on shopping (OR: 2.16; 95% CI: 1.17 – 4.01 and 3) searching for specific information (OR: 4.77; 95% CI: 2.55 – 8.93).

With these, the study findings can be used in promoting and increasing nutrition label use in the country, serve as basis for improvement of nutrition labeling policies and a reference in the development of interventions especially in healthy diet promotions and prevention of non-communicable diseases.

ANALYSIS OF TIMING OF FIRST PREGNANCY FROM FIRST SEXUALINTERCOURSE AMONG FILIPINO WOMEN USING SURVIVAL ANALYSIS

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Studying birth intervals or birth spacing have become a particular interest nowadays globally. This phenomenon involves a lot of dynamics ranging from family planning (WHO, 2018), population dynamics (PNDHS, 2017), timing of births and cumulative fertility (Alam, 2015), and maternal and child health (Sayem and Nury, 2011). Survival analysis on the other hand is a unique approach in studying timing of first pregnancies from first sexual intercourse as this entails modeling time to event patterns. This study will utilize the abovementioned statistical modeling process and evaluate the relationship of different factors associated with timing of pregnancy to help policy makers develop contraception and other health services delivery that may improve child and maternal, family, and population health in the country.

*** Study still under development and will be finished by April

DEVELOPMENT AND VALIDATION OF A SEMI-QUANTITATIVE FOOD FREQUENCY QUESTIONNAIRE (SFFQ) AS AN ASSESSMENT TOOL FOR IRON INTAKE OF FILIPINO WOMEN OF REPRODUCTIVE AGE (WRA)

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Dietary iron intakes are useful in epidemiological studies and in conducting screening for at-risk groups. To date, there is no validated culturally sensitive semi-quantitative food frequency questionnaire (SFFQ) available for the estimation of dietary iron intake for Filipinos. This study aimed to determine the criterion and relative validity of a developed semi-quantitative food frequency questionnaire (SFFQ) for the estimation of iron intake among Filipino WRA.

The study employed an exploratory mixed method design of grounded theory for the development of the SFFQ and cross-sectional, analytic design for the validity study to address the study objectives. Development phase involved creating food list using FCT, data from the NNS, and FGD while validation phase was conducted among 60 WRA and data on dietary intake were acquired using SFFQ and 3-day nonconsecutive food record. A subsample of 36 study participants had their hemoglobin levels checked.

Results showed that although the SFFQ had valid agreement for relative validity as assessed by the Bland-Altman method, the difference between the methods is significantly different (3.95±0.59 mg, p-value=0.000). For criterion validity, there is no significant correlation (r=0.0789, p-value=0.6472) between the SFFQ and the biomarker. Findings of the study showed that the development process employed may not be sufficient and appropriate to produce a valid SFFQ for the estimation of iron intake.

*Adviser

ASTHRDP GRADUATE SCHOLARS CONFERENCE - YEAR 9

"ASTHRDP: Science, Technology and Innovation Towards Achieving Sustainable Development Goals"

November 26-27, 2020

Day 1 | 26 November 2020

8:30 AM	**Joining Time**	
8:50	**House Rules**	
9:00	**Opening Program**	
	National Anthem	
	Doxology	
	Welcome Remarks	***Dr. Josette T. Biyo*** *Director, Science Education Institute*
	Inspirational Message	***Prof. Fortunato T. de la Peña*** *Secretary, Department of Science and Technology*
9:30	**Group Photo Session**	
9:40	**Introduction of Plenary Speaker 1**	***Dr. Giovanni A. Tapang*** *Dean, College of Science and ASTHRDP-NSC Project Leader, University of the Philippines Diliman*
9:45	**Plenary Presentation 1**	"*Doing Archaeological Science and the discovery of H. luzonensis*" ***Dr. Armand Salvador B. Mijares*** *Associate Professor, Archaeological Studies Program University of the Philippines Diliman*
10:15	**Open Forum**	
10:30	**Introduction of Plenary Speaker 2**	***Dr. Jose V. Camacho, Jr.*** *Chancellor, University of the Philippines Los Baños*
10:35	**Plenary Presentation 2**	"*Accelerating Transformation Through Agricultural Innovation towards achieving SDG*" ***Dr. Glenn B. Gregorio*** *Director, Southeast Asian Regional Center for Graduate Study and Research in Agriculture*
11:15	**Open Forum**	
11:30	**Introduction of Plenary Speaker 3**	***Dr. Arnold V. Hallare*** *Director, National Graduate Office for the Health Sciences and ASTHRDP-NSC Project Leader, University of the Philippines Manila*
11:35	**Plenary Presentation 3**	"*One Health*" ***Dr. Bernadette L. Ramirez*** *Scientist, World Health Organization, Geneva, Switzerland*
12:15 PM	**Open Forum**	
1:30 - 5:00	**Parallel Oral Session (via Zoom Breakout Rooms)**	
4:00	**Poster Session** (via Webpage)	
	Day 1 Evaluation	

Masters of Ceremonies

Dr. Aimee Lynn B. Dupo
Professor, Institute of Biological Sciences, College of Arts and Sciences, University of the Philippines Los Baños

Dr. Ronilo Jose D. Flores
Assistant Professor, Institute of Biological Sciences, College of Arts and Sciences, University of the Philippines Los Baños

"ASTHRDP: Science, Technology and Innovation Towards Achieving Sustainable Development Goals"

November 26-27, 2020

Day 2 | 27 November 2020

8:30 AM	**Joining Time**	
8:45	**House Rules/Recap of Day 1**	
9:00	**Elevator Pitch Competition**	
10:00	*NSC Chair's Report*	***Dr. Fabian M. Dayrit*** *Chair, ASTHRDP-NSC Steering Council and* *ASTHRDP-NSC Project Leader, Ateneo de Manila University*
10:20	*Dialogue*	***Dr. Josette T. Biyo*** *Director, Science Education Institute*
11:00	**Closing Program**	
	Announcement/Awarding of Winners	
	• *Oral Presentation*	***Dr. Rex Ferdinand M. Traifalgar*** *Director, Institute of Aquaculture, College of Fisheries and Ocean Sciences and ASTHRDP-NSC Project Leader, University of the Philippines Visayas*
	• *Poster Presentation*	***Dr. Victor B. Asio*** *Dean, College of Agriculture and Food Science and* *ASTHRDP-NSC Project Leader, Visayas State University*
	Synthesis/Closing Remarks	***Dr. Glenn V. Alea*** *Dean and Conference Chair, College of Science and* *ASTHRDP-NSC Project Leader, De La Salle University*
	Day 2 Evaluation and Issuance of Certificates	

Masters of Ceremonies

Dr. Arnold V. Hallare
Director, National Graduate Office for the Health Sciences, University of the Philippines Manila

Dr. Leslie Michelle M. Dalmacio
Assistant to the Vice Chancellor for Academic Affairs, University of the Philippines Manila

ASTHRDP Graduate Scholars Conference - Year 9

"ASTHRDP: Towards Achieving Sustainable Development Goals"

November 26-27, 2020

DAY 1: 26 NOVEMBER 2020

8:30 AM	JOINING TIME
8:50 AM	HOUSE RULES
9:00 AM	OPENING PROGRAM
9:30 AM	GROUP PHOTO SESSION
8:40 AM	BREAK
9:45 AM	PLENARY PRESENTATION 1
10:15 AM	OPEN FORUM
10:35 AM	PLENARY PRESENTATION 2
11:15 AM	OPEN FORUM
11:35 AM	PLENARY PRESENTATION 3
12:15 NN	OPEN FORUM

1:30 PM to 5:00 PM	ORAL SESSIONS				
	Parallel Session 1	Parallel Session 2	Parallel Session 3	Parallel Session 4	Parallel Session 5
	Biology/ Genetics	Chemistry/ Food Science	Mathematics	Env. Science/ Soil Science	Physics
		Animal Sci./ Fisheries/ Entomology	Mathematics	Horticulture/ Agronomy/ Plant Science	Physics

4:00 PM	POSTER SESSIONS

DAY 2: 27 NOVEMBER 2020

8:30 AM	JOINING TIME
8:45 AM	HOUSE RULES/RECAP OF DAY 1
9:00 AM	ELEVATOR PITCH COMPETITION
10:00 AM	NSC CHAIR'S REPORT
10:20 AM	DIALOGUE
11:00 AM	CLOSING PROGRAM


CENTRAL LUZON STATE UNIVERSITY
NUEVA ECIJA - 1907 - PHILIPPINES
ATENEO DE MANILA
DE LA SALLE UNIVERSITY
RELIGIO MORES CULTURA
MANILA
MSU - ILIGAN INSTITUTE OF TECHNOLOGY
1968
UNIVERSITY OF THE PHILIPPINES
1908
SCIENTIA · VIRTUS · DEVOTIO
UNIVERSITY OF SAN CARLOS
WITNESS TO THE WORD
PONTIFICAL AND ROYAL UNIVERSITY OF SANTO TOMAS, MANILA
1611
VISAYAS STATE UNIVERSITY
WORK · TRUTH
KNOWLEDGE · RELEVANCE
1924