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**TRANSACTIONS
of the
NATIONAL ACADEMY OF SCIENCE
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Philippines**

**ABSTRACTS of PAPERS
Presented during the
30th NAST Annual Scientific Meeting**

*“Energy, Security and Sustainability:
Assessing the Present and Foreseeing the Future”*

9 -10 July 2008

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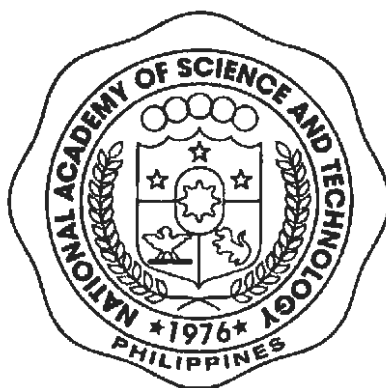


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AGRICULTURAL SCIENCES DIVISION

ASD-1

PHYSICO-MECHANICAL CHARACTERIZATION OF PLANTATION-GROWN PALASAN (*CALAMUS MERRILLII* BECC.) CANES

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To promote the utilization of plantation-grown canes so as to preserve the remaining palasan canes growing in natural forests, the physical and mechanical attributes of plantation-grown Palasan (*Calamus merrillii* Becc.) canes were compared to wild rattan canes. Likewise, the effect of fiber percentage and cane age on the strength properties of the material was assessed. This was accomplished through standard static bending tests and structural evaluation of palasan canes derived from various plantations in the Philippines. In terms of modulus of rupture (MOR) and modulus of elasticity (MOE), plantation-grown canes were more or less similar to wild rattan canes. Contrary to plantation-grown trees, plantation canes were not at all inferior in strength properties to wild canes. Oven-dried specific gravity and fiber percentage were also similar. These two parameters did not influence the variation in strength properties of a particular position within the cane. Similarly, cane age had no significant influence on the mechanical attributes of the cane. Apparently, young canes also possess the same strength values as that of a more mature stem. This would imply that plantation-grown canes could also be used by the industry without negatively altering the mechanical qualities of the finished products. Hence, it could serve as a good substitute to wild canes which ensure the industry with an exhaustible supply of raw canes paving the way to the preservation of the country's remaining wild rattan resources.

Keywords: plantation-grown canes; modulus of rupture, modulus of elasticity, specific gravity, fiber percentage, good substitute

ASD-2

**INFLUENCE OF STRUCTURE ON THE POTENTIAL
YIELD OF BUNTAL FIBERS COMING FROM
BURI PALMS (*CORYPHA UTAN* LAMK.)**

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Knowing the significant contribution of buntal fibers to the livelihood of farmers and how inefficient they are extracted from the fronds of Buri palms (*Corypha utan* Lamk.), anatomical evaluation was conducted to determine the distribution of the buntals within the fronds in order to find ways in which buntal fiber yield could be maximized. The fronds were divided into three regions: top portion (T); middle portion (M); and basal portion (B). Likewise, the position across the radius of the fronds [Periphery1 (outermost layer or P1), Core (C), and Periphery2 (innermost layer or P2)] were considered. Vascular bundle composition, ground parenchyma percentage and vascular bundle diameter were measured using the ImageJ analysis software. Fiber length, fiber diameter, lumen diameter and cell wall thickness were also determined using an Olympus microscope with a built in micrometer. Anatomical observation showed that buntal fibers were actually the vascular bundle itself. The bundles were made up of two layers of fiber strands that envelop the conducting tissues e.g., xylem and phloem. Such design provides stability to the bundle during manual extraction of the buntal. Vascular bundle was abundant in P1 of the middle portion whilst ground parenchyma percentage was highest at the basal region. Fiber length was longest at the middle portion and cell wall thickness was thickest in the top region. Bundle diameter was greatest in P1 of the basal region which dramatically decreased at C and P2. The top and middle portions gave almost the same values. Therefore, buntal fibers could be extracted in any part of the fronds; however, the yield would be highest in the middle portion. More over, the same portion would yield uniform buntal quality as indicated by the more or less even bundle diameter.

Keywords: Buntal fibers, Buri palms, vascular bundle, ground parenchyma, fiber length, cell wall thickness

ASD-3

**GERMINATION STUDY AND EFFECTS OF
BIOLOGICAL FERTILIZERS ON SURVIVAL
AND EARLY GROWTH OF ALUPAG
(*Euphoria didyma* Blanco)**

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Alupag (*Euphoria didyma* Blanco) is one of the lesser-used endemic tree species of the country that has been depleted by logging amidst its potential as food and timber crop. Most documented study on Alupag failed due to poor germination count (Caguioa, 1936). The effects of pre germination treatments (soaking, nicking and control) and biological fertilizers (Mykovam, Bio-N and control) on the growth and survival of Alupag were investigated. Two RCBD set-up having 4 blocks and 3 treatments were adopted. Different germination and growth parameters were measured which include, percent germination, height increment, biomass and other indicators.

Results showed low to moderate germination turn-out (36-69%) with nicking having earlier germination ($p=0.048$), and higher germination, 58.5% compared to control (50.8%) and soaked seeds (42.8%) ($p=0.0135$). Alupag exhibit hypogeal type of germination. It is also polyembryonic and it can possibly be grown using vegetative means of propagation.

Application of Bio-N improved the growth of Alupag seedling but the observation period may not be enough to observe significant results. On the contrary, application of Mykovam reduced the growth of Alupag seedlings during the 50 days observation. Investigation of the property of the soil used for potting revealed abnormally high amount of Phosphorous (83-98 ppm) resulting to nutrient imbalance in Alupag as evidenced by shoot chlorosis.

Keywords: Alupag (*Euphoria didyma* Blanco), germination, **Bio-N**, Mykovam, Phosphorous

ASD-4

NODULATION AND GROWTH OF TRANSPLANTED *ALNUS MARITIMA* MARSH NUTT. IN FERTILIZER ENRICHED MINE SPOIL

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The sub-marginal condition of mine spoil or mine waste soil may adversely affect the degree of nodulation in *Alnus* and its growth. This study was conducted to determine the degree of nodulation of *Alnus maritima* Marsh nutt. in unfertilized and fertilized mine spoil and relate its nodulation to growth.

Bare-root seedlings of *Alnus* washed with distilled water were transplanted in plastic cups containing either pure mine spoil, mine spoil with compost, mine spoil with urea or soil taken from natural *Alnus* stand. After two months, height increment, biomass, survival and nodulation were measured.

Results showed that all seedlings formed live nodules, in spite of the critical concentration of cadmium (Cd), 7.13 mg kg⁻¹ and Chromium (Cr), 117 mg kg⁻¹ in the mine spoil. However some existing nodules died after transplanting among those planted in pure mine spoil and mine spoil with urea. Nodulation in garden soil > mine spoil + compost > pure mine spoil > mine spoil + urea.

Growth of *Alnus* as reflected by root, shoot and total biomass appear in the treatment order garden soil > mine spoil + compost > mine spoil = mine spoil + urea. In terms of height increment, mine spoil with compost and garden soil are significantly taller than mine spoil and mine spoil + urea 60 days after treatment application at 1% level of significance using LSD. The comparative growth of those grown in garden soil and mine spoil with compost indicate the potential of the *Alnus* in the rehabilitation of mine sites.

Keywords: *Alnus maritima* Marsh nutt. root nodules, mine spoil, fertilizer, heavy metals

ASD-5

**GROWTH AND YIELD PERFORMANCE OF
PROMISING NAPIER GRASS (*Pennisetum purpureum*)
ACCESSIONS AS AFFECTED BY THE
FREQUENCY OF CHICKEN MANURE
APPLICATION**

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Three frequencies of chicken manure application, i.e. zero, single, and split, were used in fertilizing seven promising accessions of napier grass. The study aimed to compare the effect of single and split chicken manure application on the growth and yield of promising napier grass accessions, to identify the high yielding napier grass accession and to compare the cost benefit ratio of producing napier grass using either single or split application of chicken manure.

The frequencies of fertilizer application were randomly distributed to three horizontal strips while the accessions were randomly distributed to the seven vertical strips with using the Strip-plot design. Each experimental plot had a measurement of 3 m x 4 m..

Results showed that frequency of chicken manure application significantly affects the number of days to shoot emergence, the number of tiller produced, height and dry herbage yield of napier grasses. Grasses with single or split chicken manure application produced new shoots earlier and more tillers than those with zero manure application. Grasses with split chicken manure application were taller and produced higher total dry matter yield than those with single or zero application.

In terms of napier grass accessions, no differences were observed on the number of days to shoot emergence and total dry herbage yield. Ex Cuba and Miniero are the accessions that consistently produced the lowest number of tillers and the shortest both in wet and dry seasons. Ex Local was the tallest during wet season while Ex Indonesia and Capricorn during dry season

Based on the result of the study, split application is better than single application because the marginal benefit cost ratio of split over single chicken manure application was 3.29. Any of the accessions could be used because they have comparable herbage yield.

Keywords: napier grass, chicken manure, frequency of application, accessions

ASD-6

**KAWAYAN CHARCOAL BRIQUETTE TECHNOLOGY
PRODUCTION OF KAWAYAN CHARCOAL BRIQUETTES
USING CHICHACORN PROCESSING
EFFLUENT AS BINDER**

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These research and technology promotion undertaking showcased the production of kawayan (bamboo) charcoal briquette (KCB) using chichacorn processing effluent and corn starch as binders with the following objectives: (a) produce charcoal briquettes and enhance recovery from bamboo waste which otherwise end up to burning and rotting, (b) find out means to reduce the volume of chichacorn effluent which otherwise are contributory to environmental problem, (c) develop products as source of additional income of bamboo processors, and (d) produce a bio-fuel that is environment friendly and economically feasible.

Recovering waste materials from harvesting and processing of bamboo, and effluent from chichacorn processing through carbonization of the bamboo waste materials and mixing it with the effluent as binder, and compacted into various forms produced an excellent bio-fuel. The briquettes had an average density of .46 g/cc, ash content of 8- 11%, heat value of 4,201 kcal/kg, 85 kg compression strength, and 5-8 percent friability. These characteristics of the briquettes are as good as the briquettes from wood and other agricultural wastes. Kawayan charcoal briquette-making is feasible with a net return of P0.89 for every peso investment.

The transfer of technology was materialized through the concept of Academic-Local Government/Cooperative partnership. A series of meetings and training activities was conducted with the target clientele (E-kawayan Producers Association), the Mariano Marcos State University, and representatives from various Local Government Units in Ilocos Norte. The community approach was an effective strategy in organizing and empowering cooperators in decision-making related to kawayan charcoal briquette production, plantation management, utilization, and commercialization.

Collectively, the experience in this project is a sound basis for the mass production of briquettes from kawayan. Likewise, it is a good example and guide in recycling of waste materials which otherwise are contributory to environmental problems.

Keywords: effluent, binder, chichacorn, carbonization, briquette, heat value

ASD-7

**IMPROVING PRODUCTIVITY OF UNMANAGED
KAWAYAN TINIK *BAMBUSA BLUMEANA* SHULTES
PLANTATION FOR POLES AND SHOOTS'**

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The productivity of previously unmanaged *Bambusa blumeana* Shultes (Kawayan tinik) plantation was assessed over a period of five years. We studied the combined effects of cleaning, irrigation, inorganic fertilizer application, mulching, and organic matter on the production of quality poles and shoots. The silvicultural treatments were combined with six pole density treatments with definite age of poles per year per clump, i.e. 4-4-4-4 which means that the successive numbers indicate the number of one, two, three or four-year old culms in each clump, counted and marked just before the shoot season.

Generally, irrigation significantly improved productivity index, shoot emergence and number of shoots per clump of *B. blumeana* for various uses. The average shoot production of 6 shoots per clump from all treatments is within the range of shoot production of *B. blumeana* in areas with a distinct dry and wet season. The clumps that received irrigation during the shoot stage had a significantly bigger diameter poles than those without irrigation. The 3-year old and the four-year old mother culms had a very low percentage shoot production of less than 3.8 percent which means that it is more advantageous to harvest the mother culms for pole production rather than for shoot production. The quality of poles in the clumps with 4-4-4-4 or 16 culms per clump produced the highest number of poles and most superior strength properties. Extending the age of the pole from three years to four years old posed advantage to productivity.

It is concluded that irrigation and cleaning significantly improved clump productivity and quality for specific use of poles. It was possible to predict the productivity the clumps following the scheme of retention of various number of poles per age giving a definite number of poles and potential number of shoots to be harvested every year in unmanaged bamboo plantation.

Keywords: clump, poles, shoots, culm, productivity, cleaning, silviculture

ASD-8

**RESPONSE OF *Toona kalantas* ON VARYING
LEVELS OF VERMICOMPOST**

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Kalantas (*Toona kalantas*) is an endemic species of forest trees. Propagating such tree would be beneficial most especially in supporting the program of the government on greening. The study was focused on the response of the *Toona kalantas* on varying levels of Vermicompost. The Vermicompost is a kind of organic fertilizer having worm casting of an African crawler (earthworm) which are bought from the Research Laboratory of Forestry of Nueva Vizcaya State University, Bayombong, Nueva Vizcaya

The study consisted of five treatments. Each treatment had 15 kalantas, so that there were 75 kalantas being planted. The 2- month seedlings of kalantas were obtained from the nursery of the Department of Environment and Natural Resources (DENR). Except the control group, the other four treatments were given varied amount of vermicompost (treatment 1- 10 g, treatment 2 – 20 g, treatment 3 - 30 g and treatment 4 - 40 g) The amount of soil was made constant in each treatment. The plants were set up using completely randomized design. Considering the rate of survival, the highest rate was treatment 2 having 100% rate and the lowest rate was treatment 3 having 80%, the total number of plants that survived was 66 kalantas which was 88%. In terms of the mean, the greatest mean was in treatment 2 (38.71 cm) and the least mean was in the control group (25.19 cm). Using Statistical Packaging for Social Sciences (SPSS), the mean height of kalantas has no significant difference. Based from the Tukey's Honestly Significant Difference (HSD), the mean height of kalantas in the control group and in treatment 2 had significant difference. The rest of the treatments had no significant difference. Through these results, the study suggested that the most appreciated amount of vermicompost to be applied was 20 g in propagating kalantas. The researchers recommend the use of vermicompost in different vegetable crops following the suggested amount of the organic fertilizer.

Keywords: Kalantas, *Toona kalantas*, vermicompost, African crawler,

ASD-9

**COATING PROPERTIES OF RAW
PAGSAHINGIN VARNISH**

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Pagsahingin, popularly known as Manila elemi in the world market is a resinous substance obtained from trunks of *Canarium spp.* that are endemic to the Philippines. According to literature pagsahingin is a good material for surface coating however, previous experiments showed that it is tacky and has long drying time.

In this study, pagsahingin was utilized as the main component in the production of varnish with reduced drying time. Four varnish formulations from pagsahingin were prepared namely: raw pagsahingin, raw pagsahingin with linseed oil, almaciga-modified pagsahingin and almaciga-modified pagsahingin with linseed oil. Physicochemical properties such as acid and saponification numbers were determined. Fourier-transformed infrared analysis to determine its functional groups was also conducted. Total solids, specific gravity and viscosity were some of the physical properties determined. Performance of the varnishes in terms of adhesion, drying time, gloss, number of coats and resistance to common household was evaluated and compared with commercial varnish. Results showed that the raw and almaciga-modified pagsahingin varnishes without linseed oil exhibited properties comparable with commercial varnish. No significant difference was observed on performance of the experimental and commercial varnishes.

Keywords: pagsahingin, Manila elemi, varnish, adhesion, specific gravity

ASD-10

UNDERUTILIZED CROPS: IMPORTANCE VALUE AS PERCEIVED BY THE FARMING COMMUNITY IN LAGUNA PROVINCE

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Underutilized crops are plant and tree species with potential, not yet fully exploited, to contribute to food security, poverty alleviation and environmental enhancement or conservation. They tend to be neglected by research, extension services, policy-makers, donors, technology providers and to some extent, even by the farmers. This study is an attempt to identify underutilized plant and tree species and evaluate their importance based on a multi-stakeholder perspective. This is also an attempt to provide a basis for prioritizing underutilized crops for further research and development.

Importance values were assessed in two parts: first - based on abundance and geographic distribution which was done through biodiversity measurement, description of their geographic distribution as well as the biophysical conditions associated with them; and second - based on the economic and non-economic values as perceived by the farming community which was done through key informant and key informant panel interviews. Presented here are the results of the second part of the study.

About 83 underutilized plant and tree species were identified in selected municipalities of the Laguna Province. These included tropical fruit trees, indigenous trees and vegetables as well as wild plants, tubers and root crops. The identified plant and tree species were rated according to importance by the respondents. Results showed that importance rating was highly influenced by the functions of these crops in the community.

This Philippines is endowed with rich natural diversity. A significant portion of the country's rural landscape consists of mixed cropping, and homegardens where important components are trees and plant species that naturally grow or planted but are left unmanaged despite their uses. Continuous neglect of these plant and tree species may lead to their eventual disappearance hence a waste of resources that otherwise could be very good sources of nutrition, alternative income and resources for environmental enhancement.

Keywords: underutilized crops; neglected; indigenous, plant and tree species; importance value, multi-stakeholder perspective; environmental enhancement; rural landscape; biodiversity

ASD-11

**BENGUET STATE UNIVERSITY ORGANIC
AGRICULTURE PROGRAM**

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Benguet State University (BSU) is located at the heart of La Trinidad, Benguet, Philippines. The university is basically an agricultural institution primarily serving farmers and other stakeholders in the cordilleras and nearby provinces in the Northern Philippines.

With its ideal climatic conditions, productions of high-value vegetable crops become a lucrative business in the farming community. For almost four decades, farmers intensively and extensively cultivate their farms adopting the conventional chemical farming practices. These practices consequently contributed to soil deterioration, soil fertility depletion and degradations as manifested by the present situations in the area i.e. Too acidic soil condition, proliferation of soil pathogens like clubroot in cabbage, pollution of water, etc. If this system goes unabated it is feared that time will come when degradation of the environment becomes irreversible and becomes unproductive. This threat is real and brought impetus in the development of organic agriculture.

As potent force of innovations, Benguet State University responds to the universal call for ecologically sound and sustainable practices by conceptualizing and adopting the concepts of organic agriculture. In doing so, it aims to promote the healthy, proper care and conservation of the remaining resources in agriculture, and foster indigenous and ecologically sound production systems that will produce sufficient, safe and nutritious food for the present and the future generations.

Benguet state university is envisioned to become the premier organic university in the highlands Philippines.

Keywords: organic agriculture, chemical farming, ecologically sound and sustainable, indigenous

ASD-12

**GROWING CROPS IN MINE-TAILED AFFECTED AREA
AMELIORATED WITH ORGANIC MATERIALS:
AN ATTEMPT**

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An on-site trial was conducted to determine the growth and yield performance of four crops (green onions, peanut, pechay, and potato) and grass (Vetiver grass) and on some physical and chemical properties of the soil ameliorated with organic fertilizer.

Plants grown in mine-tailed area ameliorated with organic fertilizers (compost, chicken dung and Giant 8-8-8) showed better growth and yield compared to those without organic amelioration.

Application of organic fertilizers improved the physical (bulk density and porosity) and chemical (pH, organic matter, nitrogen, phosphorus and potassium content) properties of the mine-tailed area.

Keywords: ameliorated, organic fertilizer, mine-tailed, mine tailings, physical and chemical properties

ASD-13

**A GIS-ASSISTED MAP OF ESTIMATING SOIL EROSION
IN PROPOSED COPPER MINING IN TAMPAKAN
SOUTH COTABATO, PHILIPPINES**

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Exploration of copper in Tampakan by Sagittarius Mining Inc has been on-going, guided by programs for sustainable mining through scientific management. Among the science-based research, which is investigated in this paper, is the use of Geographical Information System to map primary impact areas (Barangay Danlag, Pula Bato and Tablu) and estimate erosion using Universal Soil Loss Equation (USLE). The research process involved primary and secondary data collection, computation of USLE factors, data organization, digitizing and editing of GIS maps, data encoding, and data analysis. Using the derived USLE factor maps, soil erosion map was generated by multiplying factors using Map Calculator function from ArcView software. The derived soil map was classified into six erosion categories expressed in tons ha⁻¹ year⁻¹ as: very slight (< 1.000), slight (1.001-2.500), moderate (2.501-5.000), high (5.001-7.500), severe (7.501-10.000), and extreme (> 10.000) soil erosion.

The erosion index value that covered large area had very slight erosion characterized by protection and production forest mostly situated in Barangay Tablu, Danlag and Pula Bato. Moderate erosion index was recorded in grassland ecosystem in Barangay Danlag, Pula Bato, and Tablu. By comparison, the area with extreme erosion index was seen from peaks of mountains located in three barangays. The problem of soil erosion in all sites sampled was enhanced by land-use, particularly shifting cultivation commonly practice in upland communities dominated by B'laan tribes. Soil erosion was further enhanced in degraded mountains, having steep slope, high annual rainfall volume, and poor soil properties. In conclusion, Barangays that are likely exposed to risk and hazard of soil erosion can be managed wisely using the soil erosion map to facilitate assessment. The GIS-based soil map will also provide the company with a holistic view of future rehabilitation plan of affected slopes and conservation strategies for areas with existing protection and production forest.

Keywords: geographical information system, Universal Soil Loss Equation, soil erosion, copper mining, Tampakan South Cotabato

ASD-14

ONLINE DATABASE INFORMATION SYSTEM OF MULTIPURPOSE INDIGENOUS PLANT SPECIES USED IN THE CORDILLERAS, NORTHERN LUZON

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The Cordilleras of the Philippines is home to a rich diversity of plant species that are used as nutrient source in organic farming and fallow systems; as nutrient source, biocontrol and soil and water conservation agents in sustainable indigenous farming systems; as herbal medicine in community health care; as food supplements; and as offering or symbols in cultural rituals. Written accounts on these plant species in the Cordilleras is fragmented and sporadic. This study aims to develop an online database information system of indigenous plant species used for various purposes in the Cordilleras, Northern Luzon.

Literature survey was conducted in Cordillera Studies Center, U.P. Baguio and Benguet State University (BSU), La Trinidad, Benguet. Key informant interviews were also conducted to document additional information particularly on the use of indigenous plants in sustainable farming systems and organic farming. The online database information system of this project was developed with MySQL and PHP, an open source development tool.

A total of 338 plant species was included in the online database information system of the project. These species were used in various purposes such as indigenous farming systems, organic farming, food and food supplement, cultural practices, construction and livelihood, ornamentals, gardening and landscaping, and community healthcare system. About 85 plant species were of multipurpose use. Out of the 338 total plant species documented, 107 species were classified as indigenous plants with majority of these species commonly used for food. *Miscanthus sinensis* (runo, pao, segbat, sapsap) was found to be the most commonly used multipurpose plant species for ornamental, gardening, construction/livelihood, for food and community health care.

The online database information system will be an important knowledge-base in sustainable farming systems, health care and family nutrition of the communities in the upland areas of the country.

Keywords: database, information system, indigenous plant species, MySQL, PHP

ASD-15

SEASONAL CLIMATE FORECAST (SCF): FARMERS' KNOWLEDGE AND PERCEPTIONS

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The Philippines is greatly affected by the two phases of El Niño Southern Oscillation (ENSO); the El Niño and La Niña. ENSO impacts all segments of society, but among most vulnerable are resource-constrained farmers whose livelihoods are greatly dependent on the changing seasons. Seasonal Climate Forecast (SCF) is one of the tools which could help farmers and decision makers better prepare for seasonal climate variability. This paper tried to document farmers' perception and awareness on SCF and its effect on rice production. Since rainfed farming is more vulnerable to climate variability, the survey was conducted in rainfed rice areas in Talugtug and Lupao, Nueva Ecija.

Majority of (95%) the farmers in rainfed areas undoubtedly valued Seasonal Climate Forecast (SCF) and climate related information, stressing their significance on their farm operations and crop decision making. It allows farmers to prepare for climatic events and aids them in deciding when to plant or commence the cropping season. They also opined that early climate forecasts and advisory would help in their decision making process. On-farm decisions affected by climate variability and disturbances were the crops to be planted and timing of planting, which are also influenced by SCF like El Niño and La Niña. Most farmers (84%) wait for signs before commencing farm operations. Farmers today do not believe on the idea of good and bad luck in managing their farms. Reliable indigenous knowledge was scarce, and farmers relied mostly on the climate and weather advisories provided by PAGASA through television and radio announcement. Very few of these farmers have risk coping mechanisms and mitigating measures at times of calamity such as drought and flood.

Keywords: Seasonal Climate Forecast (SCF), El Niño, La Niña, El Niño Southern Oscillation (ENSO), climate variability

ASD-16

**BIOCAPACITY AND ECOLOGICAL FOOTPRINT
FOR RICE AND WOOD IN THE PHILIPPINES**

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A national assessment on the availability and use of resources for rice from 2003 to 2005, and wood from 2003 to 2004 was conducted using biocapacity and ecofootprint analyses. The assessment was accomplished by determining the demand and supply for rice and expressed the demand into ecofootprint while supply into biocapacity. Ecological surpluses and deficits were determined through biocapacity and ecofootprint comparisons. Ecofootprint for rice and wood were also interfaced to reflect the environmental conditions of riceland and forest ecosystems, reinforced by forest cover area, flood occurrences, and extent of irrigated rice areas.

For food alone, the Philippines could have a minimal ecological surplus. If seeds, feeds and wastes are included, the country had an ecological deficit of about 0.50 million nationwide hectares (M nwha) or a per capita of 0.005 nwha from 2003 to 2005. For wood, the Philippines had a biocapacity of 7.168 M nwha in 2003 and 2004, while ecofootprints were 18.19 and 13.78 M nwha, respectively. This means a national ecological deficit of 11.02 and 6.62 M nwha or a per capita of 0.135 and 0.078 nwha for 2003 and 2004, respectively. Importations supplemented the deficits for both rice and wood.

Consumption reduction, population control and increase productivity could reduce ecological deficits. Avoidance of loss and reduce seed use could also reduce deficits for rice, while improved harvesting and wood processing could reduce wood deficits.

Interface of ecofootprint for rice and wood identified 14 provinces that are vulnerable to flooding hazards and should be given considerations for any future action.

Keywords: biocapacity, ecofootprint, ecological surplus/deficit, nationwide hectare, global hectare

ASD-17

SUBMERGENCE TOLERANT RICE FOR POOR FARMERS IN FLOOD-PRONE AREAS

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Submergence afflicts some 15 million ha of rice lands in Asia, and annual losses to rice production are estimated at over \$650 million. Short-term flash floods (for 1 to 2 weeks) can occur at any stage of plant development, sometimes more than once, with consequent severe yield losses. In direct-seeded rice, submergence after sowing substantially reduces stand establishment because of the high sensitivity of existing rice varieties. Additionally, water-logging or stagnation for up to 50 cm for a few months during the growing season is a serious problem in some rainfed areas. Modern rice varieties are not adapted to these conditions and this is probably the reason these varieties are not widely adopted in these areas and farmers still grow their local landraces with low yield. The Sub1A gene, derived from FR13A, a rice variety from Orissa, India, confers tolerance of up to 2 weeks of complete submergence. This gene can be introduced through marker-assisted backcrossing (MAB) into popular varieties, providing some protection to farmers against short-term flooding. The MAB approach was used to transfer Sub1A into six rice "mega varieties" Swarna, Samba Mahsuri, IR64, Thadokkam 1 (TDK1), CR1009 and BRII. Other sources of submergence tolerance were identified and further genetic studies are on-going. Varieties with the Sub1A gene have the same yield and other characteristics as the original varieties, and they can be used to replace these varieties in flood-prone areas. To elicit farmer's variety preferences, participatory variety selection (PVS) approach is being implemented in 28 on-farm locations using varieties with Sub1A gene and the improved local varieties known to be tolerant to submergence. Seed multiplication of existing varieties and development of new Sub1 varieties is now proceeding in India, Bangladesh, Cambodia, Indonesia, Laos, Thailand, Vietnam and Philippines in partnership with the National Agricultural Research and Extension Systems (NARES).

Keywords: submergence tolerant rice, Sub1A gene, flooding, abiotic stress, marker assisted backcrossing

ASD-18

SEED PRIMING AND ITS MORPHO-BIOCHEMICAL EFFECTS DURING SUBMERGENCE IN DIRECT-SEEDED RICE

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Poor seedling establishment is a major constraint for direct seeding of rice (*Oryza sativa* L.). Germinating seeds are highly sensitive to oxygen deficiency, hence the need for tolerance to submergence or low oxygen concentration during germination. Priming of seeds could enhance seed germination and seedling establishment during submergence. The objective of this study was to determine the effect of seed priming on submergence tolerance through morpho-biochemical analysis of rice cultivars contrasting in tolerance to flooding during germination. Two genotypes of rice Khao hlan on (tolerant) and IR42 (intolerant) were used. Percentage germination and coleoptile and root growth were measured after seven days of germination, whereas activities of alcohol dehydrogenase (ADH) and pyruvate decarboxylase (PDC) were measured at different time intervals. Results showed that under low oxygen or hypoxia, seed priming did not improve percentage germination of the two genotypes, but significantly improved coleoptile growth in both genotypes. Moreover, growth of roots of Khao hlan on was reduced by priming while for intolerant IR42 no significant reduction in root growth was observed. Enzyme analysis revealed that seed priming stimulated ADH and PDC activities between 24 to 72 hours after the start of imbibition in both Khao hlan on and IR42. Results suggest that seed priming enhanced coleoptile growth during hypoxia via the increase in PDC activity, which is a control point for anaerobic energy production, thus improving submergence tolerance of rice during germination.

Keywords: alcohol dehydrogenase, coleoptile growth, germination, direct-seeded rice, pyruvate decarboxylase, seed priming

ASD-19

MOISTURE SORPTION CHARACTERIZATION OF HYBRID RICE SEEDS: PSB RC72H (MESTIZO 1) AND NSIC RC116H (MESTIZO 3)

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Rice self-sufficiency in the country has potentially exhibited increasing productivity with the nationwide implementation of hybrid rice technology. Hybrid rice technology increases rice yield by 15% better than inbred varieties. Postproduction technologies are geared towards the development of suitable practices and facilities such as dryers and storage facilities. Simulating postharvest operations may be hampered due to insufficient data in the literature to predict rates of adsorption of moisture by the recently released varieties of hybrid rice seeds.

Equilibrium moisture content (EMC) data are necessary for the optimization of most postharvest operations. Hence, the study was conducted to establish the moisture sorption characteristics of two public-bred hybrid rice seeds.

Equilibrium moisture contents (EMC) of PSB Rc72H (Mestizo 1) and NSIC Rc116H (Mestizo 3) were measured at 25, 35, 45°C with relative humidities (RHs) ranging from 5.6 to 84.43%. Equilibrium moisture content was determined using the gravimetric static method. Five EMC model equations and their estimated parameters were evaluated for goodness of fit, namely: (1) Henderson Equation, (2) Oswin Equation, (3) Chung-Pfost Equation, (4) Halsey Equation and (5) GAB Equation.

The generalized correlation (R^2), standard error of estimates (SEE), mean standard error (MSE) and the mean relative percentage error (P) of the developed models were in the range of 96.33790 - 99.8523, 0.2062 - 1.02682, 0.04251 - 1.0544, -3.99184 - 0.240997, respectively for Mestizo 1 and Mestizo 3. Using the SEE , MSE and P values as criteria to evaluate the ability of the developed models to provide a well fit curve, the modified Henderson is the best model used.

A single model equation can be used for Mestizo 1 and Mestizo 3. Developed models are generally adequate to describe the fitting performance of the predicted FMC values against the experimental values. Henderson equation is the best model having the least residual errors.

Keywords: hybrid rice seeds, Equilibrium Moisture Content (EMC), storage, sorption isotherms

ASD-20

EFFECT OF MOISTURE CONTENT ON RICE SEED VIABILITY AT LOW TEMPERATURE STORAGE

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Seed moisture content is one of the factors that affect the viability of seeds at storage. One of Harrington's rule of thumb is that for every one percent increase in seed moisture content, the seed life is halved. This study was conducted to determine the correlation of rice seed viability and moisture content under cold storage condition. Seeds packed in aluminum foil and were in storage for 3 years in freezers were tested for viability following standard germination test. The seed moisture content of each sample was also measured using portable moisture meter. Seeds were germinated in between moistened paper towel and incubated in 30oC incubator. Seeds were placed in 50oC oven for five days to break dormancy prior to germination test. Scoring was done 14 days after sowing. The moisture content of the seed samples ranged between <8 to 15.0%. A total of 1024 seed samples were tested and 618 samples (60% of the total samples tested) showed no germination. Most entries (532 samples) that showed no germination have moisture content ranging between 11.0-15.0%. The results showed that seed viability is correlated with seed moisture content ($r=0.74$).

Keywords: Seed viability, moisture content, dormancy, germination

ASD-21

MONITORING OF RICE DORMANCY FOR GENETIC RESOURCES CONSERVATION

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Viability monitoring is an important core activity in rice genetic resources conservation to ensure good quality of stored seeds. Germplasm materials need to

be tested for germination prior to their storage. One of the factors that could affect the result in germination tests of the conserved germplasm is dormancy. In rice, some varieties are dormant at harvest and the degree of dormancy decreases over time. In this study, seed dormancy in 22 traditional and modern varieties was monitored. Sampling of each seed lot was done at harvest and every 2 weeks thereafter. Seed samples were germinated in Petri dishes and incubated in 30°C incubator. Another batch of seeds was placed in the oven set at 50°C for five days to break the seed dormancy and also sampled for germination test. Scoring of normal and abnormal seedlings was done seven and 14 days after sowing. Germination test showed that at harvest, germination of seeds that were not placed in the oven (non-oven seeds) to break seed dormancy ranged between 0-55% in contrast to the seeds placed in the oven (oven seeds) which exhibited 3-93% total germination. Germination of non-oven seeds four weeks after harvest had increased with values ranging between 0-92% total germination. In oven seeds, germination observed ranged between 39-99% total germination. Some seedlots showed very low germination even after longer period of storage. Seedlot FG 21 only had 9% total germination even after 12 weeks of storage in contrast to its oven seeds which showed 96% germination. This showed that germination test of germplasm for storage should not be done immediately after harvest even if the seeds will be placed in the oven to break its dormancy since germination is not yet at its optimum.

Keywords: dormancy, rice genetic resources, germplasm, germination

ASD-22

MUTATION HASTENS DEVELOPMENT OF IMPROVED BREEDING LINES FROM TRADITIONAL RICE VARIETY POKKALI

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Gamma-irradiation (250 gy ⁶⁰Co) was used to treat the seeds of Pokkali, a salt-tolerant, tall, with spreading culm, late maturing, photosensitive, low yielding and with poor grain quality traditional rice variety from India. The M₁ and M₂

populations established in 2005 dry (DS) and wet season (WS), respectively, generated 59 M₁ plants with reduced plant height and maturity. The M₁ plants, established plant to a row in 2006 DS, generated M₂ lines, of which 32 were selected. The selections, advanced to M₃, were field evaluated in 2006 WS, and 18 lines chosen. The M₃ lines were evaluated for phenotypic acceptability, plant height, maturity and yield potential in 2007 DS. In 2007 WS, evaluation of M₃ lines, under irrigated and rainfed condition, identified 15 most agronomically improved mutant lines which have intermediate to erect culm, reduced plant height of 92-115 cm, compared with 137-176 cm for Pokkali checks, and shortened maturity of 109-127 days after sowing (DAS), compared with 120-126 DAS for the checks. The mutants had more productive tillers, 15-28, compared with 7-17 for the checks. The mutants yielded 4.1-8.5 tha⁻¹ and 3.1-5.9 tha⁻¹, while Pokkali checks had 1.6-4.9 tha⁻¹ and 0.7-3.8 tha⁻¹ yield, under irrigated and rainfed condition, respectively. The mutants were improved for grain quality, viz., from awned to awnless grains, intermediate to short and slender grains, and from red to white pericarp. The milling potentials of most mutants are within the standards, chalkiness reduced, amylose content of 17.5%-24.4%, and of intermediate to low gelatinization temperature. The mutants are to be evaluated in multi-location trials targeting possible release as varieties. It took only three seasons to generate the stable mutants and another three for evaluation prior to multi-location trials, as compared with at least six seasons to generate stable lines and additional six for performance trials with conventional pedigree method of breeding line development.

Keywords: γ -irradiation, mutant, traditional variety, Pokkali, grain quality

ASD-23

RICE GRAIN QUALITY AS AFFECTED BY DROUGHT STRESS

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The effect of drought on rice grain quality was determined from 11 breeding lines grown under irrigated and drought-stressed condition. The traits

included % brown rice, % milled rice, % head rice for milling potentials, grain size (length and width) and shape and % chalky grains for physical attributes, % amylose content and alkali spreading value for physicochemical characteristics. Grains from drought-stressed plants were creamish white and dull in color compared with white and glossy grains from well irrigated plants. A reduction of 1.1%-19.3%, 1.5%-19.5% and 2.5%-32.4% in brown rice of six (55%) lines, milling recovery of all lines, and head rice of seven (64%) lines, respectively, were observed for grains harvested from stressed plants. The head rice of two stressed lines increased by 3.2% and 6.1%, while comparable with unstressed plants for two other lines. Drought stress reduced grain length by 0.1 mm-1.2 mm in 10 lines, while increased grain width in eight lines by 0.08 mm-0.42 mm. Drought stress resulted in an increase in grain length-width ratio (grain shape) of four lines, and a decrease in seven lines. When classified, only one line, shifted from intermediate to slender shape. The other lines remained intermediate or slender. Chalkiness in drought-stressed plants was increased by 1.8%-19.2%. Drought stress decreased amylose content by 0.9%-6.5% in eight lines and increased by 1.1%-6.5% in three lines. Drought stress further resulted in reduction of alkali spreading value in 10 lines and an increase in one line. Results indicate that the degree of the effects of drought in grain quality varies with genotype, and analysis with grain samples from stressed plants may not reflect the real genetic potentials of the genotypes. The source of grain samples for analysis has significant bearing in breeding line selection and/or commercialization where grain quality is of important consideration, particularly when the target environments for cultivation are drought-prone areas.

Keywords: drought stress, grain quality, milling potential, physical attributes, physicochemical characteristics, brown rice, milled rice, head rice, grain size and shape, chalkiness, amylose content, alkali spreading value

ASD-24

**RELATIVE WARP ANALYSIS OF SHAPE VARIABILITY
IN THE RICE BLACK BUG, *SCOTINOPHARA* SPP.
(*COARCTATA* GROUP) OF THE PHILIPPINES
AND MALAYSIA**

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The landmark-based geometric morphometric approach of relative warps (rw) was used to determine the relationships of rice black bugs (RBB), *Scotinophara* spp. belonging to the *coarctata* group, of diverse geographic origins in the Philippines and in one site in Malaysia. The first two relative warps extracted from the matrix of all shape variables (rw scores) accounted for 25- to more than 40% of the total variation. The plots showed that in many cases, the landmark configurations are continuous. Landmark configurations of the prosternum in males separated the RBB from Agusan del Norte and Ajuy, Iloilo. In the discriminant analyses using the relative warp scores, more RBB were correctly classified when the shape of the prosternum was used to delineate the groups (>70% in both sexes). Cluster analyses showed differences in the shapes of the pronotum, prosternum and head between the Philippine RBB and those collected from Omar, Malaysia except for the female prosternum. Considerable shape differences between populations were also found locally within Luzon, Iloilo, Palawan and Mindanao based from the results of the discriminant analyses. The biological relevance of the morphological distinctness of the RBB from the different sites has yet to be further studied.

Keywords: *Scotinophara* spp. (*coarctata* group), rice black bug, relative warp analysis, geometric morphometrics, species groups

ASD-25

SYSTEMATIC RELATIONSHIPS OF PHILIPPINE RICE BLACK BUGS, *SCOTINOPHARA* SPP. (HEMIPTERA: PENTATOMIDAE: PODOPINI)

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The systematic relationships of Philippine rice black bugs (RBBs), *Scotinophara* spp. was inferred using Nonmetric multidimensional scaling technique (MDSALF) and parsimony analysis to determine patterns of variation among the species and species groups. The MDSALF result revealed a very distinct structure with clusters representing species groups visually apparent in the map. The distinct gaps in the phenetic spaces between species groups reflect the ease by which the species can be classified using numerical phenetics.

On the contrary, parsimony analysis showed that the species groups did not form monophyletic groups. It is suggested that more parsimony informative characters should be included to shed light into our basic understanding of the various evolutionary processes involved in the differentiation of these species of black bugs.

Keywords: *Scotinophara* spp., black bugs, Nonmetric multidimensional scaling, Parsimony analysis, autapomorphies, minimum spanning tree, species complex, systematics

ASD-26

TRENDS ON FERTILIZER USE IN RICE PRODUCTION IN THE PHILIPPINES

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The study sought to determine the trends in the use of fertilizer in rice production across ecosystems and seasons for the past ten years. The five-season data from the 33 major rice producing provinces of the Integrated Farm Household Analysis Project (IFHAP) was used in this study.

Results revealed that majority of the farmers applied inorganic fertilizer two to three times in their rice crop. Very few used the combination of inorganic and organic fertilizer. In irrigated areas, the percentage of farmers applying fertilizers rose from 96 percent in 1996 to almost 100 percent in 2006. However, a more dramatic increase was noted among farmers in rainfed areas, with the percentage of farmers applying fertilizers increasing from 81 percent in 1996 to 99 percent in 2006. Additional findings on farmers' use of inorganic fertilizers reveal that the rate of application of nitrogen, phosphorus, and potassium has been increasing over the past 10 years, both in irrigated and rainfed farms. The share of fertilizer ranges from 7 to 12 percent of the total cost of production.

With the increasing use of fertilizers and given its very important role in the food security program, support services ensuring efficient access of such inputs should be availed by small farmers to enhance their productivity and profitability in rice production. Farmers should be encouraged and trained on how to evaluate soil and plant conditions from which form the basis on the proper fertilizer management practices. Techniques and tools on how to diagnose the nutrient status of the soil and rice plant such as the Leaf Color Chart (LCC) and Minus One Element Technique (MOET) must be intensively promoted. The farmers must be educated on the importance of understanding the soil resource base and crop's demand for fertilizer at certain stages of the rice crop.

Keywords: organic fertilizer, inorganic fertilizer, nitrogen, phosphorus, potassium

ASD-27

MANAGEMENT OF ORGANIC MATERIALS IN AN ORGANIC-BASED RICE FARMING SYSTEM

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The amount of organic matter in soil is a function of the amount of plant residues returned to the soil and the rate at which these residues decompose. Plant residues are not only the substrate for the replenishment of soil organic matter, but they also serve as an important source of nutrients for paddy rice.

A Straw Quality Index (SQI) was developed from a series of perfusion experiments to determine the decomposition rate of straw from different rice varieties (*Oryza sativa L.*). The correlation matrix of the initial composition of straw samples and the cumulative C release established the relationships between residue quality parameters and decomposition rates: $SQI = -56.85 + (11.68 \times \%N) + (1.25 \times \%DOM) + (2.59 \times \%lignin)$. It uses important descriptors of plant residue quality: nitrogen, digestible organic matter (DOM), and lignin concentration. These findings indicate the potential of SQI in assessing the quality of straw materials in predicting their usefulness in crop-residue management systems.

The efficiency of SQI and its relationship with rice grain yield was further examined under field condition. To evaluate the influence of organic materials' addition on the growth performance of rice and quality of paddy soil, a field experiment was conducted on a low-fertility clayey soil Maahas Series (*Aquandic Epiaqualf*) at IRRRI-U.P Los Baños Experiment Station. The experiment confirmed the importance of SQI in assessing the quality of rice straw (*Oryza sativa L.*) and on multi-purpose tree species (*Gliricidia sepium* and *Macaranga tanarius*) under field condition. The effect of organic materials on rice grain yield and the subsequent changes on the properties of rice paddy soil was further investigated. There was a direct relationship between SQI and rice dry grain yield ($r^2 = 0.87$). Management of organic materials in an organic-based farming systems demonstrated great potential in enhancing the sustainability of lowland rice cropping systems.

Keywords: organic material, decomposition, plant quality, organic farming

ASD-28

ASSESSING THE QUALITY OF PLANT TO ENHANCE THE SUSTAINABILITY OF LOWLAND RICE ICE CROPPING SYSTEM

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The initial benefit of plant residues appears to be related to their quality and decomposition rate and associated nutrient release. Plant residues are vital resource in the replenishment of nutrients in soil and in affecting the sustainability of rice production.

A glasshouse pot experiment was conducted to study nutrient availability after rice straws (*Oryza sativa L.*) of different quality were incorporated to an Alfisol sandy loam soil. The effects of water condition (flooded and non-flooded) and straw residue treatments on the availability of nutrients in the soil were examined at different sampling times (active tillering, maximum tillering and maturity). There was higher concentration of total C (C_T) and total N (N_T) remaining in the soil in straw residues with high Straw Quality Index (SQI) than those residues with low SQI. Flooded soil condition significantly decreased C_T concentration in all straw-residue treatments. Decomposition rate of straw residue was faster under aerobic than anaerobic conditions. The results demonstrated that nutrient availability is dependent on the quality of residues after the straw has been incorporated into the soil.

A field experiment was conducted to confirm the results of glasshouse experiment and evaluate the influence of 'quality' of plant residues on rice grain yield and properties of soil. The leaves of multi-purpose plant species (*Gliricidia sepium* and *Macaranga tanarius*) and straws of different rice varieties were incorporated on a low-fertility clayey soil (*Aquandic Epiqualf*) at IRRI-UPLB Experiment Station in Los Baños, Laguna. Results showed that application of plant residues improved rice grain production. No significant changes in soil organic matter after 3 rice crops but its level increased afterwards. The study recognized the value of plant residue quality as an important aspect of low-input sustainable rice production systems. Maintaining adequate levels of soil organic matter is an important factor in the long-term productivity of such systems.

Keywords: nutrients, decomposition rate, plant residues, plant quality, soil organic matter

ASD-29

**SEQUENCE-BASED IDENTIFICATION,
AGGRESSIVENESS AND FUMONISIN PRODUCTION
OF A POPULATION OF *FUSARIUM* SPECIES CAUSING
BAKANAЕ DISEASE OF RICE IN THE PHILIPPINES**

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Forty *Fusarium* strains were isolated from rice stems, shoots and grains in the Philippine provinces of Nueva Ecija and Laguna. All isolates were identified as *Fusarium fujikuroi* based on the elongation factor -1 α sequence except three isolates which were identified as *F. proliferatum*, *F. sacchari* and *F. oxysporum*. Based on PCR amplification of *MAT* (mating type) specific sequences, the 37 *F. fujikuroi* segregated 10:27 of *MAT-1* and *MAT-2*, respectively. Only five isolates produced fumonisins in liquid culture: concentrations, estimated by Enzyme Linked Immunosorbent Assay (ELISA), ranged from 0.025 ppm to 0.238 ppm. High Performance Liquid Chromatography (HPLC) analysis of 20 isolates revealed seven isolates as fumonisin producers with production ranging from 0.86 $\mu\text{g/g}$ -210 $\mu\text{g/g}$. Amplification of a partial sequence of the *fum1* gene (a key gene in fumonisin biosynthesis) by Real Time-PCR (RT-PCR) is in agreement with the results obtained by fumonisin analyses. No association between fumonisin production and aggressiveness of isolates under lab and greenhouse conditions was observed. The production of fumonisins of *F. fujikuroi* in rice and implies the need to explore a larger population of this pathogen to promote food safety.

Keywords: aggressiveness, bakanae, elongation factor -1 α sequence, Enzyme Linked Immunosorbent Assay (ELISA), fumonisins, *Fusarium fujikuroi*, High Performance Liquid Chromatography (HPLC), Real Time-PCR (RT-PCR), rice

ASD-30

**SITE-SPECIFIC NUTRIENT MANAGEMENT FOR MAIZE:
A CASE IN ISABELA, BUKIDNON, NUEVA ECIIJA
AND TARLAC, PHILIPPINES**

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Increasing the productivity of irrigated and rainfed maize requires the efficient use of nutrients from soil indigenous and fertilizer sources to meet the nutrient needs for high and sustainable yield. This research was conducted to develop, evaluate and disseminate a new site-specific nutrient management (SSNM) approach for maize under varied soil and climatic conditions in key maize growing areas in the Philippines

Five replicated on-farm trials with hybrid maize were conducted in 83 farms in Isabela, Bukidnon and Nueva Ecija/Tarlac in 2005-2007. Irrigated maize was grown in the dry-season after wet-season rice in Nueva Ecija/Tarlac, while two wet-season maize crops were grown under rainfed conditions in Isabela and Bukidnon. Attainable yield was estimated in NPK treatments with ample nutrient supply (200 kg N, 120 kg P₂O₅, and 120 kg K₂O ha⁻¹). Soil indigenous nutrient supplies of N, P, and K were estimated as grain yield in omission plots where nutrients other than the omitted were not limiting yield. SSNM recommendations were developed based on attainable yield and the estimated yield responses to fertilizer N, P and K. Other treatments included planting densities, timing and split N application and the use of leaf color chart (LCC) for optimizing N management.

Planting densities of 65,000 to 75,000 plants ha⁻¹ produce high yield and profit. Yield results obtained in the farms ranged from 6-10 t ha⁻¹ in Isabela, 6-8 t ha⁻¹ in Bukidnon, and 8-10 t ha⁻¹ in Nueva Ecija/Tarlac. Using optimal planting densities and SSNM guided fertilizer recommendations increased yield by 0.6-2.0 t ha⁻¹ and net benefit by 6-21% compared to the farmers' practice across all sites and seasons.

SSNM for maize is now ready for wider scale evaluation and current activities focus on farmer participatory evaluation of SSNM recommendations including the use of the LCC to fine tune mid-season N management.

Keywords: maize, planting density, site-specific nutrient management, omission plot, leaf color chart

ASD-31

GREENHOUSE TECHNOLOGY IN THE PHILIPPINES: PROSPECTS AND PROBLEMS

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A marked increase in the number of greenhouse structures in the Philippines was observed within the last ten years brought about by the intensive promotion of greenhouse supplies and structures, available local government and foreign funding coupled with the realization to produce high value crops out of season and with less pesticides. The structures are of different models and utilize different covering materials.

The Central Luzon State University and the Pampanga Agricultural College are among the state colleges and universities that made advances in high value crop researches under greenhouse condition in Luzon. Developed technologies were promoted and commercialized in four provinces of Central Luzon with funding from Philippine Council for Agriculture, Forestry and Natural Resources (PCARRD) through the Central Luzon Agricultural Resources Research and Development Consortium (CLARRDEC) in cooperation with local government units.

Twenty greenhouse cooperators were selected based on the criteria set by the project, i.e. very low utilization of the structures and lack of technical know-how on greenhouse culture. Science and technology interventions were made on technical problems that include crop and variety, water requirement, pest control and fertilization. Other technical problems such as covering material used, location of the greenhouse were the variables considered in differentiating the performance of the technology introduced.

Greenhouses which nylon mesh covering material (70%) and higher can be utilized for high value crop production for 9 to 10 months (June to April.) growing period generating a net income of about Php 12,000 to 20,000 per 100 m².

Greenhouses which are dominantly UV plastics can only be utilized profitably for 6 to 7 months without cooling/ventilation system such as blowers/fans. Lower income were derived from these greenhouses because of heat stress of plants inside the structure.

Keywords: greenhouse,, abiotic factors, covering material, ventilation,

ASD-32

FRUIT AND SHOOT REMOVAL AS METHODS TO CONTROL EGGPLANT FRUIT AND SHOOTBORER *Leucinodes orbonalis* GUENEE

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The study was undertaken to evaluate treatments on removal of infected plant parts such as fruits and shoots of eggplant every other day, every three days, weekly and every 10 days in controlling eggplant fruit and shootborer *Leucinodes orbonalis* Guenee. Untreated plants and recommended insecticide application using Profenofos at the rate of 400 L per hectare were used as standard checks.

Treatments on removal of the infested plant parts every other day, every 3 days, weekly and every 10 days significantly reduced the fruit and shootborer damage in eggplant. Moreover, these treatments produced more undamaged fruits compared to the untreated check and recommended insecticide application. Among the treatments, removal of the infested plant parts every other day and every 3 days produced the highest percentage undamaged fruits. The more frequent the removal of infested fruits and shoots the greater is the reduction of damaged fruits.

Cost and return analysis showed that removal of infested plant parts every other day gave the highest gross income but the practice is not economical considering the higher labor cost due to more frequent removal of infested plant parts. Removal of infested plant parts every week and every 10 days gave the insect enough time to complete its development thereby allowing them to do greater harm to plants. Removal of infested plant parts every 3 days is the most practical and economically viable.

Keywords: eggplant, shootborer, Profenofos

ASD-33

**FARMER KNOWS BEST – CHANGING TRENDS IN
PRODUCTION PRACTICES AND PEST MANAGEMENT IN
AN EGGPLANT AFTER RICE CROPPING SYSTEM
IN BALETE, BATANGAS**

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The province of Batangas produces about two percent of the total eggplant in the country and the bulk of production comes from Balete, Batangas. Known as the eggplant capital of Batangas, most farmers in this area grow eggplant after rice in the last 40 years and only recently some farmers shifted to growing eggplant the whole year round. Insect pests and diseases were the major problem in eggplant production and the use of pesticides is the common practice to control these pests. However, continuous spraying brought a lot of health and environmental problems and this had encouraged farmers to look for alternative measures. This project aims to survey the eggplant production and pest management practices among farmers in Balete, Batangas and document some of the approaches they discovered themselves to reduce pest incidence. Also, different eggplant cultivars were introduced and screened for pest resistance and consumer preference in five selected farmer cooperators.

In collaboration with the Office of the Mayor and the Municipal Agriculture Office of the Local Government Unit of Balete, thirty-three farmers were interviewed regarding their profiles, production practices and pest management discoveries.

Results showed that most farmers were tenants, farming an average of 0.5 eggplant monoculture fields. For pest management practices, the farmers used pesticides to control insect pests and diseases and spray twice weekly.

Male members decide what to do with pest problems and get knowledge on pesticides from DA technicians and dealers. Only 25% of them attended an IPM seminar.

The farmers were hesitant to plant and sell the off-type cultivars (A300, Abar and EG203) and only planted the Casino hybrid. Off-types were only for home consumption. Grafted eggplant (Casino-scion, EG203-rootstock) was acceptable because of the higher yield and the fruits (like Casino) and moderately resistant to bacterial wilt and phomopsis.

The most significant change in farmer's practices which they discovered themselves is the reduction in their pesticide spraying (only at vegetative stage) and retaining trimmed weeds in the alley to lower pest population thus saving pesticide cost. Some farmers also observed decrease in pest incidence when other crops were planted inside or within the eggplant field and significantly increased their income. Once the practice had become known and successful as a result of increased income, the farmers started to copy one another's experience and today, the area not only practiced reduced spraying but also planted other vegetables. With this changing perception and environmental awareness among eggplant farmers of Balete, Batangas, having discovered what is best for them and their farming practices, the place will always be known as the eggplant capital and continue to produce premium, consumer-friendly and environmentally-safe eggplants and vegetables.

Keywords: pest management, eggplant production, Balete, Batangas, Casino hybrid, grafted eggplant

ASD-34

GROWING LETTUCE ON RECYCLED BOTTLES WITH SNAP

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Simple Nutrient Addition Program (SNAP) is a hydroponics system being popularized for the mass production of crops such as lettuce in areas with small available space. This method of growing crops is applicable in urban areas where soil or space for growing crops is not adequate. This is called urban farming. Urban farming can be done in apartments and townhouses where small terraces can be used for growing plants. Residents in these types of houses can grow crops for their own consumption.

This study has included some modification to the SNAP hydroponics system through the use of recyclable softdrink bottles and addition of potting mixtures for anchorage and additional nutrient source for the crop. Furthermore, the effect of microbial based fertilizers on the yield of the crop and its interaction with the nutrient solution was investigated.

The experiment was conducted at the Institute of Plant Breeding following a two factor randomized complete block design (RCBD) with six replicates per treatment. Factor A involved two levels of SNAP, the full strength (FS) and half strength (HS) while factor B involved the use of the biofertilizers BioGroe and Mykovam.

Incorporation of the potting mixture sterilized soil: sand: coir dust: rice hull: charcoal (1:1:1:1, v/v) at the upper part of the bottle provided better growth for the lettuce seedlings because of added nutrients and root anchorage. The use of half strength SNAP solution showed higher marketable yield, shoot fresh weight compared to the full strength. Biofertilizer application increased the marketable yield when applied with half strength SNAP solution. Simple financial analysis showed the feasibility of acquiring a quantitative income using the SNAP hydroponics system.

Keywords: Lettuce, SNAP, Mykovam, BioGroe, urban-farming

ASD-35

BIOMASS, NITROGEN UPTAKE AND NITROGEN FIXED PARTITIONING in MUNGBEAN (*Vigna radiata* [L.] Wilczek) GROWN UNDER FIELD CONDITION

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Legumes like mungbean have the ability of converting atmospheric nitrogen into a form that can be used by the plant through the biological nitrogen fixation (BNF) process. A field trial was conducted at UPLB to determine the effect of inoculation with *Bradyrhizobium* sp. strain M6 on biomass, harvest index (HI), nitrogen harvest index (NHI), BNF and partitioning of nitrogen fixed in four mungbean genotypes. BNF was estimated using the ^{15}N isotope dilution technique which involved the application of ^{15}N labelled ammonium sulphate fertilizer with 5% atom excess in designated microplots at the rate of 20 kg N ha^{-1} and analysis of ground plant samples for ^{15}N atom excess by mass spectrophotometry. In general, the inoculated and control plots did not differ significantly in terms of the above parameters measured due to high native rhizobia population present.

The four mungbean entries differed significantly in terms of biomass and grain yield. Pag-asa 7 produced the highest yield followed by Pag-asa 3 while Acc 15781 produced the lowest yield as a result of its susceptibility to insect pests and diseases. Significant differences in HI, N uptake and NHI were mainly due to differences in total biomass production. However, the four entries did not differ significantly in terms of BNF with % N derived from air (Ndfa) ranging from 30.43 to 37.94 % and 22.82 -39.79 kg N fixed per ha. From the total N fixed, 39.89%-43.08% was partitioned to the grains while 51.54%-55.74% of N fixed was left in the shoots. Hence, it is important to plow back mungbean stover because of the considerable amount of N and N fixed left in the shoots. The high N demand by grains were shown by the net soil N removal of 22.66 to 33.57 kg N per ha.

Keywords: Biological Nitrogen Fixation, ^{15}N isotope dilution technique, Nitrogen Harvest Index, Harvest Index

ASD-36

VEGETATIVE COMPATIBILITY GROUPINGS AND VIRULENCE OF *FUSARIUM OXYSPORUM* IN BITTER GOURD AND BOTTLE GOURD IN THE PHILIPPINES

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Vegetative compatibility groups (VCGs) were determined for 57 *Fusarium oxysporum* isolates from *Momordica charantia* L. (bitter gourd) and *Lagenaria siceraria* (Mol.) Standley (bottle gourd) in two provinces in the Philippines namely Batangas and Bulacan using nitrate-nonutilizing (nit) mutants. Sixty one and 25 nit mutants were generated from *F. oxysporum* f. sp. *momordicae* and *F. oxysporum* f. sp. *lagenariae* isolates, respectively. Frequency of reversion to wild type was higher in *F. oxysporum* f. sp. *momordicae* than in the *lagenariae* populations. Two and four VCGs were found in bitter gourd from Batangas and Bulacan, respectively with a ratio of VCGs to isolates (VCG_{div}) of 0.20 - 0.33. Two and three VCGs were found in bottle gourd from the two locations with VCG_{div} of 0.40 - 0.50. VCG was not correlated with radial growth rates of *F. oxysporum* in either hosts or locations. The two *formae speciales* of *F. oxysporum* were not vegetatively compatible. Low VCG diversity of *F. oxysporum* populations in both hosts and locations could be attributed to clonal reproduction, parasexual recombination and limited gene flow. Bottle gourd isolates from Bulacan were not compatible with those from Batangas whereas some bitter gourd isolates from both locations were compatible. incompatibility of bitter gourd and bottle gourd isolates suggests high host specificity of *F. oxysporum*. Virulence of some bitter gourd isolates tested was not associated with a particular VCG. Cross-inoculation tests showed that bitter gourd isolates were not pathogenic to bottle gourd and vice versa.

Keywords: *Fusarium oxysporum* f. sp. *momordicae*, *Fusarium oxysporum* f. sp. *lagenariae*, bitter gourd, bottle gourd, vegetative compatibility groups

ASD-37

DEVELOPMENT OF PURELINE FRESH MARKET TOMATO CULTIVARS

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The development of pureline fresh market tomato cultivars was conducted in Ilocos Norte from 2000 – 2006. This started with the three MMSU off-season tomato F1 hybrids: Native x Line 1, Native x Line 2 and Native x Line 3. These were developed into pureline cultivars through continuous selections until the desirable characteristics become stable. Stabilization was done using pedigree method from F1 up to F8 generation or until there were no longer segregation. Selections were undertaken during the vegetative, flowering and fruiting stages based primarily on the growth habit, reaction to pests, crop vigor, fruit size and shape, fruit setting, yield and yield components. The developed fresh market tomato purelines were further evaluated based on their performance on-station and on-farmers field and then select the best for off-season planting, i.e., wet season.

The four selected lines (MT3-25-26-4-43-16-13, MT2-18-16-6-16-4-1, MT3-25-6-18-41-14-5 and MT3-43-12-10-60-26-14) showed good performance and outyielded the MMSU tomato hybrids. These lines produced an average yield of 37.82, 34.44, 37.22 and 37.28 t/ha², respectively. These have pinkish to pinkish red fruit color, the fruit shapes are round to flat round, characteristics are mostly preferred by the consumers. All the selected lines have juicy and sour tastes which resembled or were comparable with the three MMSU hybrids, wherein these desirable qualities are most preferred for fresh market tomatoes.

The advantage of planting purelines is its stability from one generation to the next, hence, farmers can still use the seeds for their next cropping seasons. By planting purelines, the cost of production particularly the amount allocated for seeds will be reduced. Hence, higher net income per hectare and per peso invested will be realized as compared in the planting of hybrids.

Keywords: purelines, fresh market tomato, off-season production, breeding, selection, development

ASD-38

A BREAKTHROUGH IN THE MICROPROPAGATION OF MANGO (*Mangifera indica* L.) VIA SOMATIC EMBRYOGENESIS AND A SIMPLE SYSTEM FOR PLANTLET ACCLIMATIZATION AND TRANSFER TO POTTING MEDIA

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The 'Carabao' mango or Manila Super, is the lone commercial variety of the Philippines. Its importance increased tremendously with the advent of flower induction by KNO₃ in the 1970's. The fruit needs further improvement in color, shelf life, size, among others, through biotechnology where a successful tissue system is a necessary step.

This paper presents a breakthrough in the micropropagation of mango and a simple system for plantlet acclimatization and transfer to soil.

Somatic embryos (1', 2', ..., n') were produced continuously using the protocol of Pateña et al. (2002). The protocol was reproducible in different 'Carabao' strains. Primary (1') somatic embryo (SE) induction ranged from 18.39 to 100%. In 2007, we induced 67 nucellar cultures and obtained 23.88% primary SE induction. This was relatively high for a woody species like the mango. We previously reported that a single somatic embryo was needed to start continuous proliferation. The somatic embryos exhibited the different developmental stages (globular, heart, torpedo, and cotyledonary stages). We identified 6 distinct tissue culture stages: SE induction, SE proliferation, SE germination, root and cotyledonary leaf formation, initial shoot formation, and true leaf formation. Somatic embryos germinated and developed into complete plants like mature seeds grown in soil. SE-derived plantlets were acclimatized and transferred to soil. On previous attempts, plantlets survived for 10-17 days in other potting media while none survived in soil. Various acclimatization techniques were tested and we have developed a simple system for transfer of plantlets to potting media. This system of continuous production of SEs, their development into complete plantlets, and successful transplant to potting media provides a means for mass propagation and a tool for improvement through biotechnology.

Keywords: 'Carabao' mango, somatic embryogenesis, micropropagation, acclimatization

ASD-39

A NEW MEDIUM FOR IN VITRO ROOTING AND PLANTLET REGENERATION AND A SIMPLE TECHNIQUE OF ACCLIMATIZING PLANTLETS

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Tissue culture is used in almost all biotechnology work to generate plants with improved characteristics. There are several factors needed to succeed in tissue culture, foremost are the medium and the acclimatization technique. These are exemplified in our work on avocado and orchids.

In avocado, the medium that we developed, Barba and Pateña's BP medium, proved to be the best in obtaining complete plantlets. We had difficulty regenerating plantlets from somatic embryos, hence, we resorted to in vitro rooting of shoot cultures of cvs 'Semil', 'Mainit' and 'RCF' Purple'. Highest rooting percentage was observed in BP medium (83%), followed by Murashige and Skoog's (MS) medium (58%) and least in the Woody Plant (WP) medium (33%); all media were supplemented with growth regulators. In orchids, the use of BP medium favored plantlet regeneration of in vitro germinated embryos.

A critical factor in tissue culture is the transfer of regenerated plantlets to soil. Our work on avocado and mango resulted to a successful technique of acclimatizing regenerants and their subsequent transfer to potting media. This included well-lighted, cool environment and the use of hydroponics-style plastic cups, an innovation first reported in this paper.

These two innovations, the BP medium and the acclimatization technique, will greatly contribute in the tissue culture of woody species, the group of crops which are difficult to tissue culture.

Keywords: woody species, tissue culture medium, BP medium, in vitro rooting, acclimatization

ASD-40

INVASIVE MEALYBUG: THE CULPRIT IN THE DECLINE OF THE ATIS INDUSTRY IN LOBO, BATANGAS

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The buff coconut mealybug (BCM), *Nipaecoccus nipae* (Maskell), is a recently introduced pest in the Philippines and has become very destructive among important agricultural crops in the last five years. This invasive pest was first observed in early 2001 and after five years, it has already been recorded in almost 60 plant species belonging to 14 genera. It is the aim of this paper to present the unfortunate situation brought about by this mealybug to the 'atis' industry of Lobo, Batangas. Through this paper, we wish to call the attention of concerned agencies to look at this very important pest and its continuing threat to more agricultural crops

in the country.

One of the most susceptible crops that did not escape from BCM attack is the famous 'atis' or sugar apple of Lobo, Batangas. Lobo "atis" is not only very special among the Batangueños but also around the country because of its delicious, sweet taste and relatively bigger size allowing ease in eating. This crop is planted along the rolling hills of Lobo situated along the coast of Batangas. This fruit is actually one of the major sources of income of the municipality with an estimated average annual production of over the past forty years. The BCM were first observed in early 2000 on the hilltops of the upper barangays of Lobo particularly in Banalo and San Miguel. The infestation progressed to the lower barangay. The farmers started to complain about this pest in 2003. They observed the decrease in yield and the secondary damage by the consequent sooty molds on the 'atis' trees and surrounding vegetation. The damage had been aggravated by long spells and the big plunge came in 2005 when there was almost no income generated.

The recent supertyphoons might have put down the mealybug population significantly. However, as early as January 2007, signs of resurging mealybug populations have already been imminent and there have been a steady increase. So far, no effective natural enemies whether parasitoids or predators have been found. The steep slope of most 'atis' farms also make chemical control or other non-biological means not only costly but also impractical. The search for effective control measures, however, continues to be stalled by lack of financial resources for R&D and lack of government support to this pest epidemic.

Keywords: buff coconut mealybug, *Nipaecoccus nipae*, Lobo, Batangas, 'atis', sugar apple

ASD-41

VIABILITY AND IN-VITRO REGENERATION OF INDIGENOUS ORCHID PODS COLLECTED FROM HOME GARDENS AND COLLECTING POINTS

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The Philippine flora possesses a tremendous diversity of taxa in the *Orchidaceae* family, with about 800 species. Plants exported from the Philippines is mainly orchids. 61-93% of exported orchids were collected from the wild while 7-39% were reported as artificially propagated. One strategy to ease over collection from the wild for trading is to collect pods from home gardens and collecting points and regenerating them *in vitro* as a viable source of planting materials.

Both mature and immature indigenous orchid pods were collected home gardens and collecting points. Intact pods were surface-sterilized in 100% commercial bleach for 20 min. Exposed seeds were subjected to 20% commercial bleach for 20 minutes followed by 10% commercial bleach for 10 min. The seeds were cultured following the standard orchid embryo culture using Knudson C as the base medium. Seed viability was determined using the standard tetrazolium test. Germination time, measured in weeks was noted.

A total of 98 genotypes from 28 species of indigenous orchids were cultured. The orchid genotypes collected showed wide variation in seed viability and germination time. Forty two percent (42%) of the orchid genotypes had a viability of 50 to 100% and germination time of 4 to 15 weeks. Within species, mature pods exhibited higher seed viability and faster germination than immature pods. Plantlet regeneration was obtained from all genotypes collected upon transfer of germinated seeds.

These results prove that both immature and mature indigenous orchid pods are viable sources of planting materials for indigenous orchid production. Thus, collection from the wild will be eased.

Keywords: indigenous orchids, embryo culture, seed viability, plantlet regeneration, Knudson C medium

ASD-42

INTRODUCED BANANAS: NEW CULTIVARS, MORE OPTIONS FOR THE BANANA FARMERS

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In the last 15 years, *Musa* researchers worldwide have identified and developed a number of new, high-yielding and disease-resistant cultivars of banana. Today, these improved cultivars are being made available for testing and distribution to smallholder farmers through Bioversity International (formerly INIBAP/IPGRI). This strategy is viewed as a shortcut to a long, tedious and expensive banana breeding program. In 2001, 24 hybrids and landraces were introduced into the country for conservation and multiplication. The performance of these new cultivars under local growing conditions was evaluated in terms of agronomic and yield characteristics, visual and organoleptic (taste) acceptability, and reaction to common diseases. Results of the study conducted by the Institute of Plant Breeding, University of the Philippines Los Baños (IPB-UPLB) showed that FHIA 17, FHIA 23 and FHIA 25 significantly produced heavier bunches than the highest yielding local cultivar (Cardaba) while FHIA 17 produced the heaviest individual fruits. However, these introduced cultivars were less sweet than the local cultivars based on TSS reading. Most of the introduced cultivars were also found to possess moderate resistance against the banana bunchy top virus (BBTV).

In terms of taste, Saba is still preferred as boiled while Lakatan is more preferred as table bananas than the introduced cultivars. However, FHIA 01 is better liked as cake compared to Buñgulan. All FHIA hybrids (except FHIA 25) are preferred over the local Saba variety for processing into honey-flavored and salted chips. This highlights the cultivars' potential as raw material for value-added processed products (banana chips) for both the local and export markets.

Keywords: Banana, local and introduced cultivars, BBTV resistance, yield, taste test, banana chips

ASD-43

**FIELD PERFORMANCE OF BANANA CV. LAKATAN
(*MUSA ACUMINATA*) UNDER TWO FERTILIZER
MANAGEMENT SCHEMES IN INFANTA
AND GEN. NAKAR, QUEZON**

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Banana cv. Lakatan (*Musa acuminata*) is an important cash crop of small farmers in the Philippines. However, crop productivity remains low due to under management and vulnerability to typhoons. This study aims to evaluate the field performance of Lakatan cv. using two fertilizer management schemes namely, (1) inorganic fertilizer recommendation (100% RF) of 250N : 30P₂O₅ : 350K₂O kg ha⁻¹ and (2) combination of biofertilizers developed by the University of the Philippines Los Baños (BIO-N® and MYKOVAM®) and a quarter of the inorganic fertilizer recommendation (25% RF+BF). Except for the fertilizer treatment, all other management practices were similar in four cooperator farms. The treatments cost an additional 24 man-days labor per ha. (i.e., PhP 2.40 plant⁻¹) and PhP 10.74 plant⁻¹ for 100% RF fertilizer materials and PhP 3.78 for 25% RF+BF. For the farmers to recover this cost, the 100% RF have to harvest at least 1.17t ha⁻¹ (0.5 kg plant⁻¹ at 2,500 plants ha⁻¹) more than the 25% RF+BF combination while the 25% RF+BF need to increase yield by 0.74 t ha⁻¹ as compared with the farmers' existing practice of no fertilization.

Generally, the 100% RF had significantly taller plants (282.47 cm), wider area of the 2nd youngest fully-expanded leaf (13,447 cm²) and larger pseudostem girth (68.89 cm) compared with 25% RF+BF at shooting. 100% RF treated plants also fruited earlier (12 months) compared to 25% RF+BF treatment which started fruiting after 14 months. Initial yield data are as follows: total weight of hands, 9.5-13 kg; number of hands, 8-13; and number of fingers, 104-181 for the 100% RF compared with 8-11 kg; 6-8; and 106-124, respectively for the 25% RF+BF treatment, with a clear trend of attaining higher than the minimum yield increase required to compensate for fertilizing banana plants. Early fruiting is an added advantage in 100% RF which could minimize by two months the risk of field exposure to natural elements and pests and diseases. Result of this study offers the farmers options on how to better manage their bananas for increased productivity and income.

Keywords: Lakatan banana, productivity, fertilizer management, growth, yield, biofertilizers

ASD-44

ROLE OF HEALTHY-LOOKING SABA AND OTHER ALTERNATE HOSTS ON THE SPREAD OF BANANA BUNCHY TOP DISEASE (BBTD)

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Banana bunchy top disease (BBTD) caused by *Banana bunchy top virus* (BBTV) is the most destructive disease of banana causing a significant yield loss on the quality and quantity of banana production. BBTV can persist naturally in banana plants with no apparent symptoms of BBTD. Apparently healthy-looking banana and alternate hosts of BBTV have implications in developing disease management strategies. Asymptomatic banana representing varying cultivars were collected from Laguna, Batangas, Cavite and Quezon where banana bunchy top disease (BBTD) was prevalent. Saba was the most frequently collected cultivar. Enzyme-linked immunosorbent assay (ELISA) was done to determine the presence or absence of BBTV on the collected banana plants. Results of ELISA showed that most of the collected banana samples were positive to the virus. This indicates the presence of the virus in the symptomless plants. Insect transmission test of selected positive samples showed that the virus can be transmitted from asymptomatic banana plants to tissue-culture derived banana cv. Lakatan. Characteristic symptoms of BBTV were observed from inoculated test plants. Symptoms started to appear 21 days after inoculation. Artificial inoculation to alternate hosts of banana aphids including camia (*Hedychium coronarium*), taro (*Colocasia esculenta*), *Colocasia* sp., *Costus* sp., *Heliconia* sp., and *Dieffenbuchia* sp. was also done. Initial studies show three possible and potential plant reservoir of BBTV outside *Musaceae* family based on insect transmission studies and ELISA. These include variegated gabi, Bandera Espanola, and *Heliconia* sp. Symptoms started to appear 4 weeks post-insect transmission only on variegated gabi and *Heliconia* sp. as marginal chlorosis and mosaic, respectively. The results showed that asymptomatic banana plants within an area with BBTD, regardless of variety, can serve as infection foci for the spread of BBTD. Crops other than those belonging to *Musacea* can also serve as source of inoculum.

Keywords: immunosorbent, *Musacea*, inoculum, chlorosis, *Musaceae*

ASD-45

DIFFERENTIAL EXPRESSION OF A NOVEL BANANA MADS-BOX GENE SHOWS DEVELOPMENTAL CONTROL OF CLIMACTERIC FRUIT RIPENING

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The regulatory role in ripening of a novel banana fruit-specific MADS-box¹ gene was investigated by quantification of its expression and correlation to the rise in ethylene production during fruit maturation. The gene, *MaMADS2*, was isolated from ripe banana fruit cDNA and had a putative protein sequence that was structurally similar to Type II MADS-box transcription factors that are implicated in key developmental processes.

Using real time PCR analysis, *MaMADS2* expression was quantified in pulp and peel tissues sampled during ripening of bananas stored in 95% (high) and 82% (low) relative humidity (RH). Ethylene and CO₂ production were measured using headspace gas analysis.

Storage under low RH decreased time to ripening with a more rapid peel color loss and firmness of banana fruits. Under low RH, no typical ethylene climacteric peak was observed, rather, the increase in ethylene production persisted until fruit deterioration. This pattern was similar in whole fruit and peel tissues, while there was no significant rise in pulp ethylene, as was observed in pulp of banana stored at high RH. In contrast, the carbon dioxide produced was similar under both storage regimes.

MaMADS2 was differentially expressed in pulp and not in peel. At high RH storage, *MaMADS2* expression increased steadily and was highest a day after the climacteric. In contrast, low RH conditions induced very high *MaMADS2* expression on the second day of storage suggesting that *MaMADS2* is dependent not only on the developmental process but also on environmental conditions. It is not clear how *MaMADS2* expression due to low RH affects the loss of pulp ethylene climacteric and the shortening of the ripening period of bananas.

Results show that *MaMADS2* is expressed before the rise in climacteric ethylene and that it has a possible regulatory role in the ripening process possibly only in pulp.

MADS-box- MADS is derived from the initials of the founder proteins Minichromosomal maintenance1, Agamous, Deficiens and Serum Response Factor

Keywords: MADS-box, developmental factors, banana, ripening, climacteric

ASD-46

BANANA TISSUE CULTURE: FROM IDRC TO IPB TO THE INDUSTRY AND BACK TO IPB

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In 1983, IDRC of Canada approved an invitational proposal, from Dr. RM. Lantican, then Director of IPB, prepared by LF Pateña (Project Leader) and RC Barba (Coordinator). The objective was to promote planting of banana in rural villages as cheap source of food, using micropropagation as the source of affordable if not free planting materials. In one year, the team completed the micropropagation of 50 banana cultivars resulting in a paper that was a finalist for the CSSP Best Paper Award. A training course was prepared by LF Pateña and implemented by AB Zamora for 6 trainees from Malaysia, Thailand and the Philippines. One Filipino trainee, Adonis Jadraque, a staff of Twin Rivers Research Center (TRRC) in Davao, set up a laboratory to mass produce a new variety of banana. The result was very successful that other corporations set up their own laboratories, with the assistance of Lydia Magnaye, the other local trainee from BPI-Davao, to produce their own planting materials of Cavendish banana for export. Meanwhile, the IPB-PCITCL micropropagated banana to serve the original purpose of the project from 1984-1995 and stopped because of budget constraint.

Lately, the Department of Agriculture (DA), Republic of the Philippines, recognized the need for planting materials and awarded IPB a grant to produce seeds and vegetatively propagated planting materials. This included a portion for the PCTC Laboratory to produce virus-free (indexed by BIOTECH) banana in 2006 and distribute/sell plantlets in 2007. The initiative of DA to support, and IPB to implement, the banana micropropagation, could be the start of a profitable commercial venture. A feasibility study is presented in a separate paper.

Keywords: banana, virus-free, micropropagation, IDRC, IPB, PCTCL, commercial venture

ASD-47

SAFEGUARDING THE SUGAR INDUSTRY FROM DISEASE INCURSION AND EPIDEMIC

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Sugarcane varietal improvement can be hastened through germplasm exchange and varietal introduction. This will only succeed if the risks of introducing exotic diseases are minimized. Post-entry quarantine measures which include regular monitoring and disease indexing must be followed. A total of 159 promising varieties were acquired and introduced to the country from Thailand, Malaysia, Indonesia, Bangladesh, Australia, China, France and Mauritius. These varieties were allowed to grow for 18 to 24 months inside the post-entry quarantine glasshouse and eight to ten months in an open field quarantine to ensure that only disease-free materials will reach the fields. Visual observation coupled with disease detection involving antibody- and nucleic acid-based techniques were employed to monitor the presence of diseases whether exotic or endemic to the Philippines. Cold soak and long hot water treatment (50C for 2 hr) and fungicide treatments were done to eliminate disease-causing organisms. Diseases like mosaic, leaf scald, ratoon stunting disease, yellow leaf scald were detected and eradicated from planting materials.

Keywords: sugar, germplasm, fungicide treatments, mosaic, leaf scald, ratoon stunting disease

ASD-48

**ACID PROTEASE PRODUCTION OF THERMOPHILIC
BACTERIA ISOLATED FROM MUD AND SOIL OF
MUDSPRING, MT. MAKILING,
LAGUNA, PHILIPPINES**

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A total of 244 bacterial isolates were isolated from mud and soil of Mudspring, Mt. Makiling, Los Baños, Laguna for acid protease production. Approximately 62% of these gave positive growth at 65°C and were screened for proteolytic activity using skim milk assay plate at 45, 55 and 65°C. Out of 150 isolates screened, six (6) bacterial isolates gave high proteolytic activity at all temperatures tested. Conventional cultural, morphological, physiological and biochemical analyses revealed that two of these are *Bacillus subtilis* (7MM-8 and 7MM-16), two *Bacillus brevis* (4MM-22 and 5SM-6), one *Bacillus pumilus* (3SM-23) and one *Bacillus polymyxa* (4MM-2). Cell suspension of these isolates was inoculated in modified soybean cake extract containing 6% soybean extract, 13% potassium phosphate, 0.8% dextrin, 0.3% magnesium sulfate, 0.5% potassium chloride, 0.02% calcium chloride and 0.2% yeast extract at pH 4.5. Cultures were incubated at 45°C with shaking and the cells were harvested from the culture supernatant by centrifugation. The supernatant, as crude acid protease, was used for the assay. The activity of the crude acid protease produced by the *Bacillus* spp. was assayed using 2% casein as substrate. Results showed that acid protease from 4MM-22 and 7MM-16 yielded activities of 277.5 and 247.0 acid protease unit (APU), respectively. Characterization of the two isolates showed that 4MM-22 was active and stable at pH 4 and 55°C and pH 2.0 to 4.0 and 20 to 50°C. Isolate, 7MM-16, was active and stable at pH 4.0 and 55°C and pH 2.0 to 5.0 and 20 to 50°C. These results reveal the promising value of the acid protease produced by the isolated thermophilic bacteria in food and industrial applications. These isolates are currently deposited in the Microbial Culture Collection of the Museum of Natural History for application in wine clarification and identification and expression of other potential thermophilic enzymes.

Keywords: thermophilic bacteria, acid protease production, acid protease unit (APU), Mudspring, Mt. Makiling, assay

ASD-49

**HETEROLOGOUS EXPRESSION OF THE COAT PROTEIN
(CP) GENE FROM THREE PHILIPPINE ISOLATES OF
ABACA BUNCHY TOP VIRUS (ABTV)**

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The abaca bunchy top virus (ABTV) coat protein (CP) gene was isolated and amplified through polymerase chain reaction. The template used for PCR was total DNA extracted from the leaves of ABTV-infected plant. The CTAB method was performed to obtain the total DNA. Primers in PCR were based upon the coat protein gene sequence of three Philippine strains of the banana bunchy top virus (BBTV). By agarose gel electrophoresis, it was shown that the PCR product was 580 bp in size, roughly the same length as the coat protein gene of BBTV. The putative CP gene was then cloned into the vector pEXP5-NT/TOPO by TOPO-TA cloning. *Escherichia coli* BL21(DE3) cells were transformed with the CP-vector construct. Sequences of the cloned gene were highly homologous to the banana bunchy top virus coat protein gene. Protein expression of the coat protein was done by IPTG induction of BL21(DE3) transformants. SDS-PAGE was used to analyze the total protein from induced BL21(DE3) cells. A ~24 kDa band corresponding to the putative CP-His tag fusion protein was obtained for Davao, Laguna, and Leyte isolates.

Keywords: abaca bunchy top virus (ABTV), coat protein, protein expression, molecular cloning

ASD-50

INSECT PESTS AND DISEASES: EMERGING PROBLEMS IN SWEET SORGHUM PRODUCTION

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Sweet sorghum, *Sorghum bicolor* offers an excellent source of feedstock in bio-ethanol production. Like other crops, insect pests and diseases could be a productivity constraint. Their identities serve as benchmark in solving possible pest problems in sweet sorghum production.

Field trials of 59 ICRISAT cultivars in the Mariano Marcos State University, City of Batac, Ilocos Norte were conducted. Samples of major insect pests and diseases were collected and identified appropriately. Promising cultivars were evaluated based on zero (0) infestation/infection of specific pests.

Based on the results obtained, the insect pests attacking the leaves were: *Spodoptera spp.* (cutworm/armyworm), *Helicoverpa armigera* (budworm), *Rhopalosiphum maidis* (corn leaf aphid) and *Schizaphis graminis* (green bug). Soft kernel pests were: headworm (*H. armigera*), webworm (*Ephestia sp.*), chinch bug (*Blissus sp.*), phalacrid beetle (*Phalacrinus rotundus*), corn sap beetle (*Carpophilus dimidiatus*), and maize weevil (*Sitophilus zeamais*). *Ostrinia furnacalis* (stalk borer) attacked the stalk from vegetative to maturity while *Delia sp.* (seedcorn maggot) attacked the base of the stem from seedling to vegetative stages. Stored seed pests noted were *S. zeamais*, *Tribolium sp.*, *Oryzaephilus sp.*, and *Ephestia sp.*

Major leaf diseases were caused by *Helminthosporium sativum*, *Fusarium graminearum* and *Puccinia purpurea*. Low incidences of bacterial stripe (*Pseudomonas sp.*) and mosaic at seedling and vegetative stages were noted.

Of the promising cultivars identified, 9 were not attacked by both *Phalacrinus rotundus*, and *Carpophilus dimidiatus*, while 7 others were not infested by *Sitophilus zeamais*. There were 9, 12, and 13 cultivars that were not attacked by *F. graminearum*, *H. sativum* and *P. purpurea* respectively while 9 others were not infected by kernel mold. These materials are relevant inputs in solving pest problems of sweet sorghum.

Keywords: emerging problems, insect pests, diseases, sweet sorghum, promising cultivars, productivity constraints

ASD-51

**CORN SILK BEETLE, MONOLEPTA BIFASCIATA
(HORNSTEDTH) A NEW PEST RECORD ON CORN
POLLEN IN THE PHILIPPINES**

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The corn silk beetle, *Monolepta bifasciata* (Hornstedth) is a common pest of corn and other fruit trees. This beetle has been reported feeding on the silk (female flower) and leaves of corn in the Philippines. Some farmers in Pampanga and Tarlac have mentioned the unusual number of these beetles on Bt corn's silk and tassel (male flower). We observed and pictorially recorded the unusual numbers of this beetle on the silk and tassel of Bt corn in Santiago, Lubao, Pampanga last October 2007. As high as 50 or more individuals were observed on each tassel. Since the beetles consume the pollen, they effectively prevent pollination resulting to non-grain formation or irregular grains on the cob. The nearby fields of sweet corn with flowering stages were not attacked at the tassel by this beetles. This observation is the first time that we know of on corn in the country wherein these beetles attacked the corn pollen in the tassel. This novel information is likewise an invaluable addition on the arthropods diversity of Bt corn in the Philippines. It certainly provides the necessary documentation on anecdotal reports related to Bt corn and its faunal diversity.

Keywords: *Monolepta bifasciata*, pollen feeder, silk, corn, Philippines, new pest record, Bt corn

ASD-52

PROLONGING THE SHELF LIFE OF CARABAO MANGO USING CONTROLLED ATMOSPHERE TECHNOLOGY

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Controlled atmosphere (CA) storage is a technology developed to extend the shelf life of various perishable products. The technology involves a process of reducing the oxygen (O₂) level while increasing the carbon dioxide (CO₂) level in a storage facility maintained with a low temperature. A validation trial using a stationary container van was conducted to evaluate the quality of 'Carabao' mangoes using CA technology for 28-day storage. Five metric tons of export quality mangoes were sorted, washed, hot water treated and dipped in fungicide. The mangoes in export quality boxes were loaded in a 40-foot container van equipped with CA facility. After attaining the number of days set for the duration of storage, the mangoes were unloaded and observed for physico-chemical and sensory evaluation. The CA-stored mangoes reached the color index 6 (CI 6 – full yellow) six days after unloading and were generally acceptable in terms of chemical characteristics and sensory qualities. The cost of processing mangoes for export using the protocol derived from this project was estimated at PhP9.47 per kilogram. Controlled atmosphere storage with levels of 4%O₂, 6%CO₂ and pulp temperature of 13°C, derived from previous laboratory experiments, was confirmed to delay the ripening process and extends the shelf life of mangoes up to 28 days. The encouraging results of the study make it possible for mango exporters to transport mangoes to distant markets requiring three weeks in sea freight using CA container vans.

Keywords: controlled atmosphere, controlled atmosphere storage, post harvest, mango storage, delayed ripening

ASD-53

**TOXICITY AND PISCICIDAL EFFECTS OF SELECTED
ENDEMIC PLANTS AGAINST AFRICAN CATFISH
(*Clarias gariepinus* Burchelle) and TILAPIA
(*Oreochromis niloticus* L.) FINGERLINGS**

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The study was conducted to determine the toxicity and piscicidal effects of the leaf extracts of makabuhai *Tinospora rumphii*, kamotong kahoi *Manihot esculenta*, and datiles *Muntingia calabura*, and bark extracts of kamatsili *Pithecellobium dulce* and payhod *Albizia procera* against African Catfish *Clarias gariepinus* and Tilapia *Oreochromis niloticus*. Lethal concentrations (LC_{50} and LC_{100}), expressed as ml L⁻¹ of plant extract to water, were determined through a laboratory static bioassay.

The 6-hour lethal concentration showed that the plant with the strongest toxicity (expressed as LC_{50}) and piscicidal (expressed as LC_{100}) activity for both *C. gariepinus* and *O. niloticus* is the bark extract of payhod.

The toxicity effects of the five plant extracts used against *C. gariepinus* arranged in order of decreasing toxicity is as follows: *A. procera* (0.95) > *T. rumphii* (1.76) > *P. dulce* (2.04) > *M. esculenta* (21.84) > *M. calabura* (28.91) and for *O. niloticus*: *A. procera* (0.45) > *T. rumphii* (1.65) > *P. dulce* (3.41) > *M. esculenta* (36.42) > *M. calabura* (37.99).

The piscicidal effects of the five plant extracts used against *C. gariepinus* arranged in order of decreasing effect is as follows: *A. procera* (1.92) > *T. rumphii* (4.79) > *P. dulce* (4.84) > *M. esculenta* (51.63) > *M. calabura* (74.59) while for *O. niloticus*: *A. procera* (1.71) > *T. rumphii* (4.65) > *P. dulce* (6.88) > *M. esculenta* (72.85) > *M. calabura* (82.80).

Results showed that the evaluated endemic plants could be a potential source of locally available toxicant to eliminate selective predators and competitors in pond.

Keywords: Toxicity tests, piscicides, endemic plants

ASD-54

OPTIMIZING PREPARED FEED RATION FOR SOMATIC GROWTH AND GONAD PRODUCTION OF THE SEA URCHIN *Tripneustes gratilla* (LINNAEUS, 1758)

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Somatic growth (wet weight and equatorial and polar test diameters), gonad production (gonadosomatic index) and gonad quality (color) of the sea urchin *T. gratilla* fed prepared diets were studied *in vitro* using glass aquaria from April to August 2006. The study consisted of five treatments with three equal replications arranged in CRD as follows: I-Fresh *Sargassum sp.* (control), II-Dried pellets at 2% body weight (BW)/day, III-Dried pellets at 3% BW/day, IV-Dried pellets at 4% BW/day, and V-Dried pellets at 5% BW/day. The dried pellets were mainly of *Sargassum sp.* with 6.0% binder (corn starch and gelatin).

Results show that Treatments I, IV and V significantly ($p < 0.05$) gave better results than Treatments II and III. The highest monthly mean growth increment was observed in Treatment V which was significantly higher ($p = 0.05$) than all the treatments except for Treatment IV. These results show that dried pellets feeding ration was optimized at 4 to 5 % BW/day. Significantly higher gonadosomatic index ($p = 0.05$) was also observed in Treatments I, IV and V than Treatments III and II, respectively. Treatments II and III did not differ significantly.

Monitored water parameters were within the favorable ranges for growth of the organisms. Significant positive correlation existed between wet weight and equatorial test diameter ($r = 0.92$, $p = 0.0001$) and polar test diameter ($r = 0.71$, $p = 0.01$). Gonadosomatic index was also significantly positively related with gonad color ($r = 0.88$, $p = 0.0002$).

Results suggest that the best ration for prepared feed based on *Sargassum sp.* would be at 4.00% BW/day since this would optimize somatic growth and gonad production and quality. Similar studies can be done using other feedstuff such as tomato and squash which are locally available pigment sources that may improve the quality of the organism.

Keywords: *Tripneustes gratilla*, prepared feed ration, somatic growth, gonad production and quality

ASD-55

CATCHING EFFICIENCY OF MULTIPLE HANDLINE OPERATED IN PAYAW AREAS

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Multiple handline fishing was carried out in payaw areas in waters off the Northwestern Ilocos coast. Three handlines with varying hook distances (50, 75, and 100 cm) attached to the mainline baited with red and silver artificial lures were used in the study. Fishing operations were done in the morning and in the afternoon. The main objective was to determine which of the artificial lures, handlines with different hook distances and time of fishing operation will give the best yield.

Results show that red lure significantly yielded more fish catch than silver lure both in terms of number and weight. The 100-cm hook distance gear significantly had the highest catch compared to the other two (50 cm and 75 cm). Fishing gears baited with red lure can be best operated in the morning particularly those with greater distances in between hooks.

Cost and return analyses show that the 100-cm hook distance gear baited with red lure had the highest net income (ROI of 225.12). Three pelagic species of fish, namely: *Thunnus albacares*, *Decapterus macarellus* and *Katsuwonus pelamis*, comprise the catch. *Thunnus albacares* relatively had the highest abundance among the three.

Table 1. Mean catch per day (kg) and return on investment (ROI, %) of the different multiple handlines (50-cm, 75-cm and 100-cm distance in between hooks) used in the study

Fishing Gear	Mean Catch/ Day (kg)	ROI (%)
50-cm Hook Distance		
Red Lure	5.83	-41.90
Silver Lure	4.67	-53.40
75-cm Hook Distance		
Red Lure	10.80	7.40
Silver Lure	6.67	-33.70
100-cm Hook Distance		
Red	32.67	225.12
Silver Lure	22.83	127.20

Keywords: line fishing, artificial lures, hook distances, fishing time

ASD-56

EDIBLE SEAWEEDS IN ILOCOS NORTE : FOOD PREPARATIONS OTHER LOCAL USES AND MARKET POTENTIAL

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The study deals with the economic importance of seaweeds in Ilocos Norte, which is an account of the researchers' survey of edible seaweeds of the province. Seaweed gatherers and vendors in public markets were interviewed to determine the respondents' socio economic profiles, the species of seaweeds that are commonly harvested for home consumption and for marketing both inside and outside the province, and the marketing channels and practices of the vendors.

Also, the researchers determined what seaweeds the respondents prefer to eat, their methods of preparation, and some other uses. The local names of the seaweeds were noted. Fresh samples from the sea and dried samples from the markets were brought in the laboratory for identification. Frequencies, percentages and means were used in the analysis of data gathered from the interview schedule.

Results of the study show that majority of the respondents of this study were young, majority female and majority married, elementary graduates belonging to small and medium household size. Majority had minimum income which was not sufficient for their basic needs.

There are 22 genera of seaweeds belonging to green, brown and red algae that are used as food in Ilocos Norte. Food preparations of the seaweeds may be in the form of salad, vegetables for viand, dessert or pickles. Other local uses include: medicine, fertilizer and insect repellent.

The flow of the wet/raw seaweeds from gatherers to consumers passes through several middlemen before it reaches the consumers. The current market price of seaweeds ranges from Php50.00/kg fresh form and Php3, 00/kg dried form.

Based on the results of the social aspect and the presence of potential species of seaweeds in Ilocos Norte, there is a need to develop food products for the gatherers to meet their basic needs in life.

Keywords: edible seaweeds, food preparation, market potential

ASD-57

COMMUNITY STRUCTURE OF MARINE BENTHIC MACROALGAE IN SELECTED AREAS OF ILIGAN BAY

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The aim of the present study was to determine the relationship of selected abiotic factors with the community structure of marine benthic macroalgae in selected coastal areas of Iligan Bay. Four sites were surveyed including three southern (Kauswagan, Linamon, Dalipuga) and one northeastern intertidal zones on December 2007 to January 2008. Macroalgal species composition, biomass, species diversity, and distribution were determined. A total of 46 macroalgal taxa were identified. Multivariate classification analysis revealed three groupings of sites, i.e. the northeastern Gimangpang site, Linamon, and the two southern sites Kauswagan and Dalipuga. Abundance, Shannon and Simpson's species diversity indices, Margalef's species richness index, and Pielou's evenness index were highest in the Gimangpang site, intermediate in Kauswagan and Dalipuga, and lowest in Linamon. Canonical correspondence analysis showed that water motion and temperature and pH gradients strongly influenced the structuring of macroalgal assemblages. For instance, *Boergesenia forbesii*, *Turbinaria ornata*, *Sargassum crassifolium*, *Hypnaea spinella*, *Hypnaea valentiae*, *Laurencia obtusa*, *Gracillaria heteroclada*, *Gracillaria salicornia*, *Gracillaria* sp., *Halimeda opuntia*, *Gelidiella acerosa*, *Coelothrix irregularis*, *Dictyota cervicornis*, and the two "green tide" species, *Chaetomorpha crassa* and *Ulva reticulata*, were most abundant in warmer, more alkaline, and quieter waters. Colder, normal seawater pH, and high water motion favored higher abundance of three *Sargassum* species, coralline *Amphiroa* species, and *Padina australis* and *Padina minor*.

Keywords: abiotic factors, macroalgal taxa, *Sargassum*, coralline *Amphiroa*

ASD-58

**THE GLEANERS OF PORO ISLAND, CENTRAL
PHILIPPINES: THEIR PRACTICES, SOCIO-ECONOMIC
STATUS AND DIVERSITY OF CATCH**

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Poro Island is the largest island in Camotes Group of Islands with wide tidal flats and wide mangrove areas serving as gleaning area. Overpopulation has been noticed in the municipalities where too much gleaning pressure has been felt. That is why this study was conducted in order to find out the gleaning methods used, species of flora and fauna gathered and the socio-economic status of gleaners.

Interview and actual visit of the gleaning areas as well as market survey were the techniques used in gathering the data. There were 15 coastal barangays being assessed where 10 barangays of the Municipality of Poro and 5 in the Municipality of Tudela.

Results showed that the gleaned organisms in the island of Poro are 20 species of mollusks; 7 species of Echinoderms; 5 species of crustaceans; 5 species of fish and 1 species of seaweed. Results further showed that barangay Paz and Villahermosa are the barangays heavily gleaned on mollusk in the entire island. For the Echinoderms, it is barangay Esperanza, Cagcagan, Paz and Daan Paz, Puertobello, Villahermosa, Mc. Arthur and Calmante. For the crustaceans it is barangay Libertad, Mabini, Eastern Poblacion, Western Poblacion, Teguis, Mercedes, Paz, Daan Paz, Puertobello, Villahermosa, Mc. Arthur and Calmante.

Handpicking, using bolo, spears and rake are the methods used by the gleaners. Catch per unit effort (CPUE) of mollusks is 1-2 hours per 1 kilo of mollusks; 1-2 hours per kilo of seaweeds; crustacean is 3-4 hrs/kilo; echinoderm is 1-3 hrs for a kilo and for fish 2-4 hours per kilo of fish. Monthly income ranges from Php. 1,000.00- 3,000.00 from animal raising and fishing. Sixty percent (60%) of the gleaned products are for consumption and 40% for the market. Houses are made of nipa and radio, TV sets and kitchen utensils are their material possessions.

Keywords: Poro Island, Gleaners, Socio- economic status, Catch Diversity.

ASD-57

**COMMUNITY STRUCTURE OF MARINE BENTHIC
MACROALGAE IN SELECTED AREAS OF ILIGAN BAY**

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The aim of the present study was to determine the relationship of selected abiotic factors with the community structure of marine benthic macroalgae in selected coastal areas of Iligan Bay. Four sites were surveyed including three southern (Kauswagan, Linamon, Dalipuga) and one northeastern intertidal zones on December 2007 to January 2008. Macroalgal species composition, biomass, species diversity, and distribution were determined. A total of 46 macroalgal taxa were identified. Multivariate classification analysis revealed three groupings of sites, i.e. the northeastern Gimangpang site, Linamon, and the two southern sites Kauswagan and Dalipuga. Abundance, Shannon and Simpson's species diversity indices, Margalef's species richness index, and Pielou's evenness index were highest in the Gimangpang site, intermediate in Kauswagan and Dalipuga, and lowest in Linamon. Canonical correspondence analysis showed that water motion and temperature and pH gradients strongly influenced the structuring of macroalgal assemblages. For instance, *Boergesenia forbesii*, *Turbinaria ornata*, *Sargassum crassifolium*, *Hypnaea spinella*, *Hypnaea valentiae*, *Laurencia obtusa*, *Gracillaria heteroclada*, *Gracillaria salicornia*, *Gracillaria* sp., *Halimeda opuntia*, *Gelidiella acerosa*, *Coelothrix irregularis*, *Dictyota cervicornis*, and the two "green tide" species, *Chaetomorpha crassa* and *Ulva reticulata*, were most abundant in warmer, more alkaline, and quieter waters. Colder, normal seawater pH, and high water motion favored higher abundance of three *Sargassum* species, coralline *Amphiroa* species, and *Padina australis* and *Padina minor*.

Keywords: abiotic factors, macroalgal taxa, *Sargassum*, coralline *Amphiroa*

ASD-58

**THE GLEANERS OF PORO ISLAND, CENTRAL
PHILIPPINES: THEIR PRACTICES, SOCIO-ECONOMIC
STATUS AND DIVERSITY OF CATCH**

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Poro Island is the largest island in Camotes Group of Islands with wide tidal flats and wide mangrove areas serving as gleaning area. Overpopulation has been noticed in the municipalities where too much gleaning pressure has been felt. That is why this study was conducted in order to find out the gleaning methods used, species of flora and fauna gathered and the socio-economic status of gleaners.

Interview and actual visit of the gleaning areas as well as market survey were the techniques used in gathering the data. There were 15 coastal barangays being assessed where 10 barangays of the Municipality of Poro and 5 in the Municipality of Tudela.

Results showed that the gleaned organisms in the island of Poro are 20 species of mollusks; 7 species of Echinoderms; 5 species of crustaceans; 5 species of fish and 1 species of seaweed. Results further showed that barangay Paz and Villahermosa are the barangays heavily gleaned on mollusk in the entire island. For the Echinoderms, it is barangay Esperanza, Cagcagan, Paz and Daan Paz, Puertobello, Villahermosa, Mc. Arthur and Calmante. For the crustaceans it is barangay Libertad, Mabini, Eastern Poblacion, Western Poblacion, Teguis, Mercedes, Paz, Daan Paz, Puertobello, Villahermosa, Mc. Arthur and Calmante.

Handpicking, using bolo, spears and rake are the methods used by the gleaners. Catch per unit effort (CPUE) of mollusks is 1-2 hours per 1 kilo of mollusks; 1-2 hours per kilo of seaweeds; crustacean is 3-4 hrs/kilo; echinoderm is 1-3 hrs for a kilo and for fish 2-4 hours per kilo of fish. Monthly income ranges from Php. 1,000.00- 3,000.00 from animal raising and fishing. Sixty percent (60%) of the gleaned products are for consumption and 40% for the market. Houses are made of nipa and radio, TV sets and kitchen utensils are their material possessions.

Keywords: Poro Island, Gleaners, Socio- economic status, Catch Diversity.

ASD-59

**INFLUENCE OF NATURAL ADDITIVES ON THE
ACCEPTABILITY OF FLAVORED FISH SAUCE FROM
ANCHOVIES, *Stolephorus spp.***

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Flavored Fish Sauce is a value-added product from fermented anchovies *Stolephorus spp.*, locally known as "patis", with natural additives such as calamansi, chili pepper and carrageenan. The product is used as dipping condiments for fish, shrimp, pork, chicken, and other fried or steamed food items. It is also used as seasoning which adds distinction to cuisines. Experimental method was employed in the study. Natural additives enhanced its flavor, color, odor, and texture. The product has amber yellow color, fish-like flavor, pleasant odor and fine consistency texture based on the sensory evaluation using descriptive testing as evaluated by the twenty five experienced panelists. The general acceptability rating of the most preferred flavored fish sauce was "Like Moderately" based on the 9-point hedonic scale. The color and texture attributes of the most preferred sample were significantly different from other experimental samples with various additives using Analysis of Variance (ANOVA) and Duncan Multiple Range Test (DMRT) at 5% level of significance. The newly formulated flavored fish sauce had a pH values of 4.57 and a bacterial count of less than 2.50×10^3 cfu/g sample, per result of laboratory analysis by the Bureau of Fisheries and Aquatic Resources (BFAR-RO7), Region 7. It has a crude protein content of 5.3, Moisture Content of 84.4, Salt Content of 4.3 and Ash Content of 8.9 as analyzed by DOST RO VII Regional Standards and Testing Center. The addition of natural additives improves the color and texture of a flavored fish sauce, decreases pH and lowers the bacterial load.

Keywords: anchovies *Stolephorus spp.* flavored fish sauce. natural additives.

ASD-60

THE EFFECTS OF CURING AND DRYING ON THE SPECIES-SPECIFIC FLAVOR AND SENSORY ATTRIBUTES OF CHEVON

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Goat is now emerging as an alternative source of meat in many parts of the world. However in the Philippines, the average annual per capita consumption of chevon is still relatively low. It is believed that one reason for the low consumption is the highly distinct chevon flavor that is desirable to some but unpleasant to many.

This research focused on combined curing and drying as a flavor modifying strategy for goat meat to provide variability in the utilization of chevon that would result in its wider acceptance among consumers.

The overall objective of this study was to determine the effects of curing and drying on the species-specific flavor and sensory characteristics of chevon. For curing, salt and nitrite were studied and the drying methods used were sundrying and smoke/oven-drying. The dried chevon products were evaluated in terms of their eating quality, acceptability and the presence of goat flavor after processing.

Results indicated that fatty acids of below C₁₀, particularly capryllic acid, believed to be a major contributor to goat-like flavor, were not detected in either fresh or cured-dried chevon. This explained the very low perceptibility of goat-like flavor in the samples as evaluated by the experienced panel.

Curing and drying presented no significant effects (P>0.05) on the percent composition of fatty acids in both fresh and cured-dried chevon. However, experienced and consumer evaluation indicated that although all samples did not give out significant strong species-specific flavor, the goat flavor of smoked/oven dried samples was less perceptible than in sundried samples.

Prepared into *caldereta*, nitrite-cured/sundried chevon were the most acceptable to the experienced panel in terms of general sensory attributes. On the other hand, all sundried samples, regardless of the curing brine used were the most desirable to the consumers in Los Baños and vicinity.

Keywords: chevon flavor, dry-cured chevon, sundrying, smoke/oven-drying

ASD-61

EFFICACY OF THE EXTRACTS OF TUBLI (*Derris elliptica*), SILI (*Capsicum* sp.), AND MALUNGGAY (*Moringa oleifera* Linn) AS PESTICIDE AND GROWTH ENHANCER OF PECHAY (*Brassica rapa* ssp. *pekinensis*)

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Vegetable farmers continue to use synthetic pesticides and fertilizers that contribute to pesticidal residue in the surrounding. The use of botanical materials is the most environmentally friendly practice in agricultural treatments.

Extracts from tubli roots, sili fruit and malunggay roots, in solution, were used as pesticide and growth enhancer of pechay. The botanical samples were extracted by maceration and mixed in water. Pechay plants were grown for 45 days on properly cultivated plots in a home garden, and treated with the prepared solutions at different concentrations (100% and 50%) and malathaion as standard. Treatments were applied at 10 days interval.

The efficacy of the said treatments was evaluated by comparing the areas of the pechay leaf blades and the damaged portion immediately after harvest. The leaves were flattened and overlapped with chicken wire. The areas were measured by the squares (3x3 mm) of the chicken wire taken as units. The rounded and irregular holes observed on the leaf blade were the only pest damage considered.

Results show that the treated pechay has larger leaf areas and lesser damaged portion compared to the control and standard, indicating that the extracts used can be a growth enhancer and substitute for the common commercial synthetic pesticides.

Keywords: pesticide; growth enhancer; leaf blade area; pest damage

ASD-62

**PERCENT RECOVERY, DIGESTIBILITY
AND FEEDING VALUE OF CATTLE RUMEN
CONTENTS IN SWINE DIETS**

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This study was conducted to determine the digestibility, nutritive and feeding value and economy of cattle rumen contents (CRC) as component of plant protein-based swine diets. Specifically, it aimed to: a) determine the percent recovery, nutrient composition of CRC; b) determine the digestibility of CRC in swine; c) evaluate the effects of CRC as a component of plant protein-based swine diets in terms of growth performance, dressing percentage, backfat thickness and livability; and, (d) assess the economy of CRC as component of plant protein-based swine diets.

Five dietary treatments were used in the feeding trials. Dietary Treatments II, III and IV were treated with CRC at 10, 12 and 14 percent levels of incorporation, respectively, while Dietary Treatments I (0% CRC) and V (Commercial Swine Feed) served as control. The dietary treatments were arranged in a Completely Randomized Design (CRD) replicated thrice with one animal per replication.

The percentage dry matter (DM) recovery of cattle rumen contents was 25.02 percent. Proximate analysis revealed that CRC contains a fairly high percentage of crude fiber (24.8%) and moderately high percentages of nitrogen-free extract (53.99%) and crude protein (15.41%) but low in gross energy (0.72 kcal/kg). The digestion trial revealed a fairly high ether extract digestion coefficient (82.48%). The digestibility of crude protein and nitrogen-free extract were moderately high (65.17% and 46.57%, respectively) while crude fiber digestibility was low (38.68%).

The average initial and final weights of the experimental animals were statistically similar. The feed conversion ratio did not significantly vary during the starting and finishing stages, but highly significant differences ($P < 0.01$) were noted during the growing stage (2.46 for Diet V vs. 2.83, 2.98, 3.20 and 3.32 for Diets I, II, IV and III, respectively).

Significant variations ($P < 0.05$) on protein efficiency ratio were noted among treatment means (2.53 for Diet V vs. 2.19, 2.09, 1.94 and 1.89 for Diets I, II, IV and III, respectively) during the growing stage but, no significant differences were noted during the starting and finishing stages.

Experimental animals fed with Diet V (Commercial Swine Feed) gave the highest dressing percentage of 65.12 percent ($P < 0.01$) while those in Diet I (0% CRC) had the lowest (54.57%).

Experimental animals given Diets II, III and IV gave comparable dressing percentages of 63.28, 62.18 and 61.84 percent, respectively. The data revealed that the diets treated with CRC had superior dressing percentages over those in the zero percent CRC diet but inferior to pigs fed with commercial swine feed. Experimental animals given 14 percent CRC produced significantly ($P < 0.01$) thinner and better backfat thickness of 1.66 cm when compared to those in the control diets (Diets I and V) with 3.00 and 2.83 cm, respectively.

Pigs fed with Diet IV (14% CRC) incurred the lowest cost of feed per unit gain-in-body weight (CFG) values during the growing and finishing stages.

Pigs fed with Diet I (0% CRC) gave the highest return above feed cost (RAFC) of P3,898.06 as compared to those in Diet V (Commercial Swine Feed) which gave the lowest RAFC of P2,617.74. Experimental animals fed with Diets II, III and IV gave RAFC of P3,539.81, P3,524.08 and P3,815.42, respectively.

With all these information, it could be deduced that nutritionally and economically, cattle rumen contents could be safely incorporated in swine diets at 10 to 14 percent levels.

Keywords: cattle rumen contents, rumen contents, cattle stomach contents, ingesta

BIOLOGICAL SCIENCES DIVISION

BSD-1

A SITUATIONER ON MICROALGAE AS ALTERNATIVE SOURCE FOR BIOFUEL

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The escalating price of petroleum and the rising concern about global warming due to the burning of fossil fuel has encouraged plant biologists, engineers and other scientists to look for alternative sources of energy. At present, plant (e.g. soybean, corn) and animal fats still serve as a major non-petroleum source of biodiesel. The concept of using microalgae as an alternative source of renewable energy, is becoming popular because of their high photosynthetic efficiency and capacity to accumulate large amount of natural oils in their cells. Microalgae can provide several types of renewable biofuels, including methane, ethanol, biodiesel and biohydrogen, or can be processed to make biocrude, a renewable equivalent of petroleum. The oil yield per acre from microalgae is far greater than soybeans or corn. Microalgae can be grown in either open ponds or photobioreactors and require much less land area and water for equivalent oil production.

Some promising species of microalgae for biofuel production are the green algae *Botryococcus braunii*, *Chorella sp.*, *Nannochloropsis*, and the diatom, *Nitzschia sp.* which we also have in the Philippines. There is increasing interest in exploring and exploiting the use of algae for biofuel production, with the number of companies publicly announcing their interest in microalgae biofuels increasing from less than five three years ago to over fifty today. The companies are forging ties with universities, national laboratories and governmental agencies to develop and commercialize the microalgae-based biofuel production technologies. These efforts have been initiated in several countries, indicating a broad and international interest in microalgae-based renewable biofuels. In the Philippines, particularly the University of the Philippines Los Baños, research efforts have initially been started. Our project proposal on the potential of microalgae for biodiesel has long been submitted for funding.

Keywords: microalgae, renewable biofuels, methane, biohydrogen, biodiesel, feedstocks

BSD-2

**SWEET SORGHUM FOR BIOFUEL, FOOD,
FEED AND FORAGE**

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The utilization of sweet sorghum (*Sorghum bicolor* (L.) Moench] for bioethanol has been undertaken by the Mariano Marcos State University. Sweet sorghum has been found to be better than other crops because it is the only crop that provides grain and stem that can be used for sugar, alcohol, syrup, jaggery, fodder, fuel, bedding, roofing, fencing, paper and chewing. It is a crop that can be grown and ratooned to give higher annual yields than sugarcane.

Results of the experiments indicate that two varieties, SPV-422 and N'TJ-2 have been found to be adaptable under Philippine conditions. These varieties are now being planted and tested in different parts of the country by the Department of Agriculture, State Colleges and Universities and the private sectors. The sorghum grains were also found to be a substitute for flour in making cakes and confectionary. It can also be used as feeds. The bagasse can be used as forage because it is soft.

The sweet sorghum varieties identified can be easily milled utilizing existing farm level sugarcane press. The varieties have a sugar content of 19 to 24% percent which is higher than sugarcane. The juice was found to be easily made to syrup and jaggery. The juice and the jaggery can be fermented by different strains of *Saccharomyces cerevisiae* and *Zymomonas mobilis* and results showed that ethanol produced is up to 12% by volume depending upon the starting amount of feedstock used. Sweet sorghum can be a very good feedstock for bioethanol production and is a very promising crop that could be tapped as an alternative for fossil fuels.

Keywords: alcohol, bioethanol, feed, fermentation, food, forage, jaggery, *Saccharomyces cerevisiae*, sweet sorghum, and *Zymomonas mobilis*

BSD-3

ISOLATION OF MICROORGANISMS FOR FIRST AND SECOND GENERATION ETHANOL PRODUCTION FROM SWEET SORGHUM (*Sorghum bicolor* L.)

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There is a worldwide race in the search for alternative sources of energy because of the soaring prices and the dwindling supply of fossil fuels. Biofuels like bioethanol are potential alternatives. Sweet sorghum has a high sugar content in its stalk could be used as feedstock for bioethanol production. Studies on the utilization of sweet sorghum as feedstock for bioethanol production at the laboratory scale using *Saccharomyces cerevisiae* show that the juice and jaggery can be very good fermentable substrates. The percent alcohol produced depends on the amount of fermentable sugar and the efficiency of the strain used. Since the strains used were isolated and optimized for sugarcane as feedstock, the need to scout for ideal fermenters for sweet sorghum as feedstock is deemed necessary. Moreover, previous fermentation studies in the laboratory reveal that the uninoculated feedstock also yielded ethanol which indicate that some native thermotolerant strains must be present. This study isolated, characterized, cultured, and screened fermenters from sweet sorghum juice and jaggery for first generation ethanol production. Results show that ten native isolates were obtained and produced 6.5 to 12% ethanol. Moreover, since the bagasse is still a viable source of second generation ethanol, biodegraders from potential sources like cow cud, cornick wastes and from landfills were isolated and used to degrade sweet sorghum bagasse. Twelve putative cellulose degrading isolates were obtained from the various sources. Initial second generation ethanol from sweet sorghum can be readily achieved using the isolates. All of the isolates from this study have a crucial role in bioethanol production using sweet sorghum as feed stock.

Keywords: biofuels, *Saccharomyces cerevisiae*, fermenters, bioethanol

BSD-4

**PERFORMANCE OF JATROPHA SEEDLINGS
OUTPLANTED IN ABANDONED MINE SITE OF
MOGPOG, MARINDUQUE**

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Jatropha curcas (physique nut) is a shrub or small tree that is widely distributed in the tropics, including the Philippines. It is a versatile crop whose importance range from its medicinal value, source of biodiesel, organic fertilizer and as feedstocks. It also adapts well in a wide range of stressed condition, like heavy metal-rich soil. For bioremediation of an abandoned mine site in Mogpog Marinduque using *Jatropha*, the plant's growth was enhanced using different ameliorating treatments. The use of commercial and non commercial endomycorrhizal fungi, together with lime, compost and their combinations were evaluated. The field experiment was laid following randomized complete block design with four blocks and ten seedlings in a row per treatment.

Initial results showed that *Jatropha* seedlings with no compost and with or without lime exhibited the poorest growth. The tallest and biggest stem diameter were observed in seedlings treated with Mykovam or MineVAM plus compost and lime. Without compost or lime, mycorrhizal inoculation was ineffective. Addition of lime, however, significantly increased stem diameter, root, leaf, stem and total dry weights by 40%, 97%, 42%, 262% and 50%, respectively, as compared with the unlimed mine soil. On the other hand, analysis of heavy metal (Cu, Zn and Pb) translocation in *Jatropha*, irrespective of the amendments applied, showed a greatly reduced translocation of these heavy metals (HMs) to the stems and leaves. In the control, Zn, Cu and Pb were found at highest concentration in the roots, stems and leaves, respectively. We are awaiting the fruiting stage of the other *Jatropha* plants since information of HM translocation in the fruits will have a bearing in the use of this plant as a source of biofuel.

Keywords: *Jatropha*, bioremediation, abandoned mine site, mycorrhiza, heavy metals, translocation

BSD-5

POLLINATION BIOLOGY OF THE PHYSIC NUT, *JATROPHA CURCAS* L.

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Floral biology, pollination and effects of pollination mechanisms on Philippine-cultivated physic nut, *Jatropha curcas* were studied. Results showed that physic nut flowers are monoecious and unisexual. Inflorescences are characteristically composed of many to several green bell-shaped cymes. Male flowers produce around 1800 ± 45 thick-exined inaperturate pollen with 71% viability. In addition, male flowers have 10 stamens, 5 united at the base only, 5 united into a column. On the other hand, female flowers are borne singly.

Floral anthesis was recorded at 4:30 am. *Calliphora* sp., *Apis mellifera*, *Vespa* sp., a pierid butterfly and two species of small ants were observed to pollinate the flowers. Calliphorid flies were observed to be the first pollinators to visit the flowers. They were seen as early as 6:00 am. By 7:00 a.m., two species of small ants (one red and one black) were observed to also pollinate the flowers. This was followed by *Apis mellifera* at 8:00 to 9:00 a.m. Larger red ants arrived around 10:00 a.m. but were only observed as collecting nectar. Wasps and butterflies were only observed only until noon. Other arthropod visitors of *Jatropha* included the ricanids and certain gargantuan lady beetles.

Meanwhile, flowers from two-year old physic nut plants from Calauan, Laguna were open-pollinated, bagged and hand-pollinated to determine effects of pollination mechanisms. Fruit set was observed a few days to a week after set-up. Both open-and hand-pollinated flowers had exhibited fruit set. However, hand-pollinated plants had produced fewer and smaller fruits than open-pollinated ones. This could have been affected by the amount of pollen transferred with a brush. On the other hand, bagged flowers had no fruit set. Thus, the physic nut, is a cross-pollinated plant.

Keywords: anthesis, cyme, exine, floral biology, floral visitor, physic nut, pollination

BSD-6

**MORHO-ANATOMICAL ASSESSMENT OF OIL CELLS
IN SEEDS OF *PONGAMIA PINNATA* Merr. (L)**

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Pongamia pinnata Merr (L), commonly called (Bani) is reported to contain oils in the seeds which may be used as an alternative source of energy. This study aims to describe the structural features of the oil cells and its development. Simple microtechnique procedures like free-hand sectioning of the seed cotyledon was utilized, and different tests for the presence of oils was employed. Characterization and documentation was done using light microscopy. Histochemical tests showed the presence of neutral lipids occurring as single large deposit in idioblastic cell, and as numerous smaller individual droplets within the cytoplasm of parenchyma cells. Idioblastic oil cells measures from 65-75 μm and are slightly larger than the surrounding ordinary parenchyma cells which have varying sizes from 20-70 μm . The lipids in idioblastic cells stain in different density than those in parenchyma cells. They contain a characteristic oil sac within the cytoplasm that encloses the deposited oil. The presence of a cupule was also observed which is another defining characteristic of oil cell. Different stages of oil cell development were also observed which were marked by the sizes of oil accumulation. There is a direct relationship between the amount of oil accumulation and the developmental stage of idioblastic oil cells. As the oil cell matures, the oil deposit also increases in amount until it filled the entire oil sac at maturity. This study can be used as a guide in identifying the location and peculiar features of oil cells which may be cost efficient in terms of extraction and production of oils from plants.

Keywords: oil cells, cupule, idioblast, lipids

BSD-7

**IN SILICO ANALYSIS OF CANDIDATE DROUGHT
TOLERANT GENES OF RICE DEDUCED FROM GENETIC
LINKAGE MAPS**

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Cell membrane stability (CMS) is one of the essential traits that was identified and associated with drought tolerance. Cloning of genes linked with CMS is essential in developing drought-tolerant rice varieties in the near future. In this study, *in silico* analysis was utilized to identify the candidate genes for CMS. Using the QTL map (QTL QCMS8.2) previously identified by Tripathy et al. (2000) and using the Gramene database, initial analysis revealed that the two markers (RG598 and EM18) associated with CMS lie on chromosome 8. Sequence search analysis revealed that one of the markers was positioned in APO5251 Bacterial Artificial Chromosome (BAC) contig. Using the Rice AGI FPC (2002), the RG598 marker was determined in the BAC clone of *Oryza sativa* (japonica cultivar group) at 130,146 bases. Using the Basic Local Alignment Search Tool (BLAST), it was determined that the target sequences aligned well with permeases and integral membrane transporters with bit scores of 113 and 100 and with E-value of 6e-24 and 8e-20, respectively. Amino acid and nucleic acid sequences of the candidate genes were downloaded from the Genebank and primers with 20 bases length, 59-60 °C melting temperature (T_m) and guanine-cytosine (GC) content ranging from 45-50% were designed.

Keywords: drought- tolerant genes, *in silico analysis*, cell membrane stability, linkage maps, rice

BSD-8

MARKER-AIDED TRANSFER OF β -CAROTENE BIOSYNTHETIC GENES INTO POPULAR PHILIPPINE RICE VARIETIES

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The development of Golden Rice, a genetically engineered rice variety capable of producing pro-vitamin A carotenoid (β -carotene) in the endosperm, is envisaged to combat the prevalent problem of Vitamin A deficiency (VAD) in many rice-eating countries. A two-pronged approach was undertaken to develop locally-adapted varieties biofortified with β -carotene using US rice variety Cocodrie containing event GR309 as donor. The first approach involved the transfer of the Golden Rice trait into two popular varieties (PSB Rc82 and NSIC Rc128) through DNA marker-aided backcrossing. Advanced backcross progenies were produced and evaluated using 60 microsatellite markers distributed in the entire genome. Genetic recovery of the selected third backcross progenies ranged from 80-89%. Based on the presence of GR309 locus as determined using event-specific DNA marker (foreground selection), genetic similarity to the recurrent parent (background selection), overall phenotypic acceptability, and intensity of yellow pigmentation in the grains, five BC3F1 populations from GR309 x NSIC Rc128 and 12 BC3F1 populations from GR309 x PSB Rc82 were advanced to BC3F2. The other approach was to develop new Golden Rice varieties with resistance to tungro and bacterial blight incorporated through conventional breeding. The addition of other important agronomic traits is hoped to facilitate wider adoption by farmers. IR64-derived lines highly resistant to tungro and bacterial blight were used as recurrent parents. Advanced backcross progenies possessing the Golden Rice genes and exhibiting resistance to tungro and bacterial blight have been identified. Production of stable lines carrying the three desired traits is being carried out through self-pollination and anther culture.

Keywords: Golden Rice, vitamin A deficiency, betacarotene, marker-aided backcrossing

BSD-9

DEVELOPMENT OF A MOLECULAR MARKER-BASED PROTOCOL FOR SEED PURITY ANALYSIS IN HYBRID RICE

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Seed purity is a major factor contributing to the attainment of higher yield in hybrid varieties in farmers' fields. However, morphological features of commercial rice seeds including inbreds and hybrid rices produced by seed growers and private companies are almost similar. This study aims to develop a molecular protocol in detecting true hybrid type in a seed lot. We have evaluated 302 microsatellite DNA markers in denaturing polyacrylamide gel electrophoresis (PAGE) to determine specific DNA pattern diagnostic to Mestizo 1 (M1), Mestizo 3 (M3) and Mestizo 7 (M7) hybrids. Genomic DNA was extracted using the modified mini scale CTAB extraction method, and polymerase chain reaction of DNA templates was carried out using a conventional thermal cycler machine. RM263 was found to be diagnostic to M3 hybrid samples while RM110 detected the DNA pattern diagnostic to both M1 and M7 hybrid samples. Alleles of RM263 could only be detected in PAGE while alleles of RM110 could be detected in non-denaturing PAGE suitable for high throughput analysis. RM21 and RM190 detected a highly specific DNA pattern diagnostic to M1. Other microsatellite loci such as RM408 and RM588 detected unique alleles for BIO401 and SL8, two of the current hybrid rice varieties in farmers' fields developed by private seed companies. These findings are currently being optimized in a controlled experiment to determine their efficiency and accuracy in detecting contaminants or non-hybrid seeds. The use of molecular techniques involving assessment of seed purity based on DNA fingerprinting is a promising approach to address this problem and protect our farmers from unscrupulous sales of mislabeled or unacceptable impurity of hybrid seeds.

Keywords: hybrid rice, microsatellite, polyacrylamide gel electrophoresis, DNA fingerprinting

BSD-10

DNA MARKER-AIDED BREEDING FOR RESISTANCE TO RICE BACTERIAL BLIGHT AND TUNGRO DISEASES

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Bacterial blight (BB) and Tungro diseases have been reported as serious constraints in rice production in irrigated and rainfed lowland environments in the Philippines. Popular varieties IR64, BPIRi10 and PSBRc14 have been highly acceptable to farmers for their good grains, good eating quality and high yielding ability, however, they are susceptible to these diseases. Improvement on bacterial blight and tungro resistance on these varieties was done by exploiting DNA marker-aided selection technique. PhilRice-bred elite lines with pyramided genes *Xa21*, *xa5*, and *Xa25* for BB resistance in IR64, PSBRc14 and BPI-Ri-10 genetic background have been generated using DNA markers and were used as sources of BB resistance together with IRRI-BB pyramided near isogenic lines IRBB61/62. For tungro, Matatag lines and ARC11554 were used as sources of resistance. Crosses were made and DNA markers were used to select plants with BB resistance genes *Xa7* and *Xa21*, and phenotyping through inoculation using BB races 3 and 6. On the other hand, rice tungro spherical virus resistance was noted by positive amplification with RM 8213. Six out of the 69 populations were positive while twenty-three plants were heterozygous to the *Xa21* gene. Moreover, twenty-five of the populations had the presence of *Xa7* gene. These plants are putatively resistant to all known races of *Xanthomonas oryzae pv. oryzae* in the Philippines. Among all of these plants, fourteen were consistent in their resistance or moderate resistance reaction to BB races 3 and 6 and had the presence of *Xa21* and *Xa7* genes. For tungro, seventeen plants were positive and twenty-one were heterozygous to the RTSV resistance gene. All in all, ten plants were selected that contain the two BB resistance genes and RTSV resistance gene. The elite lines that will be produced in the long run will become bacterial blight-and tungro- resistant varieties. Plants with two or more resistance genes have higher level of resistance to BB and tungro diseases than would be expected from the sum of the parental varieties.

Keywords: bacterial blight, DNA-MAS, rice, tungro

BSD-10

DNA MARKER-AIDED BREEDING FOR RESISTANCE TO RICE BACTERIAL BLIGHT AND TUNGRO DISEASES

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Keywords: bacterial blight, DNA-MAS, rice, tungro

BSD-12

PROPIONIC ACID AND METHYLAMINE AS DETOXICANTS OF AFLATOXIN IN COPRA MEAL

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Aflatoxins are one of the most carcinogenic substances known. Aflatoxin contamination is a major problem in agriculture because aflatoxin-producing *Aspergillus parasiticus* and *Aspergillus flavus* are common and widespread in nature and as such can easily colonize and contaminate agricultural crops before harvest and during storage.

The efficacy of propionic acid and methylamine to detoxify aflatoxin in copra meal was evaluated. Aflatoxin-contaminated copra meal samples were treated with varying concentrations of propionic acid and methylamine and then assayed for aflatoxin at several time intervals to determine aflatoxin content reduction.

Propionic acid at 2% (v/w) caused the highest percent reduction of aflatoxin B1 at 70.87% when meal was treated for 7 days at room temperature. When coupled with heat at 100°C for 90 minutes, 2% (v/w) still caused the highest reduction of aflatoxin B1 at 79.73%. On the other hand, highest percent reduction of 99.37% was attained when methylamine at 2% (v/w) was used. This reduction was not significantly different when a 1.5% methylamine (98.22% reduction) was utilized in the treatment of aflatoxin for 90 minutes at 100°C.

A bench scale study of aflatoxin detoxication in copra meal confirmed the efficacy of methylamine (1.5% v/w) in reducing aflatoxin contamination in copra meal.

Keywords: aflatoxins, *Aspergillus parasiticus*, *Aspergillus flavus*, methylamineamine, propionic acid

BSD-13

**CYTOGENETICS AND MORPHOLOGICAL ANALYSES OF
NINE ACCESSIONS OF SUGARCANE (*SACCHARUM
OFFICINARUM* L.) FROM THE PHILIPPINES**

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Nine Philippine accessions of sugarcane (*Saccharum officinarum* L.) were morphologically and cytogenetically analyzed using acetocarmine squash technique. Fifty cells each of diakinesis, metaphase I, anaphase I and telophase I were observed and chromosome number determined at diakinesis. Cytological abnormalities were also determined. Morphological analysis was done by the National Plant Genetic Resources Laboratory of the Institute of Plant Breeding. The different accessions showed a range of chromosome number. Mean chromosome number of VMC accessions ranged from 86-96, while Phil. accessions showed 98-108. VMC 68-774 showed the highest mean of 96 while Phil 80-5874 showed 108. Although cytogenetic abnormalities like laggards and non-congression were noted at metaphase I, anaphase I and telophase I, these occurred at low frequencies. Normal metaphase I ranged from 60-100% for VMC accessions while 90-100 % for Phil. accessions. Normal anaphase I ranged from 74-100 for VMC while 76-92 for Phil. accessions. Normal telophase I for VMC and Phil. accessions ranged from 80-100 and 78-100%, respectively. Lagging and non congression of chromosomes were noted but the chromosomes managed to catch-up with the others towards the opposite poles. This explains why a high frequency of normal telophase I was noted. For morphological analysis, VMC68-774 had the highest plant height of 453.5 cm. and the longest stalk length of 337 cm. Phil 64-21 gave the highest plant height of 466.6 cm for Phil. accessions and the longest stalk length of 352.3 cm. VMC 81-21 gave the highest mid internode diameter of 2.89 cm while 3.03 cm was noted for Phil 80-5874. VMC 81-21 had the highest average brix reading of 16.72 while 20.88 for Phil. 89-1233. Accessions with long, wide stalk diameter and high brix reading have potential use for our sugarcane industry. These include VMC 68-774, VMC 68-438, Phil 64-21, and Phil 89-1233.

Keywords: sugarcane, cytogenetics, laggards, internode length, noncongression

BSD-14

PLANTLET REGENERATION FROM CELL SUSPENSION CULTURES OF BANANA CV. 'SABA' VIA SOMATIC EMBRYOGENESIS

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Bananas and plantains (*Musa* sp.) are among the important fruit crops in the world. Its biological and genetic complexities limit improvement of these species through conventional breeding methods, hence, genetic engineering can be used which relied on efficient regeneration system particularly through somatic embryogenesis. This research was undertaken to generate plantlets from cell suspension cultures via somatic embryogenesis in 'Saba' cultivar.

Sterile shoot tip cultures were obtained from air-dried 'Saba' suckers that were double sterilized with 5% calcium hypochlorite solution for 20 minutes. Highest number of meristematic buds (scalps) proliferated in basal region of shoot tip cultures in modified MS + 1 μ M IAA + 100 μ M BA in less than 3 weeks of incubation. Treatment with TDZ (1 μ M) produced higher number of scalps than with BA (22.2 μ M), suggesting that TDZ was a better cytokinin over BA in inducing formation and maintenance of good quality scalps. Yellowish and glossy meristematic globules formed from enlarged scalps in $\frac{1}{2}$ MS macro and Fe-EDTA with 5 μ M 2,4-D + 1 μ M zeatin. Refreshing the culture medium every 2 days for the first 2 weeks of culture effectively reduced browning of scalps. Embryogenic cells released from meristematic globules were induced to undergo embryogenesis in liquid MS + 9.1 μ M zeatin. Primary embryo development was already evident after 2 weeks of incubation, which when transferred onto semi-solid MS + 9.1 μ M zeatin formed secondary embryos. This indicates that a change in physical property of the medium further enhanced growth of embryos. Secondary embryos that germinated in the latter medium which were transferred and subcultured 4 times onto MS + 1 μ M IAA + 22.2 μ M BA produced an average of 7.6 shoots.

To our knowledge, this is the first report on plantlet regeneration from cell suspension cultures on local banana cultivar.

Abbreviations: MS Murashige and Skoog, BA Benzyladenine, Fe-EDTA Iron-ethylenediaminetetra-acetic acid, IAA Indole acetic acid, TDZ Thidiazuron

Keywords: *in vitro*, meristematic cell suspension cultures, meristematic globules, somatic embryogenesis, 'Saba',

BSD-15

FIELD SCREENING AND FRUIT EVALUATION OF BC₁ AND BC₂ SIB-CROSSED PAPAYA PLANTS INTROGRESSED WITH PRSV- P RESISTANCE

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Field performance of BC₁ and BC₂ sib-cross plants against papaya ringspot virus (PRSV-P) and its fruit quality were evaluated. BC₁ plants are product of introgressing the PRSV-P trait from papaya wild type *Vasconcellea quercifolia* to *Carica papaya*. BC₂ sib-crosses were developed by sib-crossing selected female and male BC₁ plants. Selection was based on ELISA test and symptom development in the field.

Six hundred thirty-four backcross plants were inoculated three times at two-week interval in screenhouse. Three hundred twenty-five backcross plants showed typical symptoms ranging from distortion of young leaves, mosaic, chlorosis to shoe-stringed on older leaves. Plants that remained symptom free together with susceptible check, Davao Solo (DS), were then transplanted in the field and were assessed for resistance/susceptibility to Philippine strain of PRSV-P. One hundred-fifteen backcross plants were planted in Mainit, Bay, Laguna. Results showed variation of symptom development in backcross lines from DS. DS produced severe symptoms after 1-2 months in the field while backcross plants remained symptom free for about 7-8 months. Difference between backcross papaya and DS was also evident in the ability of trees to bear good fruits. DS produced few small and unmarketable fruits. Backcross plants in contrast to DS had the ability to recover from early infection based on visual inspection and ELISA test.

Fruit qualities of backcross plants and DS were evaluated. Fruit weight of backcross plants ranged from 834.53-754.92 grams in contrast with DS's 202.67 grams. Fruits have firm yellow orange flesh, with mild papaya aroma. TSS (°B) values of BC₁, BC₂ sib-cross lines and DS were 10.0, 12.2, and 9.3 respectively which corresponds to sweet taste for backcross lines and not so sweet for DS.

The promising result of backcross plants produced by conventional breeding could provide a sustainable approach in restoration of Philippine papaya industry previously devastated by PRSV-P.

Keywords: Papaya ringspot virus (PRSV-P), backcrossing, ELISA, resistance, susceptibility

BSD-16

PRELIMINARY SCREENING OF MALUNGGAY (*Moringa oleifera*) EXTRACT AGAINST *Streptococcus mutans* B-10231, DENTAL PLAQUE CAUSING ORGANISM

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Malunggay (*Moringa oleifera* Lam) is very famous for its rich nutritive value and remedies for different ailments. The flowers, leaves and roots are used in folk remedies for tumors. Root juice is applied externally as rubefacient or counter irritant. Leaves are applied to sores, rubbed on the temples for headaches and said to have purgative properties (Hartwell, 1971). There are other good uses of malunggay and several researchers reported the production of active compounds from malunggay prevented the growth of pathogenic organisms.

This study considered the oral diseases, such as dental caries and periodontal disease, as consequences of ecological driven imbalance of oral microorganisms. The control of these organisms like *Streptococcus mutans* is fundamental to the maintenance of oral health and prevention of dental caries.

The leaves and seeds of malunggay were extracted with water and 95% ethanol by blending equal parts of malunggay with water or ethanol (1:1), filtered and assayed by paper disc method against *S. mutans* B-10231 as test organism. Ethanol extract of malunggay seeds produced the highest zone of inhibition (zoi) (12.28 mm.dia.) Against *S. mutans* B-10231 as test organism. Ethanol extract of malunggay seeds produced the highest zone of inhibition (zoi) (12.28 mm.dia.) against *S. mutans* which is not significantly different than the positive control (commercial mouthwash), 12.3 mm. zoi. However, the ethanol extract of leaves has 11.26 mm zoi is not significantly different than the water extract of seeds (11.34 mm). The lowest zoi was produced by water extract of leaves (10.8mm). Results showed that the ethanol extract of malunggay seeds can be used as mouthwash which is much cheaper and readily available. These findings revealed that active compounds from malunggay is effective against *S. mutans*.

Keywords: Malunggay, *Streptococcus mutans*, zoi, dental plaque, mouthwash

BSD-17

IN VITRO CALLUS FORMATION IN COTYLEDONS OF MALUNGGAY (*Moringa oleifera*)

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Moringa oleifera, a small to medium-sized tree, contains important secondary products with anti-oxidant properties which can inhibit tumor cell growth and cure certain chronic diseases. *In vitro* propagation is an important tool for mass propagation and enhancement of secondary metabolites. This study aimed to develop *in vitro* protocol for callus and shoot induction from green mature seeds using cotyledon explants.

Sterile cultures were established by treating the seeds with fungicide, double sterilized with 5% CaOCl for 30 minutes, and disinfected with 1% streptomycin solution. After 5 days of incubation in MS basal medium (MS), 89% sterile cultures were obtained.

Callusing was induced using MS + 2,4-D (0-5.0 μ M) + BA (0-2.5 μ M) with and without 5.0 μ M TDZ, however, highest (97%) callus formation was observed in MS + 2.5 μ M 2,4-D + 0.5 μ M BA + 5.0 μ M TDZ. Loose crystalline calli were observed in MS with 2,4-D and BA singly or in combination, whereas compact, nodular and loose types of calli were obtained in the same media formulations with TDZ suggesting that calli from the latter treatments maybe potential material for shoot induction. High callus weights were observed in MS with 1.0 μ M 2,4-D + 0.5-1.0 μ M BA, 2.5 μ M 2,4-D and BA, and 5.0 μ M 2,4-D + 0.5 μ M BA enriched with 5.0 μ M TDZ. Microscopic observation on green calli after 4 weeks of incubation revealed heterogenous and asynchronous cell growth showing actively dividing cells. Xylem differentiation was evident, indicating early growth of bud initials. It is therefore suggested that transfer of calli showing early bud initiation onto shoot induction media containing high concentration of cytokinin or combination with other plant growth regulator maybe necessary for further organogenesis.

Abbreviations: CaOCl Calcium hypochlorite, MS Murashige and Skoog, BA Benzyladenine, 2,4-D - 2,4-dichlorophenoxyacetic acid, TDZ Thidiazuron

Keywords: *Moringa oleifera* Lam., malunggay, *in vitro*, callus induction, dividing cells, xylem differentiation

BSD-18

Garcinia mangostana* (MANGOSTEEN) RIND EXTRACT AS A NOVEL RADIOPROTECTOR AGAINST WHOLE-BODY GAMMA IRRADIATION OF *Mus musculus

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The radioprotective potential of various concentrations (0, 50, 500 and 1000 mg/kg b. wt.) of orally-administered powdered *Garcinia mangostana* rind extract (GMRE) mixed in distilled water was studied in mice whole-body exposed to 5.0 Gy of γ -irradiation. As assayed through the Micronucleus Test, it was observed that all doses of GMRE considered administered 8 days prior to irradiation conferred a radioprotective effect. The frequency of micronucleated polychromatic erythrocytes (MPCEs) was significantly decreased ($p=0.00$). Mice administered 0 mg/kg GMRE had the highest mean MPCE frequency (8.83 ± 2.730); followed by 50 mg/kg (3.93 ± 1.174), 500 mg/kg (1.97 ± 1.273), and then by 1000 mg/kg (0.39 ± 0.778). The radioprotective action of GMRE increased in a dose-dependent manner up to 1000 mg/kg, where the smallest number of MPCEs formed (0.39 ± 0.778). It showed no significant difference from the negative control ($p=1.00$). The high concentration of xanthenes present in GMRE possibly conferred radioprotection through free-radical scavenging and immunomodulatory mechanisms. This study demonstrates that orally-administered GMRE, which protected mice against γ radiation-induced cell damage at a maximally effective dose of 1000 mg/kg, could be a novel radioprotector, with advantages of low cost, non-toxicity and high efficiency.

Keywords: *Garcinia mangostana*, Mangosteen, Mice, Micronucleus Test, Radioprotection

BSD-19

**ISOZYME POLYMORPHISM IN SOME PHILIPPINE
NATIVE ORCHIDS: *Dendrobium anosmum* Lindl.,
Dendrobium sanderae Rolfe, *Cymbidium finlaysonianum* Lindl.,
and *Cymbidium aliciae* Quis**

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Isozyme polymorphism in *Dendrobium anosmum* Lindl., *D. sanderae* Rolfe, *Cymbidium finlaysonianum* Lindl., and *C. aliciae* Quis was analyzed based on four enzyme systems: acid phosphatase (ACPH), esterase (EST), malate dehydrogenase (MDH), and malic enzyme (ME) using starch gel electrophoresis. Isozyme banding patterns showed a total of seven presumptive loci: three isoloci for EST (*EST-1*, *EST-2*, and *EST-3*), two for ACPH (*ACPH-1* and *ACPH-2*), one each for MDH (*MDH-1*) and ME (*ME-1*). The degree of genetic variability in the four species was determined by estimating the proportion of polymorphism (P), average allele per locus (A), average heterozygosity (H), genetic identity (I_N), genotypic similarity (I_H), and genetic distance (D). The P values of *D. sanderae* (20.00%) and *C. aliciae* (50.00%) were quite low compared to *D. anosmum* (83.33%) and *C. finlaysonianum* (71.43%). It was also noted that the H values of the four orchid species were below 50%. The low P and H values suggest that there is low intraspecific variation in each of the four species. Based on the enzyme loci surveyed, *D. anosmum* and *C. finlaysonianum* had approximately two alleles per locus (average 1.774) while *D. sanderae* and *C. aliciae* had approximately one allele per locus (average 1.35). The computed estimates for genetic variation showed that the least genetic identity ($I_N = 0.565$), lowest genotypic similarity ($I_H = 0.466$), and the greatest genetic distance ($D = 0.571$) occurred between *D. sanderae* and *C. finlaysonianum*. This could be attributed to the inherent genetic differences between the two genera. One notable difference was the presence of *EST-3* locus in the two *Cymbidium* species and absence in the two *Dendrobium* species. However, *D. anosmum* and *C. finlaysonianum* exhibited the greatest genetic identity ($I_N = 0.793$), highest genotypic similarity ($I_H = 0.641$) and the lowest genetic distance ($D = 0.232$) even though they belong to different genera. It is possible that the variation between these two genera was not represented well based on the four enzyme systems used. The use of other enzyme systems is therefore recommended.

Keywords: *Dendrobium* sp., *Cymbidium* sp., orchids, isozyme polymorphism, starch gel electrophoresis, genetic variation

BSD-20

**TOWARDS THE CATALOGUING OF THE
PHENYLALANINE AMMONIA LYASE (PAL) AND
CAFFEATE-O-METHYLTRANSFERASE (COMT) GENES
FROM THE RHIZOMES OF ZINGIBER OFFICINALE
ROSC. AND ALPINIA GALANGA (L.) SW.**

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This study aims to provide the groundwork in constructing a gene catalogue that encodes for the two primary enzymes of the phenylpropanoid-hydroxycinnamate pathway, *phenylalanine-ammonia lyase (PAL)* and *caffeate-O-methyltransferase (COMT)*, which are responsible for the subsequent synthesis of the medicinal secondary metabolites as an example is gingerol, of *Zingiber officinale* and *Alpinia galanga*. The designed gene-specific primers for PAL (forward primer, 5'-TTCAAGATCGCCGGCATCGA-3'; and reverse primer-5'-GTTCCACTCCTTGAGGCACTCGAG-3'), and COMT (forward primer, 5'-CAACGGGCCTACTGTCATTCG-3'; and reverse primer, 5'-TTCAAGATCGCCGGCATCGA-3'), enabled the amplification of polymerase chain reaction (PCR) products from genomic DNA and total RNA of both plants. Results revealed that genomic DNA PCR amplicons are expressed as single copies in both plant genomes with sizes 1,700 bp for COMT and 1,300 bp for PAL. Reverse transcription polymerase chain reaction (RT-PCR) of *Zingiber officinale* total RNA yielded four putative cDNA isoforms for PAL with sizes 1,400 kb, 700 kb, 550 kb and 300 kb. With this is inferred that at the replication level, *Comt* and *Pal* genes in both plants are expressed as single copies in both genomes indicating that these enzymes are highly regulated. However, at the transcription level, *Pal* gene in *Z. officinale* is expressed as four putative cDNAs for isoforms of PAL indicating that molecules of the same family perform different functions in the phenylpropanoid-hydroxycinnamate pathway to synthesize medicinal secondary metabolites, and molecules of the same function performing in other pathways to synthesize other medicinal secondary metabolites. This study is the first to report of possible alternative splicing mechanisms in the gene expression of PAL in *Z. officinale* suggesting probable regulatory functions in the alternative phenylpropanoid-hydroxycinnamate pathway.

Keywords: phenylpropanoid-hydroxycinnamate pathway, phenylalanine-ammonia lyase (PAL) and caffeate-O-methyltransferase (COMT)

BSD-21

SEQUENCE ANALYSIS OF *VIBRIO HARVEYI* *TOXR* GENE FOR INSIGHTS ON ITS POSSIBLE ROLE IN PATHOGENICITY

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The gene *toxR*, an ancestral gene of Family Vibrionaceae, codes for the protein ToxR, a transmembrane transcription regulator of several virulence factors. This study explored the possibility of distinguishing pathogenic from non-pathogenic *Vibrio harveyi* strains at the molecular level using *toxR* as gene marker.

Complete *toxR* gene sequence of type strain *V. harveyi* NBRC 15634 was obtained after amplifying 5. and 3. regions flanking a 576-bp *V. harveyi* gene fragment previously sequenced. A 750-bp terminal 5. *toxR* gene sequence was from an amplified fragment using a forward primer (*VhtoxRpv*) based on known 5. *toxR* sequences in *V. parahaemolyticus* and *V. vulnificus* and a reverse primer (*VctoxR2R*) targeting an internal region of the 576-bp fragment.

The 900-bp 3. terminal *toxR* region was amplified using a primer pair *toxRS1* and *toxRS 2* based on *V. parahaemolyticus* and *V. vulnificus* *toxR* and *toxS*. Sequence analysis and alignment of the complete 882 bp *toxR* revealed that *V. harveyi* shares 87% similarity with *toxR* of *V. parahaemolyticus*, 84% with *V. fluvialis*, 83% with *V. vulnificus*, and 74% with *V. campbelli*, indicating wider divergence in *toxR* compared to 16S rRNA gene among *Vibrios*. Nucleotide sequence comparison of the *toxR* from the pathogenic versus the non pathogenic strains revealed significant nucleotide sequence variation from the type strains *V. harveyi*, including a 19 bp deletion in one non-pathogenic isolate and mutations that resulted in stop codons in the other three *toxR*. Significant protein sequence variation was observed between the pathogenic and non-pathogenic *V. harveyi*, resulting in mutations that affected protein structure associated with the periplasm. While hemolysin gene and protein sequences were comparable among pathogenic and non-pathogenic *V. harveyi* strains used in this study, variations in *toxR* might have affected the function of the ToxR gene product, implicating *toxR* gene mutations to loss of pathogenicity.

Keywords: periplasm, *toxR*, Vibrionaceae, *Vibrio harveyi* PCR, hemolysin, mutations, p sequence analysis pathogenicity *V. campbelli*

BSD-22

***HRP B* GENE SEQUENCES REFLECT THE ORIGIN AND
HOST RANGE OF *RALSTONIA SOLANACEARUM***

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Ralstonia solanacearum is an important plant pathogen, causing bacterial wilt of vegetables and banana plants. Knowledge of their genetic diversity is very important in order to understand their origin, host range, and for implementation of proper control measures. The *hrpB* gene is vital for the pathogenicity of *R. solanacearum*. *HrpB* gene encodes the regulatory protein that controls the expression of the Type III Secretion Apparatus (TTSS) together with several effector proteins. In this study, we have analyzed the *hrpB* sequences from different strains of *Ralstonia solanacearum* as they pertain to the origin and host range of the strains. *HrpB* genes of different isolates of *R. solanacearum* in the Philippines were amplified by PCR using specific primers for *hrpB* gene. The amplified *hrpB* genes were purified, sequenced and analyzed. Additional *hrpB* sequences of *R. solanacearum* from other countries, blood disease bacterium (BDB), and *Pseudomonas syzygii* from Indonesia that were previously reported were included in the analysis. Based on the results, the strains were divided into 4 clusters or phylotypes. Race 1 strains, wide host range, were found in phylotype 1. Race 2 strains, typical potato strains and banana strains, were in phylotype 2. Asian biovar N2 from potato, the isolates from clove, BDB and *Pseudomonas syzygii* were all grouped in phylotype 4. Phylotype 3 contained strains exclusively isolated from Africa. Phylotypes 1 (Asian) and 3 (African) are most closely related than to other phylotypes. The results showed the very diverse characteristic of *R. solanacearum* strains found in Asia as they were present in three out of the four phylotypes. Biovar N2 strains were very different from the other strains infecting potato in the Philippines. The origin and host range of this relatively new strain entails more research to understand their importance.

Keywords: HrpB gene, biovar classification, *Ralstonia solanacearum*

BSD-23

**NITROGEN-FIXING BACTERIA ASSOCIATED WITH THE
ROOTS OF PHILIPPINE SHALLOT 'SIBUYAS
TAGALOG' (*Allium ascalonicum*)**

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This paper reports nitrogen-fixing bacteria associated with a top exportable vegetable, Philippine shallot (*Allium ascalonicum*) or Sibuyas Tagalog, with the hope of using them as biofertilizer amendment to organic fertilizers for onion farming in the future.

The nitrogen-fixing bacteria associated with roots of Sibuyas Tagalog were enumerated and isolated using the MPN technique combined with acetylene reduction assay (ARA). The MPN population of nitrogen-fixing bacteria was found to be 5.22×10^4 and 1.80×10^5 per gram root dry weight, in malate and in glucose semi-solid media respectively. Isolates from ARA-positive MPN cultures were found to have specific nitrogenase activity that ranged from 334-450 nmol C_2H_4 mg protein⁻¹ hr⁻¹. Strain RdG1 was characterized to be a Gram negative short rod, motile, resistant to several antibiotics, non-spore forming, non-fermentative, non-nitrate reducing, and able to utilize a wide variety of organic compounds similar to the root exudates of plants. In addition, RdG1 fixes nitrogen under microaerobic conditions the same oxygen levels as would be found in roots and rhizosphere of plants. It is interesting to note that no *Azospirillum* spp. nor diazotrophic enterobacteria have been isolated from Sibuyas Tagalog roots in this study.

API, Biolog, and manual tallying of phenotypic data from literature showed that RdG1 has similarities to *Burkholderia*. However, percentage similarity of RdG1 to *B. cepacia* based on phenotypic characteristics is relatively low. There is the possibility that RdG1 may be a novel strain or species. Unlike *B. cepacia*, RdG1 is not pathogenic to onion.

Keywords: Nitrogen-fixing Burkholderia, Allium ascalonicum auct, Allium cepa var. grp. aggregatum, diazotroph, Sibuya Tagalog, biofertilizer

BSD-24

PHENOTYPIC PROFILE OF HETEROTROPHIC BACTERIA IN *Penaeus monodon* POND SEDIMENT, REARING WATER AND WATER SOURCE IN ONE REARING CYCLE

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Profile of heterotrophic bacteria in *Penaeus monodon* pond sediment, rearing water and water source of BFAR-NFRDI ponds at Pacita, Lala, Lanao del Norte was determined within one rearing cycle. Sampling was done weekly in the four designated sites: site A (water source), site B and C (ponds with *P. monodon*) and site D (pond without *P. monodon*). Composite samples of water and sediment were collected and cultured in nutrient agar medium by serial dilution and streak plate method. Isolates were then purified and subjected to biochemical tests.

A total of 185 isolates were obtained. Gram-negative bacteria were higher in sediments (58-63%) than in the water samples (54-60%). Vibrionaceae had the most number of isolates in water samples (7 to 13 isolates). Micrococcaceae had the most number of representative isolates and highest density for several weeks in the sediments of the reared and undreared ponds, respectively. Decrease in both diversity and evenness in the rearing water were observed after introduction of feeds. In this period, Vibrionaceae and Bacillaceae dominated in the reared ponds. Diversity and evenness decreased on the fifth week in sediment samples. Ratio of Vibrionaceae against other bacterial groups was generally higher in the rearing water than the pond sediments. The abundance of bacterial groups is influenced by presence of other biotic components, prawn rearing practices, and water quality within the ponds.

Keywords: heterotrophic bacteria, *Penaeus monodon*

BSD-25

**A RAPID IN VITRO CALORIMETRIC METHOD OF
DETERMINING BACTERICIDAL POTENCY OF
ANTIMICROBIALS**

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The increase of antibiotic-resistant microorganisms possibly leading to severe clinical infections necessitates the development and application of rapid and accurate antimicrobial susceptibility assays. These new tests can be used to screen natural products for potential antimicrobial properties. These assays are also used to determine bactericidal potency, a very important parameter for the proper evaluation of generic antibiotics. Colorimetric based assays are rapid alternative methods for antimicrobial susceptibility testing. This involves the reduction of a tetrazolium salt by metabolically active cells to a colored water-soluble formazan derivative and quantified using a spectrophotometer. In this study the bactericidal potency of a generic antibiotic was compared to a branded commercial product. The bactericidal potency was characterized using the American Type Culture collection (ATCC) reference strains as recommended by the CLSI. Furthermore, bacteria isolated from different clinical cases were also used. The bactericidal pharmacodynamics of the various antibiotics against the different target microorganisms was analyzed by generating a concentration-killing-curve (CKC). Half-maximal effective concentration (EC_{50}) of the different antimicrobial agents was obtained from an experimentally derived dose-response curve. Potency of the different antibiotics was statistically calculated using Parallel Line Assay. Different bacterial strains show different CKC profiles but no difference in potency was observed between the generic and branded commercial antibiotic. Difference in sensitivities between ATCC strains and clinical isolates of the same genera were observed. *In vitro*-based antimicrobial susceptibility assay promises to be a useful and rapid method for evaluating potency of generic antibiotics. Furthermore, it is recommended that bacterial isolates from clinical cases other than ATCC reference strains be used to evaluate antimicrobials.

Keywords: Antimicrobial susceptibility test, Bactericidal Potency, concentration-killing-curve, Generic antibiotic

BSD-26

**VALIDATION TRIALS FOR THE PCR-BASED
DETECTION OF *E. coli* O157:H7 IN FOODS USING THE
LOCALLY-DEVELOPED DNA AMPLIFICATION
SYSTEM (DAS) KIT**

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The study aimed to validate the applicability of the BIOTECH UPLB-DOST DAS kit in detecting enterohemorrhagic *E. coli* O157:H7 in fresh produce, meats and dairy products. Uninoculated and artificially-contaminated hamburger patties, white cheese and liquid milk samples were enriched for 24 h at 37°C in modified Tryptic soy broth (mTSB) supplemented with 0.02 mg/ml novobiocin. Vegetable samples were washed in Butterfield's Phosphate buffer and the washings enriched for 20 h in Buffered peptone water + novobiocin. The presence of the target analyte was determined by plating on Tellurite-Sorbitol MacConkey agar and by PCR using the *E. coli* O157:H7 DAS kit. IMViC tests were conducted on presumptive EHEC O157:H7 isolates obtained from white cheese and uninoculated hamburger patties samples. In the analysis of vegetable samples, the DAS result indicated all uninoculated samples as negative and all EHEC O157:H7-seeded replicates as positive. The plating method scored the uninoculated mixed lettuce as presumptive positive and one replicate of seeded carrots and two replicates of seeded salad tomatoes as negative. For the fifteen cheese samples, the percent agreement between the culture method and the DAS kit was 86.67%. Two uninoculated cheese samples yielded the target amplicon however, in the cultural method, none or very few presumptive colonies were detected in these two samples. A total number of 45 colonies from cheese samples subjected to IMViC identified only one, from a seeded sample, as *E. coli*. For the fifteen milk samples, 100% percent agreement was obtained in the parallel testing of the two methods. In the analysis of hamburger patties, all samples tested positive with the *E. coli* O157:H7 DAS kit. Verification of natural contamination of the hamburger patties samples was done by employing both methods prior to enrichment (T_0), after 6 h (T_6) and 24 h (T_{24}) in mTSB + novobiocin at 37°C. A total of 50 presumptive isolates from T_{24} did not show typical *E. coli* reactions with IMViC tests and all 21 isolates tested by PCR were negative for the target amplicon. Because of the difficulty in isolating EHEC O157:H7 from meat microflora for confirmation by cultural method, it was not established whether this batch of hamburger patties samples was indeed contaminated by EHEC O157:H7. Improvement in isolation procedures and analyses with higher sample size are underway.

Keywords: *E. coli* O157:H7, polymerase chain reaction, pathogen detection, detection kit, food safety

BSD-27

COMBINATION OF POLYMYXIN B AND BACTERIOPHAGE F116: AN EFFECTIVE TREATMENT FOR *Pseudomonas aeruginosa* BIOFILM

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The effects of combined Polymyxin B (PB) and bacteriophage F116 in culture on *Pseudomonas aeruginosa* biofilm was investigated. The study also explored the effectivity of the augmentation on the different stages of biofilm development. *P. aeruginosa* biofilms were grown and the different stages of development were treated with PB, bacteriophage F116, and a combination of PB and phage F116. Cell viability was assessed through 2,3-bis 2-methoxy-4-nitro-5-sulphophenyl-2 H-tetrazolium-5-carboxanilide) (XTT) assay. Furthermore, the total amount of biofilm (bacterial cells and exopolysaccharide substances EPS matrix) was determined through crystal violet staining. The effectivity of the treatments in degrading the EPS matrix was investigated using the scanning electron microscope (SEM); and deoxyribonucleic acid (DNA) analysis was conducted to assess if there was lysogeny of the biofilm cells that survived the combined treatment. Lysogeny indicates an integration of bacteriophage F116 DNA to the bacterial genome. Twoway analysis of variance was done to confirm if the treatments and biofilm development significantly affected the survival of the biofilm. Results revealed that the combined PB and bacteriophage F116 treatment reduced the mature biofilm's cell viability and total amount by 72% and 75%, respectively compared to PB treatment alone that resulted only in an 11% and 4% reduction in similar assays. SEM investigation confirmed the decrease in the apparent thickness of the EPS matrix with the combined treatments. Lysogeny was also observed in the bacterial cells, suggesting that the bacteriophage treatment alone could be ineffective without PB. Statistical analysis showed that both treatments and stages of biofilm development significantly affect the survival of the biofilm cells.

Keywords: *Pseudomonas aeruginosa* biofilm, Bacteriophage F116, Polymyxin B

BSD-28

EVALUATION OF PRODUCTION SAFETY OF A PORK SAUSAGE VARIANT (“HAMONADO LONGANISA”) WITH RESPECT TO *ESCHERICHIA COLI* SURVIVAL THROUGH THE USE OF SELECTED PREDICTIVE MODELS

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Population kinetics of *Escherichia coli* (BIOTECH 1098¹) in a commercially available pork sausage variant (hamonado “longanisa”) was determined at various temperatures employed during the production process. The hamonado “longanisa” was evaluated for production safety with respect to *E. coli* by using challenge tests and two currently available predictive microbiological models, MicroFit v. 1 (Baranyi Model) and Pathogen Modeling Program 6.1 (PMP 6.1). Results obtained showed that as temperature was increased over time to 35 °C, maximum specific growth rate (μ_{max}) also increased while a shorter generation or doubling time (t_d) was observed under the conditions tested in this study.

The predictions generated by MicroFit v. 1 (Baranyi Model) and PMP 6. 1 were found to be generally consistent with observed results for the majority of the challenge tests. Bias factors (B_f) and accuracy factors (A_p) were used as comparison indices. Based on the B_f and A_p , the Baranyi Model generated estimates fit more closely to the observed values, particularly for the lag phase and its transition into the log phase of growth for *E. coli*. The obtained results indicate that the Baranyi model may be used to adequately predict end product safety and acceptability in an actual food environment at different temperatures. In general, results of this study indicate that as long as the prescribed time and temperature limits are strictly adhered to and Hazard Analysis Critical Control Point (HACCP) protocols are followed during production, end product safety with respect to *E. coli* for the studied hamonado longanisa variant will be maintained.

Keywords: predictive microbiology, hamonado “longanisa”, *Escherichia coli*, MicroFit v.1 (Baranyi Model), Pathogen Modeling Program 6.1

BSD-29

LEAD PHYTOEXTRACTION OF ROBUST PLANT SPECIES PRESENT IN HEAVY METAL CONTAMINATED SITES

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Lead contamination of soils is implicated to various environmental problems and toxicity in flora, fauna and humans. Pb levels in plant and soil samples from two military firing ranges were analyzed using Inductively-Coupled Plasma Atomic Emission Spectrometry (ICP-AES). Physicochemical analysis of soil from different distances in site 1 and 2 revealed variable profiles in soil pH, cation exchange capacity (CEC), organic matter (OM), and Pb concentrations. The average Pb concentration in site 2 (3185.17 ppm) was higher compared with site 1 (1173.14 ppm). These Pb concentrations in contaminated sites were two orders of magnitude higher than that of the control site (10 ppm). Correlation analysis indicated that the soil Pb concentrations were positively correlated with soil pH and OM but negatively associated with soil CEC. Likewise, Pb-tolerant plant species belonging to family Poaceae, Leguminosae and Euphorbiaceae were identified in both sites with high Pb bioaccumulation in their root and shoot tissues. Pb concentrations in the root and shoot tissues of *Mimosa pudica* (1693.45 ppm), *Dichanthium sericeum* (1486.75), *Centrosema pufescens* (1239.00 ppm), *Eleusine indica* (981.05 ppm), *Panicum antidotale* Retz (851.55 ppm), *Cynodon dactylon* (823.90 ppm), *Cyperus rotundus* (646.60 ppm) and *Ricinus communis* (52.15 ppm) were considerably higher compared to their control counterparts. Correlation analysis showed that total Pb accumulation was positively associated with root and shoot Pb, relative dominance (RD), and relative frequency (RF), and importance value (IV) of the species. *Centrosema pufescens* had the highest bioconcentration factor (BCF) of 0.86. *C. pufescens*, *M. pudica*, *Cynodon sp.*, *E. indica* and *P. antidotale* R. were the candidate robust plant species that can hyperaccumulate Pb in their root and shoot tissues. Our results provide compelling evidence on the ability of these robust plant species in extracting Pb from heavy metal contaminated sites.

Keywords: phytoextraction, phytoremediation, robust species, Pb contamination, bioconcentration factor

BSD-30

PHYTOEXTRACTION OF NICKEL BY *BRASSICA JUNCEA* (INDIAN MUSTARD) AND *ZEA MAYS* (CORN) CULTIVATED IN NICKELIFEROUS LATERITE FROM BROOKE'S POINT, PALAWAN, PHILIPPINES

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This study tested the growth responses and accumulative capacity of *Brassica juncea* and *Zea mays* to nickel from nickeliferous laterite soil. Addition of compost in one of the soil groups was employed. Concentrations of nickel were measured at 100 ppm (garden soil), 7000 ppm (laterites with compost) and 7600 ppm (laterites).

In evaluating growth responses of plants to nickel, percent shoot and root length difference, growth rate, dry matter production and water content were measured. Visible phytotoxic effects were noted through ocular inspection. Nickel accumulation was quantified through Atomic Absorption Spectrophotometry (AAS). For both species, the bioconcentration factor (BCF) and phytoextraction rate were determined as the measure of the plants' phytoextraction capacity.

In an evaluation of the growth responses of both species to nickel through the measurement of salient parameters, visible and quantifiable results indicated that the addition of the compost was able to alleviate the nickel toxicity in *Brassica juncea* grown in nickeliferous laterites while *Zea mays* plants did not elicit any visible phytotoxic effects.

Nickel toxicity effects observed in *Brassica juncea* were wilting, discoloration (chlorosis) and stunted growth. The effects began to be elicited by the plants during the 3rd week of growth. For *Zea mays*, toxic effects observed were stunted growth. Results reveal that there is an increase in the nickel concentration in plants at higher soil metal concentration. Using the BCF values as the measure of phytoextraction capacity of the plants, *Zea mays* showed medium nickel accumulation while *Brassica juncea* showed slight nickel accumulation.

Keywords: Phytoextraction; nickel uptake; nickeliferous laterites; *Brassica juncea*; *Zea mays*

BSD-31

BIOREMEDIATION POTENTIAL OF FUNGI ISOLATED FROM WASTE SITE SOIL SAMPLES

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Bioremediation is the process by which microorganisms degrade toxic substances to environmentally safe levels in soils and other systems. This study was conducted to determine the bioremediation potential of fungi isolated from the soil sample waste site of Technological University of the Philippines, Manila. A total of four isolates were obtained. One fungal isolate was evaluated for its potential to degrade lead. Pure culture of the organism was inoculated into Sabouraud Dextrose Agar (SDA) with lead nitrate of varying concentrations (62.5 ppm, 187.5 ppm and 312.5 ppm). Mycelial Growth Extension and Mycelial Dry Weight were measured. Fungal species was identified based on its morphology, surface color and texture appearance on SDA. Concentrations of lead in SDA was determined using Atomic Absorption Spectrophotometry. Results showed that *Mucor sp.*, the identified organism can degrade high concentrations of lead.

Keywords : bioremediation, fungi, lead, mycelial growth extension, mycelial dry weight

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FUNGAL DIVERSITY AND ETHNICAL VALUES: ROLE IN BIODIVERSITY CONSERVATION of CORON, PALAWAN, PHILIPPINES

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Coron as member of Calamian group of islands in Northern Palawan is among the ecotourism hotspot in the Philippines - a home of rich biodiversity resources like fungal flora, which form part of Tagbanua's culture. However, anthropogenic impacts like migration, industrialization, and kaingin farming have caused biodiversity degradation, requiring conservation strategies to restore the island and mountain ecosystems. This research will determine fungal diversity in Coron, assess their ethnical values for Tagbanua, and evaluate conservation strategies that sustain island biodiversity. Fungal diversity and ethnical values from different ecosystems (Boho-forest, kaingin-forest, limestone forest) within Mt Darala and Dungon Islands were investigated in wet and dry periods (2006-2007). A 3-4 km transect was stretched along three ecosystems, where three 10 x 10m quadrants were alternately established at equal interval to characterize fungal morphology for identification and quantify density and diversity indices. Indigenous knowledge on fungal flora was obtained through key informant interview approach.

There were 64 fungal species belonging to 44 genera and five orders (Aphyllporales, Agaricales, Sphaeriales, Tremellales and Thelophorales) grouped into two classes (Basidiomycetes, Ascomycetes). Fungal density per 100 m² was higher in Mt Darala (727 1,074 individuals) than Dungon islands (213 403 individuals). Though even in distribution ($e=0.7900$), fungal diversity in Mt. Darala was moderate ($H'=2.7570$) and low in Dungon Island ($H'=1.6100$) due to human activities. Fungal diversity during wet season was 18.5% higher than collections in dry period, suggesting importance of moisture in their life cycle. Based on respondents, everyone utilized fungi as alternative food while 43% stated their cultural values and 7% uses fungi as biofertilizer. Overall, ethnomycological values indicate possible strategies for sustainable biodiversity conservation by protecting fungal habitat, regulating harvest and consumption of wild fungi, minimize burning during site preparation of upland farms, and delineation of areas for mushroom collection.

Keywords: Fungal diversity, ethnomycology, biodiversity conservation, island and mountain ecosystems, Coron Palawan

BSD-33

MICROBIAL COMMUNITY ASSESSMENT OF MT. MAKILING MUDSPRING, LAGUNA, PHILIPPINES AS REVEALED BY 16S rDNA

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During the last decade, molecular biology techniques based on DNA extraction have given microbiologists a powerful tool to explore the microbial communities of extreme environments such as geothermal acidic environments, revealing uncharacterized members belonging to both the bacterial and archaeal domains. Consequently, considering the diversity of potential habitats and the great genetic diversity of microbes, the vast majority, most of which are as yet unknown microbes from solfataric environments, could well be a huge source of novel molecular structures. Mt. Makiling Mudspring is a thermophilic acidophilic environment harboring a wide range of microorganisms waiting to be discovered. This study was the first attempt to study the site using molecular techniques. Efforts were made to extract DNA of a high quality and quantity from SM and SSW samples and to establish the first phylogenetic analysis.

Among the five environmental DNA isolation techniques with several modifications tried, the only method where DNA was successfully isolated was with the BIO 101 Fast DNA Spin Kit for Soil using freshly sampled sediments from the upper layer of solfataric soils with hot spring water (SULSSW5) from Mt Makiling Mudspring. No DNA was isolated from solfataric mud (SM) regardless of the method used.

Phylogenetic analysis using archaeal (23FPL-1391R) and universal (519F - 1392R) primer pairs showed that twelve clones were clustered with *Sulfolobus tokodaii*, and five clones with *S. solfataricus* and *S. islandicus*. Seven clones clustered with clones named MTC-A. One clone, D519-8, had low similarity with uncultured archaeon clone KOZ184; hence, it is believed to be novel. The clones from the bacterial primer pair (11F and 1492R) did not reveal any significant BLAST result.

The cloning and sequencing of environmental 16S rDNA fragments have led to the detection of the *Sulfolobus* group of organisms thriving in the aforementioned environment based on universal and archaeal 16S rRNA analyses. The bacterial clone library did not show any significant group of organisms. This is a pioneering work in the use of environmental DNA for the analysis of the microbial community of Mt Makiling, Mudspring and of any environment in the Philippines.

BSD-34

**COMMUNITY ASSEMBLAGE OF MICROALGAL
EPILITHON IN CAGAYAN DE ORO RIVER**

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There is a paucity of information on the community assemblage of epilithon in Philippine rivers. We, therefore, conducted a preliminary study of benthic microalgal assemblages in different areas of Cagayan de Oro River which is the major river system of Cagayan de Oro City. We sampled epilithon from riffle and pool sites in upstream, midstream and downstream segments of the river in January 2008. Physical (sampling site elevation) and water conditions (temperature, pH, dissolved oxygen, conductivity, total suspended solids, and velocity) were also determined during sampling. Thirty-five genera comprised the epilithon of Cagayan de Oro River most of which belong to Bacillariophyceae (21 genera) followed by Chlorophyceae (7 genera), Cyanophyceae (6 genera) and Xanthophyceae (1 genus). Most of the genera in Bacillariophyceae were mostly pennate diatoms with *Stauroneis* as the most abundant. *Microspora* was the most abundant among the Chlorophyceae. The Shannon index of diversity was highest in the downstream pool site ($H' = 2.27$) while lowest was in upstream riffle site ($H' = 1.62$). In terms of generic richness, the riffle midstream sites had the highest value ($S = 27$) and the least was in the pool upstream site ($S = 22$). Multivariate analysis of data using the Redundancy Analysis (RDA) of CANOCO software version 4.54 showed that only elevation had a significant ($p < 0.01$) influence on the distribution of epilithon genera, with most of the diatoms favoring lower elevations.

Keywords: epilithon, Bacillariophyceae, Chlorophyceae, Cyanophyceae, Chlorophyceae

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**IDENTIFICATION OF 18S RIBOSOMAL DNA GENOTYPES
OF *ACANTHAMOEBA* SPECIES ISOLATED
IN THE PHILIPPINES**

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Acanthamoeba is a genus of ubiquitous free-living amoebae which commonly causes the human eye infection *Acanthamoeba* keratitis (AK) as well as the fatal brain infection known as granulomatous amoebic encephalitis (GAE). Cyst morphology was commonly used in the identification of *Acanthamoeba* at the subgenus level. A more accurate and consistent method based on the analysis of complete sequences of nuclear small ribosomal subunit RNA genes (*Rns*) has been developed. To date, no *Acanthamoeba* genotype identification and distribution in the Philippines has been reported. In this study, the ASA.S1 region of the *Acanthamoeba* sp. *Rns* was sequenced from 17 samples isolated from soil, water, and contact lens storage cases from different regions of the Philippines. Genotypes of the isolates were identified using BLAST and their phylogenetic positions relative to known *Acanthamoeba* isolates were determined using the model based (GTR+ Γ) neighbor-joining, maximum likelihood and Bayesian inference analyses and the non-model based maximum parsimony analysis. Results show that the genotypes T5 and T4 are commonly found in soil, water, and contact lens storage case samples from different parts of the Philippines. Apart from these, a contact lens case isolate was identified as genotype T15.

Keywords: *Acanthamoeba*, *Rns* genotype, subgenus classification, phylogenetics, Philippines

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**THE SMALL SUBUNIT (SSU) RIBOSOMAL RNA GENE
AS A GENETIC MARKER FOR IDENTIFYING INFECTIVE
3RD JUVENILE STAGE *Angiostrongylus cantonensis*
IN GARDEN SLUGS**

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Angiostrongylus cantonensis is a strongylid nematode parasite that utilizes a variety of gastropods as intermediate hosts and the rat as final host. Its third juvenile stage can accidentally infect humans and cause eosinophilic meningoencephalitis. Accurately identifying the juvenile *A. cantonensis* in gastropod intermediate hosts can aid in controlling the disease the nematode causes. Here we have developed a molecular method using PCR-direct sequencing to identify the infective 3rd juvenile stage of *A. cantonensis*. We demonstrate that the 5' end of the small subunit (SSU) ribosomal (r) RNA gene is a suitable marker to identify *A. cantonensis* and distinguish it from other closely related *Angiostrongylus* species. When the SSU rRNA marker was employed on nematode populations extracted from the black slug *Laevicaulis alte* collected from 2 test sites in Quezon City, Philippines, the juvenile *A. cantonensis* was detected without difficulty. Other nematode species were also extracted from the slugs, and their phylogenetic position was also determined using the same SSU rRNA marker. The molecular technique developed in this study provides a rapid and accurate method for the identification of *A. cantonensis* when morphological identification proves difficult or inadequate.

Keywords: *Angiostrongylus cantonensis*, infective 3rd juvenile stage, SSU rRNA gene marker, *Laevicaulis alte*, molecular identification, eosinophilic meningoencephalitis

BSD-37

ISOLATION OF ACETYLCHOLINESTERASE INHIBITING PEPTIDES FROM CONUS MUSTELINUS VENOM

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Venom from *Conus* is known to contain peptides which inhibit the function of ion channels and neurotransmitter receptors, but an effort to evaluate its inhibition against acetylcholinesterase (AChE) has yet to be conducted. Through Ellman's calorimetric method and *Mus musculus* bioassay, the crude venom extract and purified venom fractions from *Conus mustelinus* were investigated for in vivo and in vitro AChE inhibition activities. The crude extract was found to have significant AChE inhibitory activity (28.9% in vivo and 54.1% in vitro) and of the two peptide fractions isolated, Potential AChE Inhibiting Fraction-10 (PAIF-10, eluted at 21.15% B90) was also found to significantly inhibit AChE (30.5% in vivo and 44.8% in vitro), however no significant activity against AChE was observed from PAIF-11 (eluted at 20.68% B90) which inhibited it by 8.9% in vivo and -4.9% in vitro. Inhibition of AChE activity by *Conus* venom thus provides a promising approach to drug formulation.

Keywords: acetylcholinesterase, *conus*

BSD-38

MOLECULAR IDENTIFICATION OF *CRYPTOSPORIDIUM* SPP. IN ANIMAL HOSTS IN THE PHILIPPINES

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Cryptosporidium spp. are coccidian parasites that are known to infect human and animal hosts. These pathogens are among the significant causes of gastrointestinal infection in many countries today. They have worldwide distribution and their infective stage (oocyst) is ubiquitous in the environment.

In the Philippines, information on *Cryptosporidium* is limited. In this study, we collected fecal samples from different known animal hosts of *Cryptosporidium*. We detected *Cryptosporidium* spp. using microscopy and a polymerase chain reaction (PCR) assay utilizing the organism's heat-shock protein gene. Pigs showed the highest rate (34.29%) of shedding *Cryptosporidium* oocysts followed by calves (20.41%) and chickens (5.66%). This study adds pigs and chickens as hosts of the pathogen in the country. In addition, we sequenced DNA fragments of the SSU rRNA gene to genotype isolates from calf stools. All the isolates were *C. parvum* except one, which was *C. canis*. This is the first report of genotyping of *Cryptosporidium* spp. in the Philippines.

Keywords: *Cryptosporidium*, genotype, heat shock protein gene, SSU rRNA gene, PCR, Philippines

BSD-39

GARLIC, GINGER AND ONION AS IMMUNOSTIMULANTS: A PRELIMINARY STUDY ON THE SPECIFIC AND NON-SPECIFIC IMMUNE RESPONSE OF AFRICAN CATFISH *CLARIAS GARIEPINUS* FINGERLINGS

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A preliminary study on the effects of garlic *Allium sativum*, ginger *Zingiber officinale* and onion *Allium cepa* as dietary immunostimulants on the specific and non-specific immune response of African catfish *Clarias gariepinus* was conducted. Catfish fingerlings (1.45±0.23) were fed with experimental diets for six weeks. After the feeding experiment, blood was taken from the caudal region of anaesthetized fish and hematocrit, total hemocyte count, total immunoglobulin and superoxide anion production were determined. Garlic-fed fish had the highest hematocrit (37.00 % ± 3.19) while the onion-fed group revealed the highest level (1.007 mg/ml) of immunoglobulin. On the other hand, the incorporation of ginger

in the diet elevated the production of superoxide anion (1.018 OD at 540nm). However, no difference were found on the levels of hematocrit, total immunoglobulin and superoxide anion production between the control and the experimental groups ($P>0.05$). The total hemocyte count showed significant difference between the control (10.37 ± 1.96) and onion (17.18 ± 1.72) fed group, but no significant difference with garlic (14.68 ± 1.0) and ginger (12.75 ± 1.20) fed group. The present study revealed that the incorporation of natural immunostimulants like garlic, ginger and onion could possibly increase the immunocompetence of the fish, and hence recommended to be tested for fish culture. The effects of age of fish, duration of feeding and the amount of immunostimulant to be used are to be investigated.

Keywords: African catfish, local immunostimulants, immune response, dietary immunostimulation, immunological parameters

BSD-40

THE EFFECT OF Cry 1Ab PROTEIN ON THE GREAT EGG FLY, *Hypolimnas bolina philippensis* (Linnaeus): A NON-TARGET LEPIDOPTERA

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This study was conducted from January 2007 August 2007 at NCPC CPC UP Los Baños to determine if ingestion of Cry1Ab protein is a hazard to *Hypolimnas bolina philippensis* (Linnaeus) larvae since it is most likely exposed to Bt corn pollen in the field.

Bioassay tests through leaf dip method were conducted using 10x the maximum Cry 1Ab protein concentration found in Bt corn pollen (0.09mg/g pollen). Three days old larvae were individually exposed to 1 cm diameter leaf disc of *Ipomoea triloba* Linnaeus soaked in solution of Cry1Ab protein. Controls were individually exposed to *I. triloba* leaf discs soaked in 0.1 M Carbonate buffer. Fifty larvae each were used in treated and control experiments, respectively.

Nine trials or 450 treated larvae and 450 non-treated larvae were utilized. A total of 30 larvae died on the treated larvae while 25 perished in the control. The larval mean percent mortality and weight of treated and control trials were statistically compared using t-test. The difference in mortality of the treated and control means were not significant ($P = 0.536$). The difference in weight between treated and control groups of larvae were also not significant ($P.d.f = 16 = 0.692$).

Although many Lepidopterous species including butterflies are known to be sensitive to Cry1Ab protein (Wolf et al., 2003), the effect of Cry1Ab protein on the butterfly, *Hypolimnas bolina philippensis* (Linnaeus) larvae was negligible in terms of larval mortality and weight. These results suggests the absence of receptor molecules for Cry1Ab protein in the guts of *H. bolina* larvae. Both cadherins and amino peptidases have been identified as putative receptor molecules for Cry1Ab proteins in other Lepidopterans (Ferré and van Rie et al., 2002).

Keywords: Cry 1Ab protein, Non-target Lepidoptera, *Hypolimnas bolina philippensis*, susceptibility, t-test, larvae

BSD-41

PACHYRRHYNCHINE WEEVILS (COLEOPTERA: CURCULIONIDAE) OF POLILLO ISLAND, QUEZON PROVINCE, PHILIPPINES

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Pachyrrhynchine weevils belong to the Order Coleoptera, Family Curculionidae. They are endemic to the Philippines and can be found in less explored mountainous regions between 500 to 2000 meters above sea level. Their habitats consist of vast tropical vegetation, open, mixed forests with dense undergrowth along rivers and ravines or on ridges and mountains, with most species living on smaller trees, bushes, shrubs, or ferns.

Polillo Island was selected as one of the sampling sites for the ongoing taxonomic study of the group as well as a contribution to the study of arthropod biodiversity of the island group. Insect collections were done by hand picking and the use of insect nets and beating sheets. Collected specimens were pinned and identified. From the available collections, twelve (12) species comprising three genera, *Homalocyrtus*, *Metapocyrtus* and *Pachyrrhynchus* were determined. One (1) species belongs to the genus *Homalocyrtus*, six (6) to the *Metapocyrtus*, and 4 to *Pachyrrhynchus*. They were mostly from the remnant primary forest of the Sibulan Watershed, Pinaglubayan in the town of Polillo and and some secondary growths in

in the town of Burdeos.

Keywords: Curculionidae, *Homalocyrtus*, *Metapocyrtus*, *Pachyrrhynchus*, weevil

BSD-42

**BOOM AND BUST TRENDS AND OTHER UPDATES
AMONG LOCAL PHILIPPINE POPULATIONS OF THE
BUFF COCONUT MEALYBUG, *NIPAECCUS NIPAE*
(MASKELL) (HEMIPTERA: PSEUDOCOCCIDAE)**

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The buff coconut mealybug, *Nipaeccus nipae* (Maskell), was introduced into the country circa 2003. Its penultimate origin is unknown and the local distribution data were last recorded in Southern Tagalog provinces of Batangas, Cavite, Laguna and Quezon, and in Davao City. Since its introduction, it has devastated the atis (*Annona squamosa* L.) industry of Lobo, Batangas and seriously affected the tuba yield in lambanog-producing areas of Laguna and Quezon. The results of our population monitoring activities in Los Baños, Laguna and surrounding areas from 1999-2007 are presented. Population booms during the dry months or long periods without rain and sudden declines after the first few weeks of the rainy season have characterized the trends in the local population levels. However, the occurrence of supertyphoon 'Milenyo' on September 28, 2006 with more than 400 cm rainfall and accompanying strong winds severely affected the local mealybug population such that they have, so far, been limited to small colonies. This does not preclude, nevertheless, the possibility of resurgence when another long period without rain comes. New host plant and locality records are also herein reported, bringing the total number of locally available host plants to 60 species and the Philippine distribution spreading to some parts of Northern, Central and Southern Luzon, Visayas and Mindanao. A few local natural enemies like the brown lacewing (Hemerobiidae) have now been observed but their biology, efficiency and predatory capacity have yet to be studied.

Keywords: buff coconut mealybug, *Nipaeccus nipae*, Pseudococcidae, invasive species

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**BUTTERFLIES (RHOPALOCERA) OF POLILLO ISLAND,
QUEZON PROVINCE, PHILIPPINES**

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The diversity of arthropods of Polillo Island are currently being studied as a contribution to the documentation of the overall biological diversity of the Polillo group of islands as well as the first of projected series of studies of terrestrial arthropod biodiversity in conservation priority areas in the Philippines. This particular portion of the research project focuses on the diversity of butterflies (Lepidoptera: Papilionoidea and Hesperioidea). A total of 117 individuals were observed and/or collected. These belong to 42 species, distributed in seven families, with the family Nymphalidae as the best represented group in terms of number of species and individuals. Papilionidae or the swallowtails, which included three that belong to the birdwing tribe, came next with seven species followed by the Pieridae with six species. In terms of number of individuals, however, pierids were superior to the papilionids. Preliminary analysis indicate a diversity value of (Shannon Index) $H = 3.480$ and $e = 0.912$. For a relatively small area, and with the limited time to observe, such number of species and diversity index are remarkably high.

The most common was the yellow pierid *Eurema hecabe* followed by an undetermined species of lycaenid belonging to *Jamides*. The common birdwing, *Troides rhadamantus*, listed together with the other *Troides* and *Trogonoptera* in CITES Appendix II, can still be found around the edges of the Sibulan watershed and the surrounding thickets of the agricultural areas of Pinaglubayan. The same is true for another endemic butterfly, *Pachliopta mariae almae*. The host plants of these butterflies in the surrounding areas still need to be investigated.

Keywords: butterflies, Rhopalocera, Papilionoidea, Hesperioidea, terrestrial arthropod biodiversity, Polillo island.

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**EFFECTS OF *Chlorella* sp. and *Spirulina* sp. ON SURVIVAL,
GROWTH, AND RESISTANCE OF *Penaeus monodon*
Larvae AGAINST *Vibrio harveyi***

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The study is focused on the effects of *Chlorella* sp. and *Spirulina* sp. on survival, growth, and resistance of *Penaeus monodon* larvae against *Vibrio harveyi*. Two set-ups with five treatments in three replicates were tested. Set-up A consists of *Skeletonema:Chlorella* (Sk:Ch) treatment ratios while set-up B consists of *Skeletonema:Spirulina* (Sk:Sp) treatment ratios. Feeding was initiated at zoea first day (Z₁) stage until the postlarval fifth day (PL₅) stage. Survival and growth were determined at mysis first day (M₁) and postlarval fifth day (PL₅) stages. Growth was measured at M₁ and PL₅. Resistance of larvae was determined in terms of survival at PL₅ after a challenge dose (1.5×10^2 cells/ml) of *V. harveyi* at M₁.

Treatments with *Chlorella:Skeletonema* ratios showed higher percentage survival, growth, and resistance compared to those with pure *Chlorella* sp. and *Skeletonema* sp. Treatments with *Spirulina* sp. showed lower survival and growth but higher resistance.

The results suggest that *Chlorella* sp. can enhance *P.monodon* survival, growth, and resistance. It also has a potential to replace *Skeletonema* as food for *P. monodon* in the earlier stages. *Spirulina* sp. has no significant role in increasing the growth and survival of *P. monodon*, but play a role in resistance against *V. harveyi*.

Keywords: *Chlorella* sp., *Spirulina* sp., *Penaeus monodon*, *Vibrio harveyi*, prawn industry

BSD-45

**A COMPARATIVE STUDY ON THE SUSCEPTIBILITY OF
THREE ERYTHRINA SPECIES TO ERYTHRINA GALL
WASP (*Quadrastichus erythrinae* K.)**

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The study characterized gall infestation of the two species and a variety of *Erythrina* trees by a tiny wasp, *Quadrastichus erythrinae* Kim, which lives in the soft tissues of young leaves and petioles, stimulating gall formation leading to defoliation, dieback and death. All of the species and a variety studied were susceptible to the pest, with *Erythrina variegata* var *orientalis* as the most susceptible, followed by *Erythrina variegata* and *Erythrina crista-galli* as the least susceptible. Average gall size in *E. variegata* var *orientalis* is 10.27mm on petiole and 5.84mm on the leaf; *E. variegata*, 9.87mm and 5.81mm respectively; and in *E. crista-galli*, 5.72 mm and 3.34 mm respectively. All four test plants of *E. variegata* var *orientalis* succumbed to the pest after 90 days; while *E. variegata* remained heavily infested but alive to the end of the experiment. Two of the four test plants of *E. crista-galli* showed light infestation, while the other two were not infested. The egg, larva and pupa stages of *Q. erythrinae* K. are spent inside the gall, ensconced in a chamber as the gall increases progressively in size or coalesce with adjacent galls. Phytochemical analyses showed no differences among infested species and a variety of *Erythrina*. Studies on surviving *Erythrina* trees found in the open are recommended with the end in view of obtaining resistant propagating materials on one hand, while studies on natural enemies of *Q. erythrinae* K. be conducted on the other.

Keywords: *Erythrina*, *Quadrastichus*, gall, phytochemical analyses, infestation

BSD-46

**IDENTIFICATION OF INDICATOR SPECIES FROM
ARTHROPOD COMMUNITIES USING PRINCIPAL
RESPONSE CURVE ANALYSIS**

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Monitoring for secondary ecological effects is part of the responsible stewardship of transgenic crops. Since it is practically impossible to study the response of all the non-target organisms in an arthropod community found in a transgenic crop ecosystem, the use of indicator species for the purpose of monitoring is recommended. The present study was conducted to identify an indicator arthropod species in Bt corn using principal response curve (PRC) analysis. The method was tested by analyzing abundance data from samples taken from arthropod communities in 3 commercial Bt corn farms. An equal number of farms planted with near isoline non-Bt corn served as controls. Affiliation of specific arthropod species and functional groups was identified using ordination plot produced by redundancy (RDA) analysis. Results of the PRC analysis revealed the highest species weight (0.57) for predatory coccinellid beetle, *Micraspis discolor*. RDA ordination plot also showed that *M. discolor* is highly associated with Bt corn. There was no specific functional group association to either Bt- or non-Bt corn. However, there were other predators associated with Bt corn such as the lady beetle *Chilomenes sexmaculatus*, the black cricket *Metioche vittaticolis* and spiders. Among the parasitoids, ichneumonids were highly associated with Bt corn. Braconids and scelionids were affiliated with non-Bt corn. The phytophagous silk beetle *Monolepta bifasciata* and the homopteran *Chanitus* sp. were also highly associated with Bt corn. There was no significant difference ($P=0.452$) in arthropod composition between Bt- and non-Bt corn farms. In conclusion, *Micraspis discolor* could be used as indicator species because it will most likely follow overall arthropod community response to Bt corn.

Keywords: indicator species, *Micraspis discolor*, principal response curve analysis, redundancy analysis, Bt corn

BSD-46

**IDENTIFICATION OF INDICATOR SPECIES FROM
ARTHROPOD COMMUNITIES USING PRINCIPAL
RESPONSE CURVE ANALYSIS**

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Keywords: indicator species, *Micraspis discolor*, principal response curve analysis, redundancy analysis, Bt corn

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**MARINE-DERIVED FUNGI FROM MANILA BAY,
CAVITE AND BATANGAS AS SOURCES OF
ANTIMICROBIAL METABOLITES**

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Several marine *Vibrio* species may cause diseases and damages to animals in aquaculture and to seaweeds in seaweed farms. If not controlled, such infection may result to great economic losses. Fungi from the marine environment could be potential sources of secondary metabolites active against species of *Vibrio*. Thus, our research study aims to isolate marine fungi from seawater and marine sediments and test their inhibitory activities against marine bacteria and standard test microorganisms. Seawater and marine sediments were collected from Manila Bay and nearby surrounding coastal provinces, Cavite and Batangas. Collected samples were spread-plated on Malt Extract Agar (MEAS) supplemented with 33 g/L marine salts, 500 mg/L tetracycline and 300 mg/L streptomycin. Following incubation, we have isolated 74 fungal strains, fourteen of which were grown on MEAS for the production of secondary metabolites and on PDA with or without marine salts for morphocultural characterization. Crude culture filtrates were then tested for their inhibitory activities against pathogenic marine bacteria and other test microorganisms. Metabolites present in the crude culture extracts were detected with different spray reagents using thin layer chromatography. Morphocultural characterization identified most of the isolates as *mycelia sterila*, as the isolates did not produce spores in culture. Several fungal strains grew better in the presence of marine salts. Results also showed that all isolates were active against at least one of the test organisms, e.g. *Vibrio fisheri*, *Aeromonas hydrophila*, *Staphylococcus aureus*, *Mycobacterium phlei*, and *Fusarium oxysporum*. None showed activity against *Vibrio harveyi* and *Escherichia coli*. Finally, detection of secondary metabolites using TLC showed the presence of steroids, sterols and triterpenes on the crude culture extracts.

Keywords: marine fungi, secondary metabolites, antimicrobial activities, bioassay

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**DRYING BEHAVIOR OF PORPHYRA (GAMET) FROM
ABLAN, BURGOS ILOCOS NORTE, NORTHERN
PHILIPPINES USING CONVECTION OVEN**

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This study was conducted to determine the drying behavior of *Porphyra* locally known as “gamet using convection oven as sun drying is the only post harvest practice employed by the gatherers in Ilocos Norte to prolong its shelf life.

Samples of *Porphyra* were gathered from the supra littoral zone of Burgos, Ilocos Norte. Drying curves were used to explain the relationship between moisture content (MC), drying rate and time. The initial MC of the samples was taken prior to the drying process and every hour thereafter until constant weight of samples was attained. The moisture reduction per hour was determined by considering the weight reduction of the samples per unit hour. Three samples were prepared for every temperature level. Drying was done by batch. Each batch was subjected to certain drying temperature (DT). The drying temperatures were 40 °C, 50 °C and 60 °C. Every hour the samples were taken out from the drying oven, placed in a dessicator for ten minutes before taking the weight loss. Drying was done until the weight of the samples was constant for at least two consecutive readings.

Results showed that *Porphyra* has reduced MC from 38% to 17%. Drying time and moisture loss was highly significant with $R^2 = 0.97$ of samples dried at 40 °C. The data were fitted to the exponential model. This model proved to have good prediction capability on oven dried *Porphyra*.

The study proved that the higher the DT, the higher is the rate of MC reduction. Conversely, the lower the DT, the higher is the correlation coefficient. These results imply that *Porphyra* should be dried at 40 °C for safer storage and better product quality for a longer shelf life than those dried under the sun.

Keywords: *Porphyra*, supra-littoral zone, convection oven, moisture content, drying behavior, drying curve

BSD-50

THE EFFECT OF PREPARED DIET ON THE SOMATIC AND GONAD GROWTH PERFORMANCE OF THE SEA URCHIN *Tripneustes gratilla* (LINNAEUS, 1758)

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Somatic growth (wet weight and equatorial and polar test diameters), gonad growth (gonadosomatic index) and gonad quality (color and granularity) of the sea urchin *T. gratilla* fed prepared diets were studied *in vitro* using plastic basins from February to June 2006. The study consisted of three treatments, replicated thrice and arranged in CRD as follows: I-Fresh *Sargassum sp.* (control), II-Dried pellets, and III-Fresh Extruded pellets. The dried and fresh extruded pellets were mainly of *Sargassum sp.* With 6.0% binder (corn starch and gelatin).

No significant variations were observed in the somatic growth of *T. gratilla* among the different feeding treatments. Highest growth rates were observed during the first culture month decreasing towards the end of the study. The fresh natural food gave better gonadosomatic index and gonad color than the prepared diets but not for granularity. However, in a follow-up study (Asia, 2006) to optimize feed ration of the organisms, the effect of natural food and prepared *Sargassum sp.* Diet (at 4.0 to 5.0% BW/day feeding ration) on gonadosomatic index and gonad color were comparable ($p < 0.05$). First spawning was observed at about 1.5 culture months. Observed water parameters were within the favorable ranges for growth and survival of *T. gratilla*.

The successful introduction of prepared diets from *T. gratilla* opens the possibility of incorporating gonad color enhancers such as carotenoids in the diet that improved the quality of the organism for market consumption. This necessitates further studies specifically using locally available pigment sources like tomato and squash. The study likewise demonstrated the viability of land-based culture of the organism using both the fresh natural food and prepared diets. This will be important in sustaining a year-round harvest and possible broodstock source for hatchery and seed stock production.

Keywords: *Tripneustes gratilla*, prepared diet, somatic growth, gonad growth and quality

BSD-51

**STOCK ASSESSMENT OF SHALLOW WATER
HOLOTHURIA IN CAMOTES ISLANDS, CEBU,
PHILIPPINES: BASIS FOR A PROPOSED
CONSERVATION AND MANAGEMENT PLAN**

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Sea cucumbers of Camotes Islands were studied. Thirty-six coastal barangays were assessed, 10 in Poro; 10 in San Francisco; eleven in Pilar and five in Tudela, Cebu. Day and night assessments were done using transect-quadrat method. Three transects were laid in the tidal area of each barangay up to 3m depth of water. Meristic and morphometric measurements and identification of the collected *Holothuria* and other associated species were done.

Results showed that there were twenty species of *holothuria* found throughout Camotes Islands and 16 were identified and 4 were unidentified. *Bat Pisor* (unidentified *Holothuria*) has the highest frequency of 250 pieces during the day assessment and *Bat Marcos* (*Stichopus hermanni*) during the night assessment with 18 pieces. *Pearsonothuria graeffei* has the lowest frequency (1) during day assessment and *Actinopyga lecanora*, *Holothuria atra*, *Pearsonothuria graeffei* and *Bat Otan-otan* during night assessment (1).

Holothuria pulla has the highest weight (175-225 grams) both in day and night assessment. *Euapta godeffroyi* has the lowest in weight (13 g.) during the day assessment and *Actinopyga lecanora* is lowest during the night assessment (8g). The species which ranked first for the highest in length is *Euapta godeffroyi* (30-43 cm) both night and day assessment and the lowest is *Holothuria nobilis* (6cm).

Results further showed that there are 13 common species of *holothuria* found in the four municipalities which are: *Bohadschia marmorata*, *Holothuria pulla*, *Holothuria scabra*, *Holothuria impatiens*, *Stichopus hermanni*, *Euapta godeffroyi*, *Bohadschia paradoxa*, *Stichopus horrens*, *Balat kagiron*, *Balat Langgi-langgi*, *Holothuria fuscopunctata*, *Stichopus variegatus* and *Stichopus sp.*

The most diverse municipality is San Francisco; Cebu which has 18 species followed by Poro (15); Pilar (14) and Tudela (13). For the distinct species, *Holothuria rigida* is found only in San Francisco, Cebu followed by *Pearsonothuria graeffei* (in Tudela and Pilar);

Keywords: Stock Assessment, *Holothuria*, Camotes Islands, Conservation

BSD-52

**ANURAN SPECIES COMPOSITION, DISTRIBUTION, AND
CONSERVATION STATUS IN MT. SAMBILIKAN, DIWATA
RANGE, AGUSAN DEL SUR**

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Mt. Sambilikan, Diwata range is a part of the country's key conservation sites and Important Bird Areas (IBA). Diversity, distribution including microhabitat preferences, and conservation status of its anurans, being biological indicators of disturbance, were determined. The area was assessed using visual encounter survey and pitfall trapping from October 21 to November 22, 2006 in three elevation gradients (670-1,050masl) with corresponding vegetation types: mixed lowland dipterocarp (1), mixed primary-secondary (2), and upper montane-mossy forest (3). Diet and endoparasite of the endemic *Rana grandocula* and non-endemic *Limnonectes magnus* were noted through digestive tract examination of voucher specimens.

Twenty-one species (four families and 14 genera) were recorded with 12 (57%) endemic and eight (38%) threatened. Highest species richness ($R=15$), species diversity ($H'=2.409$), and evenness ($E=0.742$) in site 2 confirm disturbance and altitude to limit frog species distribution. Microhabitat preferences revealed that majority of the anurans were terrestrial, burrowers, or amphibious species (type IV). Three species were found to be economically important as food. Diet and endoparasite examination of *L. magnus* and *R. grandocula* depict the frogs' high dependence on invertebrate fauna especially of the order Orthoptera, niche overlap, possible competition between endemic and non-endemic species, and the importance of both species as intermediate hosts to cestodes and nematodes. Unsustainable hunting and habitat loss through conversion of forest fragments into abaca and Falcata plantations appear to be the major threats in the area.

Mt. Sambilikan although disturbed, still harbors forest-dependent, endemic, and threatened anuran species. Unfortunately, a high probability of risk exists if present rates of forest destruction and unsustainable community practices continue. A pressing need to create holistic conservation mechanisms, with the involvement of the local community, to effectively protect and possibly connect last fragments of habitats of the local biodiversity, is crucial for the survival of these endemic and threatened species.

Keywords: anuran diversity, environmental health, biodiversity loss, conservation

BSD-43

**BUTTERFLIES (RHOPALOCERA) OF POLILLO ISLAND,
QUEZON PROVINCE, PHILIPPINES**

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The diversity of arthropods of Polillo Island are currently being studied as a contribution to the documentation of the overall biological diversity of the Polillo group of islands as well as the first of projected series of studies of terrestrial arthropod biodiversity in conservation priority areas in the Philippines. This particular portion of the research project focuses on the diversity of butterflies (Lepidoptera: Papilionoidea and Hesperioidea). A total of 117 individuals were observed and/or collected. These belong to 42 species, distributed in seven families, with the family Nymphalidae as the best represented group in terms of number of species and individuals. Papilionidae or the swallowtails, which included three that belong to the birdwing tribe, came next with seven species followed by the Pieridae with six species. In terms of number of individuals, however, pierids were superior to the papilionids. Preliminary analysis indicate a diversity value of (Shannon Index) $H = 3.480$ and $e = 0.912$. For a relatively small area, and with the limited time to observe, such number of species and diversity index are remarkably high.

The most common was the yellow pierid *Eurema hecabe* followed by an undetermined species of lycaenid belonging to *Jamides*. The common birdwing, *Troides rhadamantus*, listed together with the other *Troides* and *Trogonoptera* in CITES Appendix II, can still be found around the edges of the Sibulan watershed and the surrounding thickets of the agricultural areas of Pinaglubayan. The same is true for another endemic butterfly, *Pachliopta mariae almae*. The host plants of these butterflies in the surrounding areas still need to be investigated.

Keywords: butterflies, Rhopalocera, Papilionoidea, Hesperioidea, terrestrial arthropod biodiversity, Polillo island.

BSD-44

EFFECTS OF *Chlorella* sp. and *Spirulina* sp. ON SURVIVAL, GROWTH, AND RESISTANCE OF *Penaeus monodon* Larvae AGAINST *Vibrio harveyi*

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The study is focused on the effects of *Chlorella* sp. and *Spirulina* sp. on survival, growth, and resistance of *Penaeus monodon* larvae against *Vibrio harveyi*. Two set-ups with five treatments in three replicates were tested. Set-up A consists of *Skeletonema:Chlorella* (Sk:Ch) treatment ratios while set-up B consists of *Skeletonema:Spirulina* (Sk:Sp) treatment ratios. Feeding was initiated at zoea first day (Z₁) stage until the postlarval fifth day (PL₅) stage. Survival and growth were determined at mysis first day (M₁) and postlarval fifth day (PL₅) stages. Growth was measured at M₁ and PL₅. Resistance of larvae was determined in terms of survival at PL₅ after a challenge dose (1.5×10^7 cells/ml) of *V. harveyi* at M₁.

Treatments with *Chlorella:Skeletonema* ratios showed higher percentage survival, growth, and resistance compared to those with pure *Chlorella* sp. and *Skeletonema* sp. Treatments with *Spirulina* sp. showed lower survival and growth but higher resistance.

The results suggest that *Chlorella* sp. can enhance *P.monodon* survival, growth, and resistance. It also has a potential to replace *Skeletonema* as food for *P. monodon* in the earlier stages. *Spirulina* sp. has no significant role in increasing the growth and survival of *P. monodon*, but play a role in resistance against *V. harveyi*.

Keywords: *Chlorella* sp., *Spirulina* sp., *Penaeus monodon*, *Vibrio harveyi*, prawn industry

BSD-45

**A COMPARATIVE STUDY ON THE SUSCEPTIBILITY OF
THREE ERYTHRINA SPECIES TO ERYTHRINA GALL
WASP (*Quadrastichus erythrinae* K.)**

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The study characterized gall infestation of the two species and a variety of *Erythrina* trees by a tiny wasp, *Quadrastichus erythrinae* Kim, which lives in the soft tissues of young leaves and petioles, stimulating gall formation leading to defoliation, dieback and death. All of the species and a variety studied were susceptible to the pest, with *Erythrina variegata* var *orientalis* as the most susceptible, followed by *Erythrina variegata* and *Erythrina crista-galli* as the least susceptible. Average gall size in *E. variegata* var *orientalis* is 10.27mm on petiole and 5.84mm on the leaf; *E. variegata*, 9.87mm and 5.81mm respectively; and in *E. crista-galli*, 5.72 mm and 3.34 mm respectively. All four test plants of *E. variegata* var *orientalis* succumbed to the pest after 90 days; while *E. variegata* remained heavily infested but alive to the end of the experiment. Two of the four test plants of *E. crista-galli* showed light infestation, while the other two were not infested. The egg, larva and pupa stages of *Q. erythrinae* K. are spent inside the gall, ensconced in a chamber as the gall increases progressively in size or coalesce with adjacent galls. Phytochemical analyses showed no differences among infested species and a variety of *Erythrina*. Studies on surviving *Erythrina* trees found in the open are recommended with the end in view of obtaining resistant propagating materials on one hand, while studies on natural enemies of *Q. erythrinae* K. be conducted on the other.

Keywords: *Erythrina*, *Quadrastichus*, gall, phytochemical analyses, infestation

BSD-46

**IDENTIFICATION OF INDICATOR SPECIES FROM
ARTHROPOD COMMUNITIES USING PRINCIPAL
RESPONSE CURVE ANALYSIS**

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Monitoring for secondary ecological effects is part of the responsible stewardship of transgenic crops. Since it is practically impossible to study the response of all the non-target organisms in an arthropod community found in a transgenic crop ecosystem, the use of indicator species for the purpose of monitoring is recommended. The present study was conducted to identify an indicator arthropod species in Bt corn using principal response curve (PRC) analysis. The method was tested by analyzing abundance data from samples taken from arthropod communities in 3 commercial Bt corn farms. An equal number of farms planted with near isoline non-Bt corn served as controls. Affiliation of specific arthropod species and functional groups was identified using ordination plot produced by redundancy (RDA) analysis. Results of the PRC analysis revealed the highest species weight (0.57) for predatory coccinellid beetle, *Micraspis discolor*. RDA ordination plot also showed that *M. discolor* is highly associated with Bt corn. There was no specific functional group association to either Bt- or non-Bt corn. However, there were other predators associated with Bt corn such as the lady beetle *Chilomenes sexmaculatus*, the black cricket *Metioche vittaticolis* and spiders. Among the parasitoids, ichneumonids were highly associated with Bt corn. Braconids and scelionids were affiliated with non-Bt corn. The phytophagous silk beetle *Monolepta bifasciata* and the homopteran *Chanitus* sp. were also highly associated with Bt corn. There was no significant difference ($P=0.452$) in arthropod composition between Bt- and non-Bt corn farms. In conclusion, *Micraspis discolor* could be used as indicator species because it will most likely follow overall arthropod community response to Bt corn.

Keywords: indicator species, *Micraspis discolor*, principal response curve analysis, redundancy analysis, Bt corn

BSD-47

**CLIMATE CHANGE IMPACT ON THE PEST STATUS
OF SMALL ISLANDS:
THE FUGA ISLAND EXPERIENCE**

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Climate change can greatly affect the pest status of small islands such as Fuga Island in the Babuyan Channel in Northern Luzon. The lack of rainfall from November 2006 led to an outbreak of migratory locust, *Locusta migratoria manilensis* Meyen on January 2007 in the island. Rice and corn were attacked. Later a similar population build-up occurred in July 2007. We did a volunteer work in this island on July 31 up to August 2, 2007 thru lectures and field practicum on how to cope up with changing pest status not only of explosive pest like the migratory locust but also the other pest that attack their crops. We also brought with us the green muscardine fungi, *Metarhizium anisopliae* to check the new population build up. This condition in Fuga Island is a repeat of the aftermath of Mt. Pinatubo eruption. There were few remaining green vegetations during that time due to ash fall. This favorable environment which is akin to the effect of drought brought about by the climate change favors the rapid population build up of explosive pest like the migratory locust in Fuga Island. We also observed this phenomenon from 1998-2003 in the islands of Masbate, Romblon, Negros and also in La Union last year.

It is imperative that mitigating measures should be formulated now together with the affected populace particularly in resource challenged islands like the Fuga Island. Early warning system should be put in place for droughts or even extreme rainfalls. Islanders should likewise be informed on the detection and management of explosive pests during dry and warm periods due to climate change.

Keywords: Climate change, Fuga Island, migratory locust, pest, small islands, Mt. Pinatubo, drought.

BSD-48

**MARINE-DERIVED FUNGI FROM MANILA BAY,
CAVITE AND BATANGAS AS SOURCES OF
ANTIMICROBIAL METABOLITES**

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Several marine *Vibrio* species may cause diseases and damages to animals in aquaculture and to seaweeds in seaweed farms. If not controlled, such infection may result to great economic losses. Fungi from the marine environment could be potential sources of secondary metabolites active against species of *Vibrio*. Thus, our research study aims to isolate marine fungi from seawater and marine sediments and test their inhibitory activities against marine bacteria and standard test microorganisms. Seawater and marine sediments were collected from Manila Bay and nearby surrounding coastal provinces, Cavite and Batangas. Collected samples were spread-plated on Malt Extract Agar (MEAS) supplemented with 33 g/L marine salts, 500 mg/L tetracycline and 300 mg/L streptomycin. Following incubation, we have isolated 74 fungal strains, fourteen of which were grown on MEAS for the production of secondary metabolites and on PDA with or without marine salts for morphocultural characterization. Crude culture filtrates were then tested for their inhibitory activities against pathogenic marine bacteria and other test microorganisms. Metabolites present in the crude culture extracts were detected with different spray reagents using thin layer chromatography. Morphocultural characterization identified most of the isolates as *mycelia sterila*, as the isolates did not produce spores in culture. Several fungal strains grew better in the presence of marine salts. Results also showed that all isolates were active against at least one of the test organisms, e.g. *Vibrio fisheri*, *Aeromonas hydrophila*, *Staphylococcus aureus*, *Mycobacterium phlei*, and *Fusarium oxysporum*. None showed activity against *Vibrio harveyi* and *Escherichia coli*. Finally, detection of secondary metabolites using TLC showed the presence of steroids, sterols and triterpenes on the crude culture extracts.

Keywords: marine fungi, secondary metabolites, antimicrobial activities, bioassay

BSD-49

**DRYING BEHAVIOR OF PORPHYRA (GAMET) FROM
ABLAN, BURGOS ILOCOS NORTE, NORTHERN
PHILIPPINES USING CONVECTION OVEN**

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This study was conducted to determine the drying behavior of *Porphyra* locally known as “gamet using convection oven as sun drying is the only post harvest practice employed by the gatherers in Ilocos Norte to prolong its shelf life.

Samples of *Porphyra* were gathered from the supra littoral zone of Burgos, Ilocos Norte. Drying curves were used to explain the relationship between moisture content (MC), drying rate and time. The initial MC of the samples was taken prior to the drying process and every hour thereafter until constant weight of samples was attained. The moisture reduction per hour was determined by considering the weight reduction of the samples per unit hour. Three samples were prepared for every temperature level. Drying was done by batch. Each batch was subjected to certain drying temperature (DT). The drying temperatures were 40 °C, 50 °C and 60 °C. Every hour the samples were taken out from the drying oven, placed in a dessicator for ten minutes before taking the weight loss. Drying was done until the weight of the samples was constant for at least two consecutive readings.

Results showed that *Porphyra* has reduced MC from 38% to 17%. Drying time and moisture loss was highly significant with $R^2 = 0.97$ of samples dried at 40 °C. The data were fitted to the exponential model. This model proved to have good prediction capability on oven dried *Porphyra*.

The study proved that the higher the DT, the higher is the rate of MC reduction. Conversely, the lower the DT, the higher is the correlation coefficient. These results imply that *Porphyra* should be dried at 40 °C for safer storage and better product quality for a longer shelf life than those dried under the sun.

Keywords: *Porphyra*, supra-littoral zone, convection oven, moisture content, drying behavior, drying curve

BSD-50

THE EFFECT OF PREPARED DIET ON THE SOMATIC AND GONAD GROWTH PERFORMANCE OF THE SEA URCHIN *Tripneustes gratilla* (LINNAEUS, 1758)

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Keywords: anuran diversity, environmental health, biodiversity loss, conservation

BSD-53

**A PRELIMINARY SURVEY ON THE AVIFAUNA AND
HERPETOFAUNA OF ANIBONG, JORDAN, MT.
PANGASUGAN RANGE, LEYTE**

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Avifaunal and herpetofaunal species diversity and distribution in Anibong, Jordan, Mt. Pangasugan range were determined. Eight study sites with different habitat types were chosen and assessed. Sampling was done on April 21-May 1, 2006 using visual encounter method, pitfall trapping for herps, mist-netting and Mackinnon's species listing for birds. Fifty-one avifaunal species belonging to 27 families and 44 genera were recorded, of which, 44 species (86%) were found to be endemic. Seventeen herpetofaunal species belonging to six families (Ranidae, Rhacophoridae, Agamidae, Scincidae, Colubridae, Viperidae) were identified with eight (47%) endemics. Four threatened species were recorded. One Anuran, *Limnonectes magnus* (near-threatened), and three bird species namely, *Penelopides panini* (endangered species), *Buceros hydrocorax* (near threatened) and *Coracina mindanensis* (vulnerable). This shows that though the area is generally slightly disturbed, it still serves as an important habitat to endemic and threatened species which are very vulnerable to environmental stressors. Habitat loss as forest fragments are converted into Abaca plantations, Illegal and unsustainable harvesting of resources and wildlife trade stand as grave threats to the local diversity. It is imperative that a more thorough study be conducted to assess sustainable conservation measures that may be applicable for the area, considering that it may be one of the few remaining natural habitats of these endemic species.

Keywords: avifauna, herpetofauna, diversity, environmental threats, biodiversity loss

BSD-55

**AN IMPROVED EXON-INTRON RECOGNITION
VIA A COMMITTEE OF MACHINES**

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The human genome consists of a sequence of gene base pairs that generate proteins called exons. Exons are bounded by subsequences, called introns, that are spliced out prior to translation. In RNA splicing, the current procedure followed by researchers to recognize the gene boundaries is the GU-AG heuristic which has the following motif: exon/GU-intron-AG/exon. However, this motif occurs so frequently that a typical intron will contain several GUs and AGs within it, resulting in many false boundaries being recognized. Several methodologies to automate the recognition of these sites have been employed by other researchers, such as support vector machines, hidden Markov models, and artificial neural networks (ANN), where the reported maximum recognition accuracy on a production set is only 81%. A production set is a set of DNA sequences whose intron-exon boundaries are known but where not used in the development of the model. A committee of machines is a computational methodology where the output of multiple models are combined into a single output. The member models' output are combined using several methodologies such as averaging, boosting, bagging and simple majority voting. It has been shown, both theoretically and empirically, that the output of the committee machine is superior to those of its constituent member models. In this effort, we developed a committee of neural network classifiers trained to classify whether a given 60bp long DNA sequence is an intron-exon (IE) boundary (acceptor site), an exon-intron (EI) boundary (donor site), or not (N). Using the same production set used by other researchers, our committee machine was able to recognize 84% of the DNA sequences, improving the recognition rate by 3%.

Keywords: intron, exon, committee machines, machine recognition

BSD-56

**Mitochondrial DNA typing of
Human Bone Samples for Forensic Applications**

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Mitochondrial DNA (mtDNA) is characterized by low molecular weight and high copy number, making mtDNA suitable for typing biological samples in forensic cases where evidence has been exposed to harsh environmental conditions for prolonged periods. MtDNA sequencing has therefore been used to analyze highly degraded remains e.g. disaster victim identification and may yield additional information when conventional DNA testing techniques, such as autosomal Short Tandem Repeat (aSTR) typing, fail to produce informative results. However, the success of different typing techniques performed on human remains varies as a result of the condition of the samples, and therefore procedures for mtDNA typing of degraded human remains should be validated prior to use in Philippine casework.

Human bone samples (n=4) exhumed three to six months after burial were processed using validated DNA extraction procedures. DNA was typed at aSTR markers and sequenced at the mtDNA Hypervariable Regions (HVR) I and II. Nuclear DNA was amplified using the COFiler[®] multiplex system. PCR amplification of mtDNA was likewise tested with combinations of primers designed to produce amplicons 1) covering the *entirety* of Hypervariable Regions (HVR) I and II (1000, 800 and 400 bp in length) and 2) short stretches (approximately 200 bp in length) *within* the HVR I and II. Amplicons were sequenced using Big Dye Terminator technology.

Analysis showed that while samples buried up to six months yielded aSTR profiles, the results showed allelic and locus dropout, which could lead to loss of information and a reduction in the discriminating power of DNA testing. MtDNA typing results showed that PCR products as long as 800bp could be amplified from bones buried up to six months.

Keywords: DNA typing, identification, mtDNA sequencing

BSD-57

ACUTE AND REPEATED SEPARATIONS ALTER THE DENSITY OF ASTROCYTES IN THE PREFRONTAL CORTEX

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Astrocytes, once considered as merely supporting cells in the brain by only assisting neuronal functions are now implicated to play crucial roles in neuronal migration, establishment and maturation of synaptic contacts during the early development. Relatively, only few reports have shown the influence of neonatal environment on glial plasticity in the medial prefrontal cortex (mPFC), the region that processes, integrates and evaluates memories of learning and experiences. Thus, the impact of separation from the family was investigated on astrocytes of *Octodon degus* pups during the first three postnatal weeks, the critical period for synaptic plasticity in rodents. The expressions of two astrocyte proteins, S100 β and GFAP (glial fibrillary acidic protein) were used to determine the impact between: control, n=5 (CON): undisturbed in the home cage from postnatal day (PND) 1-21; acute separation (AS), n=6: 6-hr separation on PND 21; and repeated separation, n=6 (RS): 1 hr/day separation from PND 1-21. The density of S100 β and GFAP-positive astrocytes was quantified in the subregions of the mPFC namely: anterior cingulate (ACd), precentral medial (PrCm), prelimbic (PL) and infralimbic (IL) cortices. The somatosensory cortex (SSC) was used as a nonlimbic control region. Both acute and repeated neonatal separations altered the density of S100 β and GFAP-positive astrocytes in the mPFC showing increases in S100 β -positive astrocytes in a region and layer-specific manner but decreases in GFAP-positive counterparts. In the SSC, acute separation did not affect the S100 β -positive astrocytes but increased the GFAP-positive counterparts. Taking these findings together, the separation-induced alterations may have consequences in neuron-glia interaction thereby affecting the participation of astrocytes in modulating the synaptic plasticity particularly during the early period of postnatal development. These findings also provide evidence of uniqueness in spatial and temporal specificity of glial response towards a particular environmental stimulation.

Keywords: astrocyte, glia, GFAP, medial prefrontal cortex, S100 β , separations

BSD-58

**COMPARATIVE STUDY OF THE UTILITY OF ABO
BLOOD-TYPING VS DNA ANALYSIS
FOR PATERNITY TESTING**

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DNA typing is the most accurate method in evaluating disputed parentage issues. However, it has been argued that given the current high cost of DNA-based paternity testing, conventional ABO blood-typing should be utilized as an initial screen prior to DNA-based testing. It is thus important to determine the effectiveness of ABO blood typing in determining paternity in comparison with a DNA-based paternity test.

A study of 53 paternity trios was conducted by the UP-NSRI DNA Analysis Laboratory from 2006 - March 2008. Each trio was subjected to DNA testing using 15 Short Tandem Repeat DNA markers and to conventional ABO blood typing. Paternity evaluations using the two methods were then compared.

Only 3 out of 53 alleged fathers (5.66%) could be excluded as being the biological father of the child using ABO blood typing. The remaining 50 alleged fathers could not be excluded as the biological father of the child.

Interestingly, while all 3 ABO paternity exclusions were also excluded using DNA testing, 12 of the alleged fathers that could not be excluded based on ABO testing were excluded by a minimum of 6 STR markers using DNA testing. The remaining 38 alleged fathers (71.69%) were included as the biological father of the child with probabilities of paternity ranging from 99.96% to as high as 99.999999%.

Given these figures, the usefulness of conventional ABO blood-typing for paternity testing is limited and is no longer cost-effective. We recommend the use of autosomal STR DNA typing for evaluations of disputed parentage cases in the Philippines.

Keywords: paternity testing, DNA, ABO blood-typing, probability of paternity, STR markers, paternity exclusion, paternity inclusion

BSD-59

A SACCHARINE SUBSTRATE-PREFERRING ZYMOMONAS STRAIN AND ITS GENETIC FINGERPRINTING USING ITS-PCR AND RAPD-PCR

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A local *Zymomonas* isolate (PNCM 1832) was found to preferably utilize brown sugar and molasses than glucose. It was subjected to preliminary DNA fingerprinting tests in comparison with two type culture strains of *Zymomonas mobilis* (1003 and 1004) and two other putative *Zymomonas mobilis* isolates (PNCM 1229 and 1231). Intergenic 16S-23S Transcribed Spacer (ITS) forward and reverse primers and five Random Amplified Polymorphic DNA (RAPD) arbitrary primers were used in Polymerase Chain Reaction (PCR) assays. Results of ITS-PCR experiment showed perfectly similar bands generated by *Z. mobilis* 1003 and 1004 with PNCM 1229 and 1231. On the other hand, PNCM 1832 was different by one major band. Composite Winboot analysis and cluster analysis by the Unweighted Pair-Group Method with Arithmetic Average (UPGMA) of the RAPD-PCR amplicons generated was done. The consensus phylogenetic tree showed that for most primers used, the strains can be grouped together, suggesting that they are genetically related, i.e. belonging to the same genera. However, in all RAPD-PCR results, PNCM 1832 was the least phylogenetically related which could have some bearing on its increased utilization of saccharine substrates that may be relevant in bio-ethanol production. Preliminary batch fermentation trials by *Zymomonas* sp. PNCM 1832 using 20% brown sugar as substrate in a 4-L bench top fermentor gave 7.19% (v/v) ethanol at 87% sugar utilization. However, fermentation efficiency was only 51%, suggestive of the production of metabolites other than ethanol.

Keywords: *Zymomonas mobilis*, winboot, amplicons

**CHEMICAL, MATHEMATICAL AND PHYSICAL SCIENCES
DIVISION**

CMPSD-1

**A STUDY ON THE COMBUSTION CHARACTERISTICS
OF EMULSIFIED WATER BLEND
IN DIESEL FUEL OIL IN INTERNAL
AND EXTERNAL COMBUSTION ENGINES**

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The Philippine government now is facing a tremendous challenge due to the continued rise of petroleum fuel cost. Concerned government agencies are joining hand in hand to find alternative solutions to this energy challenge. In fact, they already have conducted several summits and conferences that directly addressed this energy as well as environmental concern. As a response to the challenge of the world oil crisis, a study has come out which deals with the combination of diesel/bunker fuel, water and additive which was invented to make a smooth and compatible ionization effect in blending of fuel with H₂O.

This research project was about an emulsified water blend in diesel fuel, mixed with diesel oil and fuel oil (bunker "C" or BFO3 and low sulfur fuel oil or LSFO). It allows the two fuels (diesel and fuel oils) to absorb water and form long-term stable hydro-oil fuel blends. When burned in a compression ignition (CI) diesel engine or fired in a steam boiler, it will result in higher energy efficiency and lower emissions.

The objective of the project is to have energy and fuel cost savings without suffering of its quality and to reduce emissions inline with the Clean Air Act.

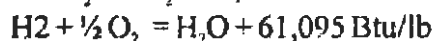
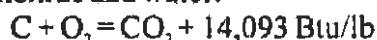
The product has use as a water emulsion fuel in combustion for different applications:

- (1) Stationary diesel engines and dual-fired boilers used in various commercial establishments (hotels, restaurants, spas, food outlets).
- (2) Transport (marine).
- (3) Industry and manufacturing (food, liquors, textiles, paper).
- (4) Power generation.
- (5) Fuel substitute for conventional diesel and high/low sulfur bunker fuel oil.

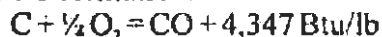
The following are the results of several experiments and testing done in this project:

Improved combustion efficiency of fuel by enhancing complete atomization of liquid fuel droplets to facilitate chemical reaction between the

carbon and hydrogen molecules with oxygen molecules to completion as carbon dioxide and water:



- Eliminates or minimizes incomplete combustion that results in energy loss, e.g. CO formation:



- With higher combustion efficiency, the resulting water addition also provides additional mass to the exhaust gas to provide greater heat transfer to boiler tubes or greater power transfer to piston of CI engines
- Higher energy efficiency means more kg steam or kWh of electricity per Liter of pure oil consumed.
- It also results in lower pollutant emissions of sulfur (as g SO₂) and carbon (as kg CO₂) per Liter of fuel.
- Pollutant concentrations (as % by volume or ppm by volume) are also lowered with the greater flue gas mass arising from water addition.

Keywords: emulsified water, combustion efficiency, sulfur dioxide, carbon monoxide and internal combustion engines.

CMPSD-2

SUPERCAPACITORS FROM NATURAL MATERIALS

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Researches today address the energy-depletion problem in the world by producing supercapacitors, devices that store extremely high amount of energy and discharge that energy at rates demanded by the specific application. The energy storage in supercapacitors is by static charge unlike in the electrochemical process that is used in the battery. This gives the supercapacitor advantageous properties, such as long cycle life, allowing it to be reused up to millions of times, and low impedance along with simple and rapid charging.

Here, pyrolytic carbons from seaweed polysaccharides (carrageenans, alginates, agar), banana fibers, and coconut fibers were synthesized and later used as electrode materials for supercapacitors. Chemical activation of the fibers using 10% ZnCl₂ or 10% KOH solutions was done to increase the surface area of the

carbonized materials, whereas no further chemical activation was done on the polysaccharides. Characterization of the samples included infrared spectroscopy, scanning electron microscopy, and BET surface area measurements.

Yields of the carbon materials were up to 72.4% for the polysaccharides, 27.6 % for banana and 55.6 % for coconut. Infrared spectra of the materials reveal functional chemical groups that are known to contribute to pseudocapacitance. The surface area obtained for carbon activated by KOH (banana, 40 m²/g; coconut, 124 m²/g) was higher than that for ZnCl₂ (banana, 18 m²/g; coconut, 68 m²/g) for both types of fibers, which in turn are much higher than the control or untreated fibers (banana, 8 m²/g; coconut, 3 m²/g). The surface area of the carbons from polysaccharides (416 to 551 m²/g) are higher than from the banana and coconut fibers.

In turn, supercapacitor electrodes from the carbonized materials were fabricated, and these were tested by cyclic voltammetry (CV), and galvanostatic and constant power cycling (GC/CPC) using a home-built apparatus. The CV results indicate supercapacitive properties yielding a range of specific capacitances from 1.32 to 69.6 F/g for the fibers and 1.1 to 21.3 F/g for the polysaccharides. The GC/CPC for a sandwich-type electrode yielded a range of specific capacitances of 0.73 to 1.96 F/g for the fibers and 0.55 to 2.56 F/g for the polysaccharides at the current load of 1 mA and power level of 1.0 mW. These correspond to energy and power densities ranging from 0.02 to 0.73 Wh/kg and 0.15 to 0.70 kW/kg, respectively.

Keywords: supercapacitor, banana fiber, coconut fiber, carrageenan

CMPSD-3

DEVELOPMENT OF THIRD GENERATION SOLAR

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Rising costs of fuel from petroleum have increased the demand for solar cells, although the commonly available silicon-based ones remain to be prohibitively expensive for consumers. Dye-sensitized solar cells (DSSCs) are third-generation photovoltaic devices that use photosensitization of wide band gap titanium oxide nanoparticles; they offer a promising alternative to the conventional solar cell due to its great potential for low cost production making them competitive on a low cost-to-efficiency ratio. The key concerns of DSSC research include the

improvement of device performance and stability, and energy conversion efficiencies.

Here, studies on DSSC based on nanoparticles of TiO₂ (anatase) were done with the following objectives: (1) to increase the absorption band of the dye sensitizer by addition of metal ions onto crude anthocyanin extracts from *duhat* and red cabbage, (2) to diminish evaporation of the redox couple by addition of a carrageenan matrix to form a gel electrolyte, and (3) to prevent leakage of the liquid electrolyte by encapsulating the device using a silicone-based sealant.

Additions of Sn²⁺, Cr³⁺ and Fe³⁺ showed increased absorption bands in comparison to those of the crude anthocyanin extracts. The addition of Cr³⁺ to the *duhat* dye increased the performance of the crude *duhat* dye as a sensitizer. It has also been found out that the crude *duhat* dye performed better than the *duhat* dye with Fe³⁺ ions.

Gel electrolytes consisting of a liquid iodide solution in a carrageenan matrix were prepared and incorporated into DSSC prototypes. Addition of carrageenan significantly increased the conductivity of the electrolyte system. There was no apparent improvement of device performance in terms of photovoltage, although the polymer matrix diminished the evaporation of the I⁻/I₃⁻ redox couple, thereby improving device stability over time.

A commercial silicone sealant was used to encapsulate all sides a prototype DSSC device, ensuring that no leaks are present and the conductive sides of the device are not covered. The compatibility of the silicone sealant to the type of electrolyte solution was determined pointing to a KI/ethylene glycol electrolyte solution as most suitable. DSSC's made from 1 cm² electrodes generate about 0.350 mV under a halogen-lamp at 633 W/m² illumination. Prototype 1-cm² DSSC cells connected in series that produce a 1.2 V output was demonstrated to run a low-power digital device such as a digital clock.

Keywords: dye-sensitized solar cell, third generation solar cell, anthocyanins, carrageenan gel electrolyte

CMPSD-4

PHYSICOCHEMICAL AND FUNCTIONAL CHARACTERISTICS OF COCOSIN AND ITS UNIQUE EMULSIFYING BEHAVIOR

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The coconut is mainly cultivated as an oilseed source. It is widely distributed and abundant all year round in the Philippines. Aside from supplying oil, the endosperm is also rich in proteins. However, the coconut proteins are not utilized extensively as a source of proteins for animal and human consumption. The major coconut protein in the endosperm is the 11S globulin or cocosin.

Cocosin was purified by a combination of salt extraction, selective precipitation and gel filtration chromatography. The total globulins were composed of 73% 11S and 27% 7S. Cocosin was more soluble at different pH at high ionic strength than at low ionic strength. The 24 and 21 kD basic polypeptides of cocosin were more resistant to digestion with chymotrypsin than the 35 and 32 kD acidic polypeptide. Cocosin emulsions were most stable at 0 M NaCl, followed by emulsions in 0.1 and 0.4 M NaCl. The available SH groups of cocosin were found to be 21.6 mole SH/mole cocosin. The thermal denaturation midpoint temperature, T_m , of the trimeric cocosin was 77.6 °C while that of the hexameric form was 100.5 °C. The percentage secondary structures of cocosin are 15.0% regular helix, 12.9% distorted helix, 10.3% regular β -strand, 11.0% distorted β -strand, 23.0% turns, and 29.0% unordered structures.

The physicochemical properties of cocosin were found to be comparable with the other 11S globulins like the soybean and pea globulins. Hence, cocosin may be used as a potential ingredient for processed foods. Moreover, the ability of cocosin to produce stable emulsions in the absence of salt is unique and could be the basis for developing new processed foods.

Keywords: coconut, 11S globulin, cocosin, physicochemical and functional properties, emulsifying behavior

CMPSD-5

PROTEIN ENGINEERING OF SULFHYDRYL GROUPS IN MUNGBEAN (*Vigna radiata* (L.) R. Wilczek) VICILIN AND EFFECTS ON ITS NUTRITIONAL AND FUNCTIONAL PROPERTIES

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Mungbean (*Vigna radiata* (L.) R. Wilczek) is an important grain legume. The 8S globulin or vicilin, the major storage protein in mungbean, lacks cysteine residues and disulfide bonds. Of the three isoforms of mungbean vicilin, 8Sa was found to be the major isoform, was successfully cloned, crystallized forming a rhombohedral structure and its three dimensional structure established. In this research, the 8S γ globulin was engineered to introduce sulfhydryl groups and disulfide bond to improve its nutritional, structural stability and functional properties toward expanding the utilization of mungbean in processed foods. Using site-directed mutagenesis, mutants F59C, I99C and A213C were designed and prepared with free sulfhydryl group, I99C/A213C with disulfide bond and F59C/I99C/A213C with both a free sulfhydryl group and a disulfide bond, based on the established structure of mungbean 8Sa globulin. Mutants I99C/A213C and F59C/I99C/A213C formed a disulfide bond as expected which was confirmed by the Ellman method. Mutants with introduced disulfide bond exhibited greater stability to thermal denaturation and greater resistance to enzymatic digestion compared to the wild type (WT). All mutants showed greater hardness of heat-induced gels than WT, especially I99C/A213C and F59C/I99C/A213C mutants at 2% protein concentration. The results indicate that increasing sulfhydryl groups and disulfide bonds increases structural stability and functional property and thus, the modified vicilin could have new, different and wide variety of food applications.

Keywords: Protein engineering; site-directed mutagenesis; structural stability; functional property; 8S γ globulin; mungbean; physicochemical properties; vicilin; *Vigna radiata*

CMPSD-6

CLASSIFICATION OF VIRGIN COCONUT OIL USING ATR-FTIR IN CONJUNCTION WITH AGGLOMERATIVE HIERARCHICAL CLUSTERING AND PRINCIPAL COMPONENT ANALYSIS

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Virgin coconut oil (VCO) has a potential to be one of the Philippines' high-value export products. The Philippine National Standard provided a criterion (PNS/BAFPS 22:2004) to ensure the quality of virgin coconut oil in the country.

However, the recommended methods cannot distinguish between VCO and ordinary refined, bleached and deodorized coconut oil (CCO).

This study investigated the possibility of using FTIR with an attenuated total reflectance (ATR) accessory in conjunction with chemometrics as means of distinguishing unsaturated oils, VCO and CCO. Results showed that unsaturated oils can be easily distinguished from saturated oils by observing the IR regions that indicate unsaturation at 3095-3010 cm^{-1} and 1660-1600 cm^{-1} . For olive (VOO), corn (CO), palm (PO), canola (CLO) and soybean (SO) oil sharp peaks are seen in both of these areas but no such peaks can be seen in the IR spectra of either CCO or VCO. Visual inspection, however, could not be used to distinguish VCO and CCO because their IR spectra are identical to the naked eye.

In order to take full advantage of the spectral information, including subtle features that may not be readily discerned, pattern recognition techniques such as Agglomerative Hierarchical Clustering (AHC) and Principal Component Analysis (PCA) are commonly used. These chemometrical techniques reveals relationships that were not previously suspected but can lead to interpretations that are not readily apparent by mere visual inspection of IR spectrum alone. AHC and PCA utilize subtle differences in the spectra to classify vegetable oils into different groups.

This study have shown that ATR-FTIR together with chemometrical techniques such as PCA or AHC can be used to differentiate unsaturated oils from saturated oils, and discriminate virgin coconut oil from ordinary refined, bleached and deodorized coconut oil.

List of Acronyms:

AHC - agglomerative hierarchical clustering; ATR - attenuated total reflectance; CCO - ordinary refined, bleached and deodorized coconut oil; CLO - canola oil; CO - corn oil; FTIR - Fourier Transform Infrared; PCA - principal component analysis; PO - palm oil; SO- soybean oil; VCO - virgin coconut oil; VOO - olive oil

Keywords: virgin coconut oil, FTIR, chemometrics, agglomerative hierarchical clustering, principal component analysis

CMPSD-7

OPTIMAL PROPERTIES OF LAURIC ACID IN AQUEOUS SOLUTION: A MOLECULAR DYNAMICS STUDY

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A promising discovery about coconut oil is its antimicrobial activity, which is believed to be due to its high laurate (C-12) content. There have been

several hypotheses regarding this antimicrobial action though it is still not clear why the C-12, among other fatty acids of other chain lengths, yields an optimal antimicrobial property. One explanation is that the inhibitory fatty acid must be sufficiently water soluble to reach an effective concentration in the aqueous solution and yet hydrophobic enough to interact with the hydrophobic proteins or lipids on the microbial cell surface.

Here, a molecular dynamics (MD) investigation of a homologous series of fatty acids from C-8 to C-16 was done to observe any structural features that may be unique for C-12 in aqueous solution. MD simulations were done for a single fatty acid molecule (in carboxylate form) in a water box (TIP3P water model) with periodic boundary conditions using NAMD 2.6 software. VegaZZ 2.1.0 was used to prepare the molecules prior to MD calculation, and analysis of the data was done using VMD 1.8.6. We hypothesize that the length of C-12 is indeed an optimal length that minimizes the effects of competing forces that affect the stability of the fatty acid in aqueous solution, and that this may be demonstrated in mapping the hydration layers surrounding the fatty acid molecule through the radial distribution function, $g(r)$. The $g_{C_n O_{H_2O}}(r)$ gives the average pair-wise separation of the C_n atom from the oxygen atoms of water (O_{H_2O}) in the simulation box. The stable folded length of the fatty acid is also calculated through the.

The MD simulations reveal that all the fatty acid molecules were stable in generally stretched conformations in aqueous solution during each 1 ns simulation run. The results show high structuring of water at or near the polar carboxylate end group, as expected due to H-bonding interactions. There is also ordering of water near the methyl terminus and an apparent water depletion around the alkyl backbone, which are attributed to the hydrophobic effect.

Keywords: lauric acid, molecular dynamics simulations, radial distribution function

CMPSD-8

EFFICACY OF THE EXTRACTS OF TUBLI (*Derris elliptica*), SILI (*Capsicum* sp.), AND MALUNGGAY (*Moringa oleifera* Linn) AS PESTICIDE AND GROWTH ENHANCER OF PECHAY (*Brassica rapa* ssp. *pekinensis*)

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Vegetable farmers continue to use synthetic pesticides and fertilizers that contribute to pesticidal residue in the surrounding. The use of botanical materials is the most environmentally friendly practice in agricultural treatments.

Extracts from tubli roots, sili fruit and malunggay roots, in solution, were used as pesticide and growth enhancer of pechay. The botanical samples were extracted by maceration and mixed in water. Pechay plants were grown for 45 days on properly cultivated plots in a home garden, and treated with the prepared solutions at different concentrations (100% and 50%) and malathaion as standard. Treatments were applied at 10 days interval.

The efficacy of the said treatments was evaluated by comparing the areas of the pechay leaf blades and the damaged portion immediately after harvest. The leaves were flattened and overlapped with chicken wire. The areas were measured by the squares (3x3 mm) of the chicken wire taken as units. The rounded and irregular holes observed on the leaf blade were the only pest damage considered.

Results show that the treated pechay has larger leaf areas and lesser damaged portion compared to the control and standard, indicating that the extracts used can be a growth enhancer and substitute for the common commercial synthetic pesticides.

Keywords: pesticide; growth enhancer; leaf blade area; pest damage

CMPSD-9

DEVELOPMENT OF SQUID *Thysanoteuthis rhombus* INK

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A squid *Thysanoteuthis rhombus* ink developed in this study is solvent-based; intermix of water, acid, glycerin, thinner and varnish used for a writing and drawing instrument. This is a liquid containing black pigment used for coloring a surface to render an image or text, drawing or writing with a pen. Experimental method of research was conducted to develop ink product with 25% squid pigment and 50% acid concentration. Based on the sensory evaluation using descriptive test by the Bachelor of Science in Industrial Technology (BSIT) major in Drafting students of Cebu State College of Science and Technology, Main Campus-College of Industrial Technology and Engineering (CITE), the Squid Ink has a moderately black color, slightly desirable solvent-like odor, ink dryness with a sharp irregular line, thick and dry ink consistency that is comparable with the commercial ink (control sample), as to color, dryness and consistency. Sensory Analysis on acceptability using the 9-point Hedonic Scale revealed that the squid ink had like moderately rating for for color, dryness and consistency and like slightly for odor.

The color and dryness properties of squid ink had the same preference ratings with the commercial ink based on Analysis of Variance (ANOVA) and Duncan Multiple Range Tests (DMRT) at 5% level of significance. The newly developed squid ink had a density of 1.045 g/ml. The Squid Ink is generally safe for use, as revealed by the Metal Detection test result from the Department of Science and Technology (DOST) Testing Center, Region VII. The lead content detected is less than 3.10 parts per million (ppm).

Keywords: squid *Thysanoteuthis rhombus*, ink, acid.

CMPSD-10

ISOLATION OF BIOSURFACTANT FROM *SACCHAROMYCES CEREVISIAE* 2031 AND OPTIMIZATION OF FERMENTATION CONDITIONS

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Biosurfactants are surface-active agents derived from microorganisms. These amphipathic molecules can either or both lower surface tension and stabilize oil in water emulsion. Biosurfactant production by different yeast isolates was investigated using glucose and waste cooking oil as substrates. Extracellular biosurfactants were not detected as evidenced by negligible emulsification activity of the culture broth after 4 days of incubation. However, heat treatment of the cells released the biosurfactant and was able to emulsify oil-in-water. From the five isolates tested, *Saccharomyces cerevisiae* 2031 showed the highest emulsification activity of 58%. Optimization and partial purification of the biosurfactant gave an emulsification activity of about 76% towards kerosene. Biochemical analysis of the isolated material revealed that it is a protein-polysaccharide complex, a mannoprotein. Emulsification activity was found to vary with biomass and the amount of glucose in the culture medium.

Biosurfactants are advantageous compared to chemical surfactants due to their biodegradability, low toxicity, effectivity at extreme conditions and better environmental compatibility. Potential applications of biosurfactants are for bioremediation of oil and petroleum-based contaminated wastes.

Keywords: biosurfactants, *Saccharomyces cerevisiae* 2031, mannoprotein

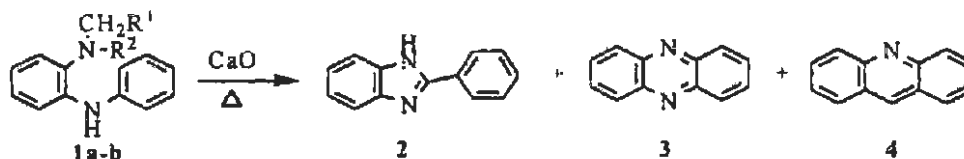
CMPSD-11

**2-PHENYLBENZIMIDAZOLE FROM THERMAL
REACTIONS OF *N*-ALKYLATED
N-PHENYL-*o*-PHENYLENEDIAMINE**

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The many applications of benzimidazole and its derivatives in the fields of medicine and material science has led to numerous studies on improving the method for its synthesis. None, however, discussed thermal cyclization as an option for the synthesis of benzimidazole.

Thermal cyclization reactions of *N*-alkylated *N*-phenyl-*o*-phenylenediamine were investigated by passing vapors of the aromatic amines over calcium oxide at 450°C–560°C. The results showed that aside from the normally expected six-membered ring products of acridine 4 and phenazine 3, the reaction also produced the unexpected 2-phenylbenzimidazole 2.

Thermal reactions of *N,N*-dimethyl-*N*-phenyl-*o*-phenylenediamine 1a gave fair yields of 2-phenylbenzimidazole 2 at 450°C and 500°C (31% and 32%, respectively) which decreased radically at 560°C (14%). This is due to the fact that although imidazoles are thermally stable, they decompose at temperatures higher than 500°C. The formation of 2-phenylbenzimidazole 2 is rather unusual and may be due to an imine intermediate followed by rearrangement after cyclization. The results for *N,N*-dibenzyl-*N*-phenyl-*o*-phenylenediamine 1b showed good yield for phenazine 3 at 450°C (52%) and fair yields for 2-phenylbenzimidazole 2 at 450°C and 500°C (33% and 37%, respectively). Decomposition at higher temperatures become predominant, thus lowering the yields of the products.

Keywords: benzimidazole, thermal cyclization, *N,N*-dimethyl-*N*-phenyl-*o*-phenylenediamine, *N,N*-dibenzyl-*N*-phenyl-*o*-phenylenediamine

CMPSD-12

CHARACTERIZATION OF "SHABU" (METHAMPHETAMINE) SOLD IN ILOILO CITY

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Analytical profiles (Marquis color testing, melting point, infrared spectroscopy, and gas chromatography mass spectrometry) for a transparent crystalline substance, suspected to be shabu, are established to ascertain the impurities and precursors of illegally prepared drug being sold in Iloilo City. Marquis test shows that the street sample is positive for methamphetamine. Methamphetamine was isolated and purified by acid-base extraction. Impurities were extracted with chloroform and the sample was analyzed to contain 5.06 ± 0.006 % methamphetamine. Melting point, fourier transform infrared spectroscopy (FT-IR) and gas chromatography mass spectroscopy (GC-MS) data confirm the presence of methamphetamine in the street sample and revealed ephedrine as the major adulterant.

Keywords: shabu, methamphetamine, ephedrine, Marquis test, fourier transform infrared spectroscopy, gas "chromatography" mass spectroscopy

CMPSD-13

A MATHEMATICAL MODEL OF THE CEPHALOSTATIN 1- INDUCED APOPTOSIS IN LEUKEMIC CELLS

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Understanding the mechanisms involved in apoptosis has been an area of extensive study due to its critical role in maintaining a homeostatic balance in multicellular organisms as a response to pro- or anti-apoptotic stimuli. Our special interest lies in understanding the apoptosis of tumor cells which are mediated by novel potential drugs. Cephalostatin 1 is a marine compound that induces apoptosis in leukemic cells in a dose- and time-dependent manner at nanomolar concentrations using a novel pathway that excludes the receptor-mediated pathway and includes both the mitochondrial- and ER-mediated pathways. In this study, the methods and tools of Petri net theory were used to construct, analyze, and validate a discrete Petri net model for cephalostatin 1-induced apoptosis.

Based on actual experimental results from the Vollmar laboratory and literature search, we constructed a discrete Petri net model consisting of 43 places and 59 transitions using a software tool called Snoopy. Standard Petri net analysis techniques such as structural and invariant analyses and modularity analysis via abstract dependent transition sets (ADT-sets) were employed using the software tool called Charlie. Results of these analyses demonstrated model consistency with known biological behavior. The sub-modules represented by the maximal ADT-sets are comparable with the functional modules of apoptosis identified by Alberghina and Colangelo. Moreover, by its readability, the Petri net model revealed a primary role for the ER-mediated pathway in cephalostatin 1-induced apoptosis, which can be verified by further experimentation.

Keywords: apoptosis, cephalostatin 1, discrete Petri net, invariant analysis, maximal ADT-sets, modularity analysis, structural analysis

CMPSD-14

**IN VITRO GLUTATHIONE CONJUGATION OF
SULFANILAMIDE ANTIBIOTICS WITH
GLUTATHIONE TRANSFERASE**

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Glutathione (GSH) is a tripeptide present in biological systems. It plays an important role in the detoxification of electrophilic foreign compounds and chemically reactive intermediates, which may arise during the biotransformation of xenobiotics. Conjugation reactions with GSH have been suggested as an important pathway of contaminant transformation, particularly in the pesticide literature. Glutathione conjugation or reaction with chemicals is catalyzed by glutathione S-transferase (GST) enzymes. GST enzymes are dimeric, mainly cytosolic, enzymes that have extensive ligand binding properties in addition to their catalytic role in detoxification and are present in most organisms including plants, animals, protozoa, fungi and bacteria. In this study, GSH was reacted with different sulfanilamide antibiotics *in vitro* with GST from equine liver. Sulfonamides used includes sulfamethizole (SMZ), sulfamethoxazole (SMX), sulfamethazine (SAZ), sulfadimethoxine (SDM), sulfathiazole (SFT), sulfadiazine (SFD) and sulfisoxazole (SFX). Results of liquid chromatography-mass-spectrometry (LC-MS) showed formation of glutathione adduct (GSH-sulfonamide product) in all samples with a pattern of GSH + sulfonamide + 13. LC-MS/MS of the samples showed GSH as one of the fragment that is formed. Neutral loss of water, glycine and glutamic acid was also observed in almost all samples. The same results were also obtained when partially purified GSTs from plants were used.

Keywords: glutathione, mass spectrometry, sulfanilamide

CMPSD-15

MOLECULARLY IMPRINTED POLYMER MICROSPHERES FOR THE SELECTIVE EXTRACTION OF ARTEMISININ

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Malaria causes about two million deaths a year worldwide according to World Health Organization. Artemisinin, a sesquiterpene, endo-peroxide lactone was found as one of the most potent anti-malarial drug at hand nowadays. An efficient method for extracting artemisinin is a serious concern to supply the need of 500 million malaria cases occurring annually worldwide. One such method to address this problem is by molecular imprinting technique.

Molecular imprinting is an efficient technique to introduce specific molecular recognition sites into a polymer matrix which can be applied for chromatographic separation and chemical sensing.

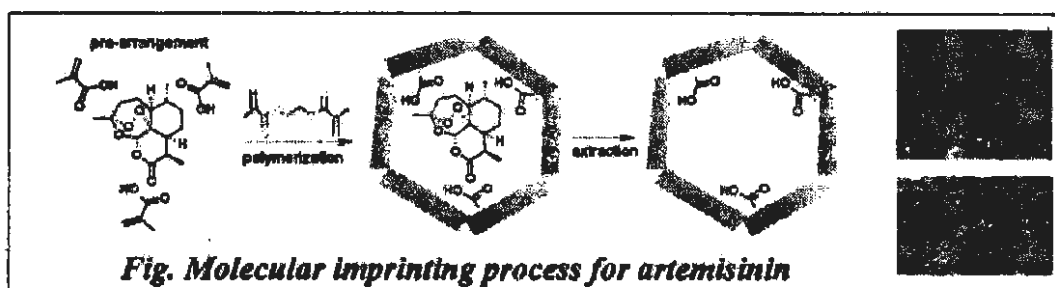


Fig. Molecular imprinting process for artemisinin

In this study, molecularly imprinted polymers (MIPs) were synthesized by traditional bulk polymerization and solid polymer blocks were obtained. Grinding and sieving of these polymers resulted to particles with irregular size and shape and low yield. New polymerization strategies have been proposed and one of the simplest formats is by precipitation polymerization.

Precipitation polymerization was investigated and uniformly-sized, microspherical artemisinin-imprinted polymers were obtained from acetonitrile (95%vol). The method was further developed to tune-in the morphology of the polymers. SEM and BET analysis showed that the size and porosity of polymers can be controlled by dilution and addition of toluene as co-solvent. Heat and UV polymerization was used, the type of monomer, and template/monomer ratio were optimized. The polymer prepared by 5:6:20 artemisinin/methacrylic acid/ethylene glycol dimethacrylate ratio in 5%toluene/acetonitrile (95%vol) solvent binds artemisinin with the highest selectivity. An equilibrium and non-equilibrium and

non-equilibrium binding isotherm study of the polymer was also established. Furthermore, these polymers were applied in solid-phase extraction of artemisinin from *Artemisia annua* plant extract.

Keywords: molecular imprinting, precipitation polymerization, artemisinin (qinghaosu)

CMPSD-16

A MATHEMATICAL MODEL OF RESPIRATION IN *HALOBACTERIUM SALINARUM*

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Halobacterium salinarum is a rod-shaped halophilic archaeon which can live under four bioenergetic regimes, namely, aerobic respiration, photosynthesis, anaerobic respiration and arginine fermentation. It is considered a model organism for photosynthesis due to its simple mechanism for energizing the membrane: it has a light-driven retinal-containing proton pump bacteriorhodopsin which is the simplest known proton pump in nature. The protons pumped via the electron transport chain also enhance the electro-chemical potential which the ATP synthase utilizes to drive ATP synthesis. In this work, we present a mathematical model of respiration in *H. salinarum* using the mathematical modeling framework of Generalized Mass Action (GMA) which one of the variants of Biochemical

Systems Theory (BST). Due to lack of kinetic data for aerobic respiration in *H. salinarum* we used the GMA modeling framework since knowledge of the exact mechanisms of each reaction is not required to set up the equations. Models can be designed based on the identity of the reactants and their reactional and regulatory interconnections.

Light inhibition of respiration in *H. salinarum* has been studied in the 70s and our model will later be used to understand the interaction of these two bioenergetic processes. Our current results can exhibit the few published data on respiration (i.e., oxygen consumption and phosphorylation) on this organism. Aside from the reactions and pumping of the complexes in respiration, our model also includes the sodium-proton antiport, the potassium uniport and the dynamic changes of the membrane potential and ΔpH . The exact nature of the sodium-proton antiport in *H. salinarum* is still not well understood hence we will consider two types, an electro-neutral antiporter and an electrogenic one and we present the model output for each one.

Keywords: Bioenergetics, respiration, oxidative phosphorylation, *Halobacterium salinarum*, Biochemical Systems Theory

CMPSD-17

THERMAL STABILITY AND CHARACTERIZATION OF A PARTIALLY PURIFIED LIPASE FROM *GEOBACILLUS SP. M5*

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Lipids are biological compounds that are non-polar and are poorly soluble or insoluble in water. They constitute a large part of the earth's biomass and of waste products from industrial processes. Lipolytic enzymes, or lipases, play an important role in the degradation of these water-insoluble compounds. *Geobacillus sp.*, M5, a microorganism isolated from a hot spring in Albay, has been identified to produce high amounts of an extracellular lipase. However, little has been done to purify the enzyme. It is the objective of this study to partially purify the enzyme and determine its stability at different temperatures. The lipase was partially purified by microfiltration and ammonium sulfate precipitation. Thermal stability was determined after each purification procedure at 55°C, 30°C, 4°C and -20°C.

The crude lipase from microfiltration retained 96 % of its activity after 90 minutes of incubation at 55°C, 49% activity after 18 hours at 30°C, 46% activity after 5 weeks at 4°C and 61% activity after 5 weeks at -20°C. The ammonium sulfate precipitated lipase retained 90% activity after 60 minutes at 55°C, 99% activity after 15 hours at 30°C, 100% activity after 5 weeks at 4°C and 92% at -20°C. The stability of the crude and ammonium sulfate lipase at 55 °C indicate that it can be used in industrial processes that require high operational temperatures.

Keywords: extracellular, Lipolytic enzymes, *Geobacillus sp*, microfiltration

CMPSD-18

EFFECT OF PROTEIN STRUCTURE DISRUPTING AGENTS AND METAL IONS ON THE ACTIVITY OF PARTIALLY PURIFIED THERMOPHILIC LIPASE FROM *GEOBACILLUS SP.*, M5

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Lipases catalyze the hydrolysis of triacylglycerols to glycerol and free fatty acids at an oil-water interface. Presence of compounds and metal ions, as well as the temperature and pH of the reaction mixture are important factors that affect the activity of the enzyme. The effect of protein structure disrupting agents and metal ions on the activity of thermophilic lipase from *Geobacillus sp.* M5 was investigated in the view of its potential application in wastewater treatment. Lipase was isolated from *Geobacillus sp.* M5 by ammonium sulfate precipitation followed by dialysis. Lipase characterization was performed on the dialyzed enzyme. The optimum temperature and pH for *Geobacillus sp.* M5 lipase was found to be at 55°C and 7.0, respectively. Lipase activity was least affected by DTT, retaining 93.103% of its activity even at 10 mM of the compound. The lipase activity inhibited by 20% upon addition of SDS and Tween80 but was most inhibited by EDTA. Activity was decreased more than half by addition of 1 mM EDTA. The effect of metal ions on the enzyme was also investigated. Lipase activity was decreased by 21.5% in the presence of sodium but was enhanced slightly in the presence of magnesium. The high activity of lipase produced by *Geobacillus sp.* M5 plus its resistance to different effectors indicated the potential of this enzyme to be used in wastewater treatment.

Keywords: *Geobacillus sp*, triacylglycerols, thermophilic

CMPSD-19

STOCHASTIC DIFFUSION OF B-LYMPHOCYTES IN A 1-DIMENSIONAL SHAPE SPACE

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The body's immune system is a complex network of cells and tissues where the *B-lymphocytes* or *B-cells* play an important role. The diversity of the immune system is further increased to facilitate the detection of mutating antigens. Furthermore, due to limited resources, *B-cells* undergo somatic hypermutation to recognize evasive antigens. In 1979, Perelson and Oster introduced a simple way of modeling the antibody-antigen interaction through the shape space formulation (Theoretical Studies of Clonal Selection: Minimal Antibody Repertoire Size and Reliability of Self-Non-self Discrimination, *J. Theor. Biol.* (1979) 81, 645-67). And in the works of Perelson and Wiegel, they modeled the mutation of *B-cells* as diffusion in shape space (Perelson S., Wiegel, F., Some Design Principles for Immune System Recognition, Complexity, John Wiley and Sons, Inc., Vol. 4, No. 5, 1999).

In this work, we present the stochastic white noise calculation of the diffusion of *B-cells* in a one dimensional shape space. To describe the proliferation of antibody producing cells and their diffusion in shape space due to antibody gene mutation, we denote $b(S, t)$ as the density in shape space of *B-cells* with shape S at time t that have been stimulated by antigen. For a 1-dimensional case, we obtain the *B-cell* density as

$$b(S, t) = \frac{1}{\sqrt{4\pi Dt}} \exp\left(-\frac{(S_B - S_A)^2}{4Dt}\right)$$

The time of detection of the antigen by the *B-cells* can be calculated using the formula obtained by Perelson and Wiegel in their studies on "Some Design Principles for Immune System Recognition". We take note that the above result resembles to the propagator of a free particle in quantum mechanics.

Keywords: B-lymphocytes, diffusion, shape space

CMPSD-20

**DETECTION OF WILSON'S DISEASE BY ATOMIC
ABSORPTION SPECTROPHOTOMETRIC ANALYSIS OF
SERUM AND URINARY COPPER AND CERULOPLASMIN
ANALYSIS**

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Healthy people can excrete unwanted copper in the body but those with Wilson's disease cannot. Wilson's disease is a rare autosomal recessive inherited disease that causes copper poisoning. In persons afflicted with this disease the mechanism of copper transport and excretion by the liver is impaired and there is progressive build up of copper primarily in the liver or the brain.

In addition to evaluation of clinical symptoms, analyses of copper in both serum and urine are utilized for detection of Wilson's disease. 24-hour urine and serum samples from different patients were analyzed for copper using flame atomic absorption spectrophotometry (AAS) after acid digestion of samples. Samples from patients with Wilson's disease had very high 24-hour urine copper levels (exceeding 60 µg/day) and their serum free copper concentrations were below normal values of 0.7-1.4 µg/ml.

This paper will also present a case of Wilson's disease in a Filipino family of three male siblings. Two of the males have the disease while the middle one is disease-free. Both have abnormally high 24-hour urine copper levels (968 and 585 µg/day vs max. of 60 µg/day for normal values). The serum free copper concentrations (0.21 µg/ml or less) were below normal values of 0.7-1.4 µg/ml. Their 24-hour urine copper levels were also monitored with drug therapy. With drug therapy, the levels of 24-hour urinary copper decrease to values approaching normal values.

Keywords: Wilson's disease, atomic absorption spectrophotometry, copper

CMPSD-21

**CHARACTERIZATION AND SOURCE IDENTIFICATION
OF AMBIENT AIR PM₁₀ IN VALENZUELA CITY
SAMPLING SITE**

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Air pollution in Metro Manila (in particular, in Valenzuela City, a highly industrialized area) and its adverse impacts to health is a source of concern to various stakeholders. The research aims to help address the problem by providing scientific data (in particular, the major sources of particulate pollution) on which to base policies to improve air quality.

Particulate matter of most concern with regard to adverse effects on human health are generally <10 µm in size and are referred to as PM₁₀. PM₁₀ samples were collected on Nuclepore filters [8µm pore size for the coarse or PM_{10-2.5} fraction and 0.4µm for the fine or PM_{2.5} fraction] using a Gent sampler. Particulate mass is determined by gravimetry using a micro analytical balance (Mettler MT5) with 1µg sensitivity. Elemental levels in air particulate samples are determined using non-destructive nuclear (or related) multielement analytical technique using an energy-dispersive x-ray fluorescence spectrometry (EDXRF) (Kevex 771-EDXRF Spectrometer).

Data for Valenzuela City sampling site show the presence of Pb in both the coarse and the fine fractions with levels relatively higher as compared with other sampling sites such as in Ateneo, Poveda and NAMRIA sampling sites. Source apportionment (using the Positive Matrix Factorization) of the Valenzuela City data distinctly shows a Pb source factor in both the coarse and the fine fractions. Conditional probability function (CPF) of Pb values from Valenzuela City in 2005 indicates large source contributions coming from the surrounding area of the sampling station particularly about NNW-N, ENE-E and SSE-W of the sampling station. Results in Valenzuela City indicate the need to do a more comprehensive evaluation of the area to determine the sources of Pb and formulate measures to bring down ambient levels.

Keywords: metro manila, admu, namria, poveda, valenzuela city, pm10, pm2.5, source apportionment

CMPSD-22

**BIOSORPTION OF CADMIUM, COPPER AND LEAD
BY *Gracilariaopsis bailinae* BIOMASS****Steve P. Janagap^{1,2} and Jay O. Martizano¹**¹Department of Chemistry, College of Arts and Sciences²Institute of Aquaculture, College of Fisheries and Ocean Sciences

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Equilibrium contact experiments were conducted to determine the ability of dried *Gracilariaopsis bailinae* to remove cadmium (Cd^{2+}), copper (Cu^{2+}) and lead (Pb^{2+}) in water. Analysis of the metals was carried out using atomic absorption spectroscopy. The outstanding function of the biosorbent for Cd^{2+} , Cu^{2+} and Pb^{2+} was demonstrated at pH 5 and were fitted to the Langmuir and Freundlich isotherms. The Langmuir model was only applicable to cadmium biosorption ($R^2 = 0.988$) with maximum uptake capacity (q_{max}) and affinity constant (b) equal to 15.02 mg g^{-1} and 0.0217 L mg^{-1} , respectively. The Freundlich model fitted the biosorption data for the three metals with R^2 ranging from 0.900 to 0.990 and the order of adsorption capacity (K) and intensity (n) of *G. bailinae* for the metals were $\text{Pb} > \text{Cd} > \text{Cu}$ and $\text{Pb} > \text{Cu} > \text{Cd}$, respectively.

The Fourier-transform infrared spectra of the *G. bailinae* and the metal-loaded biomass were obtained to determine the chemical groups present, which may be involved in the biosorption of the heavy metals. It was found that amide and sulfate groups were present in the biomass which could be responsible for the biosorption. *G. bailinae* can be a potential biosorbent for heavy metals especially for lead.

Keywords: *Gracilariaopsis bailinae*, biosorption, metals, Langmuir, isotherm

CMPSD-23

**MONITORING PETROLEUM HYDROCARBONS IN
SEDIMENTS USING TOTAL SOLVENT EXTRACTABLE
MATERIALS (TSEM)**

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There are many analytical techniques available to measure total petroleum hydrocarbon (TPH) concentrations in the environment and one of the major problems that we encountered in the assessment of petroleum hydrocarbon contamination due to oil spill is the absence of common approach to determine TPH levels in sediments. The usual practice is to use the oil and grease method (US EPA Method 9017b) to establish the amount of petroleum hydrocarbons in sediments. However, we found out that the n-hexane extractable materials (HEM) were non-specific to petroleum hydrocarbons as revealed by the FTIR spectra of the HEM and the standard oil sample. Moreover, HEM values were not correlated with polycyclic aromatic hydrocarbons thus making it a poor method in assessing the severity of petroleum contamination. Accordingly, we looked for an alternative method that is the TSEM, as described by Wang and Fingas (1994) and tested for monitoring. We found out that the TSEM method has high recovery (82-87%) in the spiked samples of wide range of concentrations, (100 $\mu\text{g/g}$ - 10000 $\mu\text{g/g}$). TSEM values are highly correlated with PAHs within six months after the oil spill and also highly correlated with TPH values determined using FTIR. The FTIR spectra of the TSEM are similar to the standard oil sample and this result implies that material extracted is mostly petroleum hydrocarbons. The study has established that TSEM is a good method to monitor petroleum hydrocarbons in sediments.

Keywords: total petroleum hydrocarbons, hexane extractable materials, total solvent extractable materials, monitoring

CMPSD-24

**APPLICATION OF THE FENTON'S PROCESS ON THE
REDUCTION OF COLOR AND COD OF TEXTILE
WASTEWATER CONTAINING
DIRECT ORANGE 26 DYE**

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The textile industry is one of the leading industries in the Philippines. Its export earnings of about US \$ 3 B corresponds to an average of 8% of the total export earnings. Textile processing uses a variety of chemicals, depending on the nature of the raw materials and products, which include different proteins, detergents, dyes, acids, sodas, salts and metals which are not degradable into non-toxic end products. The textile factories, like other factories, are required to treat their effluent before discharge, in compliance to DENR Administrative Order No. 35 which limits the COD and BOD level to 150 and 300 mg/L, respectively. Likewise, color and turbidity should be reduced, as these could cause aesthetic problem and real hazard to the environment. Residual dye in textile wastewater pose problem in absorption and reflection of sunlight entering the water. Hence, too much color, indirectly interferes with the growth of bacteria to levels insufficient to biologically degrade impurities in water. It may also hinder the photosynthetic activity of aquatic plants.

Chemical Treatment:

Oxidative treatment, under the chemical treatments available, usually gives better results and promising outcome because it involves the degradation process of wastewater contaminants (Ciardelli, 1998). One of these oxidative treatments is the Fenton's process. The effectivity of this treatment was studied on a simulated textile wastewater. This type of textile dye was chosen for its availability in the market. The effect of varying certain amount of factors of the process was considered. Thus, color removal and the COD reduction reflect the effects of varying these factors.

Objectives:

This study generally aimed to evaluate the application of Fenton's process on the treatment of simulated textile wastewater containing Direct Orange 26. Specifically, the study aimed to:

- 1) determine the pH, color and COD of the simulated wastewater;
- 2) determine the effect of varying the amount of H_2O_2 on the reduction of COD;

- 3) evaluate the effect of varying the amount of $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ solution, which contained the catalyst, Fe^{2+} , on the reduction of COD;
- 4) assess the effect of varying the concentration of the simulated textile wastewater on the reduction of COD; and
- 5) propose a degradation mechanism of the reaction of Direct Orange 26 with Fenton reagent.

Summary and Conclusion:

The treatment of simulated textile wastewater containing Direct Orange 26 was conducted using the Fenton's process. Varying the amounts of the Fenton's reagent, such as Hydrogen peroxide and iron catalyst, was made to determine the effect on COD and color. Different amounts H_2O_2 (5, 10, 15 and 20 mL) and iron catalyst (2, 4, 6 and 8 mL), and different concentrations of simulated textile wastewater (4000, 5000, 6000 and 7000 ppm) were used. The COD level and color of the treated wastewater were measured. The highest percent COD reduction was 98.48% and was obtained from the ratio 4:15:20 (mL of iron catalyst: mL of H_2O_2 : mL of wastewater), with a 5000 ppm concentration of the simulated textile wastewater. The treated wastewater was completely decolorized. The degradation mechanism was proposed with the possible end products. The Fenton's process was found to be an effective treatment for this kind of wastewater.

Keywords: Fenton, reagent, textile wastewater

CMPSD-25

APPLICATION OF ION TRAP-MASS SPECTROMETRY IN MONITORING CHANGES IN ACTIVATED SLUDGE PHYSIOLOGY UPON EXPOSURE TO TOXIC COMPOUNDS

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The activated sludge process is the most commonly used biological wastewater treatment technology employed. Microbial communities in activated sludge usually undergo different physiological and structural modifications upon exposure to toxic chemicals. One modification might lead to the release of chemicals/metabolites as specific response to a given toxic compound, which could serve as biomarker for that particular toxicant. The purpose of this study is to apply liquid chromatography with ion trap mass spectrometry to monitor the changes on the composition of the soluble fraction of activated sludge mixed liquor after

exposing to different toxic chemicals. Toxic chemicals used include heavy metals like lead and cadmium and organic compounds such as chlorodinitrobenzene, dinitrotoluene and dinitrophenol. Results indicated the formation of several peaks not found in untreated samples. Looking at the peaks revealed the appearance of high molecular weight compounds which could be fragments of biomolecules (proteins or polysaccharides) that are usually expressed by microorganisms when exposed to toxic chemicals. These results provide insight on the potential of LC-IT-MS to monitor the rapid changes in the activated sludge physiology upon exposure to toxic compounds. It could also be used as an early warning instrument of upset events in activated sludge.

Keywords: activated sludge, mass spectrometry, organics

CMPSD-26

COMPARATIVE TREATABILITY STUDIES FOR THE DECOLORIZATION AND COD REMOVAL OF SUGAR REFINERY SPENT ION-EXCHANGE-PROCESS (SIEP) EFFLUENT

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Treatability studies were conducted for the decolorization and COD removal from Sugar-Refinery-Spent-Ion-Exchange-Process (SIEP) effluent by electrochemical oxidation electrochemical coagulation/flocculation.

Batch electrolysis experiments were conducted at different operating currents, and removal efficiencies for color and COD were evaluated. With sintered platinum as the anode, the electro-oxidation of SIEP effluent at 3 and 5 Amperes resulted to more than 99 percent decolorization efficiency after 7 hours of treatment. For both currents, the decolorization efficiency increased with the treatment time but leveled off during the 6th hour at 3 Amperes and during the 3rd hour at the 5 Amperes operating current. Higher decolorization efficiency was observed at 5 Amperes than at 3 Amperes since higher amount of oxidants was produced as the current was increased. The COD removal efficiency also increased with time, indicating that

the organic matter removed corresponds to the color removed from the SIEP effluent. In electroflocculation, the Al^{3+} flocculants generated from an aluminum anode removed as much as 75 percent of the color at 5 Amperes operating current for 8 hours electrolysis time. However, no significant differences were observed between the decolorization efficiencies and COD removal efficiencies at the 3 Amperes and 5 Amperes operating currents. An increasing trend in both the decolorization and COD removal efficiencies with time was also observed.

Based on the results, electro-oxidation proved to be more effective method in removing color and COD from the SIEP effluent than electroflocculation.

Keywords: electrooxidation, electroflocculation, spent ion-exchange-process effluent

CMPSD-27

ELECTROCHEMICAL TREATMENT OF TANNERY WASTEWATER

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The feasibility of electrochemical treatment to remove total chromium and COD from tannery wastewater was investigated. Electrocoagulation was done for chromium removal while electrooxidation was used as a second-stage treatment for COD removal.

Complete chromium removal was obtained using 2A operating current after 3 hours electrocoagulation. Adsorption of chromium ions onto aluminum hydroxide flocs generated (from the dissolution of aluminum anode and its reaction with hydroxyl ions generated at the cathode) was considered the major mechanism for removal. This was because the pH of the wastewater was in the range where chromium does not precipitate as its metal hydroxide, but was favorable for the precipitation of aluminum hydroxides. Charge dose defined as the amount of electricity required to remove a unit mass of chromium by electrocoagulation was found to be inapplicable as a scale-up factor in this process. An alternative strategy to charge dose was explored for scale up/operation based on the relationship between volumetric current and kinetic rate constant (found to be first-order by the integral method).

Electrooxidation, as a second-stage treatment for COD removal, could obtain a COD removal efficiency of 34% in 3 hours at 4A operating current. However, a COD level conforming to DENR effluent standards could still be possible by extending the electrolysis time. The concept of charge dose for COD removal was found applicable and could be used as a useful factor for operation and scale-up.

Keywords: electrocoagulation, electrooxidation, electrolysis, tannery wastewater, chromium, charge dose

CMPSD-28

DIFFERENTIAL EXPRESSION OF A NOVEL BANANA MADS-BOX GENE SHOWS DEVELOPMENTAL CONTROL OF CLIMACTERIC FRUIT RIPENING

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The regulatory role in ripening of a novel banana fruit-specific MADS-box³ gene was investigated by quantification of its expression and correlation to the rise in ethylene production during fruit maturation. The gene, *MaMADS2*, was isolated from ripe banana fruit cDNA and had a putative protein sequence that was structurally similar to Type II MADS-box transcription factors that are implicated in key developmental processes.

Using real time PCR analysis, *MaMADS2* expression was quantified in banana pulp and peel tissues sampled during ripening of bananas stored in 95% (high) and 82% (low) relative humidity (RH). Ethylene and CO₂ production were measured from whole fingers and tissues using headspace gas analysis. *MaMADS2* expression was relatively high only in the pulp under both storage conditions ranging from 15% to 167% relative to expression in peel at 2 days of high RH storage. The expression in pulp tissues increased from 6 to 10 days in high humidity storage followed by a decline in levels. The corresponding ethylene climacteric peak occurred on the 9th day. In the peel, increases in ethylene were observed only on the 12th day of storage. The highest relative expression (167%) was observed at 2 days after low RH storage indicating that the gene is responsive to environmental stress. Under low RH, pulp ethylene production was lower but fruit deterioration

was earlier. This indicates an earlier developmental shift to the ripening stage brought about by the low moisture conditions.

The results conclusively show that *MAMADS2* is already expressed before the initiation of ripening with maximum expression levels corresponding to the ethylene climacteric peak. *MaMADS2* may thus act in the developmental regulation of banana ripening.

³MADS-box- MADS is derived from the initials of the founder proteins Minichromosomal maintenance1, Agamous, Deficiens and Serum Response Factor

Keywords: MADS-box, developmental factors, banana, ripening, climacteric

CMPSD-29

ADSORPTION CAPACITY OF CARBONIZED RICE HUSK BAMBOO CHARCOAL OF NITRATE NITROGEN

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The contamination of the groundwater with nitrate is becoming a global issue that can be pinned down from man-made sources such as intensive use of nitrogenous fertilizers, septic tank effluent, industrial wastewater, and leachate from landfills resulting in the formation of methemoglobin, and nitrosamine.

Several technologies have already been developed for nitrate removal from drinking water, however, their applications are in large scales. Thus, the focus of this study is to explore the potential of adsorption using carbon from bamboo and rice husk owing to lower production cost and assured availability of materials.

Consequently, adsorption isotherms of NO₃-N using bamboo charcoal (BC) and carbonized rice husk (CRH) from aqueous medium have been investigated. BC and CRH were prepared by HCl-treatment (BC1) and CO₂ activation (BC2), and HCl- (CRH1) and NaOH&HCl (CRH2)- treatment, respectively. Results showed that NO₃-N adsorption of BC and CRH exhibited maximum adsorption values at pH 3.0. Moreover, adsorption performance of BC1 and CRH1 was mainly influenced by the electrostatic interaction between the positively-charged surface of both adsorbents, and negative charge of nitrate ions. On the other hand, adsorption performance of BC2 was mainly influenced by the large surface area of 1029 m²/g, while CRH2 was due to the increased fixed carbon as influenced by the leaching

process with NaOH. The adsorption equilibrium studies for all the adsorbents were examined at pH 3.0 under constant temperature of 30°C, and isotherms were determined and correlated with Langmuir and Freundlich models. The removal of NO₃-N by BC 1&2, and CRH 1&2 can be best modeled using Langmuir isotherm that gave them maximum uptake capacities of 2.380, 1.988, 0.806, and 2.04 mg NO₃-N/g. The results indicate that both materials show potential for adsorption of nitrate-nitrogen.

Keywords: nitrate-nitrogen, adsorption, bamboo charcoal, carbonized rice husk

CMPSD-30

ON THE POWERGRAPH OF A SET

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Let S be a set. The powerset of a set, denoted by $\wp(S)$, is the set of all subsets of S . A graph is a set of vertices together with the set of edges formed by connecting two vertices. We define the powergraph of S , denoted by $G(\wp(S))$, as the graph obtained from $\wp(S)$ by taking every element of $\wp(S)$ as vertices in and where two vertices x and y in $G(\wp(S))$ are adjacent if and only if the sets corresponding to these vertices have a non-empty intersection.

In this paper, we have characterized all sets which have empty powergraph. Furthermore, we have determined that for a set which contains no element, its corresponding powergraph is a complete graph of order one. We have established that a powergraph of any set S contains a vertex v such that its degree is zero. It is also shown in this paper that for a set containing more than two elements, the size of its powergraph is greater than its order. Among the different observations, we also verified some properties of the vertices corresponding to subsets with different number of elements with respect to the degree. In addition, results on the order of powergraph involving the number of elements of subset S^* are also generated. Lastly, among others, we also investigated some of the properties of graphs induced by the powerset of a given set.

Keywords: set, powerset, powergraph

CMPSD-31

ISOMORPHISM OF SET SYSTEM

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Mathematics deals with statements concerning objects and the relation between them. Standard mathematical procedure is to identify relations in terms of sets: a relation is a set of objects of a particular kind. In this paper, we will exploit the idea about the isomorphism of set systems. If an isomorphism can be found from a relatively unfamiliar part of mathematics into well studied division of mathematics, where various theorems are already proven, and many methods already exist to find answers, then the function can be used to map problems out of ambiguity over to familiarity where the problem is easier to comprehend.

Isomorphism is studied in mathematics in order to extend insights from one occurrence to another: if two objects are isomorphic, then any property which is preserved by an isomorphism and which is true of one of the objects is also true of the other. When a particularly simple bijection between two sets has been specified, it is sometimes possible to view an object in the domain and its image in the range as virtually indistinguishable: one may be seen as a renaming or a way of rewriting the other. For example, singleton sets and ordered 1-tuples are, strictly speaking, different, but not much harm is done if we occasionally blur the distinction, because of the obvious bijection f such that $f(\{a\}) = (a)$ for any singleton $\{a\}$. Moreover, we have generated results on the isomorphism of set system and presented various examples to further support our assertion. In conclusion, isomorphism is a very useful mathematical resource to aid our venture towards mathematical excellence.

Keywords: Isomorphism, bijection, singleton, 1-tuples

CMPSD-32

ON THE RATIONAL WEIGHT OF AN OPEN SET

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Given a topological space (U, τ) where the cardinality of U is n , we define the rational weight of an element a of an open set A , denoted by $\omega(a)$ as the image of a under the mapping: $\omega : U \rightarrow [0, +\infty)$ given by $\omega(a) = \frac{S_a}{|U|} = \frac{S_a}{n}$

where S_a is the number of sets containing a . For each open set A , we define the rational weight of A as its image of A under the mapping $\Omega : T \rightarrow [0, +\infty)$ where

$$\Omega(A) = \sum \omega_a$$

In this paper, we determined the rational weights involving the basic set operations such as union, intersection, difference, complement, and operations on comparable sets with the notions of topological properties of open sets. Moreover,

we have characterized all open sets with rational weight equal to $\frac{2^{n-1}}{n}$ and those

with rational weight equal to 2^{n-1} for each $n \geq 1$.

Keywords: rational weight, set, cardinality, mapping, topological space

CMPSD-33

The r – COMBINATORIAL SUBSET AND THE r – COMPLEMENTARY UNION OF SETS

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This study introduces the unique r – element subset(s) of a finite set in which the sequence of cardinalities follows from the binomial coefficients. It is an endeavour of this paper to give similarities and unusual properties that distinguishes it from the usual set. This study also presents a generalization of

inclusion and exclusion principle, the r -element inclusion and exclusion principle.

The existence of some elements which can be found from the r -element subsets of the union of nonempty finite sets which cannot be found in the union of r -element subsets for every nonempty finite set triggers the researchers to extend the field of set theory especially in the concentration of cardinalities. For these reason, the researchers establish an r -element universal set which is the best tool in finding the complement of every r -element subset. Moreover, the De' Morgans theorem, the subset property, and the intersection property satisfy under this field.

Consequently, the researchers aim to show that this extension could give a generalization of every principle in the usual set. Hence, the researchers also aim to give significant principle even in the field of combinatorics. Specifically, the inclusion and exclusion principle could be extended into an r -element inclusion and exclusion principle since the 1-element subset follows the usual principle. If $r > 1$, then we use the r -element inclusion and exclusion principle generated from the combinatorial subsets, the r -element subsets of a set.

Keywords: r -combinatorial subset, r -universal set, complement of r -combinatorial subset, r -complementary union of sets

CMPSD-34

ACCESSIBILITY NUMBER OF SETS

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Let A and B be finite sets. The distance $d(a,b)$ between two sets A and B is given by $d(a,b) = \min\{d(a,b): a \in A, b \in B\}$. A set is said to be k -accessible from set B if for every $a \in A$, there exists a $b \in B$ such that $d(a,b) \leq k$. The accessibility number of sets from A is given by

$$\delta_{acc}(A,B) = \min\{d(a,b): a \in A, b \in B\}.$$

If A is an empty set, then we say that $\delta_{acc}(A,B) = +\infty$. Given those special subsets of R , we define the most accessible set to A as the set with the least distance to A or the set with the least accessibility number among those given sets. And we define the set with accessibility number equal to positive infinity as the farthest set from A , given that A is the reference set given.

In this study, we provided necessary and sufficient conditions for a set A to have an accessibility number equal to some nonnegative integer. We have also established results on the accessibility number of special subsets of R .

Keywords: accessibility number, sets, absolute difference, distance, k-accessible

CMPSD-35

BINARY OPERATION ON ISOMORPHIC SETS

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Given two sets $A = \{a_1, a_2, \dots, a_n\}$ and $B = \{b_1, b_2, \dots, b_n\}$ where $n \in \mathbb{N}$ such $a_i \leq a_{i+1}$ and $b_j < b_{j+1}$. We say that A and B are homomorphic if for all a_i 's, b_j 's such that $a_i \neq b_j, \forall i, j \in \mathbb{N}, A \cap B = \phi$. Furthermore, two sets are said to be isomorphic if and only if the two sets A and B holds the homomorphism property of two sets and these sets hold the same properties of a sequence. We define the binary operation of a set as

$$A + B = \{a_1 + b_1, a_2 + b_2, \dots, a_n + b_n\} \quad \forall n \in \mathbb{N} ;$$

$$A \cdot B = \{a_1 b_1, a_2 b_2, \dots, a_n b_n\} \quad \forall n \in \mathbb{N} ;$$

$$\frac{A}{B} = \left\{ \frac{a_n}{b_n}, \frac{a_{n-1}}{b_{n-1}}, \dots, \frac{a_1}{b_1} \right\} \quad \forall n \in \mathbb{N} ;$$

We have shown in this study that the binary operations such as addition, subtraction, multiplication, and division of two isomorphic sets exist. In addition, the sets $A = \{a_1, a_2, \dots, a_n\}$ and $\frac{1}{A} = \left\{ \frac{1}{a_n}, \frac{1}{a_{n-1}}, \dots, \frac{1}{a_1} \right\}$ are isomorphic sets. Moreover, we have established important results on these binary set operations,

Keywords: homomorphism, isomorphism, binary operation, set

CMPSD-36

ON SOME RESULTS OF THE TORSION-FREE ABELIAN TRACE AND KERNEL GROUPS

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A subgroup K of a group G is said to be *pure* in G (denoted $K \leq G$), if whenever $ny \in K$ for some $n \in \mathbb{Z}$ and $y \in G$, then $y \in K$. Equivalently, K is pure in G if and only if $K \cap nG = nK$ for all $n \in \mathbb{Z}^+$.

For any torsion-free abelian groups G and H , the *pure trace* of H in G is defined to be $tr(H, G) = \left\{ g \in G : ng \in \left\langle \sum f(H), f \in Hom(H, G) \right\rangle \text{ for some } n \in \mathbb{Z}^+ \right\}$ and the *kernel* of H in G is defined to be $ker(G, H) = \bigcap_{f \in Hom(H, G)} ker f$. The pure trace and kernel of H in G are pure fully invariant subgroups of G .

Two classes of groups emerged from these classes of pure fully invariant subgroups. A torsion-free abelian group G is said to be a *trace group* if for every pure fully invariant subgroup M of G , $M = tr(M, G)$ and G is said to be a *kernel group* if $M = ker(G, G/M)$ for every pure fully invariant subgroup M of G .

The groups of integers and rational numbers are both trace and kernel groups. More generally, since an irreducible group is a group having no proper pure fully invariant subgroups, it is then a trace and kernel group. Hence, the strongly irreducible groups which are known to be irreducible, are also trace and kernel groups. It is important to note that in the literature, the class of strongly irreducible groups serves as the very foundation or building blocks in the classification of torsion-free abelian groups.

This paper proves the properties of the trace and kernel groups in relation to the direct summands and direct sum of groups.

Keywords: trace groups, kernel groups, pure fully invariant subgroups, irreducible groups, strongly irreducible groups.

CMPSD-37**ON THE k -SUBGRAPHS OF THE GENERALIZED HYPERCUBES****Geoffrey A. Solano¹ and Jaime D.L. Caro²**¹Department of Physical Sciences and Mathematics
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Graphs are used in modeling interconnections networks and measuring their properties. Knowing and understanding the graph theoretical/combinatorial properties of the underlying networks are necessary in developing more efficient parallel algorithms as well as fault-tolerant communication/routing algorithms.

The hypercube is one of the most versatile and efficient networks yet discovered for parallel computation. One generalization of the hypercube is the n -cube $Q(n,m)$ which is a graph whose vertices are all the binary n -tuples, such that two vertices are adjacent whenever they differ in exactly m coordinates. The k -subgraph of the Generalized n -cube $Q_i(n,m)$ is the induced subgraph of the n -cube $Q(n,m)$ where $q=2$, such that a vertex $v \in V(Q_i(n,m))$ if and only if $v \in V(Q(n,m))$ and v is of parity k .

This paper presents some degree properties of $Q_i(n,m)$ as well as some isomorphisms it has with other graphs, namely:

- 1) $Q_{n-1}(n,2)$ is isomorphic to Kn
- 2) $Q_k(n,2i)$ is isomorphic to $G_i(n,k)$
- 3) $Q_n(n,2i)$ is isomorphic to $SG_i(n)$

Keywords: graphs, hypercubes, networks, parity, graph properties

CMPSD-38**CONVEX ACCESSIBILITY OF GRAPHS****Randy L. Caga-anan* and Rosalio G. Artes, Jr.**Department of Mathematics, College of Science and Mathematics
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This study endeavored to help solve some current and future energy allocation problems which can be modeled by a particular notion in graph theory studied in this paper.

Given a connected graph G , we define the distance $d_i(u,v)$ between two vertices u and v in G as the length of a shortest path joining u and v in G . A subset S of $V(G)$ is said to be convex if for every pair of vertices u and v in S , the vertices of any u - v shortest path lie entirely in S . A graph G is said to be convex k -accessible if G contains a proper convex set S such that for every $v \in V(G)$, $d_i(u,v) \leq k$ for some $u \in S$. The convex accessibility number of G is given by $con_a(G) = \min\{k : G \text{ is a convex } k\text{-accessible graph}\}$.

This paper combined the concept of convexity borrowed from analysis and the notion of accessibility in graph theory. For a positive number $k \geq 1$, it is shown that there exists a graph G of convex accessibility number exactly equal to k . The construction of such a graph is then given. Moreover, it characterized all graphs having convex accessibility number equal to 1. Finally, it established results on the convex accessibility number of path, cycle, wheel, fan, complete graph, complete bipartite graph, and graphs resulting from some binary graph operations.

Keywords: convex, accessibility, proper, k -accessible, distance

CMPSD-39

ON THE BUNDLE NUMBERS OF GRAPHS

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A *clique* is a set of pairwise adjacent vertices in a graph G . We denote by $C(G)$ and $c(G)$, to be the set of cliques and the cardinality of $C(G)$, respectively. We shall call $c(G)$ the *bundle number* of G . Let $C_k(G)$ be the set of k -cliques in G . Then the number of k -cliques in G denoted by $c_k(G)$ is the order of $C_k(G)$, that is, $c_k(G) = |C_k(G)|$. This paper is a research in Graph Theory which uses both simple counting techniques and sophisticated combinatorial arguments in computing the number of cliques in a graph. Results involving the bundle numbers of some special graphs like trees, cycles, complete bipartite graphs, corona of two graphs, and union of graphs are presented.

Specifically, this study generated among others the following results:

1. Given a graph G with the clique number $\omega(G)$. Then $c(G) = \bigcup_{k=0}^{\omega(G)} C_k(G)$
 and so $c(G) = \sum_{k=0}^{\omega(G)} c_k(G)$
2. Let G be a graph with $V(G) = \{v_1, v_2, \dots, v_n\}$. Then the number of k -cliques in G is at most $\binom{n}{k}$. That is, $c_k(G) \leq \binom{n}{k}$ and

$$c(G) \leq \sum_{k=0}^n \binom{n}{k} = 2^n.$$
3. $c(G + H) \geq c(G) + c(H)$ for two graphs G and H .
4. Let G and H be graphs. Then $c(G \circ H) = c(G) + |G| [c(H + v_i) - 2]$,
 $v_i \in V(G)$
5. Given $p > 0$, there exists a graph G , not necessarily unique, such that $c(G) = p$.

Lastly, this study has discovered some practical applications to business, economics, and organizational studies. For instance, in business and economics, the bigger the bundle number the better is the condition of the business.

Keywords: clique, cardinality, bundle number, corona

CMPSD-40

FOLDING BIPARTITE GRAPHS AND THE SUM OF GRAPHS

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If two non-adjacent vertices of a connected non-complete graph G that have a common neighbor are identified and the resulting multiple edges are reduced to simple edges, then we obtain another connected graph of order one less than that of the original graph. If a similar process is applied to the new graph, and we repeat the

operation until there are no more non-adjacent vertices, we finally get a complete graph. We say that the graph is folded into a complete graph. We denote by $F(G)$, called the fold of G , the set of all complete graphs, up to isomorphism, into which a graph G can be folded. Among others, this study characterizes the graphs that folds into the complete graph K_2 and shows that the fold of the sum of a finite number of graphs is equal to the sum of the folds of the graphs.

This study came up with the following results:

1. $F(G)=K_2$ if and only if G is a (connected) bipartite graph.
2. (a) $K_{\chi(G)}$ is the smallest folding of a graph G , where $\chi(G)$ is the chromatic number of G .

(b) $(G + H) = (G) + (H)$, for any two connected graphs G and H .

3. (a) $F(G + H) = F(G) + F(H)$, for any two graphs G and H .

(b) $F\left(\sum_{i=1}^n G_i\right) = \sum_{i=1}^n F(G_i)$, for all graphs G_i , $i = 1, 2, \dots, n$.

4. (a) $F(G + H) = K_2$ if and only if G and H are bipartite graphs.

(b) $F\left(\sum_{i=1}^n G_i\right) = K_2$ if and only if G_i is a bipartite graph i , $i = 1, \dots, n$.

Keywords: fold of a graph, complete graph, sum of graphs, bipartite, chromatic number

CMPSD-41

EDGE-MONOPHONIC NUMBER OF THE JOIN OF GRAPHS

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A subset $S \subseteq V(G)$ of a graph G is an *edge-monophonic set* of G if every edge of G lies on some monophonic or chordless path joining two vertices of S . The *edge-monophonic number* of G , denoted by $enm(G)$, is the minimum cardinality of an edge-monophonic set of G . This study characterizes edge-monophonic sets in the join of graphs and gives the edge-monophonic number of such graphs.

Keywords: edge-monophonic, chordless path, cardinality

CMPSD-42**ON THE LINEAR SUM OF GRAPHS****Joselito A. Uy^{1*}, Rowena T. Isla¹ and Teresa L. Tacbobo²**

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A linear labeling of a graph G is a one-to-one mapping from the vertex set of G into the set $\{1, 2, \dots, n\}$. The linear sum of linear labeling f of G is $\sum |f(u) - f(v)|$, where the sum is taken over all edges uv in G . The linear sum $s(G)$ of G is the minimum of all linear sums of linear labelings of G . This paper investigated the linear sum of graphs resulting from graph operations. Let v and e be a vertex and an edge, respectively, of complete graph K_n . For any n , $s(K_n - e) = (n^3 - 7n + 6)/6$. If $n \geq 2$, then $s(G) = n(n-1)(n-2)/6$. Graph operations particularly considered were cartesian product, edge and vertex deletion, closure, line graph, and complement.

Keywords: linear labeling, linear sum of labeling, linear sum of graph

CMPSD-43**DERIVATIVE OF A CONTINUOUS GRAPH VIA ITS DEGREE SEQUENCE POLYNOMIAL REPRESENTATION****Joan B. Ybañez^{*} and Rosalio G. Artes, Jr.**

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A non-empty graph G is said to be continuous if every pair of vertices x and y in G are joined by a path. In a continuous graph G , the degree of a vertex v is the number of edges incident with v in G . The degree sequence polynomial

representation of a graph G is the polynomial of the form $f_G(x) = \sum_{i=0}^k a_i x^i$,

where a_i is the number of vertices in G with degree i . From this representation, we

define the derivative of the degree sequence polynomial as $f'_G(x) = \sum_{i=1}^k i a_i x^{i-1}$

A continuous graph G is also said to be semi-differentiable if and only if there exists a graph G' such that $f'_G(x) = f_{G'}(x)$. A graph G' , if it exists, is a semi-

derivative of G . A semi-differentiable graph is said to be differentiable if G' is unique. In this case, G' is the derivative of G .

In this paper, we established some basic properties of the derivative of a continuous graph via its degree sequence polynomial representation. We also determined the derivative of some special graphs such as path, cycle, fan, wheel, complete graph, and complete bipartite graph. Furthermore, the derivative of graphs resulting from the join and the corona of graphs are also generated. Moreover, we have shown that for positive integer n , there exists a differentiable graph of order n . Further, we have generated a result that if a graph G is 3-regular, then G admits a unique continuous derivative.

Keywords: derivative, continuous graph, degree sequence polynomial representation

CMPSD-44

DOMINATING SET AND DOMINATING NUMBER OVER A COLLECTION

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Let X be a non-empty set and Ω be a collection of subsets of X . A subset $A \in \Omega$ is said to *dominate* $B \in \Omega$ if $A \cap B \neq \emptyset$ and $|A \cap B| \geq |A \cap C|$ for any $C \in \Omega$. The *dominating number of A over Ω* , denoted by $dom_{X,\Omega}(A)$, is the number of subsets of X in Ω which are dominated by A . If Ω_1 is the subcollection of Ω containing all the subsets of X dominated by A , the $dom_{X,\Omega}(A) = |\Omega_1|$.

We have characterized all subsets of X which have dominating number over Ω equal to some non-negative integers. A non-empty set X is said to *dominate every element of Ω* . Hence $dom_{X,\Omega}(X) = |\Omega|$, whenever $X \notin \Omega$. In addition, we have shown that for any A subset of B , the dominating number of A over Ω .

In this study, we established some basic properties of the dominating number of a set over a collection. We also determined some important existent theorems and behavior of the dominating number over a collection of subsets of a non-empty set X .

Keywords: cardinality, dominating set, dominating number, collection of subsets, subcollection

CMPSD-45

TRAINING-LESS OPTICAL RECOGNITION OF PRINTED CHARACTERS USING EQUATION FITTING

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We present a novel computational method for optical recognition of printed characters based on our observation that a character image can be divided into several partitions, where each represents a simple mathematical equation. In this paper, we derived a set of mathematical equations to respectively fit parts of an alphanumeric character. Using these equations in tandem with digital image processing, we can identify characters without going through tedious supervised machine training sequences where large samples of learning patterns is required. We digitized ten samples each of printed alphanumeric characters, and store each image in a matrix M , where the (i,j) th matrix element $m_{ij} = I$. To remove noise, we converted M into binary using a thresholding value h , setting all $m_{ij} > h$ to 1, and to 0 otherwise. We "thinned" M by reducing to 0 some matrix elements in the Moore neighborhood of a chosen $m_{ij} = 1$, following the Rutovitz and Hilditch thinning procedures, to make sure that a continuous thin line is visible in M . We divided the thinned M into six partitions: two columns and three rows. In each partition, we extracted the coordinates (i,j) of each $m_{ij} = 1$ and subjected them to equation fitting.

We determined which equation the image part fits best using a simple correlation analysis. We developed a table of patterns for each character, wherein a table entry that matches the 6-part pattern determines the alphanumeric character. We validated our method using 360 images where our method correctly classified 94% of Arial fonts. Of the 6% error, our method interchangeably identified C as G, 9 as S, and I as T. Based on the promising result from our validation method, we

conclude that our method is a potential alternative optical recognition scheme, specifically on machine printed characters.

Keywords: optical character recognition, training-less, equation fitting.

CMPSD-46

CONSTRAINED MULTIPLE SEQUENCE ALIGNMENT TOOL

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Constrained Multiple Sequence Alignment provides biologists a way to incorporate their knowledge about the functionalities and structure of sequences in their alignments. It has been anticipated that constrained sequence alignment was to integrate the knowledge of biologists with regards to the structures/functionalities/consensus of their data sets into sequence alignments such that specified residues matching the given constraints are aligned together in the result.

The "Constrained Multiple Sequence Alignment Tool" (CMSA Tool) is an online application which uses the memory-efficient CPSA (Constrained Pairwise Sequence Alignment) algorithm in aligning multiple sequences. Input validation provided by CMSA Tool ensures that the data processed by the server are correct. Sequence input can be done via text files, text area and from the sequence database. The CMSA Tool generates a text file that is available for the user to download. The CMSA Tool Database allows users to browse through the biological sequences, substitution matrices and CMSA results. The tutorial module built within the CMSA Tool allows the lesson administrator to update the text part of the lessons in the database, upload images and supplementary materials important in the understanding of the lessons. The tutorial module also allows users to take an automatically generated test assess their knowledge of the lessons.

Keywords: constrained multiple sequence alignment, memory-efficient, biological sequences, substitution matrices

CMPSD-47

COMBINATORIAL PATTERN DISCOVERY TOOL

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Sequence pattern discovery aims at developing tools and methods for finding a priori unknown patterns in a given set of biological sequences, patterns that are frequent, unexpected or interesting according to some formal criteria. A pattern or a motif is a repeating subsequence and often has a vital biological role.

The Combinatorial Pattern Discovery Tool is a web-based application tool which aims to find the maximal patterns from a given set of protein/DNA/RNA sequences. Maximal patterns are found using the Teiresias algorithm involving two phases: scanning phase and convolution phase. The offset lists corresponding to the maximal patterns, which determine the locations of a specific maximal pattern in the input sequences, are also displayed. The users of the system can browse through each of the maximal patterns and their corresponding offset list and save them in their hard disks. In addition, there is a tutorial module which provides lectures and supplementary materials to aid in the understanding of concepts behind the discovery of patterns in biological sequences. A Flash animation file is also included to demonstrate how the Teiresias algorithm works given a sample input. An automatically generated test is also provided to test the users about maximal patterns. Teiresias algorithm does not enumerate the entire solution space, thus saving a considerable amount of time. The reported patterns generated possess the maximality property and cannot be made more specific without simultaneously reducing the size of its offset list. However, it requires significant amount of memory to perform its task.

Finding the maximal patterns found in biological sequences is important for molecular biologists as these usually corresponds to residues conserved during the evolution due to an important structure or functional role.

Keywords: maximal patterns, biological sequences, sequence similarity, Teiresias algorithm

CMPSD-48

MSA: MULTIPLE SEQUENCE ALIGNMENT

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MSA: Multiple Sequence Alignment is a web-based tool capable of aligning three or more biological sequences which can either be DNA, RNA, or protein. In general, the input set of query sequences are assumed to have an evolutionary relationship by which they share a lineage and are descended from a common ancestor. From the resulting MSA, sequence homology can be inferred and phylogenetic analysis can be conducted to assess the sequences' shared evolutionary origins.

MSAs require more sophisticated methodologies than pairwise alignment because they are more computationally complex to produce. Most multiple sequence alignment programs use heuristic methods rather than global optimization because identifying the optimal alignment between more than a few sequences of moderate length is prohibitively computationally expensive.

This MSA project was patterned after ClustalW and hence employs heuristics to find a good multiple sequence alignment. It starts by doing pairwise alignment between sequences to determine the degree of similarity between each pair. The result of this alignment is stored in a distance matrix. The second step involves the construction of a similarity tree using the distance matrix and the Neighbor-Joining method wherein the root is placed at the midpoint of the longest chain of consecutive edges. The last step involves the combination of the alignments starting from the most closely related groups to the most distantly related groups by going from tip of tree to the root of the tree.

This MSA project can accept sequences with the following format: NBRF / PIR, EMBL / UniProtKB/ Swiss-Prot, Pearson (Fasta), GDE, ALN / ClustalW, GCG / MSF, RSF. The user can adjust a number of parameters such as the gap and pag-extension penalties.

Keywords: multiple sequence alignment, phylogenetics, ClustalW

CMPSD-49

A JOHNSON SCHEME INTERPRETATION OF NUCLEOTIDE ALPHABET COMPOSITION

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The purine-pyrimidine and hydrogen donor-acceptor pattern governing nucleotide recognition have been shown to correspond formally to a digital error-detecting (parity) code when the said properties are used to give each informationally distinct nucleotide a unique 4-bit numerical representation. The potential nucleotide alphabet of 16 letters corresponds to the set of all 16 4-bit numbers (the binary space B^4). McDonnail has shown that nucleotide, so interpreted, may be depicted as positions on a hypercube Q_4 . By introducing a mapping $(v) = v'$, of $v = a_1 a_2 a_3 a_4 \in Q_4$ into a set v' such that $j \in v'$ if and only if $a_j = 1$. The set of all resulting v' 's will yield the power set 2^A where $A = \{1, 2, 3, 4\}$, which can be expressed as vertices of the i th graphs of the Johnson Scheme $G_i(n, k)$ for $k = 0 \dots 4$. We note that a particular i th graph of the Johnson Scheme $G_i(4, 2)$ is a graph where two vertices are adjacent if they are base pairs.

It has already been suggested before that factors other than physiochemical issues alone shaped the natural nucleotide alphabet. This paper shows that such shaping as well as the interrelationships of the nucleotide alphabet are supported by the theory of association schemes.

Keywords: DNA, parity, association schemes, johnson scheme, nucleotide

CMPSD-50

ELECTRICAL CHARACTERISTICS OF AMORPHOUS ZnO FOR UV SENSORS APPLICATION

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Active materials of UV detectors such as single crystalline ZnO, are capable to convert electromagnetic energy to current and are commonly grown in vacuum condition which is expensive. In this study, we introduce an amorphous ZnO having 99.0% purity as an alternative semiconductor for photodetectors using Metal-Semiconductor-Metal (MSM) configuration via point and interlocking electrode configurations. The preparation and characterization were done in a non-vacuum condition which is economical. The ZnO powders were dried at 200, 300 and 400°C for 1 hour and were then pelletized at 8 tons for 2 minutes/sample. The electrical characteristics of the samples were measured using the Van der Pauw technique and results show the resistivity of the dried samples decreases about 10 times lower than that of the undried and as-prepared samples which could be due to the removal of moisture after drying. All samples exhibit n-type behavior and the conductivities (10^{-7} - 10^{-3} S/cm) of the samples increase with higher temperature. In comparison to a single crystal ZnO grown using hydrothermal method, the carrier concentrations of the samples are low n-type (10^{10} - 10^{11} cm⁻³) material. No significant change of the Hall factor of the samples is observed; but it is 100,000 times lower than the reported ZnO single crystal. The Hall mobility is of the order 10^4 - 10^5 cm²/V·s which is large and investigations are undergoing for further clarification.

The current-voltage curves for samples with the point electrode configuration under UV illumination (365nm) using two-probe technique show significant change in the conductivity about 10-10,000 times that of the dark condition. For the current-voltage curves of the samples with interlocking electrode MSM configuration exhibits the same behavior of increasing conductivity under UV illumination, but the increase is about 10 times that of its dark condition. These findings show the potential of amorphous ZnO for UV sensing.

Keywords: photodetector, ZnO, metal-semiconductor-metal, Van der Pauw technique

CMPSD-51

GERMICIDAL LAMP-INDUCED SYNTHESIS OF SILVER NANOPARTICLES IN CROSSLINKED POLYMER GLOBULES

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A lot of photochemical methods for synthesizing nanoparticles have been presented in literature already but they involve expensive materials and equipment like the use of high pressure mercury lamp under nitrogen atmosphere. This study presents a very simple and cheap method of generating nanoparticles stabilized

by a crosslinked polymer globule. The process involves the addition of varying amount of silver nitrate into a 1 mg/mL aqueous solution of polyacrylic acid (PAA) and irradiating the sample using four 10-watt UVC germicidal lamps in open air vessels.

Polyacrylic acid assumes a coiled conformation in its unionized form and an extended conformation in its ionized form. Addition of silver ions collapses the PAA chains into globules. Irradiation crosslinks the PAA chains and makes the globular structure as verified by kinematic viscosity studies. The viscosity of the original silver ions/PAA solution was 1.057 centipoise. Titrating it with sodium hydroxide caused the viscosity of the unirradiated solution to increase to 961.1 cP while that of the irradiated solution increased only slightly to 1.292 cP. This difference indicates that the silver-PAA complex retained its globular structure and resist large conformational changes after the irradiation process.

Increasing the radiation exposure not only crosslinks the PAA but also reduces the silver ions into the metallic state. UV-Vis spectra of the solutions showed the characteristic plasmon absorbance of silver nanoparticles at 440 nm and the AgPAA complex absorbance at around 800 nm. Scanning electron micrographs of the silver-PAA complex showed the particles synthesized using this method have sizes ranging from 50-300 nm.

Keywords: crosslinked polymer globules, silver nanoparticles, UVC germicidal lamp radiation

CMPSD-52

SURFACE MORPHOLOGY OF POLYANISIDINE-POLYVINYLACETATE COMPOSITE FILMS

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Fabrication of polyanisidine (PAnis) composite films using five different concentrations of polyvinyl acetate (PVA) was successfully carried out. In this present study, we aim to investigate the possibility of film formation through the use of PVA, a synthetic polymer determined to contain a functional additive called plasticizer which accounts for the flexibility associated with its use. Morphological investigations on the films were facilitated using a Hitachi TM-1000 Tabletop scanning electron microscope.

Standard oxidative polymerization was used in the synthesis of our Polyanisidine samples. Perchloric acid was used as the dopant since theoretical and experimental results attest for its ability to increase the samples' conductivity.

Formation of the films was done by combining five different concentrations of PVA with the polyanisidine samples. The amount of PANis was set to a constant mass for each sample. Each of these mixtures was then uniformly layered onto sensitized film substrates.

We captured images of each of the five fabricated films at 500x magnification from the scanning electron microscope and these were used to look into the morphology of the fabricated films. The images revealed clear mixing of PANis and binder. At low binder concentration, the films were still coarse with the grains of our PANis still visible. But with the films of higher binder concentration, smoothing of the film surfaces were now observed.

It can be interpreted that the inclusion of binder in substantial degree of concentration facilitates effective dispersion of the polymer grains into the binder and results to the smoothing of the film surfaces as was observed.

Keywords: polyanisidine, conducting polymer, composite films

CMPSD-53

DIP SELF-ASSEMBLY OF AgPAA-PDDA ON GLASS: INFLUENCE OF IONIC STRENGTH

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Dip self-assembly is a popular method of fabricating thin films with highly ordered structures and tunable properties. The main attraction of the technique, which is based on alternate deposition of oppositely charged species on a charged surface, is due to the low cost and ease with which functional thin films can be designed. In this study, the method is applied to the preparation of multilayers composed of silver polyacrylate (AgPAA) nanocomposites and polydiallyldimethylammonium chloride (PDDA) on a glass substrate. The salt content of the PDDA solution was varied to study the effect of ionic strength on the deposition of AgPAA on PDDA.

The AgPAA nanocomposites have a net negative charge due to residual carboxylate groups on PAA. In turn, this negative charge allowed the deposition of AgPAA on the surface of a polycation, PDDA. The thickness and surface roughness of the films produced are influenced by ionic strength of the PDDA dipping solution. With no added salt, 5 nm-thin and flat films are produced. Increasing the salt concentration to 0.1 M produced 80 nm-thick and rough films as shown in the atomic force microscopy (AFM) images. This difference is explained by considering the conformational transition from extended chains at low ionic strength to globular coil at high ionic strength of PDDA in solution. However, further increase in salt concentration resulted in thinner films. It is possible that the chloride ions from the added salt effectively competed with AgPAA for positively charged sites and displaced it from the PDDA surface. Thus, for a PDDA/AgPAA polyelectrolyte multilayer system, the best condition for deposition is at 0.1 M NaCl concentration.

Knowing these conditions, one can tailor the thickness and morphology of AgPAA-PDDA thin films and apply it to the fabrication of photonic Bragg-stack structures.

Keywords: dip self-assembly, silver-polyacrylate nanocomposite, polymer multilayers

CMPSD-54

OPTIMAL CONTROL OF THIN FILM FLOW WITH STATE ESTIMATION FROM NOISY MEASUREMENTS

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The Kuramoto-Sivashinsky (KS) equation is a (one-dimensional) simplified form of the Navier Stokes equations which is useful in studying certain cases of thin film flow. This equation was first introduced by Kuramoto in the study of phase turbulence in the Belousov-Zhabontinsky reaction and has been useful in a wide range of applications including concentration waves, plasma physics, flame

propagation and viscous flow problems. In this work, we study its applications where the vertical flow of a thin film is desired to have as small fluctuations as possible, e.g., in applications where a certain material lying horizontally on a conveyor belt is coated with a film flowing vertically.

Let $z \in \Omega = [-\pi, \pi]$ denote the vertical axis, and let $\eta(z, t)$ denote the distance of the film from the vertical plane. The KS equation is given by

$$\frac{\partial \eta(z, t)}{\partial t} + \frac{\partial^4 \eta(z, t)}{\partial z^4} + \frac{\partial^2 \eta(z, t)}{\partial z^2} + \eta \frac{\partial \eta(z, t)}{\partial z} = 0$$

(1)

with initial condition $\eta(z, 0) = \eta_0(z)$

(2)

and periodic boundary conditions $\frac{\partial^n \eta(-\pi, t)}{\partial z^n} = \frac{\partial^n \eta(\pi, t)}{\partial z^n}, n = 0, 1, 2, 3.$

(3)

The displacement η is not measured at all points along the vertical surface, and typically, one or two point sensors along the wall are employed. Thus, the full displacements (or the full state of the system) must be reconstructed from one or two point observations. Furthermore, these measurements are corrupted by noise and hence we will consider measurements with white Gaussian noise. By employing appropriate approximation methods (i.e., choosing basis functions which satisfy the boundary conditions (2) and which satisfy the necessary smoothness requirements), then the finite-dimensional (in space) KS equation can be written in the form

$$\begin{aligned} M\dot{x}(t) + Ax(t) + N(x(t)) &= Bu(t) + w(t), x(0) = x_0 \\ y(t) &= Cx(t) + v(t). \end{aligned}$$

(4)

Here x is the state vector, u is the control vector, w is the system noise, C is the state observation operator, y is the noise-corrupted state measurements, and the function N contains the non-linear components of the model.

The Linear Quadratic Gaussian (LQG) Problem is to minimize the performance index

$$\min J(u(t)) = \lim_{T \rightarrow \infty} \frac{1}{T} E \left\{ \frac{1}{2} \int_0^{\infty} [x^T(t)Qx(t) + u^T(t)Ru(t)] dt \right\}$$

(5)

subject to (4).

By solving the LQG problem, we obtain the optimal control in feedback form. We present our numerical results in Figures 1, 2, and 3. Figure 1 shows the true state of the uncontrolled system, Figure 2 is the controlled system using linear control and partial state observation (with a point measurements at $z=\pi/2$) and Figure 2 is the controlled system using LQG feedback control.

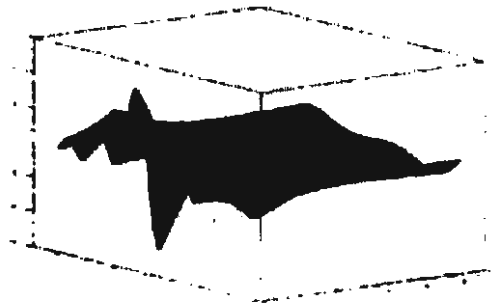


Figure : The uncontrolled system

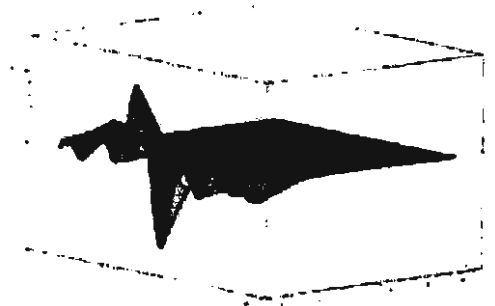


Figure : Controlled system using linear control and state reconstruction

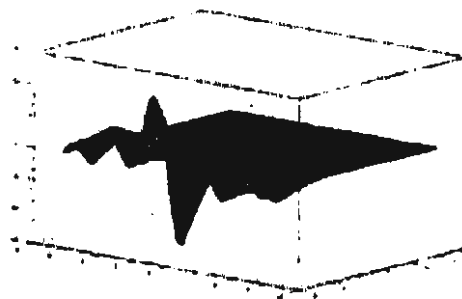


Figure : Controlled system using LQG optimal control with state reconstruction

Keywords: LQG Control, state estimation, optimal feedback control, Kuramoto Sivashinsky equations, thin film flow

CMPSD-55

SURFACE MORPHOLOGY OF BI-2212 FILMS GROWN BY PULSED LASER DEPOSITION

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Bi-2212 films on MgO substrates were grown via pulsed laser deposition technique. A bulk Bi-2212 superconductor stoichiometric target and substrate are mounted inside the vacuum chamber. The target was irradiated with a 1064 nm pulsed Nd: YAG laser with repetition rate of 10 Hz under an atmospheric pressure of 10^{-3} mbar. The films were annealed ex-situ at different duration. A longer annealing time produced better morphological properties, such as growth of more planar grains, smoother surface and more homogenous composition. XRD of longer annealed films also indicated better film crystallinity.

Keywords: surface morphology, stoichiometric, planar grains, film crystallinity

CMPSD-56

CALCULATION OF THE WINDING PROBABILITY FOR AN ENTANGLED POLYMER WITH A HARMONICALLY LENGTH VARYING POTENTIAL

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Recently C.C.Bernido et.al. use the stochastic white noise analysis to solve the polymer entanglement problem for a class of length dependent potentials (C.Bernido, M.V.Carpio-Bernido and J.Bornales 2005,2006,2007).

Their calculations follow the Hida and Streit formulation of the path-integral. The results of their calculations were able to describe some interesting physical characteristics of proteins such as chirality.

In this work we calculate the winding probability of an entangled polymers for a class of harmonically length varying potentials. Moreover we use the procedure developed by Wiegel (Wiegel,1986) wherein the winding probability is solved from a diffusion like equation. Here, we take as an example the case where the potential varies as a periodic cosine of the form

$$W_n(N) \approx \frac{R}{l} \sqrt{\frac{4\pi}{N}} \exp \left\{ -\frac{R^2}{Nl^2} \left[2\pi n - \frac{k}{2\alpha R^2} \sin^2(\alpha L) \right]^2 \right\}$$

where R is the winding radius. For $k = 0$ we obtain the result for a random walk in a circle (Wiegel,1983).

Keywords: entanglement, winding probabilities

CMPSD-57

SINGLE BEAM PERFORMANCE TEST FOR THE GLOBAL LARGE DETECTOR CALORIMETER

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The International Linear Collider (ILC) is a proposed linear collider that would surpass any other linear colliders of today in terms of center-of-mass collisions. One of the goals of the ILC is to understand the mechanism behind mass generation. This would extend the capability of the Standard Model to describe the fundamental particles, thus it is essential that every part of the ILC be studied well to ensure that all events in the ILC are well understood. This study, through computer simulation using SimTools and ROOT programming, checks the capability of the Global Large Detector (GLD) calorimeter for the ILC in terms of response linearity and energy resolution. Using gamma and kaon0L as test particles, the energy response of the GLD calorimeter is determined to be linear as a function of incident energy. A calibration factor of 24.18 is obtained when using the energy deposit of gamma particles in the calorimeter. The energy resolution when using gamma particles is $(14.92 \pm 0.69)\% / \sqrt{E}$ ($1.9 \pm 1.1\%$), while for kaon0L particles is $(45.98 \pm 2.8)\% / \sqrt{E}$ ($11.3 \pm 2.9\%$). Varying the initial direction of particles does not affect the linearity of the energy response for both particles and on calculating the calibration factor when using gamma particles. It also reveals that the energy

resolution is better at the barrel region than at the endcap. From the analysis of the obtained data, we can conclude that the GLD calorimeter, in terms of response linearity and energy resolution, is a suitable calorimeter for the ILC project.

Keywords: collider, energy response linearity, energy resolution, calibration factor, barrel region, endcap region, calorimeter, gamma particles, kaon0L particles, Standard Model, SimTools, ROOT programming

CMPSD-58

STUDY OF AVALANCHE PROCESSES IN A GAS ELECTRON MULTIPLIER USING GARFIELD

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A Time Projection Chamber (TPC) is the primary option for the main tracker of the detector at a future e^+e^- linear collider. The design issues for developing a high performance TPC are discussed with particular emphasis on the R&D, since using contemporary high-density readout electronics, a proportional gain of several thousand is required for fully efficient detection of minimum ionizing particle in thin layers of gas. A new type of gas amplification system, based on Gas Electron Multiplier (GEM) structures meets this challenge.

To study in details the operation mechanism of gas multiplication process and the charge transfer parameters in a GEM structure, the simulation program GARFIELD was used. First the field maps for the potential, electric field and dielectric medium were produced by MAXWELL using the method of finite elements. These files can be imported by GARFIELD and further drift simulations for the avalanche processes in a GEM can be run. The effective gain of the structure, defined as the ratio of collected to primary charge was measured by investigating the start and end points of the tracks followed by the created electrons and ions.

Results of the avalanche simulations worked at a mixture of 93%Argon-5%Isobutane-2%Carbon dioxide gas and performed at atmospheric and low pressure, with single electron starting from points randomly distributed above the GEM, give an effective gain from 10^4 up to 10^5 . Half of the produced electrons are lost due to absorption on the lower surface of the GEM and approximately 40% of the total electrons can leave the GEM hole and a fraction of it contributes to the signal.

Keywords: Time Projection Chamber (TPC), Gas Electron Multiplier (GEM), GARFIELD, MAXWELL, avalanche process, effective gain.

CMPSD-59

GREEN FUNCTION AND ENERGY SPECTRUM OF A 3D DIRAC OSCILLATOR

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The Dirac oscillator is the counterpart of harmonic oscillator in relativistic quantum mechanics. It behaves like a harmonic oscillator with a spin-orbit coupling in the classical limit [Monshisky et al., 1989]. Here, we utilize the Feynman path integral prescription to obtain the Green function that satisfies the iterated Dirac equation for a three-dimensional Dirac oscillator.

The Green function, $g(\mathbf{r}'', \mathbf{r}')$, that satisfies the iterated Dirac equation is given by

$$g(\mathbf{r}'', \mathbf{r}') = \frac{i}{2M} \sum_s \eta \eta^* \int_0^\infty \langle \mathbf{r}'' | \exp\{-iH_{eff}\Lambda\} | \mathbf{r}' \rangle d\Lambda$$

where $\eta = \langle \chi | \otimes m \rangle$, $\eta^* = \langle m | \otimes \chi \rangle$, $\mathbf{r} = \mathbf{r}(x, y, z)$ and $H_{eff} = M^2 - \hat{D}^2$ with

$$\hat{D} = -\beta \boldsymbol{\alpha} \cdot (\mathbf{p} - iMf\beta \mathbf{r}) + \beta E$$

Here $\boldsymbol{\alpha}$ and β are the usual Dirac

matrices, M is the mass of the particle, f is the oscillation frequency and E the energy and where and we set $\hbar = c = 1$.

The integrand in Eq.(1) is similar in form to a quantum propagator of a particle which starts at initial point \mathbf{r}' and terminates at point \mathbf{r}'' that evolves in a time-like parameter Λ . Expressing the integrand as Feynman path integral, i.e.,

$$\langle x'' y'' z'' | \exp\{-iH_s \Lambda\} | x' y' z' \rangle = \int \exp\left\{i \int_0^\Lambda L d\lambda\right\} d[xyz]$$

where L is the Lagrangian of the system. The Lagrangian can be obtained by performing the Legendre transformation which yields a form similar to a non-relativistic harmonic oscillator plus a term due to the spin-orbit coupling and some constants. The evaluation of the path integral, Eq.(2), is then carried by following the same procedure as in the non-relativistic case. Expressing the results in terms of Hermite polynomials, the second order Green function for the Dirac oscillator is

$$g(\mathbf{r}'', \mathbf{r}') = \sqrt{\frac{Mf^3}{\pi^3}} \sum_{\mathbf{r}} \eta \eta^* \exp \left[\frac{-Mf}{2} \left\{ x'^2 + x''^2 + y'^2 + y''^2 + z'^2 + z''^2 \right\} \right] \cdot \sum_{l=0}^{\infty} \sum_{m=0}^{\infty} \sum_{n=0}^{\infty} \frac{1}{2^{l+m+n+1} (l! m! n!)} H_l(\sqrt{Mfx'}) H_l(\sqrt{Mfx''}) H_m(\sqrt{Mfy'}) H_m(\sqrt{Mfy''}) \cdot H_n(\sqrt{Mfz'}) H_n(\sqrt{Mfz''}) \left\{ \mathcal{F} \left(l+m+n + \frac{3}{2} \left(\frac{\beta}{2} + \frac{f\epsilon}{2} (2j+1) + \frac{E^2 - M^2}{2M} \right) - i\kappa \right) \right\}^{-1}$$

in the limit as 0 where $\beta = \pm 1$ and $\epsilon = \pm 1$.

The energy spectrum of the system can be extracted from the poles of Eq.(3). For positive energy states (when $\beta = +1$), $E^2 - M^2 = Mf \{ 2(N+1) + \epsilon(2j+1) \}$

and for negative energy states (when $\beta = -1$), $E^2 - M^2 = Mf \{ 2(N+2) + \epsilon(2j+1) \}$

where we set $N=l+m+n$ with $l, m, n = 0, 1, 2, \dots$. These results agree to the spectrum obtained by Benitez et al. in 1990.

Keywords: relativistic quantum mechanics, Dirac oscillator, path integral, Green function, energy spectrum

CMPSD-60

ON THE PROPAGATOR OF A CHARGED PARTICLE IN A CONSTANT MAGNETIC FIELD WITH 2-D ANISOTROPIC HARMONIC OSCILLATOR POTENTIAL: A WHITE NOISE FUNCTIONAL APPROACH

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The Feynman propagator for a charged particle in a constant magnetic field with a two-dimensional anisotropic harmonic oscillator potential is evaluated using white noise analysis. In this framework, the Feynman propagator can be expressed as,

$$K(\mathbf{x}'', \mathbf{y}'', \mathbf{z}''; \mathbf{x}', \mathbf{y}', \mathbf{z}'; T) = \int I d\mu(\omega)$$

(1)

where $I = I_0 \delta(\mathbf{x}(T) - \mathbf{x}') \exp \left[-i \int_0^T V(\mathbf{x}(\tau)) d\tau \right]$ and

$$I_0 = N \exp \left[\left(\frac{i+1}{2} \right) \int_0^T \omega(\tau)^2 d\tau \right].$$

For the system being considered, the

potential V is given by $V = \Omega_y^2 y^2 + \Omega_z^2 z^2 - \gamma(x y - y x)$. In white noise

analysis, the integration over the Gaussian white noise measure $d\mu(\omega)$ in Eq. (1) is just the T-transform of the functional I . Performing the T-transform and following the procedures discussed separately in a paper by C.C. Bernido and M.V. Carpio-Bernido (2002) and in a paper by de Faria et al. (1991), we obtained the following results:

$$K(x'', y'', z''; x', y', z'; T)$$

$$= [H(\Omega)]^{-1/2} K_0(x'', x'; T) K_{\Omega_y}(y'', y'; T) K_{\Omega_z}(z'', z'; T) \exp \left[\frac{i\gamma}{2} (x'' y'' - x' y') \right]$$

$$\times \exp \left[\frac{i\gamma^2 g(\Omega T)}{2\Omega^3 T^2 H(\Omega T)} (x' - x'')^2 + \frac{i\gamma \tan \frac{\Omega T}{2}}{\Omega T H(\Omega T)} (x' - x'')(y' + y'') + \frac{i\gamma \tan^2 \frac{\Omega T}{2}}{2\Omega^2 T H(\Omega T)} (y' + y'')^2 \right]$$

where, $K_0(x'', x'; T)$, $K_{\Omega_y}(y'', y'; T)$, and $K_{\Omega_z}(z'', z'; T)$

are propagators for free-particle in x , harmonic oscillator in z , respectively;

$\gamma = qH$, q is the charge, H is the magnetic field; $\Omega^2 = \Omega_y^2 + \gamma^2$, Ω_y

is the frequency along y ; $H(\Omega T) = 1 - \gamma^2 g(\Omega T) / (\Omega^3 T)$,

$g(\Omega T) = \Omega T - 2 \tan(\Omega T / 2)$. The final propagator agrees with the known result.

Keywords: Brownian motion, white noise analysis, T-transform, Feynman path integral, functional

CMPSD-61

**WHITE NOISE APPROACH ON THREE DIMENSIONAL
ANISOTROPIC HARMONIC OSCILLATOR IN A
MAGNETIC FIELD**

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The two and three-dimensional anisotropic harmonic oscillator (AHO), which describes the behavior of the electron in an anisotropic lattice in semiconductor physics, have been solved successfully through Feynman Calculus or time-slicing method. In this study, the 3-dimensional AHO in a magnetic field is resolved via a different approach called the white noise functional, which is mathematically well established compared to the time-slicing method. Although Feynman calculus had penetrated the problems in quantum mechanics with great success but it lacks the solid mathematical foundation. In the white noise approach, the effective action of AHO with external magnetic field is set-up and expressed in terms of the white noise variable $\omega(\tau)$, or just the time derivative of the Brownian motion, and following the procedures discussed in the separate papers of B.K. Cheng (*J. Phys. A: Math. Gen.* 17, 1984) and C.C. Bernido, et al. (*Functional Integrals in Stochastic and Quantum Dynamics*, Jagna, Bohol, CVIF, 2001), the propagator separable in xy and z resulted. Finally, employing the change of coordinates from Cartesian to Cylindrical system, the propagator for AHO is obtained as expressed in the paper of D. Peak, et al. (*Journal of Mathematical Physics*, Volume 10, Number 8, August 1969) which was done through the method of time-slicing.

Keywords: white noise functional, time-slicing method, anisotropic harmonic oscillator, brownian motion

CMPSD-62

INVESTIGATION ON THE DIFFERENCE BETWEEN THE SOUND EMITTED BY QUEEN-RIGHT AND QUEENLESS HIVES OF TRIGONA BIROI

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Investigations on the frequency of the sounds produced by the stingless bee *Trigona biroi* were done. This is to determine the possible frequency range difference that would arise between a queen-right hive and a queenless hive. Frequency analysis showed the presence of an additional frequency peak in the absence of the queen.

We sampled three hives and recorded the sound coming from each one with the use of Logger Pro™ Microphone. Sound recordings were done at 5- and 10-second durations, 10 trials for each. A hive was then intentionally divided to insure the absence of the queen and the same recording procedures were done. The raw data (sound pressure versus time) was obtained through the use of LabPro™ interface and stored on the computer.

In order for us to determine the frequency of the sounds of these bees, Fast Fourier Transforms (FFT) was applied to the data gathered which was projected as a graph of amplitude versus frequency. The resulting FFT graphs revealed frequency peaks at 300-350 Hertz and this was generally observed for each of the recordings that were done in all hives. It is also important to note the presence of a peak at 200 Hertz which was gradually reduced as recordings proceeded.

Upon the division of one of the hives however, in which case the hive is already queenless, we observed an additional peak at 200 Hertz and considerably higher than the 300-350 Hertz peak that was observed when the colony was still intact. This observed peak on the queenless colonies could indicate when the queen is present or not in a hive.

Keywords: stingless bees, *trigona biroi*, fast fourier transforms, frequency peaks

ENGINEERING SCIENCES & TECHNOLOGY DIVISION

ESTD-1

FORMATION OF BIODIESEL FROM DIFFERENT OILS

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Biodiesel is a renewable and biodegradable fuel extracted from plant oils. It is a natural hydrocarbon with little sulfur content and can be used in diesel engines without any need for engine modification. This study was undertaken to produce and compare the biodiesel derived from coconut oil, vegetable oil, used oil and lard. Biodiesel is produced from the tranesterification of oil using methyl alcohol in the presence of a catalyst in 0.1N NaOH, heated to 50-80°C for four hours. The biodiesel is separated from the glycerol by decantation, 5 N HCl is added to neutralize the pH, washed with water at 50°C and the washed water evaporated. This process forces out the unwanted components in the oil, which could cause the gumming and clogging of fuel systems and eventually lead to engine failure in the long term. Coconut oil produced a clear to yellow liquid, pH 7.0, acid value of 0.27, viscosity of 2.6 mm²/sec at 40°C. Vegetable oil produced a clear yellow liquid, pH 7.0, acid value of 0.29 and viscosity of 3.2 mm²/sec at 40°C. Used oil was a clear brownish liquid, pH 7.0, acid value of 0.42 and viscosity of 4.7 mm²/sec at 40°C. The above data were within the American Society for Testing and Materials (ASTM) standard limits. No data was obtained for lard because it solidifies in a very short period of time and no biodiesel was produced. The gas chromatography-mass spectra of the biodiesel gave a base peak at 74m/z corresponding to mono alkyl esters of long chain fatty acids which confirmed the presence of methyl esters in the samples.

Keywords: biodiesel, tranesterification, viscosity, acid value, gas chromatography-mass spectra

ESTD-2

**ENZYME-ASSISTED EXTRACTION
AND *Carica papaya* LATEX-CATALYZED
TRANSESTERIFICATION OF *Jatropha curcas* L. OIL
FOR BIODIESEL PRODUCTION.**

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The never ending oil price hike and growing environmental concerns with regards to the use of these fuels have triggered the search for alternative sources of energy, biodiesel is one. Biodiesel is produced from the transesterification of oil. The seed from the *Jatropha curcas* plant contains extractable oil and it can be used to produce biodiesel.

The oil was extracted enzymatically using the enzymes xylanase, cellulase, amylase and lipase. The enzyme together with the seed slurry was incubated in a water bath at the optimum temperature and incubation time for each enzyme. Extraction was done individually with these enzymes as well as combinations of the four enzymes. Individually the highest oil yield of 44.13% was obtained for the enzyme xylanase (X), then 42.13% for cellulase (C), 32.38% for amylase (A) and 28.88% for lipase (L). These enzymes were used consecutively in the order XACL and this resulted in a higher oil yield of 74.44%. The solvent extraction process resulted in a 76.63% oil yield.

The oil extracted was then transesterified with *Carica papaya* latex acting as catalyst. Methanol and oil was mixed in a 4:1 mol/mol ratio, papaya latex was then added and the mixture incubated at the optimum temperature. Papaya latex transesterification resulted in a percent conversion of 80% while the base-catalyzed process resulted in an 84.5% conversion.

The use of enzymes and enzyme combination for oil extraction was found to be comparable to the traditional chemical extraction method using solvents. The same was observed for the transesterification of the oil using latex from papaya.

Keywords: jatropha, extraction, transesterification, biodiesel, enzyme

ESTD-3

RE-MAP: A DECISION SUPPORT SYSTEM FOR MAPPING RENEWABLE ENERGY RESOURCES AND SYSTEMS IN THE PHILIPPINES

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Renewable energy (RE) resource data and information are important in the development and implementation of RE projects in the country. These include technical data and information that are required in the conceptualization/design of potential RE projects and market information that are necessary in evaluating the economic/financial viability of RE projects. Hence, there is a need to address such updating of RE data and information to aid and fast track development and implementation of RE projects; facilitate the generation of useful databases and the expedient exchange of information; and to update and augment existing resource data for use by RE developers/investors, for use in policy advocacy and strategic planning to estimate energy mix and address energy independence. Thus, the MMSU-ANEC developed a decision support system called *RE-MAP* or *Renewable Energy-Mapping Analysis Program* to build wealth of geo-referenced data and information on RE resources (solar, wind, hydro, and biomass) *for policy research and development on RE resources and systems. Geo-referenced database and thematic maps as major outputs of RE-MAP showed various indicators on assessment, monitoring and evaluation, and efficiency thrusts that are useful for energy research, planning and policy options for rationalization and resource management of energy mix required under the medium- and long-term energy development and investment plan of the country. The use of remote sensing, geographic information system, and global positioning system for building of wealth of spatial databases on RE resources and systems, as well as other geographic features of the country are innovative geoinformatics mapping tools to share RE data and information which could be easily updated, stored, ready for any subsequent analysis, and can be shared to other twenty ANECs strategically located all over the country, Department of Energy, and other stakeholders.*

Keywords: decision support system, geographic information system, global positioning system, renewable energy

ESTD-4

PERSISTENT ORGANIC POLLUTANT INFORMATION AND SURVEYING SYSTEM

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An international warning has been raised against a dangerous group of chemicals, the Persistent Organic Pollutants (POPs). They are a class of chemicals that are capable of long-range transport, can accumulate into plant and animal tissues and can persist for a long period of time. Pollutant concentration within living tissues is dangerous. It would cause various health problems. This threat is further worsened by the fact that even if a pollutant was not manufactured in an area, it could reach distant places far from where it was originally produced.

It is a good precaution if people know of the presence of POPs in their area. The Online Persistent Organic Pollutant Information and Surveying System is developed as means of risk assessment for citizens and authorities, so that they may take proper action in response to the threat. The system allows the general public to view the map marking pollutant concentration of different POPs within Metro Manila. Staff from the DENR-Environment Management Bureau for example who are represented in the system as the researcher is allowed to input areas of pollutant concentration and environmental data. The system leaves to the chemical analyst the task of verifying and accepting or rejecting data submitted by field researchers. The chemical analyst is also allowed to add and edit pollutant records. The system administrator manages the accounts of other system users. All of the registered users are allowed to access the bulletin board, where discussions concerning the system can be held.

The system is able to make predictions of the future levels of POPs concentration. However it neglects transfer of pollutants from other areas and also disregards pollutants produced after the data's time of entry.

Keywords: bioaccumulation, persistence, persistent organic pollutants, risk assessment

ESTD-5

ANIMAP: A WEB-BASED CITY POUND MANAGER AND GEOGRAPHICAL INFORMATION SYSTEM

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Animap is a web-based city pound geographic information system (GIS) for collection and storage of information related to dogs impounded by the city pound; specifically designed to be utilized by the City Pound of Makati. The City Pound and the Makati Veterinary Office works together for the control of strayed dogs in the area since both are concerned on areas where there is high prevalence of strayed dogs. City Pound needs to know areas where dog impounding operations is required while the Makati Veterinary Office needs the same information to determine where to hold informative lecture on proper animal care including schedule of vaccination.

With an integrated Geographical Information System, location of dogs impounded is depicted in a dynamic map interface. Managing records of impounded dogs is done using point-click system that does not only update the database with data concerning the animal but also shows other information through the map. Information about the dogs is also available to the general public for browsing to facilitate adoption and retrieval.

Since one of the primary information supplied in the records are locations in Makati where impounded dogs are found, the system would efficiently assist the officials of the said institution to *visualize* these information.

Keywords: city pound, dogs, geographical information system, scalable vector graphics, Makati

ESTD-5

ANIMAP: A WEB-BASED CITY POUND MANAGER AND GEOGRAPHICAL INFORMATION SYSTEM

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Keywords: city pound, dogs, geographical information system, scalable vector graphics, Makati

ESTD-7

MT. ISAROG BIODIVERSITY INFORMATION SYSTEM

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The Philippines used to have rich tropical rainforests but much has been reduced during the latter half of the 20th century. The loss of habitats for many species has led to their extinction. Mount Isarog in Camarines Sur has a rich diversity of flora and fauna and home to at least 143 kinds of birds 15 of which are endemic in Luzon. Recent studies have shown that many species had become locally extinct and are now listed as endangered by the International Union for the Conservation of Nature and Natural Resources (IUCN).

Biologists gather vast amounts of data that comprise biodiversity databases especially in the light of rapid species declines and extinctions. There is a need for the development of information infrastructure to support the collection, management and dissemination of biodiversity data.

The Mt. Isarog Biodiversity Information System contains the different biodiversity data in its database. Biologists can update the species database and store data on environmental factors such as rainfall, temperature and humidity. Users can view all these information entered by the biologist. Users can also view the map of Mt. Isarog, view frequently asked questions on biodiversity issues in Mt. Isarog and view the message board containing biodiversity issues. Registered users can post new topics and messages on the message board. The government representative (Mt. Isarog Protected Area Office, Provincial Environment and Natural Resources Office) can upload laws/legislations pertinent to Mt. Isarog. The system administrator can update user accounts and moderate message board.

A biodiversity informatics system greatly satisfy the need to systematize the data in a usable format by the decision-making individuals and institutions particularly the Mt. Isarog Protected Area Office. The availability of online information satisfies the need for larger publicity and access about biodiversity with the aim to increase public awareness on its preservation.

Keywords: biodiversity, mt. Isarog, endangered species, information systems

ESTD-8

SCALE UP FACTORS FOR CHEMICAL OXYGEN DEMAND (COD) REMOVAL FROM SUGAR REFINERY SPENT ION EXCHANGE PROCESS (SIEP) EFFLUENT BY INDIRECT ELECTROCHEMICAL OXIDATION

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Batch electro-oxidation experiments were conducted on raw and undiluted sugar refinery spent ion-exchange process (SIEP) effluent beyond the point of near complete decolorization, to determine whether complete COD removal is possible with the process, and to obtain useful engineering relationships for operation and scale up. Electro-oxidation involves the electrolytic generation of oxidants from the chloride ions present in the effluent. Experiments were conducted at different levels of constant operating current. With an initial COD of 26,000 mg/L and color of 39,000 PCU, results showed that near-complete COD removal is possible with a proper combination of operating current and electrolysis time. The rates of COD removal were initially high but gradually slowed down and leveled off to values nearing complete removal. The initial COD removal rates increased with higher operating current, in accordance with Faraday's Law which predicts that higher operating currents would generate higher amounts of oxidants for removal of COD and color. Complete decolorization was verified to occur earlier than near-complete removal of COD, indicating that COD removal controls the treatment process. An alternative approach to charge dose, for scale-up and operation, was explored using the relationship between volumetric current and the reaction rate constant (determined as first order by the integral method).

Keywords: electro-oxidation, electrolysis, charge dose, volumetric current

ESTD-9

DEVELOPMENT AND PHYSICAL PROPERTIES OF CORDIERITE BASED MATERIAL FOR THERMAL INSULATION APPLICATION UTILIZING SOLSONA WHITE CLAY, BANGUI SOAPSTONE AND OTHER ADDITIVES

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This study was conducted to develop and determine the physical properties like bulk density and apparent porosity of the formulated cordierite based material for thermal insulation application utilizing Solsona white clay, Bangui soapstone, and other additives like imported clay, imported talc and magnesium carbonate containing different percentages addition of pulverized charcoal and fired at different temperatures.

It aims also to determine the possibility of substituting local raw materials to the very expensive imported raw materials to minimize the cost of producing cordierite insulating firebrick. Five formulations were developed with specific ratio of raw materials used. Test specimens were formed in a metal mold having a dimension of 4x1x1 inches. The pressing pressure was set at 150 MPa using manual hydraulic pressing machine during forming. The formed test specimens were fired at temperatures 1100°C and 1050°C with soaking time of two (2) hours. ASTM standard method was used to determine the bulk density and apparent porosity of the fired test specimen.

Results showed that the test specimens in all five developed formulations fired at temperature 1100°C have higher bulk density and lower apparent porosity than the test specimens fired at temperature 1050°C.

The developed formulations of cordierite material substituting local materials were very much acceptable and have strong potential to be used in the manufacture of cordierite insulating firebrick.

Keywords: cordierite material, thermal insulation, insulating firebrick

HEALTH SCIENCES DIVISION

HSD-1

APPLICATION OF AN ALTERNATIVE ASSAY IN DETERMINING EYE IRRITATION POTENTIAL OF PHARMACEUTICAL PRODUCTS

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In-vitro assays which accurately assess safety of pharmaceutical products and replace, refine and reduce animal testing are currently undergoing international validation for regulatory acceptance. One of the *in-vitro* methods being adopted in UNILAB as an alternative to the Draize test is the HET-CAM*. It is simple, rapid, sensitive and inexpensive. The qualitative nature of this assay is compensated by the inclusion of positive standards and a comprehensive scheme for scoring irritant effects.

Seven-day old fertilized hen's eggs are rotated for 2 days in an incubator and candled next day to ascertain embryo viability. The shell around the air cell is pared off, exposing the chorioallantoic membrane. Test chemicals are instilled on the CAM for 5 minutes. Appearance of hemorrhage, lysis and/or coagulation of blood vessels and the time when these reactions occur are noted. Irritancy Scores (IS) are determined to evaluate irritation potential of the chemical.

A total of 43 chemicals were assayed. Out of 17 ZEBET** reference chemicals tested, 16 resulted in similar classifications. Sixteen compounds with published EU and OECD classifications yielded comparable results. Of these, 11 chemicals obtained the same irritation potential as those classified by EU and OECD, while 5 chemicals were classified differently. Another 15 chemicals, previously unclassified, were included to establish internal reference standards. Finally, 21 UL products including 8 samples of feminine wash, 5 facial lotions and 8 lotions with sunscreen were tested and classified as non- to slight irritants using the HET-CAM test. These confirm results of earlier experiments using the *in-vivo* Draize test.

While most chemicals tested using HET-CAM agreed with classifications published by ZEBET, EU and OECD***, a more comprehensive database of different pharmaceutical and dermatological products is needed.

For current purposes, employing the GHS**** stepwise approach, HET-CAM could be used to identify severe irritants without need for animal testing.

* Hen's Egg Test – Chorioallantoic Membrane

** ZEBET: Test protocol used in Phase II of German Validation Study for Replacement of Draize Eye Test

*** Organization for Economic Cooperation and Development

**** Globally Harmonized System

Keywords: hemorrhage, lysis, coagulation, chorioallantoic membrane, irritation potential

HSD-2

ANTITRICHOMONAL ACTIVITY OF PLANT EXTRACTS FROM FAMILY LAMIACEAE (*COLEUS BLUMEI*, *OREGANUM VULGARE*, AND *VITEX NEGUNDO*): IN VITRO STUDIES

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Trichomoniasis is an infection caused by the protozoan *Trichomonas vaginalis*, and ranked as the most common nonviral sexually transmitted disease (STD) in the world. A recent Philippine study on the prevalence of trichomoniasis estimates an infection rate of 37% among Filipino women. Efforts to contain and alleviate this problem remain a continuing initiative of government health institutions. As an alternative to conventional therapeutic regimen utilizing endemic natural products, this study was conducted to determine the activity of three crude ethanolic plant extracts from family Lamiaceae (i.e., *Coleus blumei*, *Vitex negundo*, and *Origanum vulgare*) against *T. vaginalis*. The crude extract from *C. blumei* exhibited the highest activity among the treatments, with a minimum inhibitory concentration (MIC) of 2 mg/mL, and an activity not significantly different from metronidazole, the drug of choice for the treatment of

trichomoniasis. Phytochemical analysis of the *C. blumei* extract indicated the presence of glycosides, plant acids, reducing agents, and alkaloids. Some of these substances have been reported to possess antitrichomonal or antiprotozoal activity, and would likely account for the observed activity of the *C. blumei* extract. The mice toxicity assay revealed minimal side effects even at several magnitudes of concentration (250-500X) higher than the MIC, suggesting a wide margin of safety for the crude extract. These initial findings warrant further studies to isolate, purify, and elucidate the active antitrichomonal natural product present in the *C. blumei* extract, and to explore its potential as an alternative STD medication for human use.

Keywords: Trichomoniasis, *Trichomonas vaginalis*, Lamiaceae, *Coleus blumei*, *Vitex negundo*, *Oreganum vulgare*, minimum inhibitory concentration, herbal medication

HSD-3

EVALUATION OF ANTIMICROBIAL ACTIVITIES OF *E. CAMALDULENSIS* DEHNH LEAF OIL AGAINST SCABIES

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The study was designed to evaluate the leaf oil extracted from *E. camaldulensis* by steam distillation for the treatment of scabies. The study was done in a depressed area in Barangay Del Remedio, San Pablo City where scabies is prevalent. Twelve subjects were selected for treatment. Six were treated with eucalyptus oil and six were treated with guava leaf extract, both in the form of ointment, for comparison.

The leaf oil was clear yellow in color, sp. gr. (25°C) 0.9518 and refractive index (25°C) 1.454. Gas chromatograph and GC-MS analysis revealed it has 25 monoterpene components, eight of these compounds were identified based on authentic samples, to wit: α -pinene, β -pinene, cineole, citronelloi, citronellal, eugenol, terpineole, phellandrene. The methanolic fraction of the oil indicated bioactivity against some microorganism. A positive response against scabies was observed after 7 days treatment with eucalyptus oil ointment unlike guava leaf extract which took 12 days of treatment.

This result has significance in that the oil is a potential alternative medicine for the treatment of scabies which is a common disease suffered by the disenfranchised members of our society.

Keywords: leaf oil, monoterpenes, *E. camaldulensis*, GC, GC-MS, scabies

HSD-4

ANTI-INFLAMMATORY COMPONENT FROM THE EXTRACT LEAVES OF *AMARANTUS VIRIDIS* LINN (KOLITIS)

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Amaranthus viridis Linn is a common roadside weed on lowlands and low altitudes throughout the Philippines. It is an erect, smooth, branched unarmed herb growing from 30 to 80 cm. tall. While the plant may be at times be purple-reddish in color, it is generally green. The aim of this study was to isolate the bioactive components from the leaves of *Amaranthus viridis* and examine its anti-inflammatory property. One thousand grams of air dried leaves were soaked in 5 li of ethyl acetate for 72 hours, the crude extract was concentrated with a rotary evaporator, constituents separated by column chromatography using petroleum ether-ethyl acetate.

The purified isolate was elucidated by infrared spectra, ultraviolet spectra and gas chromatography-mass spectra analysis. Anti-inflammatory assay was done with the crude extract. The percentage yield in the extraction process was 2.42%. The compound was insoluble in water and soluble in non-polar solvents. The crude extract was positive for tannins using ferric chloride solution.

Infrared spectra of the compound K_1 gave the following functional group: C-H aromatic stretch, C-H stretch, C=O stretch and OH bend. The ultraviolet spectrum gave a maximum absorption was at 237nm with an absorbance of 2.035 which indicated the presence of an aromatic and carbonyl groups. The gas chromatography-mass spectra of K_1 showed the presence of 2-thiopheneacetic acid, heptyl ester.

The IR spectrum of K_1 isolate showed a broad peak at 3353.81 cm^{-1} indicating the presence of OH group. Sharp signals at 2923.21 cm^{-1} and 2852.43 cm^{-1} were detected indicating C-H stretching for methyl and methylene groups respectively. Sharp peaks at 1640.28 cm^{-1} showed C=O stretch indicating a carbonyl group which falls in the range of carboxylic stretching. Medium signals detected at 1451.52 cm^{-1} indicated a C=C bending and a signal at 1259.82 cm^{-1} for Ar-OR stretch. The λ max for K_2 was at 245 nm. The gas chromatography-mass spectra for K_2 matched the chromatogram of phytol with a molecular weight of 296 and a molecular formula of $C_{20}H_{40}O$.

The crude extract was tested for possible anti-inflammatory activity with carrageenan-induced edema assay was used. Percentage inhibition or protection of the extract was obtained and compared to the positive control of aspirin. In 250-500mg/kg dose of the crude extract injected to the rats gave negative percent protection but in 1000 mg/kg dose gave positive result of 15.87%

Keywords: anti-inflammatory, carrageenan-induced edema, infrared spectra, ultraviolet spectra, gc-mass spectra

HSD-5

PROXIMATE ANALYSIS AND CHROMATOGRAPHIC CHARACTERIZATION OF ANTIMICROBIAL COMPOUNDS OF INDIGENOUS MEDICINAL FUNGI (*Ganoderma lucidum* Karst.)

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Increasing fungal and bacterial resistance have already made many anti-fungal drugs and antibiotics obsolete. Thus, the quest for effective and cheaper alternatives never ceases. The role of fungi, *Ganoderma lucidum* in particular, as a source of medicine has always been considered, but research pertaining to it seems to be less extensive.

The supernate was used in proximate analysis following AOAC (1980) procedure. Characterization of antimicrobial components was investigated using TSK-G 4000 PWXL column with 0.7% Na₂SO₄ solution as the mobile phase and RI for detection. Recently, the feasibility of employing high performance thin-layer chromatography (HPTLC) for the fingerprint profiling of polysaccharides extracted from the fruiting bodies of the medicinal fungi. HPTLC chromatogram of acid hydrolyzates of polysaccharides from water extracts of three different *Ganoderma* species were obtained under total hydrolysis conditions.

Proximate analysis of three medicinal fungi species were determined in terms of general food analysis, inorganic matter, vitamins and antimicrobial components. Average protein and carbohydrate contents of the three isolates were moderately high, equivalent to 29.30 and 43.60 %, respectively. Low amounts of fiber, fat and ash were noted. Dried basidiocarp contains high amounts of potassium, phosphorous and magnesium and fair amounts of calcium, iron and sodium. High amounts of choline (1,274 mg/100g) and inositol (319.91mg/100g) were noted. Antimicrobial component like polysaccharide G (PSG) was identified at an average of 16.93%.

Hydrolysis with total free acids (TFA) and determination by high-pH anion-exchange chromatography revealed that a bioactive proteoglycan isolated from *G. lucidum* was composed of eight different monosaccharides, predominantly d-glucose, d-galactose and d-mannose in the molar ratio of 3:1:1. Other components include galacturonic acid, glucuronic acid, galactose, arabinose, xylose and fructose. Rhamnose was detected only in water extracts of BQY002 basidiocarp.

An antimicrobial component like Polysaccharide-G (PSG) was detected and identified indicating that this medicinal fungus contains bioactive properties.

Keywords: proximate analysis, high performance thin-layer chromatography (HPTLC), *Ganoderma lucidum*, Polysaccharide-G (PSG), antimicrobial compounds

HSD-6**ACTIVE COMPOUND(S) FROM CRUDE EXTRACTS OF
Euphorbia milli var splendens: A POTENT ANTIBIOTIC**

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Search for drugs for mutant bacteria are the major problem in the field of medicine. The prevalence of people getting sick from disease causing bacteria has increased year by year due to continuous environmental destruction and pollution. Vancomycin is the only cure to fight mutant bacteria like Methicillin-resistant *Staphylococcus aureus* (MRSA) but it cannot be denied that these drugs have been already resisted and developed immunity by most bacteria. This study is found timely and relevant to test the potential use of flavanoids and milliamines from commonly available plants like *Euphorbia*.

Hexane, ethyl acetate and butanol extracts of *Euphorbia milli var. splendens* leaves and stem were tested against MRSA, *Salmonella* sp. #47 P', Str', Cn', Er' and *Escherichia coli* B-1195 Str', Km', Spec', Ap' by paper disc method. Zones of inhibition (dia. mm.) were measured and compared with the standard antibiotics. Bioautography (Marfori et al,2003) was done to determine the active spot against the test organisms.

Ethyl acetate extract of *Euphorbia* leaves has the highest zone of inhibition against MRSA #1 (15.5mm), MRSA #4 (17.6mm), *Salmonella* sp (13.4mm) and *E. coli* (18.9mm). However, the hexane extract of leaves greatly inhibited MRSA # 2 (13.3mm) while butanol extract of leaves inhibited MRSA #3 (16.5mm). The fractionated crude extract from the leaves and stem of *Euphorbia*, has a remarkable activity against Methicillin-resistant *Staphylococcus aureus*. The active compound possess a broad spectrum antibiotic. These findings confirmed that *Euphorbia* can be an abundant source bioactive compounds.

Keywords: *Euphorbia*, MRSA, *Salmonella*, *E. coli*, zone of inhibition

HSD-7

MANGOSTEEN (*Garcinia mangostana*) EXTRACT...POTENTIAL AGENT AGAINST METHICILLIN- RESISTANT *Staphylococcus aureus* (MRSA)

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Methicillin-resistant *Staphylococcus aureus* (MRSA) was considered a major clinical and epidemiological pathogen in hospitals worldwide. The drug of last resort is vancomycin but there is a fear that *Staphylococci* are now resistant to vancomycin. With the emergence of resistant organisms against antibiotics, it is high time to continue search for bioactive compounds that inhibit the growth of pathogens resistant to other antibiotics.

Mangosteen (*Garcinia mangostana*), the queen of fruits, was used by tribes in Southeast Asia as early as 600 AD as a general remedy and healing agent. This preliminary study search the bioactive compounds in mangosteen that is effective against MRSA.

The crown, skin, rind and seed of mangosteen were extracted with water and 95% ethanol by blending equal parts (1:1) with water or ethanol and assayed by paper disc method against 2 strains of MRSA. Ethanol extract of rind has the highest zone of inhibition (zoi) against MRSA 1 (13.1mm.dia.) while the ethanol extract of skin produced the highest zoi (15.8mm. dia.) against MRSA 8 which is not significantly different than the control antibiotic (12.3 and 17.7, respectively). Results showed that the water extract produced smaller zoi which ranges from 6.6 mm to 7.4mm against both test organisms. The ethanol extract of the crown of mangosteen inhibited MRSA 1 and 8 (11.0mm and 13.5mm, respectively). However, the ethanol seed extract has lower zoi (8.7 mm and 10.9mm) against MRSA 1 and MRSA 8, respectively. These findings revealed that active compounds from mangosteen are also effective against MRSA.

Keywords: Mangosteen, MRSA, paper disc assay, zone of inhibition, antibiotic resistant

HSD-8

NUTRITIVE VALUE OF CAMARO

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Mole crickets (*Gryllotalpa* sp.) or aro-aro in Tagalog, are known insect pests of rice in Central Luzon which local residents have resourcefully turned into a seasonal spicy delicacy called camaro. In order to assess the potential of this native delicacy as an alternative energy and protein source for Filipinos, the mean nutritive values of the camaro were determined through proximate analysis.

Energy content of this food item was estimated based on the known percentage of protein fat and carbohydrates. The carbohydrate content was calculated as the difference between 100 and the sum of the percentages of protein, moisture, fat and ash. Conversion factors used were 16.74 kilojoules (4.0 kilocalories per gram) for protein and carbohydrates and 37.66 kilojoules (9.0 kilocalories per gram) for fat.

Results of the analysis showed that this stir-fried cricket dish is a good source of both energy and protein. Based on the 2002 recommended energy and nutrient intake of Filipinos, a single serving of camaro or 150 grams of this dish will meet 28% and 74% of the daily energy and protein requirements of adult Filipinos between the ages 19-49.

Comparing the energy and protein content of camaro with another common protein source like a 150 grams fried chicken leg showed that camaro had higher energy and protein content. Fried chicken leg weighing 150 grams will provide around 20% and 63% of the recommended daily requirement of 19-49 year old Filipinos for energy and protein, respectively. Camaro therefore, can serve as a cheap alternative energy and protein source for Filipinos.

Keywords: alternative, ash, camaro, fat, grams, insect, kilojoules, kilocalories, nutrition, protein, proximate analysis, rice

HSD-9

MULTIVARIATE ANALYSIS OF SELECTED BIOMETRIC AND SOCIOECONOMIC FACTORS AND INTESTINAL HELMINTHIASIS IN CHILDREN IN TUBOD, LANA DEL NORTE

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Helminthiasis has long been known to be attributed to ecological and socioeconomic factors. However, rather than focusing primarily on chemotherapeutic intervention, many recent studies emphasize the importance of site-specific conditions in the proper management of infection. Guided by this framework, a study was conducted to determine levels of helminthiasis among children ages 3 to 10 years old in Barangay Poblacion, Tubod, Lanao del Norte, and apply a multivariate method in establishing relationships between helminth abundance and selected biometric and socioeconomic indicators. Fresh stools from 123 randomly selected volunteer children were screened. Biometric and socioeconomic data were obtained using the questionnaire method. Respondents showed 27% infection with *Ascaris lumbricoides* alone, 7% with *Trichuris trichura*, 2% double infection with *A. lumbricoides* and *T. trichura*, and 1% with *A. lumbricoides* and *Ancylostoma duodenale*. Canonical correspondence analysis revealed highly significant relationships between ascariasis with low body mass index, low income, slum area neighborhood, high number of household members, more people sleeping in one room, and attendance in schools. On the other hand, trichuriasis is strongly associated with the presence of cockroaches in the house, religion, and absence of toilets, while hookworm infection was significantly associated with the female gender. Our data confirmed that soil transmitted helminthiasis is very common in the sampling site in spite of government deworming program. We recommend a more comprehensive but practical approach in the design and implementation of management interventions to lessen morbidity due to soil transmitted helminths.

Keywords: ascariasis, trichuriasis, helminths, socioeconomic factors, parasitism, hookworms

HSD-10

HER2 EXPRESSION PROFILE OF A POPULATION OF INVASIVE DUCTAL CARCINOMA OF THE BREAST: CLINICO-PATHOLOGIC AND CYTOLOGIC CORRELATES

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The HER2 profile of a population of 44 randomly picked women diagnosed with invasive ductal carcinoma (IDC) of the breast was assessed using immunohistochemistry (IHC). The youngest patient was 29 years old, and the oldest was 83 years old, with a median of 56 years. Clinico-pathologic and cytologic characteristics obtained from the final pathology reports and HER2 expression scores, were correlated using the *chi square test* and Spearman correlation (StataV9). HER2 overexpression used as marker for cancer aggressiveness, was expressed in five (5) patients, which accounted for 11.36% of the total sample size. Among the five patients with overexpression of HER2, three fell within the age range of 36 to 50 years old.

Correlation analysis revealed that tumor size, one of the clinico-pathologic characteristics considered, was significantly associated with HER2 overexpression. Observed necrosis, one of the cytologic variables considered, also revealed significant correlation with HER2 overexpression. Although the Spearman correlation did not show highly significant results, careful analysis of the clinico-pathologic data revealed a positive correlation between HER2 overexpression, cancer stage, tumor size, and proportion of positive nodes or nodal status. Furthermore, two cytologic variables, namely; presence of prominent nucleus and observed necrosis also had positive correlation with HER2 overexpression.

The result of this study is valuable in improving the treatment course and prognosis of IDC by clinicians. As the first study of its kind in the Philippines, this can serve as a benchmark for similar molecular marker studies on breast cancer in women across age groups, ethnic categories, and other social clustering.

Keywords: HER2, invasive ductal carcinoma, immunohistochemistry, cancer aggressiveness, correlation analysis

HSD-11

BONE MINERAL DENSITY (BMD) AND FRACTURE RISK ASSESSMENT TOOL

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A bone mineral density (BMD) test is used to measure bone density of minerals such as calcium, determine fracture risk for osteoporosis, and monitor the effectiveness of treatments for osteoporosis. A BMD test can be performed using a special X-ray, computed tomography (CT) scan, or ultrasound. BMD results are generally scored by two measures, the T-score and the Z-score. The World Health Organization uses T-scores to define normal bone mass, low bone mass (or osteopenia), and osteoporosis. The T-score compares a person's bone density to the average bone density of young healthy adults of the same gender. A Z-score compares his bone density to the average values for a person of his age and gender. A low Z-score (below -2.0) is a warning sign that he has less bone mass (and/or may be losing bone more rapidly) than expected for someone his age.

The Bone Mineral Density and Fracture Risk Assessment Tool is an online system that aims to empower physicians with treatment management tools for effective interpretation of osteoporosis risk factors based on Kanis' Method, Black's Method, and the Canadian Osteoporotic Society Method. The risk assessment tool incorporates not only bone density, but other, important risk factors, including age, body mass index, smoking habit, corticosteroid usage, and other factors. It also classifies patients as either normal, osteopenic, or osteoporotic.

Keywords: Bone Mineral Density (BMD), osteoporosis, Kanis' Method, Black's Method, Canadian Osteoporotic Society Method, fracture risk assessment

HSD-12

MOLECULAR DESIGN OF SUNFLOWER (*Helianthus annuus*) TRYPSIN INHIBITOR-1 (SFTI-1) PEPTIDE ANALOGUES AS DENGUE VIRUS NS2B-NS3 SERINE PROTEASE INHIBITOR

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The dengue NS2B (non-structural protein 2B) cofactor and NS3 (non-structural protein 3) protease forms a complex that functions in polyprotein processing, thus representing an attractive target for the development of anti-viral drugs. The sunflower trypsin inhibitor-1 (SFTI-1) was considered as a good template for the design of inhibitors of the dengue NS3 protease and dengue NS2B-NS3 protease complex. In the absence of complete crystal structures of the four NS3 protease and NS2B-NS3 protease corresponding to the four serotypes of the dengue virus, homology modeling was performed. Structural analysis of the models revealed a conformational change upon binding of the NS2B cofactor to the NS3 protease. Trp61 of the NS2B cofactor provided Π -cation interaction with the protease residue 142 of dengue 1, dengue 2 and dengue 4. The loss of this interaction for dengue 3 was compensated by the formation of a salt-bridge between Glu63 of the cofactor with Arg142 of the protease. Docking experiments of the SFTI-1 peptide analogues with the homology models was able to identify an analogue with the sequence GNleCRRSGSGHCFPD as the most potent inhibitor of any of the four serotypes of the dengue virus. This peptide analogue also exhibited a structural homology with the template with an RMSD of 0.82Å and 0.76Å for the backbone and α -carbon atoms respectively. Langevin dynamics simulation of the docked structures of this peptide analogue showed increased distance with respect to the Ser135 γ oxygen of the NS2B-NS3 protease and Arg5 carbonyl atom of the peptide analogue compared to the NS3 protease only. The results indicate that the peptide analogue can inhibit any serotype of the dengue virus with the NS2B-NS3 protease having a longer time to cleave the scissile bond of the analogue, thus it can slow down or totally inhibit the proliferation of the virus inside the human body.

Keywords: homology modeling, SFTI-1 analogue, NS3 protease, NS2B-NS3 protease

HSD-13

PCR-RFLP DETECTS CLARITHROMYCIN-RESISTANT *Helicobacter pylori* STRAINS ISOLATED FROM BIOPSY SAMPLES

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Helicobacter pylori is a human pathogen associated with chronic gastritis, peptic ulcer disease and in cases of adenocarcinoma and mucosa-associated lymphoid tissue (MALT) lymphoma. Eradication of this organism has become a medical challenge due to increasing incidence of antibiotic resistance. However, due to difficulty of growing the organism, detecting its antibiotic susceptibility is another problem. In this study, clarithromycin-resistant *H. pylori* isolated from Filipino patients was determined using *23s rRNA gene* mutation and sensitivity testing.

Nineteen strains of *H. pylori* from gastric biopsies of patients with gastroduodenal diseases were cultured. DNA was extracted (QIAGEN DNA Mini Kit). Point mutation (AG) on the *23s rRNA gene* at positions 2143 and 2142 was associated with clarithromycin resistance. The presence of mutation was determined using Polymerase Chain Reaction-Restriction Fragment Length Polymorphism (PCR-RFLP). The product, which shows a band of approximately 1.4kb, was digested using *Bsa I* and *Mbo II* enzymes. The digested fragments were separated on 2% agarose and analyzed by UV transilluminator.

The Epsilometer (E-Test) was used to determine the antimicrobial susceptibility of the 19 isolates. The strip was placed onto the surface of the agar plate inoculated with bacteria and incubated for 3 days at 37C under microaerophilic condition. The elliptical zone of inhibited growth was interpreted.

E-Test results showed 16 of the 19 strains were clarithromycin-sensitive (0.25ug/ml) while 3 strains (153c, 189c, 193) were resistant (1.0ug/ml). Using PCR-RFLP, 4 out of the 19 strains were resistant (38a, 153c, 189c, 193). Three of these have A2142G mutation as detected using *Mbo II* and one has A2143G mutation using *Bsa I*.

In this study, we found that PCR-RFLP is an efficient tool for detection of clarithromycin-resistant *H. pylori*. It can also be used in identifying the mutation type, which will be helpful in establishing treatment regimens.

Keywords: *H. pylori*, Clarithromycin, *Bsa I*, *Mbo II*, PCR-RFLP

HSD-12

MOLECULAR DESIGN OF SUNFLOWER (*Helianthus annuus*) TRYPSIN INHIBITOR-1 (SFTI-1) PEPTIDE ANALOGUES AS DENGUE VIRUS NS2B-NS3 SERINE PROTEASE INHIBITOR

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In this study, we found that PCR-RFLP is an efficient tool for detection of clarithromycin-resistant *H. pylori*. It can also be used in identifying the mutation type, which will be helpful in establishing treatment regimens.

Keywords: *H. pylori*, Clarithromycin, *Bsa I*, *Mbo II*, PCR-RFLP

HSD-14

**CHARACTERIZATION OF HEPATITIS C VIRUS
GENOTYPE 1 ISOLATES USING PCR-RFLP AND
SEQUENCE ANALYSIS**

**Michael O. Baclig,¹ May M. Rivera,¹ Rey Z. Predicala,¹ Mark Pierre
S. Dimamay,¹ Ronald R. Matias,¹ Filipinas F. Natividad,¹ Juliet Gopez
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Introduction: Hepatitis C virus (HCV) can be classified into six major genotypes, HCV-1 to HCV-6, and many subtypes with the predominant genotype in most areas of the world being genotype 1. Studies have shown that patients with HCV-1 infection are more likely to develop liver cirrhosis and hepatocellular carcinoma than patients with other HCV genotypes. Furthermore, variations at the subtype level may play a role in the progression of the disease. Therefore, accurate genotyping and subtyping is important in the clinical management and epidemiological studies of Hepatitis C infection.

Methodology: HCV genotyping was performed by polymerase chain reaction-restriction fragment length polymorphism (PCR-RFLP) of the 5' non-coding region (5'-NCR) using five restriction enzymes. Subtypes of HCV-1 isolates were identified by sequence analysis of the non-structural protein 5A (NSSA) gene. Sequence data were analyzed using BioEdit software. Nucleotide sequences were compared for homology with sequences in the National Center for Biotechnology Information GenBank using basic local alignment search tool (BLAST) program.

Results: Out of the 15 isolates, 4 (27%) and 11 (73%) were classified as HCV-1a and HCV-1b, respectively using PCR-RFLP. Sequence analysis disclosed that all of the isolates were subtype 1b.

Conclusion: HCV-1b is the predominant genotype in this study. Sequence-based analysis of the NSSA region can be used for accurate identification of Hepatitis C virus subtypes.

Keywords: Hepatitis C virus, non-structural protein 5A, sequencing, genotyping, subtyping

HSD-15

TREATMENT OUTCOMES IN TB SYMPTOMATICS ENROLLED AT THE PTSI-QI DOTS, YEAR 2006

**Lynore M. Sandoval^{1,2}, Donna Mae de la Cruz¹, Catherine Dupra¹,
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Detection and cure remains the cornerstone for tuberculosis (TB) control. Cure and prevention of drug resistance is dependent upon the adherence of patients to the recommended anti-TB treatment regimen. Directly observed therapy short course (DOTS) ensures adherence. This paper investigated the treatment outcomes and success rate of the Philippine Tuberculosis Society, Inc.-Quezon Institute DOTS Center among 113/176 (64.2%) TB symptomatics who were enrolled and initiated to treatment during the year 2006. Using the guidelines set by the National TB Control Program of the Department of Health, the patients' sputum smears were stained with Ziehl Neelsen and searched for the presence of acid fast bacilli (AFB) at recommended periods before and during treatment. Of the 113 TB symptomatics, 64 were new smear positives; 33, new smear negatives, 13 relapse cases, one failed, and two were unclassified and did not undergo chemotherapy. The treatment outcomes were: 61 (55%) cured, 32 (28.8%) completed treatment, 1 (0.9%) died, 3 (2.7%) failed treatment, 6 (5.4%) defaulted, and 8 (7.2%) transferred-out. Treatment success rate of the PTSI-QI DOTS Center was computed at 83.8%, a little below the WHO target of 85%. This study documented the achievement of the PTSI-QI DOTS Center in their implementation of the DOTS strategy. It further highlighted the critical role played by DOTS centers in TB control.

Keywords: tuberculosis, DOTS, TB control, PTSI-QI DOTS Center, treatment outcomes

HSD-14

CHARACTERIZATION OF HEPATITIS C VIRUS GENOTYPE 1 ISOLATES USING PCR-RFLP AND SEQUENCE ANALYSIS

**Michael O. Baclig,¹ May M. Rivera,¹ Rey Z. Predicala,¹ Mark Pierre
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Methodology: HCV genotyping was performed by polymerase chain reaction-restriction fragment length polymorphism (PCR-RFLP) of the 5' non-coding region (5'-NCR) using five restriction enzymes. Subtypes of HCV-1 isolates were identified by sequence analysis of the non-structural protein 5A (NS5A) gene. Sequence data were analyzed using BioEdit software. Nucleotide sequences were compared for homology with sequences in the National Center for Biotechnology Information GenBank using basic local alignment search tool (BLAST) program.

Results: Out of the 15 isolates, 4 (27%) and 11 (73%) were classified as HCV-1a and HCV-1b, respectively using PCR-RFLP. Sequence analysis disclosed that all of the isolates were subtype 1b.

Conclusion: HCV-1b is the predominant genotype in this study. Sequence-based analysis of the NS5A region can be used for accurate identification of Hepatitis C virus subtypes.

Keywords: Hepatitis C virus, non-structural protein 5A, sequencing, genotyping, subtyping

HSD-15

**TREATMENT OUTCOMES IN TB SYMPTOMATICS
ENROLLED AT THE PTSI-QI DOTS, YEAR 2006**

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Keywords: tuberculosis, DOTS, TB control, PTSI-QI DOTS Center, treatment outcomes

Number (MPN) per gram. Based on the microbiological analyses conducted by the microbiologist of the Bureau of Fisheries and Aquatic Resources 7 using AOAC and APHA methods, *Perna viridis* taken from the Lapulapu market had the highest weighted mean bacterial load of 2.90×10^4 cfu/g, while samples taken from Mandaue City market contained 5.10×10^3 cfu/g. However, green mussels obtained from the two Cities of Lapulapu and Mandaue markets were not safe for human consumption based on the MPN per gram of *Escherichia coli*, which contained 460 MPN/g and 93 MPN/g, respectively. The green mussels taken from the markets of the two cities are not safe for human consumption based on MPN/g of *E. coli*, if eaten fresh, however when this commodity be cooked thoroughly, the product are safe to eat since *E. coli* can easily be destroyed above boiling point.

Keywords: *Perna viridis*, microbial flora densities, *Escherichia coli*

HSD-20

HAND HYGIENE COMPLIANCE IN A LOCAL TERTIARY HOSPITAL IN ILIGAN CITY

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One third of all hospital infections have been documented to be preventable. Majority of these cases has been associated with transmission of nosocomial pathogens by the hands of healthcare workers. Hand hygiene has been identified to be the simplest and most effective course of action for preventing hospital-acquired illnesses. Registered nurses and student nurses on duty at a government-run tertiary hospital in Iligan City were asked to participate in the study for the assessment of hand hygiene compliance. Structured observations of routine patient care were conducted and hand-swab samples of the healthcare worker's dominant hand were taken to quantify bacterial colony counts at the end of a defined period of patient care. All of the subjects reported to have had formal education and informal training on hand hygiene but this did not reflect on their actual usage patterns. Few of the registered nurses or student nurses performed hand hygiene procedure in every after patient contact and at any time in between seeing ten patients. Hand hygiene procedures were done after they were told that their hands will be swabbed.

It was observed that incorrect handwashing procedures and insufficient time for hand-rubs were done. The noncompliance to prescribed hand hygiene protocols was due to the belief of low risk in acquiring infection from patients and blatant disregard to guidelines and protocols. Bacterial counts from the hands of student nurses were significantly higher than the registered nurses ($p=0.052895$). More than 60% of both population harbored *Staphylococcus aureus* and all had gram-negative bacilli. *S. aureus* and gram-negative bacilli are considered important nosocomial pathogens causing a wide array of severe infections. This study highlights the need for stricter adherence to hand hygiene policies among healthcare workers which may in turn be crucial in lowering nosocomial infections.

Keywords: hand hygiene, nosocomial infections, handwashing, hand-rubs

HSD-21

MICROBIAL AIR QUALITY OF GREGORIO T. LLUCH MEMORIAL HOSPITAL, ILIGAN CITY

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The rising incidence of hospital acquired infections has been attributed to the lack of cleanliness in hospitals. The risk of acquiring nosocomial infections increases with elevated aerobic bacterial counts. The level of airborne microorganisms in Gregorio T. Lluh Memorial Hospital of Iligan City was unknown and the study was carried out to monitor the bacterial densities and distribution in different areas of the tertiary hospital. The settle plate method was employed using nutrient agar for heterotrophic bacterial counts and blood agar for hemolytic microorganisms. The hospital's lobby and obstetrics-gynecology ward exhibited the highest HPC count of which occupant density was identified as a contributing factor in influencing the level of airborne microorganisms. Predominant bacterial strains were *Staphylococcus*, *Streptococcus* and *Enterococcus*, all of which are considered causative agents of severe nosocomial infections. Surveillance is essential in recognizing causative factors which may lead to increased nosocomial infections and results of constant monitoring will lead to formulation of recommendations as well as guidelines for effective preventive measures.

Keywords: microbial air quality, nosocomial infections, settle plate method

HSD-16

A CROSSOVER COMPARISON OF ULTRAVIOLET IRRADIATION AND ALCOHOL DISINFECTION OF NOSOCOMIAL PATHOGENS

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The rising incidence of hospital acquired infections is compounded by the emergence of antibiotic resistance bacterial strains. These non-susceptible potentially pathogenic microorganisms associated with nosocomial infections may be transferred by person-to-person contact and can even be transmitted via airborne route. In order to reduce nosocomial infections, there is the need to employ constant monitoring of efficacy of disinfecting procedures as well as to identify of the predominant contaminant bacteria. Ultraviolet (UV) irradiation and isopropyl alcohol are commonly used for disinfecting air, various surfaces and personnel skins. Nosocomial pathogens were isolated using settle plate method for air microflora, swabs from a variety of hospital surfaces and hand cultures of healthcare workers after routine disinfection procedures. Twenty-four hour old bacterial cultures of the five predominant antibiotic resistant bacterial strains were exposed for 15 minutes at 30 watts of UV light to determine the UV resistance abilities and were mixed separately in varying concentrations of isopropyl alcohol for 30 minutes to identify resistance to alcohol disinfectants. *Enterococcus* had the highest UV resistance exhibiting growth of colonies even after nine minutes of exposure, while *Escherichia coli* had nine colonies after one minute of UV exposure. Sensitivity tests showed that 16% of *Streptococcus* remained viable in 10% alcohol and conversely *Enterococcus* were recovered in full at 25% alcohol concentration. The results have shown that all five antibiotic resistant nosocomial pathogens are still susceptible to the effects of UV and isopropyl alcohol. However, the efficacy of both disinfectants is species-specific. Strong negative relationship between the efficacy of UV and isopropyl was observed for *E. coli*, *Enterobacter* and *Enterococcus* and a moderately negative relationship was exhibited by *Staphylococcus* and *Streptococcus*. The importance of hospital microflora still remains largely ignored and epidemiology associated with local nosocomial infections remains poorly understood. Thus, there is a need of constant monitoring for formulation of effective infection control measures.

Keywords: nosocomial pathogens, UV irradiation, antibiotic resistance, disinfectants

HSD-17

**SURVEILLANCE FOR METHICILLIN-RESISTANT
Staphylococcus aureus AMONG MEDICAL PERSONNEL OF
VETERANS MEMORIA MEDICAL CENTER**

**Juniper G. Germinal, Marie Grace B. Lavadia, Suzette R. Malapad,
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Methicillin-Resistant *Staphylococcus aureus* (MRSA), also known as Oxacillin-Resistant *S. aureus* (ORSA), is a significant hospital-associated pathogen that resists multiple beta-lactam antibiotics. The spread of MRSA can be difficult to control because of asymptomatic nasopharyngeal carriage, which threatens the safety of patients when healthcare personnel carries them. This study determined the incidence of MRSA among hospital staff of Veterans Memorial Medical Center (VMMC). Forty medical personnel (10 physicians, 10 medical technologists, 10 nurses, and 10 nursing aides) were randomly selected, their forearms and external nares swabbed, which were then cultured for the presence of MRSA using Mannitol Salt Agar for isolation, and the Oxacillin and Cefoxitin Disk Tests for susceptibility. There were reports that some of these MRSAs may have inducible clindamycin resistance, and the D test was also performed. Results showed that 17/40 (42%) and 29/40 (73/40) of the isolates were *S. aureus*, from the forearms and nares, respectively. From these, 5/17 (29%) from the forearm was identified as MRSAs (from two medical technologists, one nurse, and two nursing aides), and from the external nares, 5/29 or 17% (from two physicians, one medical technologist, and two nursing aides). One nursing aide was colonized with MRSA in both nares and forearm. Methicillin-sensitive *S. aureus* with inducible clindamycin resistance was identified from the forearm of one medical technologist. Our findings indicate the presence of MRSAs among healthcare workers that could facilitate unknowingly the spread of MRSAs in the hospital setting. Medical personnel, therefore, should use proper hygienic measures to prevent transfer of the organism from themselves to patients or among patients.

Keywords: Methicillin-Resistant *Staphylococcus aureus*, MRSA, nasopharyngeal carriage, healthcare workers, ORSA, inducible clindamycin resistance

HSD-17

SURVEILLANCE FOR METHICILLIN-RESISTANT *Staphylococcus aureus* AMONG MEDICAL PERSONNEL OF VETERANS MEMORIA MEDICAL CENTER

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Keywords: Methicillin-Resistant *Staphylococcus aureus*, MRSA, nasopharyngeal carriage, healthcare workers, ORSA, inducible clindamycin resistance

On a daily basis, close to 6,000 individuals were served with 65% school children, 23% young adults, and 12% adults.

Although fish ball street vending has been shown to be a good livelihood requiring little investment and technical skill, a number of factors were identified as potential risk factors in terms of food safety and public health. Fly infestation, dirty fingernails of food handlers, lack of personal hygiene and garbage disposal, polluted surroundings, lack of clean water source, and use of recycled cooking oil, are the identified risks in fish ball street vending.

There is therefore an urgent need to address these risk factors through the formulation and implementation of pertinent ordinances for street food vending by the local government units. The academe will have an important role in information, education and training for street food vendors.

Keywords: street food, fish ball, food safety, public health, risk factors

HSD-19

MICROBIAL FLORA DENSITIES OF *Perna viridis* DISTRIBUTED IN THE CITIES OF MANDAUE AND LAPULAPU MARKETS, CEBU PROVINCE

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Green mussels *Perna viridis* is commonly distributed in the province of Cebu particularly in the Cities of Lapulapu and Mandaue markets and an outbreak on gastroenteritis was felt by the Mandaue residents as published by BFAR personnel (2005) in the local newspaper. The science faculty member of Tabok National High School was so concerned on this problem thus, the Cebu State College of Science and Technology (CSCST), Main Campus, College of Industrial Technology and Engineering (CITE), major in Food Technology conducted a research to investigate the safety of green mussels, locally known "tahong" distributed in the two cities in collaboration with the Science Department of Tabok National High School, Mandaue City, based on the microbial flora densities and evaluate its potential hazard specifically on the *Escherichia coli* in Most Probable

Number (MPN) per gram. Based on the microbiological analyses conducted by the microbiologist of the Bureau of Fisheries and Aquatic Resources 7 using AOAC and APHA methods, *Perna viridis* taken from the Lapulapu market had the highest weighted mean bacterial load of 2.90×10^4 cfu/g, while samples taken from Mandaue City market contained 5.10×10^3 cfu/g. However, green mussels obtained from the two Cities of Lapulapu and Mandaue markets were not safe for human consumption based on the MPN per gram of *Escherichia coli*, which contained 460 MPN/g and 93 MPN/g, respectively. The green mussels taken from the markets of the two cities are not safe for human consumption based on MPN/g of *E. coli*, if eaten fresh, however when this commodity be cooked thoroughly, the product are safe to eat since *E. coli* can easily be destroyed above boiling point.

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HSD-20

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One third of all hospital infections have been documented to be preventable. Majority of these cases has been associated with transmission of nosocomial pathogens by the hands of healthcare workers. Hand hygiene has been identified to be the simplest and most effective course of action for preventing hospital-acquired illnesses. Registered nurses and student nurses on duty at a government-run tertiary hospital in Iligan City were asked to participate in the study for the assessment of hand hygiene compliance. Structured observations of routine patient care were conducted and hand-swab samples of the healthcare worker's dominant hand were taken to quantify bacterial colony counts at the end of a defined period of patient care. All of the subjects reported to have had formal education and informal training on hand hygiene but this did not reflect on their actual usage patterns. Few of the registered nurses or student nurses performed hand hygiene procedure in every after patient contact and at any time in between seeing ten patients. Hand hygiene procedures were done after they were told that their hands will be swabbed.

It was observed that incorrect handwashing procedures and insufficient time for hand-rubs were done. The noncompliance to prescribed hand hygiene protocols was due to the belief of low risk in acquiring infection from patients and blatant disregard to guidelines and protocols. Bacterial counts from the hands of student nurses were significantly higher than the registered nurses ($p=0.052895$). More than 60% of both population harbored *Staphylococcus aureus* and all had gram-negative bacilli. *S. aureus* and gram-negative bacilli are considered important nosocomial pathogens causing a wide array of severe infections. This study highlights the need for stricter adherence to hand hygiene policies among healthcare workers which may in turn be crucial in lowering nosocomial infections.

Keywords: hand hygiene, nosocomial infections, handwashing, hand-rubs

HSD-21

MICROBIAL AIR QUALITY OF GREGORIO T. LLUCH MEMORIAL HOSPITAL, ILIGAN CITY

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The rising incidence of hospital acquired infections has been attributed to the lack of cleanliness in hospitals. The risk of acquiring nosocomial infections increases with elevated aerobic bacterial counts. The level of airborne microorganisms in Gregorio T. Lluich Memorial Hospital of Iligan City was unknown and the study was carried out to monitor the bacterial densities and distribution in different areas of the tertiary hospital. The settle plate method was employed using nutrient agar for heterotrophic bacterial counts and blood agar for hemolytic microorganisms. The hospital's lobby and obstetrics-gynecology ward exhibited the highest HPC count of which occupant density was identified as a contributing factor in influencing the level of airborne microorganisms. Predominant bacterial strains were *Staphylococcus*, *Streptococcus* and *Enterococcus*, all of which are considered causative agents of severe nosocomial infections. Surveillance is essential in recognizing causative factors which may lead to increased nosocomial infections and results of constant monitoring will lead to formulation of recommendations as well as guidelines for effective preventive measures.

Keywords: microbial air quality, nosocomial infections, settle plate method

HSD-22

**PROTECTING PATIENT IDENTITY THROUGH
DEIDENTIFICATION OF PATIENT MEDICAL DATA:
A CRUCIAL STEP TO MEDICAL RESEARCH**

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One of the benefits of computerization of patient records is that it enables the researcher, if given permission by the hospital's Institutional Review Board (IRB), to access these data to answer a number of new and exciting research questions. However it is also important to maintain patient's anonymity to ensure his privacy. This paper discusses the techniques that can be employed to implement deidentification over two different database environments: 1) text-based pathology case report files, and 2) entire patient database in order to remove clues that would lead to the patient's identity. These techniques include substitution and encryption. Furthermore, data masking techniques that are not applicable for medical research are likewise discussed.

An overview of SPIN (Shared Pathology Informatics Network), an open-source, publicly accessible database of deidentified patients with surgical pathology reports, is presented to illustrate how deidentification can be implemented in text-based pathology case report files. This is followed by a discussion of Data Masker, a proprietary deidentification tool that can operate on an entire database and whose degree of customizability, i.e. depth of cleansing required, is at the discretion of the user.

By using a database of deidentified patients provided by the institution, both the researcher and the institution can avoid possible litigation costs due to alleged violations of one's privacy or due to alleged misuse of identified patient information. Some researchers can make their deidentified patient database downloadable and hence can easily be loaded onto a number of statistical software to encourage others to do more research. Furthermore, other researchers will be able to validate claims made by the researcher or improve upon his conclusions. Without access to such data, readers are asked to just accept the findings as an act of faith, rather than as a scientific conclusion.

Keywords: deidentification, data masking, data scrubbing, anonymization, SPIN, Data Masker, medical research

HSD-23

DETECTION OF *mecA* GENE IN PHENOTYPICALLY-CONFIRMED METHICILLIN-RESISTANT *Staphylococcus aureus* (MRSA) AMONG LOCAL CLINICAL ISOLATES

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In the Philippines, the presence of the *mecA* gene on MRSA clinical isolates has not yet been established. A head-to-head comparison using the automated Vitek system, the Oxacillin and Cefoxitin Disk Tests, and polymerase chain reaction (PCR) was done to correlate the utility of the phenotypic and molecular assays in detecting oxacillin resistance in local staphylococcal clinical isolates. Using the PCR-amplified products of *mecA* gene as gold standard, MRSA were confirmed in 32.9% or 23/70 clinical isolates: five (5) from the lower respiratory tract, one (1) from the upper respiratory tract, three (3) from the genito-urinary tract, eight (8) from the skin/soft tissues, four (4) from the blood, and two (2) from other sources. Results of the study indicated that Oxacillin (OXA) and Cefoxitin (FOX) Disk tests would detect oxacillin-resistance in *S. aureus* at a sensitivity of 82.6%, specificity of 100%, and efficiency of 94.3%. However, based on the results, the Vitek system would only be sensitive at 43.5% and efficient at 81.4%. It should be done in conjunction with a supplementary test that is more reliable.

Keywords: MRSA, Methicillin-Resistant *Staphylococcus aureus*, *mecA* gene, Oxacillin Disk test, Cefoxitin Disk test, Vitek

HSD-24

PRE-CLINICAL STUDY ON THE ANALGESIC EFFECT OF ESSENTIAL OILS FROM SOME PHILIPPINE PLANTS

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The analgesic activity of seven (7) locally produced essential oils of *Cymbopogon citratus* (DC) Stapf. (lemongrass), *C. winterianus* (citronella), *Eucalyptus camaldulensis* (eucalyptus), *Zingiber officinale* (ginger), *Psidium guajava* (guava) and *Cinnamomum mercadoi* Vidal (cinnamon) bark and leaves was evaluated using the Plantar test or Hargreaves method. Bio-assay of these oils involved the use of Sprague-Dawley rats with acetyl salicylic acid (aspirin) and normal saline solution (NSS) as the positive and negative controls, respectively. Three (3) increasing doses of the test material were given orally to the animals. Physico-chemical properties of these oils were also analyzed.

Among the essential oils studied, ginger oil exhibited the highest analgesic activity of 58.3% at 500 mg/kg dose. Lemongrass oil showed analgesic activity of 47.8% at the same dose, while essential oils of guava and cinnamon leaves exhibited slight % protection. Guava oil gave 36.8% while cinnamon leaf oil showed 40.0%. Low % protection was exhibited by eucalyptus oil.

The positive control aspirin showed % protection of 52.2% at 300 mg/kg dose.

The results obtained will serve as a basis in the development of analgesic products from natural essential oils

Keywords: analgesic, *Cymbopogon citrates*, *Zingiber officinale*

HSD-25

CAFFEINE: A NOVEL SLIMMING AGENT

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A fat-burner cream was developed using phytobioactives that include a citrus oil and caffeine. An oil-in-water emulsion was formulated incorporating the phytobioactive ingredients in concentrations of 3.0% and 5.0%. A placebo was also prepared for use as control. Clinical testing for the efficacy claim substantiation of the formulated product as fat-burner/slimming agent was conducted by dermatologists from Ospital ng Maynila Medical Center for 4 and 8 weeks of testing involving 63 subjects. Subjects were grouped into three (3) for 3.0%, and 5.0% concentration of phytobioactives; respectively; and placebo. Changes in weight, waist ((W) & hip (H) measurements, W-H ratio and body mass index (BMI)

were measured. Results showed that both concentrations (3% and 5%) of the fat-burner cream were statistically superior to placebo on all efficacy parameters. Reduction in weight, waist and hip measurements generally occurred during the 8-weeks of treatment. Of the groups analyzed, the highest reduction on efficacy parameters occurred in group 2, making the 5% concentration of the fat-burner cream more effective over the 3% preparation.

Keywords: phytobioactives, BMI, caffeine

SOCIALSCIENCES DIVISION

SSD-1

PERCEPTION AND ATTITUDE TOWARDS THE CO-MANAGEMENT OF MT MAKILING FOREST RESERVE, LAGUNA, PHILIPPINES

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The study sought to determine the Bagong Silang upland community's perception of and attitude towards the co-management approach in managing the Mt. Makiling Forest Reserve (MFR) in Los Baños, Laguna. Specifically, it aims to: 1) determine the socio-demographic characteristics of the Bagong Silang upland community; 2) identify the co-management practices, its nature and extent, between Bagong Silang upland community and the University of the Philippines; 3) determine the perception and attitude of the Bagong Silang upland community regarding co-managing the Makiling Forest Reserve with the University of the Philippines Los Baños (UPLB); and 4) determine the relationships between the community's socio-demographic characteristics and perception of and attitude towards co-managing the Makiling Forest Reserve. Using the sampling proportion technique, the study covered 36 respondents from the 152 households in the community. A key informant interview was also conducted to capture the perceptions of the university personnel towards the co-management of MFR. Spearman's Rho (at 0.1 level of significance) and Factor Analysis technique was employed to determine the statistical relationships of the different aspects or components studied. Results revealed that across the 52 components considered in the study, only 12 yielded strong correlation values that are grouped into 3 factors. First, Factor 1 can be explained that the *"project development processes are perceived to be significantly important for a co-management between UP and Bagong Silang community of managing MFR to be effective"*. The 3 strongly correlated components contributed to the analysis of this factor include: 1. the community member's position to their organization; 2) the resident's perception that they should be involved in the planning and decision-making processes with the UPLB; and 3) the perception that the participation in the co-management should entail proper benefits to the community. Secondly, Factor 2 suggested that *"the prescribed landuse activities of UPLB eg. agroforestry, soil and water conservation, and ecotourism were perceived to be a shared responsibility among the community members hence each member should fairly participate in the forest*

conservation activities". Six major components yielded strong correlations under this factor: 1) participation in agroforestry activities; 2) participation in soil and water conservation programs; 3) involvement of the community members in the ecotourism activities; 4) active local participation in tree planting activities of the university; 5) number of years the member has been serving their organization; and 6) active local support to the UPLB's strict of rules and regulations regarding the forest settlement. Lastly, Factor 3 suggested that "*benefits of co-management should be ensured for it to be sustainable*". The 3 related components that were distilled in this group include: 1) scholarships should be awarded to the community members' children; 2) skills training should be provided to the community; and 3) non-farm livelihood trainings such as automechanic, dressmaking, and others should be provided to the community. Overall, the study concluded that the co-management system to be sustainable and effective, it would require the active involvement of the community in the planning and decision-making activities, ensuring the benefits of co-management, and cohesive rapport between the co-managers of MFR.

Keywords: Mt. Makiling, perception and attitude, co-management, forest conservation

SSD-2

LOCAL PERCEPTIONS ON ECOLOGICAL CONSERVATION PRACTICES IN SUSTAINING THE ECOTOURISM OF PAGSANJAN FALLS

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Ecotourism is one the most effective management approach to ecological conservation. Being a non-extractive land use practice, it brings dual benefits: ecological conservation and source of livelihood for local stakeholders. Given this, proper knowledge and appreciation regarding the need for environmental protection and the effective involvement of major stakeholders in conservation activities are crucial. Pagsanjan Falls is a well-known ecotourist destination in the Philippines where ecological conservation is set as a high priority as it serves as a means to sustain various forms of livelihood and income of the community

For such reason, a study was conducted to distill the local interventions that the local stakeholders make to sustain the ecotourism value of the falls, and capture their local perceptions about the changing conditions of the watershed (forest and river basin) and their perceived causes. A semi-structured interview with local stakeholders and executives, and an exhaustive review of existing documents were employed. As a result, eight key Natural Resource Management (NRM) policies were reviewed. These policies serve different objectives such as: a) providing regulatory frameworks in managing the Pagsanjan Gorge Tourist zone; b) organizing river councils (People's Organization) that will help implement the environmental projects of the government; and c) implementation of rehabilitation projects in the Pagsanjan-Lumban River Basin by the DENR-LLDA. Respondents perceived that these policies are very significant in improving the ecological conditions of the basin. Perceptions on the condition of the watershed however showed varied results. Thirty-three percent (33%) believed that the watershed has deteriorated because of the illegal timber poaching activities and the increase in commercial establishments along Pagsanjan River, seventeen percent (17%) believed that the watershed has improved upon the implementation of rehabilitation projects of the government, and fifty percent (50%) perceived that there was no change in the conditions of the watershed over the past ten years. Perceived local interventions that will help improve the conditions of the watershed include: ecological seminars in schools conducted by the municipal LGUs, joint tree plantation projects of various NGOs such as Rotary Club and Lions Club, active involvement of the local communities in the projects of DENR-LLDA, and strict implementation of forest policies by the municipal LGU. On the perceptions about the condition of aquatic ecosystem, majority (67%) believed that the water condition of the basin has deteriorated and fish yield has declined. These problems were attributed to unmanaged agricultural and domestic wastes from the upstream rivers of the nearby municipalities that causes high turbidity and decreased oxygen-level in the river waters. Perceived interventions that help address these problems include: the active local participation in the Sagip-Ilog Program (a solid-waste management project of the municipal LGU), and the river clean-up drives which are mostly participated by "bangkeros" or boatman associations. Overall, the respondents believe that the ecotourism value of the Pagsanjan Falls is so far being sustained because of the local interventions being shared by the different stakeholders. Perceived problems however pose serious threats that needs to be properly addressed.

Keywords: ecotourism, local perception, ecological conservation, watershed

SSD-3

**PATTERNS OF INTERNET-BASED FRIENDSHIP AMONG
RESIDENTS
OF LOS BAÑOS, LAGUNA: THE FRIENDSTER CASE**

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The prevalent use of the street lingo “Friendster” to refer to a friend is evidence that the Internet has become a pervasive entity that influences Filipinos. Because the Internet has become an ubiquitous medium for faceless and remote social interaction via services called social networking, data such as gender, geographic location, age and a person’s list of friends have become readily available, making it possible to analyze on a community-scale the demography and the friendship characteristics of a population, without resorting to the traditional procedure of surveying a population sample. We developed a computer program that extracted the demographic and friendship data of 7,172 Friendster™ members whose listed hometown is Los Baños, Laguna. Based on our demographic analysis, we found that: (1) There are more female participants (52.34%) than male (47.66%); (2) Ages 15-25 of both genders compose 68% of the participants, with ages 26-40 following at 28%, ages 41-85 at 4%, and senior citizens (64-85) at 1%; (2) The birds-of-a-feather adage (i.e., homophily) is observed in age level preference such that the members are strongly biased towards being friends with people of a similar age; And, (3) there is heterophily in gender preference such that friendship among individuals of the opposite gender occurs more often. Based on our network analysis, we found that: (1) The friendship network is well-connected and robust to node removal; (2) It exhibits a small-world characteristic with an average path length of 4.5 (maximum=12) among connected members, shorter than the well-known “six degrees of separation” finding by Travers and Milgram in 1969; And (3) the network exhibits a scale-free characteristics with heavily-tailed power-law distribution (power = -1.02 and $R^2 = 0.84$) suggesting the presence of many members acting as the network hubs.

Keywords: demography, Internet, friend-of-a-friend network, small-world, scale-free.

SSD-4

**SELF-AWARENESS AS AN APPROACH TO
STRESS MANAGEMENT: ASSESSING THE
LEVEL OF FRUSTRATION AND STRESS
LEVEL OF SELECTED FRESHMEN
STUDENTS OF THE UNIVERSITY OF THE
PHILIPPINES LOS BAÑOS**

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Stress is an unavoidable universal human phenomenon which is oftentimes disquieting. Stress-related disorders have become prevalent, threatening the quality of human resource. An alternative approach to stress management is self-awareness. A keen understanding of oneself facilitates clear identification of ways to handle stress factors.

This study attempts to determine vulnerability to stress as measured by the level of frustration. Frustration occurs when one is prevented from attaining an aspiration or achieving a goal. Stress due to frustration can be alleviated by finding equally rewarding alternatives to the original aspirations or goals.

A questionnaire was administered to a sample of 258 college students of Physical Education 1 (PE1) classes at the University of the Philippines Los Baños. The subjects were asked to indicate their perceptions of frustration that trigger stress.

Responses affirm that as the level of frustration rises, the stress also increases. Results reveal that out of the 258 students, there were 140 students (54.26%) with high frustration and high stress level; 108 students (41.86%) with moderate frustration and moderate stress level; and 10 students (3.88%) with low frustration and low stress level.

Assessment of frustration levels can direct future research in the area of stress management. Corresponding to the level of frustration, an appropriate program can be designed to combat stress.

Keywords: Stress, self-awareness, frustration level, stress level, stress management

SSD-5

**UTILIZATION OF BIOGAS IN ILOCOS NORTE AND
ILOCOS SUR: ITS IMPACT TO THE USERS**

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The Biogas plant was established as part of the comprehensive energy program to ensure the promotion and commercialization of non-conventional energy resources and technologies which are technically feasible, socially desirable and acceptable and economically viable.

This study was conducted to evaluate the socio-economic and environmental impact of biogas system to the users.

The study was conducted through an interview of biogas users in the two Ilocos provinces. Biogas users were generally middle aged, mean age of 48 years, generally married males with a high level of educational attainment. They had small to medium family size with an average annual income of P247,411.77 ranging from 10,000.00 – P600,000.00 which means that their average annual income is above the poverty threshold. Most had little experience in biogas operation. However, they had moderate knowledge level of the various practices of the biogas. Their attitudes towards the biogas and the technicians are high.

The respondents' perception on the biogas plant effectiveness and extent of plant utilization is moderate. In addition, the socio-economic impact is perceived to be moderate and the environmental impact is perceived to be very sound. Out of the ten socio-demographic variables tested, three variables were significantly related to the socio-economic impact. These are educational attainment, family income, and knowledge level. Five variables, age, educational attainment and family income, attitude towards the biogas and attitudes towards the technicians were related to the environmental impact. However, only two demographic variables were significantly correlated with the extent of biogas utilization. These are educational attainment and family income. Extent of biogas utilization is related to both the socio-economic and environmental impact. The biogas plant effectiveness is significantly related to the extent of biogas utilization.

Keywords: biogas, biogas utilization, environmental and socio-economic impact

SSD-6

**TINDUPĪ, P'RAS, SAMALUNĀ, GANŪS: SEASONAL
CALENDAR, CLIMATE CHANGE AND ADAPTIVE
STRATEGIES AMONG THE SUBANUN
IN MT. MALINDANG**

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After long years of residing in the Mt. Malindang area in Northwestern Mindanao, the Subanun of Misamis Occidental have learned to face societal demands and the harshness borne by a changing environment. As an indigenous people interacting with and dependent on the environment, they have crafted adaptive strategies through concrete experiences in undertaking survival tasks.

Their knowledge of the seasonal calendar constitutes an element of cultural system and institutions putting order to the relationship between the community and the biophysical environment. This indigenous knowledge epitomizes part of Subanun culture-ecosystem relation.

The Subanun of Mt. Malindang recognize two (2) general seasons in the six (6) communities constituting the study sites – (tindupĪ, or rainy / wet season, and p'ras, or sunny / dry season). They also recognize a number of intermittent seasons: samalunĀ (season when rainy and sunny periods occur interchangeably); ganus (windy season); gan'us dupĪ (rainy period with occasional winds or storms); p'ras gan'us (season of frequent sunshine with winds/storms); p'ras gilāt'lugong (season of frequent sunshine with lightning and thunderstorms). There are distinct differences among the study sites in terms of the time of occurrence and the length or duration of the seasons. The differentiations in physico-geographic characteristics of the communities dictate the type of adaptive strategies (farming, hunting, and fishing) resorted to for survival, underlain by a belief system that sustains the conservational characteristics of biodiversity.

Tragically, climate change and other environmental conditions now compel farmers to take the risk in carrying out some activities at any time of the year despite indigenous knowledge about which seasons are appropriate or ideal for undertaking such activities. Adaptive strategies and survival tasks are changing. After all, either rain or sun may come, anytime.

Keywords: seasonal calendar, culture-ecosystem relation, environmental change, survival strategies, biodiversity conservation

SSD-7

READINESS OF MSU-IIT STUDENTS FOR QUANTUM MECHANICS

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Understanding the fundamental concepts in modern physics especially in quantum mechanics is of utmost importance because most technological advancements of today arise from the quantum nature of matter. However, learning quantum mechanics is difficult because of unfamiliar mathematics such as complex vector spaces with inner products and its abstract concepts could be a barrier in connecting mathematical objects to the real world.

We devised a measuring instrument for assessing the readiness of MSU-IIT students for quantum mechanics. This consists of 3 parts: a 1-hr power point lecture-presentation complete with appropriate animations/simulations and a 18-item pre- and post-examination questionnaire comprising four themes of quantum mechanics: de Broglie waves, wavefunctions and Schrödinger equation, uncertainty principle and the modern model of the atom. In the questionnaire, two were non-multiple choice items. For each multiple-choice question, the students were also asked to indicate their level of confidence or certainty in the correctness of their answers.

In total, 45 science students (physics, engineering, physics education majors) participated in this study. The students are aged 16-19 years old; mostly freshmen and sophomores. All of them have not yet taken up any formal modern physics course. The student responses were categorized into two types. Group A: 28 students took both the 18-item pre-examination (post-examination) before (after) the power point lecture-presentation, while Group B: 17 students who took only the post-examination.

For Group A students, an average of only $52 \pm 5\%$ give correct answers per question during the pre-examination and this increased to $75 \pm 3\%$ average-per-question during the post-examination. There is also a remarkable increase in the per-question-average level of student certainty in their answers:

$58 \pm 1\%$ during the pre-examination and $81 \pm 1\%$ in the post-examination.

However, for Group B students who heard the power point lecture-presentation but only took the post-examination, an average of only $51 \pm 6\%$ give correct answers per question and their average level of confidence is only $48 \pm 2\%$ per question.

The results can also be analyzed in terms of the number of students who gave correct answers to at least half of the 18-item questionnaire. For Group A, in the pre-examination, 9 students or 32% of the students failed this criterion but during the post-examination, all of the 28 students passed with all students registering improved performance. For Group B students, however only 9 of the 17 students passed this criterion.

Our study therefore shows that a pre-examination is significant in the learning process. In addition, a non-traditional lecture-presentation consisting of computer animations/simulations, even of short duration and given by beginning graduate students gives a significant impact in improving the performance of students in written tests.

Keywords: quantum mechanics, Schrödinger equation, computer animations/simulation

SSD-8

PSYCHOMETRIC EVALUATION OF DEPRESSIVE SYMPTOMS IN UNIVERSITY STUDENTS OF MSU-IIT

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Depression is a common emotional disorder, which causes distress and impairs functioning. The Cognitive, physiological, behavioral and motivational symptoms are the core features of this disorder and different combinations of these symptoms are experienced by depressed individuals. Depressive disorders are identified by the World Health Organization as *priority mental health disorder* of adolescence because of its high prevalence, recurrence, ability to cause significant complications and impairment.

This study evaluates the psychometric properties of the depressive behaviors among non-clinical university students of MSU-IIT as well as the frequency of depressed, dysphoric individuals, and non-depressed individuals.

Beck Depression Inventory (BDI) was administered to 824 students (366 males and 458 females) of MSU-IIT. Reliability and discriminant analysis were used to test the psychometric properties and validity of BDI in evaluating the depressive symptoms of the said population. Principal component analysis was performed to assess the factor structure of the depressive behaviors of the

students as diagnosed by the BDI.

Severe depression was observed in 25% (N=206) having 60% (N=124) of it were females. Dysphoria was observed in 133 individuals (16.14%), and the remaining 58.86% were non-depressed. The mean total BDI scores was higher (14.76, SD=9.46) than its western counterpart and showed no significant difference according to non-parametric Mann-Whitney Statistics. However, females recorded higher mean total BDI scores (15.44, SD=9.82) than males (13.92, SD=8.94). Reliability test shows to be good with Cronbach's alpha, $\alpha=0.87$ and with high discrimination of depressive symptoms (89.7%). Of the five significant factors extracted in the principal component analysis, only two were considered. Factor 1 is highly associated with the cognitive-affective dimension such as sense of failure, self-dislike, sadness, pessimism, guilt-feelings, self-accusation, sense of punishment, and lack of satisfaction. This accounts for the 30% of the variability. On the other hand, factor 2 is highly associated to somatic-nonspecific dimension such as distortion of body image, sleep disturbance, work inhibition, and loss of appetite. This factor accounts for an additional 7.58% of the variability.

Depressive symptoms can be reliably assessed by the Beck Depression Inventory in the non-clinical university based students of MSU-IIT, with validity comparable to that for international studies.

Keywords: Depression, dysphoria, Beck Depression Inventory (BDI)

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1. To recognize exemplary science and technology achievements among the young and among peers
2. To encourage individual Academy members to continue their scholarly pursuits thereby making the Academy the principal reservoir of scientific and technological expertise in the nation
3. To provide independent and science-based advice on problems facing the nation and the world
4. To link with like-minded institutions and individuals in promoting scientific achievements in the Philippines and abroad
5. To promote a strong science culture in Philippine society

Its **MANDATE:**

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

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