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Infrastructure, Information, and Innovation (I³) for National Development, Competitiveness, and Resiliency

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36th ANNUAL SCIENTIFIC MEETING

Infrastructure, Information, and Innovation (I³) for National Development, Competitiveness, and Resiliency

36th ANNUAL SCIENTIFIC MEETING

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AGRICULTURAL SCIENCES

AS-01

CONSERVATION AGRICULTURE PRACTICE SYSTEMS (CAPS): INFLUENCES ON AGRONOMIC EFFICIENCIES AND CARBON PRODUCTIVITY OF CORN-BASED CROPPING SYSTEMS IN NORTHERN MINDANAO

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Conservation Agriculture Practice Systems (CAPS) is a tailor-fitted approach for successful adoption and implementation of Conservation Agriculture (CA). A recent agronomic innovation currently gaining ground globally and still untested under local condition. Its three main pillars namely: 1) continuous crop rotation 2) minimal tillage and 3) continuous ground cover were used simultaneously in various cropping systems. Hence, this study was conducted to test the viability and efficiency of CAPS locally and was established in a 23 percent sloping site. Experiment was carried out in two-cropping seasons (November 2011- November 2012) utilizing five corn-based cropping systems (CS), namely: CS₁ (corn + Arachis pintoi), CS₂ (corn + Stylosanthes guianensis), CS₃ (corn + cowpea - upland rice + cowpea), CS_4 (corn + rice bean) and CS_5 (corn-corn), respectively. Agronomic characteristics and carbon productivity were measured among various CAPS wherein dry mater yield, grain yield and carbon productivity differed among the CAPS treatments relative to sole corn. Higher grain yields were obtained in cropping systems under CAPS or corn intercropped or sequenced with legume) compared to the conventional (CS_s) cropping system. Highest grain yield was obtained in CS, while highest carbon productivity measured through dry weight was recorded in CS₁, respectively. Viability of CAPS utilizing associated legumes and its three main pillars under a sloping upland as model is proven to be a potential option for sustainable crop production amidst climate change.

Keywords: Conservation Agriculture Practice Systems, cropping systems, sloping uplands, associated legumes, Northern Mindanao

PHENOLOGY, GROWTH HABIT AND PRODUCTION OF DRAGON FRUIT (*Hylocerus* spp.) IN NORTHERN MINDANAO

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Dragon fruit is a climbing epiphytic cacti and member of the Cactaceae family also known as pitaya. It commands high price in the market. Local supply is limited owing to their value as food products, high nutritive and medicinal values. The challenge of adopting this crop in Claveria, Misamis Oriental, an agroecosystem with high rainfall intensity (> 2000 mm/year) and acidic soil is daunting. Three cultivated varieties of the crop (red, white and yellow) were planted using cuttings. Wooden poles with used rubber tires were used as initial support structure, periodic application of organic and inorganic fertilizers were observed and water sprouts were eliminated as soon as it emerges from the branch. Crop phenology were recorded and documented, insect pests and rodent infestation were also observed. Flowering and subsequently fruiting started at 14-15 months from planting for the red and white color (flesh) varieties while yellow cultivar flowered after 16-18 months after planting. Flower opening started from 6 to 7 PM, a complete bloom is from 9 to 10 PM and flower closes at 4 to 5 AM in the ensuing day. Fruits mature at 45-50 days after anthesis, harvested fruits were comparably sweet as compared to fruits cultivated from other nearby provinces. The experience and knowledge gained in the actual backyard dragon fruit cultivation will serve as the basic technical capital in large scale commercial production to supply demand gaps in Northern Mindanao.

Keywords: epiphytic, Cactaceae, crop phenology, pitaya, Northern Mindanao

SUPPLEMENTAL LIGHTING DURING THE NIGHT ON DRAGON FRUIT: A POTENTIAL TECHNOLOGY FOR OFF-SEASON PRODUCTION

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Under natural conditions, dragon cactus produces flowers and bears fruits only during the long-day months. Because of no local production during short-day months, the domestic supply of dragon fruit is dependent on imported ones. Through the provision of supplemental light at night in short-day months, fruits can now be available locally during off-season.

The experiment was laid out in Randomized Complete Bock Design in Sub-sampling using different light bulbs as the treatments: 100 watt-incandescent bulb (IB), 26 watt-compact fluorescent bulb (CFL) and 6 watt- light emitting diode (LED).

Dragon cactus lighted with different bulbs between 10 o'clock in the evening until two o'clock the following morning did not show significant differences on the number of fruits, weight per fruit and yield per post. In a 1,000 m² area, the cactus lighted with 6-W LED bulbs gave the highest cost of electricity, followed by those with 26-W CFL while the plots with 100-W IB rose relatively. In six month-period, plants lighted with 6-W LED bulbs (PhP86,726.00) and 26-W CFL (PhP82,421.00) had higher net income than those in the 100-W IB (PhP26,647.00) plots.

Flowering of dragon cactus during off-season can be induced by supplemental lighting using CFL or LED bulbs.

Keywords: dragon fruit, supplemental lighting, off season production, compact fluorescent lamp, light emitting diode bulb

PRODUCTIVITY AND RESPONSE OF ROBUSTA COFFEE TREES TO DIFFERENT PRUNING SYSTEMS IN AN ACID UPLAND SOIL

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Rejuvenative pruning can be considered as a mechanism to revive and lengthen the productive life of coffee in Claveria, Misamis Oriental. Coffee is an important economic crop grown in the uplands of Northern Mindanao but owing to advanced age of the trees, productivity is low resulting to lower economic gains among farmers. Different pruning systems were employed in a 22-year old Robusta trees plantation in an agroecosystem characterized as upland soil. The study aimed to evaluate the response of coffee to various pruning systems imposed as treatments as follows: PS₀ - all water sprouts allowed to grow after pruning; PS₁ - only two vigorous water sprouts were selected and maintained at 1.5m stem height; PS₂ - only four vigorous water sprouts were selected and maintained at 1.5m stem height; PS₃ - same with PS₂ but sprouts were allowed to grow its maximum height; and PS_4 - same with PS_1 but sprouts were allowed to grow its maximum height. Growth, yield and economic efficiencies were measured. Coffee trees subjected with PS_o had comparably significant agronomic responses compared to other imposed systems. Results on the study revealed that pruning technique wherein old stems/branches were cut and all waters sprouts were allowed to grow without removal of apical buds and without repruning from start of rejuvenation until the termination of the experiment had commendable results compared to other pruning systems. Return on Investment (ROI) values were better using PS_0 and PS_4 , hence these pruning techniques are recommended for validation.

Keywords: pruning, Robusta, growth and agronomic efficiencies, rejuvenation, Northern Mindanao

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POTENTIALS OF TRADITIONAL UPLAND RICE (Oryza sativa L.) VARIETY FOR DROUGHT ADAPTATION IN MARGINAL UPLANDS

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The Philippine government is promoting upland rice farming in every region of the country to augment the total national rice production towards rice self sufficiency. Marginal upland rice ecosystem however, is threatened by persistent climatic changes affecting marginal upland rice production. Upland rice has shallow root systems, thus it is more susceptible to drought than other crops. Evaluation of existing traditional (Dinorado, Speaker, Cabuyok) and improved (UPL Ri5, UPL Ri7, IR-55419) upland rice varieties grown organically in the field (dry season) and under rain shelter condition were conducted to characterize promising high yielding drought tolerant germplasms for marginal uplands. The traditional upland rice variety "Speaker" produced comparably higher dry matter and grain yield with improved upland rice variety IR 55419 outperforming the improved check variety UPL Ri-5 and two other traditional varieties, Dinorado and Cabuyok, respectively. The yield of traditional variety "Speaker" and improved upland rice variety IR 55419 were consistently higher even subjected to drought induction. The amount of accumulated nitrogen decreases as the duration of drought induction increases. Speaker maintained significantly higher relative chlorophyll content before and after heading. Moreover, relative growth rate (RGR) was significantly higher before and after heading in Speaker. The higher RGR in Speaker was attributed by higher net assimilation rate (NAR) and larger leaf area index (LAI) before and after heading than in IR 55419, suggesting higher photosynthetic. These results suggest the potential characteristics of traditional upland rice variety Speaker for improving upland rice variety for drought adaptation in marginal uplands.

Keywords: upland rice varieties, marginal uplands, dry matter accumulation, harvest index, climate change

IMPROVED TOMATO STORAGE TECHNOLOGY

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Result of a survey conducted by the Mariano Marcos State University revealed that storing tomatoes is already a practice of farmers in the Ilocos, specifically in Barangay Quiling Sur, City of Batac. Aside from farming, it was reported that tomato storage is an additional source of their income. Tomatoes are cheap during the month of March because of the high supply available in the market, hence, farmers are trying to increase their income by storing their produce to catch up with a higher price during the lean months. The farmers were able to store tomatoes up to two months.

Most of the farmers store their tomatoes in containers that are available like bamboo baskets, plastic sacks, sando bags, plastic/wooden box, plastic pail, and paper box. When plastic sacks were used as containers, they are either hanged, laid horizontal or in vertical position. The place of storing tomatoes is in the open space or inside their houses with roofing made of either light materials or galvanized iron. One of the problems encountered by farmers is high rotting percentage.

Farmers' practices were improved through several experiments using different packaging materials and the incorporation of rice hay, rice hull and saw dust. Packed tomatoes were stored at ambient temperature and elevated for good ventilation. The best containers identified for storing tomatoes were plastic sack and paper box; the best material to be incorporated was rice hay. The improved storage technology resulted to good quality fruits and provided 99 to 178% return of investment.

Keywords: storage, storage practices, container, deteriorative changes, profitable
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PROPAGATION TECHNIQUES OF FB CACHOLA BREADFRUIT, Artocarpus altilis, Moraceae AND MMSU SRO SWEET JACKFRUIT, Artocarpus heterophyllus, Lam.

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Promising fruit trees, such as FB Cachola breadfruit (*Artocarpus altilis*, Moraceae) and MMSU SRO *Sweet* jackfruit (*Artocarpus heterophyllus*, Lam.) varieties have been developed at the Mariano Marcos State University. Production of true-to-type planting materials was made possible through *invitro* and conventional methods.

In vitro propagation of breadfruit made use of explants collected in the month of July to December. Soaking the explants for 2 hours with antioxidants, 15% ascorbic acid and 10% citric acid, as surface sterilants, resulted to 62.67% survival. Shoot tip of explants with the inclusion of the base node gave 64.52% survival. Multiple shoots were produced at fifth reflasking of explants inoculated in MS+5ppm benzyl aminopurine (BAP) culture media. Conventional method was successful through grafting. Cut scion of FB Cachola were grafted to one-year-old seeded breadfruit seedlings, individually wrapping them with polyethelene bag.

In vitro propagation of jackfruit made use of explants taken from growing tips of branches and lateral buds from mainstems; surface sterilize explants with anti-oxidants for 2 hours. Inoculating plantlets in MS+5ppm BAP hastened shoot multiplication after 60 days. In grafting MMSU SRO *Sweet* jackfruit, scion were cut 5-15cm long to obtain higher survival and better vigor of seedlings.

With the appropriate propagation techniques, planting materials of superior varieties of FB Cachola breadfruit and MMSU SRO *Sweet* jackfruit can be made available and accessible to the growers/orchardists at the right time, quantity and quality.

Keywords: *in vitro* propagation, conventional method, breadfruit, jackfruit, grafting

CARBON SEQUESTRATION POTENTIAL OF A JATROPHA-BASED ALLEY CROPPING SYSTEM

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Global warming is one of the primary causes of climate change. Increasing carbon stocks in the atmosphere is a significant contributing factor to this phenomenon. Attempts to reduce carbon in the atmosphere have been a primary concern worldwide. The vegetation in various land uses such as agroforestry is believed to be a sink of carbon.

This study was conducted to evaluate the total carbon stocks sequestered in a jatropha (*Jatropha curcas* I.) based alley cropping systems treated with varying fertilizer applications. The alley which was planted with corn in two seasons was laid-out in Randomized Complete Block Design with three replications. Treatments include control (no fertilizer), organic fertilizer and inorganic fertilizer applied to the alley crops.

Findings revealed that the treatments with fertilizer applications had higher carbon stock in the jatropha hedges. The carbon content of the corn stover was also higher in organic and inorganic fertilizer-applied treatments. However, highest soil carbon content was shown in treatments applied with organic fertilizer (4.28 Ton Ha⁻¹). The inorganic fertilizer treatments had the lowest soil carbon content with a mean of 4.28 Ton Ha⁻¹. In terms of total carbon stock of the entire jatropha-based alley cropping system, there was a significant difference among treatments with organic fertilizer application having the highest mean of 7.79 Ton Ha⁻¹ while the inorganic treated plots had 6.53 Ton Ha⁻¹. The no fertilizer treatment had the least carbon stocks with 6.53 Ton Ha⁻¹.

Results of the study revealed that the jatropha-based alley cropping system is a potential use for carbon sequestration. The farming system needs to be promoted in upland areas to function not only as soil and water conservation measures but also as possible remedy for global warming.

Keywords: alley cropping, agroforestry, carbon sequestration, *Jatropha curcas*, hedgerow

AS - 09 DISTRIBUTION, PHENOLOGY AND FRUIT YIELD POTENTIALS OF BITAOG (*Calophyllum inophyllum* Linn.) IN ILOCOS NORTE

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Interests are increasing on biofuel production and efforts are being done to come up with economically feasible and environmentally sustainable production technologies. Bitaog is one of the indigenous tree species that has potential as biofuel source. Its seeds contain high amount of fatty oil which is being considered as a feed stock in the production of biodiesel. Thus, a study was conducted to determine the distribution and estimate the population of this species in the province; and document its phenology and fruit yield.

The location of bitaog trees was determined through DA technicians, DENR field personnel and LGUs and verified by reconnaissance surveys. Eight sample trees per location/municipality were used in the phenology and fruit yield assessments. The phenology and yield tree⁻¹ were monitored for two years.

Bitaog trees were observed in 12 towns and two cities of Ilocos Norte, with a population of about 3,275. Most of the bitaog stands were found on level, coastal and swampy areas and near banks of creeks, rivers and irrigation canals. More than half of the trees were relatively young with diameter at breast height (DBH) ranging from 10 to 30 cm. Almost half (49.7%) of the trees were found in Pasuquin.

There were slight variations on the occurrences of leaf flushing, flower and fruit development, and fruit maturity of bitaog growing in Batac, Paoay, Currimao and Pasuquin. Flowering was observed twice a year but fruit development occurred only during the months of December and January. The fruits matured during the months of March-June. Highest fruit yield was observed in Currimao (117 kg tree⁻¹ year⁻¹) while those growing in Batac had the least (33 kg tree⁻¹ year⁻¹). Fruit yield of bitaog was positively correlated with the DBH of the trees.

Results imply that bitaog trees in Ilocos Norte are relatively young and concentrated in Pasuquin. Most of these are growing in level, coastal areas and near bodies of water. Variation in the phenology is minimal and fruit yield is highest in Currimao.

Keywords: phenology, fruit yield, biofuel sources, indigenous trees

ARTIFICIAL SEED INDUCTION VIA SOMATIC EMBRYOGENESIS AND PLANT REGENERATION IN PAPAYA

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The use of artificial seeds using somatic embryos induced from zvgotic embryos of papaya was explored as a way of rapidly increasing plant production in vitro. Cross- and self-pollination of selected parents and inbred lines, respectively was done to generate zygotic embryos as explants materials. These genetic materials contain tolerance to papaya ringspot virus type-P (PRSV-P). Ninety to 120 day old papaya fruit of selected inbred lines and hybrids were harvested and ivory-colored seeds were dissected to obtain the zygotic embryos. These embryos were explanted in MS medium supplemented with 10 mg/L 2,4-D. A mixture of somatic embryos and calli developed on the apical dome of the zygotic embryos 1-2 months after explanting and continue to proliferate until the 6th month after explanting. Torpedo-type somatic embryos mixed with calli developed 8 months after explanting on De Fossard medium without plant growth regulators. These embryos regenerated into whole plants with complete roots and shoot 9-12 months after explanting. However, abnormal plants with fused stem, split meristem, thickened roots, and misshapen leaves also develop but tend to become normal as the plant grows. The regenerated plants were potted-out in a sterile mixture of garden soil, vermin-compost and coir dust. They were acclimatized inside an acclimatization box placed inside the screenhouse. The hardened plants were ready for planting in soil one month after acclimatization

Keywords: De Fossard medium, MS medium, papaya, regeneration, somatic embryos, zygotic embryos

FIELD PERFORMANCE OF ADLAI (*Coix lacrymajobi*) UNDER DIFFERENT WEED MANAGEMENT STRATEGIES

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To promote adlai as a new additional staple crop in the Philippines to help attain food security, DA-BAR spearheaded and funded research studies to government institutions such as State Colleges and Universities (SCUs) since 2011. Recommended cultural management practices need to be established for the holistic promotion of this crop for nation-wide production. This study was conducted to compare six possible weed management strategies (WMS) for adlai. Specifically, it aimed to determine the agronomic and yield characteristics of Gulian variety (of the Subanens of Zamboanga del Sur). The study was laid out in RCBD with three replications at Musuan, Bukidnon from June to December 2012. Data were analyzed using ANOVA and LSD for treatment mean comparisons. Fifteen weed species were identified prior to land preparation but only 13 were observed during the growth cycle of adlai until harvest. Mimosa pudica and Mikania cordata were no longer observed which suggest these were not associated with the crop, and there are possible allelopathic effects of adlai on these species. As per ANOVA, 11 of 15 parameters measured differed significantly among WMS. Unweeded plots (WMS2) matured 3 days late (162 DAP) than the plots with other WMS. WMS1 (weed-free plots) had the highest mean yield (2,903 kg/ha). This was followed by WMS3 (hilling up at 30 DAP) with 2,354 kg/ha which also had the heaviest seeds at 93 g/1000 seeds. Among 6 WMS, WMS3 had the highest gross sales and had the highest ROI (6.34). Therefore, WMS3 is recommended for adlai.

Keywords: adlai, weed management, *Coix lacryma-jobi*, food security, additional food

EFFECT OF 2-DEOXYADENOSINE MONOHYDRATE ON THE QUALITY OF FROZEN-THAWED WATER BUFFALO SPERMATOZOA

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Effects of 2-deoxyadenosine monohydrate (2-DXA) on improving the quality of frozen-thawed water buffalo spermatozoa known to have poor quality were examined. 2-DXA is an analogue of adenosine that increases the cyclic adenosine monophosphate levels among poorly motile and metabolically quiescent sperm cells of cancer and oligospermia patients in human. Two studies were conducted; Study 1 examined the effects of different concentrations (0, 1, 5, 10 mM) of 2-DXA in the in vitro fertilization medium, and Study 2 examined the effect of extended incubation periods (0, 6, 12, 18h) with 2-DXA on semen quality. Frozen semen was thawed at 37°C for 15 sec and post-thaw quality was examined then the semen samples were divided into the different treatment regimes. Motility, livability and plasma membrane integrities were gathered. Post-thaw motility and livability of the semen sample were 38.18±3.17% and 38.57±1.94%, respectively. After treatment with 2-DXA, significantly higher (P<0.05) (35.77±4.01% vs. 25.85±3.71%) 10 mM treated sperm cells were alive at 18 h of treatment compared to control group though percent motility and plasma membrane integrity were not different between treatment groups. Results suggest that the effect of 2-DXA is beneficial on extended time particularly in improving the livability of frozen-thawed buffalo semen.

Keywords: 2-DXA, buffalo, semen, spermatozoa, sperm motility

PARENTAGE TESTING OF PHILLIPPINE SWAMP BUFFALOES (*Bubalus bubalis* Linn.) USING MICROSATELLITE MARKERS

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The Philippine Carabao Center (PCC) established its genetic improvement program to be able to identify genetically superior animals for breeding in order to increase the milk production and growth potential of water buffaloes (Bubalus bubalis Linn.). The accuracy of predicting the genetic merit of individual animals using Best Linear Unbiased Prediction (BLUP) relies on correct identification of sires and dams in the pedigree record. Twenty cattle microsatellite (MS) markers were already identified for parentage in riverine buffaloes. As there are genetic variations and divergence between swamp and riverine buffaloes, this study is aimed to examine the possible usage of these markers for parentage testing in swamp buffaloes. Blood and semen samples from two PCC institutional herds were molecularly processed to extract DNA using standard protocols. Twenty five MS markers used from previous studies were tried on swamp buffaloes. Marker selection was carried out using Cervus 3.0 software and the selection of suitable markers was based on expected heterozygosity, polymorphic information content (PIC) values and number of alleles at the locus. Results showed that 17 MS markers were polymorphic (MB101, FBN12, BM1706, BMS2152, CSSM019, CSSM047, ILSTS012, RM04, TGLA227, BMS1001, RM372 BMS555, MAF45, CSSM038, CSSM060, ETH3 and INRA026), whereas only three markers were monomorphic. Using the 17 polymorphic markers, parentage analyses on the similarities between the candidate parent IDs and expected parent revealed that among the 24 animals tested, one offspring did not match to its expected sire while another offspring did not match its dam record. These MS markers could potentially be useful in herd management wherein individual animals with incorrect pedigree could be identified and corrected thus, increasing the accuracy of breeding value estimation in genetic evaluation.

Keywords: buffalo, parentage testing, microsatellite markers

AS - 14 GENETIC TESTING FOR PORCINE STRESS SYNDROME USING MUTAGENICALLY SEPARATED- POLYMERASE CHAIN REACTION

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Porcine Stress Syndrome (PSS) is a defect in the Halothane (Hal) gene that produces pale, soft and exudative (PSE) meat which is an inferior quality that results to the significant losses in the meat industry. Pigs under PSS may suffer heat stress, labored breathing, collapse and in worst case, death. This study was conducted to develop a method that can determine the PSS genotypes of pigs which are used for breeding purposes. Characterization of the gene responsible for PSS was done by collecting blood samples of the breeding stock for DNA extraction. Genotyping was done by optimizing a one step detection method known as Mutagenically Separated Polymerase Chain Reaction (MS-PCR) that was viewed under the gel electrophoresis. They were classified whether stress-resistant (NN), stress carrier (Nn), and stress positive (nn). Statistical analysis was then used to analyze results. Out of the 50 samples, 33 pigs were found to be normal (*NN*) with a frequency of 66%; 11 are heterozygotes (*Nn*) with a frequency of 22%; and only 6 are stress-positive (nn) with 12% genotypic frequency. Frequency of the *n* allele in the population was found to be higher than the expected though the result from the chi-square test revealed no difference between the observed frequencies and the expected ones. MS-PCR method for screening PSS was found to be accurate and efficient. In addition, the occurrence of the n allele in the population may be due to mismanaged crossbreeding causing the meat tissue to be Pale, Soft, and Exudative (PSE) which is an inferior quality. This screening will allow a new breeding system to be developed ensuring that all offspring are free of the stress gene by simply replacing the swine positive for PSS gene with those that are PSSgene negative

Keywords: Swine, PSS, Genotyping, MS-PCR, PSE

GROWTH PERFORMANCE OF SHEEP (Ovies aries) FED WITH IPIL-IPIL (Leucaena leucocephala) AND MADRE DE CACAO LEAVES (Gliricidia sepium) AS SUPPLEMENTS

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The study was conducted at the Mariano Marcos State University sheep research project located at Nagbacsan, Tabug, Batac City, Ilocos Norte from September 8, 2011 to January 5, 2012. It aimed to determine the final weight and average daily gain in weight of sheep fed with Ipil-ipil and Madre de cacao supplements; compare the total feed consumption in dry matter basis of sheep fed with and without supplementation; compare the feed conversion efficiency of sheep fed with and without supplementation and compare the feed cost per kilogram gain in weight of sheep fed with and without leguminous forage supplementation. The nine sheep were randomly distributed to the three dietary treatments with three replications using Randomized Complete Block Design. The dietary treatments used were: 100 Napier Grass, 80% Napier + 20% Ipil-ipil Leaves (IIL) and 80% Napier + 20 % Madre de Cacao Leaves (MDCL).

The results showed that supplementing Ipil-ipil and Madre de cacao leaves on the ration of sheep significantly improved their total gain in weight and average daily gain in weight than those sheep fed with Napier grass alone. Sheep with supplementation had a greater weight increase than those fed with Napier grass alone.

Based on the results, Ipil-ipil leaves is a better feed for sheep but it is comparable with Madre de cacao leaves than feeding Napier grass alone. IIL and MDCL could also be used to augment the feeds of sheep when grasses are insufficient. A feeding trial using a higher level of IIL and MDCL should therefore be conducted to determine the optimum level of IIL and MDCL in the ration of sheep to give a better growth performance in sheep.

Keywords: Madre de Cacao, Ipil-ipil, feed, supplementation, DM

AS - 16 *Anisakis* INFECTION IN PHILIPPINE CETACEANS: A SOURCE OF ZOONOTIC WORMS TO MARINE FISHES

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The third-stage (L3) larvae of zoonotic worms of the genus Anisakis are important etiological agents for human anisakiasis and allergy-associated health risks. Adult worms are found in definitive host cetaceans such as whales and dolphins, whereas L3 larvae are released in the marine environment infecting paratenic hosts such as cephalopods and fishes. It is through consumption of raw, partly cooked, or marinated paratenic hosts where humans can acquire these diseases. The current study aimed in investigating the species identity of adult Anisakis worms isolated from 6 different stranded cetaceans (Pygmy sperm whale Kogia breviceps, dwarf sperm whale Kogia sima, Blainville beaked whale Mesoplodon densirostris, beaked whale Mesoplodon sp., melon-headed dolphin Peponocephala electra and Fraser's dolphin Lagenodelphis hosei) in the Philippine waters. Such species identification is an utmost importance for strengthening international standards for safe fish food consumption. Initial species identification was performed molecularly using PCR-RFLP on the ITS region, followed by sequencing and phylogenetic analyses using MEGA5, PAUP4 and MrBayes 3.1 on the 3 gene regions (ITS, mtDNA cox1, and mtDNA cox2). The anterior and posterior ends of adult male and female worms were morphologically examined using light and scanning electron microscopy. Results of the examinations revealed presence of 4 valid Anisakis species (A. brevispiculata, A. typica, A. paggiae and A. ziphidarum). Apart from these, morphological data revealed existence of 3 new Anisakis species. All tree topologies support the morphological findings that the 3 new Anisakis species are independent species among known Anisakis species. The existence of different Anisakis species in the definitive hosts indicates distribution of such Anisakis infection in the paratenic hosts within the Philippine waters; thereby needing implementation of stricter guidelines for fish processing and handling for the safety of consumers.

Keywords: Anisakis, cetaceans, Anisakis infection, fisheries, food safety

AS - 17 COMPOSITION AND ABUNDANCE OF NET PHYTOPLANKTON DURING UPWELLING MONTHS IN 2012 AND 2013 IN A SARDINE FISHERY SITE OFF ZAMBOANGA DEL NORTE, PHILIPPINES

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Phytoplankton and zooplankton are important prey of sardines, but these organisms are often least studied. The interest to properly manage the sardine fishery in the waters around the Zamboanga Peninsula has given impetus to plankton studies in the area. Hence, phytoplankton species diversity, abundance and distribution were studied in the upwelling area in Dipolog Bay-Sindangan Bay off Zamboanga del Norte during the year 2012 and 2013. A total of 48 phytoplankton species were identified representing 26 genera and 19 families. These species were mainly composed of diatoms (29 species), dinoflagellates (13 species), and cyanobacteria (4 species). Guinardia flaccida was the most abundant species in 2012, but replaced by Skeletonema costatum in 2013. Abundance of the different phytoplankton species was significantly correlated with certain environmental parameters, and correlations differed between 2012 and 2013. These varying correlations between phytoplankton and environmental parameters agree with the contrasting location of abundance peaks between the two years, in that in 2012 maximum abundance are located in stations closest to shore, but quite the opposite in 2013 where the peak abundance was found in stations located farther offshore. We believe that these shifting locations are associated with interannual variation in upwelling strength, which may influence size of recruitment and stocks of the sardine fishery in the area.

Keywords: net phytoplankton, community ecology, upwelling, Zamboanga Peninsula

Senna tora L. – AN UNDERUTILIZED MULTIPURPOSE INDIGENOUS SPECIES FOR FOOD, FEED AND MEDICINE

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One key to agricultural sustainability is the use of multi-functional crop species. Senna tora L. (former Cassia tora L., locally known as manimani) is a common leguminous "weed" in Bukidnon. It grows in pasture areas, roadsides, wastelands, uncultivated lands and along farmlands. It is very prolific hence its ecotypic diversity and uses were assessed. Seed and leaf collection was done, genetic diversity of *in situ* populations was determined, and uses in Bukidnon were documented in all 22 municipalities and cities from December 2009 to January 2010 and from September to October 2010. On December 2012 to January 2013, 13 municipalities were resurveyed. Seed and leaf protein analyses were done using the Kjeldahl method. Data were analyzed using Shannon-Weaver Diversity Index (H') and Pearson's Simple Correlation Analysis. Food, feed and medicinal uses were documented. S. tora L. has potentials as vegetable for humans and forage for livestock. Seed percent crude protein (PCP) ranged from 12.40% to 20.46%. Plants bear 14 to 27 seeds/pod and 15 to 129 pods/plant. Young leaves showed higher leaf PCP (18.19% to 39.02%) than older leaves (16.94% to 33.68%). Diversity (H') of seeds, young leaves and mature leaves PCP was high: 0.93, 0.79, and 0.81, respectively. Selection of better ecotypes is therefore possible. C. tora is a hardy underutilized species that could become a cheap protein source for Filipinos and for our livestock, as well as, for some medicinal use.

Keywords: Bukidnon, *Senna tora*, *Cassia tora*, resilient crops, multipurpose crops, multi-functional crops, sustainable agriculture

BIOPHYSICAL CHARACTERIZATION OF THE SUBWATERSHED COVERING PERMANENT FIELD LABORATORY AREAS 1, 2 AND 3, MT. MAKILING FOREST RESERVE, PHILIPPINES

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The site of the study is the Maitim Subwatershed covering PFLAs 1, 2 and 3. This study aims to: enumerate the biophysical characteristics of PFLAs 1, 2 and 3, and; characterize on the subwatersheds covering the three PFLAs. This study used the available compiled maps in the Environmental Remote Sensing and Geo-Information (ERSG) Laboratory IRNR, CFNR, UPLB and Office of the Coordinator for Research and Extension Linkages (OCREL), CFNR.

This study consists of subwatershed delineation, biophysical and geomorphological characterization using ArcGIS 9.3. The data obtained include the following: elevation range is 30 - 440 m asl; 44. 812% of the area of the subwatershed falls under the slope class 18-32%; five soil textures found in the three PFLAs are light clay, silty clay, clay loam, light clay, silt loam and heavy clay and the pH ranges from 5.4 - 6.5; the average monthly rainfall is not less than 60 mm, and; majority of the area is natural forest. These characteristics make the area suitable for Agroforestry based on the Land Use Suitability Criteria presented in the DENR Guidebook on he Preparation of Sustainable Land Use Plan. Application of Geographic Information System (GIS) is a useful tool in performing biophysical and geomorphological characterization with the use of maps as secondary data. However, it is recommended to conduct further studies and perform ground truthing to validate or update the data to be used in the study.

Keywords: biophysical, geomoprphological characteristics, GIS, land use suitability criteria, subwatersheds

RICE -DUCK INTEGRATION FOR RICE BLACK BUG MANAGEMENT

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Farmers grow rice and rice mallard ducks in the same piece of land. Serving as biological control agent, ducks reduce the population of golden apple snail (*Pomacea canaliculata*) and rice black bug (*Scotinophara coarctata* F.) [RBB] by eating them, thereby minimizing the use of pesticides. This study evaluated the number of duckling herded in the rice field that could effectively control RBB. It was laid out in Randomized Complete Block design with four treatments replicated three times.

In Wet Season 2012 and Dry Season 2013, plots deployed with high number of ducklings (200 heads/ha) had lower RBB population (0.63% to 6.67%); less ducklings (150 heads/ha) had higher RBB (0.71% to 11.04%) at 45 to 75 days after transplanting. Plots sprayed with insecticides had higher population of RBB (1.64% to 35.16%). In terms of net income, plots with ducklings earned much (P52,220./ha to 65,060./ha) than plots sprayed with insecticides (P23,150./ha to 34,410./ha). Herding of mallard ducks in the rice field is found to be potential and an environment-friendly practice in controlling RBB population.

Keywords: rice-duck for RBB management; RBB management

BIOEFFICACY OF FIVE PESTICIDES AGAINST MANGO LEAF HOPPERS (*Idioscopus clypealis* Leith), TIP BORERS (*Clumetia transversa* Wlk) AND FRUIT FLIES (*Dacus dorsalis* Hendel)

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Huge economic loss in mango (Mangifera indica Linn.) production is usually attributed to diseases caused by pests. To protect crops against harmful pests, most mango farmers currently rely on pesticides to control mango pests. However, there are some apprehensions on the effectiveness of these pesticides to target pests as well as non-target and beneficial insects. This study investigated the bioefficacy of Confidor, Karate, Decis, Cymbush and Chess in controlling mango insect pests (e.g., Idioscopus clypealis Leith, Clumetia transversa Wlk and Dacus dorsalis Hendel) Results indicated that the number of nymph mango hopper (*I. clypealis*), adult leafhopper and tip borer (C. transversa Wlk) significantly decreased after the 4th spray of the five pesticides. Mango trees sprayed with Karate, Decis and Cymbush produced more fruits compared with the control. During the pre-bloom stage, there were numerous dead fly (Diptera) pollinators were noted in trees treated with Confidor compared to the four pesticides and the control. Only few bee pollinators were present during the prebloom and full-bloom stages. Number of marketable fruits at 120-140 days after flower induction was significantly increased after spraying with five pesticides. Among the five pesticides, Confidor treated trees had heavier and marketable fruits

Keywords: mango, pesticides, pests, bioefficacy, non-target insects

REPELLENT ACTIVITY OF Zingiber officinalis (GINGER) AGAINST Sitophilus oryzae (RICE WEEVIL) IN STORED MILLED RICE

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Rice weevils are common pests of stored grains and seeds. Various synthetic pesticides are already available but they can cause residual pollution, and pests can develop resistance to synthetic pesticides. This study was undertaken to examine the repellent activity of ginger (Zingiber officinalis) against the rice weevil, Sitophilus oryzae. Four different doses (5, 10, 15 and 20 g) of pounded gingers were tested for fumigant repellency in a dualchoice bioassay apparatus. Twenty adult rice weevils were introduced into the container containing 50 g of milled rice. The effects of fresh or air-dried gingers were also evaluated for repellent activity against adults of S. oryzae. Three trials were conducted and each treatment was replicated three times. Results revealed that pounded air-dried ginger is effective in repelling rice weevils in stored milled rice compared to pounded fresh ginger (t=-3.116; p<0.05). After 1h exposure, 50% and 60% of weevils were repelled in containers with 15 g and 20 g pounded air-dried ginger, respectively. On the other hand, only 5% of weevils were repelled in containers with 20 g pounded fresh ginger. No weevils were repelled in negative control. Good repellency activity was observed in gingers that were air-dried for two weeks but poor repellency was noted using one month air-dried ginger. Phytochemical screening of Z. officinalis used in this study showed the presence of glycosides, flavones, and flavonoids. This study demonstrated the use of pounded air-dried ginger as repellent of adult rice weevils in stored milled rice. Further studies should be conducted to isolate and identify the active components responsible for the repellent activity of ginger against S. oryzae. Repellency assay using pounded air-dried ginger should also be done against other types of weevils and pests.

Keywords: repellency, *Zingiber officinalis*, ginger, *Sitophilus oryzae*, rice weevil, stored rice

DETECTION AND GENETIC DIVERSITY OF Fusarium oxysporum f. sp. cubense (FOC) TROPICAL RACE 4 (TR4) COLLECTED FROM MINDANAO

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Fusarium wilt or Panama disease of banana (*Musa* spp.) caused by *Fusarium oxysporum* f. sp. *cubense* (FOC) is one of the most devastating diseases in different banana growing countries. The FOC pathogen is also known to infect different varieties of banana resulting to different races due to its evolutionary adaptability. Presently, the most important FOC race is the Tropical race 4 which affects banana cultivars that comprise 80% of the world's banana production. In the Philippines this has now been an alarming incident to banana growers especially to those with Cavendish plantations.

Survey and collection of samples from banana plants showing typical wilting symptoms were conducted in different areas in Davao del Norte and Davao del Sur, where most banana plantation were located. Race identification using race-specific primers and genetic diversity analysis of 57 isolates were carried out. Fifty two (91%) samples were confirmed to be FOC Tropical Race 4 when tested using FocTR4-F/FocTR4-R, primer pair that can discriminate isolates that belong to Vegetative Compatibility Grouping (VCG) 1213. The FOC isolates from Davao showed 34-100% similarity using ERIC-PCRand 40-100% using M13 primers. It was greatly observed that isolates from Davao positive for TR4 are genetically related regardless of its place of collection and cultivar. The use of molecular tools in studying the genetic variation and rapid detection of Tropical Race 4 (TR4) would be useful in developing effective disease management strategies to minimize the spread of the disease from Mindanao to other parts of the country where the disease is not yet present.

Keywords: fusarium wilt, panama disease, tropical race 4

PHENOTYPE AND GENOTYPE CHARACTERIZATION OF *Fusarium* SPECIES CAUSING FUSARIUM EAR ROT OF CORN IN THE PHILIPPINES

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Fusarium species causing Fusarium ear rot in corn can contaminate the grains with Fumonisins (Fs), a family of mycotoxins that can cause esophageal cancer in humans and equine leukoencephalomalacia and porcine pulmonary edema in animals. Very limited research on this disease was conducted in the country. The widespread occurrence of corn ear rots in our major corn production areas is alarming enough to investigate the species identity of the pathogen isolates present in the Philippines. This will facilitate better management strategies to combat this malady.

The collected Fusarium ear rots all over the country on yellow and white corn were processed into pure culture. The pathogen isolates were characterized based on pathogen isolate morphology and cultural growth on Potato Dextrose Agar. Almost all isolates exhibited macroconidia and microconidia that fitted the description of *F. verticillioides* but they obviously differed on colony color. Morphologically, *F. verticillioides* and *F. proliferatum* were similar. *F. graminearum* produced macroconidia distinct from the other two and it did not produced microconidia. They were accurately identified using molecular analysis based on species-specific primers. All *F. verticillioides* isolates produced Fs. Isolates that were positive to Fs but were not *F. verticillioides* were tested for the other two species.

Results showed that out of 225 isolates collected, 215 were *F. verticillioides*, 3 were *F. graminearum*, 1 was *F. proliferatum* and the other 6 were unidentified. Presence of *F. graminearum* is threatening because it can colonize corn and wheat plant tissues asymptomatically.

Keywords: Fusarium ear rot, species specific primer, *Fusarium* verticillioides, *F. proliferatum* and *F. graminearum*

IMPORTANT SWEET SORGHUM DISEASES IN THE PHILIPPINES

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Sorghum is a relatively new crop in the Philippines but rapidly gaining popularity not only as feed and food but also as biofuel. It has many qualities suitable for large-scale production as a feedstock to bioethanol distilleries with relatively low cost. It is drought tolerant, short-duration crop and can grow in marginal areas. However, our present sweet sorghum lines and populations are susceptible to many important damaging diseases as observed in different trial sites from 2011-2013. Observations were done at UP Los Baños Experimental Station, Pampanga State University Station, Isabela State University (ISU) Experiment Station, Mariano Marcos State University (MMSU), La Carlota IPB Experimental Station and Sagay, Negros Occidental.

Through symptom expressions and microscopic observations of pathogen structures, the sorghum diseases present in each trial site were identified. Tar spot was the most predominant sweet sorghum disease present in all areas except in MMSU, Batac, Ilocos Norte and ISU, Echague, Isabela. Rhizoctonia banded leaf and sheath blight, rust, bacterial stalk rot and Helminthosporium leaf spots were present in all sites. Zonate leaf spot and gray leaf spot were observed only in UP Los Baños Experimental Station; Sagay and La Carlota, Negros Occidental and MMSU. Descriptions and pictures of symptoms and pathogens were presented.

Identification of these diseases in sweet sorghum will facilitate in the formulation of proper management strategies to resist or minimize them.

Keywords: Sweet sorghum, tar spot, Rhizoctonia banded leaf and sheath blight, rust, bacterial stalk rot, Helminthosporium leaf spot, zonate leaf spot and gray leaf spot

A SCREENING PROTOCOL FOR SQUASH LEAF CURL VIRUS (SLCV) USING AN INFECTIOUS CDNA CLONE

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Squash leaf curl virus (SLCV), a whitefly transmitted begomovirus can cause severe damage to squash by rendering plants totally unproductive. While host plant resistance considers to be the most economical way of minimizing losses, its success in a disease resistance breeding program relies on the availability of an efficient screening protocol. For SLCV which is non-mechanically transmissible, the use of whiteflies is cumbersome and may create some difficulty in resistance evaluation due to the virus-vectorhost complexities. The use of infectious cDNA clone via agroinoculation has been developed for SLCV resistance screening in squash. The full length DNA-A and B of SLCV - Laguna strain have been cloned, sequenced and inserted into a Ti-plasmid vector (pCambia 0380) producing constructs of DNA-A and DNA- B genomes. Each of these were transformed into a commercially available Agrobacterium tumefaciens - LBA 4404, and transformants were selected and cultured separately. Bacterial suspension of DNA-A and B were mixed and used to inoculate 10 day-old squash seedlings with a fine syringe needle (0.5mm) by injecting the base of the stem and other parts of the seedling 10 times. Mild chlorotic spots appeared on inoculated leaves one week post inoculation, followed by mild leaf curling on the second week. Moderate to severe leaf curl symptoms were observed 3-4 weeks post agroinoculation while the healthy control plants remained symptomless. Positive identification of SLCV was confirmed by Polymerase Chain Reaction (PCR). This study showed the promise of using infectious cDNA clone in transmission and screening for resistance against non mechanically transmitted viruses like SLCV.

Keywords: SLCV, infectious clone, agroinoculation, DNA-A, DNA-B

GENETIC DIVERSITY AMONG SQUASH LEAF CURL VIRUS (SLCV) ISOLATES IN THE PHILIPPINES

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Plant viruses such as Squash leaf curl virus (SLCV) can cause severe crop damage by rendering squash plants totally unproductive. Breeding for resistance is often considered the most efficient and simplest way to minimize the losses. However, resistances may differ in their specificity and stability wherein the level of protection depends on the virus strain or strains present in the area. To determine the genetic diversity of SLCV, squash leaf samples in major growing areas in the country were collected. A total of 57 out of the 88 leaf samples from major growing areas in the country showed the expected ~1.5kb PCR product. Multiple sequence alignment of the DNA-A fragments of SLCV isolates from Pangasinan, Cavite, Laguna, Palawan, Camarines Sur, Albay, Cebu, Misamis Oriental, Davao, Bukidnon and South Cotabato shared 92.0-98.3% identities. Furthermore, neighboring provinces like Cavite and Laguna (98.0%), Camarines Sur and Albay (97.8%) and Misamis Oriental and Bukidnon (98.3%) showed the highest similarities which imply that these isolates don't diverged from each other and may come from one population. Isolates within Luzon showed 93.6-98.0% similarities while Mindanao isolates revealed 93.4-98.3% also suggesting that no differences are present within the main island groups in the country. There are also no differences found among the isolates between island groups wherein Luzon and Visayas isolates shared 94.5-97.5% nucleotide identities, Luzon and Mindanao isolates with 92.0-97.7% and Visayas and Mindanao isolates with 93.2-97.8%. Based on these results, variants of SLCV are not present in the country. However, variation may be present in other parts of the SLCV genome thus further studies should be done

Keywords: SLCV, DNA-A, identities, genetic diversity, virus strain

SPECIES COMPOSITION AND DIVERSITY OF MACROFUNGI IN BOMBONGAN-LEWIN SUBWATERSHED, CAVINTI, LAGUNA, PHILIPPINES

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Fungi are heterotrophic organisms essential in organic decomposition and nutrient cycling in a watershed ecosystem. However, information on fungal species and their diversity are very limited which is the focus of this investigation. A two-hectare biodiversity monitoring plot was established in the Bombongan-Lewin subwatershed in Cavinti, Laguna and subdivided into fifty 20x20m subplots, taking into consideration different habitats. Macrofungi were identified morphologically in each subplots then determined substrate and ecological parameters, including fungal diversity following Shannon index. A total of 163 macrofungal species from 57 genera that belongs to 35 families and 16 orders were found within seven vegetation types. Most fungi were saprophytic (79%) like Polyporales that preferred woody substrates while others are mycorrhizal (21%) exemplified by Boletales. Abundance of fungi was in the order: secondary growth forest > mixed forest > bamboo grove > grassland + trees > lanzones plantation > coconut farm > rangeland. Overall, diversity index was moderate (H'=2.4812) to very high (H'=4.1260) and found evenly distributed (e= 0.8109). Richness of fungal flora in the watershed suggests their potential role in sustaining functions and health of ecosystem. Variations in different habitats indicate proper land use. Fungal conservation is important in watershed management that should be equally monitored and assessed together with other biodiversity resources. Furthermore, their nutrient status should be analysed in fungal biomass and soil to determine their capacity in maintaining and balancing the ecosystem.

Keywords: species composition, macrofungi, diversity, watershed, conservation

COMBINING TOLERANCE OF SALINITY AND SUBMERGENCE INTO IR64 BACKGROUND THROUGH MARKER-ASSISTED BACKCROSSING (MABC)

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In coastal areas, both submergence and salinity are commonly encountered within the same season and tolerance of both stresses is required in high yielding varieties for better adaptability and stable production. By incorporating one of SUB1 parents into the Saltol marker-assisted backcrossing (MABC) program, a variety combining both Saltol and SUB1 can be developed using foreground and flanking markers for each quantitative trait loci (QTL). A MABC population employing IR64-Sub1 and IR64-Saltol developed independently before. Crosses were made between IR64-Saltol and IR64-Sub1 to combine submergence and salinity tolerance. Using MABC helped in hastening the selection of recombinants with Saltol and SUB1 introgressed into one genetic background. In this process, F₁ seeds were advanced to F₂ generation and 310 F₂ plants were genotyped for Saltol QTL located on chromosome 1 and SUB1 QTL on chromosome 9 using closely linked simple sequence repeat (SSR) markers. Twenty one $F_{2:3}$ families with homozygous alleles for both Saltol and SUB1 were selected and phenotyped for salinity tolerance at 12 dS m⁻¹ and submergence tolerance for 21 d. Surviving plants were rescued for recovery and genotyped again for Saltol and Sub1, and 6 F, plants derived from the selected survivors were again screened for both salinity and submergence tolerance. Currently advanced lines at F₅ stage are being reevaluated and their seeds increased for sharing with NARES collaborators in coastal areas for subsequent field evaluation.

Keywords: *Saltol*, *SUB1*, marker-assisted backcrossing, quantitative trait loci, simple sequence repeat

MORPHOLOGICAL AND MOLECULAR CHARACTERIZATION OF NOVEL SALT-TOLERANT GERMPLASMS OF RICE (*Oryza sativa* L.) FROM THE PHILIPPINES AND BANGLADESH

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To screen for new sources of salinity tolerance, 688 traditional rice varieties from the Philippines and Bangladesh were assembled and their tolerance to hypersaline conditions at the seedling stage was observed. A total of 29 Philippine lines and 15 Bangladesh lines were scored as salttolerant. Morphological assessment was done for each variety (plant height, biomass, and Na-K ratio). Percent shoot length reduction was computed for each accession and two genotypes, Betalga and Maranao, were found to values lower than that of FL478 (tolerant check) indicating a good tolerance mechanism. Seventy-five percent of the population have a mean shoot biomass percent loss that is statistically similar with that of FL478. For the shoot fresh and dry weight percent growth reduction, 48% and 70% of the population, respectively, had values lower than FL478. The Na-K ratio was a good measure of salinity tolerance with a Á value of 0.78 when paired along with the Standardized Evaluation Score (SES). Notably, AC, which is one of the rice germplasms used, obtained a Na-K ratio that is statistically lower than FL478 indicating a good tolerance mechanism. To determine the genetic diversity of the 46 genotypes, 33 SSR markers were used wherein a total of 129 alleles were detected across all loci. The PIC values of 18 markers were found to be highly informative (PIC > 0.5). Cluster analysis at a similarity index of 2.5% showed that the Bangladesh accessions: Roa, Napatasa, Chondoni, Moisdol, Asha, and Jakor, were genetically different from the other accessions. At at a similarity index of 6.5%, AC, Akundo, and Kuplod were clustered along with FL478 indicating a strong genetic relatedness between these genotypes. Casibon was found to be singly separated. These accessions are of interest since the genotype each represent might be different from the classical salinity-tolerant Pokkali-type. Finally, the haplotype analysis revealed that none of the 44 genotypes have a similar allele combination as FL478.

Keywords: rice, SSR, Na-K ratio, salinity tolerance, traditional landraces

PREDICTING PHYSICAL ATTRIBUTES IN MILLED RICE USING IMAGE PROCESSING SOFTWARE

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One of the important considerations in developing new rice varieties is grain quality. However, developing rice varieties with the desired quality requires intensive evaluation especially for physical attributes. Physical attributes in milled rice consist of four parameters, namely: % chalky grains, % immature grains, grain length, and grain shape. These traits are manually done by skilled classifiers using their naked eye. Usually, classifiers evaluate 600-800 promising elite lines every year using duplicate samples of 30g milled rice This process however, is time consuming and tedious. This study therefore aimed to develop image processing software that can predict physical attributes of milled rice and automate the classification process. The predicting value of the developed PhilRice grain classifier software (PGCS) showed R² ranging from 0.80 to 0.90 in the four parameters considered. Comparison of visual and automated process of evaluating chalkiness showed significant difference particularly in the number of samples that can be evaluated and manpower needed to accomplish the task in a day. This investigation confirmed that visual judgment is influenced by various human factors while image processing software provides faster and straightforward, more accurate, and stable results. Outcome of this study can benefit several concerned individuals such as: physical attribute classifiers by simplifying their strenuous work; plant breeders by helping them objectively assess the genetics of the chalk trait, and farmers by assuring them of a variety with premium grain quality, thereby increasing farmer's profitability.

Keywords: image processing software, grain quality, chalkiness, milled rice, grain classifier

AS - 32 PHYSIOLOGICAL TRAITS PIVOTAL FOR TOLERANCE OF PARTIAL STAGNANT FLOODING IN RICE

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Frequency, volatility, and intensity of flooding are projected to escalate, due to climate change. These inundations put rainfed rice production, primarily prevalent in developing countries, at greater risk of yield losses. Though SUB1-introgressed varieties proved to be effective for complete submergence, they had poor performance under partial stagnant flooding of longer durations (SF), a different flooding regime. A set of genotypes selected from previous screening with contrasting responses to SF, including three Sub1 varieties, were subjected to SF with water depth increased by 10 cm weekly after transplanting until it reaches 55 cm, then maintained through maturity. Water depth in control plots was kept at 5 cm. The study aims to understand the physiological bases of variation in SF tolerance. Tolerant varieties (IRRI 119 and IRRI 154) had higher survival and yield under SF than sensitive varieties (PSBRc18-Sub1 and Swarna-Sub1). SF resulted in significant decreases in root length (by 7 %**) and tiller number (44 %**) and increases in lengths of shoot, leaf sheath and leaf blade (by 19%**, 32%**, and 11%**, respectively). About 52% of shoot elongation was attributed to leaf sheath extension. Tolerant varieties had taller shoots and less impairment of root growth under SF due to sustained sugar allocation, and proper gas exchange facilitated by aerenchyma. Tolerant varieties maintained tillers as compared with sensitive lines (decline of 26%* and 34%* respectively). The SF screening procedure developed and the highly correlated phenotypes and physiological mechanisms identified can be used for quantitative trait loci (QTL) analysis and can facilitate breeding of high-yielding varieties to manage different flooding regimes.

Keywords: quantitative traits, rainfed lowlands, SUB1, submergence tolerance, stagnant flooding, survival vessel composting, bioreactor composting, *Eichhornia crassipes*

AS - 33 YIELD POTENTIAL AND GRAIN QUALITY OF IRRIGATED LOWLAND RICE VARIETIES WITH LEAF COLOR CHART (LCC)-BASED NITROGEN FERTILIZER APPLICATION

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Yield potential is the maximum yield of a variety under optimum crop management and favorable weather condition. High yield potential and good grain quality are the major traits considered by farmers when choosing a rice variety. However, grain quality may have inverse relationship with grain vield potential due to differential energy requirements. Yield potential can be achieved with improved nitrogen (N) fertilizer management. The PhilRice Leaf Color Chart (LCC) can be used to assess the "real-time" crop need for N fertilizer to increase N use efficiency and achieve the yield potential. Field experiment was conducted at PhilRice Nueva Ecija in 2012 wet season to assess the yield potential and grain quality attributes, i.e., milling recovery, crude protein content, and amylose content of irrigated lowland inbred rice varieties NSIC Rc240, NSIC Rc13, NSIC Rc160 and PSB Rc82, hybrid Mestiso 20 and traditional varieties Balatinaw and Dinorado in response to LCC-based N fertilizer application. Treatments were (1) control or no N fertilizer and (2) application of 4 bags/ha of 'complete fertilizer', i.e., 14-14-14-12S, were applied at 14 days after transplanting (DAT) followed by LCC-based N application of 23 kg N/ha of urea (46-0-0) when LCC reading was below 4. PSB Rc82 had grain yields of 4.6 t/ha in the control and 6.4 t/ ha with LCC-based N application. Dinorado and Balatinaw had the lowest yields of 1.6 to 4.0 t/ha. Grain yields with LCC-based N application were significantly higher than yields in the control. NSIC Rc240 had the highest amylose content (23.05%) and milling recovery among varieties across treatments. Balatinaw had the highest crude protein content of 7.3% in control and 10.5% with LCC-based N application. Grain yield and grain quality had positive linear correlation but coefficients were not significant. However, grain yield potential may not have been achieved in wet season due to lower irradiance.

Keywords: yield potential, grain quality, leaf color chart-based nitrogen application, inbred rice, hybrid rice, traditional rice varieties

AS - 34 EVALUATION OF FIELD TECHNIQUES FOR FERTILIZER RECOMMENDATION IN IRRIGATED LOWLAND RICE

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The presence of a number of nutrient diagnostic techniques (NuDTs) for fertilizer recommendation in irrigated lowland rice may be confusing to farmers and technicians. The 2012 and 2013 dry season (DS) field studies compared three NuDTs with the Farmer's Fertilizer Practice (FFP) based on grain yield and nutrient use efficiency. Test variety was the popular inbred PSB Rc82. The experiment was laid out in randomized complete block design using FFP and the 3 NuDTs: (1) PalayCheck System that used the PhilRice Leaf Color Chart (PCheck-LCC) for 'real-time' assessment of plant nitrogen (N) needs and Minus-One Element Technique for visual plant assessment of phosphorus (P), potassium (K), zinc, and sulfur deficiencies at the vegetative stage, (2) Soil Test Kit (STK) that used a prepared solution for a fairly dry soil sample to determine soil pH and NPK levels by colorimetric method and a table for fertilizer recommendation, and (3) Nutrient Manager (NM), a software program providing fertilizer recommendation based on standard soil and crop input data, e.g., topography, source of fertilizer and water, rice variety and date of crop establishment. Results showed that grain yields were 8.4 t/ha for PCheck-LCC with average total fertilizer application of 147-42-42 kg NPK/ha, 8.1 t/ha for STK with average total fertilizer application of 120-40-30 kg NPK/ha, 7.7 t/ha for FFP with average total fertilizer application of 106-14-14 kg NPK/ha, and 7.6 t/ha for NM with average total fertilizer application of 101-27.5-40 kg NPK/ha. Agronomic nitrogen-use efficiencies were 32.2 kg grain increase/kg N applied for FFP, 26.8 kg grain increase/kg N applied for NM, 23.0 kg grain increase/kg N applied for PCheck-LCC, and 22.6 kg grain increase/kg N applied for STK. NuDTs had comparative grain yield performance. Higher agronomic nitrogen-use efficiency (ANUE) can be expected at lower fertilizer application and/or lower grain yield.

Keywords: Irrigated lowland rice, nutrient diagnostic techniques, farmer's fertilizer practice, PalayCheck System-Leaf Color Chart, soil test kit, nutrient manager, inbred rice, grain yield, agronomic nitrogen use efficiency

AS - 35 GENE MINING THE PHILIPPINE TRADITIONAL RICE VARIETIES FOR SALT-TOLERANCE

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Breeding for climate change-adapted crops is economical since abiotic stresses such as salinity of farmlands due to changing climate can be difficult and expensive to manage. Hence, crop production of archipelagic countries like the Philippines near the coastlines is susceptible to increasing salinity stress. Rice which is the preferred staple of more than half of the world's population is becoming more vulnerable although several salinitytolerant rice varieties had been developed having the saltol gene. However, saltol contributes only 45% tolerance to salinity. It has been introgressed to most rice mega-varieties but additional genes can increase level of tolerance. For possible gene mining, 26 previously identified salt-tolerant Philippine traditional rice varieties (stPTRVs) were characterized at the CMU-Agricultural Experiment Station from July 2012 to January 2013. Molecular analysis was done at IRRI on December 2013. As per ANOVA, only plant height, panicle length, number of spikelets per panicle, number of filled grains per panicle and percent filled grains per panicle differed among stPTRVs. Standardized Shannon-Weaver Diversity Index (H') estimated high variability for 12 of 18 traits that ranged from H' = 0.76 to 0.93. Cluster analysis using Ward's Minimum Variance of morpho-agronomic traits showed that some genotypes were duplicates (100% similarity). However, molecular diversity analysis using 19 polymorphic Simple Sequence Repeats (SSR) markers detected no duplicates although, the genotypes Betalga and Maranao were the most similar (~89%). This set of Philippine stPTRVs may have some new potential genes for salinity tolerance for possible pyramiding with *saltol* for increased tolerance of rice varieties.

Keywords: Philippines, *saltol*, rice, traditional rice varieties, rice breeding, salt-tolerance, salinity, gene mining

AS - 36 INFLUENCE OF SLOPE GRADIENTS ON THE GROWTH AND SURVIVAL OF FOUR ENDEMIC TREE SPECIES IN MT. MUSUAN BUKIDNON, PHILIPPINES

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The use of endemic tree species in reforestation efforts has become a trend in the present time. A field experiment was conducted to assess the growth and survival of endemic tree species planted at various slope gradients in Mt. Musuan rainforestation site. The study was laid-out in split-plot Randomized Complete Block Design, replicated three times. The mainplot were the endemic tree species with ages 7 to 8 months and initial height of 25 to 28 cms. These include narra (*Pterocarpus indicus* Wild.), kalumpit (*Terminalia microcarpa* Decne.), white lauan (*Shorea contorta* Vidal.), and lumbayau (*Heritiera javanica* Kosterm.). The slope gradients served as the subplot: slope 1 (28.5%), slope 2 (31%), and slope 3 (1.5%). The observational period of the study is one year and the parameters measured were height, diameter and number of leaves.

The results of the study indicated that slope gradients influenced the growth performance of four endemic tree species. Among the four endemic tree species, kalumpit *(T. microcarpa)* had the highest height increment with 7.86 cm. This species is also highest in diameter increment and number of leaves produced with 1.26 mm and 5.75, respectively. On the other hand, narra *(P. indicus)* had the highest survival rate with 96.30%. In terms of slope gradients, all endemic tree species planted at slope 3 (1.5%) had the highest height, diameter and number of leaves produced. In terms of percent survival, the four endemic tree species showed high in plain portion (1.5%) of the site.

Furthermore, findings showed that the interaction of kalumpit (*T. microcarpa*) tree and slope 3 (1.5%) had the highest growth and number of leaves produced in the area. Among the four species, kalumpit (*T. microcarpa*) was the most suitable reforestation species in the marginal area along with narra (*P. indicus*) which showed high adaptability in the site.

Keywords: endemic tree, slope gradient, Mt. Musuan, rainforestation, growth

IMPROVING THE PROPERTIES OF KAUAYAN-TINIK (Bambusa blumeana Schultes f.) USING THERMAL MODIFICATION PROCESS

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Engineered bamboo products use glue lamination technology to produce wide and long boards. However, foremost important for the products to last in service is the dimensional stability and durability of bamboo against decay fungi and insects. This project aimed to improve the physico-mechanical properties and durability of kauayan-tinik through thermal modification process. High temperature steam in a closed cylindrical vessel was used to elevate the temperature to 3 levels (150, 175 and 200°C) and 2 treatment durations (30 and 60 min) were used to modify the 60 cm long quarter-cut kauayan-tinik culm samples. Two-factor factorial experiments and simple CRD were used to analyze the data.

Results showed that bamboo color changed from light yellowish brown to dark brown with increasing treatment temperature. Treatments resulted in improved dimensional stability as indicated by the reduction in thickness (radial) and width (tangential) swelling by as much as 55.9% and 43.4%, respectively. Mechanical properties as measured by modulus of rupture (MOR) and modulus of elasticity (MOE) slightly increased until the temperature of 175°C. Improved resistance of thermally modified bamboo samples against decay fungi (white and brown rot), termites (subterranean and drywood) and powder post beetles were observed as shown by the lower percentage of biodegradation as evidenced by lower weight losses compared to untreated samples.

Keywords: thermal modification, bamboo, kauayan-tinik, dimensional stability, durability

RESPONSES OF FORAGE LEGUMES TO DROUGHT, FLOODING AND SALINITY STRESSES AT SEEDLING STAGE

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Philippine agriculture becomes more vulnerable as the consequences of climate change (CC) have become more pronounced. Advanced countries have developed CC-ready cultivars and are also exploring the possibility of CC-proofing their crops. IRRI and PhilRice have released some CCready varieties but fewer efforts are still devoted to other crops. This study did a preliminary assessment of the responses to drought, flooding and salinity of 16 forage legumes at seedling stage from May to December 2013. Experiments 1 (drought stress) and 2 (flooding stress) were done in RCBD (split-plot arrangement). Experiment 3 (salinity stress) was done in simple RCBD per species. At most, 10 seedling traits were assessed per experiment. Data were analyzed for ANOVA and trait correlation. For Experiment 1, 12 of 16 forage legumes withheld of moisture for a week showed comparable traits with control treatments, which suggest of potential tolerance to drought. Shoot length (SL) and seedling height (SH) showed the highest correlation (r=0.98). For Experiment 2, all 16 forage legumes showed comparable responses on 7 of 9 traits. Leaf area (LA) and root length differed between the control and flooded treatments. Control plants had higher LA vs. flooded plants. However, flooded plants had longer roots vs. control plants. Similarly, SL and SH showed the highest correlation (r=0.97). For Experiment 3, six species showed comparable traits for control and saline treatments which suggest potential tolerance to salinity. Some probable useful genes for tolerance to drought, flooding and salinity therefore, may be found on these forage species.

Keywords: forage legumes, abiotic stress, flooding, salinity, abiotic stress, climate change, feeds, livestock industry

THE EFFECT OF DIFFERENT STORAGE CONTAINERS ON THE GERMINATION OF PHYSIC NUT (Jatropha curcas)

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The establishment of Physic nut *(jatropha curcas)* plantation necessitates quality seeds with high germinating percentage for nursery establishment. One of the major factors in maintaining the viability of seeds is the length of storage and storage materials used. This study aims to determine the effect of different storage containers on the germination as well as the best length of storage time for optimal germination of jatropha seeds. Sun and air-dried and sorted seeds were stored at room temperature using the following treatments: Transparent polyethylene bag (T_1) ; Netted plastic bag (T_2) ; Flour sack (T_3) ; Plastic container (T_4) ; Paper bag (T_6) ; and Plastic rice sack (T_7) . Treatments were replicated three (3) times using the Complete Randomized Design (CRD). Seeds were randomly selected at weekly interval which were then tested for germination using seed boxes.

Result revealed that T_7 (plastic rice sack) had the highest seed germination percentage followed by T_2 (netted plastic bag). The lowest seed germination percentage was recorded by T_1 (transparent polyethylene bag). The best length of storage period for optimal seed germination of jatropha is up to the six (6) weeks. However, seeds stored in plastic rice sack could be safely stored up to nine (9) weeks. Statistical analysis showed that there is a significant differences between the treatments used. The study recommends that jatropha seeds should be stored in plastic rice sacks to obtain and maintain high percentage of seed germination; seeds used as planting materials should be stored not longer than six (6) weeks and similar studies should be conducted using other storage containers as well as longer storage period.

Keywords: germination of jatropha, seed storage materials, length of storage

VARIETAL EVALUATION OF CORN HYBRIDS AND OPEN POLLINATED VARIETIES IN REGION 1

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Varietal improvement of crop varieties is one of the important aspects in crop production for the main purpose of increasing yield & profit of the corn farmers. Corn belongs to the cereal crop which is mainly grown for food and feed. Corn has a lot of uses; the plant, the grain, and corn by – product. Yellow corn grain production must be sustained to support the needs of the feed millers and the glutinous corn production to support the raw materials of the cornick processors.

The project conduct field testing of new promising varieties of corn developed by government agencies or private seed companies to generate adequate and reliable basic information as basis for variety recommendation. Based on the result of the study, it was concluded that most of the entries of yellow corn hybrids and open pollinated varieties of corn performed well under Ilocos condition with high grain yields. Few entries were recommended to the NSIC for commercial release based from the results. T 18334; USMARC 11103Y;USMARC 09102Y; IES 10-04 & IES Cn9 were recommended commercial release as National. The corn hybrids and OPV's recommended for commercial releases for Luzon were the following: TCT 1701; P3990 YR; BC 91538; P 3774 YR & IES Cn7.

All the recommended varieties were resistant to lodging and rated 1 with a descriptive rating resistant to the reaction to insect pests and diseases particularly on borer, earworm, rust and stalk rot, high yield potential, good shelling recovery, excellent ear fill characteristics, longer ears and good husk cover.

Keywords: corn hybrids, OPV's, special corn type (glutinous)

RESISTANCE IDENTIFICATION OF DIFFERENT MANGO GENOTYPES TO INSECT PESTS AND DISEASES

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Mango (Mangifera indica L), the Philippine national fruit, is the third most important fruit crop in the country based on export volume and value, next to banana and pineapple. Carabao' mango is one of the best varieties in the world but despite its high production, the export potential of this variety is hampered by different factors mainly on its general susceptibility to insect pests and diseases. This study was conducted to produce 'Carabao' mango fruit with resistance to insect pests and diseases using 124 accessions collected from different areas in the Philippines. The mean number of hopper per panicle ranged from 1.5 to 16 of which four (4) most promising accessions were selected. On the other hand, the mean fruit damage went to as high as 73.64% for fruitfly and 86.05% for cecid fly. The fruit samples from La Union and Nueva Ecija were heavily infested by both insects while the fruit samples from Davao City had the least damage. Out of 88 accessions evaluated, 18 promising trees were selected for having <10% damage by both insects. The resistance reaction of these selected mango genotypes to insects will be confirmed in a screencage. Furthermore, fruits from eight (8) accessions had a resistant reaction to Colletotrichum gloeosporioides with infection ranging from 10.0 - 13.89% 12 days after inoculation. Against Botryodiplodia theobromae, three (3) accessions vielded fruits with intermediate reaction when artificially inoculated with the pathogen. Mango genotypes with resistance to these pests will be used as parentals for 'Carabao' mango varietal improvement or can be directly commercialized. This will also increase the production and improve the quality of mango fruits.

Keywords: accessions, *Botryodiplodia theobromae*, cecid fly, *Colletotrichum gloeosporioides*, fuitfly, hopper, parentals, resistance

AS - 42 PHENOTYPIC DIVERSITY ANALYSIS OF DIFFERENT MANGO (*Mangifera indica* L.) ACCESSIONS ON SELECTED AREAS IN THE PHILIPPINES

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Mango is known for its distinct taste and nutritional value establishing both domestic and international market niche; next to pineapple and banana. In Philippines alone, different varieties of mangoes grow but there are few with high export quality. Mango diversity across the Philippines is significant to the identification of potential accessions or varieties exhibiting qualitative and quantitative traits for local and export market.

Fruits from 100 mango accessions were collected from seven (7) different locations including Los Baños, Laguna; Tiaong, Quezon; Castillejos, Zambales and vicinities; Don Mariano Marcos State University, La Union; Central Luzon State University, Nueva Ecija; Toril and Hagonoy, Davao City; and Tacurong, Sultan Kudarat.

These were characterized using IPBGRI Descriptor for Mango and evaluated for diversity using Shannon-Weaver Diversity Index, on the basis of 22 morphological traits, eight (8) of which were qualitative and fourteen (14) were quantitative traits. The mean Shannon-Weaver Diversity Index for qualitative traits was H' = 0.63 with pulp aroma being the most diverse (H'=0.83) and skin color of ripe fruit being the least diverse (H=0.42). Significant diversity was also observed in all quantitative traits especially in fruit length, fruit width, pulp thickness, pulp Total Soluble Solids (TSS), % pulp EP (Edible Portion), skin thickness, stone length, stone width, stone thickness, stone weight, and seed weight with >0.70 diversity indices. The mean Shannon-Weaver Diversity Index for both qualitative and quantitative traits was H'= 0.69 indicating a high level of diversity. This level of diversity among 100 M. indica accessions studied indicates that these accessions could be very useful in enriching the mango germplasms and utilizing these valuable accessions for varietal improvement under different mango breeding programs. Philippines should explore more on mango researches particularly on mango collections with more phenotypic variations useful for the conservation and utilization of germplasm for varietal development as well as use of plant genetic resources for food security.

Keywords: accessions, germplasm, IPBGRI Descriptor, *Mangifera indica*, Shannon-Weaver Diversity Index
AS - 43 LEAF AND ROOT OSMOTIC ADJUSTMENT AND DRY MATTER YIELD OF RICE IN RESPONSE TO WATER DEFICIT AND MECHANICAL IMPEDANCE TO ROOT GROWTH

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Rainfed rice occupies 1.5 M hectares or 32% of the total rice area in the Philippines and suffers from a complex array of environmental factors collectively referred to as "drought". With rainfall deficit, the decrease in soil and plant status or water potential (" $! O_{soil}$ and " $! O_{plant}$ in MPa), soil dryness causing soil hardness or increased mechanical impedance to root growth, can reduce crop growth and yield. **Osmotic adjustment** (**OA**), the lowering of osmotic potential (" $!Ø_{p}$) due to net accumulation of compatible solutes, i.e., amino acids, sugars and ions, is an adaptive mechanism during drought to maintain cell turgor and growth. Genotypic variation in leaf OA has been reported for rice in published papers. However, there is a lack of study on rice root OA. The present study assessed leaf and root OA, shoot and root dry matter yields of genotypes CT9993-5-10-1-M and IR62266-42-6-2 in response to soil water deficits and mechanical impedance to root growth. OA was assessed after measuring leaf and root osmotic potentials (\emptyset leaf_p and \emptyset root_p) with a Wescor microvoltmeter connected to C52 psychrometers calibrated against known concentrations of NaCl. Our study is the first report on rice root OA in response to soil water deficit and mechanical impedance to root growth due to increased soil strength and hard pan simulated by a wax layer. The degree of leaf OA was greater and root OA lower with the upland breeding line CT9993-5-10-1-M or CT than the lowland breeding line IR6226-42-6-2 or IR. Shoot dry weight was strongly correlated with leaf OA for CT and IR at 0.05 and 0.40 MPa wax strengths and lower with root dry weight and root OA. Hence, with greater OA in leaves than in roots, shoot growth dry matter yield was less inhibited than root growth possibly due to preferential partitioning of more assimilates to the leaves to sustain some physiological processes.

Keywords: leaf and root osmotic adjustment, growth, dry matter yield

AS - 44 ASSESSMENT OF GENETIC DIVERSITY OF NIPA PALM (*Nypa fruticans* Wurmb., Arecaceae) GERMPLASM USING SSR MARKERS

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Nipa palm has been identified as potential source of energy for rice farming. It produces high amount of sap that can be converted to bioethanol. With the aim of breeding for high sap yield for increased alcohol productivity, determination of genetic diversity is a basic requirement for efficient development and improvement of nipa cultivars.

A total of more than 400 nipa palm germplasm were collected and being maintained at PhilRice Los Banos starting from February 2012 to present. Ninety percent (90%) of the collections were from Camarines Norte and Quezon while 10% from Bulacan provinces. Out of these, 163 accessions were assessed for genetic diversity using 31 SSR markers, 25 of which were identified as polymorphic. A high level of allelic diversity was observed among the 170 alleles detected which ranged from 2-15 with an average of 6.8 alleles per locus. A 0.61 overall genetic diversity was revealed indicating relatively appropriate level of genetic variation among the accessions. Cluster analysis of the germplasm generated by PowerMarker software identified seven major groups with additional subclusters within each group. Accessions from similar habitats or having similar adaptations tended to cluster however, some exceptions were also observed as accessions from Bulacan (Central Luzon) formed cluster with those from Quezon (Southern Luzon). The study revealed that SSR markers were useful for genetic diversity analysis as they successfully distinguished polymorphisms among nipa palm collections. Also, the observed genetic diversity among these accessions will therefore be useful in designing an improvement program for high sap yield for nipa palm.

Keywords: Nipa Palm, *Nypa fruiticans*, genetic diversity, SSR marker, bioethanol, rice farming

AS - 45

MORPHOLOGY, STRENGTH AND RELATED PROPERTIES OF PHILIPPINE TEAK (*Tectona philippinensis* Benth. and Hook. *f*.)

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The morphological characteristics strength and related properties of Philippine teak was studied to identify its potential uses for optimum utilization. Philippine teak's general environment and habitat is in secondary forests on sedimentary igneous rock and volcanic rock formations. They are predominantly found in dry exposed ridges of southeastern Batangas particularly in the municipalities of Lobo, Taysan, Batangas City and San Juan. Naturally grown trees were therefore gathered in Lobo, Batangas as wood samples. The ASTM Standard for Testing Small Clear Specimens of Timber (D143-94) was followed in the evaluation of specimens. Based on the mean values of mechanical properties of different height level at green condition, the top and middle portion was higher than those in the butt except in toughness. Other strength properties along height level are almost the same. The similarity of trends among properties can be attributed to the predominant effect of relative density and maturity of all tree samples. Based on FPRDI Standards, the wood of the Philippine teak falls under Class 1 (high strength), and may be used for heavy duty construction. Further, among the strength properties that fall under Class 1 are relative density (RD), modulus of rupture (MOR), compression parallel to grain and shear parallel to grain. The volumetric shrinkage falls under Class 4 (moderately low) and may be used for carving, drafting and conventional furniture.

Keywords: Tectona, Philippine teak, strength, mechanical properties, Lobo, Batangas

AS - 46 TREE GROWTH ANALYSIS AND GIS-ASSISTED INVENTORY OF THE PERMANENT FIELD LABORATORY AREA (PFLA) 2 IN MT. MAKILING FOREST RESERVE, LOS BAÑOS, LAGUNA

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The study focused on the analysis of growth of individual trees and on the establishment of a GIS-assisted database of the inventory in the Makiling Forest Reserve Permanent Field Laboratory Area (PFLA) 2. This study aims to identify the trees that are 5cm and above diameter at breast height (DBH), determine the location and distribution of each tree determine the growth of trees in the area and manipulate and analyze data using GIS-based technologies.

The data that were gathered in the one-hectare permanent plot were: DBH, merchantable height, total height, tag number and the location of individual trees in each grid. The database was created using the ArcView GIS 3.2a, using the features and attributes (spatial and non-spatial). Using the gathered data, analysis was done on the database established. The database was manipulated and subjected to different processes. The study found out that PFLA 2 was highly diverse based on the abundant tree species that exist in the area. Growth analysis was done using the inventory data in 2006 and in 2008. The DBH was used to determine the growth of individual tree species in period of two years. The growth of individual trees used five measures of increment. These are the growth increment including in-growth or secondary growth, gross increment of initial DBH, net increment including in-growth, net increment of initial DBH and the net increase in growing stock. The total of each measures were: 2088, 953.7, 401.7, -732.6, and 401.7 respectively. Projection of the trend of growth of trees can determine the biomass accumulated by the entire stand.

Keywords: Arc View GIS 3.2. GIS- assisted database, DBH, growth analysis

AS - 47

RESPONSE OF JOB'S TEARS (*Coix lacryma-jobi*) TO VARYING LEVELS OF VERMICAST

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To address food insufficiency, the national government through the Department of Agriculture-Bureau of Agricultural Research (DA-BAR) identified Job's Tears or Adlai as an additional staple crop however, its adaptability as well as menu of technology (MOT) has to be developed. One of the MOTs studied was on the use of organic fertilizer for the crop, also in consonance to Republic Act 10068 (Organic Agriculture Act of the Philippines). This study was specifically conducted to assess the effects of varying levels of vermicast on the agronomic and yield characteristics of Job's Tears (Gulian variety). The study was laid out in RCBD with three replications at Musuan, Bukidnon from July 2012 to January 2013. Data were analyzed using ANOVA and LSD for treatment mean comparisons. The nutrient sources for the test crop were: F1 – No fertilizer; F2 - 70-90-60 kg/ ha NPK and varying levels of vermicast: F3 - 1T/ha; F4 - 2T/ha; F5 - 3T/ha and F6-4T/ha. Of the 14 parameters measured, 6 significantly differed (days to emergence, number of productive tillers, number of panicles, length of panicles, number of branchlets per panicle, and grain yield). Compared to untreated plants, Job's Tears applied with 2T/ha vermicast has the most number of panicles and the highest grain yield (2,027 kg/ha) at par with inorganic fertilizer-treated plants (2,272kgha). Findings suggest that Job's Tears is not a fertilizer intensive crop having low input requirements. Likely, being a weed-crop, it can be suited in less fertile and marginal soils.

Keywords: Job's tears, adlai, vermicast, weed-crop, Gulian variety

AS - 48

ENHANCED CROP YIELD IN ACIDIC SOILS THROUGH PGPB INOCULATION

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Acid soils in the Philippines are generally characterized by aluminum and manganese toxicities, low pH and phosphorus deficiency. Beneficial bacteria in the plant rhizosphere were known to promote root growth and thereby enhanced nutrient use efficiency. Development of microbial inoculants containing plant growth promoting bacteria (PGPB) is a timely research endeavor to increase crop productivity of acid soils. PGPB isolates were obtained from enrichment cultures derived from soils collected from Cavinti, Calauan, and Los Baños, Laguna and Bukidnon. Twelve selected isolates consisting of 7 nitrogen fixers and 5 phosphate solubilizers and which also produced IAA and showed 1-aminocyclopropane-1-carboxylic acid (ACC) deaminase activity were screened for plant growth promotion along with an existing acid tolerant isolate and an uninoculated control under aseptic condition using eggplant (Solanum melongena L.) as test crop. At four weeks after transplanting, PGPB 84 and 89 gave the highest dry matter yields. Field trial established at the Cavinti Municipal Nursery, Cavinti, Laguna also showed the benefit derived from PGPB inoculation under two levels of fertilization in soil with pH of 5.5 using hot pepper variety 'Aruy-uy' as test plant. Inoculation with PGPB strain 89 increased average total fruit weight by 105% and average total fruit number by 96% across fertilizer treatment

Keywords: acidic soil, PGPB, IAA, ACC deaminase, phosphate solubilizer

AS - 49 DEVELOPMENT OF PGPB INOCULANT FOR SALINE ENVIRONMENT

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The low crop productivity in saline soils has been attributed to the adverse effect of the excessive amount of soluble salts in the root environment on nutrient uptake and utilization as well as toxic ion accumulation. Inoculation with plant growth promoting bacteria (PGPB) is one of the strategies for improving crop productivity in saline soils because of their ability to produce a wide array of plant growth regulators like indole 3-acetic acid ,cytokinins and gibberellins. Promising PGPB isolates were obtained from enrichment cultures using soils collected from Cavinti, Calauan, and Los Baños, Laguna. These isolates were selected from among 80 saline tolerant, 80 nitrogen fixers and 20 phosphate solubilizers. The response of hot pepper varieties, Aruy-uy and Django F1 to PGPB inoculants containing isolates 52, 55 and 80 was evaluated under highly saline and moderately saline condition, EC_{se} (dS/m) 14.2 and 2.31, respectively. A 5% reduction in plant height due to salt amendment was observed while in general, PGPB inoculation increased plant height across salinity level and variety. PGPB inoculation of Aruy-uy increased average fruit yield by 38% across salinity level while Django F1 had an average 33% increase in yield with inoculation. The response of Aruy-uy and DjangoF1 to PGPB inoculants 52, 55 and 80 differed significantly in terms of average fruit weight. Aruy-uy had significantly higher average fruit weight when inoculated with PGPB inoculants 52 and 80 while DjangoF1 had a significantly higher average fruit weight than Aruy-uy when inoculated with PGPB 55. These results indicate the potential of developing PGPB inoculant for saline soils.

Keywords: saline soil, PGPB, hot pepper, nitrogen fixer, phosphate solubilizer

BIOLOGICAL SCIENCES

GENOTOXIC STRESS INDUCED BY INTENSIVE AQUACULTURE ACTIVITIES IN TAAL LAKE (PHILIPPINES) ON CIRCULATING FISH ERYTHROCYTES USING COMET ASSAY AND MICRONUCLEUS TEST

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The present study determined the genotoxicological effects of intensive fish cage aquaculture in Taal Lake (Philippines) on Nile tilapia (Oreochromis niloticus) erythrocytes using the comet assay and micronucleus test. Water and sediment samples were collected from three sampling sites namely: Gonzales, Bañaga, and Balakilong, which are non-aquaculture, moderate aquaculture, and heavy aquaculture respectively. About 1 ml blood was extracted by caudal puncture in five samples of O. niloticus per site. The extracted blood was immediately processed for micronucleus test while the rest was transferred into citrated tubes, then transported for the comet assay. The highest incidence of tail moments, micronuclei and nuclear abnormalities was detected in Balakilong. The nuclear abnormalities of erythrocytes included blebbed, notched and lobed nuclei. The gradient established by cumulative results of the comet assay and micronucleus test is as follows: Balakilong > Bañaga > Gonzales. Using post-hoc analyses, the two aquaculture sites showed no significant differences in both mean tail moment and frequency of nuclear abnormalities. The observed genotoxic responses were discussed in relation to the presence of contaminants such as ammonia and copper, which have settled in the sediments from unconsumed feeds. Results of the study demonstrate that fish cage aquaculture has a harmful impact on lake quality.

Keywords: genotoxicity, fish cage, ammonia, heavy metals, sediment quality, Tilapia

HISTOPATHOLOGICAL EFFECTS OF AQUACULTURE ACTIVITIES ON THE KIDNEYS AND GILLS OF NILE TILAPIA (*Oreochromis niloticus L.*) FROM LAKE TAAL, PHILIPPINES

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The present study investigated and compared the histopathological alterations in Nile tilapia kidneys and gills collected from three sampling sites within Taal Lake that differ in the degree of aquaculture activities. Kidney and gill samples were extracted and subjected to routine histopathological examination. Physico-chemical parameters of the water and sediments from the lake were also measured. Histopathological findings revealed that samples from the high aquaculture site of Balakilong, Laurel manifested more histological alterations as compared to the moderate and non-aquaculture sites of Bañaga, Agoncillo and Gonzales, Tanauan, respectively. Among the alterations observed in both organs include karyopyknosis, necrosis, pigmented macrophage aggregates, hemorrhage, fatty acid vacuolization and epithelial lifting. The high concentrations of phosphorus, copper and unionized ammonia (UIA) which exceeded the standards for aquaculture have been implicated on the observed structural changes. It was concluded that tilapia samples from aquaculture sites are indeed living under stressful conditions.

Keywords: aquaculture, histopathology, Nile tilapia, kidneys, gills, Taal Lake, ammonia, phosphorus, copper

CLASTOGENIC EVALUATION OF SUB-ACUTE LEAD CHLORIDE IN THE SUCKERMOUTH ARMORED CATFISH *Pterygoplichthys pardalis*

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Pterygoplichthys pardalis, locally known as janitor fish is a dominant fish species in many polluted freshwaters in the country. This study aims to investigate the clastogenic effects of sub-acute lead chloride (PbCl₂) in this highly invasive fish through piscine micronucleus test (PMT) and single cell gel electrophoresis (SCGE) in gill erythrocytes. Levels of Pb were also determined in the vital organs of this fish through atomic absorption spectrophotometry (AAS). Results show that pattern of lead accumulation was in the order of gut> liver>gill>muscle of which Pb was significantly accumulated in the gut at highest concentration (46.33mg/L). Day-response analysis for seven days shows that both PMT and SCGE assays significantly detected clastogenic effects in the gill erythrocytes of treated fish over the control. Micronuclei formation was the least frequently observed nuclear abnormality compared to other morphologic aberrations in the nucleus such as nuclear fragmentation, deformed and irregularly shaped nucleus and bilobed and binucleated cells. Day-response effect on the 3rd and 7th day was detected using SCGE however; no form of DNA repair or recovery by the cells during the study period. Further, assessing DNA damage for SCGE required DNA tail length as an additional endpoint aside from tail moment to distinguish significant effects. SCGE in this study was shown to be more efficient in detecting time-response trends. Nonsignificant changes in % MNi and the higher occurrence of % NAs in gill RBCs throughout the period may suggest indirect pathway of clastogenic effect of Pb through indirect interactions such as oxidative stress. The study demonstrated the robustness of P. pardalis exposed to the sub-acute treatment since no mortality was observed among treated specimens during the study.

Keywords: Janitor fish, clastogen, micronuclei, comet assay

MACROINVERTEBRATE POPULATION STRUCTURE IN SELECTED FRESHWATER SYSTEMS NEAR KEY MINING AREAS IN CARAGA REGION, PHILIPPINES

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Aquatic macroinvertebrates are considered bioindicators of pollution. This study was conducted to determine possible variations in macroinvertebrate communities near large scale nickel, large scale and small scale gold mining areas for the period of April- June, 2013. The data on abundance was square root-transformed and subjected to multivariate analyses.

Results show 78 identified species from three phyla- Arthropoda (69%); Annelida (2%) and Mollusca (29%). Dominance of certain Hemipterans (gerrids)and aquatic worms (leeches) indicated disturbances in several aquatic areas. The data in representative sites in Agusan del Sur (large scale and small scale gold mines) suggests that the different sites were nearly similar having Anosim R value of 0.076 (p= 0.001). In Surigao del Norte, there is perfect separation of samples between AMRI-Taganito River system, Claver (large scale nickel) and Bauy River, Gigaquit (no mining activity) with Anosim R value of 1 (p= 0.029) and PERMANOVA with p<0.05. While significant difference of locations were observed in Surigao del Sur between Hinatuan River (no mining activity) and Sorex River, Barobo (small scale gold mining activity) with Anosim R value of 0.667 and PERMANOVA p<0.05. The results were supported with the cluster analyses and multivariate ordination using in non-metric multidimensional scaling and principal coordinates.

The results indicate that sites near key mining areas with different population structure compared to sites without mining can be largely due to mining related activities. The data is significant for future management of freshwater habitats in relation to mining and related anthropogenic activities.

Keywords: macroinvertebrate, mining areas, multivariate analysis, similarity matrix, Caraga region

BRYOFLORAL SPECIES OF MT. KALATUNGAN NATURAL PARK, BUKIDNON

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The bryophyte flora of Mt. Kalatungan Natural Park, Bukidnon was studied and investigated. Specifically, the study aimed to identify the bryophytes as to its species richness and composition; document the distribution of bryophyte species across different habitats; and assess their conservation status. A floristic survey through transect walk was employed by recording all the species. Site validations were employed to establish two sample plots with a 20x20 m quadrat in each vegetation type namely: dipterocarp, montane and mossy. Visual estimates of bryophyte cover were recorded. Each species were classified, identified and described according to its diagnostic characters using field lens and microscopy examinations. Taxonomic characters based on habit, habitat, leaf arrangement and orientation, stem structure, and sporophyte characters were used to identify the bryophytes into families, genera and species. Results revealed a total of 231 species, 75 genera and 33 families. Of these, 176 species of mosses belonging to 53 genera and 20 families. The liverworts showed 54 species, 21 genera and 12 families. Only one species was noted for the hornworts. The brvofloral species are confined on tree trunks, decayed logs, twigs, litters and on moist rocks. Bryophyte cover ranges 20-85% within study sites. This trend of moisture level at the mossy forest reflects the highest species population. Likewise, different microclimate regimes and substrates strongly influenced bryophytes cover and species composition. Local assessment for the species was observed as rare, endemic, widespread, threatened and possibly new. Five bryofloral species were found endemic and of these, 2 are endangered and 3 were possibly new.

Keywords: floristic, taxa, habitat preference, microclimate

CORAL COVER AND DIVERSITY ANALYSIS OF CARIAS AND QUEZON ISLANDS OF THE HUNDRED ISLANDS NATIONAL PARK

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The present study aimed to determine the current coral cover and diversity of two reef stations of the Hundred Islands National Park of Alaminos, Pangasinan; namely, Carias and Quezon Islands. Line Intercept Transect (LIT)-based photography was used to determine the status of the reef stations. Photographs were analyzed using the Coral Point Count with Excel Extensions (CPCe) version 4.1 software. A total of 26 and 51 coral species was recorded in Carias and Quezon, respectively. Acropora and Montipora were the dominant genera in Carias and Quezon reef stations, respectively. The Reef Condition Index revealed a shift from the previous "excellent" condition (84% live coral cover) of Quezon in 2008 to a "good" condition (66.54%). Mortality Index (MI) value, however, has shown that both reef stations are in excellent status due to the small proportion of dead corals in both areas. Both reef stations exhibited high diversity as revealed by the Shannon and Simpson Index. However, Quezon reef station had the highest diversity and evenness. Difference in coral distribution and diversity was found to be correlated to variations in seawater temperature, salinity, pH, DO level, substrate dry bulk density, and substrate particle size (of e" 1.18 mm, 600 µm, d" 300µm) which can affect the physiology, survival, reproduction, and settlement of the corals. Findings of the present study provided information on the abundance, diversity, and condition of the reef stations. Such data may be used to predict the effects of human activities to ecological processes and to make appropriate decisions on how to further enhance the control, supervision, and management of the Park.

Keywords: coral cover, diversity, environmental variation, Hundred Islands National Park

OCCURRENCE AND DIVERSITY OF FUNGI IN THE NATIONAL PARK AND PROTECTED LANDSCAPE OF SOUTHERN TAGALOG REGION, PHILIPPINES

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Protected areas in the Philippines are ideal study sites for fungi due to its cool climate and rich vegetation. Thus, our research study aims to determine the fungi present in the declared National Park and Protected Landscape in the Philippines' Southern Tagalog Region (PSTR). Four transect lines were established in each seven study sites from 100m to 1050 m asl with 20m x 50m quadrat sampling each transect line (TL) and with an interval of 200m between quadrats. The fungal species within the quadrats along the TL's were collected, identified and recorded. Opportunistic sampling method was also used during the survey.

A total of 240 species under 103 genera, and 44 families were collected from the study sites, with a high number of fungi collected in different substrates, i.e 100-110 species, collected from stump. Ninety species were obtained from the soil. Species diversity was also observed to be high on twigs. Among the significant findings include *Ganoderma tsugae*, *Cymatoderma elegans*, *Cookeina sulcipes*, *Macrolepiota rhacodes*, and *Galliela rufa*, as the new record fungal species in PSTR, and one possible new species of the genus *Hexagonia*. Further field surveys of the protected areas are anticipated to uncover a rich and diverse fungal flora in the area. Although generally well protected, the areas are currently experiencing some degree of anthropogenic disturbances such as carabao logging, minor forest products gathering, and *kaingin* making or slash-and-burn farming. Fungal diversity research efforts need to be encouraged to evaluate the effects of these human disruptions on the ecology of the national park and protected landscape.

Keywords: fungi, protected landscape, species abundance, species distribution, species diversity

AMPHIBIANS AND REPTILES OF QUEZON PROTECTED LANDSCAPE, QUEZON PROVINCE, LUZON ISLAND, PHILIPPINES

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Quezon Protected Landscape (QPL) is a limestone karst forest consists mainly of calcium carbonate formed million years ago and was tectonically lifted above sea level. This type of forest is unique and highly diverse habitat because of their complex environments physiognomy and variable climatic conditions which suitable for amphibians and reptiles. Herpetofaunal survey was done using strip tansects (10x100m) and by opportunistic sampling in both day and night. A total of 34 new records of amphibians and reptiles were collected and observed genera, four snakes, and one turtle for reptiles and 15 frogs from nine different genera for amphibians. Based from the data gathered, this kind of habitat suggests a complex characteristic and requires extensive field survey and management of this unique landscape.

Keywords: limestone karst forest, Quezon Protected Landscape, amphibians, reptiles, biodiversity

SPECIES COMPOSITION, DIVERSITY AND ABUNDANCE OF SEAWEEDS ALONG THE INTERTIDAL ZONE OF NANGARAMOAN, SAN VICENTE, STA. ANA, CAGAYAN

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This study was conducted to describe, identify and classify species present in the study are and determine Seaweeds diversity in the intertidal zone of Nagaramoan Sta. Ana, Cagayan.

There were 31 different species of seaweeds identified in the study area belonging to the families *Galaxauraceae*, *Corallinaceae*, *Solieriaceae*, *Lomentariceae*, *Rhodomelaceae*, *Rhodoymeceae*, *Rhodoymeceae*, *Dictyotaceae*, *Scytosiphonaceae*, *Sargassaceae*, *Ulvaceae*, *Cladophoraceae*, *Siphonocladaceae*, *Siphonocladaceae*, *Caulerpaceae*, *Halimedaceae*,. Different species of Seaweeds vary in abundance in the different stations. *Padina sanctae-crucis* has the highest density while *Cheilosporum cultratum* and *Bornotella spherical* has the lowest density. *Padina sanctae-crucis* and *Padina australis* vary in abundance in the different Stations. All the species identified has a very low density ranging from 0.00200 to 7.95533. Relative density is also very low ranging from 0.00672 to 16.13 %. It was found that *Mastophora rosea*, *Coelothix irregularus*, *Padina australis*, *Padina sanctae-crucis*, *Padina minor*, *Turbinaria ornata*, *Ulva clathrata*, *Ulva fasciata*, *Chaetomorpha crassa*, *Caulerpa racemosa and Halimeda opuntia* were present in all stations .

There is species diversity of seaweeds along the intertidal zone of Nangaramoan, San Vicente, Sta. Ana, Cagayan.

Keywords: species diversity, Seaweeds, abundance, distribution, density, species richness, frequency

THE DIVERSITY OF FRESHWATER GASTROPODS IN LAKES TAAL, SAMPALOC AND LAGUNA DE BAY, LUZON IS., PHILIPPINES

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Freshwater gastropods are the least studied molluscan class due to the dullness of their physical attributes. This remains to be the case in the Philippines where updates on the biology of freshwater gastropods are lacking. This study aimed to identify and classify the gastropods present in the three major aquaculture lakes in Luzon Is., namely Lakes Taal, Sampaloc, and Laguna de Bay, through thorough examination of their radula, shell, and digestive system. A total of 3, 896 samples were obtained and 17 species were identified inhabiting the three lakes, with Tarebia granifera dominating the three lakes which comprised 35% of the total samples obtained while the least observed was a planorbid snail, Indoplanorbis exustus which only comprised 0.02% of the samples. Of the three lakes, Lakes Taal and Sampaloc had more similar values for species diversity compared to Laguna de Bay. We have been able to establish 9 new records including three nonnative species. This study shows how gastropod diversity in these three major lakes have already been impacted by changes in water quality and the introduction of non-native species which may have implications on over-all ecosystem health given the role of gastropods as major prey items, fisheries commodity and as final or intermediate hosts of parasites.

Keywords: molluscs, freshwater ecosystems, aquaculture, planorbids, non-native species

DIVERSITY OF HOLOTHURIANS IN THE ISLAND MUNICIPALITIES OF NORTHERN CEBU, CENTRAL, PHILIPPINES

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Sea cucumbers are very valuable resource where they are the target animals by the collectors for food and for other purposes. Extraction of the resource was great and declined catch was felt by the gleaners. Hence, this study was conducted to find out the species diversity in Camotes Islands and Bantayan Island for possible conservation and sustainability purposes. Camotes Island is composed of four municipalities namely: San Francisco, Poro, Tudela and Pilar.Bantayan Island is composed of 3 municipalities namely: Sta. Fe, Bantayan and Madridejos.

Field collection was done in the field during the day and night and an interview guide was used to gather socio-economic data. Morphomeristic and spicules analysis were made to determine species of sea cucumbers in Northern Cebu.

Results show that there are 37 species of sea cucumbers found in Camotes Islands and Bantayan Islands belonging to 4 families namely: Family *Holothuriidae*, *Stichopodidae*, *Synaptidae* and *Phyllophoridae*. There were 10 species which are of high commercial importance; 14 are commercially important and 13 are less commercially important. Their price ranges from Php. 300.00 to Php. 6,000.00.

Keywords: Holothurians, diversity, Northern, Cebu, Philippines

DIVERSITY AND ENDEMICITY OF ORCHIDS IN MT. MALINDANG AND MT. HAMIGUITAN, MINDANAO ISLAND, PHILIPPINES

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The family Orchidaceae is considered to be the most threatened group of plants in the Philippines. Taxonomic studies are therefore badly needed to determine their local distribution and abundance in order to identify and prioritize the specific species and areas for conservation initiatives. Inventory and assessment of orchids were carried out in onehectare permanent plot established in Mt. Malindang at 1,571 masl elevation in Misamis Occidental and Mt. Hamiguitan at 1,952 masl elevation in Davao Oriental. Field collections and documentations were made for taxonomic confirmations of the specimens. Results revealed a total of 30 orchid species belonging to 16 genera. Species richness and diversity was both higher in Mt. Hamiguitan (H'=0.319) represented by 17 species than Mt. Malindang (H'=0.304) with only 13 species. Species endemicity however was higher in Mt. Malindang (53.8%) than Mt. Hamiguitan (47.058%). The specificity for pollinators and mycorrhizal association as well as the differences in the elevation and the microclimate condition may explain such difference in the species composition and levels of diversification between the two sites. A total of four (4) new local records of orchid species were also documented which were previously known only from few regions in the country. Two (2) rare and critically endangered species of Paphiopedilum were also recorded within the Mt. Hamiguitan range. As excellent biological indicators, monitoring the population of orchids particularly the rare and endemic species would be imperative for environmental assessment.

Keywords: Species diversity, Endemic, Orchidaceae, Conservation, Mindanao

TREE DIVERSITY ASSESSMENT OF THE BEACH FOREST TRAIL OF THE PUERTO PRINCESA SUBTERRANEAN RIVER NATIONAL PARK

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The tree species diversity and edaphic factors of the beach forest trail of Puerto Princesa Subterranean River National Park (PPSRNP) were assessed in this study. A modification of the Point Center Quadrat Method (PCQM) was employed for the sampling of the tree species. The importance value of each family and tree species was computed and the species richness and diversity of the site were measured using Shannon-Wiener, Simpson's and Margalef's indices. Soil samples were also gathered to give an ecological description of the soil along the trail. The trail had two zones, the true beach forest and the ecotone, designated based on the combined results of soil analysis and floral composition of the areas. The most important family is Calophyllaceae and the most important species is *Calophyllum inophyllum*. This species can survive in the beach forest despite the high leaching of the nutrients in the soil. The high species richness and diversity (Shannon-Wiener Index of Diversity - 1.812, Simpson's Diversity Index - 0.014, and Margalef's Index 36.112) at the site were attributed to the relatively low level of disturbance at the site as well the edge effect since the beach forest meets with the mangrove and lowland forests.

Keywords: biodiversity, beach forest, edge effect, ecotone, Calophyllaceae, Palawan, tropical rainforest

DIVERSITY OF BUTTERFLIES ACROSS THE DISTURBED AND UNDISTURBED AREAS OF MIMBALUT FALLS, BURUUN, ILIGAN CITY, LANAO DEL NORTE, PHILIPPINES

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Mimbalut is one of the important water resources in Lanao del Norte. The falls has abundant and clear water. Its rapid zone below was used by the community as a source of water for bathing and washing clothes. It is open for public for ecotourism, swimming pools and resorts. The upper portion is inhabited with original plants on the stream bank and the surrounding mountain. However, butterflies- the quality environment indicators are not yet documented. Thus, this paper aims to provide information on butterfly species composition, diversity and status in the disturbed and undisturbed segments of Mimbalut waterfalls. Using 3 hours time constraint sampling for 5 days (Dec. 26-30, 2013). Study revealed 14 species of butterflies. Eight of the 14 species were in the undisturbed habitat. Shannon-Weinner Diversity Index showed that undisturbed area has higher diversity level for butterflies H' 0.59 than the disturbed habitat H' 0.556. Status assessment showed 3 out of 14 species (21%) were endemics, 2 were rare and 8 were common with 1 possible new species Dacala sp.. Similarity of species composition showed that 54% are disconcordant and 37% out of it are endemic species and that they prefer to live in undisturbed forested habitat. The 14 species in Mimbalut waterfalls are for conservation. A concerted effort of the LGU and the community to conserve the existing vegetation near the falls, and the surrounding mountain ecosystem is recommended to conserve the waterfalls and the species therein.

Keywords: butterflies, Mimbalut Lanao del Norte, Philippines

DIVERSITY OF ODONATA ACROSS VEGETATION TYPES OF MT. KITANGLAD, BUKIDNON, PHILIPPINES

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Diversity of odonata across the vegetation types of Mt. Kitanglad was carried out using 250 m transect belt to provide information on odonata species composition and diversity trend of odonata across vegetation types viz., agroecosystem, dipterocarp and montane forests in the eastern and western slopes of Mt. Kitanglad. Results revealed 8 families, 14 genera and 17 species of odonata. Species richness of odonata was highest in dipterocarp with 16 species (H' 1.123), followed by agroecosystem with 9 species (H'0.779) and montane 2 species (H'0.301). Similarity of species composition using Bray-Curtis analysis showed 3 discernible clusters of habitats for odonata. The odonata species in the agroecosystem are of low concordance with the species from dipterocarp forest and montane forest. Most of the species found in the agroecosystem were common species while most of the endemic and rare were found in the dipterocarp and montane forests (47% and 8% respectively). This may be due to the presence of quality water in the dipterocarp forest from which most of the ground waters came out as headwaters of the river systems in the western slope. The 17 species of odonata are for conservation. Conserving the odonata in the forest will also conserve the habitats and the water bodies therein.

Keywords: nodonata diversity Mt Kitanglad vegetation types Bukidnon

SPECIES RICHNESS AND STATUS OF AVIFAUNA IN MT. KITANGLAD AND MT. APO, PHILIPPINES

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Mindanao is considered as one of the most diverse island in the Philippines with high percentage of endemism. Two of the mountain ecosystems unexplored for bird fauna are Mt. Apo and Mt. Kitanglad. This paper aimed to provide information on species level diversity and current conservation status of birds in two Long Term ecological Research (LTER) sites in Mindanao located in Mt. Apo and Mt. Kitanglad. Sampling techniques employed includes mist-netting for 210-220 net days/site and transect survey; both performed inside the established 1-ha permanent plot and its vicinity specifically established at the montane vegetation around 1900-2200 masl. A total of 50 bird species were noted in two mountain ecosystems in which 38 species with 195 individuals were listed in Mt. Apo, and 27 species with 140 individuals were recorded in Mt. Kitanglad. Endemism was determined and revealed that 42.10% of the birds noted in Mt. Apo are endemic and 44.44% in Mt. Kitanglad. Hypocryptadious *cinnamomeous* is a Mindanao endemic bird was observed to be the most abundant species in both sites. Eurylaimus steerii is the sole species observed that fall under the threatened category. Considering that only one hectare was being surveyed, the two mountains showed high species richness. This could be due to diverse plant community in the area which provides food and shelter for birds, further, it was observed that as elevation increases and temperature decreases species richness tends to decline but endemism increases. The 38 species in Mt. Apo and 27 species in Mt. Kitanglad are for monitoring and conservation, specially the endemic species.

Keywords: Birds, Long Term Ecological Research sites, endemism, conservation status, assessment, Mindanao

BS - 17 SURVEY OF DIATOMS AND AQUATIC INSECTS IN SAMIL RIVER, LUCBAN, QUEZON

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The use of biological components of a river is one of the basic approaches in assessing its ecological condition. Several biota inhabiting a river system respond rapidly and predictably to changes in the physical and chemical characteristics of the river. Among these are macroinvertebrates, zooplankton and phytoplankton and especially diatoms. Information on the biodiversity of Samil River, one of the most vital tributaries in Lucban, Quezon, is very limited. This biodiversity survey was conducted in Samil River to provide baseline information in assessing the ecological condition of the River. Diatom and aquatic insect assemblages in the river and some biological indices were determined. Microscopic examination revealed that there are 37 diatom species in Samil River belonging to 11 genera. They were Navicula, Melosira, Surirella, Achnanthes, Cocconeis, Gvrosigma, Pinnularia, Cymbella, Gomphonema, Nitzschia, Synedra and *Chlorococcum.* Among the 11 genera, *Navicula*, the typical diatom in all lotic system, is the most abundant in terms of the number of species (17) and cell count (1.6 x 10^7 cells/ml) followed by cosmopolitan diatom in polluted streams, Nitszchia with (3.7 x 10⁶ cells/ml). Chlorococcum humicola has the least cell count with 2.6 x 10⁴ cells/ml. With regard to aquatic insects, a total of 384 individuals were collected. They belong to eight (8) orders, 14 families (Gomphidae, Gerridae, Gyrinnidaae, Leptophlebidae, Vellidae, Calopterygidae, Corduliidae, Libellulidae, Pieridae, Tetrigidae, Cercopidae, Apidae, and Nymphalidae), 8 known species and 11 unknown species. Although Odonata was the most diverse in terms of number of species (7), order Hemiptera had the most individuals (270) collected in the study. Rhagovelia sp. largely contributed to the Hemipteran population which comprised 184 individuals or 42.92 percent of the total catch. The species diversity for diatoms and aquatic insects were 3.224 and 1.862 while Dominance index were 0.9408 and 0.2725 for diatoms and aquatic insects. Survey showed that Samil River is still biodiversity rich and this should be protected and conserved.

Keywords: diatoms, aquatic insects, biodiversity, Samil River, Lucban, Quezon

FISH DIVERSITY AND WATER QUALITY OF SAMIL RIVER, LUCBAN, QUEZON, THE PHILIPPINES

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Freshwater fish survey was conducted in Samil River, a high altitude stream at the foot of Mount Banahaw de Lucban. This river serves as source of foods and water for drinking, agricultural and domestic purposes as well as recreational water. Using multiple fishing methods, 351 fish individuals belonging to seven (7) species were found in Samil River represented by one (1) endemic, Nomoramphus vivipara; one (1) native, Glossogobius celebius and five (5) introduced. The species diversity was relatively low (0.9372). Native Glossogobius celebius, an insectivorous species, dominated the total catch (74.36%). Physico-chemical analysis revealed that the water in Samil River was within the DENR standard for Class A water except for the total and fecal coliform making the river water not potable particularly in the mid- and lower streams. Like other river systems, Samil River experiences undue pressures due to evident increase in the domestic and agricultural activities and recreational and infrastructure development brought about by the increasing population in the area. A communitybased management strategy must be in-place to achieve environmental and ecological sustainability. And because education and public awareness campaign will also play an important role towards achieving a sustainable environment, hence a policy brief was developed.

Keywords: fish diversity, water quality, Nomoramphus vivipara, Glossogobius celebius, Lucban, Quezon

PHENETIC ANALYSIS AND GENETIC DIVERSITY OF SOME ENDEMIC *Nepenthes* SPECIES OF THE PHILIPPINES

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A great number of endemic and economically important tropical pitcher plants (Nepenthes sp.) in the Philippines are already endangered due to over collection, illegal trade, and destruction of its habitat. This study was conducted to determine the extent of diversity of this genus based on morphology and 18s rDNA sequences. Numerical techniques were utilized to estimate the phenetic relationship among the thirteen Nepenthes species. Cluster analyses based on Ward's method; and ordination by principal component analysis (PCA) were performed. These analyses revealed the same results, the Nepenthes species collected could be partitioned into seven distinct groupings. Analysis of the variables by PCA revealed that pitcher and lamina characters play significant roles in the identification of the Nepenthes species. Genetic diversity analysis was done using 18s rDNA gene. The genetic distance between sequences was computed using Kimura-2-Parameter (K2P) method. N. bellii has the highest intragroup genetic distance of 0.15986, and the overall intergroup genetic divergence is 0.03844. The mean diversity within population (0.02316), in entire population (0.03973), mean interpopulational diversity (0.01657), and coefficient of differentiation (0.41705) were determined using Jukes-Cantor model. A similarity in the clustering of the species was observed when the maximum likelihood tree using the 18s rDNA sequences with 1000 bootstrap replicates was compared with the phenogram based on morphology.

Keywords: Nepenthes, endemic, phenetic analysis, diversity, 18s rDNA

DIVERSITY OF HERBACEOUS PTERIDOPHYTES IN TWO MOUNTAIN ECOSYSTEMS IN MINDANAO

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Mindanao Island harbors a diversity of pteridophytes which are continuously affected by natural and anthropogenic activities. A study on the diversity of herbaceous pteridophytes was conducted in the two mountain ecosystems in Mindanao viz., Mt. Apo, North Cotabato and Mt Kitanglad, Bukidnon. A one-hectare permanent plot with 25 subplots measuring 20 x 20 meters was established in each site. Diversity values and similarity indices were determined. Classification, identification and assessment of the conservation status were also done. Complete inventory of the species within the one-hectare plot of the two mountain ecosystems revealed a total of 110 species of herbaceous pteridophytes. Of these, 56 species are found in Mt. Kitanglad and 54 species in Mt. Apo. Among the two mountains, Mt. Kitanglad had higher species diversity value with H2 = 1.37 compared to Mt. Apo with H2 = 1.26. Similarity of sites through species occurrence is relatively high which imply that many common species were observed in both sites. Species with high Species Importance Value (SIV) in Mt. Kitanglad were Asplenium normale D. Don, and Hymenophyllum sp. While species with high SIV in Mt. Apo were Plagiogyra christii Copel. and Selliguea triloba (Houtt) M.G.Price. A total of 9 species are threatened. Of these, 3 species are endangered and 6 are vulnerable. These data are important for the long term monitoring and conservation of herbaceous pteridophytes species in the permanent plots.

Keywords: pteridophytes, species richness, species diversity, permanent plot, threatened

BS - 21 POTENTIAL RHIZOREMEDIATORS FROM PINTO PEANUT (*Arachis pintoi*) GROWN IN LEAD CONTAMINATED SOIL

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The role of rhizosphere microbial population for maintenance of root health, nutrient uptake and tolerance to environmental stresses had been recognized. Pinto peanut (Arachis pintoi) can accumulate heavy metals from contaminated soils. However, its mechanism as a phytoremediator is still not totally studied. Isolation and characterization of microbes from the rhizosphere of this plant established possible mechanism of heavy metal accumulation of the plant. The study aimed to characterize and determine the bioremediation potential of microbial isolates in the rhizosphere of Arachis pintoi grown in sanitary landfill compost and garden soil. The study isolated three bacteria from the Sanitary Landfill Compost namely Isolates A, B, C and three bacteria from the Garden Soil namely Isolates D, E, F. Isolates A and C from the Compost and Isolates D and F from the Garden Soil are all Gram (+) rod while Isolate B and E from the compost and garden soil are Gram (-) rod. On the other hand, there were eight (8) fungi isolates. Fungus A is orange, unseptated, with conidiophores and unbranched hyphae. Fungus B is white, unseptated, with sporangiospore and exhibited branching hyphae. Fungus C is blue-green, unseptated, with sporangiospore and exhibited unbranched hyphae. Fungus D is black, unseptated, with sporangiospore and unbranched hyphae. Fungus E is orange, unseptated, with conidiophores and unbranched hyphae. Fungus F is white, unseptated, with sporangiospore and exhibited branching hyphae. Fungus G is blue-green, unseptated, with sporangiospore and exhibited unbranched hyphae and Fungus H is black, coenocytic, with sporangiospore and exhibited unbranched hyphae. These microbial isolates were able to grow and survive in media containing lead nitrate in different concentrations (40 ppm, 80 ppm, 120 ppm, 160 ppm and 200 ppm) which indicates their high lead tolerance and potential to bioremediate lead-contaminated soil and assist the plant in its phytoremediation activity.

Keywords: rhizoremediators, rhizosphere, Arachis pintoi, lead bioremediation

HEAVY METAL-RESISTANT, BIOFILM-FORMING BACTERIA FOR POTENTIAL USE IN REHABILITATION OF HEAVY METAL-CONTAMINATED WASTEWATER

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Technologies for the removal of heavy metals from environments are mostly based on ion-exchange technologies and/or precipitation of the cation in an inert form, which are commercially impractical. This study aims to discover microorganism(s) that can be immobilized as biofilms on carriers in a bioreactor, to clean up heavy metal-contaminated wastewater in an efficient and cost-effective manner. Of the 90 microbial isolates from copper-contaminated wastewater from a local semiconductor company resistant to copper as high as 250 ppm, 49 produced biofilm with varying thickness on microtiter plate using Tryptic Soy Broth as substrate. Based on 16S ribosomal DNA sequences, the isolates have been provisionally identified as Pseudomonas aeruginosa, Bacillus megaterium, Ochrobactrum, Pseudochrobactrum, Brucella, Agromyces sp. and Bacillus sp. P. aeruginosa is an opportunistic human pathogen while Ochrobactrum and *Brucella* are potential pathogens. The *Bacillus* sp. isolate grows very slowly even in rich culture medium. To our knowledge, B. megaterium has not been reported to be detrimental to humans and animals. As free cells, this isolate could reduce copper concentration, hence, appeared to be the best isolate to cultivate as biofilm for potential use in rehabilitation of heavy metal contaminated wastewater.

Keywords: biofilm, heavy metal-resistance, *Bacillus megaterium*, bioremediation, copper

MOTILITY CHARACTERISTICS OF EJACULATED BOVINE SPERMATOZOA IN L-CARNITINE SUPPLEMENTED TRIS EGG YOLK EXTENDER

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L-carnitine is an amino acid that plays important role in the production of ATP. Its addition in the tris egg yolk extender was examined to assess its possible effect in improving the motilities of the sperm cells at extended time. Tris egg yolk extender was supplemented with L-carnitine at 0.5, 1, 10 and 30 mM concentrations with the absence of L-carnitine served as control. Ejaculated sperm cells were diluted with the extender containing different concentrations of L-carnitine and stored at room temperature (25°C) until 24 hours. Motility characteristics were examined at 2, 6 and 24 hours using computer assisted sperm analysis.

Results showed that L-carnitine at 0.5 to 10 mM is beneficial in improving motility characteristics but high concentration (30 mM) has negative effects. At 2 h of exposure, 1 mM L-carnitine supplementation exhibited significantly higher overall motility (80.5 vs. 71.4%, P<0.007), progressive motility (26.2 vs. 20.5%, P<0.0001), average path velocity (118.5 vs 104.0%, P<0.0001), progressive velocity (82.2 vs. 70.9 %, P<0.0005), track speed or culvilinear velocity (211.7 vs. 186.2%, P<0.09), and rapid sperm (61.2 vs. 53.9%, P<0.01) than those in control group. At 6 to 24 h extended condition, better motility characteristics were observed in 0.5 to 10 mM L-carnitine treatment suggesting that L-carnitine improves motility characteristics of sperm cells.

Keywords: L-carnitine, buffalo, semen, spermatozoa, sperm motility

REDUCTION OF LIPID PEROXIDATION BY COCOA POWDER SUPPLEMENTATION IN CIGARETTE SMOKE-EXPOSED Mus musculus

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Cigarette smoke can damage the lungs by inducing lipid peroxidation as a result of free radical formation in tissues. However, the damage could be mitigated by providing antioxidants through the diet. This study evaluated the effectiveness of cocoa powder supplementation in lowering lipid peroxide levels in the lungs of cigarette smoke exposed BALB/c mice. The test animals were divided into five groups: Group 1 and Group 2 were given no dietary supplementation; Group 3 mice were provided with 10g/L vitamin C; Group 4 and Group 5 were given 0.1 g and 1.0 g cocoa powder per kg body weight, respectively. Following their designated dietary regimen, all test mice, except for those in Group 1, were exposed to cigarette smoke in an custom-made smoking chamber for 10 minutes a day for a period of twelve days. Each mouse was thereafter humanely sacrificed. Bronchoalveolar lavage fluid (BALF) and lung tissue homogenates were obtained and assayed spectrophotometrically for levels of malondialdehyde (MDA) and total protein. Results show that among the smoke-exposed mice, those given the low and high amounts of cocoa powder have lower levels of BALF and lung tissue MDA than in the unsupplemented mice. These reduced levels were also about similar to the mean values found among the vitamin C-supplemented mice (which served as the positive control group), and are indicative of decreased lipid peroxidation. The findings suggest that the consumption of cocoa-derived products which contain dietary antioxidants can help reduce oxidative stresses to the lungs acquired through secondhand smoke.

Keywords: lipid peroxidation, cocoa powder, antioxidants, bronchoalveolar lavage, malondialdehyde

SOIL-VEGETATION INTERRELATIONSHIPS OF TREE SPECIES IN A LOWLAND FOREST IN THE PUERTO PRINCESA SUBTERRANEAN RIVER NATIONAL PARK

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In this study, we tried to determine the association between the ten most ecologically important tree species and different soil parameters along the jungle trail of Puerto Princesa Subterranean River National Park (PPSRNP). Soil and vegetation data were collected from sampling sites along a three-kilometer transect. The ten most ecologically important tree species out of the 106 species identified were chosen based on their importance values. Using Canonical Correspondence Analysis (CCA), soil parameters were tested against data on vegetation. Two axes were produced: the first was an axis of pH while the second was an axis of soil fertility. The ordination plot created from these axes suggested that majority of the sampling sites exhibited low soil fertility and possessed relatively acidic soils. The ordination plot for tree species showed that Hernandia ovigera and Intsia bijuga favored basic soils, and Durio sp., Casearia grewiifolia, Dimorphocalvx murinus, and Intsia bijuga, preferred areas with relatively lower soil fertility. Other species analyzed showed differing preferences. This information can help predict areas of optimal growth for these tree species, providing helpful insight for forest managers in their reforestation efforts at PPSRNP

Keywords: habitat preference, species ordination, canonical correspondence analysis, plant ecology, tropical forest management, Palawan

WATER QUALITY ASSESSMENT USING IMMATURE ARTHROPODS IN NATIGBASAN STREAM IMPASUG-ONG, BUKIDNON, PHILIPPINES

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Water quality assessment was conducted using the most sensitive organisms to environmental changes the -immature arthropods to provide information on the water quality of Natigbasan stream. Three stations were established along the stream: station1, the head water with native riparian trees; station 2, near the pool and station 3 near the falls with trees but with more soap suds from washing and bathing. Immature arthropods were collected using surface and dip net sampling. Results revealed the total of 40 immature arthropod species at 676 individuals in 11 insect orders. Stations 1 and 2 with strong ground waters free from inorganic pollutants had the highest species composition (25 and 19 species respectively) and diversity level (H' 1.324 and H' 1.056 respectively). Immature arthropods were only few in the segment of the stream with frequent inorganic and organic pollutants (12 common species and H' 0.789). A total of 14 pollution sensitive and 11 pollution tolerant species recorded. Similarity of species composition showed low across stations suggests that immature arthropods have habitat specificity for oxygen requirements, water temperature, pH, current, depth quality and clarity of water. Hilsenhoff's Biotic index results showed good water quality of Natigbasan stream segments with ground water. This supports the diversity level in stations 1 and 2. This result suggests that diversity of immature arthropods can be used to monitor water quality with less expense.

Keywords: immature arthropods, water quality indicator
ETHNOBOTANICAL STUDIES ON MEDICINAL AND TOXIC PLANTS AMONG THE THREE TRIBES IN LUZON, PHILIPPINES

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An ethnobotanical survey was carried out using survey questionnaire and focus group discussion among the Aetas of Bataan, Igorots of Nueva Vizcaya and Dumagats of Aurora. A total of 27 medicinal and 18 toxic plants were documented in this study. The said medicinal and toxic plants are common in the 3 tribes. Based on the survey, fresh parts of the plants, specifically leaf and roots are oftentimes used as decoction for medicinal purposes. Different parts (leaves and stems) of the toxic plants when in contact may have irritating effect to humans and other animals. Thus, the tribal people avoid these plants in the forest. The adverse effects of toxic plants include severe itchiness and swelling of the eyes and face. We observed that even today, tribal people in the three tribes in Luzon are still dependent on plants as their sources of medicines to cure common ailments such as stomach ache, dysentery, sprain and wounds among others.

Keywords: ethnobotanical, medicinal, toxic

BS - 28 MALACOLOGICAL SURVEY ALONG THE INTERTIDAL ZONE OF TWO SITES IN MANILA BAY (LAS PIÑAS-PARAÑAQUE CRITICAL HABITAT AND ECOTOURISM AREA (LPPCHEA) AND BRGY. STA. MERCEDES, MARAGONDON, CAVITE

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Two sites were chosen for a malacological survey in Manila Bay.

The first site is the Las Piñas-Parañaque Critical Habitat and Ecotourism Area (LPPCHEA), the only critical habitat located within Metropolitan Manila. It is a significant component of the East Asian-Australian Flyway, hosting about 5,000 heads of migratory and native bird species that feed on its mudflats and breed in its mangrove forests. However, it has been exposed to urban pollution. The second site, Brgy. Sta. Mercedes in Maragondon, Cavite has been exposed to less pollution. This can be attributed to the fact that there are no industries that produce chemical contaminants in the area. The two sites have contrasting conditions and malacological study was conducted to establish the malacological profile of the areas. The sampling protocol utilized was adapted from the Natural Geography In-Shore Areas (NaGISA) method for rapid and regular monitoring of beach and shoreline sites. Transects with a length of 100 meters were laid in three sampling sites. Each transect consisted of 20 sampling points or quadrats. Samples in each quadrat were collected using corers within three successive weekends (November 2012). The mollusk species were then identified. In LPPCHEA, 34 molluscan families were identified, out of which 28 species were bivalves and 35 were gastropods. In Brgy. Sta. Mercedes, Maragondon, Cavite, a total of 37 molluscan families were identified. Of these, 23 were gastropods and 14 were bivalves. Six gastropod and eight bivalve families were common to both areas. There are 17 gastropod and 6 bivalve families exclusive to Brgy. Sta. Mercedes while there are 14 gastropod and 7 bivalve families exclusive to LPPCHEA.

Keywords: LPPCHEA, intertidal zone, Sta, Mercedes, Maragondon, mollusks

UTILIZATION OF MARINE MOLLUSCS IN MARKETS AND BEACH RESORTS OF ISLAND GARDEN CITY OF SAMAL (IGACOS), DAVAO DEL NORTE: IMPLICATIONS TO CONSERVATION

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Marine molluscs are economically important species that are widely exploited as source of food, medicine and for aesthetic value. Despite of its economic usefulness, study on the conservation aspect of the marine molluses in IGACOS, Davao del Norte is nil. This paper aims to provide information on species composition, existing utilization and local status of the said taxa in the markets and beach resorts of IGACOS. A total of twenty three (23) species from sixteen (16) different families of marine molluscs were listed. Of the 23 species, 22 are utilized as food and all are ornaments. These are sold fresh in the market for food at Php 60.00 per plate and the shells of the 23 species are sold for decoration purposes. Local assessment showed : Tridacna squamosa as very rare and listed in the CITES, 3 rare species: Pinctada margaritifera, Casmaria vibex, and Cypraea tigris and 3 locally common species: Conus spp., Pinctada and Cypraea which despite its status, harvesting by locals needs permit under the 1990 Fisheries Administrative Order 168. The 23 economically important marine mollusc species listed in IGACOS are for conservation. The collection of the rare and currently traded species must be regulated. If regulation of trading of marine molluscs in IGACOS is taken for granted, many members of the taxa may become endangered or probably extinct.

Keywords: Utilization marine molluses harvests conservation IGACOS Philippines

SPECIES COMPOSITION OF TERRESTRIAL MOLLUSKS IN MT. MALINDANG (LONG TERM ECOLOGICAL RESEARCH SITE)

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Mollusks are highly successful invertebrates in terms of ecology and adaptation and are found nearly in all habitats. Considering the role of molluscs in maintaining the overall environmental conditions, exploration and conservation of this group is of urgent need. Study of terrestrial mollusks was conducted in the permanent plot in Mt. Malindang, Misamis Occidental to provide information on species composition of mollusk in Mt. Malindang. The sampling plot is a one-hectare permanent plot located at 08p 55' North and 123p 36' East in Mt. Malindang. Twelve subplots in one hectare permanent plot, each 20 meters by 20 meters were sampled. Sampling was done using visual sampling and handpickung for within one year. Results revealed fourteen species of terrestrial mollusks from the one hectare permanent plot. The documented terrestrial mollusks are represented with five families. Out of 14 species, six species belonged to the family Helicarionidae, three species to Ariophantidae, two species to Bradybaenidae, two species to Cyclophoridae and one to Camaenidae. The most common species was Hemiglypta sp2 and sp20 both from the family Helicarionidae. The habitat preference of these mollusks is strongly associated with vegetation and leaf litter and they also play an important role in food chain as well as in litter decomposition in the terrestrial ecosystem. Therefore conservation of mollusc in mt. Malindang will also conserve their habitat. Monitoring is recommended for a wider range analysis.

Keywords: Long Term Ecological Research Site, permanent plot, invertebrates, visual sampling, five families

DIVERSITY AND ABUNDANCE OF TERRESTRIAL MOLLUSK IN MINDANAO LONG TERM ECOLOGICAL RESEARCH (LTER) SITE

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Mollusks, along with other animals and plants, are undergoing a shocking rate of extinction. Diversity studies are therefore badly needed to assess the status of these economically and ecologically important fauna. Diversity study on terrestrial mollusks was conducted in five long term ecological research sites in Mindanao to provide information on species composition and diversity trend. One hectare permanent plot was established in each Mindanao LTER sites viz. (1) Mt. Apo in North Cotabato, (06p 59' North, 125p 15' East); (2) Mt. Kitanglad in Bukidnon (08p 0.57' North, 124p 55.35' East); (3) Mt. Hamiguitan in Davao Oriental (06p 43.95' North, 126p 10.01' East); (4) Mt. Malindang in Misamis Occidental (08p 17.73' North, 123p 36.58' East) and (5) Mt. Musuan in Maramag, Bukidnon (07p 52.94' North, 125p 03.92' East). Mollusc sampling were done in twelve subplots in one hectare permanent plot, each subplot measured 20 meters by 20 meters. A total of 407 individuals of mollusks were counted across the 5 LTER sites. These were placed in 44 different species in 7 families. Species richness was highest in Mt. Malindang with 14 species, followed by Mt. Apo with 13 species, Mt. Hamiguitan with 11 species, Mt. kitanglad with 9 species and last Mt. Musuan with 2 species. Diversity using the Shannon-Weiner index showed higher in Mt. Malindang with H' = 0.888, possibly because of the physical characteristics of the soil and the humidity of the site. The mollusks listed are for conservation and for monitoring to provide clearer picture on the status of mollusk in the LTER sites.

Keywords: long term ecological research site, mollusks

BS - 32 ESTABLISHMENT OF LOCAL BIOINFORMATICS PIPELINE FOR IDENTIFICATION OF INDUCED MUTATION ON CANDIDATE HOST FACTOR GENES FOR VIRUS RESISTANCE IN TOMATO

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Induction of mutation using ethylmethane sulfonate (EMS) allows the creation of new sources of alleles for any target gene, and in the case of this research, for resistance against virus diseases which threaten tomato production worldwide. With the advancement in next-generation sequencing (NGS), rapid screening for induced mutation points in deep-pooled DNA samples of large tomato mutant population is possible. However, lack of publication on bioinformatics analysis of NGS data for this specific application has been limited.

Using Illumina MiSeq, NGS paired-end reads were generated for 14 amplified tomato host factor genes based on genomic DNA deep pools of 190 M_2 families. NGS reads were cleaned using Trimmomatic v0.32 tool by trimming reads below average base phred quality of 32. The quality-trimmed short reads were mapped and assembled on the reference sequences using the Bowtie program. The SAM file output of Bowtie was then converted into BAM file using SAMTOOLS and putative single nucleotide variants (SNVs) were identified using LoFreq variant caller program.

Five (5) SNVs were identified using this local bioinformatics pipeline as described. Four (4) of these SNVs are located on host factor genes for *Tomato leaf curl virus* (ToLCV) while one (1) for *Cucumber mosaic virus* (CMV) infection in tomato. These SNVs are characterized with very low frequency and EMS-induced mutations. Primers were designed specific to these SNVs for use in later screening to identify the mutant family/tomato plant that carries the mutation. The progenis of the tomato mutant shall then be evaluated for induced resistance reaction against ToLCV and CMV.

Keywords: bioinformatics, EMS, NGS, TILLING, tomato, resistance

BS - 33 SILENCING OF VP9 GENE IMPAIRS WSSV INFECTIVITY IN Macrobrachium rosenbergii, Marsupenaeus japonicus AND Peneaus monodon

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White Spot Syndrome Virus (WSSV) remains the most widespread and devastating infectious agent that hit the shrimp aquaculture industry worldwide. To date, there are no known effective strategies yet to combat WSSV infection. Hence, functional studies on genes critical for viral infection, is essential in elucidating shrimp-virus interaction. Here we report the function of a gene from WSSV coding for a non-structural protein, VP9, utilizing RNA interference. Silencing of VP9 gene effectively silenced other regions in the WSSV genome (wsv168 gene) as early as 1 dpi (day post infection). VP9- and GFP-dsRNA injected shrimps showed a significant survival rate of 80% and 100%, respectively, in contrast to 20% of the PBS injected shrimps at 10 dpi. Re-infection of shrimp survivors treated with VP9- and GFP-dsRNA, using a higher viral titer at 10⁻¹ concentration. concurrent with the infection of new shrimp samples for PBS control group, showed a significant 67% survival rate for VP9-dsRNA compared to 0% with that of GFP-dsRNA and PBS. Challenge test on two more species, Penaeus monodon and Marsupenaeus japonicus, also increased survival rate after VP9-dsRNA treatment. Our results provided evidence that VP9 gene plays an essential role in WSSV replication. This is the first report of an antiviral gene effective in at least 3 species of shrimp. Hence, VP9 is an excellent target gene in the future development of RNAi therapeutics for the shrimp aquaculture industry.

Keywords: VP9, RNA interference, *Macrobrachium rosenbergii*, gene silencing, WSSV, *Marsupenaeus japonicus* and *Peneaus monodon*

CHARACTERIZATION OF THE ABACA BUNCHY TOP VIRUS DNA-C GENE COMPONENT

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Bunchy top viruses are major pathogens of the abaca Musa textilis Nee that stunts the growth of the plant resulting to decrease abaca fiber yield. Between the Abaca bunchy top virus (ABTV) and Banana bunchy top virus (BBTV), ABTV gene components have not been functionally characterized. ABTV DNA-C gene component codes for a putative cell cycle link protein (Clink) that enhances replication of the other gene components. ABTV DNA-C was isolated from total DNA extracted from bunchy top infected leaf samples via PCR using neighboring oligonucleotide primers. Generated amplicon was 1026 bp in size and subcloned in pGEM T-easy vector. BLAST analysis revealed 99% nucleotide similarity to ABTV DNA-C Q1108 isolate. To facilitate transfer of ABTV DNA-C to a plant expression vector, pGEM T-easy with ABTV DNA-C was cut with HindIII. Molar excess of ABTV DNA-C was ligated to a linearized pCAMBIA-1300 to produce a pCAMBIA-ABTV DNA-C dimer. This construct contains two copies of the gene component in tandem with the coding region intact. Colony screening via PCR showed that a ~2.2 kb indicated the presence of the pCAMBIA-ABTV DNA-C dimer. Restriction analysis using KspI and BstXI showed digests of ~8.6 kb and ~2.4 kb for pCAMBIA-ABTV DNA-C dimer compared to the ~6.6 kb and ~2.4 kb digests for pCAMBIA-1300.

Keywords: Abaca, bunchy top, cloning, Clink, dimer

BS - 35 HETEROLOGOUS EXPRESSION OF THE REPLICATION INITIATION PROTEIN (REP) OF THE BUNCHY TOP VIRUSES AND PRODUCTION OF POLYCLONAL ANTISERUM

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Viral diseases in abaca cause significant reduction in yield and quality of fiber in the abaca-producing regions of the Philippines. The most damaging is the bunchy top disease caused by the abaca bunchy top virus (ABTV) and the banana bunchy top virus (BBTV). Development of immunodiagnostic assays for detection and characterization of infectious agents is necessary for effective disease risk management. In this study, the replication initiation proteins (Rep) of bunchy top viruses were expressed as antigens for antiserum production. Bacterial pEXP5-NT-TOPO® expression vectors containing ABTV and BBTV Rep genes were transformed into BL21(DE3)pLysS E.coli. The ABTV and BBTV 862-bp ORF sequences showed 99% sequence identity with the ABTV Rep and BBTV Rep gene database sequences respectively and 80% sequence identity with each other. Recombinant expression was induced by IPTG and characterized through SDS-PAGE and Western blot. The recombinant proteins had 85% sequence identity and similar molecular weights of approximately 40 kDa. Rabbits were injected through intramuscular route using either ABTV or BBTV Rep as antigen with complete or incomplete Freund's adjuvant. Antisera was collected and purified by ammonium sulphate precipitation and dialysis. Enzyme-linked immunosorbent assay (ELISA) was performed using antisera as primary antibody against the recombinant protein and extracts of both healthy and infected abaca leaves. Significant activity was observed against recombinant antigens, although antisera failed to distinguish between ABTV and BBTV Rep.

Keywords: abaca bunchy top virus, banana bunchy top virus, replication initiation protein (Rep), recombinant expression, polyclonal antiserum

BS - 36 THE IDENTITY AND FUNCTION OF THREE Macrobrachium rosenbergii Contigs: 17, 31 AND 34

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In order to understand host-virus interactions and combat disease, functional studies on host genes are needed to be done yet remain scarce. In response to this, the study focused on three host genes, contig 17 (MrC17), contig 31 (MrC31) and contig 34 (MrC34), to reveal the identity and function of each gene and unravel the complex interaction between host and virus. RT-PCR showed that all contigs are expressed on immunerelated organs of the shrimp, namely the gills and hemocyte, suggesting its role in combating pathogens. RACE-PCR was done and samples were submitted for sequencing. Blast analysis of the sequences identified MrC17 as lipopolysaccharide and beta-1,3-glucan binding protein (LGBP), which plays an important role in the innate immune response of crustaceans and insects. Phylogenetic analysis showed its high homology with other LGBP from other crustaceans supported with 93% bootstrap value. MrC31 was revealed to be the enzyme lactase dehydrogenase (LDH), commonly released during tissue damage and is a marker for disease. MrC31 formed sister clades to other shrimp species, P. monodon and L. vannamei, supported with 100% and 72% bootstrap values, respectively. Lastly, MrC34 was highly homologous to the glycogen phosphorylase (GP) enzymes of other organisms including that of another shrimp, *M. japonicus*, bearing a bootstrap value of 99%. This study is to the first to report on the possible identities and functions of contigs 17, 31 and 34, providing valuable data in the shrimp's genome.

Keywords: host-virus, WSSV, gene silencing, giant freshwater prawn, contig

RECONSTRUCTION OF JOSE RIZAL'S MATERNAL GENEALOGY USING MITOCHONDRIAL LINEAGE MARKERS

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Genealogy is the 'study of families and tracing of their lineages and history.' In this study, we used bioinformatics to determine Dr. Jose Rizal's maternal genealogy using mitochondrial lineage markers. DNA samples provided by ten (10) Rizal descendants who have a continuous maternal line through four of Rizal's sisters (Saturnina, Narcisa, Maria and Soledad) to Doña Teodora Alonso were sequenced at 980 nucleotide positions of the mitochondrial hypervariable regions I and II (HVR-I and HVR-II). All samples had the same HVR-I and HVR-II sequences. The maternal haplogroup of these sequences were determined using HaploGrep (haplogrep.uibk.ac.at) with PhyloTree mtDNA TreeBuild 15 (http://www. phylotree.org). This paper aims to report the result of analysis of the mitochondrial DNA sequences of Rizal descendants that have a continuous maternal link to Dr. Jose Rizal and analyze these in the context of the current knowledge of Philippine genetics as well as other groups in Asia.

Keywords: Jose Rizal, genealogy, genetic ancestry, mitochondrial DNA, lineage markers, maternal haplogroup

FIVE NOVELTIES IN PHILIPPINE VANGUERIEAE (IXOROIDEAE, RUBIACEAE) INFERRED FROM MOLECULAR SEQUENCE DATA

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The utilization of molecular data has resulted to the establishment of well-supported groups in the tribe of Vanguerieae. The genus Canthium sensu stricto (s.s.) was recircumscribed to include representatives with spines resulting to the transfer of other species to either Pyrostria s.s. or Psydrax. In the Philippines, Canthium and Psydrax only represent Vanguerieae. As part of the ongoing taxonomic revision in Vanguerieae, collection of several representatives of the tribe was conducted in various forested regions of the Philippines. In this study, the ITS and *trnLF* of the Philippine endemic C. brunneum and diverging species of three Psydrax as well as Pyrostria were amplified, sequenced and aligned with the sequences of related species to determine their true generic affiliations and phylogenetic positions. The majority-rule consensus tree of the ITS-trnLF datasets showed a wellsupported (PP=1.00;BS=100) clade of the whole Vanguerieae. Interestingly, Bayesian inference strongly supports the placement of three Psydrax cf (PP=0.75;BS=70) within Psydrax clade while C. brunneum and Pyrostria cf within *Pyrostria* clade is likewise strongly supported (PP=0.92;BS=95). The absence of spines in C. brunneun as well as the morphological features shared by our taxa with Psydrax and Pyrostria s.s. further strengthen our molecular results. Hence, the following novelties are proposed for the tribe Vanguerieae; Pyrostria brunnea (Merr.) Arriola and Alejandro, comb nov.; Pyrostria triflora Arriola and Alejandro, sp. nov.; Psydrax amplifolia var. cuspidata; Psydrax amplifolia var. obovata; and Psydrax philippinensis Arriola and Alejandro, sp. nov.

Keywords: biodiversity, endemics, phylogeny, Rubiaceae, Vanguerieae

BS - 39 SECONDARY STRUCTURES IN FUNGAL HOMOACONITASE MESSENGER RNA: CONTROL POINTS FOR GENE REGULATION

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Molecular genetic studies of the fungal alpha-aminoadipate (\dot{a} -AA) pathway continue to reveal new information on its regulation. For years, efforts yield only a handful of genes considered to be regulatory to the pathway, in which the homoaconitase (*lys3*) gene has been shown to be one. Its regulatory function is still shrouded with mystery except for the fact that as an aconitase, its cubane iron-sulfur cluster plays an important shifting role in regulation and catalysis. This paper aims to present another framework for understanding *lys3* regulation – secondary structures in its mRNA.

A 2.001 kilobase (kb) mRNA transcript of the *lys3* gene was obtained *in silico* using DNASTAR® software from a 2.406 kilobase pair *lys3* gene sequence from *Penicillium chrysogenum*. The mRNA sequence was divided into two regions with no more than 1,000 bases to comply with the sequence length requirement for secondary structure prediction using mFOLD software (The RNA Institute, University of Albany, USA). The top three most stable models based on free energy requirements were chosen, analyzed, and compared to the secondary structures of iron regulatory protein 1 (IRP1), another regulatory aconitase in humans. Secondary structures identified include hairpin loops (stem-loops), helices, internal loops, bulges, junction secondary structures, and the more complex pseudoknots, kissing hairpins, and hairpin-bulge contacts. These structures either up-regulate or down-regulate translation to protein, or provide transcriptional attenuation signals through interaction with transcriptional and translational factors.

The presence of several secondary structures in the *lys3* mRNA reveals the complexity of its own regulation. Depending on intracellular dynamics, interaction with transcriptional and translational factors could up- or down-regulate *lys3* expression, which in turn control interaction with other genes in the á-AA pathway.

Keywords: homoaconitase, mRNA, secondary structures, IRP1, á-AA

DEVELOPMENT AND CHARACTERIZATION OF MICROSATELLITE MARKERS IN FOUR PHILIPPINE ENDEMIC AND NATIVE CYPRINID SPECIES

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Family Cyprinidae has the most number of species in the world, several of which are native/endemic in the Philippines. These endemic and native species are threatened by both human practices and the changing environment and yet little or no information is known about them. Using microsatellite enrichment protocol, microsatellites were isolated, characterized, and markers were developed from *Puntius bantolanensis*, P. manguaoensis, Rasbora argyrotaenia, and Nematabramis alestes. The ubiquitous distribution of microsatellites among teleost species is evident since most of the sequences were similar to microsatellite-containing DNA sequences of zebrafish and common carp. Different microsatellite motifs from dinucleotides to tetranucleotides were observed. Seven primer pairs from *P. bantolanensis*, five from *P. manguaoensis*, and three from *R.* argvrotaenia, were designed. A total of twelve primer pairs including a previously published primer pair successfully amplified microsatellite loci across four species. The markers were mostly polymorphic when tested for cross-amplification against the four species. Using the developed markers, preliminary analysis of 13-15 individuals from each species detected as high as eleven alleles per locus. The average expected heterozygosity (H₂) ranged from 0.400 to 0.659. The markers have generally good polymorphic information content (PIC) values with the average ranging from 0.411 to 0 6 3 4

Keywords: Cyprinidae, microsatellites, microsatellite enrichment, primer design, cross-species amplification

BS - 41 DISASTER VICTIM IDENTIFICATION THROUGH DNA ANALYSIS: M/V ST. THOMAS AQUINAS AND SULPICIO EXPRESS SIETE SEA COLLISION

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DNA analysis is recognized as one of the primary modes of identification for disaster victim identification (DVI). As part of the DVI response of the Philippine National Police (PNP) to the sea collision involving M/V St. Thomas Aquinas and Sulpicio Express Siete sea vessels in Cebu on August 16, 2013, the PNP Crime laboratory was tasked to identify the 115 recovered victims. Seventy were identified through secondary and primary identifiers other than DNA analysis. Bones samples from the remaining 45 bodies that cannot be identified through medical, dental, or fingerprint techniques were subjected to autosomal DNA identification along with 75 buccal swabs from relatives as references using short tandem repeat (STR). DNA analysis yielded full DNA profiles from 42 bone samples and partial profiles from three bone samples. Combined DNA Index System (CODIS) 7.0 kinship software was used to identify kinship matches between the DNA profiles obtained from the relatives against the DNA profiles obtained from the victims. All matches were cross-checked with the data available for the post-mortem (PM) and ante-mortem (AM) ensuring that the sex determination from the DNA analysis concurred with the sex reported for the PM among others. As initial result, subsequent comparison of DNA profiles through kinship matching resulted in the positive identification and released of seven victims to their relatives; three body parts were associated to one victim. This is the first mass disaster victim identification conducted in the country that used DNA analysis of bones from highly decomposed bodies and the utilization of the CODIS software for comparison of DNA profiles through kinship matching. This will help developed practical approach for mass disaster human remains DNA identification process in the Philippines.

Keywords: disaster victim identification, STR, human remains, forensics, CODIS

SCREENING FOR POLYMORPHISM IN Myogenin (Myog) GENE ASSOCIATED WITH GROWTH RATE AND MUSCLE MASS IN LOCAL PIGS (Sus scrofa)

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The use of marker-assisted selection in pig (Sus scrofa) industry has become an essential component in culling/selection program for breeder animals. One of the genes of interest is the Myog (myogenin) which belongs to the MvoD gene family that controls the muscle fiber formation or myogenesis during embryonic development. Based on previous studies, the number of myofibers is positively correlated with growth rate and muscle mass gain in pigs. Thus, this study aimed to identify polymorphism of myogenin gene associated with growth rate and muscle mass in local pig population. Genomic DNA samples were extracted from blood samples of 255 pigs of various breeds. Using *Myog* marker, samples were analyzed through Polymerase Chain Reaction (PCR)-Restriction Fragment Length Polymorphism (RFLP) technique. The PCR products were digested by MspI restriction enzyme. Sequence analysis of the PCR products were done with the ABI Genetic Analyzer 3500. The sequence information obtained from the PCR products were verified with reference sequence using National Center for Biotechnology Information (NCBI) BLAST. Results revealed the genotypic frequencies were 0.91, 0.08 and 0 for AA, AB and BB genotypes, respectively, and the allele frequencies were 0.95 for A, and 0.05 for B. Sequences also showed 94-98% for AA and 85-93% for AB similarity with the genotype of Sus scrofa myogenin gene, complete coding region (cds) using NCBI BLAST. The presence of allele A of myogenin gene favors the growth rate and the muscle mass of the animal. This beneficial allele A was discovered to be a T to C transition in exon 1 of pig chromosome 9. Through the use of this genetic marker, selection of allele A will potentially increase the efficiency of swine production in the country. Larger sample size is recommended for further research

Keywords: pig, *myogenin*, myofiber, myogenesis, marker-assisted selection (MAS)

BS - 43 GROWTH PROMOTING PERFORMANCE OF BACTERIAL ISOLATES FROM THE RHIZOSPHERE OF TARO (Colacasia esculenta Linn.) ON CORN (Zea mays L.)

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The process of manipulating crop rhizosphere microbial population by inoculation of beneficial bacteria to increase plant growth (PGPR Technology) is an option by crop growers to improve plant yield while attaining food security and modest income, regaining biodiversity and supplying quality food to the local communities. This study evaluated the growth promoting performance of bacteria from the rhizosphere of Taro (C. esculenta) on Corn. Vegetative growth response of corn grown for one month on soil inoculated with the rhizobacteria was evaluated using these parameters: percent germination, number of leaves, plant height, root, shoot and total plant biomass. There were three rhizobial isolates from Taro: Isolates A (Gram positive circular coccus), Isolate B (Gram positive irregular rod) and Isolate C (Gram negative circular coccus). PGPR activity of the three isolates on corn showed comparable responses in terms of % germination, survival and number of leaves. Control plants (no inoculants) and plants inoculated with Isolate A obtained the highest percent (90%) germination and survival and 70% and 65% for plants grown with Isolates B and C as inoculants. Similarly comparable growth in height was observed in control and experimental plants at 7 Days After Emergence (DAE) with 15.13cm height in control plants and 12.77 cm, 12.24 cm, and 11.62 cm for Isolates C, B and A respectively. However, at 14, 21 and 28 DAE, experimental plants were noncomparably taller with greater biomass than control plants with plants grown in soil inoculated with Isolate C being the tallest (62.11 cm) with 5.18g biomass but comparable to those grown in soil inoculated with Isolates B and A with 61.85 cm , 5.08g and 58.62 cm,5.5g in height and biomass respectively while the control plants were the shortest (48.62 cm) with 3.48g biomass. Results indicate PGPR property of the isolates from Taro thus establishing their potential as bio fertilizer.

Keywords: PGPR technology, rhizosphere, taro, corn, biofertilizer

ISOLATION, IDENTIFICATION, AND PARTIAL EVALUATION OF POLYETHYLENE GLYCOL AND LOW-DENSITY POLYETHYLENE DEGRADING-BACTERIA FROM PAYATAS DUMPSITE, QUEZON CITY, PHILIPPINES

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The durability, inexpensiveness, and versatility of plastics have made them a staple item in our lifestyle. However, disposal of plastics poses a problem because they remain unchanged for many years even after disposal as they are non-polar and inert in nature. The employment of biological systems, such as bacteria and fungi, presents a potentially more efficient process of degrading plastics in comparison to other methods such as incineration and burial. The latter processes both release chemicals causing health and environmental issues. This study isolated and identified four bacteria from Payatas Dumpsite which are capable of degrading plastic components such as polyethylene glycol (PEG) and low density polyethylene (LDPE) films. These bacteria were identified as Kocuria kristinae, Dermacoccus nishinomiyaensis, Pseudomonas stutzeri, and Acinetobacter haemolyticus. They were evaluated in terms of their plastic degrading capabilities through their emission levels of carbon dioxide. Furthermore, scanning electron microscope (SEM) microphotographs were used to view the degradation, as evident by the cracks and crevices present on the surface of the films, caused by the bacteria. Given the optimum conditions, these bacteria may have the potential to degrade plastics, particularly PEG and LDPE, in a faster and more efficient way than they do in the dumpsites.

Keywords: polyethylene glycol, low density polyethylene, clear zone technique, scanning electron microscopy

FIRST REPORT OF PLASMODIAL MYXOMYCETES IN QUEZON NATIONAL PARK – A LOWLAND KARST LANDSCAPE IN THE PHILIPPINES

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Karst forest has a distinct landscape characterized by a highly alkaline soil. This specialized topography support many unique species of plants and animals. Can this also be true for slime molds? Thus, documenting species in this area is important for biodiversity research. In this study, aerial and ground leaf litter, and twigs from karst forest in Quezon National Park were cultured in moist chambers and assessed for abundance, occurrence, and diversity of myxomycetes. From the 35% positive moist chambers for myxomycetes, a total of 23 species from 9 genera were identified. One species, *Physarum pezizoideum*, is a new record for the Philippines. Aerial litter from the karsts forests had the highest number of species as compared to other substrates. *Arcyria cinerea* was the most abundant among the species recorded. This is the first study to document the occurrence and diversity of myxomycetes from a lowland karst landscape.

Keywords: biodiversity, checklist, limestone forest, slime molds, tropics

ISOLATION AND IDENTIFICATION OF ENTEROBACTER SP. ISOLATED FROM FROGS FOR ANTI— Batrachochytrium dendrobatidis ACTIVITY

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Batrachochytrium dendrobatidis, a chytrid fungus, is the causative agent of chytridiomycosis that has been associated with mass mortality and amphibian extinctions worldwide. Mitigating strategies are, thus, among the major concerns in the conservation of amphibian population and biodiversity. In this study, cutaneous bacteria from frogs were isolated and examined for anti-B. dendrobatidis activity. Six species of frogs were collected at Mt. Palay-palay Mataas na Gulod National Park in Cavite - a site positive for the presence of chytrid fungus-including Hylarana similis, Limnonectes woodworthi, Occidozyga laevis, Platymantis corrugatus, Rhacophorus pardalis and Polypedates leucomystax. Bacteria were isolated from the skin of frogs by swabbing surfaces of the body and inoculated in R2A agar incubated at 23±3°C for 24 hours. Bacteria were challenged against *B. dendrobatidis in vitro* through zoospore inhibition assay. Formation of clear zone around the bacterial isolate indicated the antifungal properties against B. dendrobatidis. Results showed that frogs shared a common bacterium Enterobacter sp. as identified using 16S rRNA universal primers for bacteria. Enterobacter sp. developed clear zones in the lawn of *B.dendrobatidis* zoospore *in vitro* which revealed the anti—*B*. dendrobatidis activity of this bacterium. As a conclusion, Enterobacter sp. isolated from skin of frogs inhibited the growth of *B.dendrobatidis* that may contribute to their defense and immunity against the lethal chytridiomycosis.

Keywords: *Enterobacter sp.*, chytrid fungus, *Batrachochytrium dendrobatidis*, chytridiomycosis, frogs

GROWTH PROMOTING ACTIVITY OF INDOLE-PRODUCING ENDOPHYTES FROM ZAMBALES MANGROVE AND ITS BIOLOGICAL CONTROL AGAINST *Ralstonia solanacearum*

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Fungal endophytes were isolated from leaves, stems and roots of mangrove plants in Zambales to investigate its ability to promote growth of Musa acuminata and as biological control against Ralstonia solanacearum. The isolates were subjected to IAA-test using Salkoswski"s reagent and agar plug assay. IAA-producing isolates formed red halo with different intensities that is proportional to the concentration of IAA produced. Out of 19 endophytic fungi isolates, two endophytes (from roots of Pemphis acidula and Excoecaria agallocha) were able to inhibit the growth of R. solanacearum (23.7mm & 10.9mm, respectively). M. acuminata plantlets were then infected with the following IAA-forming endophytes to assess the potential of promoting shoot growth. Isolate from leaves Bruguiera sexangula produced the highest level of IAA, Three treatments were done (T1 endophytes from leaves of *B. sexangula*, T2 from roots of *P.* acidula & T3 was mixture of both) and observation of the plantlets height were observed every 2 weeks. Results showed that both treatment 2 and 3 promoted growth of *M. acuminata*. Based on this result, IAA-producing endophytes can significantly increase the growth of *M. acuminata* and can be used as biocontrol agents against R. solanacearum.

Keywords: Ralstonia, Pemphis, Musa acuminate, IAA, endophytes

ISOLATION AND CHARACTERIZATION OF BACTERIA CAPABLE OF CRUDE OIL DEGRADATION IN MUSUAN, BUKIDNON

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Isolation and characterization of morphological characteristics of bacterial isolates from uncontaminated and forested areas in Musuan, Bukidnon with the capability to degrade hydrocarbon materials was carried out through enrichment and purification methods for one month, and confirmed by measuring the range of clear zone produced. This study aimed to provide additional information on microorganisms that has the capability of degrading toxic contaminants but present in an area unexposed to pollutants, through basic microscopy and macroscopic characteristic useful in the field of bioremediation. Results revealed that out of 19 pure isolates obtained, 12 isolates (63%) showed positive results for oil degradation and 7 (37%) were negative. The highest measurement of clear zone confirmation test for oil-degrading bacteria was 18 mm (1.8 cm) observed in isolates 2 and 18, followed by isolate 1 with clear zone 1.7 cm. Both isolates 2 and 18 are gram-negative bacilli (rod shape) but with different colonial morphology. These results suggest that hydrocarbon degrading microorganisms are naturally present in the nature; thus, there is great efficiency in breaking down the toxic pollutants naturally in places that are inadvertently contaminated with oil. Therefore the 12 isolates positive for oil degradation are very useful in bioremediation. Further study is recommended to explore more on the eco-physiological activities of these bacteria for bioremediation purposes.

Keywords: bacterial isolates, bioremediation, hydrocarbon, clear zone, bacilli

ANTI-BACTERIAL ACTIVITY OF LACTIC ACID BACTERIA ISOLATED FROM MUSCOVADO-BASED KEFIR FROM LEYTE, PHILIPPINES

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Kefir is an acidic beverage made from the fermentation of different substrates such as milk, soymilk, rice, oat milk, coconut, fruit and sugary water by kefir grains. A village in Leyte, Philippines, however, uses muscovado sugar solution as the fermentation substrate for kefir grains. The muscovado sugar-based kefir was analyzed daily for three days in terms of lactic acid bacterial counts on de Mann Rogosa and Sharpe Agar (MRSA), which ranged from 10⁵ to 10⁶ CFU/ml.

Extraction of the DNA of ten selected putative lactic acid bacterial isolates was done. Amplification of the 16S rRNA gene was performed using the universal bacterial primer pair 27F and 1492R. Sequence analysis revealed that isolates 64a, 77, 86, 87a and 93 were Lactobacillus satsumensis str. NRIC 0604, isolates 72 and 79 were Lactobacillus paracasei subsp. tolerans str. NBRC 15906, Isolate 88 was Lactobacillus oeni str. 59b and Isolate 96 was *Lactobacillus ghanensis* str. L489. In addition, isolate 78 was confirmed as Corynebacterium variabile str. DSM 20132. The antibacterial activity of the lactic acid bacteria isolated from muscovado-based kefir drink, which was done using the direct inhibition assay, was exhibited in varying degrees by Lactobacillus satsumensis (64a), Lactobacillus oeni (88), Lactobacillus ghanensis (96) and the Lactobacillus paracasei isolates (72 and 79) against eight test organisms namely, Listeria innocua 33090, Listeria ivanovii, enterohemorrhagic Escherichia coli 10311 (EHEC), Klebsiella oxytoca B-1753, Serratia marcescens B-1748, Enterobacter aerogenes B-1141, Salmonella Enteritidis and Bacillus cereus 1509.

Keywords: kefir, kefir grains, fermentation, muscovado sugar, lactic acid bacteria, anti-bacterial activity

BS - 50 MYXOBACTERIA WITH NEMATICIDAL ACTIVITY ISOLATED FROM FOREST SOILS OF MT. MALINAO, ALBAY PROVINCE, PHILIPPINES

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Myxobacteria are swarming Gram negative rods which typically produce fruiting bodies. They are considered to be a good source of novel secondary metabolites but local studies on myxobacteria are limited due to the difficulty in isolating and purifying them. This study was conducted to isolate myxobacteria from forest soils collected from Mt. Malinao and evaluate their nematicidal activity. Eleven putative myxobacteria were isolated using the dung plate, coli-spot and yeast-spot plate methods. Cluster analysis of the myxobacterial phenotypes (based on vegetative cell morphology, swarm colonies, fruiting bodies and myxospores) using PAST software and analysis of their 16S rDNA sequences were conducted using CLUSTAL W algorithm of MEGA Version 5. Representative isolates were cultivated for four days in CTT medium (150 rpm at 30°C) containing XAD-16 adsorber resin. The crude extracts were recovered using methanol-acetone (1:1) solvent and tested (using 50 mg/ml) for nematicidal activity against Caenorhabditis elegans Bristol N2 fed with Escherichia coli OP50. Cluster analysis revealed that the isolates belonged to suborders Cystobacterineae and Nannocystineae. The

16S rDNA sequences showed that only isolates L4D5 and L4D9 had 100% similarity with *Myxococcus fulvus* and *M. virescens*, respectively. High percentage nematode mortalities were noted for isolates L4D1 (90.33% \pm 3.06), L4D9 (86.00% \pm 3.61 and L5C1 (71.67 \pm 5.51); the positive control mebendazole (20 mg/ml) exhibited 100% mortality. To our knowledge, this is the first report of nematicidal activity of local myxobacterial isolates.

Keywords: myxobacteria, nematicide, Mt. Malinao, *Myxococcus*, *Caenorhabditis elegans*

ISOLATION AND CHARACTERIZATION OF PLANT GROWTH PROMOTING RHIZOBACTERIA FROM SELECTED PLANT RHIZOSPHERES

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Organic vegetable production is now becoming popular worldwide. The contribution of microbials in supplementing nutrients for plant growth and development cannot be denied. Thus, the study was conducted to isolate and characterize plant growth promoting rhizobacteria (PGPR) from selected plants rhizosphere from November 2012 to March 2013. Samples were gathered and standard procedure for microbial isolation was performed. Isolated colonies were characterized in terms of size, form, margin, elevation, surface, pigmentation, opacity and gram stain reaction. Microbial isolates were purified and mass produced for evaluation. Six isolates were applied and evaluated on corn plant through a pot experiment under screen house condition. This was arranged in Complete Randomized Design with three replications. Plant height and total plant biomass were gathered. Analysis of variance was determined using Crop Stat and mean comparison was done using Least Significant Difference Test.

All the isolates have creamy to dirty white color, circular, raised elevation, sharply defined ages and gram positive. Inoculated corn plants using the six isolates were taller than the uninoculated corn plants. Moreover, corn plants inoculated with LB1 produced the heaviest total biomass with 3.20 g followed by LR1 (2.57 g) and SC4 (2.40 g). Result of the biochemical characterization of the three isolates confirmed that the three isolates have the ability to reduce nitrate, can utilize citrate as their carbon use and they are aerobic. The three isolates have positive reaction to mannitol, xylose glucose, mannose, maltose and trehalose. Also, LB1 has a positive reaction to lactose, cellobiose and fructose indicating that the isolate can degrade cellulose. Biochemical characterization suggests that the three isolates are under Bacillus sp.

Keywords: microbials, rhizosphere, rhizobacteria, isolates, biochemical reaction

BS - 52 UTILIZATION OF CRUDE OIL BY *Pseudomonas* sp. M4 ISOLATED FROM SOIL

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Crude oil is a complex mixture of hydrocarbons and nonhydrocarbons, including a wide range of nitrogen, sulphur, oxygen and chlorine containing compounds. The complex structure of raw petroleum makes it a good substrate for biodegradation studies. The current study aimed to isolate and identify bacteria from soil capable of utilizing crude oil as carbon and energy source. One part of the study included analysis of individual bacterial growth and residual oil as parameters to determine bacterial isolates capable of utilizing crude oil as carbon source. 16S rRNA gene sequencing identified one of the candidates as Pseudomonas sp. M4. The growth of *Pseudomonas* sp. M4 was significantly higher (p < 0.05) in mineral medium with 1% crude oil than in mineral medium without crude oil (Fig 1). Results of spectrophotometric analysis (ABS $_{420}$) showed that residual oil in the experimental group was significantly lower than the control (Fig 2). Both results suggest that the bacterial isolate can utilize crude oil as carbon source. The results of the present study are consistent with other reports suggesting the ability of members of the genus Pseudomonas to utilize a wide range of substrates including crude oil.



Keywords: biodegradation, crude oil, hydrocarbons, 16S rDNA, *Pseudomonas*

BS - 53 AQUACULTURE ANTIBIOTHERAPY ALTERNATIVE: BACTERIOPHAGE COCKTAIL THERAPY FOR MOTILE AEROMONAD SEPTICEMIA (MAS) INFECTED Oreochromis niloticus (TILAPIA)

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The emergence of antibiotic resistance to numerous medically and industrially significant bacteria such as Aeromonas hydrophila poses dilemma over the search for novel therapeutic agents. Bacteriophages possessing lytic activity towards host bacterial cells are now being explored by pharmaceutical companies as alternative to the burdening antibiotic resistance. The potential of a previously isolated phage (UP87) and a newly isolated phage (B614) both belonging to Family Myoviridae were tested as therapeutic agents in bacterial disease control against Motile Aeromonas Septicemia (MAS)-infected O. niloticus (Tilapia). Experimentally induced septicemia was done by i.p. injection (108 CFU/ml) in juvenile Tilapia. After 24 h- post infection, efficacy testing was performed by oral administration of antibiotic impregnated feeds (0.35 mg tetracycline g⁻¹ bw⁻¹ day⁻¹ for 14 days) and phage impregnated feeds both for mono-therapy with phage UP87 (4.8 x 10¹¹ PFU g⁻¹ 5% bw⁻¹ day⁻¹ for 14 days) and B614 (1.33 x 10¹¹ PFU g⁻¹ 5% bw⁻¹ day⁻¹ for 14 days) and cocktail therapy phage UP87/B614 (4.8 x 10^{11} PFU/1.33 x 10^{11} PFU g⁻¹ 5% bw⁻¹ day⁻¹ for 14 days). Blood analysis by plate count method revealed no significant differences between reductions in bacterial colony growth for all the treatments done. The results suggest that the curative potentials of phage therapy (mono- and cocktail) and antibiotherapy are the same for each treatment, indicating that phage therapy is as effective as antibiotic therapy. Furthermore, phage therapy offers advantages over the conventional anti-biotherapy as it is (i) eco-friendly, (ii) cost efficient and (iii) there is ease of production.

Keywords: *Aeromonas hydrophila*, antibiotic resistance, phage therapy, tetracycline, *myoviridae*

CHARACTERIZATION OF LACTIC ACID BACTERIA ISOLATED FROM CAPE GOOSEBERRY OR LOBO LOBOHAN (*Physalis peruviana*)

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The recent trend in the Philippines' scientific research is the

development of functional food products from probiotic microbial resources and selected common plants due to their reported health benefits. Thus, the objective of this study is to isolate lactic acid bacteria (LAB) from cape gooseberry and to determine their antimicrobial activities and diacetyl production.

Out of the sixty-seven presumptive LAB isolates obtained from ripe fruit of cape gooseberry, five were putative, namely Lb 6, Lb 17, Lb 21, Lb 24 and Lb 29. All were lactic acid-formers, Gram (+), KOH (-) catalase (-)and diacetyl producers. Antimicrobial activities (mm²/cfu) by dual agar overlay method showed that Lb 17 exhibited highest antimicrobial activity against *Listeria inocua* (9.42), *Staphylococcus aureus* (34.61) and *Bacillus cereus* (27.49) while Lb 21 exhibited highest antimicrobial activity against *Escherichia coli* (15.56) and *Salmonella typhimurium* (11.34). Both isolates have comparative antimicrobial activities against *E. coli* 0157:H7. All the isolates tested showed no inhibition against *Enterococcus faecium* indicating possible co-culture in living systems. Based on 16S rRNA analysis, Lb 17 and Lb 29 were identified as *Streptococcus luteciae* and *S. lutetiensis*, respectively while the other three will still to be confirmed.

The results suggest that, using these LAB isolates and lobo lobohan, there is a possibility of developing functional food products and natural antimicrobials applicable not only for humans but also for animals.

Keywords: antimicrobial, cape gooseberry, functional food, lactic acid bacteria, probiotics

POLYPHENOLS FROM DURIAN PEEL – EXTRACTION, ANTIOXIDANT CAPACITY AND UTILIZATION IN YOGURT

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Studies have shown that durian flesh or aril possessed high nutritional and bioactive phenolic compounds. The peel is about 70-85% of the fruit and with tons of durian fruits consumed and processed, tons of durian peels as wastes were generated. The study aims to determine the potential of the peel as source of phenolic antioxidants.

The study deals with the enzymatic extraction of polyphenolics from durian peel, characterization of its antioxidant properties such as 2,2 diphenyl-1-picrylhydrazyl free radical scavenging activity (DPPH assay), ferric reducing activity (FRAP test) and copper reducing activity (CUPRAC test). The durian phenolic extract was supplemented in yogurt as functional ingredient to fortify its phenolic content.

The established enzymatic process of polyphenolics extraction from durian peel increased phenolic yield by 36%. The durian peel phenolic extract exhibited higher antioxidant properties than ascorbic acid and synthetic antioxidants but lower than pure phenolic compound, gallic acid. Sensory evaluation and chemical analysis of phenolic fortified yogurt showed that durian phenolics had no detrimental effect on the acceptability and color of yogurt. The health benefitting effect of yogurt was enhanced as indicated by increased phenolic content and improved antioxidant capacity.

The results showed that durian peel can be potential source of polyphenolics that could be used as food supplement supplying antioxidants that could reduce the risk of developing chronic diseases.

Keywords: polyphenols, antioxidants, DPPH activity, reducing activity

CHLOROPHYLLS A AND B FROM CAMOTE LEAVES: EXTRACTION, COLOR STABILITY AND APPLICATION

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Matured camote leaves can be utilized and serve as an excellent value-added product source of chlorophylls as food colorant. The study aimed to obtain an optimized protocol for the enzymatic extraction of chlorophylls from camote leaves, evaluate their stability and use them as food colorant.

To obtain maximum yield efficiency, enzymatic process conditions that include type and concentration of enzyme, duration of pre-treatment time, duration of extraction and volume of extracting solvent, were optimized. The optimized conditions were cellulase, 3 mg, 0.03 h - vortex mixer, 6 h and 40 mL, respectively.

The color stability was evaluated in terms of the effect of light, pH and temperature using the CIELab colour parameters (L*, a*, b* and $\ddot{A}E^*_{ab}$). At low pHs, chlorophylls *a* and *b* degrade faster than at higher pHs. Furthermore, exposure to light and high temperatures during storage degrade chlorophylls.

Extracts were subjected to freeze-drying with different maltodextrin concentrations (2.5, 2.0 and 1.5%) and used in jelly and hard sugar candies. The green color of candies lasted for six days using subjective optical evaluation.

Keywords: chlorophyll a and b, natural colorant, food dye, enzymatic extraction, CIELab colour parameters

SCREENING AND TISSUE LOCALIZATION OF PHYTOCHEMICALS ON THE RHIZOME AND LEAVES OF *Etlingera dalican* (Elm.) A.D. POULSEN (ZINGIBERACEAE)

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Etlingera dalican (Elm.) A.D. Poulsen is a Philippine endemic species which belongs to family Zingiberaceae, a family characterized to possess aromatic oils and many species having medicinal values. The study was conducted to evaluate the presence of phytochemicals and determine the localization on the different tissues of *E. dalican*. Determination of the presence and relative abundance of phytochemicals in terms of color reaction and precipitate formation were done through qualitative phytochemical screening. Likewise, histochemical tests were done to determine the presence of some active components and their localization on the tissues of rhizome and leaves. Phytochemical studies revealed that alkaloids, fixed oils and fats, flavonoids, arbutin, proteins, reducing sugars, saponins and tannins were present on the leaf and rhizome of E. dalican. Fats and oils, saponins, tannins and reducing sugars were found to be highly concentrated both in rhizome and leaf. On the other hand, amygdalin and gums and mucilages are undetectable in both rhizome and leaf. Histochemical tests supported the result revealed in the phytochemical screening; that is, alkaloids, fixed oils and fats, saponins and tannins were observed to be present on the different tissues of the rhizome and leaf of E. dalican. Furthermore, amygdalin was neither observed in the tissues of rhizome nor in the leaf. In this study, the phytochemicals found in the rhizome were also found in the leaves. However, they vary in their relative abundance and localization on the different tissues

Keywords: *Etlingera dalican,, flavonoids, phytochemical, histochemical, Zingiberaceae*

ASSESSMENT OF Jatropha curcas L. BIODIESEL SEED CAKE TOXICITY USING THE ZEBRAFISH EMBRYO TOXICITY (ZFET) TEST

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Consequent to the growing demand for alternative sources of energy, the seeds from J. curcas remain to be the favourite for biodiesel production. However, a significant volume of the residual organic mass (seed cake) is produced during the extraction process which raises concerns on safe waste disposal. In the present study, we assessed the toxicity of J.curcas seed cake using the zebrafish embryotoxicity (ZFET) test. Within 1 hour postfertilization, the eggs were exposed to 5 mass concentrations of J. curcas seed cake extracts and were followed through 24, 48, and 72 hpf. Toxicity was evaluated based on lethal endpoints induced on zebrafish embryos namely; egg coagulation, non-formation of somites, and non-detachment of tail. The lowest concentration tested, 1 g/L, was not able to elicit toxicity on embryos whereas 100% mortality was recorded at the highest concentration at 2.15 g/L. The computed LC50 for the J. curcas seed cake was 1.61 g/L. No further increase in mortality was observed in the succeeding time points (48 hpf and 72hpf) indicating that J. curcas seed cake exerted acute toxicity to zebrafish embryos. A number of sublethal endpoints (eg. pericardial and yolk sac edema, less pigmentation, and embryo malformations) were noted in zebrafish embryos exposed to higher concentrations. The observed toxicity endpoints induced on zebrafish embryos were discussed in relation to the phorbol esters that have remained in the seed cake even after extraction

Keywords: zebrafish, *Danio rerio*, embryotoxicity, Jatropha curcas, phorbol esters, seed cake, ZFET test

CASHEW (Anacardium occidentale L.) BARK EXUDATE AS ALTERNATIVE MOUNTING MEDIUM FOR BONE UNDECALCIFIED SECTION

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The feasibility of using cashew (*Anacardium occidentale* L.) bark exudates as a mounting medium for bone undecalcified section in microscopy was explored using two criteria for evaluation: 1) clarity of the mounted material and 2) adhesion.

Ten slides of bone undecalcified sections mounted with cashew bark exudates were compared to 10 slides of the same material mounted with Canada Balsam. Slide preparation was randomized to avoid bias towards any group. Ten respondents assisted in the evaluation following the blinding method. Nominal scales for the two criteria were set. For Clarity: 1 - clear, 2 – not clear and 3 - undecided. For Adhesion: 1 - strong if the cover slip does not move, 2 - weak if the coverslip moves and 3 – undecided. The t-test was used in the data analysis.

The findings show no significant difference between the two groups as regards clarity and adhesion. Furthermore, only 70% ETOH was used in the processing of the cashew- mounted sections. Unlike the balsam mounts, clearing was not needed and noxious odor was not observed in the cashew group. Slight discolorations in some slides were seen but this did not affect clarity.

Keywords: cashew exudates, mounting medium, microscopy

PHILIPPINE WILD Ganoderma lucidum (W.Curt.:Fr.) P. KARST. (HIGHER BASIDIOMYCETES) EXHIBITS APHRODISIAC PROPERTY IN MALE MICE (Mus musculus)

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Sexual dysfunction, the inability to achieve normal sexual intercourse, is a significant problem that may contribute to infertility function. With this fact, people are searching for natural agents (food or plant extracts) that would enhance their sexual behavior and fertility, which are termed as aphrodisiac. Many studies have been conducted to discover different plant extracts with aphrodisiac property, however, no study was found using mushrooms. In this study, the aphrodisiac activity of Philippine wild Ganoderma lucidum extract was evaluated in male mice. Male and female mice (21-34 g) were purchased and acclimatized. Male mice were administered with the hot water extract (100% and 50% concentrations) in two means (oral gavage and intraperitoneally). Thirty minutes after administration, male mice were introduced to female mice and their sexual behavior was observed. Result revealed that 50% of G. lucidum extract orally administered was the most effective which significantly registered the highest number of mounting with a mean of 4.67, highest number of whiffing of vagina with a mean of 25.33, shortest time of occurrence of mounting and highest rate of sexual behavior. Low rate of sexual behavior was observed in intraperitoneally administered male mice primarily due to the physical stress brought by the extract administration. This first study proved that mushroom, G. lucidum, extract exhibits aphrodisiac property in male mice.

Keywords: G. lucidum, aphrodisiac, mounting, infertility, mushrooms

ANTIOXIDANT PROPERTY AND HEPATOPROTECTIVE EFFECT OF ROSELLE (*Hibiscus sabdariffa L.*) FRUIT PEEL EXTRACT IN WHITE MICE (*Mus musculus L.*)

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This study determined the physiologically active constituents responsible for the antioxidant property of the ethanolic fruit peel extract of roselle (*Hibiscus sabdariffa L.*); investigated its antioxidant property by means of DPPH and *In-Vitro* Lipid Peroxidation Assays, and evaluated its hepatoprotective effect in white mice through histological examination and liver function marker.

The study was laid out in Completely Randomized Design (CRD) with two different sets of treatments for the bioassays and replicated three times. Data were analyzed using Analysis of Variance (ANOVA).

The determination of the active constituents present in the concentrated ethanolic roselle fruit peel extract followed the standard procedures. Based from the results, this contains alkaloids, deoxysugars present in steroids, ¥-benzopyrene nucleus present in flavonoids, and polyphenolic compounds. It also contains high degree of abundance of gums, mucilages, glycosides; carbohydrates, reducing sugars, proteins and its derivatives and a low degree of abundance of tannin and tannin derivatives.

Results on the DPPH assay showed that there is a highly significant difference among the different treatments. It shows that T1 (2%) has the greater antioxidant property. However, results on the In-vitro Lipid Peroxidation assay, revealed that there is no significant difference among the different treatments.

The results on the liver function marker showed that there is a hepatoprotective effect of roselle fruit peel extract as revealed by the level of aspartate aminotransferase and histological examination.

Keywords: antioxidant, lipid peroxidation, hepatoprotective, liver function marker, aspartate aminotransferase

PHYTOCHEMICAL SCREENING IN TWO NEW SPECIES OF PITCHER PLANTS, Nepenthes ceciliae AND N. pulchra

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New species of pitcher plants are continually being discovered, especially with the observed high hybridization rate in this group of carnivorous plants. There are reports on their medicinal use, particularly the fluid of unopened pitchers. This study carried out qualitative phytochemical tests on the fluid of the unopened pitcher and methanolic extracts from leaves with pitchers of the two species, Nepenthes ceciliae and N. pulchra. Phytochemical tests showed that *N. ceciliae* contains gum and mucilages, flavonoids and acidic compounds in the fluid of its unopened pitcher. The leaf methanolic extract was positive for glycosides, tannins, flavonoids, phenolic compounds and acidic compounds. On the one hand, it was revealed that the fluid of unopened pitcher of *N. pulchra* contained fixed oils and fats, gum and mucilages, and acidic compounds. The leaf methanolic extract of N. pulchra had the presence of flavonoids, acidic compounds and fixed oils and fats. Both species contain flavonoids and acidic compounds. However, glycosides, tannins and phenolic compounds were detected only in *N. ceciliae* while proteins, fixed oils and fats were found only in *N*. pulchra. Alkaloids, saponins, steroids and terpenoids were not detected in the extracts for both species. Certain phytochemicals are used by pitcher plants to create a slippery surface in pitchers for catching its prey as well as for digestion of prey. Furthermore, the presence of these phytochemicals suggests a potential of these two new species of pitcher plants as medicinal source.

Keywords: phytochemicals, pitcher, plants, extracts, carnivorous
ANTIANGIOGENIC AND DEVELOPMENTAL EFFECTS OF *Excoecaria agallocha* L. (Euphorbiaceae) LEAF EXTRACT USING TWO VERTEBRATE MODELS

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This study explored the use of ethanolic leaf extract concentrations from the mangrove *Excoecaria agallocha* L. for potential antiangiogenic properties, as well as evaluate the effect of the treatment in relation to the overall growth and development in avian and mammal models—the duck *Anas platyrhynchos* and the *Rattus norvegicus* Sprague Dawley rat strain embryos. The antiangiogenic potential of the extract was also tested using the duck model for chorioallantoic membrane (CAM) assay.

Results show that *E. agallocha* ethanolic leaf extracts have a potent antiangiogenic property as evidenced by suppression of blood vessel growth through decreased vascular densities in the duck chorioallantoic membrane (CAM) assay which are significantly reduced with the higher doses (75% & 100%). However, higher concentrations utilized were able to induce disruption in growth and development for both duck and rodent embryos. High concentrations of the extract (75%, 100%) were able to induce resorption of embryos although no resorption was observed in lower doses and morphometric indices were normal for treated samples.

Results of this study suggest that the extract has potential antiangiogenic activity; however, should not be applied for gestating subjects as seen in its capacity to resorb embryos at higher concentrations. These results of this study confirm the potent effects of the plant that is applied to poison fish and as abortifacient in folk medicine. The present results open new therapeutic potentials of *E. agallocha* as antiangiogenic if formulated in lower concentrations in addition to its myriad of therapeutic effects towards chemo-prevention.

Keywords: Buta-buta, angiogenesis, CAM, morphometry

BS - 64 REPRODUCTIVE MODE AND PATTERN OF THE SCLERACTINIAN CORAL *Porites cylindrica* IN BOLINAO-ANDA REEF COMPLEX, NORTHWESTERN PHILIPPINES

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The study reports the first evidence of the reproductive mode of the coral Porites cylindrica in the Bolinao-Anda reef complex northwestern Philippines. P. cylindrica was found to brood and release actively swimming zooxanthellate larvae. The reproductive pattern experiments during 4 lunar cycles: March-April, May-June, September-October and November-December 2013 reveal that Porites cylindrica demonstrate remarkable lunar periodicity in planulation with the grand mean peak of release on the 25th - 27th lunar day or few days before the new moon. Planulation was also observed to occur at each colony within one to eight consecutive days during the specified lunar phase. However, what the lunar cycle entrains, like in other lunar periodicity studies, remains a question. P. cylindrica also showed significant diel timing in planulation. Unlike most brooders that release during the dark hours or before sunrise, planulation exclusively occurred during daytime and no release at night. Observations were made at 3-hour intervals for 24 hours and planulation generally occurred from 6:00 until 18:00. The grand mean hour of planulation was between 8:00-11:00, observed within 5 diel cycles in April to November 2013. Its exclusive release at daytime is an indication that the larva requires light for prompt settlement and also for the photosynthesis of the symbiont. The relatively small size of the *P. cylindrica* planula $(0.04 \pm 0.01 \text{ mm}^3)$ compared to larvae of other brooding coral species implies that it has fewer energy reserves further lending support to its need to photosynthesize immediately after release

Keywords: scleractinian, reproductive mode, reproductive pattern, diel timing, lunar periodicity

EFFECTS OF VARYING SULFUR DIOXIDE EXPOSURES ON THE EXTENT OF LIPID PEROXIDATION IN Drosophila melanogaster

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Exposure to sulfur dioxide (SO_2) has been found to cause oxidative stress, a consequence of which is a lipid peroxidation, a tissue-damaging process. The extent of the lipid peroxidation was investigated in Drosophila melanogaster flies following the exposure of larval cultures of fruit flies to 0, 0.04 and 0.4 ppm sulfur dioxide gas (designated as control, LSE group and HSE group, respectively) in an incubating chamber maintained at 27° C. The emergent adult flies from each treatment group were collected, sorted by sex and sacrificed by freezing. Homogenates of whole body tissues were subjected to colorimetric assays for catalase activity and thiobarbituric acid reactive substances (TBARS). Results revealed that catalase activity was 64% lower in the HSE groups than in the LSE group, while TBARS level was 53% higher for the HSE group of flies than in the control. The exposure of the larvae to 0.4 ppm SO, had apparently suppressed the antioxidative activity of catalase in the adult stage, hence, more lipid peroxidation byproducts such as TBARS had accumulated. Although TBARS levels were not significantly different between the HSE and LSE groups of flies, the higher catalase activity (at 0.06 nm_{AA240}/min/mg protein) in the latter group may have lessened the severity of oxidative stress effects. Because catalase levels between the control flies and the HSE group did not vary significantly, it is suggested that TBARS levels could be a more relevant biomarker of oxidative stress in the fruit fly model in relatively low level SO₂ pollution.

Keywords: lipid peroxidaton, sulfur dioxide, oxidative stress, thiobarbituric acid, catalase

PHYTOCHEMICAL STUDIES IN NORMAL AND MUTANT "MAKAPUNO" COCONUT (Cocos nucifera L.) ENDOSPERMS

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Makapuno is a mutant coconut (Cocos nucifera L.) characterized by over-proliferating endosperm, mainly grown in the Philippines and Dutch East Indies. It has a softer, viscous endosperm compared to normal coconut. This study was carried out to compare the phytochemicals of the solid and liquid endosperms of normal and mutant makapuno coconut across developmental stages (5-6, 6-7, 7-8 mos). Methanolic and hexane extracts from solid endosperms were subjected to various phytochemical tests using qualitative method. It was observed that makapuno solid and liquid endosperms generally had lower amounts of phytochemicals. The presence of alkaloids, flavonoids, saponins, terpenoids, steroids and tannins at very high concentration in normal coconut supports the claim on its nutraceutical property. Makapuno also contains all these phytochemicals but at lower concentration, suggesting a difference in metabolism between normal coconut and makapuno. Generally, methanol extracted more phytochemicals than hexane. Phytochemicals were also found mostly to increase in amount as the fruit matures. Comparing mature normal coconut and makapuno samples from four different locations also revealed a lower concentration of phytochemicals in makapuno. Variations in phytochemicals were also observed among samples from four locations probably due to soil conditions. Furthermore, these data may help shed light towards the elucidation on the molecular basis of the makapuno phenomenon.

Keywords: makapuno, endosperm, phytochemicals, coconut, extracts

TAXONOMY AND DISTRIBUTION OF CLADOCERA (WATER FLEAS) IN PHILIPPINE INLAND WATERS

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Zooplankton diversity is considered as a good indicator of the health of aquatic ecosystems and serves as the primary source of food for aquaculture fishes in the Philippines. Proper determination of their taxonomy and distribution are very important in the precise evaluation of the status of their aquatic habitats. This study updates the diversity and distribution of four Cladoceran families (Moinidae, Bosminidae, Sididae and Chydoridae) in selected Philippine inland waters. Zooplankton were collected from 86 sampling locations in major freshwaters in the archipelago which includes 53 lakes, 17 river systems, 4 reservoirs, and 12 other freshwaters such as swamps, ponds and temporary pools. From 56 species reported in previous literatures, only 15 species were encountered in this study. Our results were able to document 78 new locality records for Philippine freshwaters. Comparisons with previous studies on Philippine cladocera revealed several discrepancies, including six synonymized species. Other differences may also be attributed to variations in morphological structures which could have resulted to misidentifications. The lesser number of species found also seemed to indicate how better microscopic examination techniques helped refine the characters used to identify to species level. Recent alterations to freshwater ecosystems may have also contributed to the disappearance of some species which seems to be the case for the Chydoridae. Though no new novel species have been identified from these four families, our study provides a better understanding of distribution patterns among these taxa.

Keywords: zooplankton, freshwater, species richness, biodiversity, lakes

IDENTIFICATION OF A WILD *Dioscorea* FROM NORTHERN LUZON

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The wild Dioscorea "buga" (Ilk), which is an important human food initially found in Northern Luzon, is described for the first time. It closely resembles the cultivated Dioscorea esculenta (lesser yam) except on the long stolons and numerous branching spines on the roots which are found in the wild "buga". Among the nine valid species of yam identified in the Philippines, none of the published original descriptions match the observed morphology of *Dioscorea* "buga", and available taxonomic key is insufficient for its identification. Thus, a taxonomic review of published Philippine Disocoreas was made, and a new taxonomic key based on original descriptions was developed. Herbarium specimens were prepared from 18 natural populations from Ilocos Norte, Ilocos Sur, Abra and Cagayan, and deposited at UPLB Botanical Herbarium (CAHUP). Comprehensive morphological characterization was done on 18 planted "buga" accessions. Ten other yam accessions belonging to D. esculenta, D. alata and D. bulbifera were included to determine their genetic relationship with "buga". Morphological characters were scored using the descriptors for yam, and later analyzed through NTSYS software.

The new taxonomic treatment proposed to "buga" is *Dioscorea* esculenta (Lour.) Burkill ssp. spinosa Antonio et al. comb. et stat. nov. The Latin term for subspecies spinosa indicate the spiny characteristics of the anchoor roots. The taxonomic treatment herein given to cultivated lesser yam is *D. esculenta ssp. esculenta*. It has absent to sparse spines in the anchor roots, and very short stolons, making the small tubers clustered immediately at stem base. Results of the multivariate analysis agree with and support above taxonomic treatments given to buga and lesser yam.

Keywords: *Dioscorea*, *Dioscorea esculenta ssp. spinosa*, scientific name, identification, taxonomic key

BS - 69 MOLECULAR AND MORPHOLOGICAL EVIDENCE OF THE HYBRID ORIGIN OF A NOVEL *Begonia* SPECIES FROM THE LIMESTONE AREAS OF DINGLE, ILOILO

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Begonias are cultivated worldwide because of their attractive and beautifully patterned leaves. In the Philippines, a large 83% of the 104 species are narrow endemics and majority of them are found in limestone forests. Recently, a potential natural hybrid of Begonia, designated in this study as Begonia hybrid, was found intermediate between two other Begonia species namely the Begonia copelandii Merr. and the Begonia rhombicarpa A. DC. at Bulabog Puti-an Natural Park (BPNP) in Dingle, Iloilo. It grows on moist, coralline slopes at 200 m elevation. Initial herbarium study of Philippine Begonia was made at the Philippine National Herbarium. After which the research team made an *in situ* study of the three Begonia taxa at the BPNP. Young leaves were collected in silica gel and processed for molecular study at the Thomas Aquinas Research Center, University of Santo Tomas. Morphologically the hybrid share common characters with the parents. However, some novel characters such as dark green glossy adaxial leaf, completely white tepals and the subrhomboid fruit shape were distinct to the hybrid. The presence of polymorphic Internal Transcribed Spacer (ITS) sequences in the putative hybrid and its position in the cladogram of maximum parsimony analysis further prove that the Begonia hybrid represents progeny from natural hybridization between B. copelandii and B. rhombicarpa.

Keywords: *Begonia copelandii, Begonia rhombicarpa*, natural hybrid, ITS sequences, Bulabog Puti-an Natural Park

SIX NOVEL SPECIES OF PHILIPPINE GUETTARDEAE— RUBIACEAE FROM DINAGAT ISLAND, SURIGAO DEL NORTE

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The Philippine archipelago exhibits classical to insular ecological systems resulting from natural forces complemented by anthropogenic factors leading to over-representation of some taxonomic groups such as tribe Guettardeae of the Rubiaceae (coffee family). In a recent floristic survey of Dinagat Island, Surigao del Norte, a number of Guettardeae species exhibiting disparate features from recognized taxa were collected. Coupling methods between 1) alpha-taxonomic evaluation and 2) molecular sequencing and phylogenetic analyses were conducted to completely understand the systematics of these enigmatic species. Probabilist analyses for phylogenetic reconstructions (maximum parsimony and Bayesian inference) using the Internal Transcribed Spacer (ITS) region (nrDNA) revealed that the sampled species are nestled in the paleotropical dioecious clade of Guettardeae with strong supports. In addition, comparisons of these specimens to extant species supported our notion to recognize six (6) nomenclatural novelties in the tribe, making the Philippines as one of its centers of diversity.

Keywords: α-taxonomy, Guettardeae, ITS region, Philippines, phylogenetics, Rubiaceae

ENGINEERING SCIENCES AND TECHNOLOGY

EST- 01

INCREASED ETHANOL YIELD FROM NIPA SAP VIA IMPROVED FERMENTATION PROTOCOL

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Nipa (*Nypa fruticans*), is an indigenous palm species native to the coastlines and estuarine habitats throughout the country. It produces sap that contains 15 to 21° Brix sugars. To harvest this sugar, nipa flower clusters are tapped before they bloom using open bamboo vessels that allow continuous aerobic fermentation. This fermented sap yields a sweet, potable alcoholic beverage called "tuba" with ethanol concentration ranging from 2 to 3% ethanol. An experiment comparing the yield of ethanol under aerobic and anaerobic storage for periods ranging from 1 to 8 days prior to distillation were conducted at the MMSU Bioethanol Laboratory (ex-situ) and at a Nipa plantation in Pamplona, Cagayan (in-situ). Nipa sap were collected in the traditional aerobic manner. Half of the materials were kept in traditional open containers (aerobic) while half were stored in containers fitted with breathers (anaerobic). Ethanol was recovered quantitatively using reflux and pot distillers at temperatures between 78°C to 96 °C. Nipa sap fermented in-situ at anaerobic condition yielded 40% (w/w) ethanol compared to 28% (w/w) at aerobic conditions in 3 days. Ex- situ set up yielded lower ethanol at 16-17% (w/w). After 8 days, fermented sap kept in open containers lost almost all its ethanol (0.75%, v/v) while those kept under anaerobic conditions remained at 4.74% (v/v). We conclude that storing the sap anaerobically after harvesting the fermented sap can increase the yield of ethanol by as much as 33%. Further increase in ethanol yield may be achieved by controlling yeast activity during the collection process and improvements in distillation. When explored, Nipa sap can be a potential feedstock for biofuel.

Keywords: bioethanol, nipa sap, aerobic fermentation, estuarine habitat, biofuel

PERFORMANCE OF A STATIONARY COMPRESSION IGNITION ENGINE USING VARIOUS BLENDS OF BIODIESEL

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The rapid depletion of petroleum reserves and the rising oil prices has led to the search for alternative fuels as a replacement or as a blend to at least prolong the predicted diminution of fuel oils. While the government sought to increase the blend in bioethanol and biodiesel as mandated by the Biofuels Act of 2006, engines must be studied so as not to sacrifice engine's performance and reliability. This study is limited to the characterization of properties of the various biodiesel blends (from jatropha) and its performance to a stationary compression-ignition (CI) engine. The treatment blends are as follows: commercial diesel (B2), B4, B6, B8, and B10. The properties of each blends was compared to the standard properties of diesel fuel and biodiesel: densities was obtained using an analytical balance, heating values were obtained using the Bureau of Standard formula, viscosity was measured using Whitford Test Method 101A (ASTM D 4212-82), flash and fire points thru open cup method (ASTM D92) and cloud point was observed in freezers. SAE J1349 was used as the guide in evaluating the performance a CI engine using different treatment blends while CO₂ concentrations were obtained thru titration technique. Results showed that the fuel properties of all the treatment blends were within the limits when compared to the standard properties of diesel fuel. In terms of brake horsepower B4, B6, B8, and B10 when compared to B2 has a percentage difference lower of 1.76%, 2%, 3.1%, and 3.8% respectively. The brake fuel economy of the latter blends when compared to B2 has 2.9%, 9%, 12.96%, and 16% lower respectively. The CO₂ concentration of the blends is better when compared to B2. It appears that the B4 was the best blend among the four blends when compared to B2. It is recommended that a longer testing period must be made to observe other performance indicators such as wears and carbon deposits.

Keywords: biodiesel, blends, Brake Fuel Rate, CI engine, fuel properties

EST- 03

VERIFICATION OF MODULAR HOUSING UNIT USING FERROCEMENT: AN INNOVATIVE LOW-COST TECHNOLOGY

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Ferrocement is a highly versatile form of reinforced concrete made of wire mesh, well graded sand, water and cement, which possess unique qualities of strength and serviceability. A study was conducted to verify the viability of developing modular housing technology using ferrocement for low-cost housing. A model house was constructed with the help of a private research partner. The model house was an extension of a house that was bound for renovation. The model house was made up of three bedrooms with a total area of 17.28 m². Material requirements for the house were identified and ferrocement elements were fabricated. Flat forms for wall panels were made and supported by lumber. It was provided with two stages of stoppers to assure that the edges of wall plates will not be off-line. Ferrocement elements were fabricated and the model house was assembled. Cost analyses for a standard house constructed using the conventional method versus the modular housing unit using ferrocement of this study revealed that labor costs and material costs are lower for this ferrocement technology thus, resulting to savings. Installations of the prefabricated materials are simple and even less skilled workers can be utilized. Two model houses were developed from this technology, a duplex type house and an apartment type. This study revealed that this technology can be used for extension purposes or can be used for progressive type of house construction.

Keywords: ferrocement plates, prefabricated materials, slotted ferrocement beams, modular housing, wire mesh

DEVELOPMENT OF A POTENTIAL PROFICIENCY TESTING MATERIAL FOR HISTAMINE IN FISH

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The characterization of a proficiency testing (PT) material for histamine measurement in canned tuna was carried out in this study. HPLC technique for histamine with fluorescence detector was first optimized using 340 nm for excitation and 445 nm for emission. Method validation of the optimized method was conducted using samples fortified (n=10) with 3 levels of histamine concentration. The precision (rsd) obtained for each level are 21%, 4.7%, 4.9% respectively. The percent recoveries obtained (99-106%) on spiked samples were very good. Interference study done using histamine and methyl histamine presente.d a good separation with retention time of about 17.6 min and 19.2 minutes for histamine and methyl histamine respectively. Studies on important parameters for PT material like the homogeneity and stability of histamine in fish matrix were undertaken using the said method. Sufficient homogeneity was observed from the results (n=10) after applying visual inspection, Cochran's test and statistical tests. The candidate PT material showed initial stability over a period of 4 months. Evaluation of the data shows no significant difference using test at 95 % confidence interval. This candidate PT material will be used for the provision of a PT scheme for histamine currently not available in the country. This activity could help improve testing laboratory performance in the country. The said material can also be used as a reference material for histamine in fish matrix that could help improve quality measures for the laboratory.

Keywords: histamine, canned tuna, method validation, PT material, homogeneity test, stability test

MOLECULAR IMPRINTING TECHNOLOGY COUPLED WITH PIEZOELECTRIC QUARTZ CRYSTAL FOR AMOXICILLIN DETECTION

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One important issue in food safety is antibiotic contamination. Both antibiotics application for therapeutic and non-therapeutic purposes are possible sources of residual antibiotic contamination in food products. In this study, a mass sensor for amoxicillin based on molecularly imprinted polymer (MIP) was proposed. The MIP was synthesized by bulk polymerization using methacrylic acid, ethylene glycol dimethacrylate (EGDMA), amoxicillin were used as monomer, cross linker, template molecule respectively. Subsequent removal of template from the MIP by Soxhlet extraction was done using 9:1 methanol-acetic acid. A specific volume of MIP suspension was spin-coated onto one side of the 10-MHz quartz crystal. The coated quartz crystal transducer was encased in a Teflon flowcell and connected to an ICM Lever oscillator, a digital frequency counter and personal computer. Optimization of sensor response was done by varying parameters like curing time, volume of coating, and effect of pH of the solution. A linear relationship between frequency shift and amoxicillin concentration from 1×10^{-6} to $1 \times 10^{-2} \mu g/mL$ (r= 0.992) was achieved. Evaluation of other characteristic performance of the sensor like sensitivity, reproducibility, detection limit selectivity was presented. The sensor could be a potential substitute for residual amoxicillin detection in food products. Further characterization using SEM-EDX, FTIR, particle size analysis, surface area analysis, and analysis of combustion gases also confirmed the molecular imprinting and rebinding processes of amoxicillin in the polymer synthesized.

Keywords: amoxicillin, quartz crystal sensor, molecularly imprinted polymer

AN INTERACTIVE MOBILE APP FOR TOURISTS OF ILOCOS NORTE

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Mobile devices present many unique characteristics that make their use as electronic tourist guides particularly attractive. Many countries are now using mobile apps as a promotion to their tourism campaign, and some countries are still developing their apps. With these technologies, tourists can navigate the beauty of the place in just a tap away. This study was conducted to address the difficulties of the Provincial Tourism Office (PTO) of Ilocos Norte in realizing their mandate to promote the tourism industry of the province. At the same time, aimed to provide a tool for tourists to guide them explore the tourist destinations in the province. The study focussed on the development of an interactive mobile application for tourist of Ilocos Norte. The application covers tourist destinations, attractions, food establishments, accommodations, and other need-to-know information within Ilocos Norte.

Keywords: tourist guide, mobile application, ilocos norte, tourism, android-based

EFFECT OF PARTICLE SIZE AND TEMPERATURE ON THE DEGRADATION OF SWEET SORGHUM BAGASSE USING ULTRASONICATION

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The use of ultrasound in solutions is a new emerging technology that has the potential as a treatment of lignocellulosic biomass for cellulose ethanol production. Ultrasound produces physical (mechanoacoustic) and chemical (sonochemical) effects, which causes homolysis of lignincarbohydrate bonds and depolymerization of structural sugars to its fermentable monomers. Still, efficiency of the treatment depends on different operating parameters that affect the severity and incidence of mechanoacoustic and sonochemical influence. This study investigates temperature and particle size. Sweet sorghum bagasse was subjected to ultrasonication using UP100H with the following operating parameters: a) loading: 1/20 (g/ml); b) cycle: 1; c) power and amplitude: 100%; d) working frequency: 30 kHz; e) liquid medium: distilled water; f) time duration: 20 min; g) temperature: uncontrolled and controlled (15-20°C); and h) particle size: physically untreated, 0.425 mm, 0.180 mm. Compositional analysis for cellulose, hemicellulose, and lignin was conducted before and after the experiment using TAPPI standard laboratory analytical procedures, whereas glucose released was determined using the protocol developed by NREL.

Ultrasound treatment of sweet sorghum bagasse with the smallest particle size of 0.180 mm resulted to better delignification at 21.49% and yielded the highest amount of glucose (4.72%w/w). Controlling the temperature at 15-20°C lead to a higher release of glucose (4.12%w/w) from the biomass as compared to samples sonicated at uncontrolled temperature (3.01%w/w). With these findings, ultrasound technology offers a promising treatment of lignocellulosic biomass for cellulose ethanol production.

Keywords: ultrasound, degradation, lignocellulosic biomass, cellulose ethanol, temperature, particle size

A SURVEY OF INDIGENOUS COPPER METALLOPHYTES IN THE MANKAYAN MINERAL DISTRICT, BENGUET, PHILIPPINES, WITH POTENTIAL APPLICATIONS TO POST-MINING REHABILITATION

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The mining activities in the Mankayan Mineral District, Benguet, Philippines have exposed the area to heavy metals, specifically copper, which if not rehabilitated will pose hazards to the natural ecosystems and human settlements. Phytoremediation is a viable rehabilitation option through the ability of plant metallophytes, especially hyperaccumulators, to accumulate large amounts of metals in their structures. The study focused on the survey of potential Cu metallophytes and hyperaccumulators in the Mankayan Mineral District. Soil and plant samples were collected from two sites within the Lepanto mining area. Soil samples were subjected to different analyses to determine the pH, texture, and nutrient content (NPK). Both soil and plant samples were prepared prior to analysis using protocols adopted from the Association of Analytical Communities (AOAC) and were analyzed using Flame Atomic Absorption Spectroscopy (FAAS).

The soils in the Mankayan Mineral District were predominantly sandy, pH values ranged from 3.0 to 5.9, low NPK content, and contained 71.1-384 mg kg⁻¹ Cu. Eleven metallophytes were identified in the study, although no hyperaccumulators were determined. This is attributed to physicochemical conditions in their environment, which were not optimal for the plants to concentrate Cu. *Pteris* sp., *P. calomelanos*, *N. hirsutula*, and *H. incisa*, which accumulated more Cu than the other analyzed plant species, could be potential hyperaccumulators. The identified metallophytes found in the Mankayan Mineral District are able to survive the different Cu concentrations of the soil as manifested in the two sampling sites in the two sampling periods. The identified metallophytes are useful and effective for ecological restoration; thus an option to post-mining rehabilitation.

Keywords: Mankayan Mineral District, hyperaccumulators, metallophytes, phytoremediation, copper

BIO-GAS PRODUCTION FROM GOAT, FOOD LEFTOVERS AND THEIR MIXTURES

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To clean up surroundings of biodegradable wastes, comparative digesters were set up. The biogas yields and the efficiency of three feedstocks namely the goat manure, food leftovers, and their mixtures were evaluated using tubular polyethylene bio-digesters and biogas reservoirs. These materials were available from the goat farm and the canteen of the university in Silang, Cavite. All collected food leftovers from the canteen were use as influent.

The study results showed that the rate (in days) taken to fill up the reservoir of 4.08 m³ there was a significant difference between performance of goat and food wastes. The efficiency of bringing 2L of water to boiling point showed there was no significant difference between LPG and biogas from goat manure. Moreover, the difference in burning time of biogas from goat manure was significant in favor of biogas from both food and mixed wastes (p<.001). Between food and mixed wastes showed significant difference. The rate of producing biogas was significantly affected by night and day temperature (p<.001), where low night temperatures slowed down production.

This showed that the production of biogas fuel was a profitable method of recycling biodegradable wastes. Goat manure was best in the rate of biogas production, in bringing 2L of water to boiling point, and in length of burning time. It also performed better at various temperature levels.

Keywords: Bio-gas, recycled wastes, goat manure and food leftovers

CONSTRUCTION OF GROUNDWATER SALINITY MAPS USING ARCVIEW GEOGRAPHICAL INFORMATION SYSTEM (GIS)

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The study was conducted to make groundwater salinity maps using ArcView GIS. Specifically to determine the levels of groundwater salinity that will indicate saltwater intrusion.

Groundwater salinity levels in terms of electrical conductivity (EC) were monitored from 25 shallow tubewells and 5 deepwells for 14 weeks in the coastal production areas in the northern part of Ilocos Norte. EC were monitored daily using the Salinity-Conductivity-Temperature (SCT) meter every 5:00 to 6:00 o'clock in the afternoon. The data were inputted to ArcView GIS and salinity maps were made for every week (weeks 1 to 14).

Apparently from the maps constructed, groundwater salinity levels were high during weeks 1, 3, 6, 8 and 10, while, weeks 2, 4, 9,11,12,13 1nd 14 have lower groundwater salinity levels. ArcView GIS use colors to indicate the salinity levels of the study area. The darker the color, the higher the groundwater salinity level. Weeks with high levels of salinity (> 1000.0 ppm, WHO threshold limit) indicated that the study area was saltwater intruded.

Thus, the maps generated would help researchers, engineers and other interested groups to draft policies on how to conduct mitigation strategies to reduce saltwater intrusion.

Keywords: salinity maps, salinity level, ArcView GIS, electrical conductivity, SCT meter

SIMULATING THE INTERACTIVE EFFECTS OF INFRASTRUCTURE IMPROVEMENTS AND TRAFFIC SCHEMES TO VEHICULAR TRAVEL TIME IN THE BICUTAN ROUNDABOUT

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We studied the interactive effects of four infrastructure improvements $I = \{i_0, i_1, i_2, i_3\}$ and six traffic schemes $T = \{t_0, t_1, \dots, t_5\}$ to the mean total delay time (D) and mean speed (S) of vehicles using the non-signalized Bicutan Roundabout (BR) in Taguig City, Metro Manila for the purpose of identifying which among the I'T combinations can provide the minimum D and S when constructed and implemented. We designed a hybridized multi-agent system (MAS) with the car-following and lane-changing models (CLM) to mimic the autonomous driving behavior of heterogeneous individuals in a microsimulation. We first simulated the current road infrastructure (i_0) in the BR with the exact observed type distribution and volume of vehicles running under the current non-signalized traffic scheme (t_0) to show that our MAS-CLM can simulate the real-world at a significance level of a=0.05. We then simulated the interactive effects of the I'T combinations, replicated 10 times, on D and S and used the respective means of these metrics as our basis of minimization. We found out at statistical significance level of a=0.05 that the combination of the following *I* and *T* provided the minimum D and S: widening of the southbound lane of the East Service Road into three lanes up to the BR continuing to the westbound lane of the Gen. Santos Avenue up to the railroad intersection coupled with a signalized traffic scheme of 15s stop in a round-robin fashion for all lanes entering the roundabout. Since traffic improvement tends to increase vehicular volume, we also simulated the effect of up to 100% increased number of vehicles in the BR and found out that the same I-T combination still provides the minimum D and S.

Keywords: simulation, MAS, CLM, Bicutan Roundabout, traffic

DESIGN OF A NATIONAL SYSTEM FOR TRACKING AND TRACING PORK "FROM FARM TO FORK"

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We present an ICT-based Pork Traceability System (PTS) that was designed for nationwide implemention, exploits the current and future ICT infrastructures in the Philippines, and employs the recent advances in digital-based data communication. The PTS is one of the vital software infrastructures in the country' preparation for the ASEAN Free Trade Area (AFTA) in 2015. This is because countries within AFTA require a traceability system for each product before they import from the Philippines. The Philippines is posed to lead AFTA in meat-based export product qualities, not only because it is the only FMD- and bird flu-free country in Asia, but also because the PTS is responsive to international standards.

The result of our design is a suite of the following five ICT-based subsystems generally aimed to automate the tagging, tracking, and recording (e-TTR) of meat produce along the full length of the supply chain "*from farm to fork*:" (1) The e-TTR of farm inputs including the recording of harmful elements (such as heavy metals in drinking water), vaccines, and medicines, as well as the mobility of the penned swine within the farm; (2) The e-TTR of individual pigs while in transit from farm to the abattoir; (3) The e-TTR of individual pigs within the abattoir, including the human workers who processed them, and the transfer of information from live pigs to their respective meat cuts; (4) The e-TTR of meat cuts while in transit from abattoir to the market; and (5) The e-TTR of meat cuts in the market, including the automated tracing of each meat cut by the consumer through a national product traceability database system.

Keywords: meat product traceability system, electronic tagging, tracking, ICT infrastructure, AFTA

ASSESSMENT OF THE SPATIO-TEMPORAL QUALITY OF THE QUIAOIT RIVER WATERSHED

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This study reports the spatio-temporal changes in water quality of the Quiaoit River watershed. Stream water samples were collected at eleven sampling stations weekly from July to December 2012 and were analyzed for five water quality parameters.

Results showed distinct spatial and temporal variations of water quality measurements and spatial heterogeneity in terms of surface water pollution was attributed to anthropogenic factors. It was found out that water quality declined as the water moves from upstream to downstream due to waste input from household and agricultural discharges. The mean dissolved oxygen concentrations are all below the standard minimum dissolved oxygen (6.0 mg/l) and minimum dissolved oxygen for fish spawning (7.0 mg/l). Likewise, mean nitrate-N concentrations within the test watershed ranged from 0.1 ppm to 3.4 ppm. Spatially, it was observed that nitrate-N concentration was highest in areas near agricultural areas.

The above results suggest the need for proper management measures to restore the water quality of the Quaioit River. It also highlights the importance for objective ecological policy and decision-making process to ensure a healthy and sustainable aquatic ecosystem.

Keywords: watershed, water quality, anthropogenic, stream, ecological

HEALTH SCIENCES

HS - 01 THE EFFICACY OF MALUNGAY LEAVES SPRINKLE IN IMPROVING THE IRON AND VITAMIN A STATUS OF 8-10 YEARS OLD SCHOOLCHILDREN

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The prevalence of iron deficiency anemia (IDA) and vitamin A deficiency (VAD) continuously remain at a significant public health level in the Philippines as shown by the series of the National Nutrition Surveys (NNS) conducted by the FNRI-DOST. In response, Moringa oleifera, locally known as Malunggay, was considered as a possible solution to these problems because of its high nutritional content. In this study conducted in two public elementary schools in Muntinlupa City, 121 underweight children aged 8-12 years old were divided into control (n = 60) and experimental (n = 61) groups. The control group was fed with snack foods (*arroz caldo*, ginataang mais, macaroni soup, pancit canton and polvoron) during recess time while the experimental group was fed with the same snack foods wherein three grams malunggay leaves powder (MLP) was added. Height and weight, food intake and hemoglobin and vitamin A were measured before and after the feeding period of 120 days. Results showed that the consumption of the snack foods significantly increased the nutrient intakes of the children. Greatest increase was recorded for vitamin A intake of the children given 3 g MLP. Endline vitamin A intake was more than the requirement for vitamin A. Increase in height and weight between the groups were not different. Proportion of severely thin children decreased from 11.7% to 5.0% among children who consumed snack foods with MLP but no change was observed among the children who consumed snack foods without MLP. Increase in hemoglobin levels was greater among children who consumed snack foods with MLP while increase in vitamin A levels was recorded in both groups. In conclusion, regular consumption of malunggay leaves may help alleviate certain micronutrient deficiencies such as IDA and VAD

Keywords: malunggay, hemoglobin, vitamin A, schoolchildren

HS - 02 EFFECT OF MICRONUTRIENT SUPPLEMENTATION ON THE HEMOGLOBIN LEVELS OF SOME FILIPINO PREGNANT WOMEN: IMPACT ON BIRTHWEIGHT AND OTHER BIRTH OUTCOMES

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The UNICEF has long been promoting the antenatal use of multiple micronutrient supplements among women in developing countries. Yet data on the supplements' efficacy in improving the hemoglobin level and pregnancy outcomes are lacking especially among Filipino pregnant women. In the present study, 131 pregnant women in their 2nd trimester (13-16 weeks gestation) whose hemoglobin falls between 8.5-10.9g/dL, and not taking any vitamin-mineral supplement at recruitment were randomly allocated to three groups - those receiving multiple micronutrient (MN group), iron and folic acid (IF group), and iron alone (Fe group). Blood samples were collected at baseline, at midline (30-32 weeks) and at endline (37-38 weeks). Hemoglobin was analyzed by cyanmethemoglobin method while dietary, lifestyle factors, gynecological and health related data including birth outcomes were collected by interview method. Results indicated that anemic women who were provided MN had remarkably improved hemoglobin status. An average increase of 1.3g/dL was obtained for the MN group, 0.8g/dL in IF group and 0.5g/dL in Fe group. With MN supplementation, anemia prevalence dropped significantly to 12.8% compared to the final anemia prevalences of 27.3% and 46.9% obtained for the IF and Fe groups, respectively. Multiple micronutrient supplementation was associated with improved birthweight. There were comparable rates in terms of incidences of low birthweight, premature delivery and neonatal death for MN and IF groups but slightly higher rates among those in the Fe group. In conclusion, MN used among pregnant women was more effective and even better than iron-folic or iron alone in improving the hematologic status of anemic pregnant women. This finding underscores the need for large-scale evaluation of multiple micronutrient supplements during pregnancy in appropriate circumstances as part of health system interventions to improve maternal nutrition and health during pregnancy.

Keywords: supplementation, hemoglobin, pregnant, birthweight

MARKOV MODEL OF OVARIAN CANCER PROGRESSION

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Adenocarcinoma of the ovary, a malignant form of ovarian cancer, is one of the leading causes of death in women. The four stages of ovarian cancer include two localized stages, one regional stage and one distant stage. Although data for the relative survival rates at each stage of adenocarcinoma exists, the data does not provide transition probabilities between stages. In this study, relative survival rates of patients diagnosed with ovarian cancer in its various stages were used to estimate the transition rates between stages using a Markov model. A parameter search method was used to calculate the matrix that minimized the error against the data. The fundamental matrix was derived and used to obtain the number of years a patient is expected to have in a given stage of ovarian cancer. In particular, a patient diagnosed with stage III ovarian cancer has an expectation of 4.6 years, while a stage IV patient is expected to have 3.4 years.

Keywords: mathematical biology, ovarian cancer, transition matrix, tumor progression, Markov chains

DETERMINATION OF OMEGA-3 (EPA, DHA, ALA) FATTY ACIDS IN COMMONLY CONSUMED SEAFOOD AND PRODUCTS BY FILIPINO ADULTS IN METRO MANILA

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Seafood like fish is a healthy food because of its nutritional benefits related to its proteins of high biological quality, desirable lipid composition, valuable mineral compounds and vitamins. The particular composition of its lipid fraction, rich in essential omega-3 polyunsaturated fatty acids (PUFA), especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), and poor in cholesterol makes it a primer food. The American Heart Association (AHA) recommends ingestion of fish (preferably oily) at least twice a week, or about 1g of EPA+DHA per day. The study aims to identify the best extraction method for omega-3 fatty acids; analyze the fatty acid profile; and determine the consumption of omega-3 (EPA, DHA, ALA in mg/ day) fatty acids in commonly consumed seafood and products by Filipino adults in Metro Manila. The results show that method 4 (saponification and transesterification using potassium hydroxide, methanol and sulfuric acid in a 55°C water bath for 3 hours and extraction with hexane) was the best extraction method for omega-3 fatty acids. Omega-3 fatty acids EPA, DHA and ALA were highest in dried anchovy (1.5, 7.3 and 0.6mg/g sample), mussel (1.5, 1.0, 0.1mg/g sample), round scad (0.9, 3.4 and 0.2mg/g sample) and skipjack tuna (1.1, 3.9 and 0.7mg/g sample). Consumption of omega-3 fatty acids (EPA, DHA, ALA) were highest in dried anchovy (36.1, 175.2 and 13.1mg/day), round scad (69.5, 268.4 and 14.4mg/day) and skipjack tuna (85.5, 304.1 and 56.3mg/day). In conclusion, the method used for extraction of fatty acids was fit for intended purpose. Dried anchovy, round scad and skipjack tuna are among the most commonly consumed seafood and products with the highest levels of EPA, DHA and ALA.

Keywords: eicosapentaenoic acid, docosahexaenoic acid, alpha-linolenic acid, omega-3 fatty acids, saponification, transesterification

EFFECTS OF HEALTH EDUCATION PROGRAM ON THE KNOWLEDGE AND HYGIENIC BEHAVIORS OF SCHOOL-AGE CHILDREN TO THE INCIDENCE OF HELMINTHIASIS

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This study sought to measure the effects of a health education program on the knowledge, behavior, and incidence of helminthiasis among school-aged children. A quasi-experimental study design was employed where 100 days after a health education package was conducted among a group of children aged 8-10, their knowledge, behavior, and the incidence of helminthiasis were measured and compared against baseline measurements and the control group. Analysis of the results showed significant improvement only in the area of knowledge between pre- and post-intervention characteristics of the study group as a result of the program although minor improvements can also be seen in other areas. Health education, therefore, although it may not address the entire problem completely, is still an important component of the effort to control helminthiasis.

Keywords: health education program, hygienic behaviors, school-age children, helminthiasis, knowledge

DEVELOPED IMMUNOCHROMATOGRAPHIC STRIPS COMPLEMENTED WITH A NEW MICROBIAL CONCENTRATOR: A METHOD FOR *in situ* DETECTION OF *Pseudomonas aeruginosa* IN NATURAL SPRINGS

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Pseudomonas aeruginosa is not normally a part of the microbial flora of natural springs. Its presence in spring water may, thus, be an indication of contamination. An immunochromatographic strip and a new *in situ* microbial concentrator were developed for environmental health assessment of natural springs.

In situ detection of P. aeruginosa in spring waters was conducted using the developed immunochromatographic strips complemented with a new microbial concentrator in three natural springs of Laguna. Positive reaction was indicated by pink to light purple color formation on the test zone of the strip. The developed technology was found effective for the detection of P. aeruginosa in spring waters as confirmed by polyphasic methods of identification captured bacterium on the test line of the strip. Bacterium isolated from the test line of the immunochromatographic strips that show positive reaction was confirmed *P. aeruginosa*. The technology had greater specificity (100%) but lower sensitivity (87.5%) compared to the membrane filtration method (12.5% and 100%, respectively). However, detection of P. aeruginosa using membrane filtration method required additional confirmatory procedures. This shows that the combination of the developed immunochromatographic strip and newly designed microbial concentrator showed a potential for straightforward in situ detection method for environmental health assessment and monitoring.

Keywords: *Pseudomonas aeruginosa*, immunochromatographic strip, *in situ* microbial concentrator, membrane filtration, natural spring

Helicobacter pylori IN GASTRIC MALIGNANCIES: A RETROSPECTIVE STUDY

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Helicobacter pylori infection has been associated with gastric malignancies like adenocarcinoma and mucosa-associated lymphoid tissue (MALT) lymphoma. Detection of this bacterium by polymerase chain reaction using specific primers allows the diagnosis and management of gastric infection. The objective of this study aims to detect *H. pylori* in patients with gastric malignancies from paraffin-embedded tissues.

Ninety-one tissue samples (paraffin-embedded) from patients with adenocarcinoma (60.4%), Signet Ring Cell Carcinoma (18.7%), MALT lymphoma (6.6%), adenocarcinoma with Signet Ring Cell Carcinoma (4.4%), gastrointestinal stromal tumor (4.4%) and other gastric malignancies (5.5%) were studied using polymerase chain reaction. *H. pylori* was detected using primers specific for the following genes: *phosphoglucosamine mutase* (*glmM*), *H. pylori specific 16s rRNA (Hp16s)* and *vacuolating cytotoxin* (*vacA*). Positive for at least two of the three genes was considered positive for *H. pylori*.

Of the 91 samples, 52.7%, 45.1% and only 6.6% were positive for *vacA*, *Hp16s* and *glmM* genes, respectively. In addition, a midregion allele, *m3*, which could not be typed with midregion allele *m1*- or *m2*-specific primers, has been identified in 35.2% of the samples. Overall, 32.9% of the gastric malignancy samples were positive for *H. pylori*.

Based on the result, *H. pylori* infection may play a role in the development of gastric malignancies. The use of PCR on DNA isolated from paraffin-embedded material is an option to study archival material.

Keywords: gastric malignancies, *Helicobacter pylori*, paraffin embedded tissues, polymerase chain reaction

Piper betle L. AS POTENTIAL XANTHINE OXIDASE INHIBITOR

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Gout is one of the most frequently recorded medical disease attributed to an elevated concentrations of uric acid in the blood stream or hyperuricemia. This is a common progressive and potentially destrutive form of inflammatory arhtritis. The primary therapeutic approach in the treatment of hyperuricemia is the employment of xanthine oxidase inhibitor (XOI) which blocks the formation of uric acid and helps reduce the risk of gout.

Allopurinol is one of the many synthetic XOIs widely used in the therapeutic and clinical management of gout but shows serious adverse effects. The use of botanical extracts as alternative treatment with superior effect in inhibiting Xanthine Oxidase (XO) and as novel alternatives to allopurinol with potent XO inhibitory activity exhibiting lesser side effects is a challenge in current research and development.

In this study, *Piper betle* L. leaf extract (PBLE) was phtyochemically analysed showing the presence of carbohydrates, reducing sugars, phenolics, diterpenes, triterpenes or phytosterols, proteins and flavonoids. Spectrophotometric analysis gave Total Flavonoid Content (TFC) of 36.5(QE)/g which is indicative of potential xanthine oxidase inhibitory activity. The XOI activity was evaluated on hydrochlorothiazide- induced male mice which were rendered hyperuricemic. PBLE significantly inhibited XO activity with 8.57, 5.87 and 3.43 mg/dL at 3,6 and 12 hrs. after treatment. Moreover, Allopurinol reduced the uric acid level by 4.87, 4.07 and 3.13 mg/dL. Statistical analysis revealed that the effect of PBLE is comparable to allopurinol in lowering uric acid level giving PBLE a considerable potentialfor clinical application.

Keywords: *Piper betle*, , Xanthine oxidase inhibitor, antihyperuricemic, gout, hyperuricemia

HS - 09 CYTOGENETIC FINDINGS IN FILIPINO PATIENTS DIAGNOSED WITH MULTIPLE MYELOMA

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Multiple Myeloma (MM), a plasma cell malignancy, is reported to occur at lower incidence rate among Asians than other racial groups. Compared with leukemia, MM is not a commonly diagnosed malignancy among Filipinos. Most if not all documented cases among Filipinos were done among those who are living in foreign countries. This study reports on clinical, cytogenetic and molecular cytogenetic findings on MM Filipino patients in the local setting. A total of 105 patients diagnosed with multiple myeloma from 2003-2013 were referred to the laboratory for cytogenetic and molecular cytogenetic analyses. The study population is composed of 51 females and 54 males with age range of 22-82 years old and a mean age of 51 years old; 44 (42%) of these were > 60 and 61 (58%) patients were < 60 years old. Using routine GTG banding technique, seventeen abnormal karyotypes were seen: 9 (53%) aneuploidies, 6 (35%) composite/complex karyotypes and 2 (12%) with specific structural anomalies. Most of the patients found with complex/composite karyotypes and aneuploids involved trisomies. In some patients with normal karyotypes, Fluorescence in situ hybridization (FISH) analysis using break away probe at IGH locus at Chromosome 14q32 was done. Results of this assay revealed translocation involving immunoglobulin heavy chain (IgH). Cytogenetic profiles of these MM patients are studied in correlation with response to treatment, disease progression and survival. In developing countries like the Philippines where cytogenetic analysis/ molecular cytogenetic assay is not yet a routine tandem with other clinical and laboratory tests largely because of economic reasons, the study population presented forms a valuable baseline data for multiple myeloma among Filipinos.

Keywords: multiple myeloma, chromosomes, cytogenetics

DIAGNOSTIC IMMUNO BLOT FROM PHILIPPINE GRASSES ALLERGENIC POLLEN EXTRACTS AS AN ALTERNATIVE TO SKIN TESTING

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Development of a diagnostic Immuno Blot have been wanting since pollen extracts used for skin testing in the clinics were imported and usually of different species from our local grasses. Skin testing, the standard method of diagnosing pollen allergy causes pain, swelling and discomfort. The present study aims to develop a diagnostic Immuno Blot and to characterize each of the pollen extracts. Pollen proteins from bermuda, carabao, cogon and talahib were extracted by PBS, tested to volunteers for skin testing and blood was extracted. Gradient SDS-PAGE and Immuno blot were developed for these pollen extracts. The results were documented by FluorchemC2 and AlphaView. The developed method was confirmed in sera of sensitive individual by IgE and IgG detection. The IgE immunoblot profile of the sera from the sensitive individual showed a single band (55.4kDa) in lanes of both bermuda and cogon extracts. Bands corresponding to carabao and talahib extracts were negative. These positive results were consistent with skin testing using the extracts. The IgG immuno blot showed bands corresponding to each of bermuda, carabao and talahib extracts. Bands corresponding to cogon extract were not observed. These results were consistent with skin testing. The presence of band in bermuda imply a crossreactivity in IgG response. The results obtained also suggest an association between positive skin testing and IgE, and negative skin testing and IgG. reactivity of pollen proteins.

Keywords: gradient SDS-PAGE, Immunoblot, pollen extracts, skin testing
ANTIBACTERIAL AND MOSQUITO LARVICIDAL ACTIVITIES OF PHILIPPINE ENDEMIC Ficus casiguranensis AND Ficus camarinensis LEAVES

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The Ficus species (family Moraceae) are known to have diverse medicinal and pharmacological properties worldwide. This study aims to use the Philippine endemic Ficus species as prevention for arboviral infection as mosquito larvicidal and an antibacterial agent for the treatment of infections. Acute oral toxicity was done following the OECD guidelines 425 to test the safety of the extract, using female Swiss mice and administered them with the crude extract through oral gavage at 175, 550, 2000 mg/kg body weight (BW). Results showed that both extracts are non-toxic up to 2000 mg/kg BW. Antimicrobial test using disc-diffusion assay showed that the crude and semi-crude extracts of both plants were active against the Gram-positive bacteria. The chloroform extract of Ficus casiguranensis was found to be active in all the organisms tested. The inhibition potential of the extracts was quite significant since most of the tested organisms were resistant to the commonly used antibiotics. A modified WHO protocol for larvicidal bioassay was used to determine the larvicidal activity of the crude and semi-crude extracts of both plants. The butanol extract of Ficus *camarinensis* had shown the lowest Lethal Concentration (LC₅₀) and LC₅₀ at 268.5ppm and 281.4ppm for 24 hours and 265.2ppm and 278.6ppm for 48 hours respectively. It can be concluded that the Ficus species are an effective source of antibacterial agent and mosquito larvicide which are safe and effective

Keywords: Ficus, Antibacterial, Larvicidal, Ficus casiguranensis, Ficus camarinensis, Moraceae

WOUND HEALING POTENTIAL OF CHITIN ISOLATED FROM FRESHWATER CLAM (*Corbicula fluminea* M.)

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The use of renewable products to produce valuable and biologically sustainable materials and to minimize waste is a challenge for current research and development. In this study, the utilization of bivalve waste specifically the shells from freshwater clam (Corbicula fluminea M.) in the isolation of chitin was realized by modified conventional method. Isolated chitin from the shells was used in the formulation of fresh water clam chitin ointment (FCCO) and has been found to have an acceleratory effect in the dermal wound healing process in both male and female white mice (Mus musculus L.) as exhibited in the higher percentage healing obtained compared to the commercially available medicine and the negative control. This was supported by the significant differences on the percentage healing of wounded male mice on day three, six, seven and highly significant differences on day eleven with complete healing observed on the twelfth day. On the other hand, wound healing in female mice exhibited highly significant differences on day three and was sustained up to day six and day eight with observed significant differences on day seven. Hence, freshwater clam chitin ointment (FCCO) was found to be an effective agent in wound healing. Daily monitoring on the morphological changes on the wounded male and female mice revealed progression as indicated by the following qualitative criteria from very red, very swollen and moist (A), to red swollen and moist with pus (B), red, slightly swollen and moist (C), considerably swollen and dry (D), with an initial indication of scar formation (E) until hair growth was observed and wound has completely healed (E).

Keywords: *Corbicula fluminea*, freshwater clam, chitin, wound healing, chitin ointment

QUANTITATIVE ASSAYS OF BONE DNA SAMPLES IN THE PRESENCE OF PCR INHIBITORS

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Human genetic polymorphisms are powerful tools for discrimination of individuals which may be used in disaster victim identification (DVI) efforts and in the resolution of civil disputes and criminal cases. There are several methods developed to analyze human genetic polymorphisms which include the PCR amplification of Short Tandem Repeats (STRs) located on autosomes and the X and Y sex chromosomes; as well as sequencing of hypervariable regions of mitochondrial DNA. In DVI, a DNA profile is generated by amplifying the DNA recovered from blood, tissue, bone or tooth samples using either one or several multiplex reactions that contain a panel of 16-24 autosomal STR markers and/or 12-27 Y-chromosomal STR markers when handling male samples. The success rate of STR typing is affected by the amount and state of DNA recovered and the presence of chemicals that may inhibit the amplification reaction.

To test robustness and sensitivity of current DNA-based procedures in the presence of known inhibitors, calcium chloride, hematin and humic acid were added to DNA of known concentration. We evaluated the effects of varying inhibitor concentrations on the amount of PCR products using real-time PCR and the quality of amplifiable DNA template by analyzing DNA profiling results.

Keywords: DNA, forensics, autosomal STR, Y-STR, and inhibitor

HS - 14 EFFECT OF Lactobacillus plantarum BS25 ON CHOLESTEROL LEVELS in vitro AND IN BALB/C MICE (Mus musculus L.)

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The risk of developing cardiovascular disease due to high cholesterol level has driven the development of functional foods that can maintain normal or lower cholesterol levels. It is well-documented that many Lactobacillus *plantarum* strains can assimilate cholesterol due to the bile salt hydrolase enzyme mechanism. In this study, the ability of Lactobacillus plantarum BS25, a candidate probiotic isolated from a fermented rice-shrimp mixture, to reduce cholesterol levels in vitro and in vivo was determined. A mangosoymilk drink and a chocolate drink containing Lactobacillus plantarum BS25 (LpBS25) were prepared. The effect of LpBS25 on cholesterol levels was first determined in vitro through a cholesterol assimilation assay. Results showed that LpBS25 isolates alone were able to assimilate an average cholesterol concentration of 32.36 µg/mL and that LpBS25 in the fermented drink can assimilate an average of 96.11 µg/mL cholesterol *in vitro*. Cholesterol assimilation in the fermented drink was observed to be significant (p < 0.05) compared to the uninoculated drink, with only 3.89 μ g/ mL cholesterol reduction in the latter. Chocolate drink containing LpBS25 was orally administered to hypercholesterolemic BALB/c mice to determine its effect on the lipid profile. Two set ups were made: A) hypercholesterolemic mice not given LpBS25 chocolate drink and B) hypercholesterolemic mice given LpBS25 chocolate drink. Hypercholesterolemia was induced by feeding the mice 3% cholesterol-enriched diet for 9 weeks then the mice in group B were given chocolate drink containing 10⁹ to 10¹¹ CFU/ml LpBS25 every other day for 5 weeks. The mean serum cholesterol levels measured at baseline and after induction of hypercholesterolemia (week 9) were significantly different for both groups (p=0.031). Descriptive statistics shows that at post treatment, the mean serum cholesterol reduction in the mice fed with LpBS25 is higher (48.05 mg/dL) than that of the control group (28.00mg/dL). These results suggest that LpBS25 can be an effective inoculum in developing probiotic drinks and at the same time can provide potential health benefits, such as cholesterol reduction, to consumers. Further experiments using animal models should be conducted to lend support to the results of this study.

Keywords: L. plantarum, probiotics, BALB/c mice, cholesterol, hypercholesterolemia

In vitro PHAGE COCKTAIL THERAPY AGAINST UROPATHOGENIC *E. coli* and *P. aeruginosa* BIOFILMS

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The increase in quantity of implant procedures with indwelling catheters prompted their proneness to device-related biofilm infections, which have emerged consequences on trauma and cost of healthcare system, multidrug resistance, mortality, and morbidity risks. This study aims to determine the efficiency of bacteriophage cocktail, a mixture of host-specific bacterial viruses against uropathogenic E. coli and P. aeruginosa biofilms as an alternative to conventional antibiotic therapy. From 10 sewage treatment plants in Metro Manila, a total of 10 E. coli and 7 P. aeruginosa hosts were isolated and identified. A total of 19 E. coli and 10 P. aeruginosa isolated lytic phages were noted to have clear plaques with sizes ranging from 0.27-2.32 mm. High phage titers within the range of 10⁵-10¹⁰ PFU/mL were obtained using modified agar overlay. Based on the host range of phages using spot test method against clinical, environmental and ATCC test strains, a total of 6 lytic phages were selected for the phage cocktail preparation. Tailed lytic phages, viewed under EM and classified under Order Caudovirales, were noted to have higher reduction of established biofilms with higher phage titer within 24 hours of incubation. Thus, this study provides a practical, efficient, and enforceable alternative therapy against uropathogenic biofilms.

Keywords: indwelling catheters, antibiotic resistance, biofilms, phage therapy, phage cocktail

MATHEMATICAL AND PHYSICAL SCIENCES

BIOLOGICAL TREATMENT OF MEAT PROCESSING WASTEWATER USING ANAEROBIC SEQUENCING BATCH REACTOR AND POST-TREATMENT WITH ACTIVATED CARBON

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Effluents from meat processing industries contain high organic matter and other contaminants that can cause harmful effects to the environment. Treatment of this wastewater to produce acceptable quality of effluent is therefore needed. This study aimed to determine the feasibility of using anaerobic sequencing batch reactor (ASBR) for treatment of meat processing wastewater and for biogas production. A lab-scale ASBR was designed and fabricated with an active volume of 10L consisting of 60% wastewater and 40% sludge inoculum. Batch ASBR operation was composed of four phases per cycle (24 h): wastewater filling -0.5 h, reaction -16 h, settling -7 h, and decantation -0.5 h. Post-treatment of effluent was done using granulated activated carbon. During biomethanation process in ASBR, pollutant removal was: 94% COD, 93% BOD, 54% suspended solids, 58% turbidity, and 53% color. The concentration of COD and BOD in treated effluent was 116 mg/L and 78 mg/L, respectively. Biogas generated during the ASBR reaction was 2.7 L/d with 61% methane content. Post-treatment of effluent further reduced the concentrations of pollutants to acceptable level with 76 mg/L COD and 20 mg/L BOD. Biological treatment using ASBR and post-treatment with activated carbon was proven effective in reducing organic pollutants in meat processing wastewater.

Keywords: anaerobic sequencing batch reactor, ASBR, biomethanation, biogas, wastewater treatment

FRACTIONATION OF ACHIOTE (*Bixa orellana*) SEED OIL USING SUPERCRITICAL CARBON DIOXIDE (SC-CO,)

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Bixa orellana or achiote seeds are commonly used as ingredient in food and a natural red dye for textiles in Philippines. In this study achiete seeds were extracted and fractionated using supercritical carbon dioxide extraction to obtain different oil extracts in three different parameters: 10Megapascal (MPa), 20 MPa and 30 MPa at a constant temperature of 40° Celsius. The highest oil yield was obtained at 20MPa with an average of 0.26% followed by 10MPa with 0.22% and 30MPa with 0.21%. All extractions were done in triplicate. 10MPa oil sample was subjected to gas chromatography- mass spectrometry (GC-MS) analysis. Nineteen compounds were detected with decahydro-3,3,4,7a-tetramethyl-Hcyclopenta[a]pentalen-7-ol (4-methylbenzenesulfonate) and (-)-spathulenol as the major compounds. 20MPa and 30MPa oil samples were subjected to fatty acid profiling which was determined by DOST-ITDI. Six free fatty acids were detected at 20MPa and seven free fatty acids were detected at 30MPa. Linoleic or omega 6, an essential fatty acid is consistently highest in terms of weight by weight which are 70% and 77.2% respectively. Two essential free fatty acids - linoleic (omega-6) and linolenic (omega-3) - were also found in both parameters.

Keywords: supercritical carbon dioxide, fractionation, gas chromatographymass spectrometry, fatty acids, bixa orellana

REDUCED GRAPHENE OXIDE/COBALT NICKEL LAYERED DOUBLE HYDROXIDE COMPOSITES FOR SUPERCAPACITOR ELECTRODE MATERIALS

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Supercapacitors, alternative energy storage devices with high energy densities and fast charge/discharge rates, are currently emerging as green and sustainable devices that can answer the rising demand for energy. Reduced graphene oxide (RGO) was prepared from oxidation of graphite *via* Hummers method, reduced using sodium borohydride and used as a base material to form RGO/cobalt-nickel layered double hydroxides (RGO/ CoNi-LDHs) for supercapacitor electrode materials.

Cyclic voltammetry (CV) was used to examine the performance of the pristine materials and composites in alkaline medium (1 M NaOH). The electrodes were cycled at 50 mVs⁻¹ for 100 cycles to evaluate their stabilities. Fourier transform infrared spectroscopy (FTIR), thermogravimetric analysis (TGA) and scanning electron microscopy (SEM) were used to examine the structural and morphological characteristics of the composites in connection to their electrochemical properties.

The CoNi-LDH composite containing an equal molar ratio of cobalt and nickel (1:1 CoNi) has an excellent charge storage capability of 424 Fg^{-1} at 10 mVs⁻¹ scan rate. Combining it with 20 mL exfoliated graphene oxide (EGO) produced an RGO/CoNi-LDH composite with a specific capacitance of 1998 Fg⁻¹, improving its capacitance ability up to 371%. The RGO/CoNi-LDH composite retained 97.3% of its capacitance after 100 cycles, illustrating its promising attribute to be used as an electrode for supercapacitors.

Keywords: supercapacitors, graphene, CoNi-LDHs, layered double hydroxides, RGO

REDUCED GRAPHENE OXIDE/POLY(3,4-ETHYLENEDIOXYTHIOPHENE)-POLY(STYRENESULFONATE) COMPOSITES FOR SUPERCAPACITOR ELECTRODE MATERIALS

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The rapid depletion of natural fuel sources has led to increasing research on energy storage, and supercapacitors are currently being touted as promising energy storage devices owing to their low cost and high power output. In this study reduced graphene oxide (RGO) was prepared by borohydride reduction of graphene oxide and combined with poly(3,4-ethylenedioxythiophene)-poly(styrenesulfonate) (PEDOT-PSS) to form RGO/PEDOT-PSS composites for supercapacitor electrode materials.

The performance of the pristine materials and composites in varying electrolytes and scan rates was studied using cyclic voltammetry (CV). Structural and morphological properties were examined using Fourier transform infrared spectroscopy (FTIR), thermogravimetric analysis (TGA) and scanning electron microscopy (SEM).

Both chemically and electrochemically polymerized PEDOT-PSS were found to be more active in acidic medium with areal capacitances of 110 Fcm⁻² and 167 Fcm⁻² at 10 mVs⁻¹, respectively. RGO acts as a good scaffold to prevent the breakdown of PEDOT-PSS during cycling, demonstrating a good areal capacitance of 144 Fcm⁻² at a low scan rate. The polymer and composite both are stable during cycling and are thus suitable and favorable for use as supercapacitor electrode materials.

Keywords: supercapacitor, PEDOT-PSS, graphene, RGO, polymer

MPS - 05 ISOLATION, PURIFICATION AND CHARACTERIZATION OF THE ANTIHYPERTENSIVE AND ANTIOXIDATIVE PROPERTIES OF THE BIOACTIVE PEPTIDES PRESENT IN THE MAJOR STORAGE PROTEIN OF "KADYOS" (*Cajanus cajan*) SEEDS

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Bioactive peptides were isolated from the purified major globulin protein of Kadyos seeds. Their antihypertensive and antioxidative activities were studied. In silico analysis of the complete amino acid sequence of the target protein was done. Extraction was done using 3.5% NaCl solution, followed by ammonium sulfate fractionation. The 90% fraction was further purified via dialysis and GFC analysis. Protein digestion was done using trypsin, chymotrypsin, pepsin, and combinations of each, at specified time intervals. The degree of enzymatic digestion was assessed through SDS-PAGE and densitometric analysis. The 24-hour digest using the enzyme combination pepsin-chymotrypsin-trypsin (PCT) showed the highest % ACE-inhibition (87.50%). The target peptides from PCT were isolated through HPLC analysis. The %H₂O₂-scavenging activities of the HPLC fractions were higher (fraction 1: 1.47%; fraction 2: 1.51%) than the PCT digest (1.25%). Same results were obtained for the Total Antioxidant Capacity (TAC) Assay, where 0.005 mg/ml each of HPLC fraction 1, HPLC fraction 2 and the PCT digest gave 0.000880 mg/ml, 0.00110 mg/ml and 0.000623 mg/ml ascorbic acid equivalents, respectively. The IC₅₀ value of the HPLC fractions were lower (fraction 1: 0.00633 mg/ml; fraction 2: 0.00432 mg/ml) than that of the PCT digest (0.0323 mg/ml). Identification of the possible amino acid sequence of each fraction was done through Thin-Layer Chromatography: fraction 1: RA, RR, DA; fraction 2: LK/KL, RA, RR.

Keywords: bioactive peptides, seeds, kadyos, antihypertensive, antioxidative

CHRONIC ECOTOXICOLOGICAL AND HISTOPATHOLOGICAL STUDIES ON THE EFFECTS OF 17á-ETHINYLESTRADIOL ON Oreochromis niloticus L. (NILE TILAPIA)

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An endocrine disrupting chemical (EDC) is one of the recognized toxicants in the aquatic ecosystem. Interest on EDCs is concentrated on synthetic hormones, found in oral contraceptives, finding their way to aquatic ecosystems through consumer urination. This study sought to analyze the effects of a synthetic estrogen, 17α -ethinylestradiol (EE2), on *Oreochromis niloticus* L. (Nile Tilapia) by (1) evaluating its effects on the growth of the test organisms; (2) the assessment of the gonad and hepatic growths through the gonadosomatic (GSI) and hepatosomatic indices (HSI), respectively; and, (3) investigation of the gill, liver, and gonad histological alterations resulting from prolonged exposure to EE2.

The results reveal that after a 28-day exposure of *O. niloticus* juveniles to EE2 it had no significant effect (p>0.05), based on One-way Analysis of Variance (ANOVA) and Dunnett's test, on the weights of the body, gonad, and liver; and, on the GS and HS indices. However, histopathology of the gill, liver, and gonad samples suggested that chronic exposure to EE2 even at extremely low concentrations (0.01, 0.1, 1, 10, 100 ng/L), cause distinct morphological tissue alterations. Information generated in this study provides a baseline data on the effects of chronic exposure of *O. niloticus* to EE2, which may aid in policy review, establishment of wastewater treatment, or a guideline for water quality assessment.

Keywords: ecotoxicology, 17α-ethinylestradiol, nile tilapia, growth, gonadosomatic and hepatosomatic indices, histopathology

ENZYME-MEDIATED EXTRACTION, ANTIOXIDANT CAPACITY AND CHROMATIC PROPERTIES OF CAROTENOIDS FROM CHILI PEPPER

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There is a growing interest in the development of colorants from natural sources for use in the food, pharmaceutical and cosmetic industries. This study aimed to develop an easy, effective and eco-friendly extraction method for colorant from chili pepper by enzymatic extraction and to determine the stability of the product after freeze-drying.

In this work, enzymatic extraction of carotenoids from chili pepper, characterization of its antioxidant properties, monitoring of product stability, and determination of different chromatic properties of the extracted carotenoids were investigated.

The pectinase-treated chili gave an increase in the total carotenoid yield of 130.71% and 83.42%, water-soluble and lipid-soluble carotenoids, respectively, as compared with the non-enzymatic (control) treatment. Both extracts showed comparable antioxidant activity with commonly-used synthetic antioxidants. Physico-chemical and chromatic properties showed varying stability of the freeze-dried products at different temperatures (60°C, 70°C, 80°C, and 90°C) and solvents, in the presence of light, oxidizing and reducing agents and sugar and salt.

These results show that chili pepper is a potential source of carotenoids that could be used as natural food colorant.

Keywords: carotenoids, antioxidants, enzymatic process, chromatic properties, natural colorants

ASSESSMENT OF THE CADMIUM ABSORPTION ABILITY OF WATER HYACINTH (*Eichhornia crassipes*)

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The efficiency of water hyacinth (*Eichhornia crassipes*) for phytoremediation of cadmium was investigated by assessing its Cd absorption ability. Dry ashing and wet acid digestion methods were used in sample preparation prior to AAS analysis.

Eichhornia crassipes from National Crop Protection Council (NCPC), Los Baños, Laguna were exposed to different Cd concentrations with the most significant uptake of Cd at 10 mg/L solution (4.287 ± 0.044 mg Cd accumulated in its roots and 2.192 ± 0.034 mg Cd in its shoots) having 79.93 % removal of the metal without exhibiting discoloration of shoots and roots systems. Using 10 mg/L Cd solution, the maximum Cd absorption of the plant was investigated with respect to the number of days of exposure. It was found that after 14 days, Eichhornia crassipes was able to accumulate cadmium at its maximum (8.644±2.731 mg Cd from its roots and 0.550±0.071 mg Cd from its shoots) with 59.19% Cd removal and with significantly low amount of Cd in the medium (6.349±0.142 mg Cd). During the time where most of the Cd in solution was absorbed by the plant, the bioaccumulation factor (BAF) was calculated to be 4947 suggesting that it is a good accumulator of cadmium while the translocation factor (TLF) was 0.0533 thereby indicating that Eichhornia crassipes is a metal excluder. The average rate of cadmium uptake was found to be 1.42 ppm/day. Using the data obtained from the 14-day exposure, it was calculated that approximately 2045 mg of Cd can be recovered from a 10 m² contaminated site with 1482 water hyacinth plants.

Keywords: phytoremediation, water hyacinth, bioaccumulation factor, translocation factor, metal excluder

COBALT II CHLORIDE-DOPED HYBRID POLYMER GRADIENT AS COLORIMETRIC WATER ACTIVITY SENSOR

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Water activity measurement is a major tool in determination of limit of microbial growth and chemical reactions on pharmaceutical and food industries since it quantifies the amount of available water in the sample at specific conditions. One method for determining the water activity is the use of a hygroscopic material that gives either a colorimetric or electrochemical response. Cobalt(II) chloride is known to change its color from blue to pink when it is converted into its hexahydrate form. The application of inorganic-organic hybrid polymer made from various polymeric systems (e.g., polyvinyl alcohol, polyethylene oxide, functionalized silanes) are investigated to control the hydration of cobalt chloride to allow quantification of the water activity of the surrounding medium through a subsequent color change.

The fabricated sensors were subjected to UV-vis spectroscopy to measure the blue to red transition at different levels of water activity. ImageJ® program was used to determine the color intensity from the photographs of the sensors. The sensors were analyzed under Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM) and contact angle measurements to confirm the presence of chemical gradients and hybrid polymer linkages. The sensors showed a decrease in intensity at 690 nm (blue region) and an increase at 480 nm (pink region). ImageJ® color map supported the changes in the color shifting of the sensors.

Keywords: water activity, polymer gradient, hybrid polymer, sensors, polymer functionalization

ISOLATION, CHARACTERIZATION AND SCREENING OF CELLULOSE DEGRADING BACTERIA FROM THE GUT AND CAST OF AFRICAN NIGHT CRAWLER

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The African night crawler is widely known as an excellent worm for vermicomposting and has been reported to play a significant role in solid waste management programs of Southeast Asian countries, including the Philippines. The decomposition of organic matter is attributed to the millions of bacteria associated with these worms. In this study, bacterial isolates from the gut and cast of African night crawler were obtained and characterized for their morphological and biochemical properties. More importantly, the isolates were tested for their potential to produce noteworthy enzymes to degrade cellulosic waste materials. Nine isolates were obtained and characterized, four from the gut (isolates A, B, C, D) and five from the cast (isolates E, F, G, H, I).

The results show that only isolate C has the potential to degrade paper, a cellulosic material. The isolate is an aerobic Gram-negative rod bacterium with its colony form as rhizoid, elevation as convex, and margin as filiform. Its slant growth type is filiform. It is an osmophile that can tolerate up to 30% sugar concentration. Interestingly, the isolate is documented to be negative in the protein, starch, gelatin, lipid hydrolysis and hemolysin tests, which indicates that it is not pathogenic. The findings suggest that isolate C exhibits cellulolytic activity and should be subjected to further study to investigate its potential for the degradation of cellulosic waste materials for industrial applications.

Keywords: African night crawler, bacteria, degradation, cellulose, waste

A DIPEPTIDE WITH ANTI-HYPERTENSIVE ACTIVITY FROM COWPEA (Vigna unguiculata) SEED 7S GLOBULIN

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The major storage protein, 7S globulin from cowpea (Vigna unguiculata) seeds has been isolated, purified and characterized. In silico analysis showed that the 7S globulin contains bioactive peptides with antihypertensive activity. The protein was isolated using borate buffer, pH 8.0 and precipitated using ammonium sulfate. Purification of the isolated protein involved dialysis and gel filtration chromatography. Protein concentration was determined using Bradford method and revealed that the crude protein extract and partially purified protein contain 6.0 mg/mL and 2.0 mg/mL protein concentration, respectively. The partially purified protein was digested using pepsin. Peptic hydrolysate of the partially purified protein after a 24-hr digestion inhibited the activity of angiotensin-I converting enzyme (ACE) by 85.5% and had an IC_{50} of 0.22 mg/mL. The hydrolysate was then subjected to reversed-phase high performance liquid chromatography (RP-HPLC) to determine and separate possible peptide fractions that caused anti-ACE activity of the hydrolysate. From the 6 fractions detected, only one fraction was notable in the chromatogram having the highest concentration and gave 90.0% inhibitory activity towards ACE and IC_{50} of 0.07 mg/mL. Acid hydrolysis of this fraction followed by thin layer chromatography indicated a dipeptide with the following possible sequences Tyr-Gly, Gly-Tyr, Ala-Phe, Phe-Ala, Gly-Phe, or Phe-Gly.

Keywords: bioactive peptide, protein purification, angiotensin I-converting enzyme (ACE), anti-hypertensive activity

A NON-AGGREGATION SURFACE PLASMON RESONANCE-BASED GOLD NANORODS COLORIMETRIC SENSOR FOR DETERMINATION OF Hg(II) IONS IN AQUEOUS MEDIUM

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There has been a growing interest in the development and application of nanomaterials-based chemical sensors for the detection of heavy metal ions due to their improved sensitivity and selectivity in comparison with conventional colorimetric chemical sensors. In this study, a simple non-aggregation colorimetric sensor for the determination of Hg(II) ions in aqueous solution based on localized surface plasmon resonance of gold nanorods (AuNRs) was developed. The AuNRs were synthesized via the seed-mediated growth method and characterized using UV-Vis spectrophotometer as having absorption bands at 520 nm and 646 nm corresponding to the characteristic transverse plasmon (TP, λ_{T}) and longitudinal plasmon (LP, λ_r) bands, respectively, of AuNRs. In the sensing system, Hg(II) ions are reduced by NaBH₄ to Hg⁰ which then interact with the AuNRs causing a color change in the solution from blue to red. This color change is also observed as a blue shift in the LP band $(\Delta \lambda_{r})$ of the AuNRs. Plot of the $\Delta\lambda_r$ against the Hg(II) ions concentration ranging from 0.65 to 0.90 mM exhibited a good linearity of 0.970 r² and sensitivity of 84.983 $\Delta \lambda_r$ /mM. The calculated limit of detection (LOD) for this method is 3.22×10^{-3} mM. The method also showed good selectivity for Hg(II) ions over Cd(II) and Pb(II) ions.

Keywords: Gold Nanorods, seed mediated growth, non-aggregation colorimetric sensor, surface plasmon resonance, mercury (II) ions

FLUORESCENCE BASED GLUCOSE BIOSENSOR WITH THE UTILIZATION OF SOL-GEL IMMOBILIZED GLUCOSE OXIDASE

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Blood glucose monitoring is routinely performed as a diagnostic and prognostic intervention in diseases such as hypoglycaemia and diabetes. Hence there is a need to develop new sensors for blood glucose monitoring. A glucose biosensor was developed using the enzyme glucose oxidase immobilized in polyacrylaminde gel. The enzyme catalyzes the conversion of glucose to gluconolactone.

Using the sol-gel technique, glucose oxidase in phosphate buffered saline solution was immobilized in polyacrylamide gel. The optimum glucose oxidase concentration in polyacrylamide gel was determined to be 4.5 mg/ml. Fluorescence of glucose oxidase in the gel was then measured after treatment with different concentrations of glucose. A decrease in fluorescence of the glucose oxidase was observed with increasing glucose concentrations. The response was linear for both low (2.0-24.0 μ M) and high (0.006-0.010 M) concentrations of glucose. The measurements were repeatable with a coefficient of variation ranging from 0.21 to 1.82%. The limit of detection (LOD) was found to be 0.03 μ M while the limit of quantification (LOQ) was 0.10 μ M. The % recoveries from the unknown sample range from 95.8 to 99.7 %. Blood serum glucose analyses from four donors ranged from 95.3 to 117 mg/dL vs. normal levels of 80-110 mg/dL.

The use of this glucose sensor was found to be simple, rapid and a potential alternative method for glucose monitoring.

Keywords: glucose, glucose biosensor, sol-gel, glucose oxidase, fluorescence

DETOXIFIED Jatropha PRESSED CAKE FOR USE AS ANIMAL/POULTRY FEEDS

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Jatropha pressed cake (JPC) can be detoxified and used for animal feeds in poultry. Detoxification process includes heating of the pressed cake at 110 °C for 4 hours followed by soaking with hexane to remove the residual oil and soak again with ethanol then dried. Phorbol esters were no longer detected and anti-nutritive compounds were reduced. Yield of detoxified Jatropha pressed cake is about 73.24%. Acute oral toxicity test of the saline extract of defatted heat treated Jatropha pressed cake showed that a high dose of 160 mL/kg did not cause death in the test animals (mice) within the 14 days observation. When applied to poultry feeds, at 3%-5% concentration in broiler diets, an increase in average body weight and feed consumption were noted. Livability of broilers ranged from 94% to 98%. Histopathology analysis showed that most of the birds in all treatments were afflicted with oryza (severe cold due to cold weather). Gross pathology showed carcass is well-muscled in all birds in the three treatments. Excessive mucus exudate in the oropharynx and nares were observed in all treatments. No gross lesions were found in 13.3% of live birds in the control; 60% in 3% JPC, and 40% in 5% JPC.

Keywords: Jatropha pressed cake oil; poultry feeds, detoxification

MPS – 15 CHARACTERIZATION OF PHILIPPINE CIVET AND NON-CIVET COFFEE VOLATILES BY HEADSPACE SOLID-PHASE MICROEXTRACTION GAS CHROMATOGRAPHY MASS SPECTROMETRY

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Civet coffee is the most expensive coffee in the world due to its unique taste and aroma. It is produced only in few countries, including Philippines. At present, there is no internationally accepted method of verifying whether a bean is civet coffee. This study aims to discriminate civet coffee with control coffee (not eaten by civet) based on volatile organic compounds (VOCs). The coffee volatiles were identified using headspace solid-phase microextraction gas chromatography mass spectrometry (HS-SPME-GCMS). The 3-phase SPME fiber extracted almost similar compounds for civet and non-civet coffee samples but of different concentrations. All coffee samples were characterized by a high amount of furfuryl alcohol and low concentrations of pyrrole and 2-methylfuran. Arabica civet coffees (Cordillera Civet and Matutum Civet) appeared to be greater in concentration for furanderivative compounds, maltol, acetic acid, dodecane and 1-H-pyrrole-2carboxaldehyde with lower amounts of guaiacol, phenol, 4-ethylguaiacol, ethanone, 1-[3-methoxyphenol] and pyrazine compounds than Robusta civet coffees (Asipulo Civet and Kalinga Civet). It was also observed that the higher amount of 2-furancarboxaldehyde in all civet coffees beans substantiates its potential as discriminating variable against control coffee beans. Chemometric analysis validated the distinction between civet and their control coffee beans. It is therefore concluded that determination of coffee volatiles is a reliable approach to evaluate the authentic aroma quality of civet coffee. The findings also suggested that the overall quality of civet coffee is variety and region specific.

Keywords: HS-SPME-GCMS, civet coffee, Arabica, Robusta, volatile compounds, authentic quality

SUITABILITY OF GROUNDWATER FOR DRINKING AND IRRIGATION IN SELECTED BARANGAYS OF BATAC, ILOCOS NORTE, PHILIPPINES

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This study was conducted to determine the suitability of groundwater sources for drinking and irrigation purposes in Quiling Sur and Tabug, Batac, Ilocos Norte. Groundwater samples were collected and analyzed for major and minor cations and anions, such as Na⁺, K⁺, Ca²⁺, Mg²⁺, Cl⁻, HCO₃⁻, CO₃⁻², and NO₃-N, as well as important chemical parameters such as Total Dissolved Solid (TDS), Electrical Conductivity (EC), pH, and bacteriological parameters, which include total coliform organisms. Concentrations of Na⁺, Cl⁻, NO₃-N, TDS, pH and total coliform organisms were used in assessing suitability for drinking. On the other hand, the EC, Adjusted Sodium Adsorption Ratio (SAR), Soluble Sodium Percentage (SSP), Magnesium Hazard (MH) and Residual Sodium Carbonate (RSC) were used for irrigation suitability assessment. The results showed that the groundwater in the study area was not fit for direct drinking with respect to TDS, NO₂-N and total coliform organisms. In some of the samples collected, the concentrations of these parameters exceeded the permissible limits of the Philippine National Standards for Drinking Water (PNSDW 2007). Seventy-five percent of samples had higher total coliform than the permissible limit. Based on MH, 50% of the groundwater samples were above the permissible limit for irrigation.

Keywords: suitability, groundwater, quality, irrigation, drinking

POTENTIAL OF PHILIPPINE GERMINATED BROWN RICE AS BASE INGREDIENT FOR FUNCTIONAL BEVERAGES

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This study aimed to evaluate the potential of germinated brown rice (GBR) for the production of functional beverages. Rice cultivars namely NSIC Rc13, NSIC Rc160, black rice (Ominio), and red rice (Chor-choros) were germinated, and characterized in terms of proximate composition, antioxidant activity, and eating quality. GBR from these varieties were also used in the development of healthy and nutritious GBR drinks. Results showed that black rice had the highest fat, protein, fiber, anthocyanin, phenolic, carotenoid, and vitamin E contents. On the other hand, germinated red rice had the highest ash content while germinated NSIC Rc13 had the highest carbohydrate content. Germinated pigmented rice samples exhibited stronger antioxidant scavenging activity than white rice samples. All beverages from germinated rice samples had comparable sensory qualities and differed only in terms of appearance. All beverages from germinated rice samples except red rice had even higher consumer preference and acceptability than commercial soya milk. This study concluded that our local varieties could be used for the production of high quality GBR. The substantial amount of nutrients and antioxidants in GBR from both white and pigmented rice varieties make them suitable as base ingredient in the development of healthy and nutritious cereal-based beverages.

Keywords: brown rice, germinated brown rice, pigmented rice, proximate composition, antioxidant activity, anthocyanin, eating quality, ready-to-drink beverage

COOKING AND TEXTURAL QUALITY AND HEALTH-PROMOTING PROPERTIES OF BROWN RICE FROM LOCAL VARIETIES

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Brown rice consumption can help address rice self-sufficiency due to its higher milling recovery. Regular consumption of nutrient-rich brown rice may also help reduce the risks of chronic diseases such as cardiovascular diseases, type 2 diabetes, and cancers thus, improving nutritional status of Filipino rice consumers. Despite the economic, health, and nutritional advantages, brown rice remains unpopular because of longer cooking time and harder texture. To increase its acceptability to consumers, we identified local rice varieties that are suitable for brown rice production and consumption. A total of 30 rice varieties were evaluated for physicochemical properties, cooking time, cooked brown rice Instron hardness, and total phenolic content (TPC), and antioxidant capacity. Cooking times were between 16.88 and 36.85 min and were significantly different among rice varieties, and correlated significantly with the gelatinization temperature or alkali spreading values. Instron hardness values of cooked brown rice ranged from 1.99 to 3.67 kg/cm² and were significantly lower for low amylose rice varieties. TPC differed significantly among the rice varieties. Highest TPC was found in PSB Rc66 with 6.84 mg GAE/g brown rice. Antioxidant capacity of brown rice extracts ranged from 54.85% to 60.14%. TPC correlated significantly with antioxidant capacity. Results suggest that rice varieties with low amylose content or those with intermediate amylose and gelatinization temperature produce brown rice with more acceptable cooking and eating quality. They are also good sources of health-promoting compounds.

Keywords: brown rice, cooking time, Instron hardness, total phenolic content, antioxidant capacity

ELECTRODEPOSITION AND THIN FILM FORMATION OF HYPERBRANCHED POLY(N-VINYLCARBAZOLE) ON GOLD AND INDIUM-TIN-OXIDE SUBSTRATES

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Carbazole-based polymers are known to have intrinsic optoelectronic and hole transport properties which make them potential materials for organic light-emitting diodes and other organic-based devices. These polymers, by virtue of the carbazole moieties in their structure, are electroactive and thus may undergo electrochemical cross-linking and electrodeposition on conducting substrates. However, the thin films formed by linear poly(Nvinylcarbazole) [LPVK], based on previous studies, were found to have high surface roughness and uneven film thickness and surface coverage. In this study, we explore on the effects of hyperbranched polymer architecture on the properties of the films formed. Hyperbranched poly(N-vinylcarbazole) [HPVK] was synthesized by reversible addition-fragmentation chain transfer polymerization in the presence of an initiator monomer, 2-(methacryloyloxy) ethyl 4-cyano-4-(phenylcarbonothioylthio) pentanoate (CPP-HEMA). The hyperbranched polymer was then electrodeposited by cyclic voltammetry on different conducting substrates to afford the electroactive thin films. The films were analyzed by surface plasmon resonance spectroscopy (SPR), atomic force microscopy (AFM), UV spectroscopy and ellipsometry. These data were compared to the ones obtained using LPVK. Effective electrodeposition on ITO substrates was proven by the shoulder peak observed at 430 nm. Furthermore, results showed that hyperbranched PVK produced smoother, more homogeneous and thinner films with a surface roughness of 10-15 nm and film thickness of less than 10 nm.

Keywords: hyperbranched polymer, electrodeposition, RAFT, poly(N-vinylcarbazole, surface roughness, film thickness

THERMO AND PH- RESPONSIVE BEHAVIOR OF HOMO AND CO- POLYMERS OF DIETHYLENE GLYCOL METHYL ETHER METHACRYLATE (DEGMEMA) AND METHACRYLIC ACID (MAA) IN AQUEOUS SOLUTIONS

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Synthetic polymers that undergo phase transitions in response to physiological stimuli such as pH and temperature, have been extensively studied over the past years for applications in drug-delivery systems, diagnostics, gene- or protein- therapy and several fields of biotechnology. Here, we report the synthesis of homopolymers of DEGMEMA and MAA, and their block and random copolymers, through reversible additionfragmentation chain transfer (RAFT) polymerization. Successful syntheses of these polymers were confirmed by H-NMR analysis, FT-IR spectra and molecular weight measurements via GPC. The behavior of the polymers in response to temperature and pH, in aqueous solutions, was investigated by determining the lower critical solution temperature (LCST) using UV-vis spectroscopy. Homo-DEGMEMA, DEGMEMA-r-MAA and DEGMEMAb-MAA demonstrated thermo-responsive behavior as they displayed LCST in the range of 27-50°C. No LCST was detected for Homo-MAA but showed turbidity below pH 5 (cloud point) confirming its pH responsiveness. DEGMEMA-r-MAA and DEGMEMA-b-MAA were proven to exhibit different LCST at different pH values (2, 4, 7, and 10) confirming their dual responsive behavior. Lastly, the surface morphology and aggregation behavior in aqueous solutions of the polymers were assessed using Atomic Force Microscopy (AFM). These results reveal the promising potential of DEGMEMA and MAA copolymers as components in formulating dualresponsive drug vesicles in order to control the release of drugs.

Keywords: RAFT, LCST, pH-responsive, thermo-responsive, cloud point

POLYANILINE/Cocos nucifera L. LEAF SHEATH MICROCELLULOSE ELECTRODE MATERIAL FOR SUPERCAPACITORS

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Supercapacitors are energy storage devices that mainly use carbon, metal oxides and hydroxides as electrode materials. With the modern shift towards green chemistry, there is more research interest in non-toxic and biodegradable alternatives. Cellulose, the most abundant biopolymer present in many agricultural residues, was used as the template for polyaniline (PANI). Cellulose was extracted from the coconut leaf sheath using alkaline and bleaching methods (M1-w/ soxhlet; M2-direct NaOH) and gave a 45 - 48% yield. Its size was then reduced to microcellulose (MC) via acid hydrolysis. To incorporate PANI, in situ chemical polymerization was performed using various aniline/MC ratios. The PANI/MC composites were subjected to 4-point probe conductivity testing and cyclic voltammetry for specific capacitance. PANI/MC composite with 90:10 ratio gave the highest conductivity of 3.9x10⁻⁵ Scm⁻¹ and specific capacitance of 104.57 Fg⁻¹. Samples were characterized by scanning electron microscopy (SEM), thermo-gravimetric analysis (TGA), and Fourier transform infrared (FTIR) spectroscopy. SEM images showed the composite had thin ribbon-like strands with a rough surface coating. TGA analysis revealed that pure cellulose (335.28°C) was more thermally stable than the extracted cellulose (M1 - 331.71°C; M2 – 312.55°C). The FTIR spectra of the composites showed characteristic peaks of both pure PANI and MC indicating success of in situ polymerization. The results indicated the valuable and promising potential of the PANI/MC as an electroactive material for supercapacitor technology.

Keywords: polyaniline, cellulose extraction, coconut leaf sheath, electrode material, microcellulose, supercapacitors

DRYING KINETICS OF OKARA (SOYA PULP) USING THE MULTI-COMMODITY HEAT PUMP DRYER (MCHPD)

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Okara (soy pulp), a by-product and waste from the production of soymilk, tufo and tokwa and soybean-based vegan food products is readily available in the university thrice a week. This study was conducted to determine the drying kinetics of soya pulp using the MCHPD. Specifically, it aimed to establish the time of drying; moisture loss per hour and percent moisture content of soya pulp and to establish the dried okara as an ingredient to other foods. The MCHPD is drying equipment that has an ideal drying condition of 50.0°C and 10.0% relative humidity. Fresh and wet soya pulp were weighed at 1.0 kg per tray (21 drying trays), laid on the trays lined with cheese cloth. The MCHPD was set to desired drying conditions. Weight loss was monitored every hour and calculated using standard formulas.

Results showed that the drying time for soya pulp was 19.0 hours; the % moisture content was reduced from 85.0% to 6.0% at an average moisture loss of 3.0 g/hr. The nutritional values of okara were favorably maintained with enhanced color. The dried okara was added as an ingredient to other healthy bakery products produced by the AUP Food Factory. Making use of okara would add nutritional values to other food products and would also help waste management concerns inside the university.

Keywords: okara, MCHPD, drying kinetics, nutritional values, waste management

ELECTROCHEMICAL AND SURFACE CHARACTERISTICS OF PULSE ELECTRODEPOSITED PDNI/GRAPHENE COMPOSITE FOR DIRECT ETHANOL FUEL CELL

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Research efforts are being undertaken to reduce the cost of Pt-based anode electrocatalysts in Direct Ethanol Fuel Cell (DEFC) by exploring less expensive Pd-based nanoparticles dispersed on a suitable support. This research aims to electrochemically synthesize and characterize a pulse electrodeposited Pd-Ni metallic particles dispersed on graphene support. Pulse electrodeposition technique was used to deposit the electrocatalyst composite. CV studies revealed that Pd/reduced graphene oxide-modified glassy carbon electrode (Pd/RGO/GCE) gave a higher current density (23.147 mA/cm²) towards ethanol oxidation in basic medium compared to Pd-modified glassy carbon electrode (Pd/GCE) (19.814 mA/cm²). Furthermore, the addition of Ni as a promoter metal enhanced its catalytic activity (93.787 mA/cm²). SEM studies showed the wrinkled morphology, characteristic of graphene and good dispersion of the metallic particles on graphene support. This study demonstrates a simple, green, and effective synthesis of PdNi nanocatalysts on graphene support using electrochemical methods which can be a potential alternative to Pt as anode materials in DEFC

Keywords: fuel cell, electrocatalyst, graphene, ethanol electrooxidation, pulse electrodeposition

POLYANILINE COMBINED WITH MICROCELLULOSE FROM *Oryza sativa* STALK AS SUPERCAPACITOR ELECTRODE

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Polyaniline (PANi) is conducting, highly porous, easy to synthesize and low cost, making it a good electrode material for supercapacitors. However, it has poor mechanical properties leading to low cycling stability. To overcome this problem, PANi was combined with microcellulose (MC) extracted from Oryza sativa (rice) stalk and characterized as a supercapacitor electrode material. Cellulose was extracted from O. sativa by dewaxing (w/-T1; w/o-T3), delignification, bleaching and purification. A 28% yield of cellulose was obtained. Extracted cellulose was then hydrolyzed using 64% (w/v) sulfuric acid to decrease its particle size into micro scale. PANi was chemically polymerized onto MC with a 50:50, 70:30, and 90:10 aniline:MC ratio by *in situ* polymerization. Using the four-point probe technique, T1 90:10 composite exhibited the highest conductivity (36.4 µScm⁻¹). T1 90:10 composite was chosen as the best sample and was further characterized using SEM, TGA, FTIR, and CV. SEM images showed the increased roughness of the surface morphology of the MC due to the coating of granular-shaped PANi. FTIR spectrum of the composite material showed the characteristic peaks of PANi. TGA curves revealed that the PANi/MC composite was less thermally stable than MC with onset decomposition temperatures of 180.2°C and 244.7°C, respectively. CV at a scan rate of 50mVs⁻¹ gave the specific capacitance of the T1 90:10 composite to be 342 Fg⁻¹.

Keywords: Polyaniline, microcellulose, supercapacitor, electrode material, rice stalk

IDENTIFICATION AND SEQUENCING OF GLUCOAMYLASE GENE FROM Bubod ISOLATE Saccharomycopsis bubodii 2066

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Saccharomycopsis bubodii 2066 is locally isolated from *bubod*, a starter used in making the traditional rice wine *tapuy*. It was found to possess amylolytic activity using raw sago starch as substrate.

A cDNA sequence (~80%) that encodes a glucoamylase gene from *S. bubodii* was determined using primers designed based on published *Saccharomycopsis fibuligera* glucoamylase sequences. The contig sequence of 1247 base pairs shows 99% identity when aligned with glucoamylase genes from at least three strains of *S. fibuligera* available in GenBank. Our data suggest that, although *S. bubodii* is a different species from *S. fibuligera*, this particular glucoamylase gene is highly conserved. The remaining sequence of the open reading frame (ORF) of the glucoamylase gene is being determined thru primer walking technique.

This is the first report of a glucoamylase gene sequence in *S. bubodii*. Subsequent identification of a raw starch-digesting amylase gene and cloning it in *Saccharomyces cerevisiae* will allow its utilization for direct ethanol production from raw sago starch.

Keywords: *Saccharomycopsis bubodii*, glucoamylase, sago starch, *Saccharomycopsis fibuligera*, cDNA

REVERSIBLE ADDITION-FRAGMENTATION CHAIN TRANSFER POLYMERIZATION AND CHARACTERIZATION OF THERMO-RESPONSIVE BLOCK COPOLYMERS OF POLY(ETHYLENE GLYCOL) METHYL ETHER METHACRYLATE AND METHACRYLIC ACID

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The synthesis of polymers designed to imitate the chemistry behind naturally-occurring polymers is an emerging field of research. Their most notable feature involves reversible transitions of the polymer in response to external stimuli, like temperature and pH. This study aims to synthesize a pH- and thermo-responsive polymer and to analytically characterize it of its fundamental properties and temperature sensitivity. The synthesis of homopolymers of poly(ethylene glycol) methyl ether methacrylate (PEGMA) and methacrylic acid (MAA), and their block copolymers, were performed via the reversible addition-fragmentation chain transfer (RAFT) polymerization technique, using 4-cyano-4-(phenylcarbonothioylthio) pentanoic acid as the chain transfer agent, and azobis(isobutyronitrile) as the initiator. The product's structure and morphology were assessed using Proton Nuclear Magnetic Resonance (1H-NMR) Spectroscopy, Fourier Transform Infrared (FT-IR) Spectroscopy, and Atomic Force Spectroscopy (AFM). The molecular weight was then determined via gel permeation chromatography. Data obtained from these analytical tools affirmed the success of the polymerization process. Lastly, the lower critical solution temperature (LCST) of the polymer was determined via turbidity measurements. An LCST value range of 50-85°C for the polymers was noted, confirming their thermo-responsive behavior. These results show the vital link between polymer thermo-responsiveness and its possible applications on sensors, drug delivery, and biotechnology.

Keywords: polymer, thermo-responsive, RAFT, PEGMA, MAA

SYNTHESIS AND CHARACTERIZATION OF CuO/Bi-TiO₂ AS A POTENTIAL CATALYST TOWARDS PHOTOCATALYTIC REDUCTION OF CARBON DIOXIDE TO METHANOL UNDER VISIBLE-LIGHT ILLUMINATION

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The synthesis and characterization of copper oxide deposited on bismuth-doped TiO_2 has been investigated as a potential catalyst towards photocatalytic conversion of carbon dioxide (CO₂) to methanol (CH₃OH) using visible-light illumination . The Bi-doped TiO_2 was prepared via sol-gel process and the copper oxide (3%, 15%, and 30% by wt.) was deposited on Bi-TiO₂ photocatalysts by an improved impregnation method. The catalysts were calcined at 500°C and were also balled–milled to improve the particle size distribution. The photocatalysts were characterized by X-ray diffraction (XRD) for phase composition analysis, Scanning Electron Microscopy (SEM) for surface morphology analysis, Energy-Dispersive X-ray (EDX) for elemental analysis and UV-Visible Diffuse Reflectance Spectroscopy (UV-Vis DRS) for spectral and band-gap measurements.

The XRD patterns of CuO/Bi-TiO₂ photocatalysts showed peaks that are associated with CuO, as well as with the anatase and rutile phases of TiO₂. CuO/Bi-doped TiO₂ was found to mainly preserve its anatase phase after calcination at 500°C. The crystallite size, estimated on the XRD data using the Debye-Scherrer equation, was in the range of 20-26 nm. The EDX data verified the presence of Ti, O, Bi, and Cu in the elemental analysis. The SEM images revealed that the CuO/Bi-TiO₂ particles were more spherical, uniform and homogenous. The UV-Vis DRS of CuO/Bi-TiO₂ showed red shift in the optical absorption, which makes the photocatalysts active in visible light. Doping and depositing Bi and CuO respectively, to TiO₂ decreases the band gap of bare TiO₂ which is 3.2 eV, to 2.15 eV for the 30% CuO/Bi-TiO₂. An increase in the CuO loading corresponded to higher cut-off wavelengths, thereby resulting to lower band gap energies.

Keywords: photoreduction, nanoparticles, visible-light photocatalyst, CuO/ $Bi-TiO_2$

THE EFFECT OF THE NUMBER OF SUCCESSIVE IONIC LAYER ADSORPTION AND REACTION (SILAR) CYCLES ON THE PHOTOVOLTAIC PERFORMANCE OF PBS/ CDSE QUANTUM DOT CO-SENSITIZED TiO₂ NANOTUBE ARRAYS PHOTOELECTRODE TOWARDS HIGHLY EFFICIENT SOLAR CELLS

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The Philippines has a wide range of opportunities for solar energy access and development due to its location. Quantum dot solar cell has the potential to produce high efficiencies with a relatively cheap cost of fabrication. This study seeks to identify the effect of the number of Successive Ionic Layer Adsorption and Reaction Cycles. The titania were fabricated using anodization method and deposition of PbS/CdSe QDs were done through SILAR method. The as-prepared photoanodes (3, 6, and 9 cycles) were characterized using SEM, EDX, and XRD. The solar cells were fabricated by sandwiching the following: FTO glass, polysulfide electrolyte, and photoanodes (6 and 9 cycles). The photovoltaic measurements of the solar cells were obtained using potentiostat. It has been found that the efficiency of 6 cycles compared to that of 9 cycles has an increase of 435.09 %. Given the set of parameters used in this study, it shows that as the number of cycles increases, the photoconversion efficiency also increases.

Keywords: PbS/CdSe, quantum dot, TiO₂ nanotube arrays, solar cells, SILAR cycles
DEVELOPMENT OF POLYANILINE-SILVER NANOCOMPOSITE-BASED SENSING MATERIAL FOR BREATH ANALYZERS

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A new approach for the detection of trimethylamine (TMA) using polyaniline-silver nanocomposite (PANI-AgNC) was investigated. The presence of TMA in breath serves as a biomarker of the disease trimethylaminuria (TMAU). TMAU is caused by the failure of a certain enzyme in the liver. This research offers a rapid diagnosis of TMAU which had very few reports due to lack of diagnosis and unawareness of the condition.

The nanocomposite was synthesized by *in-situ* chemical oxidation polymerization of aniline in the presence of silver nanoparticles (AgNPs). The optimized parameters for the synthesis of AgNPs include the use of ascorbic acid as a reductant at pH 10.07, in the ratio 9:1 AgNO₃: ascorbic acid, and in the presence of 0.3% aqueous ammonia. SEM micrographs of PANI-AgNC showed an average diameter of 699 ± 83.1 nm for AgNPs. PANI-AgNC exhibited a linear concentration range of 1 to 100 ppm TMA with a sensitivity of -140 5ØÅÞ / -log ppm [TMA] and a correlation coefficient of 0.9231. In addition, it presented a high repeatability towards 1ppm TMA with 8.127 % rsd and a fast average response time of 180 seconds. PANI-AgNC showed enhanced sensitivity and linearity compared to pristine PANI. The addition of AgNPs to pure PANI, therefore, indicates enhanced sensor characteristics.

Keywords: polyaniline-silver nanocomposite, trimethylamine, trimethylaminuria, silver nanoparticles, ascorbic acid

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ROOM TEMPERATURE TRIMETHYLAMINE SENSOR BASED ON HYBRID GRAPHENE/POLYANILINE NANOCOMPOSITE

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Graphene nanosheets/polyaniline (PANI) nanocomposites were prepared by solution blending the dispersed reduced graphene oxide to water soluble PANI at different volume ratios. The prepared nanocomposite was analysed for its surface, thermal and electrical characteristics. The nanocomposite was embedded on a polymer membrane serving as a platform of the nanomaterial for chemiresistive gas sensing characterization. The sensors which were exposed at room temperature to different concentrations of trimethylamine (TMA) gas exhibited linearity within a concentration range between 23 and 230 mg/L with a Pearson coefficient (r²) of 0.9588. The sensitivity of rGO/PANI nanocomposite to amine vapour was determined at 1.58 x 10⁻² ÄR/mg L⁻¹. The TMA sensor can detect gaseous TMA as low as 1.0 mg/L. It is noteworthy to mention that the developed trimethylamine sensor exhibited reversibility and repeatability towards to the analyte. This implies that the nanocomposite can be a promising candidate as a gas sensor for TMA gas.

Keywords: graphene, trimethylamine, hybrid conducting polymer, chemiresistor and polymer nanocomposite

DISEASES AND CLIMATE CHANGE IN THE PROVINCE OF ILOCOS NORTE

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Secondary data on the leading diseases based on morbidity and mortality rates for the years 2001-2010 were gathered from the municipalities of Ilocos Norte were analyzed together with weather data (maximum temperature). The association between weather and the diseases were analyzed using the time-series analysis tool. In addition, monthly morbidity and mortality rates and the maximum temperatures from 2011 to 2012 were also taken.

Results showed that the temperature in Ilocos Norte experienced an increase with values numbers rising as high as 33.4 °C during the years 2003, 2004 and 2007, which is above the average temperature of 27 °C. In the City of Batac, AURI (acute upper respiratory infections) and CVA (cerebrovascular accident/stroke) had an average of 2289 cases and 103 mortalities per year, respectively. Monthly time-series analysis (2011-2012) also showed that as the temperature rises, ailments/diseases such as the AURI and cardiac diseases also rose in number. Results from the town of Adams show that when the temperature rose to 34 °C, AURI and other respiratory infections simultaneously increased.

The most common diseases that afflicted the towns in the Province over the past decade were AURI, bronchial asthma, and bronchitis, while CVA and MI (myocardial infarction) were the most common cause of death in the locality. Time-series analysis also showed that higher temperatures increased the aforementioned illnesses.

Keywords: morbidity, mortality, climate change, diseases, impact

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SYNTHESIS OF GLYCEROL MONOESTERS BY PROTECTION/DEPROTECTION METHOD AND THEIR EFFECT ON FUNGAL GROWTH

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Glycerol Monoesters synthesized from glycerol have many applications such as emulsifying agents in food, cosmetics or in detergents. Protection of glycerol using acetone was employed followed by DCC/ DMAP coupled esterification of the protected glycerol and fatty acids such as lauric acid, palmitic acid and myristic acid. Deprotection using acetic acid was also employed to yield monoglycerides in high yield and purity. Inhibitory effects of each synthesized monoglycerides on the growth of fungi were analyzed and compared.

Keywords: Glycerol Monoesters, deprotection, monoglycerides, lauric acid, palmitic acid

THE APPLICATION OF ISOTOPE AND GEOCHEMICAL TECHNIQUES TO REVEAL CONTRIBUTIONS OF SUBMARINE GROUNDWATER AND SEPTIC SYSTEMS DISCHARGES TO ALGAL BLOOM IN BORACAY ISLAND

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The study showed that critical areas in Boracay island are contaminated by coliform bacteria and blue green algae (cyanobacteria). The distribution of tritium, ¹⁸O, ¹⁵N, and ¹³C in seawater, biota and sediments in the intertidal zone, helped to identify sites with septic sewage outflows and submarine groundwater discharge, SGD. Nitrates (from 0.0 to 2.3 parts per million, ppm) and nutrients were discovered in seawater, particularly in four identified sites in the bathing zone. Point sources of infiltrating plumes were exposed by anomalies in tritium and ¹⁸O in sea water. Septic and canal outflows as well as land based run-offs and submarine groundwater discharge were the identified causes of nutrient enrichments in sites with eminent algal bloom. The isotope composition implied that algae acquire nutrients from septic contamination, while a number of corals assimilate inorganic fertilizer nutrients from land-based plumes and SGD. The elements identified in sediments and corals were related to the natural mineral matrix of calcareous beach zone materials; however, sporadic spikes of lead, chromium and zinc were detected in particular sites at certain depths. These element spikes proxy processes linked to anthropogenic pollution and/or organic matter decomposition in the sediment-water interfaces. The practicality of applying isotope-based techniques in conjunction with other chemical methods for the tracking down of the sources of nutrient contamination in polluted systems is demonstrated by the study.

Keywords: submarine groundwater discharge, algal bloom, stable isotopes, tritium

FABRICATION OF AN INEXPENSIVE PHOTOSENSITIVE FLOW THROUGH DEVICE FOR TURBIDITY MEASUREMENT

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The aim of this study is the construction of a portable, simple to use, on-line photosensitive device which measures turbidity in water. The turbidity measuring device uses a light emitting diode, LED, light source shining on a light dependent resistor, LDR, which is connected in series to a circuit supplying a constant voltage and a digital voltmeter, DVM. Light shines through a tube containing the sample, and onto a photosensitive circuit. A clear tube of water is the BLANK and has zero absorbance. A fraction of the incident light that is obstructed by the turbidity of the sample can be used for calculable determination of turbidity in water. The turbidity is related to the absorbance reading, following Beer's law. The amount of incident and transmitted light are expressed in Voltage units, by a voltmeter. The sample is delivered into the sampling chamber by a rubber tubing attached to a powerhead submersible pump which is immersed in the pool of water to be sampled. The instrument shows excellent response over the range of turbidity values (5 NTU to 180 NTU). Linearity (R²=0.95) has been achieved using the device, working with 6 trials per particular NTU value. The NTU readings of the turbidity meter were calibrated against solutions of varying NTUs measured using a HORIBA multi-parameter probe. The other features of the device include: simplicity of operation, low-cost, rugged, handy and can be used in on-line and flow mode applications.

Keywords: turbidity, flow through device, NTU, Beer's Law, LED, LDR

ACCURATE AND PRECISE MAJOR AND TRACE ELEMENT DETERMINATION IN MARINE SAMPLES BY NEUTRON ACTIVATION ANALYSIS

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The determination of elemental composition of marine samples has attracted a great deal of attention in environmental investigations, despite the obscurities presented by extremely low trace element concentrations and high calcium, sodium, and chloride interferences in those matrices. In this study, the expediency of instrumental neutron activation analysis, INAA, to measure major and trace elements in white sand, fish tissue, coral, and algae samples was evaluated. Sample irradiation was done at the IVV-9 nuclear research reactor in Dalat, Vietnam, using a fuel of WWR-M2, LEU (19.75% 235 U), and a neutron flux of 4.2×10^{12} n/cm²/s for both short and long irradiation. Counts were determined using high purity coaxial type germanium detector, and quantified by K-zero method. The accuracy of the method was validated by a concurrent analyses of standard reference materials, NIST SRM 1646a (estuarine sediment) and NIST SRM 1400 (bone ash). No significant matrix effects were observed and the obtained results were in good agreement with certified values (accuracy 0f 5-15%). The less elaborate sample preparation in INAA compared to other wet techniques of trace element analysis has been shown to produce lesser risk of ultratrace element contamination and losses. Detection limits in the order of parts per billion, ppb, range can be reached. The relative standard deviations for most elements were found to be about or below zero, indicating good reproducibility.

Keywords: neutron activation analysis, trace analysis, K-zero method, standard reference materials, contamination

MPS – 36 A NOVEL CDNA OF PILI (*Canarium ovatum* Engl.) SHOWS SEQUENCE HOMOLOGY WITH SMALL HEAT SHOCK PROTEINS FAMILY

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Pili is one of the 7 major fruit trees in the country and also one of the most typhoon-resistant species. Heat shock proteins (HSP) play a role in plant stress response. They are involved in the proper folding and/or elimination of misfolded proteins, thus contributing to cell survival. This study is a component of a research project on pili genomics and specifically aimed to isolate and characterize full length cDNAs of pili.

Total RNA was isolated from immature pili pulp of '*Katutubo*' variety and full length first-strand cDNAs were synthesized using the SeeGene CapFishingTM Full Length cDNA mini kit. A $(TC)_9$ -RA primer was used as target-specific primer for 3'-Rapid Amplification of cDNA Ends (RACE). The 3'-RACE amplicons were size-selected and cloned using the pGEM-T Easy vector system. A ~600 bp amplicon showed high homology with small HSPs and its upstream sequence was amplified using 5'-RACE to obtain a consensus full length sequence.

A 583 bp 3'-RACE product and a 187 bp 5'-RACE product have been amplified, cloned and sequenced. The two sequences were overlapped to obtain a 739 bp full length cDNA sequence. BLASTn multiple sequence analysis of the pili cDNA showed high similarity with small HSP genes of different crops. The deduced protein had 212 amino acid residues and contained the conserved á-crystalline domain (900-100 amino acids long) which is the basic building block of small HSPs. The deduced amino acid sequence was analyzed using BLASTp and showed highest homology with cytosolic small HSP of *Jatropha curcas* (83%).

The nucleotide and deduced amino acid sequences of the obtained cDNA were both highly homologous to cytosolic class I small HSPs. This is the first report of a full length novel cDNA in pili pulp which corresponds to the gene sequence of small heat shock proteins.

Keywords: pili, cDNA, heat shock protein

MPS – 37 GRAIN QUALITY AND STARCH PROPERTIES OF PHILIPPINE WAXY AND LOW AMYLOSE RICES WITH ATYPICAL GRAIN QUALITY

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Physicochemical and starch properties of atypical waxy and lowapparent amylose content (AC) rices with intermediate gelatinization temperature (GT) by alkali spreading value (ASV) were studied and compared to those with typical AC-GT combinations. NSIC Rc222, an intermediate-AC intermediate-GT rice as released, with hard cooked rice uncommon to such AC-GT combination, was similarly characterized and was actually high-AC.

Waxy and low-AC cultivars with intermediate GT by ASV were actually intermediate-high (IH)-GT by actual GT values. Low-GT had S-type amylopectin while intermediate- and IH-GT had L-type. Proportions of short chains were highly correlated with ASV, GT, Instron staled rice hardness and stickiness. Amylopectin staling was greater in IH-GT than in low-GT. High-performance size exclusion chromatography (HPSEC) of debranched starch yielded three fractions. Long-chain amylopectin content (LCA) was not appreciably present in waxy rices and did not exceed 6% in low-AC rices. True amylose content of NSIC Rc222 was similar with other intermediate-AC rices, while its LCA was 7.5% comparable to high-AC rices such as PSB Rc10. HPSEC starch fractions correlated significantly with cooked rice texture indices. Native waxy starch fractionation gave two peaks for Improved *Malagkit Sungsong* 2 (IMS2) and a single sharp peak for RD4, indicating that mean molecular weight of low-GT waxy amylopectin was lower than that of IH-GT. *Tapol*'s elution profile was intermediate to IMS2 and RD4.

Keywords: alkali spreading value, amylopectin, gelatinization temperature, grain quality, low-amylose rice, starch, waxy rice

IDENTIFICATION AND MOLECULAR CHARACTERIZATION OF BANANA BRACT MOSAIC VIRUS FROM ABACA AND BANANA IN THE PHILIPPINES

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Banana bract mosaic disease caused by Banana bract mosaic virus (BBrMV) infects banana clones. However, in 2000 BBrMV was reported causing natural infection on abaca in Albay, Bicol exhibiting various types of symptoms. No reports on the molecular analysis on at least 3 protein-coding genes of BBrMV from abaca cultivars are available in the database. In this study, abaca (cvs. Abuab, Nilagonoy, Tangongon and Negro) and banana (cv. Saba ABB) showing typical streaks symptoms on bract, pseudostem and leaves were analyzed and tested for BBrMV infection using IC-PCR. Target genes CP and 3' UTR, CI and NIb were amplified using specific and potyvirus universal primers. High homologies were obtained among abaca isolates and among banana isolates with a maximum identity of 99.8% and 98.6%, respectively, on the basis of core CP and 3' UTR genes. Sequences were highly diverse from Abaca mosaic virus (AbMV) with 57.4% to 57.9% similarity at nucleotide level, and a 71.7% similarity on amino acid. This paper first reports the 864 nt sequences of CI gene and 349 nt sequences of part of the NIb gene obtained from abaca cultivars. The CI and NIb sequences will further extend the characterization of the virus' large polyprotein that reflects more accurately the complete ORF of BBrMV. Furthermore, the close relationships between BBrMV isolated from banana and abaca will provide possibility in generating the same control strategies.

Keywords: Banana bract mosaic virus, Abaca mosaic virus, NIb gene, homology, potyvirus

COMBINED EFFECT OF SONICATION AND BIOLOGICAL TREATMENT ON THE RELEASE OF FERMENTABLE SUGARS FROM BANANA STALK

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Pretreatment refers to a process of liberating cellulose from its lignin-hemicellulose seal and reducing cellulosic crystalinity to enable cellulase enzyme sytems to be effective. In general, pretreatment methods can be classified into three categories: physical, chemical, and biological pretreatment, or combinations of either two or three of these methods. In a previous study, banana stalks were biologically pre-treated with *Pleurotus ostreatus* and the compositional analysis was reported at the 34th ASM of NAST. The present study deals with the further release of fermentable sugar from the biologically deconstructed biomass via ultrasonication technology.

A 45-day fungal-treated banana stalk biomass was used in this study. Destructive samplings were done 2 and 4 weeks after fungal inoculation. Dried fungal-treated biomass were hydrated at 5% consistency and treated with ultrasonication for 15 min at 10% biomass-water consistency. Sugars released before and after sonication treatment were determined by HPLC using NREL protocol. Untreated biomass was used as control. *Pleurotus* treatment indicated biodegradation effect on the biomass. Without sonication, only mannose, xylose and arabinose (hemicellulose sugars) were released from the biomass in increasing amounts over time. With sonication, more glucose and other sugar monomers were released from the fungal-treated biomass. Even in the untreated biomass, sonication also brought about the release of loosely bound sugar like mannose from the lignocellulose complex.

Keywoards: Bioprocessing, bioethanol, ligninolytic enzyme, SSF, biodegradation

MPS - 40

PVK/MWNTS CPN NANOCOMPOSITE FILMS ON STAINLESS STEEL SUBSTRATE VIA ELECTROCHEMICAL DEPOSITION FOR ANTI-CORROSION APPLICATION

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The effects of the PVK/MWNTs CPN nanocomposite films on their ability to protect the stainless steel substrates against corrosion were studied. Stainless steel substrates were prepared, coated and electropolymerized and submerged in 0.5 M aqueous NaCl solution for 50 days to study their corrosion resistance by means of electrochemical impedance spectroscopy (EIS). EIS measurements showed that the addition of MWNTs to PVK CPN films increased their charge transfer resistance in comparison with the pure PVK and PVK/MWNTs nanocomposite coatings. This result suggests an enhancement of corrosion protection of the PVK/MWNTs CPN nanocomposite film coatings. The impedance spectra obtained from this study are analyzed using Boukamp software to show the equivalent circuit that fits the corrosion data. The PVK/MWNTs CPN nanocomposite films coatings on stainless steel substrates exhibited good anti-corrosion properties as revealed by electrochemical analysis (EIS) and AFM analysis which was used to capture the progress of the sample against corrosion.

Keywords: carbon nanotubes, nanocomposites, anti-corrosion, EIS, stainless steel substrate

ESTIMATING EARTHQUAKE RISK USING RAPID EARTHQUAKE DAMAGE ASSESSMENT SYSTEM: A CASE STUDY IN NUEVA VIZCAYA

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The Rapid Earthquake Damage Assessment System (REDAS) was used to simulate earthquake impact to buildings, in terms of floor area damage, in three barangays of Bayombong, Nueva Vizcaya, namely: Don Domingo Maddela, Don Tomas Maddela, and Magsaysay. All three barangays would sustain heavy damage under strong earthquake, i.e., 7.8 magnitude, 200 m deep, with epicenter around 17 km south east of the barangays.

Considering that the building composition in the three barangays is more or less similar, i.e., predominantly reinforced concrete moment frames (C1), the age of buildings was the major determinant of variation in degree of damage between barangays. Floor area damage is predicted to be more intense in areas where old, large and tall buildings are found. Magsaysay is the most vulnerable with 22% of total floor area being damaged. Don Domingo Maddela and Don Tomas Maddela would sustain 13% and 23% damage, respectively. The recovery costs are highly and positively correlated with floor area damage, and a total of PhP382 million for the three barangays was calculated.

Using a few parameters in simulating an earthquake scenario, this study has demonstrated REDAS usefulness in earthquake damage assessment. Further development of the system should incorporate a larger number of parameters so that results of simulation can be more comprehensive.

Keywords: REDAS, earthquake, seismic hazard assessment, risk reduction and management

MPS – 42 CHEMOTAXONOMIC SIGNIFICANCE ON THE ISOLA-TION OF NORIRIDOIDS FROM THE LEAVES OF THE PHILIPPINE ENDEMIC Villaria odorata

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Many of the plant species endemic to the Philippines are members of the coffee family (Rubiaceae). With about 611 genera and more than 13,000 species, Rubiaceae is considered as the fourth largest angiosperm family in the world. In our interest of finding biologically-active principles from the Rubiaceae species endemic to the Philippines, we investigate the leaves of Villaria odorata collected from Mauban, Quezon. Following the conventional extraction procedure of the air-dried leaves using methanol, the obtained crude extract was separated and purified using gravity and flash column chromatography. This has resulted in the purification of three NMR-pure isolates namely hydrophylin A (1), hydrophylin B (2) and vomifoliol (3). The structures of the noriridoids were elucidated by extensive 1D & 2D-NMR and MS analyses and in comparison with the literature data. This has reported for the first time the three compounds from the genus Villaria. Compounds 1 and 2 have been previously reported from Scyphiphora hydrophyllacea (Rubiaceae). Compound 3 was previously identified from other Rubiaceae species- Hedyotis corymbosa, Ochreinauclea maingavii, Palicourea alpina and Morinda citrifolia. Thus, on a chemotaxonomic point, noriridoids may be useful as chemical markers for the different Rubiaceae species.





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ACCUMULATION AND DISTRIBUTION OF HEAVY METALS IN Avicennia marina SEDIMENTS, LEAVES AND ROOTS IN LAS PIÑAS – PARAÑAQUE CRITICAL HABITAT AND ECOTOURISM AREA (LPPCHEA)

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The accumulation and distribution of Pb, Cu, Zn, and Cd in the sediments, roots and leaves of the mangrove species *Avicennia marina* in Las Pinas–Paranaque Critical Habitat and Ecotourism Area (LPPCHEA), Manila Bay, were evaluated together with an assessment of the phytoremediation capability of *A. marina*. The concentration of heavy metals was analyzed using Acetylene-Atomic Absorption Spectroscopy (A-AAS). Plant-to-Soil Biological Concentration Factor (BCF), Translocation Factor (TF), and Biological Accumulation Coefficient (BAC) were calculated in order to determine the bioconcentration, mobility, and bioaccumulation of the aforementioned heavy metals from sediments to plant root and leaf tissues.

The total heavy metal concentrations in sediments ranged as follows: Pb (<0.001 to 0.65 ppm), Cu (0.10 to 0.56 ppm), Zn (0.82 to 2.04 ppm), and Cd (0.004 to 0.01 ppm). The accumulation in sediments showed a general trend of Zn<Cu<Cd<Pb, while accumulation in the leaves and roots showed a general trend of Cd<Pb<Zn<Cu. Based on the computed BCF and TF values, *A. marina* has the potential for phytostabilization of Cu. On the other hand, the BAC values for all sites showed that *A. marina* is suitable for phytoextraction of Cu and Cd.

Keywords: accumulation, *Avicennia marina*, mangrove, heavy metals, phytoextraction, phytostabilization

IDENTIFYING VERTEX COVERING NUMBER OF BALLOON, K-PODE, FAN, AND WHEEL GRAPHS

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A vertex cover in a graph G is a subset T of vertices in G that covers all the edges of G. A cover T has a nonempty intersection with every edge of G, that is, $e \cap T \neq \emptyset$. An identifying vertex cover in a graph G is a subset T that is itself a vertex cover that distinguishes the edges, that is, $e \cap T \neq f \cap T$ for every two distinct edges e and f in G. The identifying vertex covering number $\tau_{\mathcal{D}}(G)$ of G is the minimum size of an identifying vertex cover in G. The study investigates the identifying vertex covering number of balloon graphs, k-pode graphs, fan graphs, and wheel graphs. We established the identifying vertex covering number of fan graph and wheel graph by showing that if G contains a vertex of degree n-1 then $\tau_D(G) = n - 1$. The upper bounds for the identifying vertex covering number of the balloon graph $B(b_1, b_2, ..., b_k)$ where each branch b_i is of order greater than or equal to 3 are established different from the identifying vertex covering number of the balloon graph $B(b_1, b_2, ..., b_k)$ where the order of each branch is 1 and from the identifying vertex covering number of the balloon graph where the order of each branch is 2. Also, the upper bounds for identifying vertex covering number of k-pode graph where each path is of order greater than or equal to 2 are established different from the identifying vertex covering number of k-pode graph where each path is of order equal to 1.

Keywords: vertex cover, identifying vertex cover, identifying vertex covering number, balloon graph, k-pode graph, fan graph, wheel graph

ROMAN DOMINATION AND ROMAN BONDAGE IN THE JOIN AND CORONA OF GRAPHS

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Roman domination in graphs is an interesting variety of domination and is very popular because of its historical significance. A function f: V (G) \rightarrow {0,1,2} is a Roman dominating function (or just RDF) if every vertex u for which f (u) = 0 is adjacent to at least one vertex v for which f (v) = 2. The value f (V (G)) = $\sum u \in v(G) f(u)$ is said to be the weight of a Roman dominating function. The minimum weight of a Roman dominating function is called the Roman domination number of G denoted by $\gamma_R(G)$. In 2011, Rad and Volkmann introduced the concept of Roman bondage number $b_R(G)$ of a graph G which is a variation of the bondage number of graphs based on Roman domination. It is the cardinality of a smallest set of edges E subset of E(G) for which R(G-E) > R(G). In this study the Roman domination number and Roman bondage number in the join and corona of graphs were investigated. As a result, exact values for the Roman domination number and Roman bondage number of the join and corona of two arbitrary graphs were obtained.

Keywords: domination, bondage number, Roman domination, Roman domination number, Roman bondage number

MPS - 46

MODELLING ACTUARIAL PRESENT VALUE UNDER STOCHASTIC DISCOUNT FUNCTION WITH JUMP PROCESSES

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In most actuarial calculations, assumptions with regard to force of mortality and discount function are simplified. Classical actuarial calculations are determined by the assumption that the discount function is constant over time. This appears as quite not good valuation since interest rates vary from time to time and hence unrealistic. In fact, extreme fluctuations of interest rates can also be experienced from time to time. To obtain a more realistic assessment, it would be beneficial when the discount function is fluctuated and has jumps from time to time. This paper presents a formula for a premium of the term insurance which is calculated based on stochastic discount function, when the discounting is presented by a stochastic differential equation as in the Vasicek model with jump processes. In this case, time to maturity in financial valuation models is adjusted with T(x), a continuous random variable representing future lifetime of a lifeaged-x. We utilize Heaviside and Dirac-delta function to accomplish our objective. Furthermore, upper bound for the distribution function of present value in convexity order is calculated. We compare our results to premiums calculated based on constant discount function.

Keywords: stochastic discount function, Vasicek model with jump processes, actuarial present value, convexity order

RECURSIVE METHODS FOR CONSTRUCTING ONE-SIDED COLLOCATION QUATERNION POLYNOMIALS WITH PRESCRIBED ZERO SETS OR SPECIFIED NODES

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One-sided quaternion polynomials with prescribed zero sets or collocation quaternion polynomials with specified nodes for interpolation can be constructed using recursive algorithms implied by the following:

Proposition 1: Let $Z_n = [z_0, ..., z_{n-1}]$ be a set of distinct quaternions and let $Z_m \subseteq Z_n$, where $Z_m = \{z^1, ..., z_{m-1}\}$. Define $w(z; Z_m) = \sum_{i=0}^{m} w_i z^i$ as the ansy-solid quaternion pelynomial having Z_m as the zero set, i.e., $Zer_0(p(z; Z_m)) = Z_m$. If we define the sequence of polynomials $p^{(2)}(z), ..., p^{(m)}(z)$ inductive y_n as follows:

 $p^{(0)}(z) = 1, \ p^{(0)}(z) = p^{(0)}(z) + z - \frac{(z^{(0)}(z) + z^{(0)}(z)}{z^{(0)}(z)^{(0)}} + p^{(0)}(z),$ and in pertervis

$$- arphi^{(n+1)}(z) = e^{i h^2}(z) \cdot z + rac{e^{i h^2}(x_n) x_n e^{i h^2}(x_n)}{(n^{2m}(x_n))^2} \cdot e^{i h^2}(z),$$

where
$$p^{(n)}(z_m)$$
 is the conjugate of $p^{(m)}(z_m) = p^{(m)}(z)\Big|_{x=z_m}$ and
 $|p^{(m)}(z_m)|^2 - \overline{e^{(m)}(z_m)} \cdot p^{(m)}(z_m)$

then $\mu(z; Z_m) = \mu^{(m)}(z)$ for m = 1, ..., n.

Proposition 2: Let $Z_{n-1} = Z_n \cup \{x_n\} = \{x_1, \dots, x_n\}$ and let f(x) be a regular quotient-onic threation with power series expansion, $f(x) = \sum_{i=1}^{n-2} a_i x^i$, where the intermediate $x_i = x_i^n$ is $f(x_i) = f(x)|_{x = x_i^n}$. If we define the *i*th degree polynomial

$$\begin{split} & P(x, Z_{n+1}) = \sum_{i=0}^{n} c_{i} x^{i} p(x, Z_{n}) \\ \text{ellow} p(x; Z_{n}) = 1, \ c_{0} = f(z_{0}) \text{ and let } \mathbf{v} = 1, \dots, \mathbf{v}, \\ & c_{0} = \left(f(z_{0}) + \sum_{i=0}^{n} c_{i} p(z_{0}) Z_{0}\right) + \frac{f(z_{0}, z_{0})}{f(z_{0}, z_{0})} \end{split}$$

then $f'(x_j) = P(x_j; Z_{n+1})$ for j = 0, ..., n. If f(x) has tinite degree *n*, that $f(x) = P(x; Z_{n+1})$.

Keywords: algorithm, collocation, interpolation, one-sided quaternion polynomial, recursion, regular quaternionic function, zero set

MPS – 48 GROWTH OF ZINC OXIDE NANOSTRUCTURES ON ELECTROCHEMICALLY -ETCHED SI(100) SUBSTRATE

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Zinc oxide (ZnO) nanostructures have gained much attention in the scientific community recently due to its potential in optoelectronic applications. It has a wide band gap of 3.37 eV and large exciton binding energy of ~60 meV at room temperature making it a good integral part of the existing silicon IC technology. Integration of ZnO on silicon (Si) has its major drawbacks because of their large lattice mismatch that will introduce dislocation and residual stress. To improve the growth of ZnO on Si, electrochemical etching process of the Si substrate prior to ZnO growth can be done. In this study, ZnO will be deposited on electrochemically-etched p-type Si(100) substrate using chemical bath deposition (CBD) method. The fabricated samples are then characterized using scanning electron microscope (SEM) and UV-Vis spectroscopy.

SEM results of the etched Si showed the presence of protrusions that are scattered over the entire surface of the substrate. The average area of these protrusions is approximately 0.332 im². SEM results also revealed that ZnO nanostructures grow more densely on etched Si substrate than on bare Si substrate. The growth of denser ZnO nanostructures may be triggered by the increase in the surface roughness of the Si substrate, thus increasing its surface area that will increase the probability of adhesion of ZnO molecules on the surface. Meanwhile, the reflectance spectra revealed that ZnO grown on etched Si substrates have ~10% lesser reflectance intensity around 200-400 nm as compared to the ZnO nanostructures grown on bare Si substrates. This is due to the density of the nanostructures present on etched Si surface which allows maximum absorption of light in the UV region which indicates that the use of etched Si substrate significantly improved the morphology and optical property of ZnO nanostructures.

Keywords: electrochemical etching, chemical bath deposition, reflectance, zinc oxide, etched silicon

MPS – 49 PATH INTEGRAL TREATMENT OF A PENNING-TRAPPED PARTICLE USING WHITE NOISE ANALYSIS

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For the past three decades, efficient particle trapping techniques have been utilized to meet the experimental needs for isolating charged particles. To give new insights for novel trapping designs, a path integral has been used to investigate the motion of a Penning-trapped particle theoretically. This can be done using path integration in the framework of white noise analysis – a formulation by T. Hida and L. Streit where a particle's position is parametrized into a Brownian path, giving the Feynman path integral mathematical rigor. The Lagrangian of this system is separable along the *xy*-plane and along *z*-axis given by:

$$L = \frac{m}{2} \left[\dot{\mathbf{X}}^2 - c_1^2 \left(z^2 - \frac{x^2 + y^2}{2} \right) - c_2 (\dot{x}y - \dot{y}x) \right].$$
(eqn 1)

where c_1 and c_2 are the cyclotron and oscillation frequencies, respectively. Along the *z*-axis is a harmonic oscillator whose procedure for white noise path integration has already been established. In the *xy*-plane we take the polar coordinate representation $(r;\theta)$ of the Lagrangian. With the trapping stability condition, we take the suggestion of Peak and Inomata of a shift in the angular variable from θ to \emptyset (where $\emptyset = \theta + c_2 t/2$), which casts the system into two independent simple harmonic oscillators in the Cartesian coordinates (x_{θ}, y_{θ}) of the shifted polar coordinates $(r; \emptyset)$. The quantum mechanical propagator is obtained by taking the product of the propagators along $(r; \theta)$ and along the *z*-axis:

$$K(r'', \theta'', r', \theta'; T) = \frac{m\Omega}{2\pi i\hbar \sin \Omega T} \exp\left\{\frac{im\Omega}{2\hbar \sin \Omega T} \left[\left(r'^2 + r''^2\right) \cos \Omega T - 2r'r'' \cos\left(\theta' - \theta' + \frac{r_2}{2}T\right) \right] \right\}$$
(eqn 2)

The energy spectrum and the wavefunction of the particle are then extracted from a symmetricized form of the propagator. Furthermore, a good trapping design can be inferred by taking the case of a fixed particle radius r whose propagator has also been solved in this study.

Keywords: particle trap, white noise, path integral, propagator, Lagrangian

MPS – 50 THE PROPAGATOR OF A PARTICLE MOVING IN A CONSTANT FORCE FIELD WITH CONSTANT FRICTION: A HIDA-STREIT FORMULATION APPROACH

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Hida-Streit formulation, otherwise known as white noise analysis, is a new tool which provides a more solid mathematical foundation to the Feynman path integral which gives the probability amplitude for a quantum mechanical particle to travel from one place to another at any time. In this study, we aim to evaluate the Feynman path integral expression for a particle moving in a constant force field with constant friction given in the context of Hida-Streit

formulation by:

$$K = \int_{x(t')=x'}^{x(t'')=x''} \mathcal{D}_{\mathrm{MP}} x(t) \, \mathrm{e}^{\gamma t/2} \exp\left\{\frac{\mathrm{i}}{\hbar} \int_{t'}^{t''} \left[\frac{m}{2} \left(\dot{x} - \frac{g}{\gamma}\right)^2 \mathrm{e}^{\gamma t}\right] \mathrm{d}t\right\}$$

There are three major steps in translating the said path integral in the language of white noise. First, we have to parametrize the paths x(t) in terms of the Brownian motion, B=+ " $\hat{u}(t)dt$ where $\hat{u}(t)$ is the white noise variable; second, to make a correspondence between the Lebesgue measure D[x] and the Gaussian measure $d\hat{i}(\hat{u})$; and last, to fix the endpoint by introducing a Donsker delta function.

After translating Eq. (1) in the context of the Hida-Streit formulation, we evaluate the resulting expression using the T-transform in white noise

analysis to obtain the propagator:

$$K = \sqrt{\frac{m\gamma}{2\pi i \hbar (\mathrm{e}^{-\gamma t'} - \mathrm{e}^{-\gamma t''})}} \exp\left\{\frac{\mathrm{i}}{\hbar} \frac{m[\gamma(x'' - x') - g(t'' - t')]^2}{2\gamma(\mathrm{e}^{-\gamma t'} - \mathrm{e}^{-\gamma t''})}\right\}$$

From this propagator, we extract the time-dependent wavefunction of a particle moving in a constant force field with constant friction thereby totally describing the system quantum mechanically.

Keywords: Hida-Streit formulation, Feynman path integral, quantum mechanical propagator, time-dependent wavefunction, T-transform

COMPUTER SIMULATIONS OF ION-SURFACE COLLISIONS

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The atom-surface scattering has been used for many years in order to obtain such information about atom-surface interaction, adsorption, deposition, and sputtering. Investigations on this type of scattering have made significant advancements toward our understanding of the surface collisional phenomena. In this study, we present the results of the simulation studies on the ion-surface scattering using Safari program. There are two cases of ion scattering that were discussed, the light and heavy atom scattering. In each case, we used incident energies that belong on hyperthermal energy regime (100 eV, 200 eV and 400 eV) at an angle of 65 degrees. The angles used in this study were measured from the surface normal. The interaction potential used in the simulation was Ziegler-Biersack-Littmark (ZBL) potential. In the light atom scattering, we used K⁺ as the particle projectile and Cu as the surface atoms, while in heavy atom scattering, Cs⁺ ions were scattered from Cu surface. Simulation results have shown that both cases appear to have a loop like structure in the plot of final energy versus final angle which tends to go nearer to the kinematic expressions for quasi single and quasi double as the incident energy increases. Based on the results, the light atom is much nearer to the kinematic expressions compared to the heavy atom.

Keywords: Safari, hyperthermal energy, surface atoms, quasi single, Ziegler-Biersack-Littmark potential

MPS – 52 MOLECULAR DYNAMICS SIMULATIONS ON SILICENE NANORIBBONS: EFFECT OF TEMPERATURE CHANGE ON THE GEOMETRIES AND TOTAL ENERGIES

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Silicene is a two-dimensional crystal of silicon atoms arranged in a hexagonal manner, almost similar to the much-celebrated graphene both in structure and properties. But unlike graphene, it is expected to be more compatible in the current silicon-based technology. For this reason, an increasing number of theoretical and experimental studies have been conducted recently on silicene most of which investigated its various properties which might be useful for various device applications.

In this study, we performed molecular dynamics (MD) simulations exploring the evolution of the geometric structures and total energies of varying dimensions of silicene nanoribbon (SiNR) structures as we changed the temperature from zero to 100 K, from 100 K to 200 K, and from 200 K to 300 K. MD calculations reveal that after optimizing the structures using an MM+ force field, most of the SiNRs did not form regular hexagonal structures completely. However, as the temperature was changed incrementally from 0 K to 300 K, most of the structures relaxed and slowly formed regular hexagons. In addition, the total energies generally decreased as the temperature was incrementally increased from 0 K to 300 K. Our MD calculations predict that as the dimensions of SiNRs are increased. the absolute differences in their total energies between the three ranges of temperature considered also increased. These results suggest that a freestanding SiNR is more likely to exist at room temperature and is kinetically stable. We also posit that these size- and temperature-dependent structural properties of SiNRs can be utilized for various device applications including SiNR-based biochemical sensors for cancer markers detection.

Keywords: molecular dynamics (MD), silicene nanoribbons (SiNRs), twodimensional crystal, MM+ force field, armchair edge, zigzag edge

SOCIAL SCIENCES

SS – 01 KNOWLEDGE, PRACTICES AND ATTITUDE OF SCIENCE EDUCATORS ON ENVIRONMENTAL EDUCATION : AN APPROACH TO SUSTAINABLE DEVELOPMENT IN SCIENCE EDUCATION

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The concept of sustainability emerged in part of the work of the World Commission on Environment and Development (WCED) established by the United Nations. Higher education is expected to play a critical role in fulfilling the goals of the United Nations Decade for Education for Sustainable Development (2005-2014). Science teachers are most influential in educating students to be leaders of tomorrow in protecting the environment. It underpins the social, economic and environmental sustainability as a whole. This study was conducted to determine the knowledge on environmental principles, practices and attitude of science educators toward sustainable development among college professors in Manila. Descriptive correlational method was used and qualitative analysis was designed to analyze inputs of the respondents.

Results showed that most of the teacher-respondents' are Chemistry majors (46%), followed by Physics majors (31%) while a small percentage were the Biology majors (23%). Science educators are knowledgeable on the environmental principles which are encapsualized explanation of environmental phenomena, issues and problems. The Analysis of Variance (ANOVA) revealed that there is no significant differences among science educators in their knowledge, practices and attitude toward environmental education for sustainable development despite differences in specialization. Likewise, correlation tests showed no significant relationships between knowledge and practices, while knowledge and attitude and attitude and practices showed positive correlation. It is clear from the results that teachers are knowledgeable and have favorable attitude and practices towards sustainable development. Tertiary level curriculum should focus on a wider range of environmental experiences so that teachers as well as students could take a more global view of environmental problems in attaining the goals of sustainable development.

Keywords: environmental education, environmental principles, environmental sustainability, science educators, sustainable development

HOW VULNERABLE AND ADAPTIVE ARE THE RICE FARMERS IN VALENCIA, BUKIDNON, PHILIPPINES TO THE IMPACT OF CLIMATE CHANGE?

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Climate change vulnerability and adaptation strategies of lowland rice farmers were studied in Valencia, Bukidnon, Philippines. Primary data gathered through personal interviews provided the socio-economic profile, communicational factor, climate hazards, climate change vulnerability and adaptation practices of rice farmers. Essential secondary data were used and supplemented with Focus Group Discussion (FGD).

Descriptive statistics such as frequencies and percentages were used to present the socio-economic, communication factors, climate hazards, extent of exposure, sensitivity and adaptive capacity as well as the vulnerability index of rice farmers. The factors affecting the degree of vulnerability of rice farmers were captured by applying the multiple linear regression analysis.

The study revealed that the most likely adverse impacts of climate change which hit the area include typhoon, heavy rain, flooding, and landslide. The average vulnerability index was 0.11 implying that rice farmers in Valencia City are moderately vulnerable to climate change.

Regression analysis found age and alternative livelihood have positive significant effects on the degree of vulnerability of rice farmers to climate change while awareness of climate change plays a negative significant role in determining the vulnerability of the farmers. Some farm practices of farmers in the area may help in making them less vulnerable to the impact of climate change including the use of stress tolerant varieties, planting of early varieties, improved cropping system, new land and water management techniques and shifting of planting dates.

Keywords: vulnerability, adaptation, climate change, awareness, practices

ANTHROPOLOGICAL AND SOCIOECONOMIC CHARACTERIZATION OF AGTA INDIGENOUS PEOPLES (IPS) IN CAMARINES SUR, BICOL REGION

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Baseline characterization of Indigenous Peoples (IPs), ethnolinguistically classified as Agta, and involved in upland and unfavorable rainfed lowland rice farming in Brgy. Gatbo, Ocampo and Brgy. San Pedro, Iriga, Camarines Sur, was conducted for policy recommendations and as reference for development managers. Anthropological and Socioeconomic methods were utilized in the analysis of this study. The anthropological component contributed ethnographic data; the sociological component described the social conditions while the economic component analyzed the production and income forces that affected the IP communities.

Gatbo, located at the foothills of Mt. Isarog, has a population of 71 Agta-Tabangnons and "Pure" Agta families, where rice was the major source of income. San Pedro in Iriga, an isolated mountain community, where the IP population is at 200 Agta-Cimarron and Agta-Tabangnon families involved in farming of fruits, root crops, copra, and corn. Structures such as schools, clinics, and local government offices can be seen in both sites. The researchers found that the IPs in the study areas were now vastly different from their precolonial ancestors. Gatbo had been influenced by modern farming techniques: rice bi- or tri-cropping systems for profit and use of modern rice varieties and commercial fertilizers. San Pedro community exhibited a traditional subsistence farming system augmented by abaca and coconut production for income. Their isolation limited their capacity to sustain resources for farming and technical know-how. Traditional rice varieties and organic fertilizers were commonly used. Overall, the communities' characteristics, locations, influences and aspirations have affected their way of living and agricultural practices.

Keywords: anthropological, socioeconomic, indigenous people, Agta, rice farming

THE IMPACT OF PERCEIVED SOCIAL SUPPORT ON THE QUALITY OF LIFE AND DEPRESSION OF PEOPLE LIVING WITH HIV/AIDS

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Cases of Human Immunnodeficiency Virus (HIV) infection in the Philippines continue to escalate each month. This study investigates the correlation and impact of Perceived Social Support on the Quality of Life and Depression of People Living with HIV/AIDS (PLWH). Following the principles of research ethics, the respondents were gathered from three institutions and they were subjected to three standardized tests : Social Provision Scale, WHO Quality of Life-HIV and Beck's Depression Inventory (BDI). In addition to the tests, focus group discussions were also conducted. Pearson r correlation resulted to a significant and direct relationship between perceived social support and quality of life with an r-value of 0.42 (re"0.2319) indicating moderate magnitude; while significant inverse relationship with a moderate magnitude was found between perceived social support and depression with an r value of -0.45 (re"0.2319). Regression analysis showed that perceived social support of PLWH is a predictive factor of quality of life and depression indicating that an increase in social support can improve the quality of life and reduce in depression level. Thus, it is recommended that intervention programs that will enhance the quality of life of PLWH's social support be implemented to increase their quality of life and alleviate depression.

Keywords: HIV, AIDS, Social Support, Quality Life, Depression

SS – 05 BIOTECH EXPERTS' INSIGHTS AND EXPERIENCES ON SCIENCE COMMUNICATION IN THE PHILIPPINES

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Scientists and the academe are the frontliners in investigating facts about biotechnology. Thus, they have a critical role of conveying accurate and comprehensible information to the public. A survey of 100 public sector researchers and university faculty was conducted to know about their views and experiences in communicating biotechnology to the public using a written questionnaire (onsite and e-mail). Using a 5-point Likert scale, it was revealed that majority of the respondents (64%) strongly agree that scientists have the responsibility to communicate with the general public, and they also disagree (58%) that they should only convey about their research through scientific papers. However, even if they acknowledge the importance of science communication, they have only devoted an average of 9.4% of their time in engaging with non-technical stakeholders and had low level of engagement (1 to 10 activities per year). Most of the time, they deal with students or staff from other institutions (57%) and farmers (17%) usually discussing about their research activities and basic biotechnology. When asked about their primary reasons in conducting science communication activities, 84 percent said that they want to foster awareness and understanding of biotechnology. Twenty five respondents have attended science communication training, mostly about risk communication on biotech crops organized by non-governmental organizations. To be better communicators of biotechnology, 40 percent of the respondents said they would need more training, while 12 percent said they need knowledge on translating technical concepts into simple language. They will be more motivated to perform more science communication activities when provided with additional funds, training, and career incentives. The respondents think that a regular forum on science communication would help enhance the skills of biotech experts in science communication.

Keywords: science communication, biotechnology, public engagement, popularization of science, scientists, academics

SS – 06 COASTAL GROUNDWATER RESOURCE UTILIZATION AND LAND USE PATTERN: CAUSES OF SALTWATER INTRUSION

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The study site is located at Barangay Sulongan, Pasuquin, Ilocos Norte. It is basically a rainfed agricultural area and one of the 8 coastal barangays of the town, located 18.22°N and 120.36 °E, 142.0 nautical feet at about 350.0 m from the coastline of the China Sea. Results revealed that the main livelihood of the people is farming with a predominant cropping pattern of rice-garlic/peanut/corn -vegetables. The Estancia-Sulongan-Caruan Communal Irrigation System is an existing source of irrigation water; however, it is only feasible during the rainy season. A matrix of shallow tube well (STW) and deep well (DW) is available in different locations installed long ago by farmers to augment the services of the communal irrigation system. These wells are extensively used for: groundwater extraction during the dry season to support the water requirement of various dry season cash crops; water withdrawal to augment rainfall during land preparation for rice when the onset of the rainy season is variable; moreover the water is also being used for domestic and industrial purposes. The land use pattern of the study area was: peanut and corn planted at the northernmost part. Peanut is grown 130 -140 days that requires 500-700 mm of freshwater for growth and corn (90 days) that needs as much as 6 to 8mm/day. Rice was planted at the center part which needs voluminous freshwater 450-700 mm/ total growing period aside from the water needed during land preparation. The southern part was planted to garlic that needs 25 cm of water weekly throughout the growing season (90 days). The total freshwater utilization of the area is 4900.0 mm both for the dry and wet seasons. Apparently the intensive use of groundwater and land use pattern caused the migration of seawater landwards with high salinity level >1000.0 ppm (WHO threshold limit), thereby saltwater intrusion was present in the study area.

Keywords: coastal groundwater, land use pattern, saltwater intrusion, water withdrawal, cropping pattern

SS – 07

COGNITIVE, PSYCHOSOCIAL AND HEALTH-RELATED FACTORS INFLUENCING THE FUNCTIONAL STATUS OF THE ELDERLY: BASIS FOR SUCCESSFUL AGING PROGRAM

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The study assessed the extent of cognitive, psychosocial, healthrelated factors and functional status of the elderly among the Seventh-day Adventist (SDA) population in West Java Conference. The relationships between the cognitive, psychosocial, and health-related factors to functional status and the significant predictors of functional status among the elderly were also identified.

The respondents' extent of cognition as measured by the extent of health literacy was high, social support high and social health, high. The over-all psychosocial factors showed a significant positive correlation with the advanced activities of daily living (AADL). The over-all health-related factors was found to be significant. Analysis of the predictors of the 3 levels of functional status were health literacy, nutrition-related practices, social support and physical exercise. Age, health literacy, nutrition-related practices, social support, sunlight exposure and physical exercise contributed a total of 26.1% to ADL, while age, nutrition-related practices, marital status, sunlight exposure, physical exercise, social support and health literacy contributed 24% to IADL. Predictors of AADL include physical exercise practices, age, social health, water intake practices, nutrition related practices, gender and trust in God, which contributed 34.8% to AADL. A successful aging program was developed which includes: assessment, health literacy enhancement, meals on wheels, adult day health services, caregiver coaching, outdoor explorations, community service programs, and healthy lifestyle promotion.

Keywords: aging program, cognitive, psychosocial, healthy lifestyle, meals on wheels

EMOTIONAL INTELLIGENCE, CORE COMPETENCIES AND CPA LICENSURE EXAMINATION PERFORMANCE

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This study aimed to determine the relationship of emotional intelligence with the degree of developed core competencies of CPA candidates and performance in the October 2009 CPA Licensure Examination. Emotional intelligence was evaluated based on the following dimensions: intrapersonal, interpersonal, stress management, impulse control, general mood, and total emotional intelligence. Core competencies were subdivided into the following dimensions: (a) Knowledge – general knowledge, organizational and business knowledge, IT knowledge, accounting and finance knowledge, and total knowledge; (b), Skills intellectual skills, interpersonal skills, communication skills, and total skills; (c) Values - professional ethics, moral values, and total values. This study employed the descriptive-correlational research design. To produce a model for CPA Licensure Examination Performance, Structural Equation Modeling through the use of AMOS 17 was also utilized. This study utilized as respondents 431 CPA board examination reviewees from ReSA Review School, Inc. who took the said examination on October 2009. The study was conducted prior to the licensure examination dates. Interpersonal, stress management, accounting and finance knowledge, communication skills, and review school performance positively and significantly correlated with CPA licensure examination performance while length of time since college graduation negatively yet significantly correlated with the performance in the aforementioned licensure examination. And among the six variables, review school performance proved to have the strongest correlation with the performance in the CPA licensure examination. The CPA Licensure Examination Performance Model proved that stress management, length of time since college graduation and review school performance significantly predict performance in the said licensure examination.

Keywords: emotional intelligence, core competencies, examination performance

SS – 09

INTEGRATION OF FIELD WORK INTO ECOLOGY CLASS: TOWARDS A PEDAGOGICAL IMPACT AND IMPROVED COGNITIVE PROCESSING

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The most common challenge given by academic heads to educators in HEIs is to make the learning meaningful and functional. This challenge can be daunting to some subject areas but is very doable to Ecology since its laboratory cannot be limited to a four-walled laboratory alone but must span to the actual field. The ultimate drawbacks, however, is the time constraint for both students and teacher especially when both have regular academic loads. This study tries to hit two birds in one stone by utilizing a field work beyond the official time of the students. Activity on turbidity, temperature, pH, and other physical parameters of Labo River in Ozamiz City were evaluated by the students. The students observed the variations in turbidity, and water velocity as the river joins the sea. They also noted the consistent pH of water which is within the optimum value for breeding aquatic life. Other aspects not in the scope of the activity was the observed pollutioncausing human activities. The whole exercise of integration proved to be very effective in effecting an optimal cognitive load of the topic as evidenced by students' improved narratives. The challenge however remained because although a meaningful learning was achieved, the time constraint remains an issue. HEIs that will be interested in venturing towards this direction may have to make comprehensive analysis on faculty and student load for a functional learning to be achieved through this fieldwork integration. Surely, there is an optimal point for the monetary and non-monetary gain of this exercise that will spell out the actual meaning of research based lesson content as well as extension programs.

Keywords: cognitive load, functional learning, meaningful learning, physical parameters, research-based

SS – 10

UTILIZING TAGBANUA INDIGENOUS KNOWLEDGE FOR PRESERVATION OF CULTURE, PEOPLE, AND NATURE

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The Tagbanua ethnolinguistic group are one of the indigenous cultural communities (ICCs) occupying Palawan island that continue to practice swidden agriculture and gathering of forest products. Belonging to the marginalized sector of Philippine society, the Tagbanua utilize traditional knowledge to provide their families subsistence and income necessary for their families' survival. This paper explores how indigenous knowledge continues to provide the Tagbanua with a sustainable livelihood while preserving their culture and tradition. Maintaining indigenous traditions and practices in resource management directly results in preservation of a richer genetic biodiversity, particularly of landraces passed on as "heirloom rice", without sacrificing the ecological integrity of the natural environment. The study seeks to document traditional swidden farming practices and indigenous knowledge systems while understanding the context to identify challenges and opportunities for sustainability. The Tagbanua community of Sitio Daan shows that there is no need to sacrifice indigenous knowledge and the natural environment in pursuit of profit or survival, but their way of life remains under threat from various social pressures. Increasing competition from migrant populations, restrictive government policies, and contrasting educational curriculum serve to threaten the continuity of Tagbanua culture. Undertaking anthropological studies can be used to identify appropriate development projects, further promoting cultural sustainability while ensuring genetic biodiversity of Philippine rice landraces and inform public policy.

Keywords: anthropology, indigenous people, Tagbanua, rice farming, swidden agriculture
SS – 11

INTRAPERSONAL INTELLIGENCE, MENTAL ABILITY, SOCIAL SUPPORT AND RELIGIOUS VALUES AS DETERMINANTS OF ADOLESCENT'S RESILIENCY: TOWARDS A PROGRAM DEVELOPMENT

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The study determined the relationship of intrapersonal intelligence, mental ability, social support, and religious values to the adolescent's resiliency. Convenience sampling was utilized to get the 500 freshmen and sophomore adolescents. To measure the mental ability of the respondents, the researcher used Otis-Lennon School Ability Test (OLSAT). The result of the study indicates that the respondents have an average intrapersonal intelligence. Most of the respondents have an average mental ability. Respondents who have high intrapersonal intelligence and mental ability, good social support and high religiosity are those who have high resiliency in terms of control, commitment and challenge. It was found that negative life events reported by parents were associated with children's psychological maladjustment and physical health problems. Also, a significant relationship was found between major life events in the parents' lives and children's affective balance. There was a positive correlation between stressful events reported by parents and depression in adolescents due to disruption in parenting practices.

Keywords: Intrapersonal intelligence, mental ability, social support, religious values, adolescent's resiliency

SS – 12

PREFERENCES FOR HEALTH CARE SERVICES AMONG OLDER FILIPINO INMATES WITH CHRONIC CONDITIONS: A CONJOINT ANALYSIS

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This quantitative study purports to explicate the preferences of chronically ill older inmates relative to the health care services they receive. An orthogonal main-effect design of conjoint analysis was used by surveying 301 older Filipino inmates with chronic ailments at the country's penitentiary via experimental vignettes. Results were then analyzed using Sawtooth Version 18. Results of this study exhibited that the conjoint analysis performed was appropriately fit; Pearson's R=.975, (p<.01) and Kendall's Tau=.783, (p < .05), Kendall's Tau for holdouts=.667, (p < .05). The most important attributes were medication administration setting (21.24%), interval (20.1%) and vital signs monitoring frequency (19.54%). In regard to part-worth of medication administration setting, infirmary proved to be the most important concern. As for medication administration interval, one at a time drug intake was preferred. Also, for vital signs monitoring, respondents favored the least frequent monitoring. Interestingly, no relationship exists between the attributes and the demographic characteristics of respondents. By and large, incarcerated Filipino elderly opted for infirmary medication administration followed by one at a time drug intake, least frequent vital signs monitoring, physician as health provider and lastly for wound care, high frequency, and little pain.

Keywords: Health care services, Penal nursing, Chronic condition, Older adults, Conjoint analysis, experimental vignettes

SS – 13

HEALTH-SEEKING PREFERENCES OF ELDERLY FILIPINOS IN THE COMMUNITY VIA CONJOINT ANALYSIS

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Health-seeking encompasses of the activities individuals perform in order to restore wellness, when they perceive themselves as ill. Alarmingly, it is apparent that there is a decrease in frequency of health-seeking as one ages. While there had been numerous studies about elderly health-seeking behavior across the globe, the need to know about their preference remains a research imperative, hence this conjoint analysis investigation. The objective of this study is to identify the health-seeking preferences of a select group of Filipino elderly in the community. To measure preferences for health-seeking, a conjoint analysis via experimental vignettes of 304 Filipino elderly aged 60 years and above was conducted from June to July 2012 using the balanced incomplete block design (BIBD). Results indicate that the most important attribute in terms of health-seeking behavior is the physician's experience. Elderly clients tend to seek health care from expert private practitioners who provide full information regarding illness and charge professional fees of less than 500 pesos (8-9 pounds or 12-13 dollars). Results suggest that there are factors that may impede or promote health care seeking in elderly clients, of which physicians' experience is deemed most important. These preferences if integrated into the current practice can help health care practitioners in improving the quality of care provided.

Keywords: elderly, conjoint analysis, health-seeking behavior, preferences, experimental vignettes

SS – 14 MULTIDRUG ADMINISTRATION PREFERENCES AMONG INCARCERATED FILIPINO ELDERLY: A CONJOINT ANALYSIS

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While there had been numerous studies about the prevalence of polypharmacy among the elderly around the world, the need to know about their preference about multidrug administration remains a research imperative. This study aims to test the feasibility of using conjoint analysis (CA) to assess the elderly patients' preferences for multiple drug administration. To gather the needed data for the study, the multiple factor full-concept method was used. By means of an orthogonal main effects design, 20 choice sets were randomly chosen from the 96 possible descriptions generated via Sawtooth Software Version 18 and were ranked by 350 incarcerated Filipino elderly. Results of this study indicated the conjoint model performed was adequately fit; Pearson R=.999, p<.05 and Kendall's t was 1.00, p<.05. Among the attributes of multidrug administration, patient education is the most important factor considered by incarcerated Filipino elderly (34.78%), followed by number of drugs taken at a time (29.47%), and nurse-patient relationship (19.07%). In regard to the part-worth of patient education, the more health teachings are given, the higher is the adherence to multidrug administration. As for the number of drugs taken at a time, the lower the quantity of drugs, the higher is the adherence. The active relationship with the nurse to the patient was preferred over nurse passivity. This information is vital to the development of a model that will guide health care providers on the preference of elderly on multidrug administration to ensure better medication adherence

Keywords: incarcerated, elderly, polypharmacy, multidrug administration, conjoint analysis, preferences, multiple factor full concept method

SS – 15 ADOPTION OF AN ITERATIVE STRATEGY IN POPULATION GENETICS RESEARCH INVOLVING INDIGENOUS PEOPLES (IPS)/INDIGENOUS CULTURAL COMMUNITIES (ICCS)

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The Philippines is composed of at least 110 Indigenous Cultural Communities/ Indigenous Peoples (ICCs/IPs). Therefore, for a population genetics research to be representative of the Philippine population, these groups should be included in the study. The conduct of research with the participation of ICCs/IPs requires the certification of the National Commission on Indigenous Peoples (NCIP), the institution mandated to protect the rights of ICCs/IPs by virtue of Republic Act Number 8371 that a particular IP/ICC group has given its approval to be part of a project. In addition, any project dealing with human samples must undergo an institutional ethics review such as that offered by UP Manila (UPM Research Ethics Board). This paper aims to report on the application process that has to be undertaken when dealing with ICCs/IPs prior to the official start of the project. Methodology: A review of guidelines of the NCIP and UPMREB was performed. Consultations with the NCIP, UPMREB, Non-government Organizations (NGOs) and People's Organizations (POs) were conducted. Results and Discussion: The most effective strategy in the conduct of this type of research involves the close collaboration amongst three main sectors namely 1) an organized group within a particular ICC/IP that is recognized by the group that they represent (PO); 2) government represented by NCIP and local government; and 3) academic institutions that provide the technical expertise. Iterative consultations between an academic institution with the participating ICCs/IPs as represented by their respective POs; and government institutions tasked to protect IP rights, e.g. NCIP, must be conducted all throughout the application and research processes.

Keywords: culture-sensitivity, indigenous peoples, information dissemination, population genetics, research ethics

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