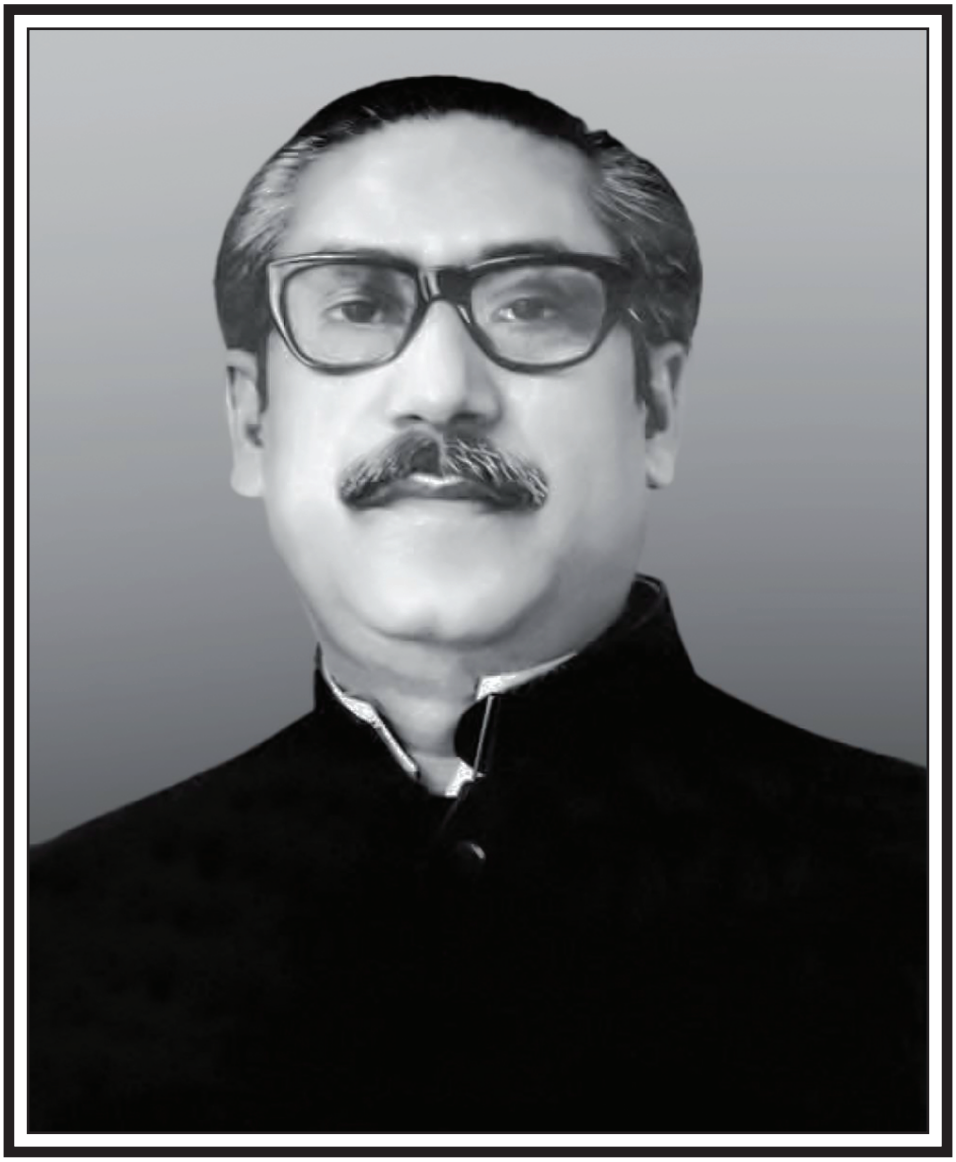
# Ministry of Science and Technology
# Funded Research Projects

# RESEARCH ABSTRACTS
## 2022-2023

**Ministry of Science and Technology**
Government of the People's Republic of Bangladesh
Bangladesh Secretariat, Dhaka 1000



**Father of the Nation**

**Bangabandhu Sheikh Mujibur Rahman**

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**Ministry of Science and Technology**
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بِسْمِ اللهِ الرَّحْمٰنِ الرَّحِيْمِ

প্রধানমন্ত্রী

**PRIME MINISTER**
GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

27 Falgun 1430
11 March 2024

# Message

I am happy to know that Ministry of Science and Technology has taken an initiative to preserve and publish the Research Abstracts of the Special Grant Research Projects. I congratulate this initiative and greet all concerned at the auspicious event of Bangabandhu Fellowship, NST Fellowship and Research Grant awarding ceremony.

The Greatest Bangalee of all time, Father of the Nation Bangabandhu Sheikh Mujibur Rahman emphasized on science-based modem education. Through science and technology-based education, he wanted to develop a science-minded nation. He arranged for using science and technology as the most important tool in rebuilding our war-ravaged country after our independence.

Following the dream of Bangabandhu Sheikh Mujib, the Awami League government has established 'Digital Bangladesh'. We are now striving to transform the country to a 'Smart Bangladesh' by 2041. Our government has established several Science and Technology Universities across the country to promote science and technology-based education. We have been providing all kinds of assistance including necessary financial grants for research on science and technology. Bangabandhu Fellowship is being offered for science and technology research at home and aboard under the Bangabandhu Science and Technology Fellowship Trust for building a science-minded nation and developing skilled and qualified manpower in the area of science, technology and innovation. National Science and Technology Fellowship is being given among the students and researchers at the MPhil and PhD levels. We are providing special allocation for research every year. From 2009 to 2022 we have allocated Taka 177.54 crore against 5,521 research projects.

The Research Abstracts of the Special Grant research projects will be useful for all the researchers. I hope, our researchers will engage their attention to using the outcome of their research for the welfare of the people and for overall socioeconomic development of the country as well.

I wish the publication all the best.

Joi Bangla, Joi Bangabandhu
May Bangladesh live forever.

**Sheikh Hasina**

**Minister**
Ministry of Science and Technology
Goverment of the People's Republic of
Bangladesh

# Message

Research is the heart of science, technology and innovation. Realising the importance of research, the present government led by the daughter of Bangabandhu Sheikh Hasina is mindful of quality research. The Hon'ble Prime Minister also reiterates on using the outcome of research for the welfare of the people.

Our government has already implemented 'Digital Bangladesh' and now we are striving for elevating the country to SMART Bangladesh. And again, the role of research is central to this pursuit. Accordingly, in order to promote research, our government is extending financial support to the researchers. Ministry of Science and Technology allocates research grants against research projects submitted by the researchers every year.

Ministry of Science and Technology has arranged for publishing research abstracts which could be useful for the next generation of researchers. In continuation of our last year's initiative, we are publishing abstracts of this year's research projects. I take pride in becoming a part of this remarkable work.

I thank all whose untiring endeavour has made the publication of research abstracts successful.

Joi Bangla, Joi Bangabandhu
May Bangladesh live forever.

**(Architect Yeafesh Osman)**

Secretary
Ministry of Science and Technology
Government of the People's Republic of Bangladesh

# Message

According to the Allocation of Business among the Different Ministries and Divisions (Schedule of I of the Rules of Business, 1996) one of the major businesses of the Ministry of Science and Technology (MoST) is to coordinate science and technology related research, development and similar areas and coordination among the users. To provide financial support to various research projects is another vital program of the MoST and every year the ministry allocates handsome money to the researchers under the special allocation for research. It is an enormous pleasure to recognize that the MoST is going to make a unique publication entitled "Research Abstracts" compiling the abstracts of completed researches under such special allocation for research on diverse fields of science and technology.

The vision of the Ministry of Science and Technology, Bangladesh is to build a science minded nation. The intrinsic meaning of the revelation is to construct a smart, technology based, progressive, and self-dependent country. Present government under the capable and patriotic leadership of Honorable Prime Minister Sheikh Hasina is striving to transform Bangladesh into Sonar Bangla as dreamt by our father of the nation Bangabandhu Sheikh Mujibur Rahaman. In every sector we are progressing with a rapid pace to convert the dream into a reality. Honorable Prime Minister always gives emphasis on research resulting in rapid and quality development of the society. In line with her aspiration, MoST is allocating public money for research and development of six vital fields of science and technology comprising of i) Physical Science ii) Engineering and Applied Science iii) Medical Science iv) Biological Science v) Environmental Science vi) Interdisciplinary Studies. Researchers from universities, educational institutions as well as research organizations are eligible for this special allocation. From 2008-2009 to 2023-2024, a total no. of 12,796 researchers qualified for 6,398 research projects spending total about 221,66,00,000 taka. Out of these, 657 important research abstracts have been chosen for this publication.

The objective of this publication is to appraise the diligent enterprises of the concerned researchers and to disseminate the research findings to the interested persons of the diverse research area. Furthermore, an accountability of the ministry to the society in terms of spending public money on research will be ensured. Hopefully, other researchers could find necessary inputs to enrich their research works and new researchers could conveniently decide on their areas/topics of researches with the help of these published research abstracts in this publication. Concerned stakeholders, policy makers will have an overview from this publication to be used to suitable cases.

I express my heartiest congratulations to the esteemed researchers who had been awarded special allocation and submitted abstracts for publication. I convey my sincere thanks to my colleagues and editorial board involved to publish this "Research Abstracts" in a nice shape within limited time frame.

Joi Bangla
May Bangladesh Live Forever.

**Md. Ali Hossain**

# Development of Potential Feed Additives for Broiler Using Black Soldier Fly Larvae Nurtured on Different Organic Waste Materials

**Group:** Biological Science **Project ID:** SRG-221001

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## Abstract

**Background:** Global acceptance is growing for black soldier fly larvae as a sustainable substitute protein source for poultry. **Objectives:** This experiment was conducted to assess how black soldier fly larvae meal (BSFLM) affected the growth performance, meat quality, and economics of broiler chickens. **Methodology:** The experiment consists of two trials, 160 broilers and four treatments/trial, four replications/treatment and 10 birds/replication. The experimental treatments were 0%, 4%, 8%, and 12% BSFLM (trial 1); and 0%, 10%, 15%, and 20% BSFLM (trial 2). To examine the meat quality and intestinal flora, 12 birds/treatment were randomly selected and slaughtered. **Findings:** Trial 1 showed that the 12% BSFLM supplemented group outperformed the control group in terms of average daily weight gain (ADWG) and feed conversion ratio (FCR) ($P<0.05$). The relative weight of breast and thigh meat increased significantly ($P<0.05$) when 4, 8, and 12% BSFLM was supplemented with broiler diet ($P<0.05$). Supplementation of 8 and 12% BSFLM increased the crude protein content of breast and thigh meat, while only 12% BSFLM increased the fat content of breast and thigh meat ($P<0.05$). All level of BSFLM reduced the cecal *Salmonella* in trial 1 ($P<0.05$). In trial 2, supplementation of 10, 15 and 20% BSFLM increased the ADWG, FCR, relative weight of breast and thigh meat, and abdominal fat of broiler ($P<0.05$). Protein content in breast and thigh meat increased with dietary 15 and 20% BSFLM, however fat content in broiler meat increased with just 20% BSFLM supplementation ($P<0.05$). Return on investment and the cost-benefit ratio both showed positive increases as BSFLM levels increased ($P<0.05$). **Conclusion:** In summary, BSFLM has the potential to improve growth performance, meat quality, and economy when added up to a 20% level and is recommended as viable protein source for chickens.

**Keywords**: Black soldier fly, larvae, growth performance, meat quality, intestinal flora, economy.

# Fuel from Noxious Water Hyacinth by Consolidated Bioprocessing Using Response Surface Modeling

**Group:** Biological Science **Project ID:** SRG-221002

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## Abstract

Lignocellulose-based second-generation biofuels have received significant attention as alternatives to fossil fuels due to their substrate availability and low cost. The present study aimed to evaluate the suitability of bioethanol production from a lignocellulose substrate, water hyacinth, by three previously isolated and identified potential cellulolytic strains namely *Bacillus aryabhattai*, *Bacillus subtilis*, and *Streptomyces filamentosus*. Among the isolates, *Bacillus aryabhattai* produced the highest ethanol production at 37˚C and pH 7 after 48 h in fermentation media containing 2% CMC as the sole carbon source. The suitability of water hyacinth was evaluated in terms of its composition, reducing sugars, and ethanol production. The contents of cellulose, hemicellulose, and lignin were 23.9%, 35.6%, and 4.7%, respectively. The release of sugars was found to vary with the pretreatment process. The combined pretreatment with $H_2SO4$ and gamma radiation showed the highest hydrolysis rate which was 40.83% and the highest released reducing sugars of 26.99 g/L among all applied pretreatment processes. However, considering the chemical hazard, cost, and time requirement, we continued bioethanol fermentation with $CaCO_3$-treated water hyacinth. The highest estimated production of ethanol (11.09 g/L) from water hyacinth was achieved by fermentation with *Bacillus aryabhattai* at 37°C and pH 7 after 48 h. To enhance ethanol production with a minimum number of medium ingredients, fermentation conditions were statistically optimized by Plackett-Burman Design (PBD). The design suggested that $Na_2HPO_4$ and NaCl had significant positive effects. Further, ethanol recovery using a simple distillation process was optimized and the obtained ethanol was 96.79% pure. Finally, it can be said that water hyacinth can be considered a promising source of lignocellulosic biomass for second-generation biofuel production in Bangladesh. We hope that our research findings will encourage further research on this area, which will soon lead to commercial biofuel production and thus revolutionize the fuel sector in this country.

**Keywords**: Bioethanol, lignocellulosc, biomass, water hyacinth, purification.

# Molecular Evaluation of the Radioprotective Potential of Honey for the Treatment of Cancer Patient Undergoing Radiotherapy

**Group:** Biological Science **Project ID:** SRG-221003

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## Abstract

Radiotherapy (RT) is a highly effective treatment modality for cancer patients, but it can induce acute side effects as radiation can affect both tumor and healthy tissues. Radioprotective substances offer solutions to protect healthy tissues from radiation damage. Honey has shown promise as a radioprotector in preclinical studies. Bangladesh is home to different types of honey, and considering the variations in composition, nutrients, and properties based on its origin, bee, and flower types, it is important to evaluate the radioprotective potential of native honey from Bangladesh. In this study, the radioprotective potential of Sundarban honey, mustard flower honey, litchi flower honey, and Nigella flower honey was determined. The assay of DNA scission was conducted using PUC19 supercoiled plasmid DNA (pUC19 2686 bp) in vitro. DPPH assay and catalase activity assay were also conducted, along with other physiochemical properties. This honey showed a pH value ranging from 3.72 to 4.04. Nigella honey displayed distinct color properties in the wavelength scan (peak 280nm) and it had the highest density (1.37g/ml) among the four. Sundarban honey had no true peak in wavelength scan but it showed the highest catalase activity. Nigella honey exhibited the maximum antioxidant activity (87.21%), followed by mustard honey (84.97%), litchi honey (76.68%), and Sundarban honey (46.29%). Despite differences in physiochemical properties, all four kinds of honey demonstrated significant radioprotective potential in the PUC19 DNA nick assay, regardless of their types. This molecular evaluation provides evidence of the radioprotective potential of native honey from Bangladesh, suggesting its potential application as an adjuvant therapy to enhance the effectiveness of radiotherapy while minimizing its side effects in cancer patients. Additional clinical investigations are necessary to validate these findings and determine the optimal dosage and administration regimen of honey for the treatment of cancer patients undergoing radiotherapy.

**Keywords**: Honey, radioprotector, antioxidant, DNA, radiotherapy.

# Experimental Study of Quenching Effect for the Fabrication of High Efficiency Solar Cells

**Group:** Biological Science **Project ID:** SRG-221004

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## Abstract

**Background**: During the fabrication process, various parameters influence the efficiency of a silicon solar cell. The contact resistance plays an important role in limiting the efficiency of solar cells. **Objectives**: In this research, we have experimentally studied and analyzed the quenching effect (time and temperature) on the contact resistance of silicon solar cells. **Methodology**: The quenching experiment was done with a modern Rapid Thermal Processing (RTP) system (ANNELSYS, France) with varying temperature from 500 0C to 1000 0C. Following the experiment, contact resistance was measured using the Transmission Line Method (TLM). Measured resistances are plotted as a function of distance and linear regression analysis used to determine the ohmic contact resistance. **Findings**: The effect of quenching temperature on contact resistance was confirmed experimentally. Contact resistance between the metal-semiconductor regions of a silicon solar cell is significantly affected by the quenching temperature. Contact resistance was found to decrease with the increases of quenching temperature up to 850 0C, and then an increasing trend was observed. At low quenching temperature, silver paste does not form a strong bonding with the semiconductor of a silicon solar cell. As a result, more contact resistance was discovered. As the quenching temperature increase, the bonding became stronger and the contact resistance gradually decreases and reaches its lowest values. Some micro cracks are formed on the busbars line at the higher temperature and the contact resistance again increases rapidly at the higher quenching temperature. Minimum contact resistance 0.414 Ωcm2 is achieved at 850 0C which will well suited for the fabrication of a high efficiency silicon solar cell. **Conclusion**: An optimized quenching temperature (850 0C) was achieved to produce a minimal contact resistance (0.414 Ωcm2) which will facilitate to fabrication of a high-efficiency silicon solar cell.

**Keywords**: Contact resistance, quenching tamperature, transmission line method, regression analysis, ohmic contact.

# Establishment of Suitable Protocol for Clonal Propagation of Stevia (*Stevia rebaudiana*) and Creating its Advanced Lines Using Gamma Ray

**Group:** Biological Science **Project ID:** SRG-221005

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## Abstract

Two type of explants viz., nodal and shoot tip explant of *Stevia rebaudiana* Bertoni were cultured on MS supplemented with different concentrations of auxin (NAA) and cytokinins (BAP, Kn) singly or in various combination for optimizing multiple shoot regeneration. The best shoot induction was observed in MS fortified with 2.0 mg/l BAP. In this combination highest percentage of explant (90%) showed shoot proliferation both for shoot tip and nodal segment. After development of *in vitro* shoots, they were sub-cultured and maintained in the same media composition for obtaining multiple shoots. Averages of 14-16 numbers of shoots were regenerated from nodal explant. Whereas 10-12 shoots regenerated from shoot tip explants after sub-cultured in the same medium. The regenerated shoots increased double to triple when they were sub-cultured in the same medium. Individual shoots from a multiple shoot mass were separated and transferred on to rooting medium. Different concentrations of IBA and NAA on MS were used as rooting medium. In case of IBA in the all concentrations, roots appeared after one to two weeks. About four weeks, roots were developed but the root induction gradually decreased with increasing the concentration of IBA. At 2.0-2.5 mg/l IBA. The best response was achieved when excised *in vitro* grown shoots were sub-cultured on MS added with 0.5mg/l IBA. All the rooted plantlets were gradually shifted to out- door condition. About 85% plantlets survived in natural condition.

**Keywords**: Plant cell culture, mutation breeding, varietal development.

# Study on Agronomic Feasibility of Growing Chia in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221006

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## Abstract

Chia (*Salvia hispanica* L.) is a very high value medicinal plant belongs to the Lamiaceae family, native to Mexico and Guatem. Introduce Chia for its high medicinal value and providing a good source of income to farmers there is a need to evaluate its cultivation as well as to develop appropriate agronomic management practices for higher growth and yield in Bangladesh. Since the cultivation is highly dependent on the environment to express its maximum agronomic potential, studies are needed to determine the factors that really affect the Chia yield. The field experiment was conducted at Agronomy Research Field, Gazipur of Bangladesh Agricultural Research Institute during rabi season of 2022-23 to assess the growth and yield of chia crop under irrigation management. Treatments included in the experiment were: $I_0$=No irrigation, $I_1$ =Irrigation at vegetative stage, $I_2$= Irrigation at vegetative stage + flower initiation stage and $I_3$= Irrigation at vegetative stage + flower initiation stage +floret formation stage. Different irrigation management differed in leaf area index (LAI), total dry matter production (TDM), yield and yield components of chia. Results revealed that, irrigation levels showed great influence on leaf area index (LAI), dry matter production and yield of chia. Significantly the highest chia yield (1134.93kg/ha) was observed in I3 (Irrigation at vegetative stage+ flower initiation stage +floret formation stage) treatment. Cost and return, analysis revealed that the highest benefit cost ratio (4.54) was found in $I_2$ (Irrigation at vegetative stage + flower initiation stage) treatment. But the highest cost of cultivation (Tk. 52790.16/ha) was obtained from $I_3$ (Irrigation at vegetative stage+ flower initiation stage + floret formation stage) treatment. The results revealed that among the different irrigation levels, $I_2$ (Irrigation at vegetative stage + flower initiation stage) was found better in respect of yield for chia cultivation.

**Keywords**: Agronomy, rabi season, irrigation treatment, yield.

# Improvement of Rice-based Cropping System Through Short Duration Non-Rice Cropping in Beel Area for Enhancing Food Crop Production as Changing Climate in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221007

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## Abstract:

Two experiments were conducted at Chalan beel (Experiment-1: Sirajgonj) and at Monglar beel (Experiment-2: Faridpur) to improve the rice-based cropping system in lowland during 2020-2021 and 2021-2022. Treatments of Experiment-1 were four cropping patterns like $T_1$=Mustard-Boro rice, $T_2$= Mustard-Jute, $T_3$= Potato-Boro rice and $T_4$= Fallow-Boro rice. Treatments of Experiment-2 were four cropping patterns viz. $T_1$=Onion-Jute, $T_2$=Onion-Broadcast aman (B. aman) rice, $T_3$= Lathyrus- B. aman rice and $T_4$= Fallow-Boro rice. Experiments were conducted in a RCB design with five dispersed replications. Crops in the patterns were sown/planted/transplanted timely in the growing season. Cultural management were done as and when necessary, as per recommendation of each crop. All relevant data was collected and analyzed systematically. The results of the Experiment-1 revealed that Mustard-Jute and Potato-Boro rice cropping patterns were found superior in respect of productivity and economic returns as compared to existing cropping pattern (i.e. Fallow-Boro rice cropping pattern). The findings of the experiment-2 indicted that Onion-Jute and Onion-B. aman rice were found as the most productive cropping patterns with better economic benefit over existing cropping pattern (ie. Fallow-Boro rice cropping pattern). Farmers are interested to adopt in these improved cropping patterns in the beel area. They will get more economic returns. Total food production of the country will be enhanced through adoption of these improved cropping patterns.

**Keywords**: Cropping system, rice, non-rice crops, productivity, beel area.

# Screening of Groundnut Lines for Drought Tolerant under Rainfed Condition for Char Area at Jamalpur

**Group:** Biological Science **Project ID:** SRG-221008

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## Abstract

**Background:** Groundnut (*Arachis hypogaea* L.) is a multi-purpose legume serving millions of farmers and their value chain actors globally. Use of old poor-performing cultivars contributes to low yields (< 1 t/ha) of groundnut in char area in Bangladesh. **Objectives**: The objectives of this study were to determine the drought tolerant lines among diverse groundnut collections using phenotypic traits and to select distinct and complementary genotypes for breeding. **Methodology**: The experiment was conducted at naubanger char under rainfed condition of Jamalpur during Rabi 2022-2023 with 9 lines with three checks and RCBD design. The plot size was 3 m 4 rows long. Seeds were sown on the 26$^{th}$ November, 2022. Data were taken on days to mature, shelling% and yield per plot. The plot yield was converted into hectare. The data were analyzed statistically. **Findings**: Among the genotypes, the highest seed yield 2538 kg/ha was produced from BAG-DF-090035, which was 53% higher yield than check variety Dhaka-1. The second highest seed yield 2215 kg/ha was recorded from BARI Chinabadam-11 followed by ICGV-00338 and ICGV-91114. BARI Chinabadam-11 gave 34% higher yield than check variety Dhaka-1 and the third highest seed yield 2117 kg/ha recorded from ICGV-00338 and ICGV-91114 which was 28% higher yield than local check Dhaka-1. The highest shelling % (79%) was recorded from ICGV-07217, ICGV-91114 and ICGV-07214 followed by BARI Chinabadam-11 (77%). The highest 100 kernel weight (55 gm) was obtained from BAG-DF-090035 followed by ICGV-00338 (47gm). All these lines took 154 -158 days to mature. **Conclusion**: The present study identified genotypes BAG-DF-090035, BARI Chinabadam-1, ICGV-00338 and ICGV-91114 to be used for Char land, which will be useful for char area at Jamalpur for effective breeding and groundnut improvement.

**Keywords:** Groundnut, screen, drought, rainfed, char area.

# Evaluation of Canola Grade and Nutrient Enriched Mustard (*Brassica juncea*) Cultivar to Meet the Edible Oil Security in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221009

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## Abstract

Mustard is one of the most important oilseed crops and very popular among Bangladeshi people. The high content of erucic acid and glucosinolates (more than 5% and 30 µmol/g FW) in mustard oil is a problem in human health. Canola grade mustard variety which contains very low percentage of erucic acid and glucosinolates (below 5% and 30 µmol/g FW). Canola oil considered nutrient rich good edible oil for health and contains a desirable profile of considers a healthy edible oil and field-level yield higher than our cultivated varieties. The objective of this study was to introduce canola grade and nutrient rich mustard (*Brassica juncea*) variety by introgression low erucic acid and glucosinolate traits. Thirteen canola grade and yellow seed-coated *Brassica juncea* mustard germplasms were collected. The genotypes were previously screened against erucic acid, glucosinolate, and yield and yield contributing characters, as well as some qualitative parameters data were collected by spectrophotometer and gas chromatography. During the trail time, we have selected some promising genotypes and self-fertilized them for maintaining their genetic purity though bagging and covering by mosquito net. The seeds of these selected genotypes were used as plant materials in this project. Among them, the selected promising genotype Cano-0122 results found that the growth duration is nearly ~110 days, oil content (42%), high level of unsaturated fatty (oleic 61%, linoleic 19.62% and linolenic 8.69%) acid, low level of saturated fatty acids (7-9%) which are of canola grade e.g. erucic acid less than 4.35% and total glucosinolate 28.70 µmol/g FW. Moreover, the same genotype yield potential is higher (2.17 ton/ha) than our local variety (1-2-1.5 ton/ha). Thus, the new genotype, Cano-0122 was identified as the promising and nutritionally rich genotype and to assure more edible-oil, achieving maximum nutrients and nutritional security in Bangladesh.

**Keywords**: Canola, erucic acid, glucosinolate, fatty acids, nutrients.

# Nutrient, Phytochemical and Antinutrient Composition of Citrus Pulp and Peel

**Group:** Biological Science **Project ID:** SRG-221010

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## Abstract

Citrus are the important fruit crops of the world which are important source of vitamin C in many countries. This research is designed to compare the proximate, vitamins, antioxidants, minerals and antinutrients contents between the peel and pulp of different citrus varieties. The study was conducted at the Central Laboratory of BARI. Fruits of different citrus varieties were analyzed for different biochemical parameters. The results showed that the individual fruit weight ranged from 71 g (BARI Kagzilebu-1) to 571 g (BARI Jaralebu-1). The percentages of pulp and peel ranged between 21.05 to 72.43 and 24.98 to77.15, respectively. The juice content of different citrus fruits ranged between 27.49 ml (BARI Kagzilebu-1) to 93.99 ml (Malta) per fruit. The highest vitamin C content was recorded from malta, while the least was recorded from BARI Jaralebu-1. In peel, the highest vitamin C content was recorded from Malta and the least from seedless lebu. BARI Jaralebu-1 showed the highest and orange showed the lowest DPPH radical scavenging activity. BARI Jaralebu-1/ orange showed the highest TPC, TFC as well as TAC values while BARI Lebu-1/ BARI Lebu-2 showed the lowest values. Soluble and total oxalate content in fruit pulps ranged only from 0.44 to 3.24 mg/100g and 0.82 to 5.22 mg/100g FM, respectively. Soluble and total oxalate content in fruit peels ranged from 3.91 to 13.94 mg/100g and 5.99 to 29.99 mg/100g FM, respectively where BARI Lebu-3/ BARI Lebu-1 showed the lowest values and orange showed the highest values. Finally, it can be concluded that citrus pulps and peels are excellent sources of vitamin C, phenol and flavonoids. They are also packed with antioxidant capacity. The oxalate content in the pulps as well as peels are very minimal and are not harmful for human consumption.

**Keywords**: Lemon, BARI varieties, vitamin C, oxalate, antioxidant.

# Production of Micronutrient Fortified Leafy Vegetables Providing Human Health Benefits through Hydroponic Cultivation

**Group:** Biological Science **Project ID:** SRG-221011

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## Abstract

Zinc, iron, and selenium are considered essential micronutrients providing human health benefits. Hydroponic systems can precisely control mineral compositions and are used for producing mineral-fortified vegetables. This research aims to optimize doses of Zn, Fe and Se in nutrient solution (NS) for producing mineral-fortified leafy vegetables. BARI Lettuce-1, Palongshak-2, and Gimakalmi-1 were used as planting material. These leafy vegetables were cultured in hydroponics with increased concentration of Zn and Fe was prepared to ×1, ×2, ×3, ×4, and ×5 times NS, while Se was applied as 0.0, 1.0, 2.0, 4.0 and 8.0 µmol/L of $Na_2SeO_4$. The selected plants were cultured in hydroponics using 50% 'Enshi' NS (EC 1.32 dS/m and pH 6.93). Mineral nutrients of shoot mass were determined using atomic absorption spectrophotometer. Shoot fresh did not decline until ×10 Zn in lettuce, ×5 Zn in spinach, and gimakalmi; improved significantly in ×5-10 Fe in lettuce, ×5-20 Fe in spinach and did not decline until ×5-10 Fe in gimakalmi; while in case of Se it was not differed. Plants grown in NS with elevated concentrations of Zn lead to 5 times higher Zn content in lettuce (0.564 mg/g DW) in ×20 Zn, 4 times higher Zn content in spinach (0.281 mg/g DW) in ×20, and 2 times higher Zn content in gimakalmi (0.203 mg/g DW) in ×20 Zn. On the other hand, plants grown in elevated concentrations of Fe resulted in 3 times higher Fe content in lettuce (1.00 mg/g DW) in ×20 Fe, but did not differ significantly in spinach and gimakalmi. Se will be determined in shoot dry mass in the follow-up studies. Considering the fresh weight and mineral nutrient uptake, ×10-15 Zn and Fe can be applied to the NS to produce Zn and Fe-enriched leafy vegetables through hydroponics.

**Keywords**: Fortification, enshi-nutrient solution, mineral uptake, health benefits.

# Salinity Stress Mitigation by Gibberellic Acid and Humic Acid Application in Tomato (*Solanum lycopersicum* L.)

**Group:** Biological Science **Project ID:** SRG-221012

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## Abstract

Salinity is a significant problem affecting agriculture resulting in substantial losses in crop yield. Two experiments - one lab and one pot experiment were conducted to investigate salinity stress mitigation by Gibberellic acid and Humic Acid application in tomato during November 2022 to April 2023. Seeds were presoaked in 100 and 200 ppm $GA_3$ and HA solutions and then applied in 0, 8 and 10 dS/m salinity. 200 ppm $GA_3$ and 1000 ppm HA were sprayed four times after 30 DAP at 15 days interval and HA @ 3 g/kg soil were applied in pot under 0, 8 and 10 dS/m salinity. Seed germination was reduced at 8 and 10 dS/m salinity compared to control and 100 ppm $GA_3$ and 200 ppm HA gave higher seed germination at 8 dS/m (91.67% and 90.00%) and 10 dS/m (81.67% and 90.00%) salinity. Mean germination time, germination index, germination rate index, germination value, mean germination time, germination energy, seedling length and dry weight, seedling vigor index were also significantly reduced at saline condition. 200 ppm $GA_3$ and 1000 ppm HA spray under salinity improved plant height, leaf area, SPAD value, plant dry weight and fruit length and breadth, number of fruits per plant, individual fruit weight, and fruit yield. But 1000 ppm HA spray produced significantly higher yield, 1.48 kg at 8 dS/m and 1.27 kg/plant at 10 dS/m salinity stress. Spray of 1000 ppm HA to the plants under salinity increased yield by 31.08% over 8 dS/m salinity and 25.20% over 10 dS/m salinity. Proline and TSS were increased with increasing salinity levels, but carotenoids were decreased at salt stress. 100 ppm $GA_3$ and 200 ppm humic acid may be used to improve tomato seed germination, and 1000 ppm humic acid could be sprayed to obtain higher tomato yield under salt stress.

**Keywords**: Germination, growth, salinity alleviation, yield.

# Integrated Management of Tomato Yellow Leaf Curl Virus Infecting Tomato (*Solanum lycopersicum* L) in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221013

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## Abstract

Tomato yellow leaf curl virus (TYLCV) transmitted by whiteflies is the major constraint in tomato production in Bangladesh. Farmers use chemicals to control the TYLCV disease and their vectors. However, successful management is often dependent on an integrated approach rather than a single approach. Thus, the study was undertaken to evaluate integrated management packages against the tomato yellow leaf curl virus and its vector whitefly. The experiment was conducted in HRC at BARI, Gazipur during the 2022-23 growing season. The sixteen treatment combinations comprised eight levels of integrated management were used including $T_1$= Yellow polythene mulch + two times foliar application of Imadicloprid + two times foliar application of neem oil, $T_2$= Yellow polythene mulch + four times foliar application of neem oil, $T_3$= Silver polythene mulch + two times foliar application of imadicloprid + neem oil, $T_4$= Silver polythene mulch + four times foliar application of neem oil, $T_5$= Yellow sticky trap + two times foliar application of imadicloprid + two times foliar application of neem oil, $T_6$= Yellow sticky trap + four times foliar application of neem oil, $T_7$= Farmer's practice and $T_8$= Untreated control along with two varieties (BARI Tomato 14 and BARI Tomato 15). The experiment was laid out in a split-plot design with three replications. Results indicated that yellow polythene mulch and two times foliar application of imidacloprid and neem oil followed by silver polythene mulch and two times foliar application of imidacloprid and neem oil at 15-day intervals showed the lowest in terms of TYLCV disease incidence and whitefly population. The same treatments provided a higher yield compared to the non-treated control. Comparing the two varieties, BARI Tomato 15 showed a higher yield than BARI Tomato 14. Plastic mulch with foliar application of chemical and bio-control was more efficient than the conventional approach (pesticide application). Therefore, plastic mulch with foliar application of imidacloprid and neem oil is effective in controlling TYLCV disease incidence as well as whitefly and increasing marketable yield of tomato.

**Keywords**: Mulch, neem oil, tomato yellow leaf curl virus, whitefly and vector.

# Development of Bottle Gourd Hybrid

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## Abstract

A study was conducted in bottle gourd to estimate the magnitude of standard heterosis for yield and its six yield related components. Seventeen hybrids generated from eight diverged parents were evaluated in a Randomized Block Design with three replications at the Olericulture Division, Horticulture Research Center (HRC), Bangladesh Agricultural Research Institute (BARI), Gazipur, Bangladesh during winter season of 2022-23. Appreciable standard heterosis was found over fifteen hybrids for all the traits studied. There was significant variability observed among the fifteen bottle gourd hybrids. The range of significant standard heterosis for number of fruits/plant and individual fruit weight was 11.58 to 12.63 per cent and 11.11 to 22.22 per cent, respectively, while for fruit length and fruit diameter, it was 9.09 to 27.27 per cent and 7.27 to 9.09 per cent, respectively. Eight hybrids showed significant positive heterotic response for fruit yield, and the range was 12.98 to 31.40 per cent. The more significant positive standard heterosis was observed in hybrids $F_1$ 103 (31.40%), $F_1$ 102 (28.65%), $F_1$ 110 (23.98%), $F_1$ 107 (22.22%), and $F_1$ 106 (19.30%). Considering yield contributing characters, the hybrids $F_1$ 105, $F_1$ 102, $F_1$ 110, $F_1$ 107, and $F_1$ 106 were found promising and may be recommended for RYT.

**Keywords**: Bottle gourd, standard heterosis, variability, positive heterosis, yield.

# Performance Evaluation of Developed Snake Gourd *Trichosanthes anguina* L. Hybrids

**Group:** Biological Science **Project ID:** SRG-221016

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## Abstract

Snake gourd is an important summer vegetable in Bangladesh. Wide range of variability exists in size, shape and color of fruits in Bangladesh. Heterosis breeding can be one of the most viable options for breaking the present yield barrier. However, the level of yield gain achieved from these hybrids is marginal. It clearly indicated that, the scope of improving the productivity of snake gourd through genetic manipulations. Keeping these points in view, the present investigation was undertaken to evaluate the developed snake gourd $F_1$'s in different aspects. The experiment was conducted at the Olericulture Division of Horticulture Research Centre of BARI during the kharif season of 2023 with fourteen $F_1$'s (viz.; BARI Chichijangha -1x TC01-1-9,TC02-1-2-2-4xTC02-1-7-2,TC02-1-2-2-1xTC08-1-6, TC02-1-2-2xTC02-1-4,BARI Chichijangha -1xTC08 -1-6, TC02-1-2-2xTC08-1-6,TC02-1-2-2xTC01-1-9,TC04-1-3-6xTC01-2-2, TC02-1-7-4xTC01-1-9, TC01-1-9 x TC08-1-6, TC07-1-4 xTC08-1-6, TC03-3-10xTC01-2-2, TC01-1-9 x TC01-2-2, TC02-1-4x TC02-1-7-2) with one commercial hybrid Asha(A.R. Malik Seed Com. Ltd.). The seven parents were also planted in same field for selfing and crossing. The seeds of these lines were sown on polybag on 24March, 2023. Sixteen days old seedlings were transplanted in the main field on 10April, 2023. The experiment was laid out in RCB design with three replications. All the tested hybrids with commercial check yield and yield contributing data were recorded and analyzed statistically. Considering yield and yield contributing characters, acceptable fruit size, harvest duration, disease and insect reactions the five tested hybrids Viz.: TC02-1-2-2-4 x TC02-1-7-2 (26.52t/ha), TC02-1-2-2 x TC01-1-9 (25.18t/ha), TC04-1-3-6 x TC01-2-2 (28.12t/ha), TC02-1-7-4 x TC01-1-9 (25.10t/ha) and TC03-3-10 x TC01-2-2 (29.15t/ha) were best. Other hybrids were not up to the mark. Now it is very important to evaluate these hybrids in different regions of Bangladesh. After that the best one or two hybrids will be released as a snake gourd hybrid variety.

**Keywords**: Summer vegetable, hybrid, snake gourd, harvest duration, yield.

# Generation Advancing and Development of Saline Tolerant Barley Variety

**Group:** Biological Science **Project ID:** SRG-221017

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## Abstract

Salinity is the major problem in southern coastal belt in Bangladesh. So far, there is no saline tolerant variety to cultivate in this salt affected soil. With this view, saline tolerant varietal development program of barley was under taken in these studies. In 2022-23, 14 $F_2$, 26 $F_3$ and 60 $F_4$ population were evaluated in Benarpota, Sathkhira and Koira, Khulna to select saline tolerant barley genotypes. Additionally, 12 $F_2$ populations were screened in artificial saline soil under greenhouse condition to obtain saline tolerant segregates. Date of sowing was last week of December 2022. Salinity level was found to increase as day progressed. At mid-February, the salinity of Satkhira and Koira was reached in peak of 9.5 and 11.0 dS/m, respectively. Based on phenotypes and stress tolerance markers, 28 individual plants, yield raging 10.5-48.5 g/plant, were selected at Satkhira. In $F_3$ generation,16 individual plants (yield range 16.5-42.4 g/plant) were selected while in $F_4$ generation, 37 families having single plant yield with 109-30.5 g where $K_4$-1, $K_4$-3, $K_4$-13 and $K_4$-32 were most susceptible families. In comparison of the reactive oxygen species like $O_2^{\bullet-}$ (superoxide) and $H_2O_2$, $Na^+/K^+$ and melondialdehyde (MDA, cell was decomposed product) with the susceptible families, the selected families showed lower ROS, $Na^+/K^+$ and MDA. Families survived Koira was considered to compare with the families survived at Satkhira. On the other hand, in green house condition, 71 saline tolerant segregates were selected where salinity level was raised from 4.8 to 14.8 dS/m during the growth period of 27 November 2022 to 15 March 2023. The above selected genotypes will be further advanced for developing saline tolerant barley lines in subsequent generation.

**Keywords**: Salt tolerant, variety development, barley, ROS, mechanism.

# Development of Bio-Rational Based Integrated Management Technology of Diseases of Cucurbits Vegetable Crops

**Group:** Biological Science **Project ID:** SRG-221018

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## Abstract

The project is related to the present need of the country because diseases viz. root knot nematode, powdery mildew, downy mildew, foot and root rot are the major constraints for successful vegetable especially cucurbits vegetable production in Bangladesh. Management of these diseases by chemical pesticides posed significant health and environmental risks. Biological control promises to be the most effective alternative for the management of plant diseases. Therefore, a project regarding development of bio-rational based integrated management technology of diseases of cucurbits vegetable crops has been implemented by Plant Pathology Division, BARI, Gazipur. Under the sub-project; different activities like survey of cucurbit vegetables diseases in Bangladesh, screening of new bio-fungicides against the powdery mildew disease and development of bio-rational based disease management technologies of root knot nematode and foot and root rot diseases have been performed. Under survey, root-knot nematode and cucumber mosaic virus diseases were found prominent in all the location. Three field experiments were conducted to evaluate the Trichoderma based Tricho-compost, organic materials, new bio-fungicides and chemical pesticide for management of root knot nematode, foot and root and powdery mildew diseases of bottle gourd, cucumber and pumpkin. Among the treatments, integration of Tricho-compost, poultry refuse and mustard oilcake with lower dose of nematicide Rugby 10 G appeared to be the best amendments for root knot nematode reduction and improvement of plant growth as well as increased yield of bottle gourd. In case of foot and root rot disease management, integration Trichoderma based bio-fungicides Tricho-composts with bio-fungicide Lycomax or mustard oil cake with bio-fungicide Lycomax or poultry refuse with Autostin are the best treatments in reducing foot and root rot disease incidence and increasing plant growth as well as yield of cucumber. Eight different new bio-fungicides viz. Clybio, Bio-Libas, Magic guard, Bio-Scion, Bio-Viron, Bio-Shield, Fizimite and Dynamic were tested and found effective against powdery mildew disease and increasing yield of pumpkin.

**Keywords**: Pumpkin, vegetable diseases, biological control, tricho-compost, health and environmental risks.

# An Integrated Approach for Management of Rhizome Rot Disease of Ginger

**Group:** Biological Science **Project ID:** SRG-221019

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## Abstract

Ginger is a high value spice crops in Bangladesh. Enormous damaging hampered ginger cultivation due to the attack of rhizome rot disease of ginger every year. A survey was conducted on rhizome rot disease of ginger in five districts namely Nilphamari, Rangpur, Bogura, Tangail and Khagrachari were visited for recording the incidence of disease. The lowest disease incidence was found in Bogura (34.5%) which was followed by Khagrachari (35.5%), Rangpur (38.0%) and Nilphamari (46.7%) while the highest disease incidence was recorded in Tangail (78.0%). Four different organisms were found associated with rhizome rot viz. *Pythium aphanidermatu*, *Fusarium oxysporum*, *Sclerotium rolfsii* and *Ralstonia solanacearum*. The field experiments were conducted at Gazipur to develop the appropriate management package for rhizome rot control in replicated manner following randomized complete block design with 6 treatments having plant materials, chemicals and different categories of seeds. The ranges of germination (85.0-97.0%) were found in the experiment. The disease incidence was the lowest (5 %) using seed treatment with Ridomil gold MZ 68WG (0.2%) and its 2 times soil drenching. The highest disease incidence (51.35 %) was recorded in the control plots. The highest yield 22.92 t/ha was obtained in seed treatment with Ridomil gold MZ 68WG (0.2%) and its 2 times soil drenching. All treatments gave higher yield compared to control. Seed infection had a significant effect on incidence of rhizome rot disease and yield of ginger. All those categories of seeds had significant effect on seed germination, disease incidence and yield of the crop. Healthy seed (0 % seed infection) showed the highest germination percentage (93%) and yield (18.20 t/ha) with lowest disease incidence (9%). The highest disease incidence (82%) with lowest percentage of germination (61%) and the lowest yield (1.98 t/ha) were observed in 100% seed infection. The yield was decreased with the increased of percent seed infection.

**Keywords**: Survey, management, integrated approach, rhizome rot, ginzer.

# Molecular Diagnosis, Distribution of Major Emerging Tomato Infecting Viruses and their Vector Population Dynamics in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221020

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## Abstract

Tomato, an important vegetable crop in Bangladesh, is grown year-round in the kitchen garden as well as in large-scale commercial cultivation. The solanaceous vegetable crop is suffering from many diseases, especially viral diseases. An attempt was made to identify and determine the distribution of the major emerging viral diseases and their insects' vectors in tomato using advanced molecular tools. To assess the viral diseases of tomato and their insect vector, a survey was conducted in Rajshahi, Jamalpur, Jessore, and Gazipur districts of Bangladesh. The survey results showed that a variety of viral diseases, with a percent incidence ranging from 20 to 100%, are the most common causes of tomato infection. These diseases include mosaic, yellowing, mottling, leaf curling, and bud necrosis. Among the different viral diseases, *Tomato leaf curl virus,* transmitted by *Bemisia tabaci,* is the predominant viral disease, with a disease incidence of 100%. Field resistance against the viral diseases was assessed among the BARI-released tomato varieties, and it was observed that all the tomato varieties tested were infected by the leaf curl virus. Curtovirus (*Beet curly top virus*) and Crinivirus (*Tomato infectious chlorosis virus*; *Tomato chlorosis virus*) infections were also detected in the assessed area, contributing to the moderate to high prevalence of curly top and chlorosis disease. The Direct Antigen Coating-Enzyme-Linked Immunosorbent Assay (DAC-ELISA) coupled with PCR and RT-PCR using group-specific degenerate primers followed by sequencing revealed that the identified viruses were *Tomato leafcurl virus*, *Tomato infectious chlorosis virus, Tomato chlorosis virus*, *Beet curly top virus*, and *Groundnut bud necrosis virus*. The primary insect that transmits *Tomato leaf curl virus*, *Tomato chlorosis virus*, and *Tomato infectious chlorosis virus* is the white fly (*Bemisia tabaci*), according to the findings of the insect Mitochondrial Cytochrome Oxidase Subunit-I genome sequencing.

**Keywords**: Tomato, viral diseases, DAC-ELISA, RT-PCR, genome sequencing.

# Climate Resilient Barley Germplasm Identification in Response to Drought and Salinity Combined Stress

**Group:** Biological Science **Project ID:** SRG-221021

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## Abstract

Salinity and drought are the two most commonly co-occurring abiotic stresses that limit crop growth and output. So, a pot experiment was carried out to examine the genotypic potentiality with regard to the generation of growth and yield and to clarify their physiological and biochemical mechanisms in the tolerance to single and combined stress of salt and drought on barley genotypes. Genotypes/varieties, BARI barley-8 (drought-tolerant); T-16 (salinity/drought-tolerant); and compared with CM-72 (salinity-tolerant). Drought and salinity stress were imposed in the conforming containers planning vegetative (2-3 leaf) and reproductive stage (anthesis). Genotypes/varieties were subjected to four treatments: (i) control (non-salinized); (ii) drought stress (D), (2 L water added and then subjected to drought stress; (iii) salinity stress treatment (S), (2 L of a 150mM NaCl solution added and (4) Drought + salinity stress (D+S), in which 2 L of a 150mM NaCl solution was added and then subjected to drought stress until SMC reduced 4%. Significant reductions in plant growth and photosynthetic parameters were caused by either drought (D) or salt (S) alone or in D+S conditions, with combined stress causing the highest suppression, and the T-16 genotype demonstrating more tolerance than CM-72. Following D + S, WUE greatly enhanced in T-16 and BARI barley-8 but not in CM-72. In comparison to CM-72, T-16, and BARI barley-8 demonstrated the highest potentiality for the bearing of $K^+$ and $K^+/Na^+$ ratio in plants during D + S stress. Additionally, T-16 and BARI barley-8 showed greater increases in the amount of catalase (CAT), ascorbate peroxidase (APX), and guaiacol peroxidase (POD) activities under D+S *vs* control than CM-72. Compared with the control, all stress treatments meaningfully reduced grain yield; however, T-16 was less affected than CM-72.

**Keywords**: Water use efficiency, catalase activity, ascorbate peroxidase, guaiacol peroxidase, soil moisture content.

# Shelf-life Extension of Pineapple Pomace Ball (Laddu) through Postharvest Treatments

**Group:** Biological Science **Project ID:** SRG-221022

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## Abstract

**Background**: After processing into different pineapple products, results in massive waste generation called pineapple pomace. The drying, storage and shipment of this waste is cost effective and its dumping causes environmental pollution. Hence, eco-friendly and low-cost processing technique of this waste as well as pineapple pomace ball is more and more necessary. **Objectives**: (i): To increase the shelf life of the pineapple pomace ball (laddu), (ii) To determine the MRL/RDA level of preservative KMS used to preparation of laddu. **Methodology**: HPLC and Spectrophotometric method was used to analysis the bioactive compounds of pineapple pomace laddu. Microbial load was count to determine the aflatoxin and mycotoxin of the laddu. **Findings**: Shelf-life of the developed laddu could be extended two months more than traditional laddus available in the market. **Conclusion**: This technology could contribute to minimize the post-harvest alleviate the postharvest loss of pineapple and uplift the socio-economic status of the producer/technology users.

**Keywords**: Pomace, nutrition, microbial count, mycotoxin, marketable life.

# Development of Mobile Apps Controlled Automatic Hydroponic System for Vegetable Production

**Group:** Biological Science **Project ID:** SRG-221023

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## Abstract

The experiment was conducted at the Hydroponic net house at HRC nursery, RARS, BARI, Jamalpur during the winter season of 2022-2023 with a view to evaluate the performance of different crops with hydroponic solution in automatic hydroponic system. Human labor is very expensive, that's why automatic and mobile apps-controlled culture system should be developed. "LC Hydroponic solution-A, B and C" were used to culture the plants and the circulating system was maintained. Three commercial lettuce varieties were used for the experiment named "BARI Lettuce-1", "Green Leaf" and "Green wave" and three capsicum lanes or varieties viz, CA0035, CA0040 and BARI Mistimorich-1 and two cherry tomato variety viz, "BARI Tomato-11" and "Indian Red Star" were used as the planting materials. For the lettuce production some rectangular boxes and PVC pipe (4 inch) were used which were made of wood, polythene and box were covered by corck sheet. Each cork sheet contained 28 lettuce plant and each PVC pipe contained 14 lettuce plants. For the capsicum 6-inch PVC pipe contained 10 plants. The experiment was laid out at CRD design with 6 replications. The nutrient circulation system was used for capsicum production and non-circulation system was used lettuce and cherry tomato production. The highest entire single plant weight recorded from "Green wave" (350 g) while but the lowest was observed in "Green Leaf" (314 g). For the capsicum per plant yield was significant and highest in "BARI Mistimorich-2" (544.0 g) and the lowest was obtained by the line "CA 0035" (357.6 g). In the cherry tomato the highest yield plant$^{-1}$ was obtained from "BARI Tomato-11" (1.82 kg) treatment while the minimum was found from "Indian Red Star" (1.30 kg) treatment. An automatic system was developed by this experimental project and the production of the crops is the justification of the system.

**Keywords**: Automatic hydroponic system, nutrient solution, tomato, capsicum, lettuce.

# Year-Round Cultivation of Peppermint through Hydroponic System for Medicinal and Aromatic Purposes

**Group:** Biological Science **Project ID:** SRG-221024

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## Abstract

Peppermint is an herb known for its aromatic leaves and is commonly used in various industries including food and medicinal products. Cultivating peppermint year-round through a hydroponic system can be a highly efficient and controlled way to grow this aromatic herb. The present study was carried out at the Regional Agricultural Research Station (RARS), BARI, Burirhat, Rangpur from July 2022 to June 2023. There were two experiments under this project, the first one was to develop a simplified hydroponic system at RARS, Burirhat, Rangpur. The Deep-Water Culture (DWC) hydroponic system was built through locally available materials at this station. The second experiment was to evaluate the performance of Peppermint production in different hydroponic nutrient solutions. Three hydroponic solutions were used: Enshi-shoo (Japanese formulation), Modified hydroponic solution-1 (BARI hydroponic solution-1), and Modified copper solution-2 (BARI hydroponic solution-2). The growth performance (plant height, branching, and plant weight) of peppermint was better in Japanese solution followed by BARI hydroponic solution-1. Low performance was observed in BARI hydroponic solution-2. Some of the notable medicinal properties of peppermint were observed: carminative, antispasmodic, diuretic activity, antibacterial and antifungal, anti-diarrheal activity, anti-asthmatic activity, fever reduction, cold management, weight management, and enhanced digestive aid. This study brings to light a transformative possibility–the potential for year-round cultivation of Peppermint using hydroponic systems indicating that Peppermint can thrive under controlled hydroponic conditions regardless of seasonal constraints. This breakthrough not only expands the cultivation window for this herb but also opens up new avenues for its sustainable production, offering valuable implications for the herbal and aromatic industries.

**Keywords**: Pudina, controlled cultivation, hydroponic solutions, herbal, aromatic uses.

# Introduction of Simplified Hydroponic System for Growing High Value Vegetables at Jashore Region

**Group:** Biological Science **Project ID:** SRG-221025

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## Abstract

Hydroponics is a nonconventional and controlled cultivation technique now popularly used for producing high value vegetables. It is a great scope for the innovative and young farmers who are seeking modern technologies of agriculture in the urban areas. The main objective of this experiment is to develop simplified hydroponic models to produce high value and quality nutritious vegetables through hydroponics with safety. The study was carried out at HRC, Regional Agricultural Research Station, BARI, Jashore in a semi-controlled net house during 2022-23. It was conducted on two types of nutrient solution namely BARI Nutrient Solution-1 (BARI NS-1) and Enshi-shoo solution (Japanese formulation) on four crops namely tomato, cucumber, kangkong (Gimakolmi) and lettuce. There were two types of hydroponic system used, namely soilless culture system (SCS) with drip irrigation and deep-water culture system (DWC). SCS was found better for fruit type vegetables and DWC was better for leafy vegetables. Considering the earliness, harvesting and yield potentiality the BARI NS-1 was performed better in tomato and cucumber cultivation. But in case of leafy vegetables like kangkong and lettuce, Enshi-shoo solution performed better over BARI NS-1. In case of low height semi controlled net house SCS is found better for fruit type vegetables and DWC is better for leafy vegetables.

**Keywords**: Hydroponics, vegetables, soilless culture, deep water, culture, nutrient solution.

# Evaluation of Sprinkler Irrigation for Improving Water Productivity of Watermelon/Sunflower in Coastal Zone of Bangladesh

**Group:** Biological Science **Project ID:** SRG-221026

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## Abstract

Sprinkler irrigation is becoming popular for increasing water productivity in the regions where the fresh water availability and resources are scare. The objectives were to evaluate the hydraulic performance of sprinkler irrigation, evaluate the effect of sprinkler irrigation on yield, water use and water productivity of watermelon/sunflower, and introduce the sprinkler irrigation. A portable sprinkler irrigation system was developed, installed and evaluated. The tested parameters were manufacturer coefficient of variation (CVm), coefficient of uniformity (CU) and the distribution uniformity (DU). A rectangular, triangular and circular spacing were considered to investigate the water uniformity at the riser height of 1 and 1.5 m. The results showed that the CVm at 1 and 1.5 m riser head performed well. The CUc showed above 85% indicating better water application for uniformly distribution to the field. The CUmc ranged 88.8-98.2% for the all combinations and the moisture content uniformity (CUmc) were more stable due to the uniform effect of water application in the soil. The DU at rectangular and circular spacing showed more than 87 percent which can be considered as excellent and indicating the acceptable spacing system for water application. The sprinkler irrigation in field conditions showed that the watermelon/sunflower yield and water productivity were greater and save water compared to traditional practice. The sunflower yield in sprinkler irrigation was greater by 6.3% than in traditional practice. The watermelon yield with sprinkler irrigation was slightly higher than traditional method. The sprinkler irrigation method saved water 19.7 % compared to traditional practice for sunflower production. The water productivity was substantially improved by sprinkler irrigation method as compared to traditional method. The sprinkler irrigation system has a great prospect to save water and improve water productivity for crop production in the coastal regions that can offer an alternative option for rabi crops cultivation in Bangladesh.

**Keywords**: Distribution uniformity, coefficient uniformity, irrigation water productivity, water use efficiency, water saving.

# Climate Change of Soil in Response to Different Organic Substances Under Onion Production

**Group:** Biological Science **Project ID:** SRG-221027

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## Abstract

Excessive use of inorganic fertilizers threatens soil health and causes environmental pollution. Field experiments on "response of different organic substances on the change of soil environment, yield and quality of onion at farmers field of Bangladesh" was conducted at Jamalpur (AEZ-9) and Gazipur (AEZ-28) during the year of 2022-23 with the objectives of improving soil carbon accumulation, soil fertility and increasing crop yield through an integrated plant nutrition system (IPNS). Six different treatments were applied in the study, viz. $T_1$: 100% chemical fertilizers from soil test basis (STB), $T_2$: 3 t $ha^{-1}$ Trico-compost (TC) + IPNS, $T_3$: 5 t $ha^{-1}$ Vermicompost (VC) + IPNS, $T_4$: 5 t $ha^{-1}$ compost + IPNS, $T_5$: 3 t $ha^{-1}$ Poultry Manure (PM) + IPNS, $T_6$: Farmer's Practice. The experiment was laid out in RCB design with four replications. Tested crop variety was onion (BARI Piaz 4). The results showed that, treatment $T_3$ produced the highest onion yields and superior quality, as measured by parameters like TSS%. Nutrient uptake by onion crop was also highest in this treatment. In contrast, the traditional farmer's practice ($T_6$) yielded the lowest results. Furthermore, the use of vermicompost with IPNS ($T_3$) increased the levels of various essential nutrients in the soil, such as nitrogen, potassium, phosphorus, sulfur, zinc and boron, while also enhancing organic carbon content and carbon accumulation. Cost-benefit analysis revealed that, $T_3$ resulted in the highest gross margin and benefit-cost ratio (BCR). These findings suggest that integrating organic substances, particularly vermicompost with IPNS can improve soil health, increase crop yield, enhance nutritional quality and ultimately boost farmers' income. This approach has the potential to reduce the reliance on excessive chemical fertilizers, mitigating environmental pollution and promoting sustainable agriculture practices. However, it is important to replicate these experiments to confirm the results and promote their adoption among farmers for long-term soil and environmental health.

**Keywords**: Yield, vermicompost, uptake, carbon, accumulation.

# Yield and Nutritional Quality of Black Rice and BRRI Dhan-87 Under Organic and Inorganic Fertilization

**Group:** Biological Science **Project ID:** SRG-221028

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## Abstract

Black rice contains carbohydrates, vitamins, essential nutrients and amino acids BRRI dhan87 has been gaining popularity among farmers. This experiment was conducted at the field laboratory of the department of Agronomy and the laboratory analysis was done in the department of Agricultural Chemistry, BAU, Mymensingh. The experiment was laid out in a completely randomized design (CRD) with different combinations of inorganic fertilizer (IF) and decomposed cow dung (CD) having six (IF0CD0, IF100CD0, IF75 CD25, IF50CD50, IF25CD75, IF0CD100) treatments and three replications. The aim of this research is to conduct a thorough examination of how combining inorganic fertilizers (IF) with cow dung (CD) affects the yield, nutritional qualities, and growth characteristics of black rice and BRRI dhan87. The results revealed that each rice was significantly affected by different combinations of IF and CD. Except plant height the highest numbers of total tillers hill-1, fertile tillers hill-1, panicle length, grains panicle-1, grain and straw yield were obtained when 75% of inorganic fertilizer + 25% of cow dung was applied. Conversely, plant height, nitrogen, protein, phosphorus and potassium contents reached their maximum levels in the treatment IF100CD0.Though the yield of BRRI dhan87 was almost double than black rice, protein and nutritional qualities except few were significantly higher in black rice compared to BRRI dhan87. The highest quantity of starch, iron, zinc and manganese concentrations were found in the highest additions of cow dung (IF0CD100). The research concludes that 75% of inorganic fertilizer + 25% of cow dung can be applied for overall growth, yield, and nutritional attributes of both rice.

**Keywords**: Inorganic fertilizer, cow dung, yield, nutrients, black rice, BRRI dhan87.

# Slow-release Nitrogen Fertilizer for Improving Soil Health and Sustainable Crop Production

**Group:** Biological Science **Project ID:** SRG-221029

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## Abstract

Leafy vegetables are packed with vitamins, minerals and fiber which fills up the needs of the daily diet in human nutrition. But farmers require an ample amount of nitrogen (N) fertilizer for the production of leafy vegetables. Excessive application of synthetic fertilizers is one of the main contributing factors for reducing soil organic matter (SOM). Using slow-release organo-mineral fertilizer and its long-term residual effect can solve this problem to some extent. The experiment was conducted at the pot house of the Department of Agricultural Chemistry, Bangladesh Agricultural University, Mymensingh to observe and compare the effect of conventional and slow-release N fertilizers. The research work conducted to measure the effect of urea, di-ammonium phosphate and brown coal-urea (BCU) basal and brown coal-urea top dressed treatments on the yield and N uptake by BINA Patshak-I. Total 80 pots were prepared for five treatments with four replications for N doses 0, 50, 75, 100 and 150 kg N $ha^{-1}$ following completely randomized design. The highest plant height, leaves $plant^{-1}$, branches $plant^{-1}$, stem girth, fresh and dry biomass yield was recorded from BCU TD treated plants than urea, DAP and BCU basal treated plants. The best results regarding the quantity of protein content and N uptake were found in treatment combination BCU TD 150 kg N $ha^{-1}$. At last, considering both the effects on yield and N use efficiency were attributed to lower N release rates of BCU TD fertilizers compared to that of the conventional N sources. Slow release BCU applied as top dressing in soils may have promising applications for sustainable agricultural development by mitigating N losses and for a longer period of residual effect.

**Keywords**: Slow-release fertilizer, nitrogen, nitrogen use efficiency, yield.

# Sugarcane Goor Production in Bangladesh: A Study on Farmers' Perception and Financial Profitability

**Group:** Biological Science **Project ID:** SRG-221030

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## Abstract

**Background:** Sugarcane *goor* has immense market potential both at the national and international levels due to its high nutritional and medicinal value as well as the mindset of people towards natural product. **Objectives:** This study was undertaken to estimate the financial profitability and assess the production practices, farmers' perception and problems of sugarcane *goor* production. **Methodology:** Based on stratified random sampling, ninety farmers were interviewed using a structured questionnaire to collect primary data. A combination of descriptive (i.e., sum, average, percentages, ratios, etc.), mathematical (i.e., financial profitability analysis) and statistical technique (i.e., Logit regression model) was used to analyze the data and to achieve the objectives. **Findings:** The study depicts that the highest number of the respondents (79%) belong to the 30-64 age group in the study areas, i.e., Chapainawabganj and Sirajganj districts of Bangladesh. Seventy six percent respondents were small farmers having land less than 1.0 ha and they allocated 38% of their farm area for sugarcane production. Sugarcane *goor* price, consumers' preferences, intercrop practices and sharing of work among household members are the main factors influencing farmers' perception of sugarcane *goor* production. Financial profitability analysis shows that sugarcane *goor* production was highly profitable and its benefit cost ratio (BCR) was more than one. Applying dichotomous logistic regression model, five factors namely, cultivating intercrops, sharing work among household members, owner of a crusher machine, income generation and access to training were identified as significant factors which influence farmers' decision to adopt sugarcane *goor* production. Unavailability of crusher machines, low output price and lack of knowledge on grading were the major problems for input, production and marketing of sugarcane *goor*, respectively. **Conclusion:** To overcome the problems related to input, production and marketing of sugarcane *goor* as well as to make this farming more profitable and potential, policies recommended are: to provide modern crusher machine, increase output price and to arrange training on grading of the product.

**Keywords**: Sugarcane goor, financial profitability, logit model, production challenges.

# Evaluation of Diesel and Electric Operated Shallow Tubewell Irrigation Mode in some Selected Areas of Mymensingh Division

**Group:** Biological Science **Project ID:** SRG-221031

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## Abstract

In the realm of agricultural practices, efficient irrigation techniques play a vital role in ensuring optimal crop growth and increased agricultural productivity. The study adopts a comparative cross-sectional research approach to assess the efficiency and effectiveness of diesel and electric-operated shallow tubewell irrigation modes in Mymensingh Division's selected locations. A purposive sampling strategy is utilized to choose 60 farmers who are actively involved in shallow tube well irrigation. The sample is divided into two groups: one for farmers who use diesel-powered shallow tubes and another for those who use electric-powered deep tubes. A questionnaire is used to collect primary data on many elements of shallow tubewell irrigation practices, such as water use, energy consumption, expenses, crop production, and overall satisfaction with the irrigation mode. The questionnaire is designed to collect data on various aspects of irrigation practices such as irrigation efficiency, water consumption, and energy consumption. The results of the study show that the use of diesel pumps is more efficient than that of electric pumps. Educating farmers about the benefits of water-efficient practices and proper irrigation management can drive widespread adoption and improve overall productivity. Promoting solar-powered electric pumps, particularly in regions with abundant sunlight, provides a sustainable and cost-effective solution for irrigation needs. Similarly, considering wind-power electric pumps in areas with consistent wind patterns offers an eco-friendly alternative to traditional diesel pumps, reducing greenhouse gas emissions and fostering a greener approach to agriculture.

**Keywords**: Agricultural productivity, irrigation modes, water consumption, wind-power electric pumps, greenhouse gas emissions.

# Students' Food Safety Concerns and Choice of Eating Place in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221032

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## Abstract
The study was conducted across a selection of public universities, utilizing a sample of 266 students. The participants were participated in an online survey on voluntary basis. The study commences by addressing the global phenomenon of increased food consumption outside the home, emphasizing the consequential food safety issues. It underscores the fact that consumers are frequently exposed to food safety Hazards due to the physical product, the conduct and attitude of the staff, and the environment in which the food is prepared and served. The paper further notes the numerous outbreaks of food-borne illness have been associated with public eating places, primarily due to improper food handling and unsanitary conditions. The methodology of the study involved collecting primary data from university students through online surveys. The data collected was subsequently analyzed using STATA software, with the results presented in the form of descriptive statistics and tabular analysis. The study provides a comprehensive socio-demographic profile of the university students who participated in the study. The majority of these students were within the age range of 21-23 years, were male and identified as Muslims. Most of the students hailed from rural areas, were single and were pursuing a Bachelor's degree. The study also presents an in-depth analysis of the student's food safety knowledge, attitudes, and practices. It provides data on various aspects such as the frequency of checking the expiration date of frozen products, the regularity of fridge cleaning to prevent bacterial growth and the usage of airtight containers or Ziploc bags for food storage. The search reveals that student's food safety practices such as checking the expiration date of frozen products and cleaning the fridge regularly, are crucial in mitigating food safety risks. Overall, the study contributes significantly to the body of knowledge on food safety practices among university students in Bangladesh. It underscores the need for continued research and interventions to improve food safety practices and reduce the risk of food borne illness in this population.

**Keywords**: Food safety, concern, eating place, student, Bangladesh.

# Perception of Fish Farmers on Environmental Degradation Due to Fish Farming

**Group:** Biological Science **Project ID:** SRG-221033

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## Abstract

Bangladesh, with its rich inland waters and river systems, has significant capture fishery and aquaculture potential. The favorable geographic position of Bangladesh comes with a large number of aquatic species and provides plenty of resources to support fisheries potential. The study was conducted to identify the present status of fish farming in Trishal upazila of Mymensingh district. The objectives of the study were to determine the perception of fish farmers on environmental degradation due to fish farming, explore the relationships between the selected characteristics of the fish farmers and their perception and problems faced by the fish farmers due to fish farming. Data were collected from a random sample of 100 fish farmers from a population of 700. A structured interview schedule was used for collecting data during September to October 2021. Pearson's Product Moment Coefficient Correlation (r) was computed to explore relationship of the respondents' selected characteristics and their perception. Trishal had a population of 419,308 people. Among them about 12000 people are fish farmers. According to office document there are 20,744 ponds in the study area. The total production of fish in Trishal upazila is about 42445 MT. The major commercial species which were commercially cultured by the fish farmers was Pangus. Shing, Tilapia, Rui, Mrigal, Pabda, carp etc. were also cultured in the study area. Results showed that 55 percent of the fish farmers had highly favorable perception and 45 percent fish farmers had moderately favorable perception on environmental degradation due to fish farming. It was evident from the correlation analysis that household size, fish farm size, annual income, communication behavior and knowledge about fish farming showed significant relationships while age, years of schooling, training received and use of ICT in fish farming activity had no relationship with the fish farmers' perception on environmental degradation due to fish farming. The findings indicated that the majority (61 percent) of the fish farmers faced medium problems, while 39 percent faced high problems. "Availability of cropland is decreasing due to fish farming." is the main problem due to fish farming. "Water quality is deteriorating day by day due to fish farming" and "Productivity of croplands are decreasing due to fish farming" related to fish farming were the second and third problem respectably. Thus, it can be concluded that the perception of the fish farmers in the study are was moderate to high and the problems were medium to high. Thus, DoF and other relevant organizations could take necessary actions to improve fish farming in the study area.

**Keywords**: Croplands, aquatic species, environmental degradation, correlation coefficient, commercial species.

# Eco-friendly Practices for Vegetable Cultivation: Farmers' Knowledge and Use

**Group:** Biological Science **Project ID:** SRG-221034

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## Abstract

**Background**: The injudicious use of pesticides by the growers in vegetable cultivation is a severe challenge that causes risk of human health and contaminates environment. **Objectives**: To assess knowledge level of vegetable growers, existing eco-friendly practices and explore the relationships between growers' characteristics and their knowledge and use of eco-friendly practices. **Methodology**: The study was conducted in Shibpur upazila under Narsingdi district with 112 vegetable growers using 24 eco-friendly practices in vegetable cultivation. Knowledge was measured by applying Bloom's Taxonomy and the use through 4-point rating scale. Descriptive statistics were used but for exploring relationships, the Pearson's Product Moment Correlation was employed. **Findings**: The majority (71.4%) of vegetable growers had moderate to high level (28.6%) of knowledge on eco-friendly practices. Our analysis on Bloom's taxonomy of knowledge revealed that majority of the respondents obtained highest average score (78.56%) in application level followed by remembering level (71.02%) of knowledge domain compared to other domains. Among the six levels of Bloom's taxonomy, respondents obtained lower average score (54.28%) in creating level. The findings also indicated that the highest proportion of the vegetable growers (64.3%) had medium and a considerably more than one-third of them (35.7%) had high level of use of eco-friendly practices for vegetable cultivation. Among the 24 selected eco-friendly practices, the first ranked eco-friendly practice under current use was "using traps (pheromone traps)" followed by "use of poly-tunnel" as second ranked practice. Correlation (r) test result identified that farmers' educational status, total expenditure in vegetable cultivation, total expenditure in pesticide application, net return from vegetable cultivation, annual family income and attitude toward eco-friendly practices have positive significant relationship with the farmers' knowledge on eco-friendly practices in vegetable cultivations. Furthermore, correlation tests revealed that only the 'age' of the farmers had a negative significant relationship with the current use status of eco-friendly practices. **Conclusions**: Vegetable growers had lack of knowledge in understanding, analyzing, and creativity level in applying their knowledge in running vegetable cultivation through eco-friendly practices.

**Keywords**: Vegetable cultivation, eco-friendly practices, knowledge gap, yield.

# Efficiency of the Cauliflower Cultivation in a Selected Area of Gazipur District

**Group:** Biological Science **Project ID:** SRG-221035

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## Abstract

Cauliflower, a pivotal winter crop, is cultivated widely in Bangladesh. This study was conducted to assess the socioeconomic characteristics and to explore the farmers' efficiency of cauliflower production in Gazipur district of Bangladesh by applying the stochastic production frontier approach. Primary data were collected through a field survey of 60 cauliflower farmers from January to March 2023, using a semi-structured interview schedule. The major findings of this study revealed that 95% of the respondents were aged between 30 and 64 years; 48.33% of households had a small family size; and 86.67% of the respondents' primary occupation was agriculture. Cauliflower production was profitable. Per hectare total cost, total return, gross margin, net return, and benefit-cost ratio (BCR) were Tk. 286112, 386250, 138218, 100138, and 1.35, respectively. The mean farmer's technical efficiency was 90%, which implies that the household cultivating the cauliflower can increase revenue by 10% at a given level of resources. Cauliflower farmers complained of a lack of quality seed, the high price of quality seed, natural calamities, and attacks of pests and diseases. Cauliflower is one of the important vegetable crops grown by farmers, mainly to generate household income. The study area has tremendous potential for cauliflower production.

**Keywords**: Inefficiency, profitability cauliflower production, Bangladesh.

# Transforming Traditional into Conservation Agroforestry Practices for Mitigating Climate Change Impact in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221036

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## Abstract

The continuous practice of mono-cropping by small-scale farmers in Bangladesh has resulted in poor soil quality and declining crop yields. As a result, there is a growing need to explore sustainable production methods that are resource-efficient and environmentally friendly. Conservation agriculture has emerged as a beneficial approach that effectively addresses these challenges by utilizing locally available resources to enhance crop productivity and soil quality. With this in mind, the objective of this study was to assess the impacts of conservation agricultural practices on the growth and yield of ginger and turmeric in the Madhupur Garh of Bangladesh. The study was conducted in Auronkhola, Gaira, Makontonagar in Madhupur district, using a Randomized Complete Block Design (RCBD) with three replications from July to September 2022. Ginger and turmeric were selected for the trial. The results showed that these spices exhibited significantly higher yields (6090 kg/ha and 11370 kg/ha, respectively) compared to traditionally cultivated vegetables in the farmers' fields. The implementation of conservation agriculture practices contributed to the improved yields. As part of conservation agriculture practices, various factors crucial for crop production, such as soil organic matter content, total nitrogen, phosphorus, potassium levels, and pH, were positively influenced. This was achieved through the use of organic manure, minimal tillage, the retention of permanent crop residues, and crop rotation. Based on the findings, the study concludes that traditional agriculture must transition to conservation agriculture methods in order to achieve increased food production while utilizing fewer resources and minimizing negative environmental impacts. This shift towards conservation agriculture offers a more efficient and sustainable approach to farming.

**Keywords**: Ginger, turmeric, tillage, soil fertility, productivity, conservation.

# Crop and Weed Response to Different Tank-Mix Herbicide Combinations in Zero Till Non Puddled Rice

**Group:** Biological Science **Project ID:** SRG-221038

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## Abstract

Herbicides are normally applied as single or in sequence by the farmers of Bangladesh to control weeds. Tank-mixture of two or more chemical groups of either pre- or post-emergence herbicide might play a vital role to manage weeds of a diversified community more effectively. Although some proprietary herbicides are available in the market, their number is very limited. In this backdrop, the current research was conducted to evaluate the crop and weed response to tank-mix pre- or post- emergence herbicide combinations to control weeds of transplant boro rice under zero-till non puddled condition. A total of 21 treatments were used in each experiment (either pre- or post-emergence herbicide). Treatments comprised six pre-emergence (Exp.#1) / post-emergence (Exp.#2) herbicides with their 13 tank-mix combinations, one proprietary pre- / post-emergence herbicide and a season-long weedy plot (control). Both the experiments were conducted under randomized complete block design with three replications. In Exp.#1, sole application of Tryafemon (pre-) performed as the best in terms of percent weed control efficiency (%WCE), grain yield and percent yield increase over control (%YOC). The second highest %WCE was observed in the proprietary pre-emergence herbicide Acetachlor 14% + Bensulfuron methyl 4%, while, second highest grain yield and %YOC was obtained from the tank-mix pre-emergence Pretilachlor + Tryafemon herbicide. In Exp.#2, tank-mix application of post-emergence herbicide Pyrazosulfuron-ethyl + Penoxsulam performed as the best in terms of %WCE, grain yield and %YOC followed by sole application of Penoxsulam (post-). As these experiments have been conducted in a single season and single location, it is not wise to draw a final conclusion based on these experimental results. Multi-location and multi-season trial considering different tank-mix ratios should be taken into account in future to draw a concrete conclusion based on these preliminary experimental results.

**Keywords**: Weed management, conservation agriculture, tank-mix herbicide, rice productivity, winter rice.

# Maximizing Farm Productivity Through Agronomic Management to Attain Food Security

**Group:** Biological Science **Project ID:** SRG-221039

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## Abstract

Four experiments were conducted in the farmer's field of Gouripur upazila, Mymnesingh during July 2022 to June 2023 to explore the possibility of growing four crops in T. *aman* rice – Fallow-*Boro* rice cropping pattern. BRRI dhan66 with application of USG produced the highest grain yield which was statistically similar with BRRI dhan66 with 2.5 t $ha^{-1}$ poultry manure (PM) + 50% of RD of nitrogen from prilled urea (PU) and BRRI dhan66 with 100% RD of nitrogen from PU. Binasarisha-4 with 125% of the RD of sulphur produced the highest seed yield of mustard which was statistically similar with Binasarisha-4 with 125% of RD recommended dose of sulphur and Binasarisha-9 with 125% of RD of sulphur. Therefore, the mustard yield could be maximized by application of 125% of RD of sulphur using Binasarisha-4 or Binasarisha-9. The highest *Patshak* yield was obtained from BJRI Patshak-3 with 100% of RD of urea. Application of urea super granule (USG) with post-emergence herbicide followed by (FB) one hand weeing (HW) at 30 DAT produced the highest grain yield of T. *aus* rice which was followed by 2.5 t $ha^{-1}$ PM with early post-emergence herbicide FB one HW at 30 DAT. T. *aman* rice was transplanted on 23 July 2022 and T. *aus* rice was harvested on 8 July 2023 that means four crops was accommodated in a year in a field. Finally, it is recommended that four crops like T. *aman* rice-Mustard- *Patshak*- T. *aus* rice could be successfully grown in two crop-based cropping systems of Bangladesh by choosing short duration *aman* rice and mustard cultivars. Therefore, farmers of Gouripur upazila can maximize their crop production as well as economic return by producing four crops in a year instead of two crops.

**Keywords**: BRRI Dhan66, Binasarish-4, *Patshak*, poultry manure, USG.

# Effect of Foliar Supplementation of Nitrogen and Zinc on Growth, Yield and Nutrition Quality of Soyabean

**Group:** Biological Science **Project ID:** SRG-221040

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## Abstract

An experiment was carried out at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during November 2021 through March 2022 to investigate the effects of foliar application of nitrogen (N) and zinc (Zn) on the performance of Bina soybean-1. The experiment comprised two factors, viz. (A) foliar supplementation of N, and (B) Zn fertilizer management. Factor A had two levels, viz. (i) no N application (control) (N0), and (ii) foliar application of 2% urea solution at pod formation stage (N1). Factor B had four levels, viz. (i) no Zn application (control) (Z0), (ii) basal application recommended dose (RD) of Zn (Z1), (iii) foliar application of 0.5% $ZnSO_4.7H_2O$ at pod formation stage (Z2), and (iii) basal application of 50% RD of Zn + foliar application of 0.5% $ZnSO_4.7H_2O$ at pod formation stage (Z3). All growth parameters (leaf area, branch production and plant height), yield contributing characters (total numberof pods $m^{-2}$, number of fertile pods $m^{-2}$, number of seeds $m^{-2}$, weight of 1000-seeds), seed yield and stover yield were significantly affected by N fertilization. The highest values were recorded with foliar application of urea (2%) at pod formation stage. Zn management and the interaction of N and Zn management significantly affected the yield contributing parameters and yields of soybean. However, plant characters were affected neither by Zn nor their interaction. Basal application of 50% RD of Zn + foliar application of 0.5% $ZnSO_4.7H_2O$ at pod formation stage produced the highest values for all yield contributing characters. Interaction of these N and Zn treatments was also found to be the best combination in terms of these parameters. However, foliar N (2% urea) application coupled with a single foilar spray of 0.5% ZnSO4.7H2O at pod formations stage was as good as the previous combination and produced the statistically similar results in all these yield contributing characters. Therefore, for higher seed yield of soybean, 2% urea solution coupled with a single foilar spray of 0.5% ZnSO4.7H2O at pod formations stage is recommended.

**Keywords**: Soybean, foliar application, nitrogen, zinc, seed yield.

# Enhancing Weed Control Efficacy by Integrating the Reduced Rate of Herbicide with Extracts of Boiled Aqueous Crop Residues in T. Aus Rice

**Group:** Biological Science **Project ID:** SRG-221041

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## Abstract

Boiled extract of allelopathic crops have the potential to control weeds successfully, particularly when integrated with reduced herbicide doses. Two field experiments were conducted to evaluate the effect of allelopathic boiled extract of sorghum and mustard crop residues combined with reduced doses of herbicide (Granite 240 SC) in T. *aus* rice. In first experiment, treatments consist of two factors viz. variety (3)-BRRI dhan48, BRRI dhan98, Binadhan-21 and application of boiled extract with reduced rate of herbicide (5)-Control, Recommended doses of herbicide at post emergence, 80% recommended doses of herbicide at post emergence + sorghum crop extracts, 70% recommended doses of herbicide at post emergence + sorghum crop extracts, 60% recommended doses of herbicide at post emergence + sorghum crop extracts. Second experiment also consists of two factors e.g. variety (3)-the same variety used in the experiment 1 and application of boiled extract with reduced rate of herbicide (5)- same as the experiment 1 with the extract of mustard. It was noticed that herb weed species were more susceptible to crop residues than grass weed species. In this respect, the highest growth inhibitions (79.80%) were observed in controlling Panilong (*Ludwigia octovalvis)* by the treatment of 80% recommended doses of herbicide at post emergence + sorghum residues extracts. Among the rice variety, BRRI dhan98 showed superior performance in respect of yield contributing characters and yield. In case of reduced rate of herbicide and boiled extract application, boiled extract of sorghum and mustard with reduced rate of herbicide (80% of recommended) as post emergence was the best for T. *aus* rice cultivation. From the findings of our study, it can be concluded that the studied crop residues extract and reduced rate of herbicide showed positive effect on weed growth, yield contributing characters and yield of T. *aus* rice.

**Keywords**: Boiled extracts, allelopathy, weed control, reduced rate, herbicide, crop yield.

# Integration of Co-Composted Faecal Sludge with Chemical Fertilizers for Sustainable Rice Production

**Group:** Biological Science **Project ID:** SRG-221042

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## Abstract

Faecal sludge management in Bangladesh is a huge challenge. Currently, the focus of research is shifting from fecal sludge disposal to reuse as fertilizer and soil conditioner. A study was therefore undertaken to judge the efficacy and economic feasibility of co-compost in increasing yield of T. aman rice following a randomized complete block design with three replications in aman season 2022 at the Bangladesh Agricultural University. Treatments included two T. aman rice varieties: BRRI dhan49 and Dhanigold; and 10 chemical fertilizer + co-compost combinations: Recommended Chemical Fertilizer (RDF), Co-compost (CC) @ 5 t $ha^{-1}$, RDF + CC @ 2 t $ha^{-1}$ ,RDF + CC @ 1.5 t $ha^{-1}$ , RDF + CC @ 1 t $ha^{-1}$ ,RDF + CC @ 0.5 t $ha^{-1}$ , 75% RDF + CC @ 2 t $ha^{-1}$ , 75% RDF + CC @ 1.5 t $ha^{-1}$ , 75% RDF + CC @ 1 t $ha^{-1}$ and 75% RDF + CC @ 0.5 t $ha^{-1}$. A clear advantage of integrating co-compost with chemical fertilizers to increase rice productivity was evident. The highest grain yield was recorded when co-compost@ 2 t/ha was integrated with RDF, but application of only co-compost @ 5 t/ha reduced grain yield by by 47%. The highest benefit : cost ratio for BRRI dhan49 and Dhanigold (1. 66 and 1.61, respectively) were calculated from RDF application. Application of only co-compost@ 5 t/ha resulted in negative net return and <1 benefit : cost ratio (0.75 and 0.73, respectively for BRRI dhan49 and Dhanigold) due to very poor yield and high cost for co-compost. Encouraging findings of this study confirm that co-compost can be integrated with chemical fertilizers to increase the productivity of T. aman rice. To conclude, co-compost could be a potential supplementary source of plant nutrients and soil conditioner to reduce chemical fertilizer dependence in rice cultivation.

**Keywords**: Soil conditioner, organic manure, fecal waste, paddy, grain yield.

# Effect of Integrated Nutrient Management on the Yield Performance of T. Aman Rice

**Group:** Biological Science **Project ID:** SRG-221043

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## Abstract

An experiment was conducted at the Agronomy Field Laboratory, BAU, Mymensingh to measure the effects of the integrated nutrient management on the yield performance of T. *aman* rice. The experiment consisted ten treatments such as control, recommended dose of NPKS, Tricho compost @ 5.0 $tha^{-1}$, Tricho-compost @ 2.5 $tha^{-1}$ + 50% less of recommended doses of NPKS, cowdung @ 5 $tha^{-1}$, cowdung @ 2.5 $tha^{-1}$+ 50% less of recommended doses of NPKS, Vermicompost @ 5 $tha^{-1}$, Vermicompost @ 2.5 $tha^{-1}$ + 50% less of recommended doses of NPKS, Bone powder @ 5 $tha^{-1}$ , Bone powder @ 2.5 $tha^{-1}$ + 50% less of recommended doses of NPKS. BRRI dhan71 was used as test crop. The experiment was laid out in Randomized Complete Black Design (RCBD) with three replications. Integrated nutrient management had significant effects on rice yield and yield contributing characteristics except panicle length, sterile spikelets per panicle, 1000-grain weight and harvest index. Highest plant height (105.67 cm), higher number of total tillers $hill^{-1}$ (11.41), higher number of effective tillers $hill^{-1}$ (9.55), longest panicle (24.51), maximum number of grains $panicle^{-1}$ (118.36), higher 1000-grain weight (25.06 g), maximum grain yield (6.48 $tha^{-1}$), maximum straw yield (7.55 $tha^{-1}$) higher biological yield (14.03 $tha^{-1}$) and higher harvest index (46.64%) was obtained at applied of tricho-compost @ 2.5 $tha^{-1}$ + 50% less of recommended doses of NPKS. Tricho compost @ 5.0 $tha^{-1}$ produced the second highest grain yield (6.05 $tha^{-1}$) followed by grain yield obtained from cowdung @ 2.5 $tha^{-1}$ + 50% less of recommended doses of NPKS. The lowest grain yield (4.07 $tha^{-1}$) was recorded at control treatment. Therefore, it was revealed that tricho-compost @ 2.5 $tha^{-1}$ + 50% less of recommended doses of NPKS could be applied for BRRI dhan71 rice cultivar for obtaining maximum yield in T. *aman* season.

**Keywords**: INM, fertilizers, Manures, NPKS, rice.

# Assessment of Allelopathic Effect of *Albizia lebbeck* Leaf Residues on Weed Growth and Yield Performance of Rice

**Group:** Biological Science **Project ID:** SRG-221044

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## Abstract

Alternative weed management methods have undergone a great deal of development as a result of the rise in herbicide-resistant weeds and environmental concerns regarding the use of synthetic herbicides. The present experiment was conducted at the Agronomy Field Laboratory, BAU, Mymensingh to study the effects of the residues of *Albizia lebbeck* on the yield performance of *boro* rice. The field experiment consisted of two rice varieties *viz*., BRRI dhan28 and BRRI dhan29, and five residual treatments of *A. lebbeck* leaves such as 0, 1.0, 2.0, 0.3 and 4.0 t $ha^{-1}$. RCBD was followed to design the experiment. Five weeds belong to four families were identified in the field such as Shama, Panikachu, Sabuj nakful, Angta, Pani chaise. Variety had significant effect on most of the yield and yield contributing characters except number of total tillers $hill^{-1}$, number of effective tillers $hill^{-1}$, number of non-effective tillers $hill^{-1}$ and harvest index. On the other hand, *A. lebbeck* residues had also significant effect on yield and yield contributing characters of rice yield except number of non-effective tillers $hill^{-1}$, panicle length, grains $panicle^{-1}$, number of sterile spikelets, and 1000-gain weight. The highest number of total tillers $hill^{-1}$, highest number of effective tillers $hill^{-1}$, higher 1000-grain weight, grain yield, straw yield and biological yield was obtained from BRRIdhan29 and residues applied @ 3.0 t $ha^{-1}$. The lowest grain yield and others yield contributing characters were found in control treatment due to lower number of effective tillers $hill^{-1}$ and higher number of sterile spikelet $panicle^{-1}$. From the above results it was found that the variety BRRI dhan29 and residues @ 3.0 t $ha^{-1}$ produced superior effect. Therefore, *A. lebbeck* residues could be a potential source of biological weed management and yield enhancement tool for sustainable crop production.

**Keywords**: Allelpathy, weed-resistant, biological control, A. leebeck, herbicide.

# Evaluation of Boro Rice Varieties by Exploiting and Adjusting Existing Technologies

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## Abstract

Management practices are very crucial for successful crop production. To evaluate cultural practices, a field experiment was carried out during the period from November 2022 to May 2023 at the Agronomy Field Laboratory, Bangladesh Agricultural University (BAU), Mymensingh with *boro* rice varieties. The experiment comprised of five *boro* rice varieties viz., BRRI dhan28 ($V_1$), BRRI dhan29 ($V_2$), BRRI dhan81 ($V_3$), BRRI dhan89 ($V_4$) and Binadhan-10 ($V_5$) and two treatments on a management practice viz., Farmers' practices (FP) and Improved practices (IP). The two factorial experiments were laid out in a randomized complete block design (RCBD) with three replications. The number of total tillers, effective tillers, number of grains panicle$^{-1}$, biological yield, and harvest index varied significantly due to variety. The highest biological yield (13.34 t ha$^{-1}$) was found in $V_4$ (BRRI dhan89) and the lowest (11.35 t ha$^{-1}$) was observed in $V_1$ (BRRI dhan28). In terms of management practices, the highest grain yield (6.29 t ha$^{-1}$) was obtained due to IP and the lowest grain yield (5.69 t ha$^{-1}$) was recorded in FP. The interactive effect of variety and management exerted that the performance of the combination $V_4 \times T_2$ was the highest (6.58 t ha$^{-1}$) for grain yield and the lowest performance (5.03 t ha$^{-1}$) in grain yield was found in $V_1 \times T_1$. Thus, the variety BRRI dhan89 with IP was superior for attaining the highest yield.

**Keywords**: Farme'rs practices, grains/panicle, 1000-grain weight, grain yield, harvest index.

# Grain Growth Pattern and Yield Performance of Maize as Influenced by Moisture Stress

**Group:** Biological Science **Project ID:** SRG-221046

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## Abstract

Moisture scarcity is a major threat in maize cultivation in Bangladesh. But the response of moisture stress to grain growth patten in field condition is not well elucidated. Therefore, an experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh to investigate the yield and yield contributing characters and grain filling pattern of inbred and hybrid maize varieties under irrigated and rainfed condition. Four maize varieties namely Khoi Bhutta, BHM-09, C-1921, P-3396 were grown under rainfed and irrigated conditions. The experiment was conducted following split-plot design with three replications. Rainfed condition inflicted relative yield loss ranged from 14.24% to 34.32% among the varieties. C-1921 allowed the least yield penalty (14.24%) while Khoi Bhutta had the maximum yield penalty (34.32%) due to rainfed condition. Khoi Bhutta is the less productive variety (4.42 t $ha^{-1}$) under rainfed condition and its relative yield loss is also higher (34.32%) than other varieties with high yield potential. On the other hand, C-1921 appeared as the most water deficit resistant variety (only 14.24% relative yield loss) with productivity of 13.82 t $ha^{-1}$. The highest value of individual grain weight of hybrid maize variety was P-3396 (308.1 mg) found under irrigated condition. The lowest weight was found in the inbred maize variety khoi bhutta (165.5 mg) with rainfed condition. The highest value of maximum grain water content of hybrid maize variety was P-3396 (193.9 mg) under irrigated condition. The grain filling rate of P-3396 and C-1921 was statistically similar. Based on the experimental results, it may be concluded that hybrid maize C-1921 can be cultivated under irrigated condition. Grain filling pattern varied for inbred and hybrid maize under both rainfed and irrigated condition. The findings of the study may be useful for Agronomist to manage of maize cultivars under water limited environment.

**Keywords**: Drought, growth stages, grain filling period, grain morphology and productivity.

# Efficacy and Economics of Neem Oil Coated Urea for Rice Cultivation in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221047

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## Abstract

In Bangladesh, farmers use lots of urea fertilizer in rice cultivation and almost 70% of that applied urea is lost in various ways. The neem oil coated urea could be a way of minimizing this loss and can save a huge amount of foreign currency each year. The study is set to find out the efficacy and productivity of neem oil coated urea on the rice performance in Bangladesh. Two experiments were set of which one in aman season and another one in boro season. In aman season three varieties (BRRI hybrid dhan4, BRRI dhan87 and Binadhan-17) and five levels of neem oil (0, 3, 5, 7 and 10ml neem oil/kg urea) were used. In boro season three varieties namely BRRI dhan28, BRRI dhan89 and Binadhan-24 with same levels of neem oil as in aman season were used as experimental treatments. The split plot design with three replications was used in the experiments where neem oil concentration was allocated in main plots and varieties were distributed in subplots. The unit plots were uniformly fertilized with, urea, triple super phosphate, muriate of potash and gypsum according to the BRRI and BINA recommended dose of aman and boro rice variety. the result revealed that in aman season, highest grain yield was produced (6.33 t/ha) when 7 ml neem oil per kg urea was used using the rice variety BRRI dhan87 and lowest was found without neem oil treated plot. In boro season, maximum grain yield (7.61 t/ha) was found in 5 ml neem oil per kg urea when BRRI dhan28 was grown though BRRI dhan89 produced statistically similar result with that of BRRI dhan28. Finally, it can be said that neem oil coating urea can produce more yield than that of without neem coated urea.

**Keywords**: Neem oil, urea, rice, Bangladesh.

# Influence of Variety and Split Application of Potassium Fertilizer on Yield and Potassium Use Efficiency of T. Aman Rice

**Group:** Biological Science **Project ID:** SRG-221048

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## Abstract

Potassium is known as quality nutrient, enhances crop yield and quality. Therefore, a field experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh, to explore the effect of variety and potassium management on yield and potassium use efficiency of rice. Three rice varieties (Bashiraj, BRRI dhan49 and BRRI hybrid dhan4) and six potassium (K) management [$K_0$ = 0 Kg $K_2O$ $ha^{-1}$ (Control), $K_1$ = 90 Kg $K_2O$ $ha^{-1}$ (All as basal), $K_2$ = 45 Kg $K_2O$ $ha^{-1}$ (Basal) + 45 Kg $K_2O$ $ha^{-1}$ (at 30 DAT), $K_3$ = 90 Kg $K_2O$ $ha^{-1}$ (at 30 DAT), $K_4$ = 45 Kg $K_2O$ $ha^{-1}$ (at 30 DAT) + 45 Kg $K_2O$ $ha^{-1}$ (at 60 DAT) and $K_5$ = 30 Kg $K_2O$ $ha^{-1}$ (Basal) + 30 Kg $K_2O$ $ha^{-1}$ (at 30 DAT) + 30 Kg $K_2O$ $ha^{-1}$ (at 60 DAT)] were used as treatments. The experiment was laid out in a randomized complete block design (RCBD) with three replications. Results revealed that BRRI hybrid dhan4 produced the highest number of grains $panicle^{-1}$, 1000-grain weight (g), grain yield (t $ha^{-1}$), biological yield (t $ha^{-1}$) and harvest index (%). The results of potassium management revealed that yield and yield components of rice except panicle length and number of sterile spikelets $panicle^{-1}$ were increased with the split application of potassium and decreased with no potassium (K) application. BRRI hybrid dhan4 variety with application of potassium in three equal split practices [30 Kg $K_2O$ $ha^{-1}$ (Basal) + 30 Kg $K_2O$ $ha^{-1}$ (at 30 DAT) + 30 Kg $K_2O$ $ha^{-1}$ (at 60 DAT)] gave the highest yield (6.37 t $ha^{-1}$) than any other varieties and treatments. Therefore, it may be concluded that, the application of potassium in three equal splits may be followed to achieve higher yield in rice cultivation.

**Keywords**: Potassium, split application, potassium uptake, hybrid rice.

# Preservation of Vital Organs and Musculoskeletal Specimens of the Goat by Cryodehydration Technique: A Low-Cost Alternative to Plastination

**Group:** Biological Science **Project ID:** SRG-221049

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## Abstract

Chemical-based tissue preservation methods have some limitations for their use in teaching and learning. The plastination technique i.e.cryodehydration of tissue preservation can be an effective and low cost alternative. This study sought to determine the effectiveness of cryodehydration technique in preserving the morphologic and morphometric attributes of the anatomical specimens of goat. Heart, lungs, spleen, liver, kidney, and musculoskeletal specimens, were collected and fixed in formalin. The fixed specimens were cryodehydrated by repeated freezing-thawing sessions, followed by wood glue coating. Finally, the macroscopic (i.e., weight, color, texture, odor, and durability) and microscopic characteristics (Hematoxylin and Eosin staining) of the specimens were studied. The cryodyhydrated specimens produced excellent color and texture. These were light in weight (60-80% weight loss), soft, dry, odorless, durable, and easy to handle. The resultant musculoskeletal specimens (left forelimb) had the minimum % of weight loss. The histoarchitectures of the heart and skeletal muscle were well preserved while some distinctive alterations were observed in the parenchymatous organs, i.e., breach in cellular integrity, loss of cell cytoplasm, loss of cytoplasmic and nuclear clarity, increased sinusoidal space, dilatation of the renal tubules, and reduction in glomerular size. The heart wall thickness was markedly reduced ($p = 0.002$) in comparison to the normal heart indicating the shrinkage of the myofibers. The alveolar surface area ($p = 0.453$), were tended to reduce in the cryodehydrated lungs. The circumference of the central vein was tended to decrease in the cryodehydrated liver compared to the normal liver. The cross-sectional area of the myofibers was tended to decrease indicating the shrinkage of myofibers following cryodehydration. Nevertheless, the basic histoarchitectures of each specimen were yet distinctly identifiable. The current research suggests that the cryodehydration technique can preserve anatomical features as well as histoarchitectures and can be an effective tool for facilitating veterinary education and research.

**Keywords**: Cryodehydration, goat, cavitary organ, parenchymatous organs, musculoskeletal specimen.

# Evaluation of Non-Formalin Fixation for Preservation of Tissues in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221050

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## Abstract

The search for formalin substitute has been evolved by two fundamental developments- it is hazardous and the fact that formalin does not assure a complete RNA recovery, essential to molecular biology now. Under these circumstances, the alternative may be alcohol-based fixatives. Fast fixation, optimal preservation of specimens and a safer workplace environment, are some of the advantages of alcoholic fixation over formalin fixation. Therefore, our present study was designed to examine the efficacy of presumably less toxic alcoholic fixative (modified EthMeth) as an alternative to formalin. Our gross study showed that it was faster in penetration of tissues than formalin, fixed tissues ideally as early as 8 hours of fixation whereas improper fixation was evident for formalin at that time. In hematoxylin and eosin (H & E) staining, cellular disintegration and weak affinity for staining were evident for formalin. But alcoholic fixatives preserved tissue architectures better than formalin. Our nucleic acid (DNA and RNA) analysis revealed that total genomic DNA and RNA yield and quality of the modified EthMeth fixed tissues were significantly higher ($P < 0.05$) than formalin fixed tissues (poor preserver). These results suggest that alcoholic fixative could be a safe alternative to formalin for morphologic and molecular analysis of tissues.

**Keywords**: Fixative, modified EthMeth, formalin, tissue architectures, nucleic acid.

# Investigation of Residual Effect of Pesticide Contamination of Market and Field Vegetables on Vital Organs of Adult Male Rabbits (*Oryctolagus cuniculus*)

**Group:** Biological Science **Project ID:** SRG-221051

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## Abstract

Pesticide residue in food and food-related products is a concern to the public health, ecosystem, biodiversity, soil health, and water quality. The most well-known and often applied broad-spectrum insecticide with a favorable toxicity profile in humans is imidacloprid (IMI). By assessing serum biochemistry and examining gross and microscopic tissue changes, the current study was designed to assess the impacts of toxicity of IMI and market/field vegetable feed in the visceral organs of rabbits. A total of 24 adult male rabbits were chosen and divided into the control group (n=8), IMI-exposed group (n=8), and market vegetable feed group (n=8). IMI-contaminated green grass IMI [Imidacloprid, Bildor® 0.5 ml (100mg)/L water] was given to IMI-exposed rabbits for every alternate day up to 15 days, and market vegetables for every alternate day for 15 days. The hepatic serum AST and AST level was significantly higher ($P \leq 0.05$) in both IMI-contaminated feed and market/field vegetable feed rabbits compared to control rabbits, indicating liver lesions. In both IMI and market vegetable feed rabbits, histopathological examination of the liver revealed coagulation necrosis, congestion, and significant infiltration of inflammatory cells on the peri-portal and portal area. In the lungs, around the terminal bronchiole granulomatous inflammation was seen. Accumulations of inflammatory cells were observed in the cortico-medullary junction in the kidney. The heart showed necrosis and infiltration of mononuclear cells within the cardiac muscles. Thus, the research results will offer a considerable understanding of the toxicity of IMI and contaminated-market vegetable feed exposure in mammals.

**Keywords**: Pesticide, market vegetables, vital organs, rabbits.

# Gastrointestinal Tract Morphometrics of Indigenous and Commercial Breeds of Chicken

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## Abstract

The experiment was conducted to the comparative study of mucosa and mucosa associated of lymphoid tissue in the gastrointestinal tract of indigenous chicken with the sonali and cock. A total of 24, 6-7 weeks old male chicken were used in the study and were divided into 3 equal groups (n=8). After ethically sacrifice, different segments of the gastrointestinal tract were collected. The histomorphological study revealed that the lamina epithelium and tunica mucosa of the esophagus were thickest in the cock, followed by sonali and indigenous chicken. Tunica mucosa of the upper part of proventriculus was thickest in the sonali, followed by indigenous chicken and cock. Duodenal and jejunal villi were highest in the cock, followed by sonali and cock. The villi of the ileum were highest in the cock, followed by sonali and indigenous chicken. Lymphocytic population in upper segments of gastrointestinal tract and small intestine were highest in indigenous chicken due to their scavenging except in the upper part of the proventriculus. The lymphocyte population of Meckel's diverticulum were highest in cock, followed by sonali and indigenous chicken. The thickness of mucosa and depth of the crypts of Lieberkühn of caecum were highest in indigenous chicken, followed by sonali and cock. The lymphocyte population of caecum were highest in sonali. The highest length of lymphatic nodules of cecal tonsil were documented in indigenous chicken. The highest depth of the crypts of Lieberkühn of cecal tonsil were found in cock, followed by indigenous chicken and sonali. The lymphocyte population of cecal tonsil were highest in indigenous chicken and cock. The thickness of tunica mucosa and depth of the crypts of Lieberkühn of colo-rectum were highest in broiler, followed by sonali, indigenous chicken and cock. The lymphocyte population of colo-rectum were highest in cock, followed by sonali, and indigenous chicken.

**Keywords**: Chicken, histo-morphology, lymphocyte population, cecal tonsil, Meckel's diverticulum.

# Libido, Semen Quality and Non-Return Rate of Black Bengal Breeding Buck

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## Abstract

Bangladesh has only one goat breed, popularly known as the Black Bengal goat that occupies the second position for livestock sector. To strengthen goat husbandry in Bangladesh, it is necessary to maximize the production potential of Black Bengal bucks. The experiment was carried out at the Artificial Insemination (AI) Center of Bangladesh Agricultural University, Mymensingh, to investigate the sexual urge, semen quality, and non-return rate (NRR) of Black Bengal bucks. Over the course of three months, data from five bucks (51, 53, 54, 55, 56) ranging in age from 17 to 19 months was collected. Libido, reaction time, fixing strength, and erection status were the sexual urge factors, whereas volume per ejaculate, sperm concentration, mass motility after collection, progressive motility, sperm viability, and normal spermatozoa percentage were the semen characteristics. In terms of sexual desire, reaction time and erection status were significant ($P<0.05$), whereas volume and concentration were also significant ($P<0.05$) in the context of fresh semen quality. The results of Libido, Reaction Time, Fixing Strength, and Erection Status were ranged from 3.60±0.24 to 4.6±0.24, 11.26±2.20 s to 36.05±7.44 s, 1.67±0.34 to 2.60±0.24, 1.80±0.20 to 2.60±0.24 respectively. However, the findings of volume per ejaculate, sperm concentration, mass motility after collection, progressive motility, sperm viability, and normal spermatozoa percentage were 0.57±0.09 ml to 0.72±0.97 ml, 74.17±3.74% to 83.00±0.93%, 66.84±3.92%to 74.68±0.94%, 79.00±3.54% to, 87.68±0.78%, 88.65±1.39% to 90.63±0.73% respectively. A strong significant ($P<0.05$) negative correlation of -0.884 was found between libido and reaction times, as well as a highly significant ($P<0.01$) positive correlation (0.970) between erection status and libido was found. Bucks had an average non-return rate of 44%, ranging from 28.57% to 66.67%. Buck 56 had the highest non-return rate and showed overall better performance in sexual urge and seminal parameters. The results of this study revealed that libido along with seminal parameters and NRR are important criteria for selection or buck evaluation for reproductive performance.

**Keywords**: Black bengal goat, buck, libido, semen, fertility.

# Semen Production Profile and Seminal Characteristics of Fresh and Short Term Preserved Spermatozoa of Indigenous Aseel Chicken in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221054

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## Abstract

Assessment of semen quality characteristics of chicken gives an excellent indicator of their reproductive potential and also a major determinant of fertility and subsequent hatchability of eggs. This study aims to know the semen production profile and the seminal characteristics of indigenous Aseel chicken in Bangladesh. Semen samples from three (3) adult Aseel chicken were collected by massaging the abdomens at three days interval and various parameters like semen volume, sperm concentration, sperm motility, viability and morphology were assessed. Semen volume, sperm concentration, motility, live, and abnormal spermatozoa varied from 0.18±0.05 to 0.20±0.04 ml, 3.24±0.31 to 3.56±0.26 × $10^9$/ml, 75.39±2.33 to 79.04±2.08%, 74.44±2.59 to 79.52±1.73% and 17.07±2.23 to 20.78±3.12%, respectively. The most frequent sperm abnormalities were recorded in the head (7.63±0.94%), followed by tail (5.91±0.66%) and mid-piece (3.17±0.91%) of spermatozoa. After being diluted using Egg Yolk Citrate (EYC) diluter and preserved at 4°C, semen samples were examined on Day 0 (0 h), Day 1 (24 h), Day 2 (48 h), Day 3 (72 h), Day 4 (96 h) and Day 5 (120 h), respectively. Sperm motility, live spermatozoa, and normal spermatozoa percentage were gradually declined as preservation time progressed. Significantly ($p<0.05$) higher percentage of motility was observed on Day 0 (78.09±4.85%) compared with Day 1 (41.94±4.85%), Day 2 (28.37±4.85%), Day 3 (11.45±4.85%), Day 4 (7.38±4.85%) and Day 5 (0.65±4.85%) in EYC diluent. Moreover, the proportion of live spermatozoa in preserved semen was also significantly ($p<0.05$) higher on Day 0 (76.68±5.06%) than the other days. The overall abnormalities were found higher on Day 5 than the other days. The findings of this study could be useful for the conservation and improvement of indigenous chicken breed in Bangladesh through implementation of AI.

**Keywords**: Aseel, chicken semen, live, EYC diluter, preserved.

# Measuring On-farm Consumptive Blue Water use for Typical Milk Production in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221055

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## Abstract

Climate change has also become an emerging concern for most of the dairy producers in Bangladesh and global level in relation to water. Therefore, the objective of this study is to estimate the total consumptive water (blue ang green) in typical dairy farms in Bangladesh. The methodology used in this study is based on the methods developed by International Farm Comparison Network (IFCN) Partial Life Cycle Assessment (LCA) which is extended for water use, water category and water footprint. The study was done in the major milk shed areas of Northern part of Bangladesh. The results revealed that Bangladesh small farm (BD-2) required 98.5% of the green water while for the Bangladesh large farm (BD-14) required 97% to produce 1 kg of milk ECM (Energy Corrected Milk). The small BD-2 farming system is mainly characterized by small family farms which represent 65-70% of the farm and the BD-14 farm organizes smallholder's crossbred dairy units which practice stall feeding and employ farm laborers. The feed is the major driver, contributing more than 90% to the water footprint. The Typical ration is mainly straw based for two cow household farms although a bit more concentrate is used in the family farm. The milk production in BD-2 farm is 4.6 liter/day/cow while for the large farm (BD-14) is 6 liter/cow/day. the total on farm water contribution in BD-2 and BD-14 are 2127 liters/kg ECM and 1045 liters/kg ECM, respectively. The on-farm water per kg DM ration requires 686 liters water for BD-2 and 672 liters for BD-14. The IFCN water footprint model is a good methodology for estimation of water footprint, and individual water use (blue, green and grey water) which is applied in two successive years and could be able to demonstrate, first total water and second total green and blue water.

**Keywords**: Dairy farming, IFCN, typical farm, green water, blue water.

# Feeding Yeast Fermented Commercial Moist Feed for the Performance of Broiler

**Group:** Biological Science **Project ID:** SRG-221056

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## Abstract

**Background**: Fermentation of feed using yeast is known for the improvement of its nutritive value, but the effect of fermentation on the commercial feed for the performance of broiler still known. **Objective**: A study was conducted to investigate the impact of feeding commercial moist diet and yeast (*Saccharomyces cerevisiae*) fermented commercial moist feed on growth performance of the broiler chickens. **Methodology**: The experiment was conducted for 35 days where commercial starter feed was fermented for 48h at room temperature (26-28 Degree Celsius) with 2% yeast and 50% moisture content. About 150-day old Indian River commercial broiler chicks were allotted for the experiment where first week were offered commercial pre-starter diet for adaptation. From age 8, the chicks were divided into five dietary groups (30 chicks each) with three replications (10 chicks each). The dietary groups were 1. Commercial Dry Feed (CDF); 2. Commercial Moist Feed (CMF); 3. Yeast added Commercial Dry Feed (Y-CDF); 4. Yeast added Commercial Moist Feed (Y-CMF) and 5. Yeast Fermented Commercial Moist Feed (YF-CMF), respectively. **Findings**: After 48h fermentation the pH of feed changed from 6.10 to 4.88. Maximum live weight gain was recorded in CMF (1867g) followed by 1665, 1598, 1583 and 1542g in Y-CMF, CDF, Y-CDF, YF-CMF groups, respectively. Feed intake was significantly increased in CMF (2472g) group compare to CDF group (2162g). Cumulative feed conversion ratio of CSD, CSM, CSDY-0, CSMY-0 and CSDY-48 groups were 1.35, 1.33, 1.38, 1.36 and 1.37 respectively, but was statistically not different. **Conclusion**: Fermentation of commercial pellet feed with yeast has no significant effect on growth performance of broiler, but moist pellet feed can increase feed intake that ultimately improve body weight gain and feed efficiency.

**Keywords**: *Saccharomyces cerevisiae*, fermentation, commercial feed, broiler, performance.

# Improving Nutritional Quality of Agricultural By-Products for Sustainable Animal Protein Production

**Group:** Biological Science **Project ID:** SRG-221057

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## Abstract

Rice bran and wheat bran are very cheap and abundant agricultural by-products in rice and wheat producing countries. Additionally, many developing countries used these by products as poultry feed. RB & WB contain high fiber and poultry is not capable to digest those fibrous feed effectively, resulting in low performance. Fermentation of bran with rumen liquor leads to desirable chemical changes. The main objectives of this study were to increase their utilization in poultry and to see the effect of different drying systems on nutritional quality of these bran after fermentation. Therefore, fermentation of bran with rumen liquor (diluted) was conducted for 48h with maintaining appropriate environment. Bran, buffer and rumen liquor were mixed in a ratio of 1:1.5:1, respectively. After brans were dried in a different drying system. Unfermented and fermented bran were analyzed to measure proximate components and other nutrients. The mean values were compared using one-way analysis of variance following Turkey's multiple comparison tests ($P<0.05$). Considering rumen liquor and hour as independent variable, two-way ANOVA was performed. In case of RB, CP was mainly increased 48h fermentation with 100% diluted rumen liquor from $19.5^{a}\pm0.58\%$ from fresh RB $18.9^{b}\pm0.01\%$. In case of WB, CP was $19.5^{a}\pm0.58\%$ from fresh WB $18.9^{b}\pm0.01\%$. CF% decreased after fermentation. CF% of RB changed from $17.5^{b}\pm0.01\%$ to $15.4^{c}\pm0.62\%$. In case of WB, CF% changed from $6.68^{b}\pm0.01\%$ to $5.22^{c}\pm0.54\%$. NDF, ADF and Hemicellulose were also decreased with increasing fermentation time. Amount of EE and NFE were increased after fermentation. After that, brans were dried in three different methods (oven dry, solar dry, sun dry). Regarding the CP% of RB and WB, there was not a significant difference among drying methods. Sun drying might be a more effective method if economic feasibility is taken into consideration among other drying systems in case of nutritional composition.

**Keywords**: Rice bran, wheat bran, fermentation, nutritional improvement, drying methods.

# Effect of Replacing Soybean Meal with Organic Acid Treated Shrimp Waste Meal on Production Performance and Egg Quality of Laying Hens

**Group:** Biological Science **Project ID:** SRG-221059

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## Abstract

This project aimed to replace soybean meal (SBM) with formic acid treated shrimp waste meal (FTSM) in laying hens diet considering performance and egg quality. Shrimp waste meal (SWM) was treated with 5.0% formic acid resulting in increased CP content (17.98%) and decreased chitin content (4.8%). A total of 90 Lohman Brown, 32 weeks aged laying hens were randomly distributed in 5 dietary treatments for 5 weeks. Diets were CON: basal diet with soybean meal; and others namely, FTSM 1: basal diet with 25.0% FTSM; FTSM 2: basal diet with 50% FTSM; FTSM 3: basal diet with 75% FTSM; FTSM 4: basal diet with 100% FTSM treated by formic acid. Highest hen day egg production (HDEP) was observed in hens given control diet (91%), and lowest ($p<0.05$) in 100% TSM (86%). Similar trend was observed in the case of egg weight. FCR in birds given 25% FTSM and 50% FTSM diet was comparable with CON diet fed hens. The highest value for eggshell weight was recorded in 100% FTSM added diets (7.43 g), however, both 50% and 75% FTSM diets fed hens showed similar pattern of response in terms of eggshell weight. The effect of FTSM in diet was dramatic in case of egg yolk color. According to the Rochy yolk color fan data, the highest value was found in 100% FTSM, followed by 75%, 50% and 25% FTSM. The lowest value was recorded in CON diet given to hens. It may be concluded that replacement of soybean meal up to 25% by formic acid treated shrimp meal may not have any detrimental effect on egg production. Therefore, it may be possible to replace at least 25% of SBM with formic acid treated SM without any negative effect on overall performance of laying hens.

**Keywords**: Formic acid, production, quality, soybean meal and shrimp meal.

# Physicochemical, Nutritional, Sensory and Microbiological Properties of Live and Dead Broiler Meats

**Group:** Biological Science **Project ID:** SRG-221060

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## Abstract

The study was conducted to identify live and dead broiler meat through sensory and physicochemical attributes at 0 h and 24 h of intervals. For this purpose, 15 live broiler and 15 dead broilers was collected from the local market. After deboning, each live and dead bird's breast, thigh and liver were collected. A 2x2 factorial experiments were used for data analyses. Water holding capacity, L*, a*, SI, Chroma mean value decreased significantly ($p< 0.05$) between live and dead birds and the mean value of pH, drip loss, water holding capacity and chroma also decreased significantly ($p< 0.05$) at 0h and 24h. pH, water holding capacity, L*, a*, b*, SI and chroma mean value decreased significantly ($p< 0.05$) between two treatment levels and the mean value of water holding capacity, a*, b*, SI, chroma also decreased significantly ($p< 0.05$) at 0 h and 24 h . In case of liver, sensory attributes like color, flavor, tenderness, juiciness, overall acceptability mean value decreased (4.90 to 1.00) significantly ($p<0.05$) between two treatment levels and the mean value of color, tenderness, juiciness, overall acceptability also decreased (3.40 to 2.80) significantly ($p<0.05$) at 0h and 24h. On the other hand, the physicochemical attributes like pH, cooking loss, L*, b*, SI and chroma mean value decreased significantly ($p< 0.05$) between two treatment levels and the mean value of cooking loss, drip loss, water holding capacity, a*, SI, chroma also decreased significantly ($p<0.05$) at 0h and 24h. On the basis of the sensory and physicochemical attributes, live broiler breast, thigh and liver at fresh condition showed better quality. For differentiation color, flavor, tenderness, juiciness, water holding capacity, L*, a*, b*, SI and chroma value can be used as an identification marker between live and dead broiler meat which is ethical as well as religious issue.

**Keywords**: Live, dead, broiler, sensory, physiochemical, instrumental color.

# Low-cost Cattle Feed Production by Ensiling Rice Straw, Poultry Droppings and Alovera Leaves

**Group:** Biological Science **Project ID:** SRG-221061

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## Abstract

An experiment was conducted with Rice straw (RS) and Aloevera leaves Waste (ALW) treated with poultry droppings (PD) and ensiled with molasses to increase the nutritional and preservation quality of rice straw having some medicinal value by adding Aloevera leaves Waste. Chopped Rice straw was ensiled with 0%, 10%, 20% and 30% PD ($T_0$, $T_1$, $T_2$, and $T_3$, respectively) in addition to 1% Aloevera leaves Waste and 5% molasses to investigate physical quality, chemical composition, *in vitro* organic matter digestibility (IVOMD) and Metabolizable Energy (ME) content at 0, 30, 45 and 60 days. The physical quality (color, smell, and hardness) of Rice straw and ALW mixer were improved in PD added treatments till 60days of ensiling. The pH value was decreased ($P<0.05$) with the increasing of PD and ensiling time. The crude protein (CP) and ash was increased ($P<0.05$) and dry matter (DM), crude fiber (CF) and ether extract (EE) were decreased ($P<0.05$) in all the treatments ($T_1$, $T_2$ and $T_3$) compared to control one $T_0$. The highest CP and ash content were found to be 8.47% and 15.46% in $T_3$ and highest DM, CF and ether extract (EE) content were found to be 64.02%, 22.57% and 1.33% in $T_0$ respectively. The lowest CP and ash content were found to be 6.88% and 11.12% in $T_0$, respectively and the lowest DM, CF and EE content were found to be 51.27%, 14.95% and 1.20% in $T_3$. The CF content was decreased ($P<0.05$) with the increase of Poultry droppings and ensiling time. The organic matter digestibility (OMD) and metabolizable energy (ME) content were increased ($P<0.05$) with the PD level and ensiling time. Considering all the physical and chemical properties, among all the treatments, $T_2$ upto 60 days and $T_3$ upto 45 days were acceptable for preparing wastelage.

**Keywords**: Rice straw, poultry droppings, alovera leaves, low-cost cattle feed.

# Quality of Cattle, Buffalo and Goat Meat Keema at Different Storage Temperature

**Group:** Biological Science **Project ID:** SRG-221062

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## Abstract

The aim of the study was to compare the quality and safety of meat keema during storage at spot and refrigeration (4±1°C) temperature for a specific storage period. Six samples of Buffalo, Beef and Goat meat were collected from Kamal Ronjit-market ("K.R. Market") of Bangladesh Agricultural University, Mymensingh and processed into meat keema. The keema was prepared by standardized formulations, processed and were stored at ambient (37±1°C) and refrigeration (4±1°C) temperature and the quality was compared. In case of the hot-boned keema, the MDA (Melondialdehyde) of meat keema was significantly ($p<0.05$) higher in goat meat than others. Water activity was higher in buffalo meat than others although the values did not differ significantly ($p>0.05$). Ash content was significantly ($p<0.05$) higher in buffalo meat than others. On the other hand, moisture content, protein content and fat content did not differ significantly ($p>0.05$) within the three species. WHC (Water holding capacity) was significantly ($p<0.05$) higher in goat meat than buffalo meat. Cooking loss was significantly ($p<0.05$) higher in beef and goat meat than buffalo meat. Color (yellowness) was significantly ($p<0.05$) higher in beef than buffalo meat. Meat pH, Keema pH, Color (lightness), Color (redness) values did not differ significantly ($p>0.05$) within the three species. In case of chilled-boned keema of Buffalo, Beef and Goat meat, the MDA and water activity was higher in goat meat than others although the values did not differ significantly ($p>0.05$). Moisture, protein, fat and ash content did not differ significantly ($p>0.05$) within the three species. Cooking loss was significantly ($p<0.05$) higher in goat meat than beef and buffalo meat. It is revealed from the study that the Buffalo meat keema (hot-boned and chilled-boned) showed better in meat quality attributes compared to the others. Beef, buffalo and goat meat keema stored in ambient temperature stored resulted in significant deterioration of quality parameters compared to the refrigeration storage.

**Keywords**: Buffalo meat, meat keema, hot-boned keema, storage, WHC, quality.

# Effect of Meat Marination Using Dahi on Chicken Meat Quality and Safety

**Group:** Biological Science **Project ID:** SRG-221063

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## Abstract

**Background:** The practice of utilizing various categories of ingredients for marination has been prevalent in both home cooking and the meat industry for an extended period. Over time, a variety of ingredients have been incorporated into marinades, shifting the primary focus from preservation to tenderization and flavor enhancement. **Objective:** To assess quality and safety attributes of fresh chicken meat by using dahi as a marinade. **Methodology:** The research material consisted of breast muscles of broiler that were marinated for 24 hours with dahi (5%, 10%, or 15%) available at Bangladesh Agricultural University campus in Mymensingh. Sensory, physical, chemical characteristics and microbial change was evaluated during refrigerated Storage for 24 hrs. Chicken samples obtained from a local producer were incorporated with 5, 10 and 15% dahi. The samples were drained, vacuum packed and stored at 4°C for a period of 24 hrs. The samples were evaluated for sensorial properties (color and odor) and microbial counts Total Viable Count (TVC), Total Coliform Count (TCC) and Total Yeast Mold Count (TYMC) on 0, 3, 6, 12 and 24 hrs of storage. Treated samples having no preservatives, with 5% dahi 10% dahi and 15% dahi which were expressed as $T_0$, $T_1$, $T_2$ and $T_3$, respectively. **Findings:** The obtained results showed that addition of dahi, significantly ($p< 0.05$) improved the microbiological quality, sensory properties and reduced lipid oxidation in chicken samples compared to the control at different hrs interval. Throughout the storage period, comparatively lower values of TVC, TCC and TYMC were detected in $T_3$ batch than control, $T_1$ and $T_3$ batches. **Conclusion:** From this comparative study of natural preservatives, it was concluded that 15% dahi could be utilized effectively. The results obtained allow to conclude that dahi can be used as a natural marinade for broiler chicken meat.

**Keywords**: Dahi, marinade, chicken meat, quality, safety.

# Snail Farming Potential to Assess its Diversified use in Aqua Feed and Raw Materials in Cosmetics Industry

**Group:** Biological Science **Project ID:** SRG-221064

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## Abstract

The aquaculture industry's rapid expansion highlights the need for sustainable alternatives to fish meal in fish feed. This research aims to investigate the effects of different levels of calcium supplement (PSP) on the growth of African giant land snail. The experiment was conducted over 90 days, from November 23, 2022, to February 23, 2023, at the "BAU Aquaponics Oasis" Laboratory in the Department of Aquaculture, Bangladesh Agricultural University, Mymensingh to assess the impact of calcium levels on captive African giant land snails (AGLS) (*Archachatina marginata*). Three treatments ($T_0$, $T_1$, and $T_2$) with three replications each were tested, varying in calcium content. Snails were housed in nine 120-liter plastic tanks at 15 snails per tank and fed formulated feed with 23% protein daily, based on their body weight. Daily temperature and humidity were monitored, while biweekly assessments tracked snail growth and production. The findings indicated that the $T_2$ treatment with 16% calcium showed the highest weight gain, daily feed intake, protein efficiency ratio (PER), survival rate, and snail production. Additionally, $T_2$ exhibited the lowest feed conversion ratio. However, $T_0$, the control group without calcium supplementation, demonstrated higher moisture, crude lipid, crude fiber, and carbohydrate content in snail meats compared to $T_2$, which displayed higher crude protein and ash contents. Throughout the experiment, temperature and humidity varied across treatments. In summary, the study suggests that African giant land snails benefit from improved growth and shell formation with a 16% calcium supplementation level.

**Keywords**: Aquaculture, calcium supplementation, giant snails, growth, feed alternatives.

# Impact of Silver Nanoparticies on the Feed Utilization and Growth Performance of Pabda *Ompok Pabda*

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## Abstract

Nanoparticle hold promises to favor growth performance, feed utilization, physiological condition, and carcass quality of aquaculture species, however, evaluation of silica nanoparticle on pabda, *Ompok pabda* remains unpacked yet. Hence, with the aim of studying the effects of silica NP on nutrition and physiology of *O. pabda*, an 8-week experiment was designed to carry out in Wet Laboratory, Bangladesh Agricultural University. Magnetically activated silica NP at different levels (0, 1, 2, 3 mg/kg diet) were incorporated into 30% proteinous diet. Fishes of 2.16 (±0.20) gm were assigned randomly to triplicate tanks maintaining for each treatment in glass aquaria of 40 L capacity and fed with their respective diets at satiation level. Results demonstrated that the effects of silica NP on length gain, survival, dry matter digestibility, RBC count, hemoglobin level, condition factor and final product composition were found insignificant ($p>0.05$). However, growth parameters (weight gain, specific growth rate, daily growth coefficient) and feed efficiency (FCR, PER) increased in a dose dependent manner. The advancement in the growth performance was gained because of highest apparent protein digestibility (APD) with strong significance ($p<0.001$) took place when fishes were fed with silica NP at 2 and 3 mg/kg diet. However, in dietary groups treated with lower concentration (1 mg/kg) of silica NP showed insignificantly ($p=0.76$) higher digestibility than control. Blood glucose data and RBC increased significantly ($p<0.05$) when fish were challenged with silica NP at 3 mg/kg, suggesting that fish got stressed at concentration higher than 2 mg/kg. Bioaccumulation study of silica interprets that incorporation of silica NP in fish feed will not compromise human health safety upon consumption. Conclusively, incorporation of silica at 1 mg/kg and 3 mg/kg diet though exposed some improvement in growth, 2 mg/kg silica NP is obviously best performer in regards of all indicators.

**Keywords**: Nanoparticle, pabda, digestibility, feed, nano-technology.

# Abundance and Categorization of Microplastics Isolated from Farmed Fish and Fish Feed

**Group:** Biological Science **Project ID:** SRG-221066

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## Abstract

To determine the occurrence, existence and abundance of MPs, the present study investigated farmed catfish, *Heteropneustes fossilis,* commercial fish feed samples *viz.,* starter and grower, some protein sources of fish feed *viz.,* fish meal, soya meal collected from three different feed companies namely Nourish, Mega and Quality fish feed and, some farmed catfish flesh. Grower feeds were 3 mm and starter were 1.2 mm in size. Density separation method of 40% NaBr solution was used to extract the microplastics from 1 g fish feed and catfish flesh. Samples were digested in 30% $H_2O_2$ solution at 1:1 ratio. Vacuum filter was used for filtration and the collected samples were examined using microscopic analysis. A total of 1,227 MPs particles were recorded and 66 were found in catfish flesh ranging from 7-15 µm. In starter feed, the protein content in the feed samples of Mega, Nourish, Quality, prepared feed with fish meal and prepared feed with soya meal were 29.19±0.62%, 35.48±0.61, 36.05±1.01%, 36.79±0.64% and 40.55±0.67% respectively. In grower feed, the protein content in the feed samples of Mega, Nourish, Quality, prepared feed with fish meal and prepared feed with soya meal were 26.45±0.76%, 26.16±1.11%, 22.38±.64%, 23.29±0.54% and 25.77±0.31% respectively. A total of 1161 microplastics were identified. The starter feed with higher percentage protein contained highest number of MPs than grower feed with lower percentage protein. Film (80.45%) was the most abundant type followed by fragments (10.77%), granules (7.14%), fiber (1.64%). 50-150 µm sized MPs were the most common type. About 54 microplastics were found in fish meal ingredient but no microplastic was found in soya meal ingredient. Among them, transparent plastics was most abundant one. The results of this study clarified small glimpse of the situation of MPs contamination in fish feed and catfish flesh, and may serve as reference for future.

**Keywords**: Microplastics, aquaculture, fish feed, catfish, density separation.

# Multiscale Contextual Information Determination of Protein-Protein Interaction Using Parallel Filter Based Deep Learning Algorithm

**Group:** Biological Science **Project ID:** SRG-221067

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## Abstract

Protein-protein interactions (PPIs) are the physical contacts between two or more proteins which is determined by two binding proteins. PPIs play a fundamental role in biological information exchange, energy production, material transportation, understanding the molecular basis of disease, and designing of new drugs. PPIs can be identified using different methods which can be costly and time-consuming. In this work, we have developed a PPI identification method which is cost-effective, fast and accurate by using in-silico sequence-based methods. Two datasets are used for training and testing the models in this work. These datasets are derived from the Biological General Repository for Interaction Datasets (BioGRID). These are human (*Homo sapiens*) datasets and yeast (Saccharomyces cerevisiae) datasets. In the proposed algorithm, a pair of protein sequences are used as input. The output consists of three-dimensional vector output indicating the probability of interaction, non-interaction and single-protein. We have used the Siamese network which involves two identical subnetworks sharing the same configuration and weights, to ensure that two input sequences are represented and analyzed equally. We have also used multiple parallel convolution (multiscale convolution) module to capture various protein features in multiscale windows. We evaluated the PPI prediction performance on the BioGRID *H. sapiens* and *S. cerevisiae* dataset based on 5-fold cross-validation. In both the cases, our proposed model's accuracy was 97% to 98%. In this work, we have developed a a new method for PPI prediction using protein sequence data. This method shows better performance than several state-of-the-art methods in terms of various quality metrics. It also has reduced biasness. This research work will contribute to more advanced biological researches.

**Keywords**: Energy production, transportation, in-silico, datasets, advanced research.

# Contribution of Culm Water Soluble Carbohydrates to Grain Filling in Grain and Fodder Type Oats (*Avena sativa* L.)

**Group:** Biological Science **Project ID:** SRG-221068

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## Abstract

Oats (*Avena sativa* L.) are commonly farmed as a grain and/or fodder crop worldwide but are considered a non-traditional crop in Bangladesh. This crop's importance is rising globally due to its higher health benefit. The grain filling process, which affects grain weight, is one of the key elements in cereal grain yield. Culm reserves and current assimilation have an impact on oat grain filling. To investigate the grain filling pattern and contribution of culm water-soluble carbohydrates to grain in oats, a field experiment was carried out, and chemical analysis was done at Bangladesh Agricultural University, Mymensingh, from November 2021 to April 2022. Two oat genotypes were used in the experiment such as i) BARI Oat-1 as grain type, and ii) a genotype collected from the Central Cattle Breeding and Dairy Farm in Savar as fodder type. The experiment was laid out in a Randomized Complete Block Design with three replications. Five tillers were sampled once a week during the grain filling period to determine the changes in dry weights of different parts, viz., leaves, culm with sheath, panicles, and grains. Data on phenological traits, grain yield, and its attributes were recorded. The bulk of the traits under investigation revealed substantial differences between the two genotypes - grain and fodder types. In the trial, grain type genotype (BARI Oat-1) produced a higher grain yield (0.939 $tha^{-1}$) compared to fodder type genotype (0.8713 t $ha^{-1}$). The grain-filling duration was the same for both genotypes. The grain type genotype exhibited a higher weight of 1000 grain than fodder type genotype, and the 1000 grain weight of the two genotypes was 31.13 g and 28.83 g, respectively. Grain type oat cultivar, BARI Oat-1 contained higher water-soluble carbohydrates in culm and contributed more to grain in oats than the fodder type genotype studied.

**Keywords**: Culm reserves, grain filling, oats.

# Effect of Seed Priming on Zinc Biofortification in Mungbean Grain

**Group:** Biological Science **Project ID:** SRG-221069

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## Abstract

Among the micronutrients, zinc (Zn) is one of the most vital nutrients required for the growth and development of plants and human. Research was conducted during *Kharif-I* season of 2023 in the Field Laboratory of the Department of Crop Botany, Bangladesh Agricultural University, Mymensingh (24°25″ N latitude and 90°50″ E longitude at the elevation of 18m above the sea level) to optimize Zn seed priming treatments for improving the plant growth, grain yield and grain biofortification of four varieties mungbean (*Vigna radiata* (L.) Wilczek) viz. BARI Mug-2, BARI Mug-3, BARI Mug-4 and BINA Mug-8. Mungbean seeds were soaked in water (hydropriming), or aerated solution of containing 0.01 or 0.05M Zn. The results showed that seed priming at 0.01 M Zn solution improved the morphological development like plant height and primary branch number, yield parameters, grain yield and seed Zn concentrations of mungbean. Seed priming with water and 0.01M Zn solution increased the grain yield by 12.3 and 5.8% and grain Zn concentrations by 12.2 and 8.2%, respectively than the crop grown with non-primed seeds. Although Zn enrichment in mungbean grain was observed with 0.05M Zn as a seed priming treatment, but the performance was not proved as better than the 0.01M Zn solution. Additionally, plant growth and yield traits, grain yield were significantly reduced when the seeds were subjected to priming with 0.05M Zn. In conclusion, mungbean seeds might be primed with 0.01 M Zn solution to have better stand establishment, and yield parameters, grain yield and grain Zn concentrations of mungbean.

**Keywords**: Enrichment, human health, micronutrient deficiency, pulse, yield.

# Investigation on the Elevated Temperature and Supply of Auxin on Breaking of Cambial Dormancy and Xylem Formation in Broad-Leaved Trees

**Group:** Biological Science **Project ID:** SRG-221070

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## Abstract

The cambial activity of trees, and cambial activity is regulated by both internal factors, such as plant hormones and environmental factors such as temperature. In this study, the effects of increases in the ambient temperature on cambial reactivation and xylem differentiation in the stems of broad-leaved trees have been studied in relation with its storage substances. The timing of cambial reactivation and xylem differentiation has been observed by light microscopy. There were clear differences between winter and spring. When spring came cambial reactivation occurred followed by xylem differentiation. Reserve materials might be important for wood formation in trees. We investigated the effects of NPA (an auxin transport inhibitor) in the presence or absence of lower branches during cambial reactivation and the initiation of formation of earlywood tracheids in seedlings of *Samanea saman* in late winter. Three treatments were applied from late January to end of February, namely control, application of the auxin-transport inhibitor N-(1-naphthyl) phthalamic acid (NPA) with lower branches, NPA without lower branches (removal of lowermost branches) for investigations of cambial activity by light microscopy. Earlywood tracheids were formed after three weeks in the presence of branch. No tracheids were formed after five weeks in NPA treated seedlings after removal of lower branch. Our results suggest that an increase in the temperature of the stem is one of the most important limiting factors in cambial reactivation, which is independent of needles and buds and of the basipetal polar transport of auxin from the top to the cambium. In addition, after cambial reactivation, for continuous formation of earlywood tracheids requires a new supply of auxin and an increase in levels of auxin from buds and needles, via polar transport, might play a regulatory role in the differentiation of earlywood tracheids early in the growing seasonin *Samanea saman.*

**Keywords**: Cambial dormancy, wood formation, role of auxin, wood quality, earlywood trachieds.

# DNA Barcoding for the Identification of Justicia Taxa Used Medicinally in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221071

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## Abstract

The medicinal plants belonging to the genus Justicia play a significant role in local healthcare systems, and accurate identification is crucial for ensuring their safe and effective use. This study focuses on the application of DNA barcoding techniques to identify various taxa of the genus Justicia, widely employed in traditional medicinal practices in Bangladesh. Four selected *Justicia* taxa were collected from Bangladesh Agricultural University Botanical Garden (BAUBG). Descriptions of key morphological features, including leaves, flowers, stems, and fruits, were recorded and illustrated, providing an essential reference for future identification and taxonomic studies. DNA barcoding marker matK was employed to generate molecular fingerprints for collected Justicia taxa. DNA was extracted from collected samples using standard protocol. The obtained sequences were analyzed using bioinformatics tools to assess their discriminatory power and reliability for species identification. The results demonstrate the effectiveness of DNA barcoding in distinguishing between closely related Justicia taxa and provide valuable insights into the genetic diversity within the genus. The utilization of DNA barcoding for quality control and authentication in the medicinal plant supply chain is discussed, emphasizing its significance in ensuring the safety and efficacy of herbal remedies derived from Justicia species.

**Keywords**: DNA Barcoding, Justicia taxa, medicinal plants, taxonomic studies, BAUBG.

# Standardization of Probiotic Ice Cream Making Technology Using Selected Lactic Starter

**Group:** Biological Science **Project ID:** SRG-221072

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## Abstract

The cost for cream contributes largely to the price of ice cream. On the other hand, Dodhi or yogurt is a very popular fermented milk product that has consistency similar to cream. Moreover, Dodhi has its characteristic flavor and appearance, which may improve the acceptability of ice cream. The objective of this project was to develop a novel ice cream based on Dodhi blend that has a probiotic benefit for consumers. All the ingredients – cream, milk powder, skim milk, sugar, Dodhi, stabilizer, emulsifier, color and flavor were mixed under a standard recipe. The mix was then be pasteurized at 80°C for 20 seconds. The pasteurized mix was cooled to 4°C before set in an ice cream freezer. The mix was then whipped in the freezer for 20 minutes at –7°C. A variety of blends were prepared to try and test the effects of Dodhi on physic-chemical properties of ice cream. The most suitable blend was standardized and proposed for the industry. All the samples were subjected to organoleptic, physical, chemical and microbiological examination. It was observed that ice cream can successfully be made exclusively from Dodhi / yoghurt if added by 20% level. The cost of making ice cream was reduced by 40%. The shelf life was satisfactory, at least 4 months at -18°C.

**Keywords**: Cream, dodhi, substitute, quality, shelf-life.

# Influence of Dietary Manipulation on the Nutritional Status and Growth Performance of Crossbred Dairy Heifer

**Group:** Biological Science **Project ID:** SRG-221073

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## Abstract

Twelve post-weaned Holstein Friesian crossbred dairy heifer calves of similar age & body weight were selected for an on farm 100-day long experiment in a completely randomized design to characterize the impact of different levels and sources of protein on nutritional status, growth performance, feed efficiency and cost of production. Selected calves were equally divided into three groups and received ration with soybean (SM) and mustard oil cake (MoC) as only protein ingredient containing 16 % CP and ME: 9.8MJ/kg DM and the third diet (control) was the BAU dairy farm formulation containing 14 % CP and ME: 9.6 MJ/kg DM, respectively. The results revealed that nutritional status (Serum glucose, triglycerides, albumin, globulin e-creatinine, urea, phosphorus and calcium) were differed non-significantly ($p>0.05$) among the experimental animal except serum total protein which was 0.8-1.0g/dL higher in experimental groups than that of the control group ($p=0.021$). Result also indicated that final body weight was 6-9% higher ($P=0.018$) in experimental groups compared to control group though the body condition score was found similar. Although statistically similar, but calves that received SM and MoC diet performed better in terms of body measurements gains; wither height (11-13 cm), body length (18-26 cm) and heart girth (8-18cm), respectively. On the other hand, dry matter intake per kg body weight gain was 8-12 Kg (around 1.5 to 2 times higher) higher in control group than that of the experimental groups. Moreover, feed cost per Kg body weight gain was lowest in SM (290 BDT/Kg BWG) fed group followed by MoC (324 BDT/Kg BWG) group and highest in control (458 BDT/Kg BWG) group, respectively ($p=0.033$). In conclusion, High protein ration fed animal perform better than that of the low protein fed animals in terms of nutritional status, growth and farm economics. But within the high protein groups soybean meal fed group perform better.

**Keywords**: Heifer calves, growth rate, blood metabolites, protein sources, feed efficiency.

# Preparation and Quality Evaluation of Mozzarella Cheese from Crossbred Holstein Friesian Cow and Non-descriptive Buffalo Milk

**Group:** Biological Science **Project ID:** SRG-221074

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## Abstract

The aim of the present study was to assess the influence of different species milk on the quality of mozzarella cheese. For this, cow milk (CM) and buffalo milk (BM) were collected from Bangladesh Agricultural University (BAU) Dairy Farm. The cheese preparation and quality assessment were conducted in the Laboratory of Dairy Chemistry and Technology, Department of Dairy Science, BAU, Mymensingh-2202. This study demonstrated that milk composition markedly influenced the compositional, textural, color, functional properties and sensory attributes of BM and CM cheese. Significant differences were observed in the composition of low moisture BM and CM mozzarella cheese. BM cheese had a higher fat and protein content. Similarly, cheese yield was significantly higher in BM cheese. CM cheese showed higher functional scores than BM cheese. Hence, it is more suitable for pizza topping. Cheese made from BM milk had significantly higher hardness, gumminess and chewiness. L* was higher in BM cheese as compared to CM cheese. In some markets where consumers are more habituated to consuming mozzarella cheese, it is white in color. BM cheese had more greenish color than CM cheese. BM and CM cheese did not show significant variation in consumers liking test. The effect of milk composition on the chemical composition, texture profile, color, functional properties, and descriptive sensory analyses of low moisture mozzarella cheese made from various bovine species requires further study with large sample size and including dairy production and cheese manufacturing factors.

**Keywords**: Color profile, texture profile, sensorial, Mozzarella cheese, genotype.

# Isolation Enterobacter Sakazakii in Powdered Infant Formula Milk

**Group:** Biological Science **Project ID:** SRG-221075

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## Abstract

The study was conducted to investigate the prevalence of *Enterobacter sakazakii (or Cronobacter* spp.) in infant milk formula and milk powder available at market of Bangladesh. A total of 16 different commercial milk powder samples from different manufacturers were purchased from retail stores across Mymensingh. The samples composed of 3 infant food formula (recommended for above 6 months old infants), 3 infant milk formula (Recommended for from birth to 1-year-old infants), 5 full cream milk powder, locally available non- branded whole milk powder. An aliquot (10 ml) of homogenate sample (10g of powder/90 ml sterile Peptone water) was added to 90 ml Enrichment Broth (EE broth) and incubated for 14–16 h at 36°C. VRBGA plates was inoculated (0.1ml) by streak method form the EE broth culture and incubated for 14–16 h at 36°C. The red or purple colonies surrounded by purple halo was examined morphologically for the sample of different branded powder milk and infant formula. Among the samples of infant formula, milk powder, no one was positive. *E. sakazakii* was not isolated from any samples of milk powder. This study was conducted to assess the general hygienic quality of the sample powder milk and the extent of microbes was observed. In the study, the total viable count of Infant milk formula (above 6 months old infants), Infant milk formula (birth to 1-year-old infants), Full cream milk powder (different brand) and Full cream milk powder (locally available non-branded) were 3.765±0.157, 3.633±0.347, 3.785±0.013, 3.897±0.010, respectively. The total viable count of branded Full cream milk powder and non-branded Full cream milk powder was significantly higher than the rest two. In case of coliform count of those were found as 0.355±0.536, 0.456±0.557, 2.505±0.875, 18.556±2.455, respectively. Full cream milk powder (Locally available non-branded) was significantly high than the other that indicates poor hygienic quality. Therefore, there is no prevalence of *E. sakazakii* in infant milk formula and milk powder but locally available non-branded products contain greater existence of coliform bacteria under the study.

**Keywords:** Powdered, milk, bacteris, coliform, formula.

# Assessment of Impacts of Some New Generation Insecticides on the Abundance and Biodiversity of Beneficial Arthropods in Brinjal Ecosystem

**Group:** Biological Science **Project ID:** SRG-221076

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## Abstract

Biodiversity is the variability among living species in a community or ecosystem. Insect biodiversity in an ecosystem may vary due to the influence of different factors but uses of broad-spectrum synthetic pesticides are the most important one. In the present study, impacts of some new generation insecticides *viz*. Suspend 5 SG (Emamectin Benzoate), Belt Expert 24 WG (Flubendiamide), Ravjum 14.5 SC (Indoxacarb), Plenum 50 WG (Pymetrozine), Prabal 10 EC (Alpha-Cypermethrin), Actara 25 WG (Thiamethoxam) were evaluated on the abundances and biodiversity of beneficial insects in brinjal ecosystem from July, 2022 to June, 2023 at the field laboratory of the Department of Entomology, Bangladesh Agricultural University (BAU), Mymensingh. The experiment was laid out in a Randomized Complete Block Design (RCBD) having three replications with three captured methods *viz.* sweeping net, pitfall trap and yellow sticky trap. Data were collected at 10 days interval and then sorted, counted and identified. In the present study, a total of 5790 insects were collected belongs to 27 species under 25 families and 10 orders. Considering the family, Hymenoptera was the most dominant order where 9 families were found that was followed by Diptera (5), Coleoptera (4), Hemiptera (2), Arenae (2) and others. Other orders namely Lepidoptera, Odonata, Dictyoptera, Dermaptera and Neuroptera those had only one family each. Based on the abundance, biodiversity and equitability index, suspend 5 SG (a bacterial fermented pesticide) was found most safe insecticide in brinjal ecosystem among the tested six insecticides. Belt Expert 24 WG (Flubendiamide) and Ravjum 14.5 SC (Indoxacarb) were the most toxic and non-compatible insecticides to beneficial insects. Other three i.e. Plenum 50 WG (Pymetrozine), Prabal 10 EC (Alpha-Cypermethrin) and Actara 2.5 WG (Thiamethoxam) were found moderately safe and compatible to beneficial insects.

**Keywords:** Biodiversity, brinjal, ecosystem, insecticides, impacts.

# Management of Cucurbit Fruit Fly, Bactrocera Cucurbitae (Coquillett) Using Eco-Friendly Approaches

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## Abstract

Cucurbit fruit fly, *Bactrocera cucurbitae* (Coquillett) is a devastating pest of different cucurbit vegetables and may cause more than 60% yield loss. To explore effective management strategy for this pest selected eco-friendly approaches were tested in the field of Bangladesh Agricultural University during July 2022 to June 2023. Eight treatments viz. $T_1$= yellow sticky trap $T_2$= white sticky trap, $T_3$= blue sticky trap, $T_4$= mashed sweet gourd trap, $T_5$= pheromone trap, $T_6$= spinosad, $T_7$=abamectin and $T_8$= control was evaluated against this pest on bitter gourd based on no. & weight of healthy & infested fruit plant$^{-1}$ & plot$^{-1}$, respectively and yield of marketable fruits ha$^{-1}$. The effect of all the treatments always varied significantly (P□0.05) than the untreated control. The highest number of healthy fruits per plant was found from the plants treated with spinosad and pheromone trap followed by white sticky trap treated plants. But the lowest mean number of healthy fruits per plant was recorded from the untreated plants. The highest mean number of infested fruits per plant was observed on the untreated plants and the lowest mean number of infested fruits was found from spinosad treated plants followed by MSG treated plants. Among the three colored sticky traps, white colored trap provided the best performance in case of all parameters studied but other two colored traps were in statistically similar for protection of fruit. It was revealed that the highest mean yield per hectare was found from the spinosad treated plants and the lowest yield was obtained from the untreated control plants. The second highest yield was recorded from the plants treated with pheromone trap followed by white sticky trap treated plants. Therefore, spinosad and the colored sticky traps might be used as eco-friendly and effective component for developing sustainable IPM packages to manage cucurbit fruit fly.

**Keywords**: Bitter gourd, colored trap, IPM, sustainable, strategy.

# Evaluation of Allelopathic Potential of *Coccinia grandis* Leaf Extracts Against Stored Grain Pests

**Group:** Biological Science **Project ID:** SRG-221078

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## Abstract

Post-harvest food commodities are seriously threatened by insect pests which causes a quarter to a third of the annual grain crop in the world is thought to be lost. Chemical pesticides have been widely employed in grain storage facilities to combat pest insects, which causes serious risks to the environment and to consumers. For that, there is a pressing need to create secure substitutes that are ecologically benign. This experiment was conducted to evaluate the allelopathic effect of telakucha (*Coccinia grandis)* leaf extract as an effective, safe and eco-friendly alternatives to protect stored grain products. The study followed a completely random design, with three replications for each treatment. The leaf extract at 100% methanol, 70% aqueous methanol and 50% aqueous methanol are used as treatment. Among the treatments, 100% and 70% extract are more effective. Three doses of each treatment are used (10%, 7.5% and 5% of grain weight). Rice weevil mortality at the dose-3 of treatment-1, was lower than the other two pests. At treatment-2, the mortality rate of pulse beetle in dose-1 and dose-2 was lower than the other two insects and the mortality rate of red flower beetle in dose-3 was found to be lower than the rest. In treatment-3, the mortality rate of rice weevil at dose-1, dose-2 and dose-3 were higher than that of red flower beetle and pulse beetle. This treatment had the best results on rice weevil and least on red flower beetle. The 10% dose showed highest allelopathic effect on each pest, whereas 5% dose showed the lowest allelopathic effect. The effectiveness of the leaf extract was found to increase proportional with the increase of doses. Therefore, telakucha (*Coccinia grandis*) leaf extract might be used for the effective and eco-friendly management of these three pests.

**Keywords**: Plant extract, Coccinia grandis, allelopathic effect, stored grain pests, ecofriendly.

# Compatibility of Detergent to Increase the Efficacy of Pesticides Against Giant Mealybug, *Drosicha Dangiferae* (Homoptera: Pseudococcidae)

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## Abstract:

The giant mealybug *Drosicha mangiferae* (Homoptera: Pseudococcidae), a polyphagous sucking insect, attack a range of economically important crops, including mango, jackfruit, citrus, papaya, brinjal, guava, tamarind, and rain-trees in Bangladesh. This study aims to enhance the control by investigating the compatibility of detergents with pesticides. The research explores the sequential and simultaneous use of detergent and pesticides to optimize pest management. Detergents were applied to facilitate the effect of subsequent biopesticides and chemical pesticides. Mortality rates were monitored every 8 hours, with four replications for each treatment. The results showed variable effectiveness when biopesticides and chemical pesticides were applied alone or with detergents. When applied individually, both biopesticides had limited efficacy, resulting in mortality rates below 15%. However, applying Biotrin after detergent notably improved efficacy, achieving a 75% mortality rate after 20 hours and over 90% with further applications. In contrast, Bioclean's effectiveness decreased when applied after detergent. The study also revealed differences in the effectiveness of chemical pesticides when applied with or without detergent, influencing pest survivability. Some pesticides exhibited limited efficacy when applied individually, while others, like Marshal, Solomon, and Ustad, showed higher effectiveness. The application of these chemical pesticides following detergent significantly improved their performance. The study provides $LT_{50}$ values (90% Confidence Level) for various biopesticides and chemical pesticides, offering insights into their effectiveness and efficiency. The addition of detergent sometimes enhanced or reduced their effectiveness, depending on the specific pesticide. The study suggests that applying Biotrin after detergent enhances control efficacy and that integrating certain chemical pesticides with detergents can improve pest management. In conclusion, this research underscores the importance of using detergents in combination with biopesticides and chemical pesticides to effectively control giant mealybugs. Overall, this research presents promising approaches to enhance pest management in agriculture.

**Keywords:** Invasive species, compatibility, detergent, bio-agents, integrated pest management.

# Prediction of SPAD Values for Paddy Leaves Using Direct Contact Imaging Method

**Group:** Biological Science **Project ID:** SRG-221080

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## Abstract

The Soil Plant Analysis Development (SPAD) value obtained from the SPAD meter directly relates to leaf chlorophyll content. The chlorophyll content is related to nitrogen content means the amount of fertilizer in a crop. Therefore, determining SPAD value is directly involved with crop health. Minolta *SPAD* meter can directly measure this value, a well-established method in the research field for measuring chlorophyll content. Still, this instrument is too costly, which is beyond a farmers' reach in the perspective of Bangladesh. The purpose of this study is to predict the SPAD value for paddy leaves using the direct contact imaging method to estimate the chlorophyll content of a paddy leaf. Numerous features were extracted from each image to predict the SPAD values. The features were then used as parameters in the multiple linear regression model. The models' performance was evaluated using images captured from a paddy field using a Minolta SPAD-502 Chlorophyll Meter. The multiple linear regression model's $R^2$ and root mean square error (RMSE) values were 0.71 and 3.6512, respectively. Therefore, this result confirms that the direct digital contact imaging method has the potential to quantify the *SPAD* value of paddy leaves accurately. In the future, an Android app will be developed using this value which can directly measure the chlorophyll content of paddy leaves.

**Keywords**: Image processing; SPAD; paddy leaf; multiple linear regression.

# Design of IoT based Automated Monitoring System for Fish Farming

**Group:** Biological Science **Project ID:** SRG-221081

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## Abstract

Bangladesh is a riverine country, and fish aquaculture has a significant economic impact on this country. It is an excellent source of inexpensive, protein-rich, and other health-beneficial nutrients. The conventional method of fish pond monitoring required regular site visits, documentation of multiple measurements, and parameter control. It takes time to acquire and analyze data and often leads to misinterpretation. Developing a new automated technique is necessary to overcome these limitations and make this task more user-friendly. Internet of Things (IoT)-based water quality monitoring system can solve all issues. The main aim of this study was to design and construct an IoT-based circuit for monitoring different parameters of pond water in the fish farm. Various types of sensors, including pH-4502C, DS18B20 temperature, gravity analog turbidity, TDS, and gravity analog DO sensors, were used in this study. A microcontroller (ESP32) was used to create a monitoring system for the pond water's pH, temperature, turbidity, total dissolved solids, and dissolved oxygen levels. The developed system automatically monitors those water parameters and displays all data in the Blynk app. An Android mobile phone was used to manage and monitor live data generated by different sensors. The developed system was deployed in the pond water to verify and validate its performance. The test results showed that the proposed automated Pond Monitoring System works successfully to monitor the water quality of a fish pond. The developed device is inexpensive and straightforward, so the fish farm owner can use it affordably to increase productivity and efficiency.

**Keywords**: Internet of things, sensor, fish pond, water parameter, microcontroller.

# Development of an IOT-Based System for Monitoring Environmental Conditions in a Poultry House

**Group:** Biological Science **Project ID:** SRG-221082

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## Abstract

Poultry is one of the most important sub-sectors of agriculture, playing an important role in providing essential dietary protein through egg and meat production. Among different environmental factors, poultry in-house temperature, relative humidity, and air quality (ammonia concentration) significantly impacts poultry growth and bird's performance. Therefore, it is crucial to maintain optimum level of temperature, relative humidity and ammonia concentration in poultry houses which is expensive and labor intensive when follows the conventional management practice. This research aimed to develop an IoT-based poultry in-house environment monitoring and controlling system to ensure precision poultry management practice and achieve sustainable production for rural poultry producers. During this study, different sensors such as DHT11, MQ135, and flame sensor were used to develop a monitoring and controlling system for temperature, relative humidity, and air quality of poultry houses along with a smart relay and GSM module. From the field test, it was observed that the developed system works perfectly and provides real-time information about the temperature, relative humidity, and air quality i.e., gas concentration of poultry houses. The developed system takes control measure automatically by switching on/off the light and ventilating fan if the level of temperature, relative humidity, and air quality exceed the threshold limits. In addition, since a GSM module was incorporated in the system, poultry farmers capable to get real-time information about poultry house environmental parameters via a SMS request remotely. Therefore, commercial application of this system would help the rural poultry farmer to maintain favorable growing environment for birds and minimize the labor cost, thereby increase overall profit. In addition, a precision control on environmental parameters and gas concentration ability of the developed system would provide health benefits for both the poultry birds as well as the workers in the farms.

**Keywords**: Poultry house; temperature; relative humidity; gas concentration; monitoring.

# Development of a Self-Aerated Compost Preparation Technique at Farmers' Level

**Group:** Biological Science **Project ID:** SRG-221083

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## Abstract

This study elucidates an attempt to develop a self-aerated compost preparation using the poultry litters at farmers' level. Survey-based data were collected through pre-tested questionnaires from some purposively selected 42 poultry farms erected within the areas of Mymensingh, Gazipur, Netrokona, and Jamalpur districts. A large amount of poultry litters was generated from broiler and layer farms daily. Most of the farmers dumped this litters in open places (50%) which caused a serious environmental and health hazard. A self-aerated composting technique was designed and developed to effectively manage and mitigate the environmental and health hazards causing from poultry litters. A compost heap was prepared with rice straw, water hyacinth, and poultry litters with the proportion 1:2:4 respectively by weight at the optimum C:N ratio of 30:1 incorporating the provision for air entraining into the bulk compost heap. Temperature and moisture contents at time interval of three days, and pH, C/N ratio, volume, and microbial properties at time interval of seven days were observed throughout the composting period of up to 60 days. Analysis was accomplished taking representative samples from the bulk compost heap using the random sampling technique. The quality of compost in terms of nitrogen, phosphorus, potassium, and organic carbon was evaluated in accordance with the Indian and Australian Standards. This technique is found environmentally safe, functional and cost-effective. The developed self-aerated composting technique would be an alternative option for safe management of poultry litters for the farmers in the rural areas.

**Keywords**: Poultry litter, water hyacinth, rice straw, composting technique.

# To Propose A Multipurpose Pump House for Coastal Areas of Bangladesh

**Group:** Biological Science **Project ID:** SRG-221084

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## Abstract

A pump house with all facilities help to meet basic human needs is a crying need for our farmers and operators to lead a healthy life, cope with weather and climatic change, mitigate loss during natural calamities and serve the nation and the family with an expected period. Aim of this study was to identify the challenges and expectations of traditional pump house stakeholders' and to propose a multipurpose pump house for Coastal areas of Bangladesh with computer aided design layout. The research work has been done by interviewing the stakeholders. In Coastal area, the irrigation process is maintained by the local farmers by the help of Bangladesh Agricultural Development Corporation (BADC) in some cases and every pump belongs to a pump house. To lift up surface water from rivers and natural canals it requires pumping elements. There are mainly two types of pump house such as pump house for diesel operated engine and pump house for electric motor operated pump machine. There was no sanitation facility with pump house. So, the farmers can not avail the opportunity to use toilet. There is no shelter house during thunderstorm. So, the fatality rate increases day by day. A pump house has been proposed providing with a toilet and operator's room. Primarily, it has appeared that the initial expenditure of a modern pump house is very high. Nevertheless, it supports bringing a momentous change in the sustainable development of farmers and pump operators working environment in the Coastal areas of Bangladesh.

**Keywords**: Challenges, expectations, stakeholder, traditional, layout.

# Reproductive and Breeding Performances of Indigenous Climbing Perch (*Anabas testudineus*) Broodstock with Vitamin E Premixed Supplemented Diet

**Group:** Biological Science **Project ID:** SRG-221085

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## Abstract

**Background:** Reproduction and breeding performances of *Anabas testudineus* using vitamin-E supplemented diet is very crucial for quality seed production and its growth improvement for commercial aquaculture. **Objectives:** The objectives were to determine the gonad maturity and breeding performance of *A. testudineus* using gonadosomatic index and gene expression analysis, and pituitary gland extract, respectively. **Methodology :** Adult *A. testudineus* were acquired from Shamgonj Beel, Netrokona district and back to Wet Laboratory, BAU, Mymensingh-2202. The fish were stocked and reared intensively in six cages considered as six different treatments ($T_0$-$T_5$) until gonadal maturation in the ponds. Subsequently, gonadosomatic index (GSI), gene expression and breeding performance was undertaken. **Findings:** The one-way ANOVA revealed that $T_2$ (100mg/kg vitamin E) was performed significantly better broodfish growth than other treatments (p value 0.001 which was $p<0.05$). In the $T_2$, the mean value of length was the highest comparing with other treatments. For weight, one-way ANOVA revealed that $T_2$ (100mg/kg vitamin E) also performed significantly better than other treatments ($p<0.05$). In the $T_2$, the mean value of weight was the highest comparing with other treatments. For GSI, one-way ANOVA among the treatments revealed that $T_2$ (100mg/kg vitamin E) performed significantly better than other treatments (p value 0.017 which was $p<0.05$). In $T_2$, the mean value of GSI was the highest comparing with other treatments. Further, GSI of A. testudineus was validated through pperforming the various trial of histology in gonad sample for maturity detection. Likely, a set of real time PCR primer has been developed for qPCR experiment which used for gene expression analysis and found $T_2$ (100mg/kg vitamin E) was the best for quality seed production via highest expression level of mRNA. **Conclusion:** Therefore, present research might be helpful for quality seed production by the hatchery operator, researcher and its conservation.

**Keywords**: Vitamin E, GSI, gene expression analysis, breeding performance, A testudineus.

# Culture of the Green Alga, *Desmodesmus* sp. and its Use in Rearing Zooplankton and Fish Larvae

**Group:** Biological Science **Project ID:** SRG-221086

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## Abstract

Microalgae have an important role in aquaculture being used as live food for the larvae of different fish and crustacean species, as well as zooplankton and bivalves. *Desmodesmus* sp. a unicellular microalga, has remarkable prospects to exert benefits to aquaculture species by increasing their growth and survivability. The present research composed of three parts. In the first part, *Desmodesmus* sp. was cultured at different light intensities to know the optimum light intensity for best growth of this species. The highest growth rate, chlorophyll-*a* content and the optical density were found at 120 $\mu Em^{-2}sec^{-1}$. In the 2nd part, two experiments of zooplankton culture were carried out. In the first experiment of zooplankton, freshwater *Diaptomus* and *Cyclops* were cultured at three different densities ($T_1$: $1 \times 10^3$ ind./L, $T_2$: $3 \times 10^3$ ind./L, and $T_3$: $6 \times 10^3$ ind./L) and fed a constant concentration of *Desmodesmus* sp. ($1 \times 10^5$ cells/ml) for 10 days. The highest population density was obtained in $T_3$ ($28.33 \pm 1.69 \times 10^3$ ind./L) on the 5th day of culture. In the second experiment, the zooplanktons were fed live cells of cultured *Desmodesmus* sp. at different concentrations ($T_1$: $1 \times 10^5$ cells/ml, $T_2$: $2 \times 10^5$ cells/ml, $T_3$: $3 \times 10^5$ cells/ml). The highest population density was found in $T_3$. Finally, the rearing of major carp *Labeo rohita* larvae was conducted with six treatments using both *Desmodesmus* sp. and zooplankton as their feed: $T_1$ (live *Desmodesmus*); $T_2$ (live zooplankton); $T_3$ (powdered *Desmodesmus*); $T_4$ (powdered zooplankton), $T_5$ (live *Desmodesmus* + live zooplankton); and $T_6$ (powdered *Desmodesmus* + powdered zooplankton). The *L. rohita* larvae fed with powdered zooplankton ($T_4$) outperformed all other treatments, with significantly higher larval length, weight, and specific growth rate, as well as survivability. The findings of the study explain the potentiality of the microalga *Desmodesmus* in the rearing of zooplankton and larvae of the major carp *Labeo rohita*.

**Keywords**: Aquaculture, microalgae, first feeding, major carps.

# Population Dynamics and Stock Assessment of Orangefin Ponyfish *Photopectoralis bindus* in the Bay of Bengal

**Group:** Biological Science **Project ID:** SRG-221087

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## Abstract

The research project assessed population parameters and maximum sustainable yield of Orangefin ponyfish, *Photopectoralis bindus* (Valenciennes, 1835) in the Bay of Bengal. Two hundred eighty specimens collected from the artisanal fisheries based at Gangamotir char, Kolapara upazilla, Patuakhai district in Bangladesh. Standard length (SL) ranged from 20 to 60 mm, and body weight (BW) from 0.2 to 7.64 g. Six age groups were detected on length frequency histogram by Bhattacharya method. The growth equations provided by three models were $SL_t = 87.13\ [1- \exp\ \{-0.153\ (t + 1.225)\}]$ for von Bertalanffy model; $SL_t = 72.03 \exp\ [-\exp\ \{-0.316\ (t - 1.137)\}]$ for Gompertz model; and $SL_t = 66.39 / [1 + \exp\ \{-0.479\ (t - 1.971)\}]$ for Robertson model respectively, where $SL_t$in mm at age t in years. Growth was best described by von Bertalanffy growth equation for the species based on $\chi^2$ values as goodness of fit index among three models. The growth performance was 3.06, and approximate longevity was 19.63 years. The SL-BW relationship was $BW=0.0003SL^{2.44}$. The von Bertalanffy growth curve fitted with weight-at-age data was $BW_t=14.2[1-\exp\{-0.183(t+1.601)\}]^3$. Since mean SL of smallest age group was considered as SL at recruitment, therefore, *P. bindus* recruited to the adult stock when they were at 24.89 mm SL and 0.98 years age. Length based catch curve and Pauly's (1980) equation calculated natural and fishing mortalities as 0.235 and 0.701 $year^{-1}$ respectively, while exploitation rate was 0.75 during the year under study. Maximum yield per recruit was 0.91 g at fishing mortality of 0.3 $year^{-1}$. Orangefin ponyfish attained 1.9 kg relatively at age of 4.9 years if 1000 individuals recruited to parent stock in the Bay of Bengal. Finally, the study suggested a format of management guide to be prepared incorporating the present findings of the research project.

**Keywords**: Age and growth, recruitment, MSY, yield per recruit, biomass model.

# Screening and Molecular Detection of Potential Probiotic Bacteria from Gastrointestinal Tract of Fresh Water Fish

**Group:** Biological Science **Project ID:** SRG-221088

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## Abstract

Probiotics (live bacteria) improve organism's health and gastrointestinal function; enhance systemic immunity, digestibility and ultimately growth/ production. A number of commercially available imported probiotics (*Lactobacillus*) has been using commonly without considering their efficiencies and effectiveness on the native fish species. Thus, it is important to isolate and identify potential probiotics from the native freshwater fishes those can be used in their culture system. Considering the above fact, the study was conducted to screen, isolate and identifies potential probiotic bacteria (*Lactobacillus*) from the native freshwater catfishes such as- Shing (*Heteropneustes fossilis*), Magur (*Clarias batrachus*) and Pabda (*Ompok pabda*). The isolates were obtained through conventional culture-based methods and identified through biochemical (pH and bile tolerance test) and molecular techniques. Samples were collected from three different areas such as- Kuliarchar Upazila (Kishoreganj), Jaria (Purbodhala, Netrokona) and Mohanganj Upazila (Netrokona) and analyzed in the Fisheries Microbiology Laboratory, Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh. A total of 60, 53, and 48 bacterial isolates were obtained from the intestinal microflora of *Heteropneustes fossilis*, *Clarias batrachus*, *Ompok pabda,* respectively and morphologically characterized. Colony morphology, pigments and surface areas were considered to select isolates and avoid similar isolates. Ten isolates from each fish species were selected for molecular identification and biochemical test based on their characteristics. Among the selected isolates, some of them were found potential and molecularly identified as potential probiotic bacteria. In future, the potential probiotics will be tested for their performances/ efficiencies in the aquaria and pond culture systems. In conclusion, it can be said that isolation and identification of potential probiotics from the native fishes will be the alternatives of the commercially available groups. These probiotics will provide better results in terms of their efficiencies, increase fish growth and control fish disease, which will ultimately enhance country's fish production.

**Keywords**: Probiotics, gut bacteria, freshwater fishes, isolation, molecular detection.

# Studies on the Likeliness and Different Quality Parameters of 'Tako Soup Powder' and 'Tako Ball' Developed from Octopus

**Group:** Biological Science **Project ID:** SRG-221089

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## Abstract

The purposes of the current study were to collect local species of octopus available at Bay of Bengal for proximate analysis at raw condition, to prepare 'Tako Soup Powder' and 'Tako Ball' from collected octopus at laboratory for evaluating their sensory quality, nutritive values and to preserve them at various storage conditions for observing the shelf life of the products. Fresh octopus were carried in clean, insulated containers to the Fisheries Technology Laboratory at Bangladesh Agricultural University. Octopus samples were cleaned properly then packed separately in polyethelene zipper packets and stored at -20°C for preparation of the products and different analysis. For standardizing the preparation procedure of the products several trials were made using different combination of ingredients and spices by an expert panel. The most preferred combination of 'Tako Soup Powder' was a mixture of 2.5% octopus powder and 97.5% soup premix. On 0 day of storage, in 'Tako Soup Powder' the percent moisture content was found 6.32, protein 71.43, lipid 3.36 and ash 3.05 at room temperature, after 60 days of storage which values changed to 10.9, 56.55, 2.47 and 2.44, respectively. On the other hand, during refrigeration (4 to 8°C) storage, the percent moisture, protein, lipid and ash content changed from the initial values to 8.05, 66.05, 3.03 and 2.80 respectively in 60 days. In the case of 'Tako Ball' the percent moisture content was found 49.63, protein 29.31, lipid 5.33 and ash 4.31 of marinated octopus on 0 day at room temperature (25 to 30°C), after 4 days of storage which values reached to 68.31, 3.67, 23.05 and 4.8, respectively. On the other hand, while 'Tako Ball' sample was stored at refrigeration temperature, the percent moisture, protein, lipid and ash content changed from the initial values to 66.2, 21.31, 4.3 and 3.73 respectively in 7 days.

**Keywords**: Octopus product, storage, proximate composition, likeliness, shelf-life.

# Quality Improvement of Traditional Dried Products Developed from Shol (*Channa striata*) and Gojar (*Channa marulius*)

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## Abstract

To evaluate the performance and quality of the traditionally made sun-dried fish, the present study was designed and conducted by producing experimentally sun-dried fish in an improved way for a comparative study. A survey was carried out along with several interview sessions at Kuliarchar Shutki Palli, Kishoreganj to acquaint with the general information relevant to dried fish production, drying activities, and marketing system to assess the present situation of the dried products, particularly in that area. Most of the dry fish processors were found unaware of the quality and safety of dried fish and have a negligible idea about packaging and storage facilities. In order to conduct the study two freshwater fish named shol (*C. striata*) and gojar (*C. marulius*) were selected for the experiment due to their higher nutritional value, popularity, and production as dried fish in the study area. The experiment was conducted for three months (90 days) under different packaging conditions to observe biochemical and microbial changes. The moisture content of raw shol and gojar was reduced in the improved dried condition, which was lower than the traditionally dried sample. The protein, lipid, and ash content were increased in improved dried fish from the raw conditions and comparatively higher than the traditional ones. The TVB-N content raised gradually with time, though it did not cross the acceptable limit except for the traditional samples in the non-sealed pack. The microbial load (APC) of dried fish decreased due to the drying process compared to the initial microbial load of fresh fish. However, the APC increased gradually during storage but was considered an acceptable quality. Results of the study indicated that if drying is appropriately done and dried products are kept in vacuum-sealed packets, they can be stored at room temperature for about 3 months without any significant deterioration in the quality.

**Keywords**: Improved quality, traditionally dried, packaging, storage facilities, chemical composition.

# Smart Breeding for Accelerating Genetic Gain in Rice by the Application of Artificial Intelligence and Traditional Techniques

**Group:** Biological Science **Project ID:** SRG-221093

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## Abstract

The world rice production scenario has been declined for the last couple of years due to abrupt climate change, high market price of the agricultural inputs, vulnerable and unstable cropping practices along with shortcoming of appropriate breeding techniques and quality seeds. Considering the facts, high yielding quality rice seed production was the prime objective of the research that led high throughput rice breeding for broad scale production to mitigate food and nutritional security in target areas of Bangladesh. Climate resilient, short duration and submergence tolerant rice farming with maximum genetic gain in benefit-cost analyses following appropriate cropping scheme were prioritized to avoid any risk factors for the producers and consumers as well. Twenty-five promising rice lines were evaluated following RCBD and CRD in three replicates during July-22 to June -23 in both field and lab conditions respectively. Promising HYV rice cultivars differed significantly (1%) for most of the yield contributing characters. The combined result of the present studies revealed that the BRRI dhan29 & BAU dhan3 were most promising based on maximum effective tiller per hill, highest number of fertile spikelet and highest 1000 grain weight. Weather data and field results were analysed based on available record and all the possible machineries and smart tools were used for getting accurate data. Genetic gains were measured as: $\Delta G = i\ \sigma A\ rMG/t$, where $\Delta G$ is the expected genetic gain, i is intensity of selection, $\sigma A$ is genetic SD, namely the square root of additive genetic component. Surplus genetic gain by 2030 were predicted to be at least 4-7% more in promising varieties which will be an avenue to mitigate huge food demands. However, in depth analyses may produce perfect features in near future which might be added rapid data gathering and ultimately will add a value of smart breeding.

**Keywords**: Genetic gain, smart breeding, stress tolerant, rice yield, grain quality.

# Introgression of Blast Resistance Genes into Elite Rice Cultivar BRRI dhan28 through Marker-Assisted Selection

**Group:** Biological Science **Project ID:** SRG-221094

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## Abstract

BRRI dhan28 an early maturing mega variety for Boro season in Bangladesh and has the largest area under cultivation. However, BB and blast explosion are highly occurred in this variety at Boro season 2022-23, which was almost difficult to control by severe spraying of fungicides. It is possible to keep this variety in farmer's field for a long time by improving BRRI dhan28 through pyramiding of efficient blast resistance genes. In the present study, we introgressed two genes (Pi2 and Pi54) governing resistance to of rice blast disease into a popular rice cultivar BRRI dhan28 through marker assisted backcross breeding (MABB). In foreground selection, seven plants homozygous for all the four genes were selected from a population of 180 $BC_2F_2$ plants and subjected to background selection coupled with phenotypic selection for agronomic and grain quality traits of the recurrent parent. Six NILs from the $BC_2F_2$ families with an RPG recovery ranging from 82.5% to 90.5% were phenotypically evaluated for agronomic performance, grain quality traits and disease resistance. The level of resistance to blast diseases in all the selected NILs was similar to that of the donor parent. The NILs were recorded a disease score of 1.0 and 1.7 for two blast isolates collected from Muktagacha and Bajitpur, respectively. The NILs were almost similar to BRRI dhan28 for major agronomic and grain quality traits with the advantage of resistance to blast diseases. The improved NILs need to further test in multi-locations, which would help to estimate their performance for commercial cultivars. These NILs of BRRI dhan28 would provide an economical and sustainable assurance for the farmers against losses due to blast diseases in the future.

**Keywords**: Rice blast, Pi genes, pyramiding, backcross, molecular markers.

# Identification of Anthocyanin Accumulation Related Genes of Potato to Introduce Biofortified Black Potato in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221095

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## Abstract

Potato (*Solanum tuberosum*), one of the most important starch producing crops, is getting more attention in poor countries, suffering from hidden hunger, due to its additional nutritional value. However, most of the released potato varieties in Bangladesh are low in processing quality and special food value, importantly, the anthocyanin content which protect human health from cancer as well as increase plant resistance capacity. Anthocyanin rich black potato varieties are limited in our country. 'Jam alu', widely and locally cultivated genotype is the only source of anthocyanin of potato in Bangladesh. Therefore, the study was conducted for characterization of this genotype for its further improvement and to increase the biodiversity of black potato. Here, we make a morpho-physiological, genetic and anatomical characterization of 'Jam alu'. The anthocyanin of 'Jam alu' is peonidin or cyanidin type which is cumulated in specific tissues of stem, leaf and tuber. Accumulation was mostly found in cuticle and trichome over the epidermis, phloem fibre, metaxylem vessel, xylem fibre and some sclerenchymatous tissue in the pith region of vascular bundle of endodermis region of the stem, in phellogen layer of periderm, vascular ring and in some pith tissues of potato tuber and lower epidermis of leaf. The accumulation at periderm of tuber was much higher than vascular ring. The *ANS* gene of purple potato was found to be mostly related to *Solanum lycopersicum*. The knowledge of this study will help to organize breeding strategy for further improvement of this genotype to introduce black potato in Bangladesh.

**Keywords**: Jam alu, peonidin, phellogen layer, ANS gene, vascular ring.

# Novel Approach in Promoting the Production of High Value Exotic Fruits Through Vegetative Propagation

**Group:** Biological Science **Project ID:** SRG-221096

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## Abstract

This project was conducted at Bangladesh Agricultural University Germplasm (BAU-GPC), Department of Horticulture, BAU, Mymensingh. The aim of the project was to explore a suitable combination of rooting media and $GA_3$ concentration for the higher success and survivability of air layering of plum. The two-factor experiment was carried out following randomized complete block design (RCBD) with three replications. Factor A comprised of three types of rooting media viz., $M_2$:100% garden soil, $M_2$: 50% garden soil + 50% well decomposed cowdung, $M_3$:50% garden soil + 50% Vermicompost and Factor B included four levels of $GA_3$ concentrations viz., $T_1$: Control, $T_2$ :500 ppm, $T_3$:1000 ppm, $T_4$:1500 ppm. About 3 cm long round cut was made and bark including cambium tissue was removed. Hormonal treatment was applied in the cut surface by using muslin cloth. Cloth piece was soaked in hormone solutions and touch with cut surface followed by apply rooting media. Root appearance, number, length, diameter, dry matter contents, % success and % survivability were measured during the experiment. The data were analyzed statistically by analysis of variance. The significance of differences between mean values was evaluated by Duncan's Multiple Range Test (DMRT). Results showed that 50% garden soil + 50% vermicompost gave the better performances in most of rooting traits. While the highest concentration (1500 ppm) $GA_3$ performed superior for most of the studied parameters. The combine effects of rooting media and concentration of $GA_3$ showed that 50% garden soil + 50% vermicompost with 1500 ppm $GA_3$ exhibited the maximum success and survivability of plum air layering. It can be recommended that 50% garden soil + 50% vermicompost with 1500 ppm $GA_3$ treatment combination would be the effective for better success and survivability of plum air layering.

**Keywords**: Rooting media, gibberellic acid, vermicompost, survivability, air layering, plum.

# Enhancing Yield and Quality of Banana through Improved Pre- and Postharvest Practices

**Group:** Biological Science **Project ID:** SRG-221097

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## Abstract

The study attempted to minimize postharvest losses of banana through improved pre- and postharvest practices. To achieve the objectives, number trials were carried out at the Horticulture Farm (Field trial) and at the Postharvest Lab (Postharvest trials), Department of Horticulture, BAU. An experiment comprised two factors, namely postharvest treatments (Control, hot water treatment at 50±5°C for 10 minutes and 5% calcium chloride dip for 10 minutes) and packaging (unwrapped/control, 50µ polypropylene-PP bag with or without potassium permanganate, $KMnO_4$). The longest shelf life (20.00 days) at room temperature was recorded in bananas treated with 5% $CaCl_2$ and held in 50µ PP bag with $KMnO_4$ as compared to control fruit. This treatment combination also gave the best color, firmness, flavor, with reduced levels of weight loss, disease incidence and severity. In another experiment gamma irradiation and sanitizers were tested to evaluate shelf life and quality of banana. The longest shelf life of mature-green bananas was found in fruits dipped in 5% NaOCl (Sodium hypochlorite) for 10 minutes followed by those soaked in $H_2O_2$ (Hydrogen peroxide). These treatments dramatically reduced postharvest diseases during the period of investigation. In a further evaluation, whole banana bunch treated with 3% $H_2O_2$ and held in LDPE (Low-density polyethylene) bag, and bunch held in LDPE bag containing $KMnO_4$ absorbed in vermiculite, caused remarkable extension of shelf life of mature-green bananas at ambient temperature, and this technology can be incorporated into the banana supply chain of Bangladesh to reduce loss and for enhanced marketing. More pre-harvest trial, organoleptic evaluation and nutritional investigation are suggested to carryout to further refine and recommend the technology.

**Keywords:** Banana, MAP, irradiation, sanitizer, shelf life.

# Effects of Indole-3-Acetic Acid (IAA) on Growth, Yield and Nutritional Quality of Tomato

**Group:** Biological Science **Project ID:** SRG-221098

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## Abstract

A single-factor experiment consisted of four different doses of indole-3-acetic acid (IAA) viz., $T_0$: Control (no IAA, control), $T_1$: 50 ppm IAA, $T_2$: 100 ppm IAA and $T_3$: 150 ppm of IAA. The experiment was laid out in Randomized Complete Block Design with three replications. BARI Tomato-15 was used as experimental material. IAA had significant influence on the growth and fruit yield and its nutritional value and bioactive compounds. The highest plant height (85.49 cm), the maximum number of leaves (26.00) and the minimum days (29.34 days) required for first flowering, the maximum number of flower clusters per plant (15.17), number of flowers per plant (37.50), number of fruits per plant (32.17) were observed in 1500 ppm of IAA treatment. The fruit length, weight and yield (96.44 t/ha) were the highest in 100 ppm of IAA. 86.29% (96.44 t/ha) more yield was obtained when treated with 100 ppm of IAA than control (51.77 t/ha). On the other hand, 12.98% (45.05 t/ha) yield reduction occurred in BARI Tomato-15 when treated with 150 ppm of IAA as compared to control (51.77 t/ha). Results revealed that 50% TSS, 23.64% TA, 24.64% ascorbic acid, 52.63% total chlorophyll, 65.62% lycopene, 53.38% TPC, 79.71% TFC, 22.47 % K, 17.98% P and 22.54% Ca of fruit increased in 150 ppm of IAA than control and 8.93% pH, 32.22% $IC_{50}$ value of fruit decreased in 150 ppm of IAA than control at stage 4 (consumption stage). At stage 6 (processing stage), 29.03% TSS, 35.71% TA, 24.40% ascorbic acid, 52.84% lycopene, 66.44% TPC, 87.78% TFC, 20.55 % K, 17.25% P and 26.27% Ca of fruit increased in 150 ppm of IAA + 100 ppm of $GA_3$ than control and 8.16% pH, 32.72% $IC_{50}$ value decreased in 150 ppm of IAA than control.

**Keywords**: Phytohormone, bioactive compounds, antioxidants, tomato, yield.

# Immunogenomics of Peripheral Blood Mononuclear Cells: Deciphering the Host-Ppr Vaccine Interactions in Goat

**Group:** Biological Science **Project ID:** SRG-221099

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## Abstract

Peste des petits ruminant (PPR) is an emerging infectious and economically important diseases of goats in Bangladesh. Black Bengal goats seem to be more resistant to general infection compared to exotic breeds, and cross-bred like Jamunapari goats; however, their genetic potential associated with PPR resistance is yet to discover. This study was aimed at exploring the molecular mechanisms and identifying the key candidate genes associated with host immune response to PPR virus infection. For this, publicly available peripheral blood mononuclear cells (PBMCs) transcriptome dataset was retrieved from NCBI-GEO database and from published research articles and performed multi-omics-based bioinformatics analyses. A list of differentially expressed genes (DEGs) in PBMCs of PPR infected goats were prepared. Using this list of DEGs, a functional enrichment analysis was performed followed by construction of a gene co-expression network and miRNA/TF regulatory network. In total, 92 and 81 DEGs showed continuous differential expression following PPR-host interaction. The protein-protein interaction network of PBMCs transcriptomes identified the potential hub genes includes HSPA5, CDC42, RPS3, PTK2B and HDAC1. DEGs were associated with the NOD-like receptor signaling pathway, IL-17 signaling pathway, TNF signaling pathway, Epstein-barr virus, PI13k-Akt signaling pathway, chemokine signaling pathway, and JAK-STAT signaling pathways. The gene-microRNA network identified the potential genes whose function are controlled by their binding miRNAs including HMGB1, BIRC3, IL6, LTF, FOS, ARRDC4, TLR4, CXCL3, etc. and the regulatory microRNAs for *PPR* virus mediated transcriptional network identified as miR-223, miR-155, miR-16a, miR15b, miR-221, and miR-181a. This study elucidated the molecular mechanisms of host-PPR virus interaction in the peripheral blood of goats and exploring the PPR resistance candidate genes in native goats in Bangladesh.

**Keywords**: Goat, immunity, transcriptome, network, pathway.

# Antimicrobial Photodynamic Therapy for Bovine Papillomatosis in Cattle

**Group:** Biological Science **Project ID:** SRG-221100

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## Abstract

**Background:** Antimicrobial photodynamic therapy (aPDT) has been proven to be a promising approach to treat wide ranges of infectious diseases. Bovine papillomatosis is a contagious viral infection causing significant economic losses to the farmers by damaging hides, weight loss, stunted growth, production losses and treatment cost. **Objective:** The present study evaluated the therapeutic efficacy of aPDT against bovine papillomatosis in cattle. **Methodology:** For aPDT, methylene blue (MB) solution was injected and sprayed to the wart-mass after diagnosis of bovine papillomatosis in six cattle attended at Veterinary Teaching Hospital, BAU. Then, the cattle were exposed to sunlight for 1 hr. The aPDT efficacy was compared with that of the intramuscular injection of anthiomaline tartrate in another group of three cattle infected with bovine papillomatosis. **Findings:** Out of 6 cattle treated with aPDT, all 6 cattle were completely recovered from papillomatosis. Recovery time was variable according to variable size of the wart-masses. Small warts of 0.5-2 cm diameter regressed after 1 week to 3 weeks. Large warts of 2-5 cm diameter regressed after 4-8 weeks. There was no recurrence of papillomatosis after recovery. Out of 3 cattle treated with anthiomaline tartrate, 2 recovered completely and another 1 did not recovered. **Conclusion:** The present study suggested that MB and sunlight mediated aPDT could be an convenient, less costly and most effective method to treat bovine papillomatosis in cattle.

**Keywords**: Bovine papillomatosis, Antimicrobial photodynamic therapy, methylene blue, sunlight, cattle.

# Molecular Epidemiology of Mobile Colistin Resistance (MCR) Carrying *Aeromonas spp*. From Retail Foods in Mymensingh District, Bangladesh

**Group:** Biological Science **Project ID:** SRG-221101

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## Abstract

Mobile colistin resistance (MCR) in bacteria is an emerging issue. There is no report of *mcr* carrying *Aeromonas* spp. isolated from retail foods in Bangladesh. Therefore, this study was carried out to determine the prevalence of *mcr* carrying *Aeromonas* spp. from retail foods in Mymensingh district, Bangladesh and their characterization. Aeromonas spp. was isolated from chicken meat, fish, and milk, and identified by PCR. Mcr-1 gene and virulence genes were detected in the isolates by PCR. Minimum inhibitory concentration (MIC) for colistin by broth microdilution method and antimicrobial susceptibility testing of the isolates by disk diffusion method were carried out. Prevalence of *mcr-1* gene carrying *Aeromonas* spp. was 30 % (15/50) in chicken, 23 % (8/35) in fish and 10 % (2/20) in milk. No other tested *mcr* gene variants (*mcr-2* to-*4*) were detected. Minimum inhibitory concentration for colistin was determined to be 80% (12/15) and 75% (6/8) of the *mcr-1* gene carrying *Aeromonas* spp. isolated from chicken and fish, respectively had an MIC of 8-16 µg/ml whereas 100% (2/2) of the isolate from milk showed MIC of 4-8 µg/ml. Most of the *mcr-1* gene carrying isolates from chicken meats, fish and milk were resistant to TET, AMP (80%-100%). Apart from multidrug resistance (MDR), extensive MDR was detected in *mcr-1* gene carrying *Aeromonas* spp. irrespective of sample's origin. In addition, virulence gene profiling indicated that among five important virulence genes (*aer act*, *hly*, *ahyB, lip* genes) tested by PCR, *lip* gene was detected in all *mcr-1* gene carrying *Aeromonas* spp. irrespective of sample's origin. Importantly, prevalence of *aer act*, *hly*, *ahyB* genes were 25% (2/8) in *mcr-1* gene carrying isolates from fish. In conclusion, prevalence of pathogenic MDR *mcr-1* gene carrying *Aeromonas* spp. in retail foods (which is the first report in Bangladesh) might be important concern for public health.

**Keywords**: Antimicrobial susceptibility, inhibitory concentration, multidrug resistance, prevalence.

# Exploring Multidrug Resistant Extended-Spectrum I²-lactamase Producing *Salmonella* from Retail Chicken Meat in Bangladesh

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## Abstract

Retail chicken meat contaminated with extended-spectrum β-lactamase (ESBL) producing *Salmonella* spp. poses a health risk for consumers. A cross sectional live bird market (LBM) survey was conducted to determine the prevalence, and extent and distribution of phenotypic as well as genotypic resistance pattern of *Salmonella* spp. in retail chicken meat and LBM sewage samples from 32 LBMs of 16 upazilas of 8 districts in 4 divisions of Bangladesh. *Salmonella* spp. were identified by culture-based and molecular methods, and subjected to antimicrobial susceptibility testing, and ESBL- *Salmonella* spp. was screened by double disk synergy test. Genes encoding for β-lactamase and plasmid-mediated quinolone resistance (PMQR) were investigated by multiplex PCR. ESBL-producing *Salmonella* spp. was found 77.5% in retail chicken meat and 81.8% in LBM sewage. Multidrug resistance (MDR) was observed in 99.4% and 100% of retail chicken meat and LBM sewage samples, respectively. Notably, three isolates of *Salmonella* spp. from retail chicken meat showed possible extensively drug resistance. All isolates of *Salmonella* spp. harbored *bla*TEM gene. The *bla*CTX-M-1 gene was detected in 2.8% of *Salmonella* spp. from retail chicken meat. The *qnrA* gene was present in 11.2% of *Salmonella* spp. from retail chicken meat. The *qnrB* gene was detected in 2.2% of *Salmonella* spp. from retail chicken meat. Moreover, 19% of *Salmonella* spp. from retail chicken meat harbored *qnrS* gene. In addition, the *qnrS* gene was also present in 38.1% of *Salmonella* spp. from LBM sewage samples. This study indicates that ESBL–*Salmonella* spp., most of them MDR, are highly prevalent in retail chicken meat and LBM sewage in Bangladesh. Therefore, it is important to ensure the good hygienic practices during slaughtering and processing of chicken in the retail market and to monitor the resistance continuously. Urgent attention is needed, including strengthening antimicrobial stewardship and surveillance programs in poultry production in Bangladesh.

**Keywords**: ESBL-*Salmonella*; MDR; resistance gene; chicken meat; poultry production.

# Welfare Assessment of Ruminant Animals in Slaughter Houses of Mymensingh District

**Group:** Biological Science **Project ID:** SRG-221103

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## Abstract

The objective of this project was to assess the animal welfare knowledge and attitudes of animal transporters and butchers during the transportation and slaughtering of animals in local slaughterhouses in Bangladesh. A pre-structured questionnaire was used to collect information from butchers at pre- and during the slaughtering of animals. The welfare data of 123 ruminant animals (84 cattle, 31 goats, and 8 sheep) subjected to slaughter was collected by direct observation and examination. Meat animals are usually purchased from the local market, some from farms, and even from imported Indian cattle are usually transported from far away to slaughterhouses. Significantly ($p < 0.01$), the highest percentage of animals were transported by walking (42.28%), followed by truck (22.76%), pick-up van (20.33%), local vehicle (11.38%), and the lowest by auto-rickshaw (3.25%). Small ruminants were kept in a lair-age for 1 to 2 days but most of the cattle were slaughtered upon arrival. Out of 123 animals investigated, 0.81 to 4.07% had lameness, 0.81 to 10.57% had skin lesions and 4.06 to 18.69% had dirty conditions in the different body regions. Diarrhea was recorded in 4.88% of animals whereas 7.32% had nasal and 4.07% had ocular discharges. Lair age was found in 85% of slaughterhouses with pacca (15.0%), kaccha (45.0%), and semi-pacca (40.0%) conditions but 80% had no bedding materials and 92.5% dirty floor condition. Mostly jute rope (89.43%) and halal method (100%) were used for casting and slaughtering of animals respectively without regular veterinary inspection. The stress caused by the transportation and slaughtering of animals was not minimized due to the lack of practice of animal welfare legislation in Bangladesh. The insufficient knowledge of animal transporters and butchers about animal behavior and animal welfare suggests that there is a need to improve the animal welfare situation through training for the concerned people. Humane slaughter of animals may reduce the incidence of animal injury and less bruise to the carcasses which improve the meat quality.

**Keywords**: Transportation, slaughter house, animal welfare, animal handling, butchers.

# Mutational Analysis of HBsAg of Hepatitis B Viruses from the Clinically Infected Patients in Mymensingh District of Bangladesh

**Group:** Biological Science **Project ID:** SRG-221104

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## Abstract

**Background**: Mutations in the hepatitis B virus (HBV) can potentially lead to vaccination failure, diagnostic escape, drug resistance, and disease progression. **Objectives**: The current study aimed to determine genetic variability of small HBsAg and RT/HBsAg overlapping regions for HBsAg escape and drug-resistant mutations in the Mymensingh region. **Methodology**: A total of 136 blood samples with sociodemographic data were collected from hepatitis B symptomatic patients for ICT and ELISA, HBV DNA, PCR, and RT-PCR, followed by sequencing and mutational analysis. **Findings**: All 136 (100%) samples were found HBsAg positive by ICT and ELISA, whereas only 88.24% (120/136) were HBV DNA positive by PCR and RT-PCR. Moreover, viral load was positively correlated with blood transfusion (p=0.005), surgery (p=0.05), and HBsAg titer (P=<0.001, r=0.98). The partial small HBsAg coding regions of 15 PCR positive samples were partially amplified and sequenced. The isolates were identified as genotype C (93.33%), followed by genotype A (6.67%), which were significantly (p=0.008) related to the serotypes adr, and adw2, respectively. The phylogenetic tree revealed that the isolates were closely related to the strains of Bangladesh, China, Malaysia, and Indonesia. Clinically significant mutations such as small HBsAg S3N and RT I91L, L180M, A181G, and M204L were identified. Antiviral drug resistant mutations were found against lamivudine, adefovir, entecavir, and telbivudine with significantly high (p=0.001) viral load. In contrast, no resistant mutation was found against tenofovir. **Conclusion**: These findings will give an insight into the current status of HBV infection in the Mymensingh region and help in better disease management through proper diagnosis, treatment, and vaccination.

**Keywords**: Hepatitis B virus, small HBsAg, mutations and drug resistance.

# Detection and Characterization of Fluoroquinolone Resistant E. Coli from Local Country Birds

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## Abstract

Antimicrobial resistance is a global health crisis. Fuoroquinolone resistant *E. coli* are major health concern. Local country birds could be potential source for fluoroquinolone resistant *E. coli*, but no data is available from Bangladesh in this regard. The objective of this study was therefore to investigate whether fecal sample from local country birds namely salik, sparrow (choroi) and crow carry fuoroquinolone resistant *E. coli* having public health significance. A total of 134 (Salik 45, Sparow 47 and Crow 42) freshly dropped fecal samples was collected (20 from Choroi, 20 from Salik, 20 from Cow) from BAU and surrounding areas of Mymensingh. Isolation and identification of *E. coli* was based on culture and PCR. Resistance phenotype and genotype were determined by disk diffusion test and PCR. About 40%, 35% and 16.63% isolates were resistant to fluoroquinolone antibiotics e.g., enrofloxacin, levofloxacin, ciprofloxacin respectively. All the isolates were also found resistant to ampicillin and ceftazidine. About 40% isolates were resistant to tetracycline, 33.33% to streptomycin, 23.30% to azithromycin and 16.33% to meropenem. No resistance was observed against fosfomycin. PCR was also done to detect fluoroquinolone resistant genes *qnrA and qnrS.* None of the isolated were found positive for *qnrS* genes. Four isolates from Crow, two from Shalik and three from Sparrow was found positive for *qnrA* gene. Local country birds namely Salik, Crow and Sparow are quite common in Bangladesh all year round. Our findings suggest that Salik, Crow and Sparow carry could be potential source for the spread of fluoroquinolne and other antibiotic resistant *E. coli*.

**Keywords**: AMR, Fuoroquinolone resistance, E. coli, qnrS, local birds.

# Isolation and Molecular Detection of Bacteria from Frequently Touched Objects of Different Public Places at Sadar Upazila of Mymensingh District

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## Abstract

Due to the frequent and inevitable use, public toilets, transports and hospital surfaces are often repleted with microorganisms. The research was conducted to investigate the magnitude of bacteriological contamination in various public places at sadar upazila of Mymensingh district. A total of 90 swab samples were collected aseptically from the most frequently touched surfaces of sample area. Bacterial load was determined from each sample by TVC method. Each sample was allowed to grow in the nutrient broth followed by culture and sub-culture in different selective media for the isolation of bacteria. Identification of the isolated bacteria was done by conventional followed by molecular detection by PCR using genus/species specific primers. Isolated organisms were then subjected to antibiogram study using disk diffusion techniques. The highest bacterial load was found in the public bus (mean log CFU/ml = 5.96) and lowest bacterial load was found in the hospital (mean log CFU/ml = 5.06). Among the samples 76.67% (n=69/90) were positive for *E. coli*, 80% (n=72/90) were positive for *Klebsiella* spp. and 68% (n=61/90) were positive for *Staphylococcus* spp. Positive *tetA* and *stx-1* gene was found from 40 and 19 *E. coli* isolates respectively. 23 positive *mecA* gene or MRSA was found from *Staphylococcus aureus* isolates. In antibiogram study, *E. coli* isolates were 100% sensitive to Gentamicin, Chloramphenicol, Ciprofloxacin and 100% resistance against Amoxicillin, Azithromycin, Tetracycline, Co-Trimoxazole followed by Colistin sulfate (73.34%). *Klebsiella* spp. is 100% sensitive to Gentamicin, Tetracycline, Chloramphenicol, Ciprofloxacin, Co-Trimoxazole, Azithromycin, Streptomycin and 100% resistance against Amoxicillin followed by Colistin sulfate (60%). *Staphylococcus aureus* isolates were 100% sensitive to Ciprofloxacin, Co-Trimoxazole, Chloramphenicol, Gentamicin, Vancomycin followed by Azithromycin (80%); Streptomycin (70%) and 100% resistant against Methicillin, Cefoxitin and Cefixime. The research can be utilized to create public awareness about the potential threat, thus prevent the spread of infectious disease through public place.

**Keywords**: Bacterial contamination, frequently touched object, public toilet, mecA.

# Assessment of the Factors Influencing Self- Medication Practice with Antibiotics and its Effects on AMR in Rural People

**Group:** Biological Science **Project ID:** SRG-221107

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## Abstract

**Background:** Antimicrobial resistance (AMR) is an emerging global health threat. Self-medication by indiscriminate use of antibiotics contribute to the development of AMR. **Objective:** The study was aimed to identify the factors influencing them to take self-medication, and interpret its impacts on AMR development. **Methodology:** A total of 90 rectal swab sample were collected from the persons we collected data. *E. coli* was isolated by sub-culturing several time on EMB and MacConkey agar media, and identified by different biochemical test and PCR amplification of 16srRNA gene. Isolated *E. coli* was tested for their antimicrobial susceptibility by using 10 commonly available antibiotics sold in the market. **Findings:** Prevalence of self-medication was higher among male (86.83%), uneducated (97.3%) people than the female (76.77%) and tertiary educated people (70.52%) respectively. There was very minor significance of family income on this practice. Employment status, family members on health sector, preferring self-treatment for minor illness, knowledge of antibiotics adverse effects were the significant factors influences this practice. A total of 43 *E. coli* was isolated and antibiotic sensitivity was performed against 10 most commonly sold antibiotics. All the isolates expressed 100% resistance to penicillin and cefixime. Isolates emerged from the persons practice self-medication revealed resistance against more antibiotics than isolates from the persons avoid. Antibiogram data and those person's different characteristics were analyzed to identify the involvement of those characteristics in MDR development. Self-medication, incompletion of antibiotic courses and antibiotic switch were significantly associated with MDR. **Conclusion:** In conclusion our findings revealed that inadequate knowledge and awareness about antibiotics influences the rural population to take self-medication which are very alarming for their health.

**Keywords**: Multidrug resistance, *E. coli*, rural population.

# Zoonotic *Campylobacter Jejuni* in Fresh Vegetables: Occurrence, Virulence Characterization and Antimicrobial Resistance Genes

**Group:** Biological Science **Project ID:** SRG-221108

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## Abstract

The objective of this study is to isolate and identify *C. jejuni* from fresh vegetables obtained from various local markets, characterize its virulence, and assess trends in antibiotic resistance. One hundred (100) vegetable samples, comprising a mix of tomato, carrot, cucumber, green chili, and coriander, were collected and immediately transported to the Bacteriology Laboratory at the Department of Microbiology and Hygiene, Bangladesh Agricultural University, Mymensingh, while maintaining a cool chain system. Using cultural, biochemical, and molecular techniques, 100 fresh vegetable samples (including tomato, carrot, cucumber, green chili, and coriander) were examined for *C. jejuni*. The isolates were further tested for virulence genes and antimicrobial susceptibility. Out of the 100 samples, 23% were confirmed as *C. jejuni,* by 16S rRNA gene-based polymerase chain reaction and all were found to be virulent with cytolethal distending toxins (*cdtA, cdtB and cdtC* genes). Antibiotic susceptibility testing revealed resistance to amoxicillin (47.83%), tetracycline (43.48%), and streptomycin (39.13%) among the isolates. However, ceftriaxone and ciprofloxacin were effective against 47.83% and 43.48% of the isolates, respectively. Moreover, 52.17% of the isolates were sensitive to erythromycin. Alarmingly, 34.78% of the *C. jejuni* isolates exhibited multidrug resistance (MDR) with eight different antibiotic resistance patterns, including four MDR patterns. Eight isolates resistant to ciprofloxacin showed the presence of *gyrA* gene. These findings highlight the presence of virulent and antibiotic-resistant *C. jejuni* in fresh vegetables, emphasizing the need for monitoring and control to ensure food safety and public health issues.

**Keywords**: Fresh vegetables, occurrence, virulence, antimicrobial resistance, genes.

# Detection of Genetic Variation and Benzimidazole Resistance-Associated SNPs in the Isotype-1 I²-tubulin Gene Predominate in *Haemonchus contortus*

**Group:** Biological Science **Project ID:** SRG-221109

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## Abstract

*Haemonchus contortus* is one of the most important parasitic nematodes of small ruminants around the world, particularly in tropical and subtropical regions. The control of *H. contortus* and related gastrointestinal nematode has relied on the treatment with anthelmintic drugs including benzimidazoles (BZs). As benzimidazole (BZ) anthelmintics have been broadly used in Bangladesh, we hypothesized that resistance is widespread. Given the link between three known single nucleotide polymorphisms (SNPs, designated F167Y, E198A and F200Y) in the isotype-1 b-tubulin gene and BZ resistance, our goal here was to explore the presence of these mutations in *H. contortus* from small ruminants (sheep and goats) from different regions in Bangladesh using PCR-coupled sequencing. For all 20 individual male adults from swven *H. contortus* populations, SNPs F200Y (TTC to TAC) was detected. In total, three genotypes were detected among the seven populations of *H. contortus*.The primary genotypes (Hs-198 and Hs-200) homozygous at both P198 and P200 had frequencies of 33.3-100% in all seven *H. contortus* populations (Mymensingh, Madhupur, Rajshahi, Rangpur, Jhenaidah, Rangamati and Bhola. Interestingly, resistance and heterozygous genotype of at P200 was found only in *H. contortus* population of Bhola. Resistance was not detected in E198A (GAA to GCA) and F167Y (TTC to TAC). But interestingly .in chromatogram, it was observed that GAA changed to AAA at P198 which might be due to BZ resistance. In the seven *H. contortus* populations, the frequency of SNP E198 (susceptible) ranged from 0% to 100%. The frequencies of (resistant) SNP 200Y ranged from 0 to 50%, and from 0 to 50% for (susceptible) SNP F200. The findings of this first study of SNPs in the isotype-1 tubulin gene of *H. contortus* populations suggest that BZ resistance is prevalent in some regions of Bangladesh, and that any control strategy might focus on monitoring BZ resistance in this country.

**Keywords**: *Haemonchus contortus*, sheep, goat, resistance, beta-tubulin gene, sequencing.

# Study on the Epidemiology and Detection of *Theileria* Parasites in Goats Using Molecular Tools

**Group:** Biological Science **Project ID:** SRG-221110

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## Abstract

Theileriosis is one of the common hemoparasitic tick-borne diseases that infect various wild and domestic animals. It is caused by *Theileria* parasites, belonging to the family Theileriidae in the order Piroplasmida. The characteristic clinical signs in goats are fever, tachycardia, cough, increased respiratory rate, anemia, anorexia, ruminal hypomotility and lymph node enlargement. It is important to identify the specific *Theileria* organism existing in the host as there are major differences in pathogenicity of different *Theileria* species. Diagnosis of theileriosis is usually done on the basis of clinical findings and microscopic identification of the schizonts in blood smears or lymph node aspirates in acute case. The limitation of these conventional methods is that the carrier animal usually goes unnoticed and differentiation between piroplasms of *Theileria* spp. is difficult. PCR has achieved preference over conventional methods for diagnosis of theileriosis. The present study was conducted to identify the molecular prevalence and characterize *Theileria* in goats from Mymensingh through PCR, DNA sequencing and phylogenetic analysis. A total of about 100 goat blood samples were collected till now from Mymensingh Sadar. Microscopic examination of blood smears was done and DNA was extracted from goat blood and PCR reactions were conducted to amplify 1098 bp fragments of the 18S ribosomal RNA gene for the identification of *Theileria* spp. Sequencing and phylogenetic analysis of the positive PCR samples will be performed. Through microscopic examination and PCR, none of the samples were found to be infected with *Theileria* sp. Further sample collection and PCR analysis will be conducted. This study will provide a new molecular parasitological data on the *Theileria* infection in goats and expected data generated through this study will be helpful for exploring the further molecular epidemiological studies and also for designing the appropriate control measures to limit the occurrence and severity of theileriosis in goats in Bangladesh.

**Keywords**: Theileriosis, prevalence, microscopic examination, PCR, sequencing.

# Infective Stage of Human Liver Flukes, a Bio-Carcinogen, in Common Estuarine Fishes in Bangladesh

**Group:** Biological Science

**Project ID:** SRG-221111

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## Abstract

Flukes belonging to the family Opisthorchiidae are known as major human liver flukes. They use various fresh fishes as the second intermediate hosts, where metacercariae (MC), the infective stage is developed. Here, we detected MC of major human liver flukes in some selected estuarine fishes, determine the organ-wise distribution and load of MC, and validated species of the fluke by PCR. We collected loitta (*Harpadon nehereus*), hilsa (*Tenualosa ilisha*), rupchanda (*Pampus chinensis*) and vetki/koral (*Lates calcarifer*) fishes from different markets of Mymensigh and examined by artificial peptic digestion. During examination, we recovered MC of fish-borne trematodes, and on the basis of morphologic and morphometrical analysis, they were tentatively identified as the MC of *Metorchis*. So far, we recovered MC of *Metorchi* from koral and hilsa. We detected MC of *Metorchis* both from flesh and gills of hilsa but only from flesh of koral. To validate the tentative identifications, we extracted total genomic DNA from the harvested MC. PCR was performed by employing specific primers and PCR products were electrophoresed. By PCR, we got amplicons at the expected level (~370 bp), confirming the presence of the MC of *Metorchis orientalis* in estuarine fishes particularly in koral and hilsha. Taken together, our results suggest that estuarine fishes can also act as the intermediate hosts of human liver flukes having zoonotic importance, and people of the country are at risk to the infection.

**Keywords**: Human liver flukes, *Metorchis orientalis*, estuarine fishes, koral, hilsha.

# Fish-borne Zoonotic Parasites: A Meta-analysis on Bangladesh Perspective for Control

**Group:** Biological Science **Project ID:** SRG-221112

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## Abstract

Fish-borne zoonotic parasites (FZPs) affect the human and animal health around the world, including Bangladesh. With the world's growing population and potential global trade of aquaculture and fish, the risk of development of fish and aquatic-derived zoonoses in humans are increasing. The main objectives of this study are to show the temporal-spatial trend regarding the zoonotic parasitoses and to draw a meaningful conclusion. This study summarized the info on the fish-borne parasite population diversity, their nationwide distribution, host preference and their impacts from vetero-medical perspectives. Meta-analysis of the existing data on FZPs in Bangladesh revealed that *Clonorchis, Opisthorchis, Metorchis, Metagonimus, Echinostoma, Echinoparyphium, Hypoderaeum conoideum, Paragonimus*, *Diphyllobothrium latum and Spirometra mansoni, Anisakis typica, Gnathostoma spinigerum, Capillaria* sp., and *Cryptosporidium* are affecting a versatile group of hosts including duck, dog, cat, human, chicken, African civet, peacock, lion, tiger, turkey etc. It was also found that the trend of publication or reports on FZPs is increasing since 2000 and highest in 2022. Mymensingh and Netrokona district were more explored compared to other parts of Bangladesh in relation to FZPs. Finally, this study provides the spatio-temporal distribution trend regarding the fish-transmitted zoonotic parasites and suggests significant concern for fish-consumers.

**Keywords**: Fish, parasites, zoonoses, meta-analysis, Bangladesh.

# Molecular Detection and Characterization of Rickettsial Pathogens from Questing Ticks in Mymensingh District of Bangladesh

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## Abstract

Tick-borne pathogens become an emerging source of zoonotic infections and have a major impact on the human health worldwide. Their incidence is increasing in the recent decades. Spotted fever group (SFG) rickettsiae is considered as important agents of human tick-borne diseases. They are mainly transmitted by vector ticks through the transovarial and transstadial pathways from animals to human and vice-versa. Despite the presence of suitable tick vectors, the occurrence of SFG rickettsiae has not yet been investigated in the country. Therefore, the present study was designed to detect and characterize the rickettsial pathogens from questing ticks in cattle. To do so, tick samples were collected randomly from cattle and were identified morphologically after the preparation of permanent slides. Genomic DNA was extracted from the representative tick specimen and PCR was performed with the amplification of 16S rDNA, *ompA* and *gltA* genes. A total of 200 ticks were collected randomly from cattle at Mymensingh Sadar upazila of Mymensingh district of which 72.5% (145/200) were identified morphologically as *Rhipicephalus microplus,* whereas 27.5% (55/200) of ticks were detected as *Haemaphysalis bispinosa*. To characterize the SFG pathogens, 16S rDNA, *ompA* and *gltA* gene were amplified by PCR and amplicons were subsequently subjected to 1.5% gel electrophoresis and confirmed the PCR amplification by showing the respective band size. Among the 200 DNAs of ticks, 17 DNAs was found to be positive for SFG pathogens reveals an overall prevalence of 8.5%. The representative PCR products were sent for sequencing. The sequence analysis of the amplified products in the NCBI blast reveals the SFG *rickettsia* pathogens in ticks from cattle and were closely related to *Rickettsia* sp. found in Korea. The present study provides very baseline data on the SFG *rickettsia* pathogens circulating in the country and further extensive research with large scale samples are needed to be performed.

**Keywords**: SFG Rickettsia, tick-borne disease, cattle, PCR, Mymensingh.

# Anti-inflammatory Wound Healing and Hepato-Protective Effects of Spirulina Platensis in Rodent Model

**Group:** Biological Science **Project ID:** SRG-221114

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## Abstract

Spirulina contains a wide variety of phytochemicals with numerous biological activities. This study was aimed to evaluate the anti-inflammatory, wound healing, and hepatoprotective effects of *Spirulina platensis* in vivo. The anti-inflammatory and hepatoprotective studies were performed in rats and the wound-healing study was conducted in mice. To induce inflammation and hepatototoxicity, 1% carrageenan and carbon tetrachloride were used respectively. The wound-healing activity of spirulina was tested in mice by creating a circular wound using a biopsy punch. For all the studies, animals were treated with spirulina at a dose rate of 250 mg and 500 mg/kg body weight. It was observed that spirulina (500 mg/kg) significantly ($p<0.001$) reduced the carrageenan-induced paw edema and wound closing time (10-12 days) compared to that of control (14 days) rats. Histological examination of the inflamed rat paws showed massive infiltration of inflammatory cells which was significantly reduced by spirulina treatment (500 mg/kg). $CCl_4$ injection significantly increased the serum AST and ALT levels, which were significantly ($p<0.05$) decreased by spirulina treatment (500 mg/kg). The histological examination of the liver showed severe hepatic cell damage that was also significantly improved by spirulina treatment (500 mg/kg). These results demonstrated that spirulina decreased inflammation and repair induced hepatotoxicity in rats. It was also able to reduce wound healing time in mice. Hence, spirulina could be a good anti-inflammatory, wound-healing and hepatoprotective agent.

**Keywords**: Spirulina, anti-inflammatory, wound healing, Hepatoprotection, ALT, AST.

# A comparative Study on the Chemical Composition of Fish between Wild and Cultured Fishes of the Same Species

**Group:** Biological Science **Project ID:** SRG-221115

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## Abstract

Fish as food plays an important role in our life. Five fish species like Rui (*Labeo rohita*), Catla (*Catla catla*), Shing (*Heteropneustes fossilis*), Golsha (*Mystus bleekeri*), and Pabda (*Ompok pabda*) usually available and consumed in Bangladesh were analysed for proximate composition. The samples were collected from Mymensingh and Sirajganj District of Bangladesh. The moisture, protein, fat and ash contents of the fishes were determined using loss in weight, micro-Kjedahl, dry-ashing and solvent extraction methods. The average moisture contents of the wild fishes varied from 71.75 to 75.17 (g/100g) with Rui having the highest moisture content followed by Pabda. The average moisture contents of the Farm fishes varied from 75 to 80 (g/100g) with Catla having the highest moisture content followed by Pabda. The protein contents of the wild fishes ranged from 15.18 to 16.48 (g/100g). The minimum and maximum protein values were reported for Golsha and Shing respectively. The average lipid contents of the wild fishes varied from 2.24 to 4.17 (g/100g) with Pabda having the highest lipid content followed by Shing. Whereas, in farm fishes, Pabda have the highest and Catla has the lowest lipid content. The wild fish have higher ash, fibre and carbohydrate content than the farm fishes. Fish in the wild eat a natural diet whereas fortified feed is given in aquaculture to increase growth and production. These potential differences between aquaculture and wild fish production create a difference in the chemical composition. Thus, for nutritional aspect analysis, this study suggests wild fish as the source of fish consumption.

**Keywords**: Fishes, wild, cultured, proximate composition.

# Discriminate and Indiscriminate use of Ciprofloxacin Antibiotic in Poultry and its Effects and Residual Status in Different Edible Tissues: A Health Perspective Study in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221116

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## Abstract

Indiscriminate and non-judicious use of antibiotics has significant effects on human health causing antibiotic resistance. Antibiotic resistance is a worldwide problem including in Bangladesh. Thus, this project was designed to detect the presence of Ciprofloxacin antibiotic residue in edible tissues and its effect on hematological and enzymatic parameters in broilers. In this study, we used broiler chicks to investigate the judicious use of ciprofloxacin. On day 14, the chicks were randomly divided into three groups namely control, discriminate, and indiscriminate antibiotic groups. The treatment was started from the day 14 onward. The discriminate group was treated with ciprofloxacin @ 100mg/Liter drinking water for 7 days followed by a withdrawal period of 7 days. On the other hand, indiscriminate group birds were treated with ciprofloxacin @ 100mg/Liter drinking water for 14 days without maintaining any withdrawal period. On day 14, the body weight of all groups of birds was not statistically significant, however, the mean body weight on the $28^{th}$ day was statistically significant in the indiscriminate group (1601.43±15.50gm). Thin Layer Chromatography (TLC) analysis revealed ciprofloxacin residues in all the samples of the indiscriminate group were positive but did not detect any antibiotic residue in the control sample and in the discriminate group 2 liver samples, 3 kidney samples, 1 spleen sample, and 1 breast muscle sample were found positive but no residues found in thigh muscle samples. Effects on hematological parameters showed that the means of the three groups were statistically significant only in TEC, Hb & ESR but not PCV. ALT & AST enzymatic analysis of blood serum showed no significant changes in both treated and control birds. The investigation is continuing and needs more investigation for a precise conclusion. Therefore, the judicious use of ciprofloxacin antibiotics is essential in the poultry sector to ensure human health.

**Keywords**: Ciprofloxacin antibiotic, indiscriminate use, poultry.

# The Effects of Gestational Exposure to the Food Additive Potassium Bromate on Reproductive and Immunological Parameters in Offspring Mice

**Group:** Biological Science **Project ID:** SRG-221117

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## Abstract

Potassium bromate ($KBrO_3$) is a member of the bromides group and a strong oxidizing agent. It has been used as a food additive. $KBrO_3$ was reported as carcinogenic and mutagenic effects. The research investigated the effects of maternal exposed $KBrO_3$ on the growth, reproductive performance and immune cells in parental mice and their F1 generation offspring mice. A total of 30 Swiss Albino mice (*Mus musculus*) (10 male and 20 female) age of 25-28 days were collected from ICDDR'B, Dhaka and at the age 45 days, mice were randomly divided into 2 groups each containing 15 mice of 5 male and 10 female. The group A served as vehicle control, while group B provided $KBrO_3$ @ 400 mg/liter drinking water. Body weights were taken at 2 weeks intervals. The results showed that $KBrO_3$ caused the retarded growth in both male and female parental mice. Estradiol, testosterone and T4 values were significantly ($p<0.01$) decreased in $KBrO_3$ treated mice. A significant ($p<0.05$) reduction in the sperm count and sperm motility was observed in $KBrO_3$ treated mice. The seminiferous tubules of the testis of $KBrO_3$-treated groups showed moderate degenerative changes. All female mice were successfully conceived, but mice treated with $KBrO_3$ took a longer time to get conceived and delivered the lower number of pups compared to the control group. $KBrO_3$-treated offspring mice had less body weight. Their body weights were slowly increasing. Neutrophils numbers were slightly increased in mice born from $KBrO_3$ treated group. F1 offspring mice of $KBrO_3$ -treated group had lower sperm count, sperm motility and testis weight ($p<0.05$). Testosterone and estradiol concentrations in F1 mice were lower in $KBrO_3$ treated group compared to F1 mice of control group. This study concludes that $KBrO_3$ may have multigenerational effects on growth and reproduction. More research on $KBrO_3$ is needed to draw a final conclusion and find out the exact mechanism of it.

**Keywords**: Potassium bromate, food additive, reproductive parameters, testosterone, gestational exposure, mice.

# Hypoglycemic, Lipid-Lowering and Atheroprotective Effects of *Aloe vera* Gel on Streptozotocin and High Fat Induced Type-2 Diabetes in Mice

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## Abstract

The present study was conducted to investigate the effect of Aloe Vera on hematology, blood glucose, serum insulin and glucose tolerance, serum total cholesterol (TC), triglycerides (TG), low-density lipoprotein-cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C) histopathological alterations in liver, and pancreas in diabetic Mice. A total of 90 Swiss Albino mice (Mus musculus), aged 25-28 days divided into 6 groups such as A-Control, Group B-diabetic control, Group C-diabetic control plus aloe vera treated group, Group D-high fat treated group, Group E- high fat diabetic group, Group F-high fat diabetic plus aloe vera treated group. At Day 30, body was significantly increased in high fat treated groups (group D, E, F). At Day 60, Hematological parameters (Hb, TEC, PCV, TLC) in High fat and diabetes induced group were significantly reduced compared to control. On the other hand, the addition of aloe vera revealed a restoration of the values compared to obese and diabetic mice. At day 30, blood glucose level was increased in high-fat treated mice compared to healthy control and diabetic control plus aloe vera treated mice. In case of lipid profile, at day 60, serum TC level was increased in diabetic control and high-fat diabetic group compared to the healthy control. Section of liver, and pancreas of the control group showed normal tissue structures. But Diabetic mice showed major changes in the histstructures. In the case of aloe vera treated mice, there were no detectable changes. The research findings suggest that exposure to Type 2 diabetes is a risk factor for hemato-biochemistry, hepatic and pancreatic system associated with hyperlipidemia and hyperglycemia. Whereas, Aloe vera acts as an antioxidant, anti-hyperlipidemic, anti-diabetic agent. However, further study is required to lower the health hazards associated with STZ and high fat exposure and to find out the exact mechanism of action of *Aloe vera*.

**Keywords**: Type-2-Diabetes, Aloe vera, Streptozotocin, glucose, lipid.

# Impact of Climatic Factors on the Seasonal Fluctuations of Aflatoxin Contamination in Maize for Ensuring Better Management and Safe Food in Bangladesh

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## Abstract

Maize (*Zea mays*) is an important emerging cereal and is susceptible to contamination with aflatoxins that are produced by *Aspergillus flavus* and *A. parasiticus*. Aflatoxins hazard to public health due to their toxicity and carcinogenicity. Experiments were conducted to assess the seasonal variation of aflatoxin contamination in selected maize hybrids viz. NH7220, DON-111, Averest, PAC-339, PAC-984, Kaveri-50 and BOSS in Sutiakhali, Mymensingh during early, mid and late season of 2022-2023, to find out the relationship between aflatoxin contamination and climate variables and to identify the toxigenic *A. flavus*. The result of aflatoxin concentration was determined by Enzyme-linked immusorbent assay (ELISA) using AgraQuant total aflatoxin detection kit. The results showed that the lowest amount of aflatoxin contamination was observed in late season than early and mid-season in all maize varieties. In early season the highest (36.77ppb) aflatoxin concentration was quantified in Kaveri-50 and the lowest (11.07ppb) aflatoxin concentration was determined in PAC-984. In late season the highest (5.56ppb) aflatoxin concentration was determined in DON-111 and the lowest (3.16ppb) aflatoxin concentration was quantified in PAC-984. The variety PAC-984 variety exhibited the lowest aflatoxin concentration in both of the seasons. Season wise regression analysis was performed between each climate variable and aflatoxin concentration. Regression analysis revealed significant positive relation between aflatoxin concentration and temperature where aflatoxin concentration increases with the increase of temperature. However, with the increase of rainfall and relative humidity, the concentration of aflatoxin reduces which depicts significant negative correlation between them. A total of 22% (eight out of 35) toxigenic *A. flavus* and 78% (27 out of 35) were identified from maize grains obtained from different varieties studied by using primers specific to *nor*, *omtA* and *apa*2. These results will serve as benchmark for monitoring aflatoxin contamination in maize hybrids to identify the resistant/tolerant for producing safe food and feed.

**Keywords:** Impact, **c**limate variables, seasons, maize hybrids, aflatoxin**.**

# Characterization of *Uromyces vicia* fabae and *Trichoderma* Induced Metabolic Responses in Faba Bean for Suppression of Rust Disease

**Group:** Biological Science **Project ID:** SRG-221120

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## Abstract

Faba bean (*Vicia fabae*) production is hampered by rust disease caused by Uromyces vicia fabae usually control by fungicide that is hazardous for environment. To develop an eco-friendly disease management approach for safe faba bean production, a potential bio-stimulant Trichoderma was screened out as an alternative of chemical fungicides against this pathogen. This research was conducted with three Trichoderma spp. (*T. harzianum*, *T. viride* and *T. asperellum*) and two induced resistance chemicals (IRCs: Bion and Chitosan) to manage rust disease of faba bean. Rust pathogen was characterized by ITS marker. Trichoderma induced pathogenesis related (PR) proteins were estimated and their performance in reducing rust disease severity of faba bean was tested in both net house and field experiments. Survey result revealed that Mymensingh region had the highest %DI and %DS of faba bean rust (62.4% and 58.2%) followed by Tangail and Gazipur district. PCR amplification of rDNA with Uromyces Mymensingh isolates (Ufa-M) resulted in the expected specific size of 620 bp. This research clearly showed that 60% culture filtrate of *T. viride*, 60 mM of bion and Amistar top resulted 100% inhibition of uredial germination at 48 h of incubation. Spraying of Tricho-suspension (@108cfu/ml) on faba bean plants significantly decreased rusty spot severity compared with control treatment under both net house and field conditions. Among the three *Trichoderma* spp., *T. viride* showed the best performance in reducing rust disease severity and increased significantly the agronomic parameters viz. plant height, number of pods/plants, seed weight (kg/plot) and seed weight (kg/ha) of faba bean. *T. viride* resulted the highest amount of total phenol and total flavonoid. Thus, the increments of POX activity, total phenol, total flavonoids and total yield revealed that *T. viride* is a promising bioagent that significantly control rust disease with three sprays (@108cfu/ml) starting from the initial rust symptom appears.

**Keywords**: Rust, faba bean, bioagents, metabolites, management.

# Evaluation of the Quality of Commercial Feeds From Selected Leading Companies Considering the Growth Performance, Carcass Yield and Meat Quality of Broiler Chickens

**Group:** Biological Science **Project ID:** SRG-221121

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## Abstract

**Background**: The quality of market ingredients and ready-made broiler feeds is in question. For gaining an accurate picture of the feeding practices, evaluating the quality of the chicken feeds and consumer's negative attitudes and perceptions, biochemical analysis (nutritional quality) of the feed and meat quality seems to be valuable. **Objectives**: Objective is to evaluate the nutrient efficacy of major available commercial feeds from randomly selected renowned companies in Bangladesh. **Methodology**: Eleven commercial company feeds (randomly selected) along with self-formulated feed (SFF) were considered for this experiment. A total of 480 Indian River Meat male broiler DOCs were divided into 12 treatment groups (considering each company feed as experimental treatment) namely $T_o$=Self formulated feed (SFF), $T_1$=commercial feed 1 (CF1), $T_2$= (CF2), $T_3$= (CF3), $T_4$= (CF4), $T_5$= (CF5), $T_6$= (CF6), $T_7$= (CF7), $T_8$= (CF8), $T_9$= (CF9), $T_{10}$= (CF10) and $T_{11}$= (CF11) having 4 replications in each with an allocation of 10 DOCs per replication. **Findings**: Results showed little variation in ME:CP ratio of CF samples (133-145) during starter phase, however, huge variations (133-160) were found in the CF samples at grower phase. Significant changes ($p<0.05$) were observed in growth performance at both starter and grower phase where birds of T1 treatment group showed the highest body weight (2381.51g), body weight gain (2339.79g) and feed intake (3645.38g) compared to other treatment groups and the lowest in $T_o$ treatment group, resulting in higher ($p<0.05$) FCR (1.92), whereas, the $T_7$ showed significantly ($p<0.05$) the lowest (1.53). **Conclusion**: Based on the above findings, it can be concluded that huge heterogenicity is present in nutrient availability of different commercial feeds, which may be due to variations in the use of some unknown feed additives or higher difference in nutrient composition at grower phase that ultimately have an influence on final growth performance, carcass yield and meat quality of broiler chickens.

**Keywords**: Commercial feed, broiler, feed mills, growth performance, meat quality.

# Effect of Lemon Juice on Laying Performance, Egg Quality and Blood Parameters in Laying Pullets

**Group:** Biological Science **Project ID:** SRG-221122

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## Abstract

The current study was conducted to explore the potential benefits of lemon juice (LJ) on laying performance, egg quality, and blood parameters of laying pullets. A total of 96 Hy-Line Brown layers aged 29 weeks were randomly selected and distributed in two three-tier pyramid type cages, having 4 treatments with 6 replications each in a daily drinking trial of six hours. The birds were provided with 0% (control), 0.5%, 1% and 1.5% LJ respectively for 6 weeks. The temperature, humidity, hen day egg production (HDEP) and egg weight (EW) were recorded. External and internal egg quality indices were measured bi-weekly. At the end of the experimental period, the blood was collected for analysis of total cholesterol (TC), triglycerides (TG), low-density lipoprotein (LDL), high-density lipoprotein (HDL), blood glucose, aspartate aminotransferase (AST), alanine aminotransferase (ALT), packed cell volume (PCV), heterophil (H), lymphocyte (L) count and heterophil-lymphocyte (H/L) ratio. The studied parameters among the various treated groups showed that the egg weight, feed conversion ratio (FCR), egg quality parameters, HDL, TG, AST, heterophil count, lymphocyte count and H/L ratio did not differ significantly ($P>0.05$). HDEP, egg mass output (EMO) and FI differed significantly ($P<0.01$) compared to the control group. The significant reduction in TC, LDL, glucose, ALT, increase in feed intake, HDEP and PCV showed that LJ had a positive effect in reducing the adverse effects of heat stress in laying pullets. Taken together, it is concluded that LJ can be used to improve the laying performance and reduce the heat stress in layers.

**Keywords**: Egg quality, heat stress, laying pullets, laying performance, lemon juice.

# Effect of Day-old Chicks Weight on Growth Performances and Egg Production Traits in Japanese Quail

**Group:** Biological Science **Project ID:** SRG-221123

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## Abstract

The weight of the birds and their development during the growth phase are factors that influence the weight of the first eggs. It is also important to observe the adequate weight of the quails at the end of the rearing period. This study was conducted to investigate the effect of Effect of day-old chick weight on growth performances and egg production traits in Japanese Quail. Two trials were done during the growing period (0-6 weeks) and the laying period of Japanese quail. In trial 1, chicks were divided into four groups each of 100 on day 7, replicated to four sub-groups each of 25 birds. Treatment-1 was below 20g, Treatment-2 was 20-22g, Treatment-3 was 23-24g and Treatment-4 was over 24g. In trial 2, chicks were divided into five groups each of 35 at the onset of laying, replicated to four sub-groups each of 7 quails. Treatment-1 was below 130g, Treatment-2 was 130-140g, Treatment-3 was 140-150g, Treatment-4 was 150-160g and Treatment-5 was mixed body weight. Results from trial 1 indicated that body weight and body weight gain were higher in the higher weight group compared with other treatment groups. Fed intake and FCR were also improved in the over 24g group than others. Results from trial 2 indicated that egg production was highest in the 150-160g group whereas, below 130g, 130-140g and 140-150g show the same egg production percentage. However, the mixed body weight group indicated lower egg production than others. Egg weight was almost the same in all the treatment groups. Based on the results of this study, it may be concluded that quail separation on the basis of body weight at 7 days and onset of production may be effective, and higher weight gives higher body weight and higher egg production.

**Keywords**: Chick separation, growth, egg production, Japanese quail.

# Online Education System During COVID-19 Pandemic in Bangladesh Agricultural University: Prospects and Challenges

**Group:** Biological Science **Project ID:** SRG-221124

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## Abstract

In Bangladesh, the first Covid-19 patient was tracked on March 8 in the capital, and the country went into general lockdowns from March 26. Since then, people are keeping themselves at home except for emergencies while educational institutions and most industries and business centers remain shut. Aside from the economy, the sector which is harmed worst by the outbreak of Covid-19 is the education sector. Different educational institutes began to shut gradually from March 17 instantly. Few private universities initiated online classes from April, where public universities and other educational institutions are at bay from it. The objective of this study was to investigate the effectiveness of online learning system in Bangladesh Agricultural University. As an academic (first-hand experience), this study has tried to find out the benefits and difficulties of virtual education system experienced by learners and academicians during the pandemic. Students and teachers' perceptions were required on different perspectives for online learning. Most of the students showed positive approach towards online classes as this is flexible for learners and instructors. Students can listen well-structured content with recorded videos as many times needed. However, from the view of teachers and students online classes are also challenging compared physical classroom because of the technological constraints, digital divide, insufficient data pack to access the material to attend the class, poor connectivity, lack of device, poor learning environment, technophobia, delayed response, and incapability of the teacher to handle efficiently the material and communication technologies. Despite all these issues, as an online path virtual learning is measured productive and effective for the learners. It is likely that after the COVID-19 pandemic calms down, there is a continued rise in learning schemes using online platforms for study aids, as well as students accepting online education for their higher education.

**Keywords**: Online education, corona, expectation, prospects, challenge.

# Effect of Water Management on Yield, Water Use Efficiency and Trace Element Accumulation in Rice Grain

**Group:** Biological Science **Project ID:** SRG-221125

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## Abstract

Water management can increase water productivity and reduce heavy certain metal concentration in rice grain. An experiment was, therefore, conducted at Bangladesh Agricultural University Farm to see how water management affects growth, yield, and arsenic (As) in the grains of certain boro rice cultivars. The treatment includes: $T_1$ (CF, continuous flooding, farmer's practice); $T_2$ (IM-1, in which intermittent irrigation was repeated every 7 days with 3-day flooding followed by 4-day off); $T_3$ (IM-2, in which intermittent irrigation was repeated every 10 days with 3-day flooding followed by 7-day off); and $T_4$ (AWD, alternate wetting and drying). There were 10 rice cultivars, including nine BRRI varieties and one BINA variety, used as test varieties in this research. The results suggested that water management approaches had diversified effects among the varieties. There was no significant variation in grain yield among the treatments in Binadhan 20 and BRRI dhan58. In the case of BRRI dhan100 and BRRI dhan89, IM-1 increased grain yield compared to the other treatments, while AWD reduced the yield. In BRRI dhan28, IM-2 reduced the grain yield compared to CF treatment. All the water management treatments reduced grain yield compared to the CF in BRRI Dhan84. The trend of grain As a whole among different treatments is CF > AWD > IM-1 > IM-2. The grain As concentration ranged from 0.17 ppm in IM-2 to 0.24 ppm in CF. Grain As concentration decreased by 12.5%, 20.8%, and 29.1% in AWD, IM-1, and IM-2, respectively, compared to the CF treatment. Water productivity ranged from 1.13 kg $m^{-3}$ in CF to 1.32 kg $m^{-3}$ in AWD. Based on the findings of the research, IM-1 and IM-2 treatments can be recommended for field applications in terms of lowering the water usage for rice production without sacrificing yield and reducing the grain As concentration.

**Keywords**: Intermittent irrigation, AWD, rice yield, water productivity, grain arsenic.

# Mitigation of the Adverse Effects of Soil Salinity in Rice and Maize Crops by Organic Amendments

**Group:** Biological Science **Project ID:** SRG-221126

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## Abstract

Salinity is a major limiting factor for crop production in coastal areas of Bangladesh. Organic amendments (OAs) could contribute to the improvement of crop production in coastal areas. A pot experiment was carried out in the net house of the Department of Soil Science, Bangladesh Agricultural University, Mymensingh to investigate the mitigation of the adverse effects of soil salinity in maize by using OAs. BARI Hybrid Maize-9 was used as test crops. Cowdung, poultry manure (PM) and compost were added to the soils before seed sowing. The experiment was laid out in a completely randomized design with three replications. The treatments were control, 30 mM NaCl, 60 mM NaCl, 30 mM NaCl + Cowdung (5t/ha), 60 mM NaCl + Cowdung (5t/ha), 30 mM NaCl + PM (3t/ha), 60 mM NaCl + PM (3 t/ha), 30 mM NaCl + Compost (6t/ha), 60 mM NaCl + Compost (6t/ha) and salinity stress exposed at vegetative stage. Salt stress caused a significant reduction in growth and yield of the maize. High salt stress (60 mM NaCl) caused a drastic decrease in growth of the maize. Salt stress also decreased $K^+/Na^+$ ratio, nutrient contents, and nutrient uptake in maize. OAs with Cowdung, Compost and PM improved salt tolerance of maize that were associated with increased plant height, plant weight, root length, root weight, $K^+/Na^+$ ratio and nutrient uptake in mild stress (30 mM) than in strong (60 mM). Organic amendments with confer tolerance to salinity in maize by increasing plant growth, nutrient uptake and $K^+$ $Na^+$ ratio. The present study suggests that BARI Hybrid Maize- 9 can be recommended to cultivate for grain production and fodder crop respectively with organic amendments in saline affected areas of Bangladesh since soil amendments with organic manures improved electrical conductivity and organic matter status under salinity condition.

**Keywords**: Soil salinity, organic amendments, maize.

# Effects of Anaesthetics With or Without Premedication in Sheep

**Group:** Biological Science **Project ID:** SRG-221127

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## Abstract

This study compared the effects of different anaesthetic combinations on clinical, haematological and biochemical parameters in sheep. The sheep of group A (BXK) were anaesthetized with intravenous administration of butorphanol @ 0.1mg/kg body weight, xylazine hydrochloride @ 0.05 mg/kg body weight plus ketamine hydrochloride @ 1.6mg/kg; group B (P) received propofol @ 6mg/kg; group C (XP) xylazine @ 0.05mg/kg plus propofol @ 5mg/kg and group D (DP) diazepam at @ 0.2 mg/kg plus propofol @ 5mg/kg. Clinical parameters were recorded and blood samples were collected before and after (5, 10, 20 min and 2h) administration of anaesthesia and analyzed for Haematological and biochemical parameters. The heart rate significantly increased ($P<0.05$) and respiration rate initially decreases during anaesthesia which returns to normal values after 2h of recovery. In group A and B there were smooth and rapid induction. The ESR significantly decreased ($P<0.05$) in group B during anaesthesia whereas it significantly increased in group D. The TEC and Hb significantly increased ($P<0.05$) in group A and B during anaesthesia. The TLC significantly increased ($P<0.05$) in group A, C and D during anesthesia. The ALT significantly decreased ($P\leq0.05$) in group A whereas it significantly increased in group B, C and D. AST significantly decreased ($P<0.05$) in group A and D during anaesthesia whereas it significantly increased in group B and C. ALP significantly increased ($P<0.05$) in all groups during anaesthesia. BUN significantly decreased ($P<0.05$) in group A during anaesthesia whereas it significantly increased in group B and C. Glucose significantly increased ($P<0.05$) in group A, C and D during anaesthesia. The findings of this study reveal that propofol alone can be most effective for performing shorter duration anaesthesia for minor surgical interventions and BXK combination and XP combination are effective for longer duration anaesthesia for major surgical interventions in sheep.

**Keywords**: Sheep, general anaesthesia, premedication.

# Leukocyte-and Platelet-rich Fibrin (L-PRF): An Alternative to Antibiotic for the Treatment of *Staphylococcus aureus* Induced Infected Wound in Animal Model

**Group:** Biological Science **Project ID:** SRG-221128

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## Abstract

**Objective:** This study has been designed to find out the effectiveness of heterologous Leukocyte-and platelet -rich fibrin (L-PRF) infectious wounds in rabbits. **Methodology:** A total of 12 surgical wounds were made in rabbits under two groups; L-PRF (group A), phosphate buffered solution (PBS) (group B, control). In group A or L-PRF group- freshly prepared L-PRF was applied topically on the wound twice a week, group B or control group- wounds received sterile saline only. Follow up information was recorded from day 0 to day 21 postoperatively. Morphological characters such edema, inflammatory swelling, pain sensation, crust formation, wound contraction and complete healing time were observed. Histological evaluation like local inflammation, collagen deposition and re-epithelialization were analyzed at days 7, 14 and 21 after skin injury. *In vivo* and *in vitro* antibacterial activity of L-PRF were also evaluated. **Results:** We have shown that L-PRF was highly effective in reducing the wound area and accelerating wound closure compared to untreated control wounds. Mean days to heal completely were 15 days for L-PRF and in the control group, it took 21 days to get similar results. Histopathological study revealed the presence of marked inflammation with irregularly arranged fibroblast in samples collected at day 7 in control group whereas these features were markedly improved in the L-PRF treated group. There was distinct thickening of epidermis and thick keratin layer in L-PRF group while these features were markedly inferior in control group at day 21. Serum biochemical analysis of L-PRF group revealed improved activities of selective biomarkers which are known for functional activities of vital organs. **Conclusions:** Our results revealed that L-PRF ameliorated septic dermal wound healing by modulating inflammation and angiogenesis, collagen synthesis and re-epithelialization.

**Keywords**: Infectious wounds, epithelialization, leukocyte, platelet, fibrin, wound healing.

# Therapeutic Efficacies of Different Wound Healing Materials Traditionally Used by Rural Farmers in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221129

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## Abstract

All over the Indian subcontinent, herbal plants and other natural medicines are widely accessible to treat farm animals. The study was conducted to compare the therapeutic efficacies of different wound healing materials traditionally used by rural farmers in Bangladesh. Thirty-six incised wounds (3 in each animal) were made in twelve Blank Bengal goats. The goats were divided into three groups; wounds treated with normal saline which was considered as control group (Group A), Group B was treated with turmeric paste and wounds treated with cotton ash in Group C. Follow-up information was recorded from day 0 to day 21 postoperatively. Morphological characteristics such the swelling of the wound, the width of the sutured area, wound contractions and duration of wound healing were also recorded. Blood samples and biopsy of tissues were collected on day 1, day 4 and day 8 for haematological and histopathological studies, respectively. Wound contraction (0.27±0.01 mm), swelling of suture area (0.37±0.03 mm) and elevation line of suture (1.43±0.05 mm) were lowest in wound treated with cotton ash compared to other groups. No significant changes were observed in RBC and WBC of all animals. In histopathological studies, epithelial regeneration and healthy collagen fiber appears in the subcutis at day 8 in group B, whereas the keratin layer of epidermis appears thick and huge accumulation of carbon particles beneath the muscularis layer in the wound treated with cotton ash. It can be concluded that cotton cloth ash, in addition to other herbal remedies, is used for the treatment of skin wounds in goats. Both turmeric paste and ash ointment are equally effective, but turmeric paste is more effective to speed up the healing process.

**Keywords**: Cotton ash, goats, histopathology, turmeric paste, wound healing.

# Physical Activity Status of Dairy Cows in Bangladesh and its Impact on Reproduction and Fertility

**Group:** Biological Science **Project ID:** SRG-221130

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## Abstract

**Background:** Physical activity has several health benefits. It boosts reproduction and fertility. Bangladeshi dairy cow activity is unknown. **Objectives:** To evaluate dairy cows' physical activity. **Methodology:** Thirty-three crossbred and local farms were visited. Farmers were interviewed with a prepared questionnaire, and farm registers were used to obtain farm and animal data. It had 74 local and 181 crossbred cattle. **Findings:** The local breed's breedable male was 19, the crossbred 41. The mean ± SD of milking cows in local and cross-breed farms were 2.555±1.580 and 5.40±5.395, respectively. Local and crossbred farms' overall milk production was 2.083±2.562 and 39.867±47.497 litres, respectively. We found that 78% of animals were under 5 years old, and 22% were above 5. Similarly, 74.5 % of local breed animals were under 5 years old, and 25.5% were above 5. Sixty-six percent crossbreds and 58.8% local breeds had 1–4 parities. Additionally, 11% of local and cross-bred animals had more than four parities. The majority of crossbreeds (67%) were lactating. Furthermore, 55% of cross-breeds and 62.7% of local breeds were pregnant. Crossbreds had 13% reproductive disease compared to 4% for native breeds. Crossbred cows rarely graze surrounding pastures. Only 12% of crossbred cows had little grazing or activity. Meanwhile, 96.1% of local breed cows grazed. Grazing in the field is a form of physical activity. The study found that cross-bred animals had 87% reproductive disease, compared to 3.9% for the local breed. Besides, the pregnancy rate in cross-breed animals is 55 % lower than local breed animals at 62.7 %. Crossbred cows lactated more than locals. Unlike local breeds, most crossbred cows (60%) received commercial and 100% stall feeding. **Conclusion:** Unlike crossbreds, local breed cows exercised while grazing in the pasture. Our crossbred cows may have lower pregnancy and fertility rates due to less physical activity.

**Keywords**: Physical activity, fertility, reproduction.

# Consumers' Preference Attributes for Indigenous and Broiler Chicken in Rural Bangladesh

**Group:** Biological Science **Project ID:** SRG-221131

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## Abstract

Consumers throughout the world are becoming more and more drawn to chicken meat, but their tastes and preferences are influenced by a number of elements relating to food quality as well as the personality of the specific consumer like demand, price, culture, religion, lifestyle, diet, knowledge, health concerns and food trends. Keeping this in mind, the study was conducted to determine the features that influence consumer's consumption frequency and their willingness to pay for indigenous and broiler chicken. Stratified random sampling was used to select 350 sample respondents from five villages under Mymensingh district to conduct field survey. Binary logit regression model was used to find out the significant attributes of consumption frequency of indigenous and broiler chicken. Years of schooling, nutrition knowledge about chicken, safety of chicken, price of chicken significantly influence consumption frequency of the respondents. Multiple linear regression model was used to find out the factors influencing consumer's willingness to pay for indigenous and broiler chicken. Consumers who are more concerned about nutrition are willing to pay 69% more for indigenous chicken and for safety concerns, they are ready to pay 71% more. According to the result, people are willing to pay even more due to the price of broiler and because of the availability of broiler chicken, people prefer broiler chicken 57% more. Other than that, taste of chicken, physical texture, tenderness, cooking time, size of chicken attributes also significantly influences consumer's willingness to pay for chicken. Finally, the study suggests to work on availability and price of indigenous chicken to ensure more consumption frequency of the respondents. This study recommends meat producing farmers and entrepreneurs to adjust the quality control measures for broiler chicken so that people can become more convenient towards the nutritional value of broiler chicken.

**Keywords**: Consumers' food selection, willingness to pay, consumption frequency, safety concern, nutritional value.

# Evaluation of Advanced Breeding Lines of Rice Developed from Fatemadhan for Earliness, Yield and Salinity Tolerance

**Group:** Biological Science **Project ID:** SRG-221132

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## Abstract

The development of mutant populations followed by their characterization offers a significant opportunity to isolate genotypes and genes with desired traits of interest. The objective of this study was to assess the yield performance and salinity tolerance of 22 advanced rice mutants derived from Fatemadhan through gamma irradiation and EMS-mutagenesis. The seeds of the mutants (M4), parents and checks were grown at the field experimental farm of the Dept. of Genetics and Plant Breeding, Bangladesh Agricultural University, Mymensingh, Bangladesh. For assessing the salt tolerance, two separate experiments were conducted at the seedling and reproductive stages along with salt tolerant and susceptible check varieties. Based on field experimental results, mutant Lines 9, 17 and 80 showed significantly higher yield per plant compared to parent and check, whereas, Lines 1 and 83 were identified as early maturing lines. Thus, the promising mutant lines can be used for the development of high-yielding and early-maturing rice varieties. In the first experiment of salinity studies, 14-day-old seedlings were subjected to salt stress (EC= 10 dS/m; 7 days) under hydroponic conditions. Salt stress caused a significant decrease in root and shoots traits and leaf chlorophyll content; however, a little decrease was found in the mutant Line-1. In contrast, a sharp increase in shoot Na+/K+ ratio was found in all the genotypes but a little increase was found in Binadhan-10, FL-478 and Line-1. Based on overall analyses, mutant Line-1 categorized as saline tolerant. The second experiment was conducted in a large plastic-tub filled with field soil and at the end of booting stage, leaves of the rice plants of each genotype were pruned leaving the flag leaf and irrigated with saline (EC=10 dS/m) water and continued for three weeks. In response to salt stress, yield and yield contributing traits decreased significantly in all the genotypes studied; however, a little decrease was found in Binadhan-10. Considering both of the experimental results, Line-1 could be selected as a high-yielding, seedling and reproductive stage salinity tolerant mutant.

**Keywords**: Gamma irradiation, mutagenesis, yield-attributing traits, seedling saline tolerance.

# Molecular Characterization and Vector Host Detection of Tracheal Flukes of Ducks

**Group:** Biological Science **Project ID:** SRG-221133

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## Abstract

The snails act as the intermediate hosts of different trematodes including the tracheal flukes of ducks which causes respiratory distress and even may lead to death. The precise molecular identification of the prevalent tracheal fluke species has not yet been done and also its vector snail hosts are not known in Bangladesh. This pioneering research work was conducted for molecular identification and snail vector host detection of the tracheal flukes in ducks in Tarakanda upazila, Mymensingh from July, 2022 to June, 2023. A total of 100ducks were slaughtered and examined, of which 16 (16%) were found infected with the tracheal fluke, *Tracheophilus cymbius.* Among the infected ducks, *T. cymbius* was found either in the trachea (87.5%, 14/16) or in nasal passage (37.5%, 6/16). In 4 (25%, 4/16) ducks the flukes were found both in trachea and nasal passage. The load of *T. cymbius* ranged from 1- 10 parasites in the infected ducks. The adult parasites were 6.3-11.5 mm long by 3-4 mm broad. Molecular detection of *cox1* and *nad* gene through PCR confirmed the *T. cymbius* species. *T. cymbius* were found to lay eggs in batch and unlike other trematodes, the eggs hatched into redia containing miracidia within 7-12 minutes. Investigation was made to find out the snail vectors through experimental infection of the laboratory reared naïve *Lymnaea auricularia*, *Lymnaea luteola*, *Indoplanorbis exustus*, *Viviparus bengalensis*, *Thiara tuberculata* and *Brotia* sp. snails with the redia containing miracidia of the *T. cymbius*. The *T. cymbius* cercariae were detected in *I. exustus* snails 15-17 days following infection indicating that *I. exustus* is the potent vector/intermediate host snail of *T. cymbius* in the study areas. Detection of immunogenic genes of the parasite and countrywide investigation of vector snail species are essentially needed to formulate control strategies against tracheal flukes in ducks in Bangladesh.

**Keywords**: *Tracheophilus cymbius*, ducks, molecular identification, snail vector, Bangladesh.

# Alleviating Action of Black Seed Oil on Reproductive Performance in Lead Treated Male Rats

**Group:** Biological Science **Project ID:** SRG-221134

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## Abstract
Lead (Pb) is a highly toxic heavy metal that can cause harm at extremely low concentrations and damage various organs. *Nigella sativa* oil (NSO) mitigates these adverse effects by regulating antioxidant enzymes like glutathione peroxidase, glutathione-S-transferase, and acting as a scavenger for reactive oxygen species in different organs. The primary objective of this research was to investigate the potential benefits of NSO on male rats exposed to chronic Pb toxicity, particularly in terms of their reproductive health. The rats were divided into four groups: a control group, a group exposed to 1.5% Pb, a group given NSO (1ml/kg feed), and a group exposed to 1.5% Pb along with NSO (1ml/kg feed). Pb exposure was administered through water, while NSO was incorporated into their feed over a period of four months. The findings indicated a significant decrease in serum concentrations of $T_4$ and testosterone in rats exposed to Pb, whereas NSO demonstrated a remarkable ability to restore these hormone levels. Moreover, Pb exposure led to a notable reduction in sperm motility, sperm concentration, testis weight, and testis diameter, accompanied by seminiferous tubule degeneration. However, the administration of NSO, a natural product, effectively counteracted the adverse effects induced by chronic Pb exposure in rats. So, it can be concluded that the consumption of NSO has shown great promise in preserving the reproductive function of rats exposed to chronic Pb toxicity.

**Keywords**: *Nigella Sativa* oil, lead, hormone, sperm and testis.

# Formulation of Microbial Bio-Pesticide from Phylloplane, Rhizospheric and Endophytic Microbiomes of Mustard for Controlling *Alternaria* Blight Disease

**Group:** Biological Science **Project ID:** SRG-221135

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## Abstract:

Anthracnose caused by a fungus (*Colletotrichum gloesporioides*) is a devastating disease of various crops, vegetables, and fruits posing economic loss every year. For the management of anthracnose of banana and papaya in an environmentally safe way, antagonist yeasts were isolated from phylloplanes and fructoplanes of various fruits. The antagonists yeast were isolated on YEPDA medium and characterized at the molecular level using 16s rDNA primers. The growth-suppressing efficacy of yeasts was investigated both in the culture medium and in the fruits. Fruit dipping and inoculation were done to assess the in-vivo efficacy at different days after intervals. A total of 80 morphotypes of yeast were isolated from the surface of either fruits or leaves. Based on the in vitro antagonism efficacy against *C. gloesporioides*, twelve treatments were assessed for various pathological parameters. Based on the antagonistic performances against *C. gloesporioides*, three isolates viz. Y3, Y4, and Y11 were selected for fruit application. In a laboratory experiment, the treatment $T_3$ (Inoculation of *C. gloeosporioides* on fruit treated with $Y_{11}$ after 24 hours) showed the highest disease suppression (60.48 %), the lowest lesion diameter 0.78 cm and the lowest lesion expansion average 0.13 cm. On the other hand, isolates $Y_4$ (54.97 %) and $Y_3$ (48.33 %) also showed significant inhibitory effects. The percent disease reduction resulted best in treatment $T_2$ (Dipping of fruits in $Y_{11}$ Solution for 15 minutes) is 44.71%, the lesion diameter 0.96 cm, and the average lesion expansion 0.16 cm in $T_2$ (Dipping of fruits in $Y_{11}$ solution for 15 minutes) showed the best result, in case of natural condition. It is thus clear that phylloplanes and fructoplanes antagonistic yeast are capable of suppressing disease lesions caused by *C. gloesporioides* in both banana and papaya to reduce post-harvest spoilage.

**Keywords**: Banana, papaya, fructoplane, phylloplane, yeast.

# Phylodynamics and Transcriptomic Signature of Dengue Viral Infection in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221136

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## Abstract

**Background** The NGS technology facilitates in-depth study of host-pathogen meta-transcriptome. We, therefore, implicated phylodynamic and transcriptomic approaches through NGS technology to know/understand the dengue virus (DENV) origin and host response with dengue fever. **Methods:** In this study, blood serum RNA was extracted from 21 dengue patients and 3 healthy individuals. Total transcriptomic data were analyzed for phylodynamic, differential express gene, and gene ontology using respective bioinformatics tools. **Results:** The viral genome sequence revealed viral genome size ranges 10647 to 10707 nucleotide. Phylodynamic analysis showed that the 2021 epidemic isolates were DENV-3 genotype-I and maintained as a new clade in compared to 2019 epidemic. Transcriptome analysis showed a total of 2686 genes were DEG in dengue patients compared to control. DESeq2 plot counts function of the top 24 genes of RNA-seq data showed that 11 genes were upregulated, whereas 13 genes were downregulated. GO analysis showed a significant upregulation in a process of multicellular organismal, nervous system, sensory perception of chemical stimulus, and G protein-coupled receptor signaling pathways in the patients. However, there were a significant downregulation of intracellular component, cellular anatomical entity, and protein-containing complex in patients. There was a significant increase of immunoregulatory proteins in patients in compared to the controls. In addition, upregulation of TLR signaling pathways were found in patients. These TLR pathways were particularly involved for the activation of innate system coupled with adaptive immune system. These differentially expressed genes could be further investigated for target based prophylactic interventions for dengue. **Conclusion:** This is a first report describing DENV complete genomic features and differentially expressed genes in patients in Bangladesh. These genes may have diagnostic and therapeutic values for dengue infection. Continual genomic surveillance is required to further investigate the shift in dominant genotypes in relation to viral pathogenesis.

**Keywords**: Next generation sequencing, dengue virus, transcriptome, gene expression.

# Effect of Sodium Molybdate on Bioenergy Production Using Household Waste Through Anaerobic Digestion

**Group:** Biological Science **Project ID:** SRG-221137

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## Abstract:

**Background:** Developed countries are beginning to explore the idea of a "circular economy" in order to minimize household waste (HW) and emissions and ensure the long-term viability of the planet through biological processes. **Objectives:** The key goals of this model are to recycle HW, improve the efficiency of anaerobic digestion process and replace the world's depleted fossil fuels. **Methodology:** The raw HW was first centrifuged at 8000 g for 10 min at 4 °C to remove the initial supernatant. Finally, the HW concentration was adjusted to 5% or 10% (wet weight of WSS/ weight of water [w/w]). The sodium molybdate dihydrate utilized in this investigation and was mixed into distilled water to provide the stock solution of 25 mg/mL. **Results:** We evaluated the methane production from the anaerobic digestion of HW at various sodium molybdate (SM) concentrations such as 30 mg/L, 60 mg/L, 120 mg/L, 240 mg/L and 480 mg/L. Interestingly, methane production was 3.2 times higher in the presence of SM (120 mg/L) compared to the control and others concentrations at day 10. As protein is a significant component of HW which is a strong indication of the degree of hydrolysis. A high level of protein concentration was found in the HW with 120 mg/L SM compared to control HW. Organic acids synthesized result were determined after the 2, 7, and 10-day incubation samples. As a result, all of the samples produced acetic acid as the major product as well as propionic acid, iso-butyric acid, and butyric acid (with or without SM). **Conclusion:** Sodium molybdate methane enhanced methane 3.2-times higher than that from the control HW. Therefore, this investigation can contribute to resource recycling via enhancing methane production.

**Keywords**: Sodium molybdate, anaerobic digestion, organic acid, microbial community, methane production.

# Preparation of Whey Protein as a Functional Food Ingredient by Using Response Surface Methodology

**Group:** Biological Science **Project ID:** SRG-221139

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## Abstract

**Background:** Whey is produced in large quantities by the dairy industry, mostly as a byproduct of the manufacturing of cheese and casein. Whey is acknowledged as a beneficial co-product that is high in lactose, proteins, minerals and other nutrients. **Objective**: Whey, which is often available in dry form, are frequently used as dietary ingredients in a wide range of health-promoting food products. Using the whey protein powder that was produced by the rennet treatment, this study aims to create ready- to-eat food product Whey Choco Ball (WCB) for the first time in Bangladesh. **Methodology:** whey protein was extracted from the waste water from dessert industry. Formerly others ingredient was mixed with it to develop WCB and compared to other Chocolate brands available in markets. **Findings**: WCB performs admirably according to proximate analysis. Due to its higher protein content and lower fat content, WCB found nutritious than the other analyzed samples. WCB was found to be microbially acceptable based on microbiological observations after 7, 15, and 30 days. WCB contains 17 amino acids and 20 fatty acids respectively. 4 more long-chain fatty acids are exclusive to WCB that are absent from the other 3 brands. *In Vivo* animal experiment did not show any significant acute toxic effects of newly developed WCB. The results of the organoleptic test indicate that WCB is quite satisfactory. Moreover, texture analysis of WCB is also comply. **Conclusion:** The findings of this study demonstrate the potential of WCB as a beneficial and sustainable resource that can address environmental issues and provide the dairy industry with a more nutritious substitute.

**Keywords**: Whey protein, amino acid, fatty acid, texture analysis, *in vivo* analysis.

# An Easy Analytical Method Development to Analyze Organo Chlorine Pesticides Residue in Water: Approach to Estimate the Contamination Level of River and Pond Water

**Group:** Biological Science **Project ID:** SRG-221140

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## Abstract

The development and validation of an efficient and sensitive method for monitoring the banned organochlorine pesticide (OCP) residue in environmental water samples is crucial to reveal the pollution status of water bodies. To facilitate environmental monitoring, an analytical method was developed to detect and quantify 19 OCPs using salting out assisted liquid-liquid microextraction (SALLME) coupled with gas chromatography-mass spectrometry (GC-MS). To achieve the highest efficiency, important parameters affecting the recovery rate of the targeted analytes, such as type of solvent (Dichloromethane, n-hexane), amount of extraction salt (NaCl) was investigated. Furthermore, the optimized method was successfully applied to measure the residual levels of OCPs for a total of 50 water samples (river water and pond water). In the optimum linearity range, the limit of quantification (LOQs) ranged from 0.0096 to 0.052 μg $L^{-1}$ for developed SALLME-GC-MS method for the selected pesticides. At spiking levels of 0.1 μg $L^{-1}$, 1 μg $L^{-1}$, 0.5 μg $L^{-1}$, 1 μg $L^{-1}$, recoveries ranged between 83 % to 109% with relative standard deviations (RSD) (n=5) of 1.2 to 7.4. The total (ΣOCPs) concentration of OCPs in water ranged from 13.61 to 792.18 μg $L^{-1}$ for pond water and 12.89 to 128.16 μg $L^{-1}$ for river water, respectively. Among the detected pesticides, residues of lindane and endosulfan exceeded the maximum permissible content of pesticides (0.1 μg $L^{-1}$ for individual pesticide) in waters established by the European Union (EU).

**Keywords**: Organo chlorine pesticides, GC-MS, river, pond, analysis.

# Genetic Diversity of Rhizobia From Faba Bean (*Viciae faba*) Nodules

**Group:** Biological Science **Project ID:** SRG-221141

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## Abstract

Faba bean (*Vicia faba* L) is a protein rich legume crop which enables to fixation of atmosphereic nitrogen in association with rhizobim for enhancing its growth and yield. A study was conducted from July 2022 to June 2023 at Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh to examine the efficacy of rhizobial strains isolated from from faba bean nodules on yield and protein content of faba bean, and to know their genetic diversity. Isolated strains were characterized by different morpho-physiological tests. Genetic diversity was analyzed by the amplification and sequencing of three different housekeeping genes and one nodulation gene. Results revealed that colony size of the strains was ranged from 1.2 to 2.00 mm. All strains showed positive result in nodulation test and also showed acid producing fast growing nature in bromothymol blue (blue) test. In salt tolerance test, most of the strains showed well growth at 1.7% NaCl and five strains and able to grow at PH 5. Six strains (BFR–1, BFR-2, BFR-26, BFR-28 and BFR-29,) were able to sustain in high temperature ($40^0$C). The high phosphate solubilization index was obtained in BFR-2 (2.75). At pot experiment, 66.67% strains showed better performance over control-1 (absolute control) while 44.4% strains showed high performance than control-2 (nitrogenous control) and only 27.74% showed lower performance due to “cheating behavior” or “selfish character”. The highest seed yield (7.33 g per plant) and protein content (33.63%) was found from inoculation with BFR-2 followed by BFR-1 and BFR-10. Three housekeeping genes (16S rRNA, *recA*, *atpD*) and one nodulation gene (*nodC*) were amplified and sequenced from 30 rhizobial strains to get genetic diversity of the strains. Phylogenetic analysis of three housekeeping genes following the latest phylogenetic species concept showed that all the strains (except two) strains belong to the species *Rhizobium binae*. This is the first report of *Rhizobium binae* farom lentil nodules.

**Keywords**: Symbiotic bacteria, morphological characters, molecular diversity.

# Shelf Life Extension of Exportable Legume Vegetables Through Gamma Irradiation and Modified Atmosphere Packaging

**Group:** Biological Science **Project ID:** SRG-221142

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## Abstract

The present study attempted to minimize postharvest losses of beans using irradiation, sanitizers and modified atmosphere packaging (MAP). The objectives were to standardize the types and thickness of MAP and to examine the efficacy of gamma irradiation on extension of shelf life to suggest postharvest technology pacakge(s) for improved shelf life and quality of country bean and yard long bean with optimal quality and safety. The experiments were carried out following CRD at the Postharvest Laboratory, Horticulture Division, BINA. In case of country bean, the highest weight loss (86.5%) was found in non-irradiated unwrapped control beans, whereas the lowest weight loss (6.3%) was observed in those beans irradiated with 200 Gy and wrapped in LDPE bags at the 15 DAI. The longest shelf life (18 days) was found in country beans irradiated @ 200 Gy and wrapped in LDPE bags. In contrast, the shortest shelf life (3.0 days) was found in the non-irradiated unwrapped country beans. In case of sanitizers, the longest shelf life (18 days) was found in country beans treated with 2% $CaCl_2$ and wrapped in LDPE bags and the shortest shelf life (4.0 days) was found in the control beans. For yard long beans, the highest weight loss (91.7%) was found in non-treated control green long country beans, whereas the lowest weight loss (4.0%) was observed in green long beans treated with 3% NaOCl and wrapped in LDPE at the 10 DAT. The longest shelf life (11 days) was found in green long yard long beans treated with 3% NaOCl when wrapped in 25 µ LDPE bags and the shortest shelf life (only 3.5 days) was found in the unwrapped untreated green long beans.

**Keywords**: Postharvest, gamma irradiation, beans, MAP, sanitizers.

# Identification of Appropriate Potting Mix for Raising the Seedlings and Growing High Value Crops (Capsicum and Spinach) in Vertically Staked Layer to Establish Vertical Farming Along with Conventional Farming in the Char Land Area

**Group:** Biological Science **Project ID:** SRG-221143

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## Abstract

The study was carried out to identify an appropriate potting mix for raising the seedlings and growing high-value crops (capsicum and spinach) to establish vertical farming along with conventional farming at the farmer's homestead at Sadar, Mymensingh during the year 2022-23 for the poor farmer of the char land area. Three experiments were conducted under the research activities and the experiments were laid out in a Randomized Complete Block Design (RCBD) with fifteen treatment combinations whereas the second experiment with each treatment was replicated three times. At the first experiment treatment Vermicompost : Soil: Sand=1:1:1 showed the highest shoot length, root length, number of leaves, leaf area, stem diameter, and fresh weight of the tomato and cauliflower seedlings than all other combinations of cocopeat, vermicompost, and rice husk. In the second experiment, vermicompost along with rice husk (70:30) potting mixture produced the highest yield of spinach and capsicum compared to single potting media of cocopeat, vermicompost, and a mixture of cocopeat, vermicompost, rice husk at different ratio. Finally, in the last experiment, the highest gross return (Tk. 10083.30) and net return (Tk. 7998.3) were observed at outdoor vertical farming combined with conventional farming while conventional farming contributed the gross return Tk. 4515 and net return Tk. 3465. The benefit-cost ratio (BCR) was also found higher in outdoor vertical farming combined with conventional farming (4.84) than in conventional farming (4.30). So it could be concluded that the inclusion of outdoor vertical farming in the homestead vegetable garden along with conventional farming is more viable in terms of production and income than only conventional farming. To establish outdoor vertical farming potting mixture containing Vermicompost : Soil: Sand=1:1:1 could be used to grow tomato and cauliflower seedlings and a potting mixture containing Vermicompost: Rice husk=70:30 could be used to grow spinach and capsicum.

**Keywords**: Potting, mix, vertical, farming, char.

# Grading of Guava Fruit Based on Mass Using Machine Vision and Multivariate Analysis

**Group:** Biological Science **Project ID:** SRG-221144

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## Abstract:

Grading guava fruit samples based on the weight can be facilitated by a machine vision system (MVS) that requires high-quality images. This study was performed to examine digital image-based processing can be applied to predict the weight of guava samples. In this regard, images of guava samples were acquired through the digital camera. The MATLAB platform was used to extract the size features of the images. Area, Major axis length, Minor axis length, Circularity, Equivalent diameter, Eccentricity, Perimeter, Maximum ferret diameter, and Minimum ferret diameter were extracted from binary images. Linear (SVM) Support Vector Machines and Quadratic SVM regression models were applied to predict the weight of the intact guava samples. The better result was found to be the Linear SVM which had an accuracy of coefficient of determination ($R^2$) =0.99 and Root mean square error (RMSE) =4.549 for calibration and $R^2$=0.98 & RMSE=5.2646 for the testing stage.

**Keywords**: Grading, guava fruit, machine vision, size features, SVM.

# Assessment of Ecosystem Services and their Drivers of Change Under Human-Dominated Pressure in the Hilly Areas of Bandarban District, Bangladesh

**Group:** Biological Science **Project ID:** SRG-221145

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## Abstract

Bandarban hill district is one of the main hilly areas of Bangladesh which is surrounded by forests and enriched with ecological resources and biodiversity. Ecosystems sustain, generate for, regulate, and offer cultural services that are essential to human well-being. Hence, it is important to reconnoiter the current situation of forests' ecosystem services available in the Bandarban hill district with the local farmers' realization of the well-being they receive from those ecosystem services as well as identifying the driving factors responsible to ecosystem service changes of the local forest areas. Through the present study, it was investigated the aforementioned things in two upazila, namely, Lama and Alikadam of Bandarban district. To investigate these, 240 respondents were interviewed through the help of a semi structured interview schedule. The findings of the study suggested that 28 ecosystem services were identified and six out of these were showing increasing trend including crop and vegetable cultivation and other 22 were following decreased. The respondents received improve to moderate services from those 28 ecosystem services which were exhibited through their perception as 68% of them had moderate to improve perception towards ecosystem services. According to the study's findings, respondents who had higher levels of education, family income, agricultural training, residential distance from forests, and income from ecosystem services had better perceptions of ecosystem services and human well-being. The top three drivers of ecosystem services change were the agricultural expansion through monoculture, unlawful activities of forest officials and over exploitation of forest resources. Due to the effects of these drivers, the local peoples' life styles were also affected. Because the residents' perceptions would make them aware of the need to conserve the forest environment, policymakers should base future decisions on the findings of this study.

**Keywords**: Ecosystem services, drivers of change, forest, Bandarban.

# Farmers' Perception towards Good Agricultural Practices in Aromatic Rice Production in Dinajpur District

**Group:** Biological Science **Project ID:** SRG-221146

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## Abstract

Aromatic rice cultivation in Dinajpur faces challenges, including declining soil fertility, environmental sustainability issues, and increasing pest and disease pressures. These challenges underscore the urgent need for farmers to adopt Good Agricultural Practices (GAPs) to enhance productivity, minimize environmental impact, and improve the quality of their aromatic rice produce. This study aims to assess farmers' perceptions and adoption of GAPs in aromatic rice cultivation. Primary data were collected from 120 respondents through face-to-face interviews using a structured interview schedule. The findings revealed that a significant proportion of respondents exhibit moderate to high levels of knowledge, maintain favorable attitudes, and have developed positive perceptions about GAPs. The perceptions of respondents regarding the environmental and quality aspects of GAPs vary, with some practices, such as rice storage, enjoying widespread recognition. However, there are discrepancies in perceptions, particularly concerning soil moisture conservation. Among the aromatic rice varieties, Chinigura (BRRI Dhan 34) has gained popularity in Dinajpur, surpassing Kalojeera and Kataribhogh, which had lower yields. The majority of farmers adhered to twenty selected GAPs, including the use of improved varieties, appropriate land preparation, timely sowing, and drainage facilities. However, some farmers paid inadequate attention to GAPs specific to aromatic rice cultivation, such as sparse sowing, ideal spacing, post-harvest management, record-keeping, and the use of rice harvesters. The adoption of GAPs among farmers was influenced by their access to information sources and the size of their farms. The study identifies notable challenges faced by farmers, such as operating combined harvesters on fragmented land, issues related to the size of straw after threshing, insufficient infrastructure for threshing and drying, and inadequate storage space. The findings underscore the need for tailored interventions and strategies to promote the adoption of GAPs and mitigate the challenges faced by farmers, ensuring the continued success of aromatic rice production in Dinajpur.

**Keywords**: Aromatic rice, good agricultural practices, adoption, sustainable agriculture.

# Household Vulnerability and Agricultural Adaptation Strategies under Changing Climate Conditions: The Case of the Lower Teesta River Basin of Bangladesh

**Group:** Biological Science **Project ID:** SRG-221147

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## Abstract

Teesta basin has been subject to regular severe weather events due to its position in the foothills of Himalayan mountains, which has an impact on rural people's livelihoods. Therefore, the present study was undertaken to explore livelihood vulnerability and adaptation practices to climate change in the Teesta river basin area of Bangladesh. A total of 180 respondents were selected as a sample for the study following a proportionate random sampling technique. Household vulnerability to climate change was measured in terms of "exposure", "sensitivity", and "adaptive capacity". The results from the meteorological data reveal that the overall variation of observed maximum temperature and minimum temperature showed an increasing trend, while rainfall and flooding showed a decreasing trend in the study area. The vast majority of respondents were of the opinion that temperature, hotness, and drought are increasing while rainfall and floods are decreasing with time in the study area over the past 10–20 years. The results of the livelihood vulnerable index (LVI) score suggested that Dimla upazila is more vulnerable in terms of adaptation efficacy, food and agriculture, and health, while Hatibandha is more vulnerable in terms of extreme climate events and self-efficacy for adaptation practices. Teesta river basin area households in Hatibandha upazila were more exposed to and sensitive to climate change and climate variability. Consequently, Hatibandha district's households were the most vulnerable to lower adaptation capacity. Overall, LVI indicates the communities of Hatibandha upazila are more vulnerable compared to Dimla upazila. The majority of the respondents were found to use "irrigation water under Teesta barrage project", "homestead gardening on elevated land", and "community-based maize cultivation" as adaptation strategies to climate change for crop production. These findings enable policymakers to formulate effective strategies to minimize vulnerability and enhance resilience by improving the livelihoods of vulnerable households in Bangladesh.

**Keywords**: Vulnerability, agriculture, climate change, adaptation.

# Exploring Agricultural Drought in Bangladesh using Google Earth Engine

**Group:** Biological Science **Project ID:** SRG-221148

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## Abstract

Drought is a very complex natural hazard and has a negative impact on the ecosystem. In this context, the present study made an effort to assess and analyses drought characteristics. Based on selected climate parameters of twenty-eight weather stations from 1989 to 2018, Hierarchical Cluster Analysis (HCA) was carried out. Among all those stations two stations, namely Rajshahi and Srimangal, were selected for further analysis based on the HCA cluster. Two drought indices, i.e., Standardized Precipitation Evapotranspiration Index (SPEI) based on meteorological data and MODIS derive Standardized Vegetation Index (SVI), characterized drought. We identified drought occurrence and its dynamics with three-lags, i.e., SPEI-1, SPEI -6, and SPEI -12 in three crop growing seasons, i.e., Kharif I (March-June), Kharif II (July- October), and Rabi (November-February). The results demonstrated that northwest regions were drought-prone. Rajshahi was in more drought conditions than other regions both annually and in all seasons, and Srimangal was wetter than others in Rabi season over the study period. Overall results confirmed that drought frequency, severity, and intensity were increased for SPEI-1, SPEI-6, and SPEI-12 in the last twelve years in the Rajshahi region annually. A similar scenario also prevailed for Rabi season in Rajshahi. In Srimangal, the frequency of SPEI-1 was more all over the study period with moderate intensity while SPEI-6 and SPEI -12 were less last twelve years than previous years considering year-round. The frequency of SPEI-6 and SPEI-12 in the Rabi season were found more in Srimangal than Rajshahi region. The results also demonstrated that SPEI-1 and SVI had a well agreement for both Srimangal and Rajshahi regions. This study highlights the potential of drought monitoring using remote sensing and GIS technique especially on the use of SPEI and SVI in Bangladesh for long term drought evaluation.

**Keywords**: Drought stress, remote sensing, cloud processing, landsat, vegetation index.

# Guava-Vegetables-Species Agroforestry System: A Sustainable Crop Production System for Food, Nutrition and Income Security

**Group:** Biological Science **Project ID:** SRG-221149

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## Abstract

Guava orchards are popular for their commercial production, which has an immense scope to integrate different vegetable and spice crops in a befitting manner. The aim is to evaluate the high-value seasonal crops in guava orchards, which can increase overall production and ensure the food, nutrition, and income security status of the farmers. A guava orchard was transformed into an agroforestry system where different vegetables (broccoli and tomato), spices/companion plants (coriander and marigold) were tested under a well-established guava orchard from September 2022 to April 2023. Land use and economic performances of agroforestry and sole systems were evaluated. Results demonstrate that the yield of guava increased up to 21.58%, while the yields of broccoli, tomato, and coriander decreased by 18.16, 22.14 and 33.06%, respectively, in agroforestry systems as compared to sole cropping systems. Compared to open fields, agroforestry resulted in the average reduction of Photosynthetically Active Radiation (PAR) by 37.11% which is the cause of yield reduction. However, soil moisture percentage is considerably higher in agroforestry systems. Despite, some adverse effects on yield parameters of understory crops, economic analysis in terms of benefit-cost ratio (BCR) was higher in the case of guava, broccoli, coriander, and marigold in agroforestry than in respective sole fields. The land equivalent ratio (LER) was higher in all agroforestry systems. Since, fruit trees, seasonal vegetables, and spices/companion plants were grown on a same land, they increased overall production with a diversity of foods and nutrition. Incorporation of vegetables and spices in guava orchards will be a latent solution to restore our farming land providing viable options to augment overall production, nutritional meetup, and income generation.

**Keywords**: Guava orchard, overall production, cost-benefit ratio, land equivalent ratio, sole crop.

# Sequential Extraction with Multivariate Apportionment of Toxic Metals from Soil and its Transfer to Vegetables in a Multi-Industrial District of Bangladesh

**Group:** Biological Science **Project ID:** SRG-221150

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## Abstract

The study focused on examining heavy metal contamination (chromium, copper, cadmium, lead, and nickel) in the soil of Kashimpur industrial area, Gazipur district, Bangladesh. This region faces potential environmental pollution due to various industries discharging wastewater into nearby irrigation canals, which could contaminate the soil. The primary objective of this study was to enhance the ecological risk assessment by exploring various methodologies. Soil samples were collected from various sites that received wastewater from different disposal systems. In sample preparation, soils were digested using a wet digestion method (US EPA 3050B method) and heavy metal concentration analyzed using an Atomic Absorption Spectrophotometer. The assessment using the geoaccumulation index (Igeo) indicated that the study areas ranged from uncontaminated to moderately contaminated, particularly concerning lead concentration. The pollution load index (PLI) results suggested slight contamination in the study areas. Moreover, based on the potential ecological risk index (RI), the Kashimpur area posed a moderate risk to the environment. In summary, the study's findings clearly indicated that the heavy metal contamination in the study areas was relatively low, qualifying as slightly contaminated. The potential risk to the environment was also deemed moderate, signifying the need for monitoring and remedial measures to mitigate any adverse impacts.

**Keywords**: Heavy metal, contamination, permissible level, load index, risk index.

# Yield Enhancement of Local Aman Rice under Late Transplanting Condition

**Group:** Biological Science **Project ID:** SRG-221151

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## Abstract

Field experiment was conducted at Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur during 2022-23 to develop high yielding and premium quality rice variety for Aman season under late transplanting condition. Hybridization technique was employed and first cross was made between premium quality modern variety BUdhan 1 and local variety Gainja from where 23 rice progenies (BU-R-G1, BU-R-G2, BU-R-G3, BU-R-G4, BU-R-G5, BU-R-G6, BU-R-G7, BU-R-G8, BU-R-G9, BU-R-G10, BU-R-G11, BU-R-G12, BU-R-G13, BU-R-G14, BU-R-G15, BU-R-G16, BU-R-G17, BU-R-G18, BU-R-G19, BU-R-G20, BU-R-G21, BU-R-G22, and BU-R-G23) were selected for first year experiment. Based on first year results, nine promising rice genotypes viz. BU-R-G3, BU-R-G4, BU-R-G10, BU-R-G14, BU-R-G16, BU-R-G20, BU-R-G21, BU-R-G22, and BU-R-G23 were compared with local variety Gainja in second year. In third year, five selected genotypes (BU-R-G3, BU-R-G10, BU-R-G20, BU-R-G21 and BU-R-G22) were evaluated. The parent Gainja was also used as check variety for the experiment. Results showed the distinct variability in different plant characteristics of new rice progenies. The tallest plant (95.8 cm) was found in BU-R-G21 and it was the shortest (79.3 cm) in BU-R-G10 rice progeny. The highest number of panicles per plant (30.18) was recorded in BU-R-G10 although it was similar to BU-R-G20 rice progeny. Similarly, number of filled spikelets per panicle, unfilled spikelets per panicle, total spikelets per panicle and seed size varied widely over the rice progenies. Considering yield, the highest seed yield (37.89 g plant$^{-1}$) was recorded from BU-R-G10 for its better yield contributing characters specially the number of panicles per plant. Other four promising rice progenies viz. viz. BU-R-G3, BU-R-G20, BU-R-G21 and BU-R-G22 also produced comparable yield over the check variety. These five promising rice progenies need further evaluation in next Aman season to compare yield performance with modern varieties under late transplanting condition.

**Keywords**: High yield, premium quality, late Aman.

# Preliminary and Multilocation Yield Trail of Advanced Lines of Aman Rice

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## Abstract

In Bangladesh, the use of numerous landraces *Aman* rice, mostly characterized by long durations, has been impacting the timely establishment of winter crops and overall system productivity. Recognizing the need for shorter duration *Aman* rice varieties, experiments were undertaken to assess the growth performance, early maturity, and high yield potential of *Aman* rice at Gazipur and Rangpur region in Bangladesh. We employed three popular *Aman* varieties, namely BRRI dhan89, BRRI dhan92, BRRI dhan96, along with two advanced lines, BU-R-Acc-06 and BU-R-Acc-07, as experimental materials. The experiments were conducted using a randomized complete block design with three replications. The results revealed significant variations among the *Aman* rice genotypes in terms of crop growth performance, crop duration, yield and yield attributes such as plant height, leaf area index, total dry matter, crop growth rate, relative growth rate, net assimilation rate, dry matter translocation, days to maturity, grain yield and quality at both locations. For instance, BU-R-Acc-06 exhibited the highest number of total tillers hill$^{-1}$ in Gazipur while BRRI dhan96 showed the highest in Rangpur. Similarly, BU-R-Acc-06 had the longest panicle length in Gazipur, while BRRI dhan92 led in Rangpur. Notably, BU-R-Acc-06 demonstrated shorter days to maturity and less time to 50% flowering compared to other genotypes, along with the highest grain yield and harvest index at both locations. Therefore, considering the stability of yield and desired short duration characteristics, BU-R-Acc-06 emerges as a preferable choice for *Aman* rice cultivation.

**Keywords**: Landraces, crop duration, grain, quality, harvest index.

# Selection, Validation and Elucidation of Physiological Mechanisms of Waterlogging Tolerant Short Duration Dwarf Soybean Genotypes

**Group:** Biological Science **Project ID:** SRG-221153

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## Abstract

Soybean genotypes BD2334, G00164, BD2331 and G00060 were found fairly waterlogging (WL) tolerant in the previous experiments supported by MoST. The present study was initiated for evaluating their physiological changes due to WL treatment. BU soybean-1 was the check variety. The genotypes were submerged (8cm) for 5 days at flowering stage following a split plot design with three replications. Grain yield and different physiological characters were affected by waterlogging (WL). Under control conditions the highest grain yield (5.8 t/ha) was found in both BD2334 and G00164. Under WL the highest yield (3.03 t/ha) was found in BD2334 followed by G00164, while BU Soybean-1 had the lowest yield (2.03 t/ha). The higher Chl a content was found in G00060 under WL. Chl b content also decreased due to WL but there were no significant changes among the genotypes. Higher amount of total Chl was found in G00060, followed by BD2331 under WL. BD2334 had the highest Pn rate in both waterlogged and controlled conditions. The lowest Pn reduction rate was in BD2334 (10%), followed by BD2331 (13%), while the highest reduction was in G00060 (44%) and G00164 (35%). After WL the greatest reduction in stomatal conductance was in BD2334 (75%) and G00060 (74%), while the smallest was in BU Soybean-1 (10%). After WL, BD2334 showed the highest decrease in Tr rate. All the five genotypes exhibited a significant increase in proline content under WL stress. The increase rate of proline content was the maximum in G000164 (116%) and the lowest (35%) was in BD2334. BU Soybean-1 had the highest increase in MDA (20%), while G00164 had the lowest (0.5%). Consiering the higher grain yield and changes in physiological parameters due to WL the genotypes BD2334 and G00164 may be validated in the coastal region of Bangladesh in the farmers' field.

**Keywords**: *Glycine max*, flooding, physiology, yield.

# Agronomic Management Strategy to Enhance Growth, Survival and Productivity of Rice under Submergence Condition

**Group:** Biological Science **Project ID:** SRG-221154

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## Abstract

Aman rice faces varying depth and duration of submergence through the growing season depending on physiography and distribution of monsoon rains. An experiment was conducted to determine the effect of crop establishment method on survival, growth and yield performance of rice under submergence. The treatments of the trial comprised of three factors, viz. factor A (crop establishment method): direct seeding (DS) and transplanting (TP); factor B (rice varieties): AZ7006 and BU dhan1; and factor C (submergence): three weeks of submergence (3 WS) and control. The experiment was laid out in a randomized complete block design with three replications. The results revealed that the crop establishment method showed a significant effect of plant survival, lodging, morphological, and yield and yield attributes of rice grown under submergence condition. About 98% plants of AZ7006 survived under 3 WS due to DS, while 70% in case of TP method. Similarly, the percent plant lodging of AZ7006 was 20 and 80% in case of DS and TP, respectively. All the plants of BU dhan1 lodged and died under both DS and TP due to 3 WS. Under 3 WS, plant height, root and shoot growth, chlorophyll content of AZ7007 was significantly higher under DS than TP method. AZ7006 yielded 4.8 t $ha^{-1}$ grain under control, while 4.1 and 2.9 t $ha^{-1}$ under 3 WS in case of DS and TP method, respectively. This result indicated that AZ7006 was capable to produce 1.2 t $ha^{-1}$ more yield under 3 WS when it was cultivated following DS method. Further, the yield loss of AZ7006 was 15 and 39% under DS and TP method, respectively, while 100% yield loss was obvious in case of BU dhan1. under both crop establishment method. As this study disclosed that AZ7006 can tolerate 3 WS stress when it is grown following DS method, further study is needed to confirm the finding.

**Keywords**: Chlorophyll content, direct seeding, growth, survival, tolerant, transplanting, yield.

# Ecophysiology of Iron Toxicity Tolerance in Rice

**Group:** Biological Science **Project ID:** SRG-221155

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## Abstract

Iron toxicity is one of the abiotic stresses impacting rice production in most of the rice-growing countries. In Bangladesh, no studies have yet been conducted on the performance of rice under iron-excess conditions. The accumulation of excess iron in irrigated soil is a threat to rice production. The study was carried out at the Research field of Bangabandhu Sheikh Mujibur Rahman Agricultural University from December 18, 2022, to May 20, 2023, under semi-controlled conditions with a view to assess iron toxicity tolerance in rice genotypes. The experiment was set up in a completely randomized design with a factorial combination of 18 rice genotypes and three Fe levels: 0 (control), 600, and 1200 mg $L^{-1}$. It reveals that increasing Fe content resulted in reduced plant height, fewer tillers and filled grains, smaller panicles, greater unfilled grains, and a lower SPAD chlorophyll index. Plants subjected to iron at 600 and 1200 mg $L^{-1}$ reduced grain yield by 31.15% and 46.28%, respectively. K-means cluster analysis and discriminant function analysis (DFA) were used to classify genotypes for Fe toxicity tolerance. Cluster 1 and Cluster 2 each had seven genotypes, followed by Cluster 3 and Cluster 4 with two genotypes each. Cluster 2 genotypes (BU Advanced lines 2, 5, 8, 9, 12, 13 and BRRI Dhan 28) performed the best, with the highest relative grain yield (0.65) with enormous effective tillers but few unfilled grains. Cluster 3 genotypes were the worst affected, with the lowest relative values in all plant traits. DFA revealed that function 1 explained 90.3% of total variation and function 2 explained 9.7% of total variance for Fe-toxicity tolerance. Unfilled grain production played the dominant role in explaining the iron toxicity tolerance in rice. However, further studies using more rice varieties are needed for confirming the findings.

**Keywords**: Iron toxicity, genetic variation, clustering, grain yield, rice.

# Assessment of Sesame Genotypes for Salt Tolerance Based on Agronomic and Physiological Markers

**Group:** Biological Science **Project ID:** SRG-221156

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## Abstract

Salt stress is an important environmental limiting factor. Sesame (*Sesamum indicum*) is an important oilseed crop in Bangladesh; however, its phenotypic and physiological response under salinity is poorly explored. For this purpose, six genotypesBD-6980, BD-7009, BD-7011, BD-6994, BD-6983 and BD-6999 (these six genotypes were screened out from 86 genotypes on the basis of % relative germination under10 dS/m salinity) were grown in pot and treated with 7.5 dS/m saline water in whole growing season. Then their phenotypic responses and physiological studies were carried out. Higher leaf water content, proline content, higher photosynthesis and transpiration rate, higher yield and less degradation of leaf chlorophyll content was observed in the genotype BD-7011. The results depicted that plant height, number of leaf and dry matter accumulation were less effected in BD-7011. These results suggest the potential tolerance of BD-7011genotype against salt stress with low detrimental effects on growth, physiological traits and yield of sesame. The findings of the present study also suggest that the lower reduction of plant height, chlorophyll content and higher accumulation of proline content, leaf water content and higher photosynthetic rate could serve as the efficient markers for understanding the defense mechanisms of sesame under the conditions of salt stress.

**Keywords**: Abiotic stress, physiological markers, oil seed.

# Advanced Coating Technologies to Improve Storage Potential of Fruits and Vegetables of Bangladesh

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## Abstract

Fruits are prone to weight loss, rapid ethylene production, peel shrinkage, microbial infection, and pulp liquefaction during post-harvest storage. The current study was carried out to find out a solution to facilitate the storage potential of mango fruits during post-harvest transport and storage. Green, unripe, mature mangoes were collected from local shop and treated with novel coating material, Starch-Zinc-Oxide (SZO) nanoparticles (NPs') at 0%, 0.2%, 0.4% and 0.6% range. Green synthesizing methods were developed and employed to produce the NPs' coating. Treated mango fruits were stored at 4 °C for 42 days, and weight loss, reducing sugar, total soluble solids (TSS), titrable acidity, color differences, and enzyme activities were assessed periodically. The results showed that 0.6% SZO coating significantly reduced the weight loss of mango fruit during storage. A 0.2% NPs' coating on the studied fruit resulted in comparatively higher weight loss, however, it better maintained total acid content, TSS, and delayed the discoloration. Compare to all the treatments, a 0.2% NPs' coating resulted in significantly uniform green color ($L^*$ 42,36, $a^*$ 7,52, $b^*$ 45.21) and reduced pectin methylesterase (PME) enzyme activity of 0.08 $mmolL^{-1}min^{-1}$ after 42 days of storage. Similar to PME, a significantly lower polyphenol oxidase (PPO) and peroxidase (POD) enzyme activity was recorded as 0.2 and 0.22 Abs/min respectively. Lower enzyme activity implies to better preserved cell membrane integrity, better texture, slower metabolic processes and ultimately increased shelf life. The findings of the study are promising and therefore, this novel treatment can be applied commercially to reduce post-harvest losses of fruits. This research provides interesting results for SZO NPs' application in fruits as advanced coating for preserving quality and enhancing shelf life.

**Keywords**: Nano particles, advanced coatings, enzyme activities, color, physiology.

# Histological and Microbiological Evaluation of Surgical Wound Healing in Cat

**Group:** Biological Science **Project ID:** SRG-221158

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## Abstract

In Bangladesh, the number of surgical procedures for cats, including spaying and neutering, has been on the rise. However, one of the prevalent complications following these surgeries is postoperative infection, which poses a global nosocomial challenge. Postoperative infections result in increased morbidity and financial burdens due to a lack of proper healthcare facilities and postoperative care. This research examines how the absence of proper postoperative care contributes to postoperative infections in cats, exploring their impact on wound healing. The research categorizes postoperative cat care into three levels: intensive care, semi-intensive care, and without care. It investigates the effects of these care systems on tissue responses and the incidence of postoperative infections. The methodology involved an experimental study using 18 native cats, considering histological and microbiological evaluations. The findings underscore the significance of intensive postoperative care, emphasizing measures such as e-collars and bandages to prevent self-inflicted trauma and promote optimal wound healing. The results reveal a stark contrast between cats receiving intensive care and those in semi-intensive or without care groups, with the latter experiencing substantial wound damage, purulent discharges, traumatized skin, an absence of healing with persistent open wounds. Histological evaluation for wound healing was feasible only in the intensive care group, where proper wound recovery was observed within 30 days. In contrast, the semi-intensive and no-care groups displayed evidence of mixed microbial infections on the surgically wounded areas, postoperatively. In conclusion, intensive care, backed by protective measures, is crucial in ensuring successful wound recovery. Preventing licking and scratching is imperative to minimize complications and support the well-being of cats. These insights hold valuable implications for cat owners and veterinary professionals in Bangladesh and beyond, contributing to the broader understanding of cat care and surgical outcomes.

**Keywords**: Cat surgery, postoperative infection, wound healing, nosocomial challenge.

# Effect of Moringa Extract on Productive and Reproductive Performance of Duck

**Group:** Biological Science **Project ID:** SRG-221159

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## Abstract

Moringa is a medicinal plant with numerous nutritional virtues and available in South Asian country. The project was conducted to reveal the effect of Moringa leaf powder (MLP) in duck ration. The experiment was carried out with different percentages of MLP (0%, 2%, 4% and 6%) with the main diet of Pekin duck. Different treatment groups were used in this research; $T_1$ (0% MLP) as control, $T_2$ (2% MLP), $T_3$ (4% MLP) and $T_4$ (6% MLP) were treatment groups. Total 120 ducks were used in this study dividing into four equal groups each have 25 ducks and 5 drakes. Different growth parameters, carcass quality, blood parameters and reproductive parameters of duck we considered for examination. The result showed that the treatment groups significantly affect the tested parameters compared to control group, and interestingly among the treatments groups $T_3$ is the best in all parameters. Therefore, from this study it is suggested that 4% MLP can be used in duck ration to enhance productive and reproductive profile of duck.

**Keywords**: Moringa, growth parameter, blood parameter, carcass quality, reproductive parameter.

# Assessment of Toxic Heavy Metal and Trace Mineral in Commercial Poultry Feed and Meat Available at Gazipur District

**Group:** Biological Science **Project ID:** SRG-221160

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## Abstract

The risk of heavy metal contamination in meat is of great concern for both food safety and human health because of the toxic nature. This study was aimed to assess the heavy metals and trace mineral concentration in commercial poultry feed and meat available at Gazipur district. Different spots of Gazipur district were selected and live broiler, feed, water, and poultry dropping were collected from the same places and time. After slaughtered the targeted samples were collected from the dressed carcass and all samples were stored for further analysis. The results of the present study indicated that the concentration of heavy metal and trace minerals (Pb, Cd, Ni, Cr, Zn, Fe, Ca, Mg, Na and K) are present in different parts of meat. Very few amount of heavy metals and trace mineral were present in Dinging Water. However, all feeds were contained more or less amount of that elements. Higher amount of feed heavy metal intake influences the higher concentration of these metals. Thigh meat had low heavy metal and trace mineral concentration compare to others parts of broiler. Breast meat also contain lower concentration of heavy metal and trace minerals than others, except thigh muscle. Liver, bone and poultry dropping were contained more higher concentration of selected all heavy metals and trace minerals compared to thigh and breast muscle. It is concerning and need to further study for produce safe and healthy food for human and awareness about health hazard.

**Keywords**: Meat, liver, bone, poultry dropping, feed.

# Development of Ant Based Mutualistic and Antagonistic Biocontrol Model Against Bean Aphid

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## Abstract

Bean aphid is considered as one of the major insect pests for their enormous capacity of sucking cell saps and transmitting viruses. In Bangladesh, despite using a wide range of insecticides, no effective control has been issued, rather, leading to resurgence and secondary pest outbreaks. Ants are known to establish antagonistic and mutualistic interactions with honeydew-producing sucking pests and their potentiality varied with presence of different co-occurring herbivores. The aim of this project was to infer the role that such interactions play in the population dynamics of ants, ladybird beetles, and aphids in country beans toward developing an effective biocontrol model. The experiments were conducted in the Department of Entomology of BSMRAU. Molecular characterization of aphid was done using *Cytochrome oxidase subunit* - 1 gene of *mtDNA along with the* taxonomy study of ants. Seven treatments including, periodic culture and mass release of ladybird beetle (LBB), inducing ants and aphids with different ranges of temperature and their effects on chlorophyll contents in cotton leaves were analyzed. Two subspecies of bean aphid, namely, *Aphis fabae fabae* and *Aphis fabae cirsiiacanthoidis* with GenBank accession OQ892174- OQ892178 and OQ892199-OQ89220 were revealed which is first-ever molecular identification of aphid in Bangladesh. Among identified ants, *Crematogaster anatris* and *Monomorium libanicum* were found effective in both natural and induced LBB conditions. The minimum leaf chlorophyll was found at $25^0$C, which also coincided with the maximum abundance of aphid signifying that the aphid infestation might have a considerable negative impact on the amount of leaf chlorophyll in presence of natural LBB and induced ants. A high abundance of LBB in the presence of *Crematogaster anatris* and *Monomorium libanicum* in 21-$23^0$C established a secured strategy to control the aphid population. These findings hold promise for the development of sustainable pest management practices in Bangladesh's country bean ecosystems.

**Keywords**: Molecular characterization, taxonomy, ecosystems, herbivores, management.

# Developing Sustainable Management Practices Against Brown Plant Hopper (BPH) of Rice in Barind Areas of Bangladesh

**Group:** Biological Science **Project ID:** SRG-221162

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## Abstract

Among the pests infesting rice, the brown planthopper (BPH), *Nilaparvata lugens* (Stal.) (Homoptera: Delphacidae) has gained major importance in several Asian countries including Bangladesh. Recently, planthoppers outbreaks have intensified across Asia resulting in heavy rice yield losses. The two field experiment was conducted with T. Aman and Boro rice in the farmer's field at Uttar Jahanpur of Dhamoirhat upazila under Noagaon district during July 2022 to June 2023 was laid out in a Randomized Complete Block Design (RCBD) with 3 replications. Plenum 50 WG (Pymetrozine 50%), Nitro 505 EC (Chlorpyrifos 50% + Cypermethrin 5%), Asataf 75 SP (Acephate 75%), Actara 25 WG (Thiamethoxam 25%), Imitaf 20 SL (Imidacloprid 20%) was applied @ recommended dose at 15 days interval. As the infestation of BPH was absent in early stage of the both T. Aman and Boro season, so there was no variation in festation at later stage of crop among the treated plots but there was significant variation with the treated and untreated plot. In both the season, the highest grain yield (t/ha), increase grain yield (%) over untreated control plot, marginal benefit cost ratio (MBCR) was found in Nitro 505 EC (3.70 ton, 35.53% and 5.92 in T. Aman season; 5.20 ton, 22.93% and 8.33 in Boro season, respectively) treated plot followed by Plenum 50 WG (3.62 ton, 32.60%, 5.40 in T. Aman season; 5.20 ton, 22.93% and 8.33 in Boro season).

**Keywords**: Monitoring, insect pests of rice, hopper burn, Nitro 505 EC.

# Bio-Intensive Integrated Pest Management of Brinjal Shoot and Fruit Borer

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## Abstract

Brinjal (*Solanum melongena*) plays a vital role in the food of Bangladeshi people, thus the production of brinjal in this country is quite high. However, the production of brinjal does not satisfy the whole demand of people owing to the severe infestation by *L. orbonalis*. In order to get maximum yield from the cultivation farmers rely on over and indiscriminate use of chemical insecticides. Due to the side effects of over and indiscriminate use of toxic insecticides, now the trend moves towards Bio-intensive Integrated Pest Management (BIPM). The present study was conducted to develop BIPM packages compared to farmer's practices and untreated control in controlling the *L. orbonalis.* The study evidenced the superiority of BIPM in all aspects viz., lesser shoot infestation (15.82 percent), greatest yield (17,170.22 kg/ha) and higher natural enemies activities (5.25 no./10plants), which was equivalent to untreated control. Besides the treatment BIPM proved its efficacy over farmer's practice and untreated control especially with high percent increase of yield (63.90%), percent reduction of shoot (64.01%), and fruit infestation (80.58%), and less percent reduction of natural enemies' population (8.70%). Apart from this the benefit cost ratio (BCR) ranked in the order of superiority as BIPM module (1:5.75), which was greater than the farmer practice (1:4.96) on brinjal.

**Keywords**: Brinjal; bio-intensive; efficacy; integrated management; *Leucinodes orbonalis*.

# Physiomorphic Characterization and Assessment of Pest Potential of Introduced Sweet Gourd Genotype for Development of Variety

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## Abstract

The present study was conducted during July 2022 to June 2023 in the field of the Department of Entomology, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur and Farmer's field at Tangail with sweet gourd genotype namely China line. The study investigated the abundance and infestation of red pumpkin beetle and fruit fly on the studied genotype. Results showed that the seasonal abundance and infestation rate of red pumpkin beetle revealed fluctuations. The highest abundance of the beetle was found in the 4$^{th}$ week of December at Gazipur and 2$^{nd}$ week January at Tangail. The mean abundance and infestation rate of the beetle in the two locations were statistically similar. The beetle showed the highest infestations at Gazipur and Tangail in first and second week of January, respectively. The seasonal fruit infestation rate of the fruit fly revealed fluctuations and the highest infestation rate was observed in the second week of February in both the locations. The mean infestation rate of the fruit fly in the two locations were statistically indifferent. The yield (ton/ha) of the sweet gourd was comparatively higher at Tangail but the results of the two locations were statistically similar.

**Keywords**: Abundance, fruit fly, red pumpkin beetle, infestation, yield.

# Determination of Antioxidant and Nutritional Variations in Lettuce Due to Soil and Soil-Less Cultivation

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## Abstract

Hydroponics is a technology for growing plants in nutrient solution with or without the use of an artificial medium. This is a soilless technique, which provides nutrient and water to plant with equal and higher yield compare to soil. In this study, we compared growth, yield, minerals and antioxidant content in lettuce grown in soil and soil-less hydroponic system. We also compared the performances of various substrates used in hydroponic system. In our first experiment, we used four treatments viz. $T_1$ = Recommended Chemical Fertilizers i.e. RCF; $T_2$ = RCF+3t/ha vermicompost i.e. RCF+VC; $T_3$ = RCF+3t/ha tricho-compost i.e. RCF+TC and $T_4$ = Soil-less hydroponic system i. e. Hydroponic System. While in the second experiment, we used five substrates as treatments in hydroponic cultivation of lettuce viz. $T_1$ = Coco-dust; $T_2$ = Brick-dust; $T_3$ = Fine sand; $T_4$ = Coarse sand and $T_5$ = Gravel. Both the experiments were conducted at RCB design and each treatment was replicated thrice. The data were analyzed statistically by the help of computer package MSTAT-C program. The mean differences of the treatments were determined by least significant difference (LSD) test. Results showed that the growth and yield of lettuce were higher in hydroponic cultivation technique than RCF cultivation. But all growth parameters and yield of lettuce in hydroponic cultivation technique were similar to RCF+VC and RCF+TC cultivation. Lettuce grown in hydroponic cultivation system had overall higher minerals, biochemical properties and antioxidant content in leaves. It also revealed that the coco dust, fine sand and coarse sand had higher growth, yield minerals, biochemical properties and antioxidant content in leaves of lettuce compare to lettuce grown in gravel and brick-dust. Therefore, we concluded that hydroponic system produced higher yield and high-quality lettuce and coco dust, fine sand and coarse sand performed better among the substrates.

**Keywords**: Soil-less cultivation, lettuce, yield and quality, nutrition, antioxidant.

# Identification of Metal Resistant Bacteria from an Urban River Influenced by Municipal and Industrial Wastes: Bioremediation Viewpoint

**Group:** Biological Science **Project ID:** SRG-221166

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## Abstract:

The urban river is influenced by municipal and industrial wastes. Therefore, a diverse range of pollutants including organic and inorganic adulterants prevailed in those rivers. In the research project, we studied the heavy metal content and microbial composition of the Turag River. The water quality parameters of selected locations were observed and found more or less similar during the same season, while varied in different seasons. The metal concentrations of water at different sampling points and bacterial composition were detected through AAS and conventional culture-dependent method respectively. The metal concentrations of water in the selected locations were lower than the defined toxic effect limit. However, the concentrations of metal in fish species were significantly higher than in water. The metal levels in fish also varied among the species and seasons. The concentration of Pb and Cr was greater than the permissible limit for human consumption. The target hazard quotient (THQ) was greater than for Pb and Cr in both dry and wet seasons for all the fish species examined. On the other hand, the hazard index (HI) was greater than the threshold value for all the fish species. At the same time, the river water is also contaminated by different pathogenic bacteria coming from municipal sewages. Aquatic organisms are the most affected organisms by the pollutants compounds and microbes. It is necessary to examine the urban and non-urban water thoroughly to know the pollution indices and their consequence in the aquatic ecosystem of Bangladesh in more detail in the future.

**Keywords**: Metalloids, microbes, municipal waste, river, hazard index, metal resistance bacteria.

# Identification of Areas with Suitability Index for Mariculture Species in the Middle Coast of Bangladesh

**Group:** Biological Science **Project ID:** SRG-221167

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## Abstract

The dynamic coastal ecosystems and coastal aquaculture supported the food, livelihoods and economy in Bangladesh. Variation in water quality affect the fish species diversity. Therefore, identifying the suitable water quality for mariculture is important. To assess the effects of environmental changes on mariculture activity in the middle coastal areas, water quality parameter was examined from July 2022 to June 2023. The value of suitability index for sea cucumber during the dry and wet seasons was > 0.6. The suitability index for scallop during the dry and wet seasons was >0.5. The suitability index for mussel was 0.5 during the dry and wet seasons. Clam is an important mariculture species and the suitability index value ranged from 0 to 0.3 during the dry and wet seasons. Sea bass is most popular species and the suitability index value was found 0.6~0.8 during the dry and wet seasons. Suitability index value for mud crab ranged from 0.5 to 0.76. Suitability index value for oyster species was 0.8. In Bangladesh, sea weed culture is less popular till now. The suitability index value ranged from 0.2 to 0.3. Similarly, shrimp (*P. monodon*) is an another economically viable species. Suitability index value ranged from 0.8 to 1 during the dry and wet seasons. However, coastal environment and estuaries are suitable for grey mullet species culture. Suitability index value for mariculture of grey mullet ranged from 0.7-0.8 during the dry and wet seasons. Sea weed, coral and clam are completely unsuitable for mariculture in the middle coastal zone and estuaries. According to suitability index value, although scallop, oyster, mussel and sea cumber are suitable for mariculture, the salinity is not suitable for these species for mariculture. Sea bass, shrimp, mullet and mud crab are suitable fish species for brackish water aquaculture in the middle coast.

**Keywords**: Coastal mariculture, water quality, brackish water, salinity, fish species.

# Effects of Dietary Probiotic Yeast and Medicinal Spices on Growth Performance, Feed Utilization and Disease Resistance in Freshwater Catfish Gulsa (*Mystus cavasius*)

**Group:** Biological Science **Project ID:** SRG-221168

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## Abstract

The present study was undertaken to evaluate the effects of dietary probiotic yeast and medicinal spices on growth performance, feed utilization and disease resistance in freshwater catfish gulsa (*Mystus cavasius*) against the pathogenic bacteria *Aeromonus hydrophila.* In 1st experiment, fish (1.2±0.07 g) were fed with experimental diet, containing black cumin powder (BCP) 10g/kg feed, black cumin extract (BCE) 3g/kg feed and control as commercial feed for 90 days culture period. In 2nd experiment, fish were fed with experimental diet, containing 1 g yeast + 3g BCE/kg feed ($T_1$); 1 g yeast + 3g black mustard seed extract (BME)/kg feed ($T_2$); 1 g yeast +1.5 g BCE +1.5g BME/kg feed ($T_3$) and control ($T_4$) for 90 days. After trail, 10 fish of each treatment were challenged by pathogenic bacteria *A. hydrophila*, by intraperitoneal injection and kept under observation for 7 days to record clinical signs and mortality rate in daily. The growth parameters (survival rate, weight gain, specific growth rate and protein efficiency ratio) were significantly ($P<0.05$) increased in BCE and BCP diets fed fish compared with control in 1st experiment. Feed conversion ratio was significantly ($P<0.05$) decreased in BCE treatment. The red blood cells, white blood cells, hemoglobin, hematocrit, mean corpuscular hemoglobin levels and immunoglobulin M (IgM) of *M. cavasius* rose when fish were fed BCE diet. The total mortality of fish was decreased in BCE when challenged by *A. hydrophila.* In experiment 2, the body weight, and specific growth rate were higher in $T_1$ than others. The RBC, WBC, hemoglobin, hematocrit, mean corpuscular hemoglobin levels and immunoglobulin M (IgM) of *M. cavasius* were the highest in $T_1$. The total mortality was the lowest in $T_1$ after challenged test. These findings suggest that black cumin extract with yeast supplement has positive effects on the growth and immune system of *M. cavasius*.

**Keywords**: Gulsha, black cumin, black mustard, yeast, immunity.

# Detection and Identification of Antibiotic Resistance Genes (ARGs) from Commercial Indian Major Carp (*Labeo rohita*) Aquaculture System Across Bangladesh

**Group:** Biological Science **Project ID:** SRG-221169

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## Abstract

The antibiotic resistance genes as emerging pollutants are of continued worry for human wellbeing. Antibiotics applied in aquaculture have stimulated the development and spread of ARGs. This study investigated the prevalence and diversity of ARGs in Indian Major Carp (*Labeo rohita*) commercial aquaculture ponds from four regions of Bangladesh using high-throughput qPCR ARG chip. A total of 140 ARGs and 10 MGEs were detected across all samples of which 62 were shared between all regions. The multidrug resistance genes were the most frequently encountered ARGs followed by b-lactam, aminoglycoside, tetracycline, and MLSB. According to the Adonis test, ARGs composition displayed a biogeographical pattern that could be separated based on the pond regions ($R2=0.34$, $p<0.001$), and further supported by a significant distance decay relationship between the ARG compositions. Redundancy analysis revealed that 61.74% of the variance in the ARG profile could be attributed to the feed-type/location of the ponds, along with MGEs and pH. The abundance of clinical intI-1 integron significantly correlated with several classes of ARGs, including MLSB, multidrug, pyrazinamide, sulfa, and vancomycin. The strong correlations between the MGEs and ARGs indicated that the ARGs might be located on MGEs, leading to a potential for HGT of ARGs. Ponds managed by Bangladesh Agricultural University had the lowest abundance and diversity of ARGs, indicating that proper management has a positive influence on the prevalence of antibiotic resistance. Our results indicate that ARGs are well spread in Indian Major Carp commercial aquaculture in Bangladesh and suggest risk for environmental ARG dissemination via horizontal gene transfer.

**Keywords**: Antibiotic resistance, qPCR, water quality, rohu, aquaculture.

# Effects of Chitosan Coating Enriched with Water Lily Extracts on the Quality and Shelf Life of Refrigerated Bighead Carp (*Hypophthalmichthys nobilis*) Fillets

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## Abstract

Considering the adverse effects of synthetic preservatives, plant-based natural extracts and chitosan are utmost interest worldwide because of their non-toxicity, antioxidative and antimicrobial activity. Effects of chitosan (CH) coating enriched with water lily extracts (WLE) on the quality and shelf life of bighead carp (*Hypophthalmichthys nobilis*) fillets during refrigerated storage at 4±1°C were evaluated. There were five treatment groups *viz*., $T_1$ (control: distilled water), $T_2$ (1.0% (w/v) CH), $T_3$ (1.0% (w/v) CH + 0.5% (w/v) WLE), $T_4$ (1.0% (w/v) CH + 1.0% (w/v) WLE), and $T_5$ (1.0% (w/v) CH + 1.5% (w/v) WLE). The chemical, bacteriological and sensory evaluation were performed every 4 days' interval to determine the shelf life of control and treated fish fillets. Significantly ($P < 0.05$) the lowest peroxide value, free fatty acid, and total volatile basic nitrogen values were observed in $T_4$ than those of $T_2$, $T_3$ and $T_5$ at 16 days of storage. However, comparatively lower thiobarbituric acid reactive substances were observed in $T_4$ than other treated fish fillets at 16 days of storage time. Significant ($P < 0.05$) reduction in bacterial counts (aerobic plate count, Enterobacteriaceae, and *Staphylococcus* count) were recorded in $T_4$ than $T_2$, $T_3$ and $T_5$ at 16 days of storage. However, $H_2S$-producing bacteria and psychrotropic bacteria count were comparatively lower in $T_4$ than other treated fillets at 16 days of storage. Chitosan enriched with WLE (1.0%) extracts-treated fillets showed better sensory characteristics than other treated and control fillets. Result of this study demonstrated that chitosan enriched with WLE (1.0%) extend the shelf life for 12 days longer than control fillets in refrigerated condition.

**Keywords**: Chitosan, water lily extracts, bighead carp fillets, shelf life, sensory evaluation.

# Effects of Java Plum (*Syzygium cumini*) Seed Powder Supplemented Diets on the Hematological Profile, Antioxidants and Immune Response of *Barbonymous Gonionotus*

**Group:** Biological Science **Project ID:** SRG-221171

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## Abstract

The study was aimed to investigate the effects of Java plum seed powder formulated feeds on the hematology, antioxidant activity and immune response of Juvenile *Barbonymous gonionotus* from 2022 to 2023 in the Department of Genetics and Fish Breeding, Bangabandhu Sheikh Mujibur Rahman Agricultural University. A total of 360 (an average 20.12 ± 0.47g) juvenile of *B. gonionotus* were collected from the private Fish Hatchery and stocked in 12 tanks (300 L of each). Each experiment was designed into four treatments: control (0 g seed powder/kg feed), $T_1$ (500 mg seed powder/kg feed), $T_2$ (1000 mg seed powder/kg feed), and $T_3$ (1500 mg seed powder/kg feed) and each having three replicates according to completely randomized designed. The stocking density was maintained at 30 fish/tank. The fish were fed (5% of body weight for juvenile fish) with formulated feed which contained 37% protein. The java plum seed powder-treated diets significantly improved the hematological parameters termed as RBC, WBC, cholesterol level, platelet level, hemoglobin level and PCV (%) compared to the control group. On the other hand, the java plum seed powder-treated diets significantly reduced the glucose level and triglyceride level in the blood compared to the control. The java plum seed powder-treated diet had significant effects on the immunological parameters such as white blood cell (WBC), lymphocytes, neutrophils, monocytes, immunoglobulin (IgM), and lysozyme level, compared to the untreated control. Similarly, Java plum seed powder treated diets significantly improved the antioxidants such as total phenolic contents and total flavonoid contents compared to the control. Taken together, our results suggest that the application of Java plum seed powder at a dose of 1 g $kg^{-1}$ feed produced the highest benefit to treated *B. gonionotus* indicating its potential for safe use in aquaculture.

**Keywords:** Java plum, seed powder, hematology, antioxidants, immunology.

# Severe Environmental Thermal-Mediated Changes in Stress Responses, Acetylcholinesterase, and Immune Responses of Kalbasu *Labeo calbasu*

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## Abstract

Extreme weather events are becoming more intense and frequent as a result of climate change. This study aimed to assess the growth, liver function, haemato-biochemical, stress responses, acetylcholinesterase level, and immune responses of *L. calbasu* at different water temperatures in laboratory conditions. Juvenile *L. calbasu* (12.53±0.82g) were collected from local hatcheries of Mymensingh, Bangladesh. The experiments were conducted in the laboratory using flow-through aquaria and exposed to four different temperatures (22, 26, 30 and 34°C). After 60 days, no significant difference was found between the mean total length and mean body weights at 26 and 30°C, but significantly higher than kept at 22 and 34°C ($P$<0.05). Results showed that temperature had significant effects in all haematological parameters. The decrease in the haematocrit values and increased WBC values clearly indicated cold and heat shock stress. The highest serum total protein concentration was observed in fish acclimated at 22°C (7.87±1.14) which was significantly higher than the others. The triglyceride level didn't change significantly with temperature fluctuations. Nevertheless, other parameters responsible in liver functions remained at the threshold level. The plasma cortisol level also increased significantly at 34°C, signifying a stress response. The level of AChE in the blood plasma was significantly inhibited at 22°C but no remarkedly differ between 30 and 34°C. Additionally, the immunoglobulin M (Ig M) level significantly decreased at control (26°C) and 30°C after 60 days. The results of the present study indicate that temperatures 34°C or higher induce stress responses, and alter immune responses of *L. calbasu* in laboratory conditions. Results from this study suggested culturing *L. calbasu* at 26–30$^{o}$C will optimize the overall production and condition of this important fish species. These findings would also be helpful for the fishery biologists and resource managers for the conservation of these important fisheries resources coping with global warming.

**Keywords**: Temperature, growth, stress, immunity, liver function.

# Molecular Characterization of Stinging Catfish (*Heteropneustes fossilis*) by Sequence Analysis of mtDNA Genes

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## Abstract

Shing (*Heteropneustes fossilis*, Bloch) is an indigenous stinging catfish of South East-Asia including Bangladesh which has been recognized for its delicious taste and market value. The fish is commercially cultured but the natural sources of stinging catfish have special demand in the market. Quality broodstock from natural sources needs to be maintained in the hatchery for sustainable production. However, there is limited information about the quality of broodstock from nature. Thus, the present study is aimed to compare the populational variation and the genetic structure of the *H*. fossilis from the natural sources of Bangladesh and compare them with the hatchery-produced stock. A total of 225 samples of shing fish (*H. fossilis*) were collected from six natural and three hatchery-originated samples from Bagerhat, Chandpur, Gazipur, Jamalpur, Jessore, Mymensingh, Pabna, Rangamati, and Sylhet, respectively. A lot of 18 morphometric measurements were recorded and the highest total length (TL) of 20.32±2.034 cm was found in Khulna and the lowest total length (TL) of 12.09±1.77 cm was found in the Sylhet population. A total of 5 meristic counts were recorded and among them, Anal Fin Ray (AFR) ranged from 62-70. Thus, the samples used in the present study were confirmed as *H. fossilis.* Then DNA extraction was done using the DNA extraction kit and the quality of the extracted DNA was measured. The three mtDNA genes cytochrome oxidase 1 (CO1), Cytochrome oxidase b (Cytb), and Control Region (CR) were planned to amplify and 4 sets of primers were designed in the present study. The partial amplification has been done and major amplification and subsequent sequencing are going to be done in the second year. Thus, the project needs to be continued for the accomplishment of the research work and finally, molecular information of stinging catfish (*H. fossilis*) will be enriched.

**Keywords**: Stinging catfish, natural sources, morphology, population, molecular marker, Bangladesh.

# Broodstock Management and Artificial Spawning Effectiveness of Ovupin in Goldfish (*Carassius auratus*) in Hatchery Conditions

**Group:** Biological Science **Project ID:** SRG-221174

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## Abstract

Optimization of artificial reproduction, by increasing the survival rate of embryos and hatching rate, is of major importance for reducing genetic diversity, especially in fish captured from their natural habitat that subsequently spawn in hatcheries. This experiment was aimed to improve broodstock management by using probiotics to improve growth, feed utilization, survival and artificial reproduction of goldfish. In Experiment I, fish were fed with probiotic (*Bacillus* sp.) mixed feed and feed without probiotic as a control. The weight gain, (%) weight gain and specific growth rate (SGR) were higher in probiotic fed fish than the control groups. In experiment II, after 3 months of rearing, fish were exposed for both artificial and natural breeding performance. For artificial spawning, a single dose of Ovupin hormone was used. There were no ovulations in females from control groups. The ovulation, fecundity, fertilization, hatching and survival rates were found higher in probiotic fed artificial spawning than the probiotic fed natural spawning fish groups. It is concluded that the inclusion of probiotic in feed improves the growth performance of goldfish fry that reduces time consumptions and increase production of fry which can bring commercial benefits to the farmers and entrepreneurs.

**Keywords**: Optimization, probiotics, artificial reproduction, growth performance, benefits.

# Effects of Bacillus Probiotics on Transportation Induced Stress Tolerance of Carp (*Labeo rohita*) Fingerlings

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## Abstract

Transportation associated stress leads to a suppression of fish production and increased mortality during aquaculture. Therefore, a study was conducted to evaluate the effects of Bacillus probiotics on transportation induced stress tolerance of Carp (*Labeo rohita*) fingerlings. About 500 *L. rohita* fingerlings were collected and were randomly distributed in plastic tanks following two treatments: control group (no probiotic); T1, 1 × 106 CFU g−1 of mixed Bacillus spp. with three replications. After rearing 120 days, fish were placed in an aerated open-transport system for 4 h. After transportation, the water's pH, temperature, dissolved oxygen, and TAN were recorded at 6.92 ± 0.1, 24 ± 0.28 °C, 8.06 ± 0.31 mg $L^{-1}$, and 0.31 ± 0.09 mg $L^{-1}$, respectively. The fish, separated by treatment, were immediately transferred to fiber-plastic tanks with a density of 30 fish/400 L of water. Survival rates were monitored, and blood samples were collected, five days post-transportation. Blood samples were taken from six fish per treatment at 0, 24, 72, and 120 h post-transportation. The survival rates of the two fish groups treated with probiotics, Bacillus spp., and the control group (no probiotic), showed no significant differences after 24h ($p > .05$) of transportation. The results showed that the cortisol level of the control group (no probiotic) significantly increased in comparison to the probiotic groups over 1–120 h post-transportation, with the highest cortisol level (22.3 µg $dL^{-1}$) observed in the control group at 0 h after transportation. Glucose, ALT and AST value was also found higher in control group in all sampling time with highest at 24h of post transportation. After hematology analysis, WBC, RBC and % hematocrit and % Lymphocyte did not show any significant variation between two treatment groups. From the study it can be concluded that probiotic may have significant effect on the stress tolerance of rui fingerlings during transportation that may play a positive role in fish growth during aquaculture after transportation.

**Keywords**: Microbes, pressure, transport, hematology, cortisol.

# On station and Farmers' Field Trial of Advanced Intercross Population for Participatory Selection of Promising Lines as Candidate Variety

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## Abstract

A major advantage for researchers in plant and animal genetics lies in the ability to create experimental populations. Such populations mix well characterized founder genomes in controlled pedigrees, and facilitate the investigation of both the genome itself and its relationship with traits and the environment. Traditional experimental populations combine the genomes of two parents with contrasting phenotypes to identify regions of the genome affecting the trait. However, each of these populations captures only a small snapshot of the factors affecting the trait due to the narrow genetic base. Recently, a multi-parent advanced generation intercross (MAGIC) strategy has been proposed to interrogate multiple alleles and to provide increased recombination and mapping resolution. An eight-parent based rice MAGIC population was developed rendering the population as BUMpop. The seeds of BUMpop were progressed to the $F_6$ generation via single seed descent (SSD) method in the field. Accordingly, based on initial performance twelve out yielded genotypes were picked up as candidate variety(s). This approach expanded the trait data and identified lines adapted to a range of production constraints. Multi-location data as observed revealed the variation in location wise genotype performance signifying the role of environment. The lines 61-A and 66-A were almost uniform in BSMRAU while huge variation was observed for the rest of two location. Highly significant positive correlations (>0.6) were detected for the trait grain yield per plant (YPP) with panicle length (PLT), primary branches per panicle (PBN), grain length (GLT), and hundred grain weight. The unweighted Neighbor-Joining tree revealed genetic relatedness among the 12 rice genotypes by clustering them into two major groups. It can help to identify quantitative trait loci (QTLs) associated with specific traits, revealing the genetic factors responsible for observed variations. This knowledge can guide marker-assisted selection (MAS), enabling breeders to efficiently develop improved plant varieties with desirable traits.

**Keywords**: MAGIC, MYT, Participatory breeding, yield and MAS.

# Molecular Epidemiology, Antimicrobial Resistance and Virulence Potentials of *Streptococcus spp*. Isolated from Milk, Feces and Environment of Mastitic Dairy Cows

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## Abstract

**Background:** *Streptococci* are the major etiology in mastitis, a cause of huge economic losses in the dairy industries. **Objective:** We aimed to study the molecular epidemiology, antimicrobial resistance and virulence potentials of *Streptococcus* spp. isolated from milk, feces and environment of mastitic dairy cows. **Methods:** Sixty (60) samples (milk = 20, feces = 20 and soil = 20) from cow with clinical mastitis (CM) were purposively collected and examined. Samples were enriched in Luria Bertani broth (LB) and *Streptococcus* spp. was isolated on Modified Edwards Medium and confirmed by 16S rRNA gene sequencing. **Results:** Twenty-two (36.67%) of the samples were positive for *Streptococcus* spp. (milk = 40.90%, feces = 31.82% and soil = 27.28%) by cultural and molecular examination. Phylogenetic analysis revealed 59.5, 30.5, 6.0% and 4.0 % of the *Streptococcus* isolates as *S. uberis*, *S. agalactiae*, *S. hyovaginalis* and *S. urinalis*, respectively. The milk samples had higher prevalence (42.75%) of *S. uberis* mastitis than feces (36.80%) and soil (20.45%) samples. Likewise, *S. agalactiae* was prevalent in 51.5%, 37.60% and 10.90% milk, feces and soil samples, respectively. The draft assembly sizes of G2M6 and G6M1 were 4,441,064 bp and 4,667, 456 bp, respectively. The strains were typed as *S. uberis* sequence type 155 (ST155) and *S. agalactiae* sequence type 58 (ST58). The G2M6 genome contained 367 SEED subsystem features, 45 antimicrobial resistance genes (ARGs) and 160 virulence and virulence related genes whereas G6M1 genome possessed 378 SEED subsystem features, 41 ARGs, and 178 virulence and virulence related genes. One plasmid replicon such as IncY of 4,012 bp, was identified in the G6M1 genome (with 95% identity and 60% coverage) while G2M6 genome harbored none. Genome completeness analysis with BUSCO showed the presence of 100% complete BUSCOs in the hybrid assembly of both genomes. **Conclusion:** *Streptococcus* spp. causing bovine mastitis are diverse, and carry an array virulence factors that need to be further investigated to identify a specific trait governing the virulence and fitness.

**Keywords**: Clinical mastitis, cow, antimicrobial resistance, virulence, genome sequencing.

# Exploring the Status, Reproductive Behaviour and Health Management of Captive Common Peafowl (*Pavo cristatus*) in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221178

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## Abstract

The study was conducted in selected areas of Bangladesh between July 2022 and June 2023 to know the current status, reproductive behavior and health management of peafowls under farming system. Ten peafowl farmers were questioned using the convenience sampling method. Primary data were collected, suitably processed and results were presented in a tabular form using descriptive statistics, *e.g.* percentage, mean and standard error. The majority of the farms were run by people aged between 31 and 40. Almost all peafowl farmers never read a book on peafowl farming, had no training or work experience. About 90% farmers raised different varieties of Common Peafowl except one farm where Green Peafowl species was also raised. The result showed that mature male weight was significantly ($p<0.0001$) higher than the female. Age of first laying, egg production/season, egg mass, clutch size and incubation period were 2.00±0.13 year, 22.90±1.43 eggs/season, 95.70±4.54 g, 9.30±0.47 and 28.90±0.43 days, respectively. Fertility and hatching rates were 87.30±1.40% and 74.30±1.07%. About 80% farmer used poultry feed for feeding their peafowl. However, all farmers regularly used drugs/additives with feed and water; and vaccinated flocks regularly. Although most of the farmers (90%) experienced diseases in their farms, but occurrence was less frequent in most of the farms (60%), frequent in 30% farms and rare in 10% farms. About 40% farmers took veterinary advice at intervals and followed biosecurity measures normally (60%). In terms of disease prevalence, Newcastle Disease (84.90%) was significantly ($p<0.05$) higher than other diseases, *viz*. Coccidiosis (72.60±0.63), Ascariasis (64.30±0.55), Mycoplasmosis (33.00±3.57) etc. It was also found that 100% peafowl farmers were profited significantly ($p<0.0001$) in comparison to the cost. Therefore, from this study it is evident that peafowl farming could be a promising venture in Bangladesh as 100% farmers were profited, although there are some constraints. In conclusion, considering its commercial value and source of gainful employment opportunity peafowl farming should be encouraged and promoted in Bangladesh.

**Keywords**: Status, peafowl, reproduction, health, Bangladesh.

# Morphological, Physicochemical and Molecular Characterization of Fig Genotypes in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221179

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## Abstract

This study investigated the diversity among five introduced fig (*Ficus carica* L.) germplasms in Bangladesh, focusing on their morphological, pomological, and biochemical characteristics. The primary goal was to assess morphological variations, including their genetic potential for future improvement, and to examine their biochemical properties. The research employed in a Randomized Complete Block Design (RCBD) with three replications. The findings demonstrated significant variations in plant growth attributes, leaf characteristics, fruit traits, sensory attributes, and biochemical properties among the genotypes under study. Notably, two genotypes, G2 (Khurtamoni) and G4 (Brown Turkey), emerged as exceptional performers based on their combined pomological and nutritional characteristics. However, G2 displayed outstanding growth characteristics, excellent fruit attributes, including a remarkable fruit yield of 65.67 fruits per plant, and exceptional nutritional properties with a total phenolic content (TPC) of 8.03 mg GAE/100g FW, total flavonoid content (TFC) of 31.084 mg QE/100g FW, and an IC50 value of 85.39 µg/ml. Besides, G4 excelled in terms of taste, texture, juiciness, and various nutritional parameters, with an ascorbic acid content of 4.4 mg/100g, TFC of 28.348 mg QE/100g FW, and an IC50 value of 83.685 µg/ml. The genotype ranking, taking into account both morphological and biochemical characteristics, reveals the following order: G2 > G4 > G1 > G3 > G5. Consequently, the study identifies G2 and G4 as promising candidates for fig cultivation and breeding in Bangladesh, due to their exceptional attributes. Furthermore, the genotype ranking offers valuable guidance for selecting germplasm for breeding programs and promoting sustainable fig cultivation in Bangladesh. Keywords: Fig germplasms, morphological diversity, pomological traits, biochemical characteristics, genetic potential.

**Keywords**: Fig germplasms, morphological diversity, biochemical attribute, genetic potential.

# Plant Growth Regulators (PGRs) Mediated Approach in Reducing Chemical Fertilizers for Tomato and Brinjal Cultivation Addressing Adverse Climate in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221180

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## Abstract

Extreme diurnal temperature variation along with unstable humidity make challenges for tomato production and the growers intend to apply excess chemical fertilizers that cause negative impact on soil fertility. Therefore, this study aimed to evaluate the exogenous application of PGRs substitute chemical fertilization without compromising the growth and yield of tomato. A pot experiment comprising two factors of chemical fertilizers and PGRs was conducted where plants were treated with fertilizers at 100, 110, 90 and 80 % of recommended doses (100 % represents 12 g of urea, 10 g of TSP, 5 g of MoP, 3 g of Gypsum, 0.5 g of $ZnSO_4$ and 0.5 g of Boric acid plant$^{-1}$) besides control (no fertilizer) and PGRs of $GA_3$, NAA, 4-CPA and SA at 50 ppm including control (distilled water). As observed, there was no significant variation among the fertilizer doses (80% to 110% of recommendation) regarding growth and yield contributing traits while exception in control. Meanwhile, among the PGRs, GA3 @ 50 ppm produced maximum number of flower clusters plant$^{-1}$ (16.85), flowers (8.80) and fruits (5.79) cluster$^{-1}$, single fruit weight (67.83 g) and fruit yield (6.61 kg plant$^{-1}$) of tomato that was statistically identical with the findings of SA. But significant reduction in yield was noted in NAA and 4-CPA (1.20 kg and 1.21 kg plant$^{-1}$, respectively). Interestingly, $GA_3$ and SA in combination with any doses of the studied fertilizers maximize the tomato morphological and reproductive traits while fertilizer combined with NAA and 4-CPA gave inferior results. Further, correlation matrix revealed strong correlation among the most of the studied variables except early vegetative growth traits, SPAD value and shoot and root dry weight. Moreover, PCA findings revealed that five fertilizer doses have no distinctiveness whereas $GA_3$ and SA has distinct position than other PGRs with the maximum dependent variables having positive contributions in total variations. The study findings suggested that 20% fertilizer requirement could be reduced with the substitution of $GA_3$ and SA @ 50 ppm for successful tomato cultivation.

**Keywords**: Abiotic stress, climate change, temperature fluctuation, soil fertility, vegetables.

# Assessing the Zoonotic Potential and Epidemiological Risk Factors of Blastocystis Infection in Smallholder Dairy Cattle in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221181

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## Abstract

*Blastocystis* sp. is a widespread protozoan parasite known to induce gastrointestinal disorders in humans and animals globally. The parasite exhibits a significant level of genetic diversity and is classified into 17 recognized subtypes (STs) among isolates from mammals and birds. Ten of the subtypes (ST1 to ST9 and ST12) have been specifically associated with infections in humans. This study aimed to investigate the occurrence, genetic diversity, and zoonotic potential of *Blastocystis* sp. in cattle. A total of 200 fresh fecal samples were collected from smallholder dairy calves in two milk pocket areas: Sirajgonj (n = 100) and Pabna (n = 100). The samples were screened and subtyped using PCR amplification and sequencing of the small subunit ribosomal RNA (*SSU* rRNA) gene. The overall prevalence of *Blastocystis* sp. infection in cattle was found to be 10.0%, with 8.0% in Sirajgonj and 12.0% in Pabna. The prevalence varied among different factors such as sex, age, breed groups, and fecal consistency, although these differences were not statistically significant. Among the 20 *Blastocystis* sp. isolates analyzed, only two subtypes, ST10 and ST14, were identified. ST10 was the most prevalent subtype. Notably, no zoonotic subtype was detected in the examined calves, suggesting a lack of zoonotic significance. In conclusion, this report provides insights into the epidemiology of *Blastocystis* infection in cattle, indicating its widespread occurrence but low genetic diversity in the study areas. Furthermore, the findings suggest that *Blastocystis* in calves from these regions do not pose a zoonotic risk. However, further research is needed to better understand the true prevalence, genetic diversity, and zoonotic potential of *Blastocystis* in cattle in Bangladesh.

**Keywords**: Risk factors, genetic diversity, zoonotic potential, smallholder dairy cattle.

# Identifying the Methods for the Reduced Spread of Antibiotic-Resistant Genes from Dairy Wastes to the Surrounding Surface Water and Groundwater for Human Consumption

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## Abstract

At present, there were increased use of antibiotics in dairy farms for boosting greater production. These antibiotics are disseminated to the nearby environment through dairy wastes. In Bangladesh, at present dairy wastes are haphazardly kept here and there near the dairy farms and there are no methods to scientifically treat the dairy wastes to make the wastes environmentally friendly. These dairy wastes contain antibiotic resistant genes (ARGs) of pathogenic bacteria which ultimately confer antibiotic resistance to human beings through food, air, and water systems. Among the ways, water is considered as a crucial method of spread. So, elucidating the methods for the reduced dissemination of ARGs of dairy pathogenic bacteria from dairy wastes to the drinking water is crucial. In this study multiple waste samples from 10 (ten), different types of dairy farms were collected and ground water and surface water adjacent to the farms were also collected. The DNA was also extracted from the waste samples and water samples and PCR is underway in our laboratory and gene sequencing will be performed from the PCR positive samples. The results of this study will help to adopt dairy farm practices having reduced dissemination of ARGs of pathogenic bacteria from dairy wastes to the nearby water bodies.

**Keywords**: Antibiotic resistance, dairy farming, environment, human health, water bodies.

# Elucidating the Effects of Formalin as Food Preservative on the Hematological Profile, Histoarchitecture of Vital Organs and Fertility of Male Swiss Albino Mice

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## Abstract

**Background:** Nowadays, formalin is used much more frequently as a food preservative in Bangladesh. **Objectives:** Therefore, this study was aimed to investigate the effects of formalin on the hematological profile, fertility and histoarchitecture of vital organs of male Swiss albino mice. **Methodology:** Male Swiss albino mice at the age of week four were divided into five groups. Normal drinking water was supplied to the control group of mice. Mice of group 1, 2, 3 and 4 were supplied drinking water mixed with formalin orally at 1%, 5%, 10% and 20% concentration, respectively. After completing 24 weeks of treatment of mice, weight of testes, gonadosomatic index (GSI), number of sperm and different hematogical parameter were measured. Moreover, gross and histopathological changes in testes and other vital organs (liver, lung, heart and kidney) were investigated. **Findings:** Weight of testes, GSI and sperm count were decreased significantly in formalin treated mice in comparison to control mice. Hematocrit value (HCT) and hemoglobin (Hb) concentration were decreased in all formalin treated mice as well. The percentage of morphologically healthy epididymal sperm was expressively reduced in formalin treated mice. Histopathologically, degenerative changes in seminiferous tubules, smaller number of spermatogenic cells, and accumulation of spermatozoa with exudates in tubular lumen and displacement of seminiferous tubule from basement membrane were observed in formalin treated group of mice. Petechial hemorrhages, congestion, necrotic foci and parenchymatous cell degeneration have been found in livers. Tubular dilatation, hypertrophied glomerulus and reduced Bowman's space have all been observed in kidney sections. Infiltration of inflammatory cells, necrosis and rupture of connective tissue have been evident in the hearts. Pulmonary alterations including hemorrhages, thicker alveolar walls and infiltration of inflammatory cells were observed in lungs. **Conclusions:** These findings suggest that formalin has deleterious effects on the hematological profile, reproductive health and vital organs in mice.

**Keywords**: Reproductive health, gonadosomatic index, sperm, hematocrit value, hemoglobin.

# Infarct Size Limiting Effect of Cardiac Tonic Extracted from Native Herb in Mouse with Experimental Myocardial Infarction Model

**Group:** Biological Science **Project ID:** SRG-221184

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## Abstract

**Background**: Cardiac remodeling is a major concern of the heart after ischemic injury. Here we investigated the effects of mixed herbal extract commonly used in different way in the belief that those have beneficial effect in cardiac diseases and prevent remodeling in an experimental mouse myocardial infarction (MI) model. **Objective**: We have hypothesized that therapy with mixed herbal extract has a protective effect in mouse models of MI. To investigate the underlying mechanism the anti-apoptosis and reduced collagen deposition thus prevention of left ventricular (LV) remodeling. **Methodology**: MI was created in switch albino mice. The herbal extract of Bark of Arjuna, Leaves of Oleander, Root of Ginseng, Garlic, Cardamon seed and Oregano leaves were prepared by rotary evaporation technique and the extracts were mixed to made a cocktail and fed at the onset of MI. 28 days after oral administration, heart tissue were collected and was assessed by histological analysis. **Findings**: A survival curve were created during the 28 days long experimental period which showed a significant ($p<0.05$) survival rate in the group received the herbal extract treatment. Heart mass especially ventricular and atrial space and ration of infarct to total heart area reveal better improvement in the treated group compared to non-treated MI-operated mice after 4 weeks, pointing to a very potent effect in the prevention of ischemic cardiomyopathy. In histological studies at 4 weeks after MI, herbal extract treated animals had less fibrosis in infarcted myocardium and higher collagen density recorded the border-zone area compared with non-treated animals. Herbal extract treated animals had strongly up-regulated levels of SOD activity means that oxidative stress also down-regulated by the treatment effect compared with non-treated animals. **Conclusion**: Less deposition of collagen prevents LV remodeling and ameliorates LV dysfunction by anti-apoptotic and anti-stress effects. Mixed herbal tonic may provide a new therapeutic modality in ischemic cardiomyopathy and ischemic heart failure.

**Keywords**: Herbal extract, coronary disease, infarction, animal model, remodeling.

# Phyllosphere Bacteria for Plant Growth Promotion and Suppression of Anthracnose Disease in Cucumber

**Group:** Biological Science **Project ID:** SRG-221185

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## Abstract

Anthracnose caused by *Colletotrichum orbicularae* is a devastating disease of cucurbits. Fungicides are commonly used to control the disease, which has severe negative consequences for the environment and public health. Microbial agents are considered sustainable alternatives of harmful fungicides. The phyllosphere or aerial parts of the plants is an important habitat for diverse microorganisms. The phyllosphere microbiome has played a substantial role in sustaining plant health and growth by regulating plant physiological as well as biochemical processes. However, limited studies have been done on the characterization, and utilization of phyllosphere microbes. In the present study, a total of 60 isolates were isolated from the phyllosphere of cucurbit plants. Then, 11 isolates were selected based on their *in vitro* plant growth-promoting attributes and antagonism of *Colletotrichum orbiculare*. The selected isolates varied qualitatively and/or quantitatively in various biochemical tests such as the KOH, motility, gram staining, catalase, protease, lipase, and cellulase tests. Analysis of 16S rRNA sequences identified *Bacillus amyloliquefaciens*, *B. velezensis*, *B. subtilis*, *B. methylotrophicus*, *B. maqaterium*, and *B. siamensis* isolates as new strains. The selected isolates produced significant quantities (10.44 to 60.44 g $mL^{-1}$) of the phytohormone indole-3-acetic acid (IAA), with GL-9 producing the most (60 $gml^{-1}$) and SG-7 producing the least. Seed treatment and foliar spray of these bacterial isolates showed a significant increase in shoot and root growth, number of leaves, and photosynthetic pigment contents in cucumber plants compared to untreated control both in the field and growth chamber. The isolates were highly antagonistic to *C. orbiculare* and when applied as a seed treatment or foliar spray suppressed anthracnose disease on cucumber leaves. Since these phyllosphere bacteria presented significant beneficial effects on cucumber plants as microbial agents, these could be utilized in the development of novel, harmless, and potential inoculants instead of chemical fungicides.

**Keywords**: Plant growth promoting, indole acetic acid, siderophore, *Bacillus*, enzymes.

# Growth Improvement and Drought Stress Mitigation by Endophytic Fungus Metarhizium in Barley (*Hordeum vulgare*)

**Group:** Biological Science **Project ID:** SRG-221186

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## Abstract

Drought is a severe environmental constraint, causing significant reduction in crop productivity across the world. *Metarhizium anisopliae* (MA) is an important endophytic fungus that improve plant growth and helps plants cope with various abiotic stresses in a variety of ways. The current study investigated the potential effects of MA on drought responses and tolerance in five barley (*Hordeum vulgare*) genotypes, namely BB6. BB7, BB8, BB9 and BHL25. Barley seeds were primed with MA and ten-day-old barley seedlings were exposed to drought stress by maintaining 100, 50 and 25 FC (field capacity) moisture. Overall seed primed with MA application helped barley seedlings to recover from chlorosis and growth inhibition. The drought induced oxidative stress symptoms and hydrogen peroxide (H2O2) and malondialdehyde contents were less in MA treated genotypes but significantly increased proline accumulation in leaves. The antioxidant enzymes superoxide dismutase, catalase, glutathione S-transferase, ascorbate peroxidase, were upregulated in MA colonized plants, which further increased under salt stress MA inoculated conditions. According to our findings, barley production in drought prone area in Bangladesh may be accomplished by using endophytic fungus *M. anisopliae.*

**Keywords**: Antioxidants; barley; drought; endophyte; *Metarhizium anisopliae*.

# A Comparison of Nutrients and their Driving Forces in the Marine Protected Areas of the Bay of Bengal, Bangladesh; Using *In Situ* and Remote Sensing Datasets

**Group:** Environmental Science **Project ID:** SRG-221187

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## Abstract:

After the declaration of Swatch of No Ground (SoNG), Nijhum Dwip, and Saint Martin Island as Marine Protected Areas (MPA) in 2014, 2019, and 2022, Bangladesh has established an example to conserve the marine biodiversity in the Bay of Bengal (BoB) on the first place. These were mainly conserved for the Whales (2 Species), Dolphins (5 species), Turtles, Hilsha, migratory birds, and corals, which are endangered species in this region. The unique geography and geology of the underwater canyon, the transportation of the sediments (about 60% of billion tons sediments), and chlorophyll-a (Chl-a) concentration and nutrients availability in a certain layer are the major factors that we have found in our analysis. Increases or decreases in Chl-a concentration and other physiochemical parameters correlate with greater or lesser transportation through river water. Again, the nutrient-rich sediments are carried downstream by rivers. In addition, both MPA's concentration level of Chl-a and nutrients is distinct from that of other places because of the island's relatively low exposure to freshwater flow. Furthermore, the trendline indicates the increasing trend of Chl-a in the SoNG. Decreasing Chl-a concentration in the Nijhum Dwip MPA is a concern for the fisheries community in that region. Even the water velocity and upwelling of the nutrient-rich water are increasing the concentration of the region, especially the SoNG MPA. So, it's preferable to say that, there should be some driving forces like water current, wind stress, temperature, and saline layer, which are likely to be responsible for the variation in this MPA region. The effect of the Chl-a concentration may also have an effect on the quality of the water, which may have some impacts on the particular species that were chosen for the MPA to be built.

**Keywords**: Swatch of no ground, nijhum dwip, saint martin island, marine protected areas, nutrients.

# Increasing Food and Nutritional Security through Appropriate Drought Management Technologies under Changing Climate in Drought Prone Barind Tract

**Group:** Biological Science **Project ID:** SRG-221188

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## Abstract:

Till today major parts of drought prone area is non-irrigated and farmers' livelihoods largely depend on rainfed agriculture which is recurrently affected by water scarcity. For this reason, 75000 hectares of land fallow in both Rabi and Kharif season. In this regard, need to increase cropping intensity, productivity, saving natural resources, reduce production cost with farmers income and livelihood in those areas. A total of eighty both validation and up scaling trials have been conducted in two upazilas of Godagai & Paba in Rajshahi district to the farmer's field. Among them, twenty-four validations and fifty-six up scaling trials have been done of different crops for two upazilas under raised bed, zero or relay crop and strip till technology. During project period, we have established drought tolerant, nutrient enriched low water requirement crops like wheat, maize, mungbean, lentil, sesame, rice, mash cultivation using drought management technologies in fallow season. As a result, increase cropping intensity about 100%, saved water about 25-30%, increased yield about 10-15% with farmers stored near about 8-10-ton quality seeds of different drought tolerant crop varieties. About 25000 farmers are directly involved in those crops' cultivation in drought prone areas. We have created lead and co-operative farmers for operation of climate small machineries and also created good market linkage among the farmers and businessmen. We have also involved women through farming systems and gender employment. We have incorporated legume crops after pod picking. As a result, improved soil fertility and crop productivity leading to use fewer chemical fertilizers. Increased farmers income and livelihood with saving natural resources like water, fuel, energy and reduce production cost and rat damage. The program is expected to uplift crop yield, economic return and help to managed drought of using the drought management technologies of drought prone and non-traditional areas with a sustainable fashion.

**Keywords**: Food security, drought management technology, climate, drought and Barind tract.

# Molecular Profiling and Bioactive Potentiality of Secondary Metabolites from Endophytic Bacteria

**Group:** Biological Science **Project ID:** SRG-221189

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## Abstract

Endophytic bacteria from medicinal plants offer the possibility of discovering a wide range of sustainable sources of natural products, which have applications in the global health sector. Isolate, characterize and identify endophytic bacteria to evaluate their plant-growth-promoting and antioxidant properties, predict and detect their secondary metabolites, and analyze potential antiviral bioactive compounds against SARS-COV-2. Five endophytic bacterial isolates were studied to identify morphologically and biochemically, according to established protocols and further confirmed by 16S rDNA Sanger sequencing, as *Priestia megaterium*, *Staphylococcus caprae*, *Neobacillus drentensis*, *Micrococcus yunnanensis*, and *Sphingomonas paucimobiliz*, then tested for phytohormone, ammonia, and hydrolytic enzyme production. Antioxidant compounds total phenolic content (TPC), and total flavonoid content (TFC) were assessed by using bacterial crude extracts obtained from 24-hour shake-flask cultures. Phylogenetic tree was analysis and after GenBank submission, accession numbers for the nucleotide sequences were found to be MW494406, MW494408, MW494401, MW494402, and MZ021340, respectively. *In silico* analysis was performed to identify their bioactive genes and compounds in the context of bioactive secondary metabolites production with medicinal value, where nine significant bioactive compounds according to six different types were identified, and their structures, gene associations, and protein-protein networks were analyzed by different computational tools and servers. Ligand-protein interactions showed that two compounds (microansamycin and aureusimine) are interacted favorably with coronavirus 3CLpro. Microansamycin and aureusimine expose pharmaceutical efficacy targeting 3CLpro of SARS-COV-2, a potential antiviral property for medication against SARS-COV-2.

**Keywords**: Secondary metabolites, sanger sequencing, SARS-COV-2, coronavirus $3CL^{pro}$.

# Unveiling the Nutritional, Toxicological and Biological Prospects of *Tetilla sp*. Marine Sponge Available in Costal Bangladesh: A Comprehensive Food and Nutritional Screening Approaches

**Group:** Biological Science **Project ID:** SRG-221190

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## Abstract

**Background:** The sponges found along the coast of Bangladesh may be rich in therapeutic properties. The marine sponge *Tetilla dactyloidea* was newly reported from Gotibangha river of Moheshkhali, Cox'sbazar district and ethyl acetate fraction of acetone extract of *Tetilla dactyloidea* was prepared for phytochemical, pharmacological evaluation. The objective of this study is to evaluate the food and nutritional value, cytotoxic activity, *in-vitro* and *in-vivo* characteristics of these substances. **Methods:** preliminary phytochemicals were identified by different methods. From preliminary phytochemical screening and GCMS report potential food and nutritional candidate was selected. Cytotoxic activity was determined by Hela cell line (a human cervical cell line). **Results:** In phytochemical screening Glycosides, flavonoids, steroids, saponins, cholesterol, protein, and amino acids are just a few of the components that may be found within marine sponge *Tetilla dactyloidea*. To determine the food and nutritional value in-vivo rat model was followed. Fattening of rats was measured after 15 days treatment of rats by extract. Blood lipid profile, liver function and kidney functions were determined by biochemistry analyzer. **Conclusion:** Marine sponge *Tetilla dactyloidea* could be a potential source for food and nutritional values which require further study to identify the drug and mechanism of action. Flavonoids, steroids, saponins, cholesterol, protein, and amino acids are having proved food and nutritional values and the fattening profile also ensure the food and nutritional activity of the extract.

**Keywords**: Sponge, food and nutritional, *Tetilla dactyloidea*, phytochemical, cytotoxic activity.

# Comparison of Nutrient Content and Antioxidant Potential of Locality Grown Endogenous and Exotic Dates

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## Abstract

Dates are nutritionally very rich and a good source of secondary metabolites. The indigenous date fruits, locally named as Khejur, grow naturally in Bangladesh and belongs to *Phoenix sylvestris* species. Recently, different cultivars of exotic date fruits belonging to *Phoenix dactylifera* are being cultivated in many parts of Bangladesh. In this present study, phytonutrients of both indigenous and five different cultivars (Ambar, Medjool, Ajwa, Sukkari and Mariam) of exotic date fruits are quantitatively measured and compared with an aim of finding the best date fruits in terms of phytonutrient contents. All experimental methods used in this study followed standard scientific protocol. Proximate analysis revealed that the khejur had lower moisture content than the exotic varieties, among which Ajwa had the highest and Medjool had the lowest moisture content. The khejur had higher ash content than the exotic variety of dates, among which highest ash content was found in Medjool variety and lowest in Ajwa variety. Sukkari variety showed the highest fat content and Mariam showed the lowest among the exotic varieties. The local variety contained moderate amount of fat. Where the highest protein content was found in Sukkari variety and the lowest in Mariam among the exotic verities, the protein content of Khejur was in between of the exotic varieties. Potassium (K) content was the highest in Sukkari (0.92±0.05%) variety and the zinc (Zn), manganese (Mn) and phosphorous (P) content was highest in Ajwa (90.32±14.33%), Mariam (63.40±6.00%) and Amber (0.68±0.01%), respectively. The K, Zn, Mn and P content in the local dates were 1.02±0.07%, 34.71±2.84%, 32.47±3.58% and 0.32±0.00%, respectively. Data revealed that no one cultivar of exotic dates is rich in all the nutrients studied. Again, the local khejur could be a good source of nutrients, even not the best.

**Keywords**: Khejur, indigenous, exotic, phytonutrient, *P. sylvestris.*

# Isolation, Identification and Biochemical Characterization of Causative Organism of Panama Disease of Banana

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## Abstract

**Background:** Panama disease of banana caused by the fungus *Fusarium oxyporum* (FOC), which is disastrous plant diseases in banana crops all over the world. **Objectives:** To isolate, purify and characterize the causative organism of Panama disease and determine the antagonistic property of the extracellular antibiotic produced by the organism. **Methodology:** The fungal materials were isolated, purified and characterized from the rhizome and roots of the infected banana plant by plating method using PDA media. We repeatedly subcultured from the mixed culture to get the pure colony. Microscopic and macroscopic observation were carried out for the morphological identification. Further, production of antibiotic in liquid medium and antimicrobial activity examination of the crude chloroform extract were performed. **Findings:** Morphological identification of *F. oxysporum* was done by observing white cottony mycelium with dark-purple undersurface on growth media and oval to ellipsoid/kidney shaped oval tapering and three septate spores. This organism produced in high concentration on 8-10 days in PDA (acidic media) broth media at 30˚ C PH 5.6. TLC analysis showed the presence of three components in the crude compound. The chloroform extract showed the antibacterial activity against a number of gram positive and gram-negative bacteria. The minimum inhibitory concentrations of the crude antibiotic against Bacillus *subtilies, Bacillus megaterium, E. coli, Vibro cholera* was128 µg/ml. The chloroform extract also showed a significant cytotoxic effect in the brine shrimp lethality bioassay. $LC_{50}$ Concentration was found 155µg/ml. **Conclusion:** *Fusarium oxyporum* is the causative fungus of panama disease of banana which produced to antibiotic and could be a source of antibiotic. However, it needs substantial research explore its full potential.

**Keywords**: Panama disease, pathogenicity, MIC, antibiotic, cytotoxicity.

# Investing the Microbiome Diversity in the Gut Of Hilsa Fish by Metagenomic Approach

**Group:** Biological Science **Project ID:** SRG-221193

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## Abstract

**Background:** Hilsa is the national fish of Bangladesh, and is a very popular and delicious food fish. It is an anadromous fish species that migrates from saltwater to freshwater for breeding purposes each year. This migration demands that hilsa fish and their associated microbiomes adapt to environmental challenges like salinity, temperature, and pH. It is important to assess the microbial diversity in hilsa and rearing water source. **Objectives:** The present study aimed to characterize and compare the microbial communities of hilsa gut, skin and surrounding water collected from different locations in Bangladesh. **Methodology:** Hilsa fish and water samples were collected from four different locations of Bangladesh. The composition and diversity of bacteria in hilsa gut, skin mucus and rearing water was explored through 16S rRNA amplicon-based metagenomic analyses. **Findings:** From amplicon sequencing, a total of 284 operational taxonomic units (OTUs), 9 phyla, 35 orders and 121 genera were identified in gut, skin and water samples respectively. More than 60% of the bacteria identified in all three environments were classified as Proteobacteria, with Firmicutes, Bacteroidetes and Actinobacteria also present. *Leucobacter* and *Serratia* were the main core bacterial genera in gut and skin, respectively, and *Acinetobacter*, *Pseudomonas* and *Psychrobacter* were differentially distributed among the gut, skin and water samples. Pathogenic bacterial genera *Acinetobacter*, *Pseudomonas*, *Salmonella*, *Escherichia-Shigella*, *Staphylococcus* and *Aeromonas* were identified in the hilsa fish gut and skin. The study also showed the effect of water microbiota and salinity on the gut and skin microbiome of hilsa. The findings of the research will lead to the improvement of hilsa in quality and quantity which might contribute in the national economy. **Conclusion:** This is the first study focusing on the gut and skin microbiome for both saltwater and freshwater hilsa flashing to understand their health status and migration pattern in the future.

**Keywords**: Gut, metagenomics, microbiome, 16S rRNA, skin.

# Study on the Prevalence of Pathogenic Fungi in Grocery Items

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## Abstract

**Background:** Food safety and food security is a global issue and Bangladesh is one of the most vulnerable country in this respect. Bangladesh is a tropical country and its weather is highly favorable for the growth and development of various fungi. Slow grocery items, especially those are sold unpackaged in grocery shop, like aromatic rice, white peas and grams are prone to fungal infection. Fungi not only can damage and degrade the quality and quantity of such food items but also may pose serious health risk for the consumers. **Methodology:** Here in this study, we collected 15 (5 of each- aromatic rice, white pea and grams) grocery samples randomly and cultured on the PDA, YES and CMA media for the isolation, identification of the fungi macroscopically and microscopically. Biochemical test for enzyme activity was done as well as the mycotoxigenic potential of the isolated fungi were assessed through secondary data analysis. **Results:** Slow grocery items- aromatic rice, grams, white peas were found infected frequently. Seven different fungal isolates were identified from the collected grocery items. They were, Aspergillus niger, Aspergillus flavus, Aspergillus fumigatus, Aspergillus terreus, Aspergillus wentii, Rhizopus stolonifer and Mucor spp. Among them Aspergillus niger was the most prevalent fungal species (found in 10 out of 15 samples). Biochemical analysis revealed that identified fungal isolates could produce extracellular amylases when cultured in starch-agar plate indicating their ability to use grocery items as nutrient source. Interpretation of the mycotoxigenic potential of the fungal isolates revealed that these could have the ability to produce mycotoxin, the most dangerous among them being aflatoxin producing Aspergillus flavus. **Conclusion:** Finally, it can be concluded that drastic measures are required to be taken to make aware the people about the food safety and its related health issues in terms of fungal food spoilage.

**Keywords:** Fungi, food spoilage, mycotoxin, grocery items.

# Study on the Association of Grin2b Gene Polymorphisms with Autism Spectrum Disorders among Indigenous Peoples of Bangladesh

**Group:** Biological Science **Project ID:** SRG-221195

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## Abstract

**Background:** Autism Spectrum Disorder (ASD) a brain-based neurodevelopmental condition that is characterized and diagnosed by disablement in social communication and social interaction in the presence of restricted, repetitive behavior or interest. **Objectives:** To investigate the association and compare the relationship of coding variants including (rs1805247 and rs1805522) of *GRIN2B* gene with ASD risk in Bangladeshi indigenous and non-indigenous communities. **Methodology:** We have designed a cross-sectional case-control study, in which, two groups of study subjects will be analyzed, one was considered as control (100) and the other was considered as case (100) collected from The Chittagong Hill Tracts. Peripheral venous blood was collected from all the patients for DNA sequencing. **Findings:** It is evident from different studies that single nucleotide polymorphisms (SNPs) play a vital role to develop ASD. However, data specifically with regard to the contribution of SNPs have been inconsistent on the basis of different environment, regions and as well as ethnicity of the population. In an effort to clarify the role of single nucleotide polymorphism of *GRIN2B* gene in the development of ASD, we have conducted PCR-sequencing and evaluated all sequence data in a study population of 100 cases and 100 controls from the hill-track areas of Chattogram city. For case-control study, we have selected rs1805247 and rs1805522 of *GRIN2B* gene. The results of our study revealed that there is a significant association of AG genotype of rs1805247 and AA genotype of rs1805522 with ASD development (*p*-value: 0.023 and 0.002 respectively) in this study population. **Conclusion:** If the sample population is increased, *GRIN2B* gene may serve as biomarker for the diagnosis and increase the awareness of the illness of ASD patients in the indigenous people of Bangladesh.

**Keywords**: Autism, *GRIN2B* gene, SNPs, Bangladesh, polymorphisms.

# A Cross-Sectional Study on KRAS and BRAF Proto-Oncogene Mutations among Colorectal Cancer Patients of Chattogram, Bangladesh

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## Abstract

**Background:** Colorectal cancer (CRC) is the fourth most common cause of cancer death worldwide. Globally, it is the second common cancer in women and third common cancer in men. Unfortunately, genetic information on CRC is unavailable from Bangladeshi population. **Objectives:** We intend to do a cross sectional hospital-based study to investigate the prevalent mutations in *KRAS* in colorectal cancer patients and also to find out whether there is any relationship with the number and type of *KRAS* gene mutation with patient's age at diagnosis, cancer stage and lifestyle. **Methodology:** To find out the possible usefulness of genetic analyses for CRC risk estimation among Bangladeshi patients, *kras* (a proto-oncogene) codon 12/13 (c12/13) and single nucleotide polymorphisms (SNP) were screened by enriched PCR-RFLP method using the DNA extracted from the colonic biopsy samples collected from the patients. **Findings:** In this study, none of the control patients had *kras* mutations. Moreover, none of the patients had *kras* c12 mutation, which was shown to be more prevalent by RASCAL studies in different populations in Europe, North America and some countries in Asia. A total of 17 patients had *kras* c13 mutation presence of any of these two mutations significantly increased the odds of CRC occurrence (*kras* c13: OR = 14.275, $p = 0.015$; *p53* c248: OR = 48.182, $p = 0.013$) and recurrence (*kras* c13: OR = 25.946, $p = 0.007$; *p53* c248: OR = 31.710, $p = 0.003$). It was also found that presence of both these mutations either increased the risk of CRC at an early age or caused chemo-radiation therapy refraction and 2-year recurrence. However, no mutation was fund in *braf* proto-oncogene. **Conclusion:** In conclusion, the findings of this study are an important addition to the unknown genetic information regarding CRC patients of Bangladesh.

**Keywords**: Colorectal cancer, *KRAS* gene, codon 12/13, mutation, PCR-RFLP.

# Investigating the Genetic Diversity, Prevalence and Antibiotic Resistance of Klebsiella Pneumoniae Isolates from Clinical Samples in Chittagong, Bangladesh

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## Abstract

**Background:** *Klebsiella pneumoniae* (KPN), a gram-negative pathogenic bacterium is linked to urinary tract infections (UTIs), pneumonia, septicemia, wounds and soft-tissue infections in hospital settings. KPN, one of the ESKAPE pathogens is collectively responsible for the majority of difficult-to-treat infections in hospitalized patients because of the increasing trend of multidrug resistance (MDR). In this study, KPN isolates collected from patients in Chattogram, Bangladesh were investigated to check the prevalence of infections, the frequency of MDR patterns, molecular and genomic understanding of KPN. **Methodology:** About 1000 clinical specimens were obtained from three different hospitals in Chattogram. After confirming the antimicrobial profile, DNA extraction, and PCR procedures were carried out to identify the prevalence and presence of MDR genes, TEM-1, and KPC-2 from selected MDR KPN isolates (n=151). Finally, whole genome sequencing of 10 MDR KPN isolates was performed to understand the genomic features. Kleborate, Prokka, ResFinder, and Rstudio were used to analyze genomic and demographic data respectively. **Result:** In this study, KPN isolates were highly resistant to cefuroxime, cefixime, and ceftriaxone while being considerably susceptible to colistin, nitrofurantoin, and amikacin. MDR KPN infection was significantly more common (44%) in children (p=0.043), and mostly found in blood. The highest number of KPN-infected patients came from Halishahar (41%) and Bandar (32%). TEM-1 was found in 81.5% while KPC-2 in 22.2% of the total isolates. Whole genome analysis showed that most isolates had ESBL genes (CTX-M-15, multiple TEM, and SHV) and carbapenemase genes (KPC, NDM, OXA). Moreover, the maximum KPN genome was found to be comprised of sequence type 11 (ST11). **Conclusion:** KPNs from hospital environments are extremely resistant to antibiotics commonly used to treat life-threatening illnesses. Abundance of outbreak causing ST11 is very concerning. Hence routine clinical testing for resistant bacteria as well as ongoing surveillance is essential to preventing serious public health issues.

**Keywords**: ESKAPE Pathogens, multidrug resistance (MDR), ESBL genes, carbapenemase genes, ResFinder.

# Relative Expression Analysis of The Transcription Factor NRF3 in Human Pathological Samples

**Group:** Biological Science **Project ID:** SRG-221198

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## Abstract

**Background:** *NRF3,* a transcription factor in the cap 'n' collar (CNC) family, is highly expressed in various cancer tissues. *NRF3* is a transcription factor controlling protein and lipid homeostasis. It inhibits tumor suppression and promotes cancer development by blocking p53 and Rb tumor suppression signals through ubiquitin-independent degradation. **Objectives:** This study was done to understand the expression of *NRF3* in the pathological samples of local population of Chattogram city, Bangladesh to understand the physiological involvement of *NRF3* in the development of cancer. **Methodology:** A total of 50 pathological samples including 10 colorectal cancer tissues, 10 normal colon tissues, 20 normal blood and 10 blood samples from blood cancer patients were collected from different diagnostic center of Chattogram city Bangladesh with the help of expert physicians. After sample collection RNA were extracted from the samples using Trizol and cDNA were synthesized by using commercial kits. Real time PCR was performed by using synthesized cDNA, specific primer and syber green to find out the expression of *NRF3* in the collected pathological samples. **Findings:** *NRF3* expression has been detected in most of the pathological samples specifically lower cycle threshold (cT) value was recorded in some colorectal cancer tissues and most blood cancer patients. Gene expression comparison with normal patients revealed that NRF3 expresses highly in some colon cancer patients of this region. In addition, gene expression comparison also revealed that *NRF3* expression is extra-ordinally high in blood cancer patients. Overall, the findings of this research implying the potential involvement of *NRF3* in the development of cancer among local people of Chattogram city, Bangladesh. **Conclusion:** *NRF3's* high expression in human colorectal and blood cancer suggests its involvement in cancer biology. Its expression may link to a poor prognosis and tumorigenesis progression. The findings of this research provide valuable insights and offer potential directions for further research and interventions.

**Keywords**: Cancer, transcription, gene, Chattogram, colon.

# Profiling Metabolic, Haemato-Biochemical and Physiological Bio-Markers for Tracing the Risk Factors Associated with Periparturient Diseases and Infertility of the Crossbred Dairy Cattle

**Group:** Biological Science **Project ID:** SRG-221200

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## Abstract

**Background:** The study was carried out in a commercial dairy farm at Hathazari upazila, Chattogram district, Bangladesh from July 2022 to June 2023. **Objectives:** Profiling metabolic, haemato-biochemical and physiological bio-markers to find out the risk factors associated with periparturient diseases and infertility of the crossbred dairy cattle. **Methodology:** Prospective cohort and retrospective cross-sectional survey were carried out. Total 20 CDC of different genotypes (Jersey×Friesian, Sahiwal×Friesian, Gir×Friesian and Local×Friesian) having at least one lactation record was selected following simple random sampling technique for the study. **Findings:** Results indicated that the packed cell volume (PCV), lymphocyte (L), neutrophil (N) and monocyte (M) differed significantly ($p<0.05$) among the genotypes. The highest PCV, L, N and M were observed in Gir × Friesian. Other parameters remained unchanged ($p>0.05$). The PCV, hemoglobin and monocyte had the highest eigenvectors controlling maximum variability in haemato-biochemical biomarkers. Discriminant analysis identified substantially different haemato-biochemical profile of the different genotype groups. The was a strong relationship between the levels of hemoglobin to PCV; PCV to lymphocyte and eosinophil to monocyte. The glucose, albumin, Na, Ca, LDL, cholesterol, TT4 and ALP differed significantly ($p<0.05$) among the genotypes. Other parameters remained unchanged ($p>0.05$). Principal component analysis revealed LDL, HDL and total cholesterol as the principal eigen vectors controlling maximum variability. Accordingly, discriminant analysis identified different metabolic profile of different genotype group. Overall, the levels of glucose, TT3, TT4 and creatinine, LDL, cholesterol were strongly correlated. **Conclusion:** More extensive systematic studies with wide sample size are required to elucidate relationship between metabolic, haemato-biochemical and physiological bio-markers and the risk factors associated with periparturient diseases and infertility of the crossbred dairy cattle.

**Keywords:** ALP, HDL, LDL, SGOT, SGPT.

# Microalgae as a Potential Feed Additive for Survival, Growth and Coloration of Ornamental Fish

**Group:** Biological Science **Project ID:** SRG-221201

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## Abstract

Suitable microalgae species for particular industrial applications are selected on the basis of their growth rates, productivity, and adaptability to laboratory conditions, pigment concentrations, and proximate profiles. In this study, fishmeal was partially replaced by *Nannochloropsis* sp. to evaluate its effect on growth, survival, proximate composition, pigment, antioxidants, breeding performance, and water quality parameters in rearing guppy (*Poecilia reticulate*). In diets, *Nannochloropsis* sp. was incorporated at different levels (control), 5 (N5), 10 (N10), and 15% (N15) and commercial feed (CMF) and fed to the fishes, twice a day at 5% of their body weight for 100 consecutive days. Results showed that the lipid profile was significantly ($P < 0.05$) higher in the 15% inclusion of *Nannochloropsis* sp. whereas there were no significant ($P > 0.05$) differences in protein and carbohydrate content in all groups. However, feed conversion ratio, specific growth rate, average daily growth, length increment, and condition factor were relatively similar in all the groups except 15% and commercial feed. The carotenoid content of fin and muscle was significantly ($P < 0.05$) higher in 15% inclusion. In addition, the fish in 15, 10, and 5% inclusions performed significantly ($P < 0.05$) earlier breeding with a higher number of offspring, respectively than the control and commercial feed fed groups. The survival rate was significantly ($P < 0.05$) higher in algal feed-fed groups (N15, N10, and N5). The addition of *Nannochloropsis* sp. to the feed improved and maintained good water quality during the culture period. In conclusion, results from this study indicate that selected marine microalga can improve reproductive performance through enhancing body coloration and lipid content of fish as well as improving their survival rate with higher antioxidant properties might help in the production of more hardy culture species for commercial aqua farming.

**Keywords**: *Nannochloropsis* sp.; fishmeal; guppy fish; breeding performance; antioxidant.

# Genotyping Markers in Candidate Genes Associated with Disease Resistance in Red Chittagong Cattle

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## Abstract

**Background:** Despite past decades of research, a comprehensive database on molecular biomarkers for Red Chittagong cattle (RCC) still needs to be generated. Considering the research gap and the usefulness of molecular breeding, we genotyped RCC cattle to identify markers in candidate genes for disease resistance. **Methodology:** Amplification of fragments of Major histocompatibility complex, class II, DRB3 (*BoLA-DRB3*) and Calcium voltage-gated channel auxiliary subunit α2 delta 1(*CACNA2D1*) was performed using polymerase chain reaction (PCR). PCR-RFLP (restricted fragment length polymorphism) utilizing restriction enzymes- *HaeIII* for *BolA-DRB3* and *HpaII* for *CACNA2D1* gene and sanger sequencing were performed for genotyping. **Findings:** We identified four RFLP genotypes in the study population -AA, AB, AC and DD for the *BolA-DRB3* gene. The *BolA-DRB3-HaeIII* AA genotype had the highest frequency in all the animals studied, followed by the AB and AC genotypes. The DD genotype had the lowest frequency in the study population. We identified three RFLP genotypes -AA, AB and AC for the *CACNA2D1* gene. The *CACNA2D1-HpaII* AB genotype had the highest frequency in all the animals studied, followed by the AC genotype. The AC genotype had the lowest frequency in the study population. Sequence analysis detected six single nucleotide polymorphisms (SNPs) in the exon 2 of the *BolA-DRB3* gene- g.163G>C, g.216C>G, g.226C>T, g.272G>A, g.313G>A and g.392G>T. All six SNPs were non-synonymous. The g.272G>A was predicted to have the highest possible impact of an amino acid substitution on the structure and function of the protein. For the g.163G>C locus, 80% of the animals were heterozygotes. The lowest frequency for the mutant allele was identified for the g.272G>A locus. A synonymous SNP g.1998G>A in the exon 25 of the *CACNA2D1* gene is segregating in 80% of the animals genotyped. **Conclusion:** This study provides a catalogue of molecular markers useful for future functional studies to explore the genetic disease resistance potential of RCC cattle in Bangladesh.

**Keywords**: Molecular biomarkers, RFLP genotypes, SNP, RCC, disease resistance.

# Genetic Improvement and Multiplication of Developed Dual Purpose Chicken

**Group:** Biological Science **Project ID:** SRG-221203

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## Abstract

People prefer indigenous chicken for its pigmentation, taste, leanness, firmness, and flavor, and even consumers are willing to pay more. Both the Hilly and Fayoumi chickens bear the native genes in earlier research, up to three generations were produced by crossing Hilly and Fayoumi, and their performance was evaluated. Therefore, research was conducted on the development of dual-purpose chickens through selection, assessing their performance phenotypically and genotypically, and estimating the profitability under semi-intensive farming conditions from July 2022 to June 2023. The crossbreds were produced in 03 contact farmers' households and their productive and reproductive parameters were evaluated. The profitability of chickens was estimated using a deterministic model in consideration of biological, nutritional, and economic variables. This study reveals that Hilly♀ (75%) × Fay♂ (25%) was better in terms of productivity (egg production: 146/d/hen, egg weight: 48g, weight at peak male: 2450g, Female: 1630g) and reproductive (fertility: 86% and hatchability: 80%) parameters in comparison to the other graded chickens and also from the backcrossed population. The highest profitability was observed for the Hilly (75) Fay (25) × Hilly (75) Fay (25) selfing genotype (USD 23.93/chicken family per year) than the other generation chickens. This genotype can be used for further genetic improvement purposes to develop a dual-purpose chicken under both semi-intensive and extensive conditions. The molecular study, the SNPs of BMPR-1B and STAT5B genes for assessing genetic diversity and genetic distance and determining the association of candidate genes with breeding values of different traits of developed chickens, and the chicken production model for this developed genotype will be done in subsequent years.

**Keywords**: Hilly chickens, generations, parameters, genetic diversity, model.

# Raft-based Mariculture of Commercially Important Green Mussel (*Perna viridis*) under Different Culture Depth Conditions for Blue Economic Development of Bangladesh

**Group:** Biological Science **Project ID:** SRG-221204

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## Abstract

The green mussel (*Perna viridis*) is an edible mollusk with enormous culture potential. This study examined the effects of various water depths (0.5 meter, 1 meter, and 1.5 meter) on green mussels' growth performance cultured in various locations (Khurushkul, Moheshkhali, and Caufaldandi) along the Moheshkhali channel, Cox's Bazar, Bangladesh. Ten (10) mussel socks having twenty uniform mussels at each depth stocked in every location. The mean specific growth rate (SGR) of *P. viridis* in 0.5 m water depth was 1.30±0.03 % $day^{-1}$ which was higher than 1 m (1.15±0.03% $day^{-1}$) and 1.5 m water depth (0.99±0.03% $day^{-1}$). Location-wise, the specific growth rate (SGR) at the Khurushkul culture site was 1.45±0.03 % $day^{-1}$ which was greater than the Moheshkhali (1.17±0.03% $day^{-1}$) and the Caufaldandi culture site (0.81±0.03% $day^{-1}$). Among different environmental parameters, salinity, pH, DO, plankton abundance, and different nutrients (Chlorophyll a, $PO_4$-P, $NO_3$-N, $NH_3$-N) were positively correlated with the green mussel's growth performance. Turbidity and nitrite ($NO_2$-N) were negatively correlated with the mussel's growth. The principal component analysis (PCA analysis) showed that turbidity, $NO_2$-N, and $PO_4$-P negatively influenced green mussels' growth performance. A significant difference was found in protein and lipid content in *P. viridis* samples from three distinct culture depths. The results of the study indicated that there were no significant differences ($p > 0.05$) in the total amino acid content of *P. viridis*. The fatty acids profile showed that *P. viridis* contains a higher percentage of saturated fatty acids but there was a significant ($p<0.001$) difference in the percentage of SAFA, MUFA, and PUFA between samples that were harvested from different culture depths. Thus, the results demonstrated that the growth of green mussels was influenced by depth, and within 1 m depth from the surface is the most feasible water depth for green mussel culture.

**Keywords**: Marine bivalves, mariculture, raft-culture, green mussel, blue economy.

# Occurrence and Antimicrobial Resistance of an Emerging Pathogen, *Escherichia albertii* in Domestic and Captive Wild Birds in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221205

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## Abstract

**Background:** *Escherichia albertii* is a zoonotic pathogen and causes diarrhoea in humans. Human infection can occur from transmitting this pathogen from birds to humans. **Objective:** This longitudinal study aimed to know the occurrence and antibiotic resistance of *E. albertii* in domestic and captive wild birds in Bangladesh. **Methodology:** A total of 200 cloacal swabs from clinically healthy domestic and wild captive birds from the Chattogram division were screened for the presence of *E. albertii* using cultural growth and polymerase chain reaction (PCR). Phenotypically antibiotic-resistant *E. albertii* isolates were investigated for the sulfonamide-resistant genes- *sul1* and *sul2*. **Findings:** Only ten isolates produced pure colourless colonies on XR-MacConkey agar, a selective growth medium for *E. albertii*. These isolates were further verified by inoculation on Eosin Methylene Blue (EMB) agar, MacConkey agar, and XR-MacConkey agar. Ten (5%) were finally found to produce characteristics colony of *E. albertii*. The presence of cytolethal-distending toxin (*Eacdt)* in *E. albertii* isolates was diagnosed based on PCR. PCR results show that only eight (4%) of the 200 isolates tested positive for the *Eacdt* gene. Among these eight isolates tested, 63% and 88% were positive for sulfonamide-resistant genes- *sul1* and *sul2*, respectively. **Conclusion:** This study provides evidence that domestic and captive wild birds in Bangladesh are harboring *E. albertii*, which instigated the importance of assessing the potential pathogenicity of these strains for humans.

**Keywords**: *Birds, escherichia albertii*, human infection, sulfonamide-resistant genes.

# Isolation and Identification of Antimicrobial Resistant Gene in *Salmonella* spp., Isolated from Poultry Farm and Live Bird Market Environment

**Group:** Biological Science **Project ID:** SRG-221206

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## Abstract

**Background**: Globally, antimicrobial resistance (AMR) is a public health concern, since antibiotics are among the most prescribed classes of drugs in humans and animals. Random use of antimicrobials in the poultry industry is considered as a contributing factor for AMR that can jeopardize human health through the potential dissemination of AMR pathogens. It is noteworthy that *Salmonella* is one of the bacterial groups considered to be of high priority in surveillance programs in the food chain and infectious diseases in poultry. Information on the circulation of *Salmonella* strains at the commercial poultry farm level is limited in many parts of the world. **Objectives**: The present study aimed to determine the prevalence and stereotyping of *Salmonella* strains circulating in the broiler farm environment with their detailed AMR profiling. **Methodology**: Pooled environmental samples were collected randomly from commercial broiler farms in Chattogram district, Bangladesh. Then the standard bacteriological procedure was followed to isolate *Salmonella sp,* and identification was confirmed by the basis of morphology, cultural characters, and genus-specific polymerase chain reaction (PCR). After phenotypic characterization of the resistance profile against commonly used antibiotics by disc diffusion technique, all strains were screened by PCR for some selected resistance genes. **Results**: Out of the 105 samples, *Salmonella* sp was isolated and identified from 8 samples. In antimicrobial sensitivity testing, 100% isolates showed resistance to ampicillin and amoxicillin, and 87.5% to gentamycin followed by tetracycline, and ciprofloxacin (75%), doxycycline (50%), Trimethoprim / Sulfamethoxazole, and Ceftriaxone (25%). The results of PCR assays revealed that all the eight isolates were carrying the *tetA* gene, the *tetB* and 16.67% the *tetC* gene. The prevalence of the isolates bearing the *Sul-I* gene, *blaTEM, blaCTX-M* were 100%, 87.5 %, and 50 %, respectively. **Conclusion**: The present study was conducted to find out the prevalence of *Salmonella* in poultry farm and to find out that there is a great risk to securing healthy poultry products due to the circulation of the multi drug resistant (MDR) *Salmonella* sp.

**Keywords**: Antimicrobial resistance, *Salmonella* sp, tetA, tetB, tetC, sul-1, *blaTEM, blaCTX-M* gene, commercial broiler, Chattogram.

# Molecular Investigation of *Ascaridia galli* in Hilly Chicken, Backyard Chicken and Fayomi Chicken along With Comparative Study of Prevalence and Risk Factor in Them

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## Abstract

Raising poultry is a highly profitable endeavor for women in rural areas, particularly those who are marginal or landless farmers. Poultry production is hindered by a number of factors, the main one being infectious disorders caused by parasites. Thus, the goal of the current study was to ascertain the incidence of GI parasite infections and the risk factors linked to them in backyard, fayoumi, and hilly chickens. For this purpose, a total of 250 fecal samples (100 from hilly chicken, 100 from fayoumi chicken, and 50 from backyard chickens) were collected from various regions of Bangladesh (hilly chicken from Bandarban, fayoumi chicken from regional poultry farm, Pahartoli, Chattogram, and backyard chicken from Comilla). Regular coproscopy (direct smear, flotation, and sedimentation technique) was used to identify the GI parasites' eggs, oocysts, and trophozoites. Results demonstrated that overall prevalence of GI parasitic infections was 19%, 27%, and 20% in hilly chicken, fayoumi chicken, and backyard chicken, respectively. This research found that free range chickens (26.23%) were more vulnerable to GI parasitic infection than semi-intensive chickens (7.69%). According to this study, the prevalence of *Ascaridia galli* infection in young chickens (≤1 year) was 33.33%, while it was 10% in adult chickens (≥2 years old). *Ascaridia galli, Heterakis gallinarum,* and *Cooperia spp*. were more common in chicken weighing 1.2 kg. The frequency was lower (10.00%) in chickens weighing ≥2 kg. Regularly dewormed chicken had a lower prevalence (12.66%) of GI parasites than non-dewormed chicken (39.39%). Again, when fenbendazol was used for deworming, the prevalence of GI parasites infection was lower (7.69%), and when levamisole was used, it was higher (18.86%). The current investigation will help relevant authorities in designing appropriate prevention and control strategies against those infections.

**Keywords:** Poultry, gastrointestinal parasitic infections, prevalence, PCR.

# Identification of Tick-Borne Pathogens by Metagenomics Next Generation Sequencing

**Group:** Biological Science **Project ID:** SRG-221208

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## Abstract

Ticks are vectors for numerous human and animal pathogens, posing significant health risks and economic losses, yet their prevalence and diversity in Bangladesh remains poorly understood. We employed shotgun metagenomics that includes 16S-amplicon screening of pooled tick to investigate tick gut microbiome and characterize the pathogenic microorganisms carried by tick populations affecting cattle. We collected over 200 ticks from different host animals and performed morphological identification, followed by genomic DNA extraction. Subsequently, we conducted high-throughput DNA sequencing on a selected subset of pooled samples and applied bioinformatics analysis to identify and characterize the microbial species. Preliminary analysis with Kraken2 tool revealed the presence of several pathogens including Anaplasma, Babesia, Pseudomonas, Acinetobacter, Staphylococcus etc. along with other fungal, protists and viral pathogens. Characterization of such pathogens would contribute to the development of a valuable vector-borne pathogen database for Bangladesh. This will help establishment of a tick-borne pathogen database, advancing research on tick gut microbiome using cutting-edge NGS and computational tools, and contributing to the understanding of vector-borne disease transmission dynamics in large ruminants. The findings would ultimately benefit both animal and human health in the region and would serve as a model for future research endeavors.

**Keywords**: Ticks, Ticks -borne Pathogens, shotgun metagenomics, NGS.

# Development of Edible Biopolymer from *Aloe vera* and its Antimicrobial and Phyto-Biochemical Analysis

**Group:** Biological Science **Project ID:** SRG-221209

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## Abstract

This study was conducted to evaluate the antioxidant capacity, phytochemical analysis, and antimicrobial activity of aloe vera and aloe vera based commercial products. Besides, it was intended to develop a product which can retain the bioactivity of aloe vera. Initially, raw aloe vera leaves were dried to make fine powder. The antioxidant capacity of whole leaf was 2.45±0.036 and inner gel was 2.31±0.106 mg/100gm. After sequential steps of qualitative phytochemical analysis, it revealed that, none of the commercial products contain phytochemicals, except one. The only commercial sample that exhibited antioxidant capacity of, in very lower range, in comparison with the dried aloe powders. Total phenolic content of whole leaf (10.172±0.018) was more than inner gel (9.410±0.281), and so for total flavonoids (252.119±0.123 and 125.131±0.090) content and total anthocyanin content (601.322±0.281 and 397.821±0.322) in mg/100gm. Different solvent system for phytochemical extraction and antioxidant activity was also under the investigation. This study conceded aqua-ethanolic extract in 50:50 ratio is an excellent solvent system for the following parameters. The selected formulation of bioactive edible film was incorporated with 35% aloe vera powder. Based on the weight of aloe vera used, bioactive film was also subjected to antioxidant capacity assay and phytochemical analysis. The film had antioxidant capacity 2.715±0.015, TPC 9.321±0.026, TFC 252.048±0.030, TAC 597.247±0.074 and acemannan concentration 4.47±0.102. These values were not significantly different from the aloe vera powder dried in 60 °C according to paired sample T-test. So, this product was proved to retain the bioactivity of aloe vera. Finally Antimicrobial activity against 6 bacterial strains of *E,coli, Salmonella spp, S. aureus, Lactobacillus spp, K. pneumoniae and Y. pestis*. In terms of MIC and ZOI. The biopolymer made by incorporating aloe vera exhibited close together antimicrobial activity with raw aloe powders.

**Keywords**: Biopolymer, antibacterial, antioxidant, acemannan, solvents, phytochemical.

# Enhancement of Blue Economy of Bangladesh Through the Determination of Abundance and Development of Aquaculture Technology of Hard-Shell Clam *Meretrix sp*

**Group:** Biological Science **Project ID:** SRG-221210

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## Abstract

Clam, a bivalve mollusk, contribute significantly to the global seafood industry and has enormous potential for commercial aquaculture and the development of Bangladesh's blue economy. Knowledge on the biology, abundance, current market channel is required for the development of the aquaculture. A total of 216 stakeholders from eleven areas of two coastal districts were surveyed through field visit, FGDs, questionnaire to investigate the current status, market structure of clam fishery. We revealed that clams, hand-picked at low tide from estuarine channels, provide sustenance and alternative income to coastal people. Women exhibit comparable collection efficiency to men with 25.96 ± 8.76 kg live clams per trip. Three Indigenous Technological Knowledge (ITK) based innovation-an oxygen pump, clam dredger, and teda-were identified. Harvest amounts and price exhibit location- and season-dependent variation, peaking from November to May and declining from June to October. We identified nine market channels and 16 stakeholders with a delivery system dominated by middlemen. The plankton in the water and gut of clam was studied and observed under microscope. A total of 40 genus of phytoplankton including 32 genera from water and 20 genera within clam gut was identified. *Coscinodiscus* and *Cyclotella* were mostly abundant in both water and gut samples. At least 08 colour morphs of clam *Meretrix* was documented of which there may be more than one species. This needs to be examined through genetic analysis. To estimate the abundance in the real-time scenario, in Choufaldondi canal, Cox's Bazar, a rectangular-shaped clam dredger of 20 inches in length was developed. The highest clam abundance was in November 2022 (6.27±0.48/ sq. ft.), while the lowest was observed in December 2022 (0.6±0.08/ sq. ft.). This study will be helpful in future endeavor to develop coastal aquaculture and artificial breeding of clam in Bangladesh.

**Keywords**: Hard clam; gut plankton, phytoplankton, market channel, color morph.

# Antimicrobial Pattern of Food Borne Bacterial Hazards Isolated from Vegetables in Dhaka City

**Group:** Biological Science **Project ID:** SRG-221211

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## Abstract

This research aims to assess the prevalence and impact of microbial contaminants, particularly antimicrobial-resistant bacteria, on fresh vegetables available in retail markets in Dhaka city, with a focus on potential contamination pathways and associated health risks. The objectives include evaluating microbiological contamination, isolating and identifying microorganisms from vegetables, determining antibiotic resistance patterns, and promoting hygienic practices throughout the farm-to-fork chain aligning with Bangladesh's goal of achieving Sustainable Development Goals (SDG) by ensuring microbial contaminant-free fresh vegetables, reducing wastage in the farm-to-fork chain. The inputs required include a supply of fresh vegetables and antimicrobial techniques. The fresh vegetable samples such as tomatoes, carrots, cucumbers, and lettuce collected from various markets. Microbial isolation and identification has been conducted following USFDA Bacteriological Analytical Method (2001). Antibiotic resistance profiles of the isolates determined using Kirby-Bauer agar diffusion assays. The University of Dhaka's FNARL, CARS serves as the implementation location. Anticipated outcomes include knowledge about microbial contamination prevalence and antimicrobial patterns in fresh vegetables. The socio-economic importance lies in emphasizing the significance of safe and fresh vegetables, reducing vitamin deficiencies, promoting good agricultural and manufacturing practices, and fostering behavioral change and awareness programs throughout the food production and consumption supply chain. The study also proposes an environmentally friendly method for washing vegetables, aiming to reduce microbial pollution, extend shelf life, and enhance microbiological quality. The use of a cost-effective sanitizer is highlighted as a practical and environmentally beneficial approach to safeguarding the food chain and the environment. Overall, this research contributes to understanding and addressing the challenges posed by microbial contaminants in fresh vegetables, offering tangible solutions for food safety and sustainability.

**Keywords**: Microbial contaminants, antimicrobial-resistant, food safety, good agricultural practice, hygienic practice.

# Molecular Characterization and Application of Lactic Acid Bacteria as Food Preservative

**Group:** Biological Science **Project ID:** SRG-221212

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## Abstract

**Background:** Lactic acid bacteria can be utilized as an alternative to chemical food preservation technologies in order to increase food shelf life and reduce the risk of foodborne illness. **Objectives:** This study examines the potential for lactic acid production in two strains of *Lactobacillus* spp. isolated from local yogurt samples. **Methodology**: Lactic acid production by two strains of *Lactobacillus* spp. ST1 and M1 was carried out in MRS medium containing 1% soluble starch at 37°C for 96 hrs. After completion of the fermentation the culture broth was centrifuged and the supernatant was used to measure the lactic acid content using titration method. **Findings:** In this project, lactic acid production from the indigenous Lactic acid bacteria (LAB) was studied for using as food preservative. To make the lactic acid production economic the fermentation condition was optimized. Highest yield of lactic acid 170 mg/ml and 200 mg/ml were achieved after 4 days of fermentation by ST1 at 30°C and M1 at 40°C, respectively. However, after 4 days of incubation at 40°C, the co-culture of ST1 and M1 produced lactic acid at a remarkable increased rate with the yield of 325 mg/ml. **Conclusion:** The co-culture of the strains will be utilized to produce lactic acid, and additional research into its purification and characterization will lead to its use in Bangladesh for the bio-preservation of food.

**Keywords**: Bio-preservation, co-culture, fermentation, *Lactobacillus* spp., lactic acid.

# Isolation, Characterization, Genotyping and Phenotyping of the Fungi Associated with the Halophyte (*Porteresia coarctata*) for their Plant Growth-Promoting Effects under Salt Stress

**Group:** Biological Science **Project ID:** SRG-221213

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## Abstract

**Background:** Rising salinity, population, and climate challenges, coupled with diminishing cultivable land, pose major hurdles for rice production in Bangladesh's coastal areas. Developing saline-tolerant rice is a solution, albeit time-consuming, with moderate success. **Objective:** Study aims to enhance salt tolerance and yield in commercial rice varieties by inoculating halotolerant endophytic fungi from the wild halophyte *Oryza coarctata*, thriving in highly saline region. **Methodology:** Endophytic fungi from the roots and rhizome of the plants were isolated, characterized, identified and studied for their effects on all developing stages of rice plant growth and their yield both with and without salt stress. **Findings:** Three different fungal endophytes were isolated from *O. coarctata*. Two isolates were identified as *Talaromyces adpressus* (OPCRE2) and *Talaromyces argentinensis* (OPCRh1) by ITS region sequencing. The remaining isolate NPCRE2 was confirmed as a novel strain named *Aspergillus welwitschiae Oc*streb1 (*AwOc*streb1) by whole genome sequencing. These endophytes showed various plant growth-promoting (PGP) abilities *in vitro* (e.g. IAA, ACC-deaminase and siderophore production, phosphate and zinc solubilization as well as nitrogen fixation), where *AwOc*streb1 was significantly more efficient compared to the other two isolates at high salinity (900 mM). Independent application of these fungi in commercial rice (*Oryza sativa)* showed significant elevation in plant growth, especially for the *AwOc*streb1 inoculants had enhanced metabolite and chlorophyll content at the seedling stage in both no-salt control and 80 mM salt-stressed plants. Also, *AwOc*streb1-treated plants had a significantly lower level of $H_2O_2$, electrolyte leakage and $Na^+/K^+$ ratio under saline conditions. **Conclusion:** This study confirmed that this endophytic fungus promotes the growth of its associated plant even under saline stress. Field experiments are required for further validation.

**Keywords**: Endophytic fungus, *Oryza coarctata*, *AwOc*streb1, rice, *Oryza sativa*, salinity tolerance.

# Role of Vitamin D and its Receptor Gene Polymorphism in Breast Cancer Development

**Group:** Biological Science **Project ID:** SRG-221214

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## Abstract

According to Globocan report, there are 13,028 new breast cancer cases are reported in 2020 in Bangladesh. Vitamin D deficiency is a driving force that increased the risk of common cancers. The present study aims to examine the correlation of vitamin D deficiency and the association of VDR gene polymorphism with the onset of breast cancer. Blood sample was collected from the study subjects. 1,25-dihydroxyvitamin D level were analyzed using HPLC in the laboratory. After DNA extraction, PCR was performed followed by RFLP to analyze the genotypes. Serum vitamin D level was 20.36 ± 1.064 and 45.26 ± 3.801 (ng/mL) in case and control respectively. The vitamin D level of patient group was significantly lower ($p < 0.001$) compared to control. The genotype frequency and risk of developing breast cancer based on VDR Taq1, VDR BSmI, and VDR Fok1 were analyzed. In case of Taq1 and Bsm1, chi-square test showed no significant difference of genotype frequency between cases and controls. VDR Fok1 showed significant difference of genotype frequency (CC, CT and TT) between cases and controls ($p<0.01$). There was no significant difference between two groups in case of CT, TT and CT+TT genotypes. From logistic regression, for CT genotype, the risk was 0.59 times compared to CC genotype (p=ns, OR=0.5909 (0.2273-1.596)). In case of TT genotype, the risk of developing breast cancer was 1.57 when compared to CC genotype (p=ns, OR=1.566 (0.5935-4.145)). For dominant model, CT+TT genotype carriers are 0.96 times more vulnerable to develop breast cancer when compared to CC genotype (p=ns, OR=0.9639 (0.3735-2.636)). In our study, we observed decreased level of vitamin D in breast cancer patients. We found an association of TT genotype of VDR FokI with the risk of developing breast cancer ($p < 0.01$), while no association with VDR gene TaqI and BsmI ($P > 0.05$).

**Keywords**: Vitamin D, breast cancer, VDR gene, polymorphism.

# Impact of *Toxoplasma gondii* Infection on Th1 and Th2 Cytokine Responses in Type-1 Diabetic Patients

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## Abstract

**Background*:*** *Toxoplasma gondii* is a facultative protozoan parasite which causes Toxoplasmosis in one-third of the world population. Although acute *T. gondii* infection exhibits mild symptoms of fever in immunocompetent individual, it can be fatal in immunocompromised subject. Diabetes mellitus (DM) is among the most severe global health challenges in the twenty-first century. T1DM patients have suppressed immunity which can be favorable for opportunistic infections like *T. gondii* although the association between *T. gondii* and T1DM is still debated. **Objectives***:* The aim of this study was to determine the seroprevalence of T. gondii in diabetes patients and to measure the level of Th1 and Th2 type cytokine level in plasma. **Methodology*:*** In this study, one hundred (N=100) patients with T1DM and one hundred (N=100) healthy controls were enrolled to determine the seroprevalence of toxoplasmosis through Rapid-anti *Toxoplasma*-antibody test. In addition, ELISA was also performed to determine the levels of Th1 and Th2 cytokines i.e. IFN-$\gamma$ and IL-12 to understand their role in the development of toxoplasmosis. **Findings*:*** In our study, rapid test assays showed lower seropositivity for both patients (16%) and control group (17%). Our data indicates a lack of association between *T. gondii* infection and T1DM patients. From the data of hematology tests, it was depicted that the T1DM patients had significantly lower levels of total WBC (P=0.0015), circulating eosinophils (P=0.0026) and neutrophils (P=0.0128) than the healthy controls whereas, the level of lymphocytes (P=0.0204) and monocytes (P=0.0067) were higher. Our study suggests a link between parasitic infection and IL-12 secretion as *T. gondii* infected T1DM patients had significantly higher level of IL-12 than the healthy controls (P=0.0018). However, there was no detectable level of IFN- $\gamma$ $\gamma$in the plasma of T1DM patients. **Conclusion*:*** The study confirms the link between *T. gondii* infection and IL-12 secretion in T1DM patients. However, further study is needed to confirm the role of IFN- $\gamma$ to the development and severity of toxoplasmosis in T1DM.

**Keywords:** *Toxoplasma gondii,* diabetes mellitus, IgG antibody, cytokines, IL-12, IFN- *ÿ*.

# Association of Polymorphisms Present in the Base Excision Repair Scaffold Protein and Macrophage Migration Inhibitory Factor Genes with the Risk of Bladder Cancer in Bangladeshi Population

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## Abstract

**Background:** Bladder cancer is the 9th most frequent malignancy in Bangladesh. Studies reported that the DNA-repair gene (XRCC1) is correlated with the pathogenesis of malignant tumors, and MIF plays a role in tumor cell growth. **Objective:** To investigate the association of XRCC1 (rs1799782 and rs25489) gene and MIF gene (rs755622) polymorphisms with the risk of developing bladder cancer in the Bangladeshi population. **Methodology:** A case-control study was conducted with 240 bladder cancer patients and 240 healthy controls. Bladder cancer was confirmed by histopathological examination and biopsy report. After obtaining consent, blood was collected from study subjects, and genomic DNA was extracted by standard method. Genotype analysis was done by PCR-RFLP method. **Findings:** The baseline characteristics of study subjects showed significant differences in age, smoking status, and family history of cancer. A positive association was found between the polymorphisms of rs1799782 (OR=2.817, 95%CI=1.928-4.102, $p<0.001$ for Arg/Trp allele and OR=4.185, 95% CI=1.361-12.34 and $p<0.05$ for Trp/Trp allele), rs25789 (OR=1.936, 95% CI=1.11-3.466, $p<0.05$ for Arg/His allele and OR=4.145, 95% CI=1.568-10.35, $p<0.01$for His/His allele), rs755622 (OR=4.616, 95% CI= 2.663-8.104, $p<0.001$ for heterozygous GC and OR= infinity, 95% CI=1.9-infinity, $p<0.05$ for double mutant CC) with urothelial carcinoma risk. Smokers show a higher frequency of heterozygous GC variant (OR=20.05; 95% CI=3.3-208, $p<0.001$) in rs755622 polymorphism that confirms a significant association with cases compared to control, but not with rs1799782 and rs25789 polymorphisms. In the rs1799782 polymorphism, a family history of cancer showed an effect on increasing the frequency of the Arg/Trp variant in cases compared to controls (OR=15; 95% CI=3.962-51.75; $p<0.001$). However, rs25789 and rs755622 polymorphisms did not. **Conclusion:** Our results suggest that XRCC1Arg194Trp (rs1799782), Arg280His (rs25789), and MIF -173G>C (rs755622) genotypes contribute to the development of bladder cancer risk in the Bangladeshi population. Besides, smoking is confirmed as an independent risk factor for bladder cancer in Bangladesh.

**Keywords**: Bladder cancer, polymorphism, XRCC1 and MIF genotype, PCR-RFLP.

# Association of Mitochondrial DNA Polymorphisms with the Risk of Cancer with Respect to Bangladeshi Population

**Group:** Biological Science **Project ID:** SRG-221217

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## Abstract:

**Background**: An increased risk of cancers is associated with specific mitochondrial DNA (mtDNA) polymorphism among various haplogroups in the human population. **Objectives**: To find out a relationship between the mtDNA 10398 G>A polymorphism and 3243 A>G polymorphism with lung and bladder cancer. **Methodology**: For determining the genotypic and allelic frequencies of the gene variants, PCR was performed followed by restriction digestion and gel electrophoresis. Allelic frequencies were determined using Hardy Weinberg calculator. **Findings**: As far as bladder cancer is concerned, a higher prevalence of the 'G' allele (63.27%) was observed compared to the 'A' (36.73%) allele among the total study participants. Much higher prevalence was observed in healthy control group (G: 76.09%, A: 23.91%) but not in bladder cancer (G: 51.92%, A: 48.08%). Statistical analysis showed that the mutant 'A' allele with respect to rs2853826 within the mitochondrial ND3 gene is associated with the risk of bladder cancer (OR = 2.95, $p < 0.05$). Allelic distribution of A3243G in the study participants revealed that no mutant 'G' allele was observed in the RFLP study, so, the prevalence of wild type "A" allele was 100% among the overall study participants. **Conclusion**: A case control study was performed to investigate whether the mutant allele of rs2853826 with respect to mitochondrial ND3 was associated with the risk of developing bladder and lung cancer in Bangladesh.

**Keywords**: Cancer, DNA, polymorphism, bladder, lung.

# Mitigation Initiative Towards Development of Drought Tolerance in Potato (*Solanum tuberosum* L.) through Genome Editing

**Group:** Biological Science **Project ID:** SRG-221218

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## Abstract

Potato (*Solanum tuberosum* L.) occupies a significant position as the third most-consumed global food crop, underscoring its crucial role in agriculture due to its nutritional value, adaptability, and industrial applications. However, the cultivation of this crop faces numerous challenges due to its complex genetics, including traits such as heterozygosity, self-incompatibility, and tetraploid nature. In response to drought-induced stress, plants produce abscisic acid (ABA), which triggers drought-related genes and encourages the closure of stomata to endure water scarcity. In the case of potatoes, an excessive breakdown of ABA by ABA 8'-hydroxylase, a cytochrome P450 monoxygenase, enhances their ability to withstand drought. The primary objective of this research is to enhance potato's resilience to drought using CRISPR-Cas9 technology to modify ABA catabolic genes, thereby reducing the breakdown of ABA. Previous research in rice has identified three homologous genes, OsABA8ox1, OsABA8ox2, and OsABA8ox3, which encode ABA 8'-hydroxylase and have a notable impact on drought sensitivity. Lowering the expression of OsABA8ox3 has proven to increase rice's ability to withstand severe drought. Similarly, in the context of potatoes, researchers have pinpointed two orthologous genes closely related to Arabidopsis CYP707A as potential targets for precise genome editing, with the goal of enhancing drought resistance. By making precise edits to ABA catabolic genes through CRISPR-Cas9 technology, our aim is to fine-tune ABA catabolism in potato plants, thus amplifying their capacity to endure drought. These newly engineered potato varieties are anticipated to exhibit enhanced resilience to drought, a quality of paramount importance in the face of climate change. As global temperatures rise and weather patterns become increasingly erratic, the imperative to enhance the drought resilience of staple crops such as potatoes becomes evident. This advancement promises to bolster food security and contribute significantly to global efforts aimed at addressing hunger and promoting sustainable agriculture amid the challenges posed by climate change.

**Keywords**: Potato, CRISPR-Cas9, drought resilience, ABA catabolic genes, agriculture, genetics, climate change.

# Evaluation of Peripheral Pro-Inflammatory Cytokine Levels and Genetic Polymorphism of Cytokine Genes in Bangladeshi patients with Obsessive Compulsive Disorder

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## Abstract

**Background:** Recently, there has been a growing interest in investigating the association between pro-inflammatory cytokines and pathogenesis of OCD. However, such studies using Bangladeshi population data is scarce. **Objective:** This study aimed at exploring the potential role of pro-inflammatory cytokine interleukin-Iβ (IL-1β) and interleukin-6 (IL-6) in the pathophysiology of OCD. **Methodology:** In this study, 58 OCD patients were recruited from Bangabandhu Sheikh Mujib Medical University Hospital, alongside 30 age, sex, and BMI-matched healthy controls. OCD was diagnosed based on DSM-V criteria, and disease severity was assessed using Yale–Brown Obsessive Compulsive Scale (Y-BOCS). Serum IL-1β and IL-6 levels were measured using ELISA assays. **Findings:** The study results showed that serum IL-1β levels were significantly (P=0.0015) elevated in OCD patients (23.68±10.88 pg/ml, mean±SD) compared to controls (15.75±4.90 pg/ml) and these increased IL-1β levels were positively correlated with Y-BOCS scores (Pearson's r=0.326, p=0.034), suggesting a potential association between peripheral IL-1β levels and OCD pathology. Similarly, OCD patients exhibited significantly (P=0.0001) higher serum IL-6 levels (44.97±4.87 pg/ml) than controls (37.04±1.58 pg/ml) and these elevated IL-6 serum levels were positively correlated with Y-BOCS scores (Pearson's r=0.28, p=0.043) implicating that IL-6 serum levels might be associated with OCD pathogenesis. ROC analysis showed that serum IL-1β level displayed a good diagnostic efficacy in differentiating OCD patients from healthy controls with AUC value of 0.796 and 76.74% sensitivity and 78.3% specificity at a cut off value of 18.38 pg/ml. Analysis also revealed that estimation of serum IL-6 levels exhibited an excellent predictive value in discriminating OCD patients from controls expressing an AUC value of 0.975 with 88.88% sensitivity and 85.71% specificity at a cut off value of 38.93 pg/ml. These results suggested that IL-1β and IL-6 serum level estimation have potential to be used as blood-based biomarkers for predicting risk for development of OCD. **Conclusion:** The study results showed that OCD patients are characterized by elevated inflammatory responses and potentiated the inflammatory hypothesis that pro-inflammatory cytokines are associated with the pathophysiology of OCD.

**Keywords**: OCD Pathogenesis, interleukin-6, interleukin-1 beta, blood-based biomarkers, cytokine.

# An Empirical Analysis of Microplastic Pollutants and its Detrimental Impact Relating Climate Change Indices on Coral and Fish Population in the Ecologically Critical Saint Martin Island

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## Abstract

Microplastic (MP) pollution is an emerging problem that proliferate negative consequences on environment. The occurrence of MPs in coastal area of Bangladesh remains uninvestigated. Climate change, ecological and human health risks due to MPs contamination in the context of Bangladesh is the new dimension of research interest. This study is the first attempt to observe MPs abundance in sediment, water and fish in the Saint Martin's Island of Bangladesh. The purpose of the study was to investigate MPs effect to mounting the global temperature arousing climate change and delineate the MPs influences on the contamination on health of general people and ecological risks. Polymer Hazard Index (PLI) and Pollution Load Index (PLI) were used to evaluate the environmental condition. Three types of MPs; Fibers, fragments and foams has been identified. Fibers were the most abundant types of MPs (75% in water,76% in beach sediment, 74% in fish, and 71% in coral samples). 509 MP items were found in per kg beach sediment and 390 MP items were found in per liter of water sample. Every fish species shows the presence of microplastics in their gut. And every coral samples were contaminated with microplastics. According to PLI (20.8) and PHI (1527.0) value, that study area has serious ecological and human health threat. Abundance of MPs is opening new dimension of climate change. MPs particles have the potential to impact on rising the temperature by emitting greenhouse gases. Ocean carbon sequestration processes can be intervened through MPs presence. So, Climate change risks has serious interdependency with the MPs pollution which needs further details study. Findings of the study says that coral colony is under the threat of microplastics pollution which will ultimately cause different types of serious negative consequences. The outcome indicates that Saint Martin's Island has high human and ecological risk potentials.

**Keywords:** Microplastic, Climate Change, Coral, Saint Martin, Bangladesh

# Causal Variants of DENND1A Gene in Patients with Polycystic Ovary Syndrome in Bangladesh and Their Mechanism of Action

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## Abstract

**Background:** Polycystic ovary syndrome (PCOS) is a multifactorial pathophysiological condition that is characterized by hyperandrogenism, dysfunctions in ovulation, and polycystic ovaries. It has been associated with an array of metabolic, reproductive, and endocrine disorders. Although the exact mechanism underlying PCOS pathogenesis is still unknown, genetic factors are considered to have an important role. Strong candidate gene DENND1A has been associated with susceptibility to polycystic ovary syndrome (PCOS) in multiple populations of diverse ethnic backgrounds. **Objectives:** The goal was to determine the genotype and allele frequencies of the rs10818854 and rs10986105 in DENND1A gene, as well as to assess the allelic distribution association in disease and control groups in Bangladeshi population. **Methodology:** A multiplex allele-specific polymerase chain reaction (ASPCR) methodology was developed in this study to genotype people with and without PCOS in the Bangladeshi population at two DENND1A gene loci: rs10818854 and rs10986105. **Results:** The frequencies of the variant alleles in the PCOS group were determined to be 0.11 for the rs10818854 locus (corresponding to the T allele) and 0.10 for the rs10986105 locus (corresponding to the G allele). Unlike the other variant, a significant correlation was observed between the allelic distribution of the rs10986105 variant and PCOS. Individuals carrying the rs10986105 variant G allele had 4.125 times greater likelihood of being diagnosed with PCOS, according to the allele model ($p = 0.007$). A significant correlation was observed between PCOS and metabolic, reproductive, and endocrine abnormalities in the study population, as determined by phenotypic feature analysis. There exists a positive correlation between PCOS and acne, serum testosterone levels, an abnormal ratio of luteinizing hormone to follicle-stimulating hormone secretion, and elevated blood glucose levels among women from Bangladesh. **Conclusion:** This research presents a straightforward and efficient approach for determining the genotypes of the DENND1A gene variants rs10818854 and rs10986105 simultaneously. This approach provides an effective method for predicting the probability of future PCOS development.

**Keywords**: Polycystic ovary; DENND1A; rs10818854; rs10986105; allele-specific PCR.

# Genetic Improvement of Processes Yielding Microbial Phytase for Application in the Poultry Industries

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## Abstract

Phytase is a crucial feed enzyme used to break down complex, unavailable forms of phytic acid into available phosphate enabling its potential nutrient value in poultry feeds. The present study was focused on the evaluation of genetically improved wild *Bacillus subtilis* MZK05 for the production of phytase. Thirty-one mutants, previously developed in our laboratory through the treatment of the wild strain with UV and EMS, were selected for investigation. Seven strains including the wild one, showed significant phytase activity in the shake flask fermentation. Some unpredicted growth patterns of the mutants encouraged us to attempt to isolate wild bacterial strains from natural sources with more potential phytase-producing ability than those of the mutants under study. Three potential bacterial isolates were obtained from different natural habitats, based on a clear zone on the phytase screening medium. Isolate SP11 gave the highest enzyme activity in the basal medium containing glucose as a carbon source with Na-phytate and was identified as *Bacillus subtilis* by microscopy, biochemical, and molecular techniques. Optimization of cultural parameters for phytase production was performed by using a more convenient and realistic statistical approach namely Plackett-Burman Design (PBD) and Response Surface Methodology (RSM). Five significant variables (Soybean Meal, Rice bran, $K_2HPO_4$, $KH_2PO_4$, and $FeSO_4$) were found to be suitable for Plackett-Burman Design (PBD). The response surface methodology based on central composite design showed the optimum levels of these significant variables along with their interactions. The model was validated by repeating the experiments under the optimized conditions that resulted in the phytase production of 72 U/ml, which is 2.25, fold higher than the unoptimized medium (32 U/ml). The enhancement in phytase production after the optimization process can be considered satisfactory and will be very useful for the development of a bioprocess of the enzyme for its large-scale production at the pilot and finally at commercial levels.

**Keywords**: Phytase, poultry feed, PBD, RSM, fermentation.

# The Effect of Vitamin C and Zinc on Modulating the State of Antibiotic Resistance of Drug-Resistant Bacteria Isolated from Patients with Diabetes Mellitus

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## Abstract

**Background**: Individuals with diabetes mellitus (DM) are usually vulnerable to bacterial infections, such as UTI and diabetic foot ulcer (DFU), compared to those without the condition. The underlying cause of the infection is thought to be associated with the formation of bacterial biofilm that often makes them drug-resistant. **Objectives**: The goal was to destroy the biofilm formation, thereby exposing bacteria to drug-mediated killing. Vitamin C was hereafter tested in association with antibiotics that were found ineffective. **Methodology**: Bacteria (n= 80) were isolated from urine and pus samples of patients with DFU admitted to BIRDEM General Hospital, Dhaka. Those were presumptively identified as *Escherichia coli*, *Klebsiella* spp, and *Staphylococcus aureus* following biochemical tests. The Antibiogram profile of the isolates helped estimate the multiple antibiotic resistance (MAR) index. Isolates having MAR of 0.2 (n = 21) were subjected to observe their biofilm formation abilities by congo-red binding assay, followed by quantitative estimation in microtiter plates spectrophotometrically at 600 nm. Likewise, the minimum inhibitory concentration (MIC) and biofilm prevention concentration (BPC) were enumerated. Scanning Electron Microscopy (SEM) was conducted to observe the biophysical changes of cell surface following treatment. **Findings**: Among the 21 multi-drug resistant (MDR) isolates, 10 isolates exhibited moderate to strong biofilm-forming ability. These were challenged with (1) vitamin C, and in combination with drugs (2) oxacillin and (3) amoxicillin that were found ineffective. It was observed that vitamin C had an inhibitory effect on the growth and biofilm formation abilities of the MDR isolates as revealed by spectrophotometric quantitation. MIC and BPC of vitamin C were found to be 25 and 12.5 mg/ml respectively. SEM demonstrated diminished biofilm formation of isolates when treated with oxacillin or amoxicillin only in presence of vitamin C. **Conclusion**: Suitable administration of vitamin C has the potential to dislodge biofilms formed by drug-resistant bacteria, thereby rendering them susceptible to the drugs that were once shown ineffective.

**Keywords**: Antibiotics, BPC, drug-resistance, MIC, vitamin C.

# Investigation of Multidrug Resistant *Enterococcus spp*. in Hospital Wastes in Dhaka, Bangladesh

**Group:** Biological Science **Project ID:** SRG-221224

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## Abstract

It is now a global concern as the innocent, easily treatable bacteria are slowly making changes resistant to antimicrobial agents because of reckless, rapid, and widespread use. As hospitals can be considered as the largest consumers of antibiotics, wastes, both solid and liquid, can be a large reservoir of antibiotic resistant bacteria. As many patients take antibiotics in the hospital, bacteria can easily become resistant and spread. They might be excreted through urine and feces and so, the sanitary tanks containing these wastes can become a perfect place for the bacteria to develop resistance. If the waste isn't disposed of properly, that might cause a massive spread of infection from antibiotic resistant bacteria through areas and might even lead to epidemics. So, the aim of the current study was to isolate antibiotic resistant bacteria from wastes of wards of different hospitals in Dhaka city. Six samples were collected from six different hospitals of Dhaka city. The pH and temperature of the samples ranged between 6.62 and 6.8 and 27˚C and 32˚C respectively. LB agar media were used to study the heterotrophic bacterial counts. In PYG medium, the bacterial count was observed ranging between $1.96\times10^6$ cfu/g and $7.06\times10^6$ cfu/g. During this study, initially 150 bacterial isolates were selected. Among 150 isolates, 30 were selected for detail studies considering their morphological and physiological characteristics. Out of 30 isolates 12 were gram positive and 18 were gram negative. The antibiotic resistance of different isolates was determined based on OD measurement with antibiotic already present in media. There has been a large amount of research work done on antibiotic resistant bacteria. This study gives an overview of the potentially dangerous antibiotic resistant microorganisms that are present in hospitals of Dhaka city.

**Keywords**: *Enterococcus*, bacteria, MDR, hospital waste, Dhaka city.

# Adaptation of Locally Available Organic Materials Coping up with Integrated Nutrient Management System for Marginal Soils in Relation to Food Security

**Group:** Biological Science **Project ID:** SRG-221225

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## Abstract

The increasing degree and extent of degradation of soil health and land use changes are threatening the soil resources and urgent action is needed to inverse this trend. Therefore, the present research has been focused on the combined application of available organic and inorganic sources of fertilizers to enhance the soil fertility and bring about higher crop production, without having any undesirable impacts on the environment. Accordingly, the effects of the self-made organic composts, such as, Rice Hull Compost (RHC), Rice Straw Compost (RSC), Sawdust Compost (SDC) and Vermicompost(V) at the rates of 0, 2, 4 and 8 t ha-1 were evaluated. Inorganic fertilizers were used as an integrated nutrient management (INM) as per treatment condition. The effects of rice hull compost, rice straw compost, sawdust compost and vermicompost on rice were found to have significant ($p < 0.05$) effects with the increased rates and kinds of treatments. The yields of rice varieties were increased from 4.5 to 6.5 for BRRI Dhan 28 and 4.7 to 7.8 for BRRI Dhan 60 by the treatments. The applied organic compost significantly ($p \geq 0.05$) improved post-harvest soils health parameters by the different rates of the treatments as compared to that of the control. Soils pH values increased from 5.3 to 6.9 for the different treatments and the maximum pH (6.9) was determined by the T12 (V8) treatment. Soil organic matter contents were increased 61, 84, 77 and 118%, respectively by the application of rice hull compost, rice straw compost, sawdust compost and vermicompost regardless of the rates of these amendments. Other soil health parameters were also influenced positively by the applied organic composts. These findings suggest that the production of rice and soil health conditions can be improved by the application of these stated organic composts, of which vermicompost was more potential among the used composts.

**Keywords**: INM, Rice production, self-made organic compost, soil health, potential source.

# Analyzing RAS2 (Proto-Oncogene) Mutation in Yeast Model Organism

**Group:** Biological Science **Project ID:** SRG-221226

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## Abstract

The RAS genes are the founding members and prototypes of the RAS superfamily of small GTPases, that are involved in relaying signals from the cell surface receptor to the cell's interior, in order to turn on various metabolic processes such as cell proliferation, cell cycle, differentiation, migration/invasion, autophagy, apoptosis, etc. More than 30% of all human cancers are due to mutation in RAS proto-oncogenes (HRAS, KRAS, and NRAS) that are greatly conserved in yeast (*RAS1* and *RAS2*). This makes yeast an efficient single-celled eukaryotic model organism to study their functions. In this current investigation, the null mutation of the *RAS2* gene was analyzed in order to find out its deleterious consequences in single cell yeast model. The key experimental analysis includes lifespan, growth and proliferation status, mtDNA mutation rate through erythromycin-resistant assay, mtDNA abundance, and distribution pattern through fluorescence microscopy. In addition, *RAS2*'s network analysis with other genes and proteins was carried out through a bioinformatics approach. The results showed that *RAS2* gene mutation caused no significant difference in the longevity and proliferation rate between the wild-type and mutant. Nevertheless, it led to slight respiratory deficiency, and a high mtDNA mutation rate, and resulted in a much lower abundance of mtDNA compared to the wild type. The *RAS2* gene deletion hampered its protein-protein interaction network. Under normal circumstances in yeast, the accumulation of Ras2 proteins in mitochondria enhances apoptosis. However, as seen in this study, its deletion inhibited apoptosis and allowed the mutant cells to survive in erythromycin-containing plates. Thus, the effects seen, and information obtained from this research have suggested that *RAS2* gene mutation indeed has a link with mtDNA mutation and depletion which may act as a tool for future research in the field of Ras-associated cancer and other diseases.

**Keywords**: RAS2, Proto-oncogene, single cell yeast, mtDNA mutation.

# In Depth Profiling of Hilsa Shad (*Tenualosa ilisha*) Allergens from Different Habitats using Transcriptome Analysis

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## Abstract

**Background:** The excellent taste of Hilsa (*Tenualosa ilisha*) may make it a highly sought-after fish, but it is known to cause allergies in certain individuals as well. **Objective:** The current study was conducted to investigate the muscle transcriptome of mature hilsa for delineating the allergenic proteins in this anadromous fish in different habitats that correspond to known food allergens. **Results:** Several well-known fish allergens belonging to 28 different families have been identified in hilsa through this analysis, including parvalbumin, tropomyosin, filamin C, creatine kinase-2, aldolase A, triosephosphate isomerase B, and glyceraldehyde-3-phosphate dehydrogenase (G3PD). Among different allergens, only creatine kinase was found to be highly abundant and displayed a statistically significant difference between freshwater and brackish water hilsa ($p<0.03$) . *In silico* differential expression analysis revealed, Sal s 2 Enolase and Equ c 6 Lysozyme were found to be up-regulated in freshwater and brackish water hilsa in contrast to deep sea. According to the molecular docking investigation, the putative linear B cell epitope AAKSGYD of parvalbumin interacts with the Complementary Determining Region (CDR) of human IgE to promote Type I hypersensitivity reactions. **Conclusion:** Screening of the unreported allergenic proteins in Hilsa fish bridges a significant gap in characterizing fish allergy in the Bangladeshi population and lays the foundation for future molecular investigations.

**Keywords**: Hilsa shad, transcriptome, allergen, allergen Online, differential expression.

# Investigation of Biochemical Nutrients and Reducing Cracking and Dropping of Litchi Fruits cv. Bombai under Different Levels of 6-BAP and 2,4-DPA

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## Abstract

**Background:** Litchi fruit dropping and cracking are the prime problem resulting in low production and reduction in the cash income of growers in Bangladesh. **Objectives:** To investigate biochemical nutrients, reducing cracking and dropping of Litchi fruits cv. Bombai under different levels of 6-BAP and 2,4-DPA and to increase litchi fruit yield and some morpho-physiological responses to 2,4 DPA and 6 BAP. **Methodology:** The study was laid out in RCBD using 6-BAP and 2,4-DPA with following four levels for each i.e. control, 20 ppm, 30 ppm, 40 ppm, respectively. Flower number, number of fruit retention, dropping, fruit crack, moisture, ash, acidity, fruit growth (length and diameter), fruit quality (TSS, ascorbic acid, total sugar, Vitamin-C, Vitamin-A, total phenol content) and yield/tree were monitored. **Findings:** The results revealed that the plant biostimulants-2,4-DPA and 6-BAP significantly reduced fruit dropping. The fruitlet and mature litchi fruit retention was higher that those of non-treated litchi plants. The fruit retention was higher in 6-BAP than that of 2,4-DPA. The litchi fruit cracking was also reduced. Both PGRs improved litchi fruit quality and food nutrient values. The highest fruit weight, length, diameter, pulp to seed and pulp to peel ratio was increased treated with 20 ppm 2,4-DPA and 6-BAP. Fruit quality such as Vitamin C, Vitamin A, total phenol content and mineral nutrients (Ca, P, Zn and Fe) were also significantly improved by using 2,4-DPA and 6-BAP. **Conclusion:** Either 20 ppm 2,4-DPA or 20 ppm 6-BAP should be applied thrice at pea size, marble size and pre-harvest stages after fruit set to improve fruit quality and also to reduce fruit dropping and cracking of litchi cv. Bombai and it increased litchi fruit yield.

**Keywords**: Cracking, retention, litchi, 24-DPA, 6-BAP.

# Endophytic and Rizospheric Bacterial Consortia-Induced Upregulation of Steviol Glycoside In Stevia Plant

**Group:** Biological Science **Project ID:** SRG-221231

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## Abstract

Stevia (*Stevia rebaudiana*) is a small plant. The leaf of stevia plant contains a sweet compound called 'stevioside' which is sweet to taste (250 to 300 times sweeter than sucrose) and used as a natural sweetener for diabetic patients. It has been drawing a great attention as sugar alternative and dietary supplement. Several agronomical approaches have been taken to improve the growth of stevia plant in Bangladesh, but is not much fruitful in field conditions. Endophytes secrete valuable metabolites and help plants to adapt in stress conditions consequently improving crop yields. Yet no study has reported the application of growth-promoting potential of endophytic bacteria on stevia plants. Here we attempted to improve the vegetative growth and stevioside content of Stevia plant by applying endophytic-bacterial consortia (mixture of bacteria). For this, four endophytic bacteria were isolated from the leaves of healthy plants and identified through whole genome sequencing. Furthermore, biochemical properties and plant-growth-promoting traits such as N-fixation, P-solubilization, auxin production activities of these naturally occurring endophytic bacteria were characterized. Endophytic bacterial consortia contained Acinetobacter sp. strain HSTU-ASn38 (MK696218.1); Enterobacter sp. strain HSTU-Sny (MK656939.1); Pantoea sp. strain HSTU-Sny4 (MK656941.1). Treatment with endophytic bacterial consortia significantly increased the leaf biomass (26.36g) and leaf area (3.57 cm2) compared to control. The amount of sugar content was higher in endophytic-bacterial consortia treated stevia leaf than that of control plants. This study suggests that endophytic bacteria from plants play a key role in enhancing stevia plant growth. Thus, these isolates could be deployed as bio-stimulants to improve crop production by creating a sustainable biological system.

**Keywords**: Steviol glycoside, endophytes, bacterial consortia, phenotypic characters.

# Sublethal and Transgenerational Effects of Imidacloprid on the Seven-Spot Ladybeetle *Coccinella septempunctata* L. (Coleoptera: Coccinellidae)

**Group:** Biological Science **Project ID:** SRG-221232

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## Abstract

The seven-spot ladybird beetle, *Coccinella septempunctata* L., an aphidophagous predator, is a potential biological control agent for various insect and mite pests in the field and greenhouse. Chlorantraniliprole is anthranilic diamide that acts on insect ryanodine receptors and is particularly effective against coleopteran and lepidopteran insect pests but it also has sublethal effects in nontarget organisms. The investigation was conducted in the laboratory to evaluate the lethal and sublethal effects of chlorantraniliprole against *C. septempunctata*. In this context, life table data were statistically analyzed utilizing the age-stage, two-sex life table approach. The development time of the second, fourth and pupa in the population treated with LC10 (4.56 mg (a.i.)/ L) and LC30 (14.84 mg (a.i.)/L) was significantly longer. The adult longevity and fecundity were significantly shortened after treatment when compared to the control. Demographic data show that the net reproductive rate (Ro) and intrinsic rate of increase (rm) in C. septempunctata populations exposed to sublethal concentrations of chlorantraniliprole were lower. This finding includes detailed information on the use of chlorantraniliprole insecticides in IPM and other pest management programs. Because sublethal concentrations of chlorantraniliprole inhibit C. septempunctata population growth, further attention should be made to the use of this chemical as a component of IPM techniques.

**Keywords**: Adult longevity, chlorantranilipole, fecundity, predator, LC10.

# Survival and Larval Development of the Invasive Fall Armyworm, *Spodoptera frugiperda* (Lepidoptera: Noctuidae) Fed on Different Hosts of Economic Importance in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221233

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## Abstract

**Background:** Fall armyworm *Spodoptera frugiperda* (Lepidoptera: Noctuidae) is a newly introduced invasive pest of maize in Bangladesh that cause serious damage of various crops. **Objectives:** The effect of four host plants (maize, cabbage, red amaranth and soybean) on the survival, larval development and oviposition preference of *S. frugiperda* were evaluated. **Methodology:** Larval development and adult female oviposition preference of *S. frugiperda* fed on maize, cabbage, red amaranth, and soybean and age-stage two-sex life table were determined in laboratory condition. **Findings:** *S. frugiperda* reared on maize showed the strongest performance with shorter larval developmental time, longer adult longevity and higher fecundity rate in female adults than those reared on cabbage, red amaranth and soybean. *S. frugiperda* laid more eggs on maize in preference to cabbage, red amaranth, and soybean in the choice test experiment and laid more eggs on maize plant than inner cage wall in non-choice tests. On the other hands, female adults of *S. frugiperda* laid more eggs on inner cage wall than cabbage, red amaranth and soybean in non-choice test. *S. frugiperda* were survived to the adult stage differed significantly among the four host plants, with 63.33% on maize, 43.33% on cabbage, 46.67% on red amaranth and 33.33% on soybean. High mortality rates were occurred in the 1st instar larvae when fed on cabbage and soybean, with mortality rates of nearly 56% on both hosts. The net reproduction rate ($Ro$= 102.89), gross reproductive rate ($GRR$=93.81), intrinsic rate of natural growth ($r$ = 0.13), mean generation time ($T$=35.75), finite rate of increase ($\lambda$ =1.14) were highest in maize, whereas population doubling times was the longest ($DT$ = 5.78) on cabbage. **Conclusion:** *S. frugiperda* larvae and adults showed less performance on cabbage, red amaranth and soybean but their progeny will be capable of establishing populations on all four hosts.

**Keywords**: Survival, larval development, egg preference, maize, cabbage, red amaranth, soybean.

# Metabolic Profiling Using 1H NMR Spectroscopy for Quality Assessment of Black and Green Tea Available in Bangladesh Market

**Group:** Biological Science **Project ID:** SRG-221234

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## Abstract

Tea (*Camellia sinensis*) is the second most popular beverage in the world after water. Metabolomics research has identified diverse metabolites of tea depending on several factors. However, until date, metabolomics approach using $^{1}$H NMR spectroscopy is still unelucidated for tea samples commonly available in Bangladesh. Therefore, in this project, eighteen branded tea samples of black, green, and herbal teas were analyzed to identify diverse tea metabolites, bioactive substances, and antioxidants by using the $^{1}$H NMR-based metabolomics approaches together with classical spectrophotometric methods. Results showed a diverse range of tea metabolites including catechin and its derivatives, catechin gallate (CG), epicatechin (EC), epicatechin-3-gallate (ECG), epigallocatechin (EGC), epigallocatechin 3-gallate (EGCG), and gallocatechin (GC), the most predominant theanine and caffeine, and other primary and secondary metabolites including acetate, 2-O-(β-L-Arabinopyranosyl)-myo-inositol (Ara), asparagine (Asn), aspartate (Asp), choline, unsaturated fatty acids (FAs), gallate, α-glucose, sucrose, and threonine, which were identified in 1D 400 MHz 1H NMR spectrum. Multivariate statistical analysis of comprehensive tea metabolites (PCA) and heatmap showed clear metabolic differentiations of tea types indicating their different fermentation process. In addition to these, the present study also showed that water extract of tea infusions has varied amount of total phenol, flavonoid, pro-anthocyanin, FRAP, DPPH based on tea categories. In general, green tea samples had the highest total phenolic content compared to black and herbal teas. The findings of the current investigation demonstrated that marketed tea is a potential source of many phytochemicals and bioactive compounds which can contribute to defeat illness and relaxing beverage as well. Furthermore, the relationship between types of tea and fermentation technology suggests a possible tea ranking and grade of Bangladesh market tea samples that might be interesting for the consumers, growers, and traders for their choice and evaluation for nutritive classification.

**Keywords**: Metabolic Profiling, $^{1}$H NMR Spectroscopy, market brand tea, antioxidants, total phenol.

# Population Structure and Genetic Diversity Based on Simple Sequence Repeat Markers of Exotic Cherry Tomato Germplasms and Generation of Experimental Hybrids

**Group:** Biological Science **Project ID:** SRG-221235

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## Abstract

Cherry tomato (*Solanum lycopersicum* var. *cerasiforme*) is cherished for its vibrant colours, unique flavors, and nutrient-dense properties though suitable cultivable varieties are limited in Bangladesh. So, the study was focused to evaluate genetic diversity incorporating yield traits, antioxidant properties and SSR markers followed by crossing among superior cherry tomato genotypes. The investigation was carried out at HSTU, Dinajpur campus from September 2022 to March 2023 in a Randomized Complete Block Design with three replications. Considering mean performances, Red0107 (3.74 kg), Red02 (3.34 kg), and Red001 (3.27 kg) were exhibited as high-yielding (kg/plant) genotypes. From biplot analysis, the genotypes Red01, CTOM-1211, Red001, Red02, TM-01, TM-02, TM-03, TM-09, CTOM-1208 favored lycopene content and percent fruit set. All 36 genotypes were grouped into five clusters. The maximum number of cherry tomato genotypes were incorporated in Cluster V (13) and maximum inter cluster distances was revealed between Cluster III and Cluster V. In the molecular study, 14 simple sequence repeat (SSRs) markers were employed where the marker SSR63 produced the maximum number of polymorphic alleles (8) and highest PIC value (0.83). Here, three populations were assumed where Population II consisted maximum genotypes (36.8%). Molecular cluster analysis also revealed three main clusters where Cluster I consisted of maximum 13 genotypes. The genotypes TM-06, Cherry tomato-5, Red03, Red007, TM-23 from morphological Cluster III and molecular Cluster I; and the genotypes Cherry tomato-2, Cherry tomato-3, BU cherry tomato-2, TM-07, Red04 from morphological Cluster V and molecular Cluster II exhibited diverse genotypes. Further experiment of 6×6 half diallel crossing revealed 11 successful parental cross combinations out of 15 crosses and generated experimental hybrid ($F_1$) seeds. Therefore, the diverse genotypes TM-07, Red03, Red04, CTOM1223, CTOM1221, Cherry tomato-6 could be used as potential parents in cherry tomato hybridization programs and 11 experimental hybrids needs further field evaluations.

**Keywords**: Cherry tomato, SSR markers, genetic diversity, hybridization, antioxidant properties.

# Altering Genetic Make-Up Through Inducing Different Concentrations of Sodium Azide to Evolve Novel Genotypes in Cotton (*Gossypium hirsutum* l.)

**Group:** Biological Science **Project ID:** SRG-221236

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## Abstract

The experiment was conducted at Cotton Research, Development, Training and Seed Multiplication Farm, Sadarpur, Dinajpur during 2022-2023. The seeds of five cotton varieties, names, CB15, CB16, CB17, CB18 and CB19 were treated with the chemical mutagen, sodium azide ($NaN_3$); three concentrations viz.10Mm/L, 15Mm/L and 25 Mm/L were used to treat the seeds. The treated seeds were sown on 13 July, 2022 following augmented design. A total of 237 suspected mutant plants were identified before 1$^{st}$ boll picking. Ten phenotypic characters were studied in the varieties as well as in the mutant plants. The variety, CB18 produced the highest number of possible mutants (51 plants) while CB17 showed rigidity to change its genetic makeup, produced the lowest mutants (43) but the important characters such as the lowest plant stature (111.03 cm), the highest means of sympodial branches/plant (24.58), bolls/plant (36.65) and seeds/boll (35.25) were recorded from the mutants derived from the variety, CB17, whereas the highest seed cotton yield/plant (136.49g) was recorded from the predicted mutant plants of the variety, CB16 and the highest lint fiber yield/ plant (122.75g) was obtained from the mutant plants originated from the variety, CB15; such expression of selected characters in the mutant plants might happened due to relaxed fixation of concerned alleles in the early generation. Nonetheless, earliness index was inversely behaved with lint fiber yield/plant, it is noted that the highest lint fiber yield/plant was recorded in the mutants of CB15 when the earliness index was the lowest (89.25%), compared to the mutants derived from other four varieties. To develop high lint fiber yielding, short duration and compact canopy structured cotton varieties that eventually would meet up the demand of the cotton growers in the northern belt of Bangladesh.

**Keywords**: Sodium azide, mutation, variable genotypes, selection, cotton.

# Determination, Molecular Characterization and Antibiotic Resistance of Organisms Isolated from Postpartum Uterine Infection in Dairy Cattle

**Group:** Biological Science **Project ID:** SRG-221237

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## Abstract

**Background**: Uterine infection usually arises as part of a complex of diseases that is referred to as the 'metritis complex: retained fetal membranes, metritis, endometritis and pyometra. Postpartum uterine infections are the major hindrance in livestock development in Bangladesh. **Objectives**: The present study was carried out to investigate the prevalence, isolation and identification, molecular characterization and antibiotic resistance pattern of bacteria causing postpartum uterine infections in cows in northern part of Bangladesh using history, clinical signs and standard bacteriological techniques. **Methodology**: The identified isolates were characterized by PCR. The identified isolates were studied in vitro for their antibiotic sensitivity by agar disc diffusion method against commonly used antibiotics. A total of 20 samples were taken for study. **Findings**: Twelve isolates of three genera of bacteria e. g., *E. coli, Staphylococcus spp.* and *Bacillus spp.* were isolated from postpartum uterine infections. Molecular detection of *E. coli, Staphylococcus spp.* were confirmed by using Eco 223, Eco 455, Sau 234 and Sau 1501 primer, target gene were 16S and 23S rRNA and size of product amplified 232 bp and 1267 bp respectively. Antibiogram profile was revealed that *E. coli* was sensitive to Amoxicillin, Levofloxacin, Ciprofloxacin, Ceftriaxone, Tetracycline, Gentamicin and intermediately resistant to Erythromycin. *Staphylococcus spp.* was intermediately resistant to Erythromycin and resistance to Ampicillin, Vancomycin, Amoxicillin, Ceftriaxone, Penicillin, Tetracycline. Bacillus spp. was sensitive to Ampicillin, Amoxicillin, Ceftriaxone, Tetracycline, intermediately resistant to Erythromycin and resistance to Vancomycin, Penicillin. Multidrug Resistant Organisms were found which suggest that antibiotic should be selected before antibiotic therapy to cows. **Conclusion**: The results of this study would be helpful for the prevention of bacterial cause of postpartum uterine infections.

**Keywords**: Uterine infections, causal agents, bacteria, antimicrobial resistance, cows.

# *In Vitro* Reconstitution of mRNA Export from the Nucleus to the Cytoplasm

**Group:** Biological Science **Project ID:** SRG-221238

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## Abstract

It has been reported that RNA molecules in the cell undergo phase separation and form liquid-like droplets. However, in plant cells, under environmental stress, the liquid-liquid phase separation remains largely unknown. In addition, how the phase separation of RNA affects the mRNA export from the nucleus to the cytoplasm remains enigmatic. Therefore, in the present study, liquid-liquid phase separation of RNA isolated from rice (*Oryza sativa*) was investigated. For those purposes, the seeds of rice were germinated and cultivated both in normal and stressful conditions, heat treatment at 42 $^{0}$C was applied on normal rice plants as stress. Then the newly grown rice plants were harvested and collected RNA from them. These RNA samples were used for the investigation of liquid-liquid phase separation using a phase contrast fluorescence microscope. From the data, RNA isolated from normal-grown rice plants, undergoes liquid-liquid phase separation, and form spherical droplets and tangle-like structure in all the physical and physiologically defined conditions *in vitro*. The number of spherical droplets increases with the increase in RNA concentrations. From this data, it can be said that RNA phase separation is an effector to export from the nucleus to the cytoplasm. Rice plants under heat-stress conditions produced a higher number of perfect RNA spherical droplets with smaller sizes. From these data, it can also be said that stress-induced less wetting with higher liquidity of smaller spherical droplets which might be an effective inducer of higher rate of RNA droplet export from the nucleus to the cytoplasm. And thereby, the rate of RNA translation would be increased under heat stress. Collectively, it can be said that heat stress regulates protein expression through the regulation of mRNA export, and for it, the driving force is the phase separation of mRNA.

**Keywords**: MRNA, Liquid–liquid phase, stress, liquid droplets, heat treatment.

# Screening the Sensitivity and Evaluation the Synergistic Effect of Biological and Chemical Agents Against *F. oxysporum* to Minimize the Excessive Use of Synthetic Fungicide

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## Abstract

*Fusarium oxysporum* is a fungus that lives in the soil and causes wilt which is one of the most common diseases of vegetable crop varieties in Bangladesh. More ecologically friendly ways for controlling this disease are currently being advocated, including the use of low dosages of synthetic fungicides and biocontrol agents such as Trichoderma and different essential oils. Thus, the goal of this study was to observe if the biological control agent Trichoderma spp. and essential oils of medicinal plants combined with low dosages of synthetic fungicide have a synergistic impact in inhibiting *F. oxysporum* mycelial growth. To conduct the synergistic essays, different concentrations of commercial fungicides, chemical agent copper sulfate, and essential oil from medicinal plants were suspended and Trichoderma spp. was placed upside down in PDA plates separately, then mycelial mats of *F. oxysporum* were placed at the center of the petri dishes by poison plate diffusion method. In this study, the results showed the growth inhibition by the chemical agent copper sulfate was approximately 30.25% to 56.75% in different concentrations such as 0.25%, 0.5%, and 1% and the combined effect of synthetic fungicide at the minimum inhibitory concentration (MIC) with chemical agent copper sulfate (CuSO4) showed a low synergistic effect. Moreover, biological agent essential oils (*E. globulus* and *C. citratus*) with synthetic fungicides showed moderate synergistic effects of 56.75% and 62.39% respectively. The other most efficient biological agent Trichoderma spp. can control the mycelial growth of *F. oxysporum* and the inhibition rate was approximately 65.62% and the combined treatment of synthetic fungicide with Trichoderma spp. showed a synergistic effect on Fusarium spp. and the growth inhibition was approximately 81.39%. These findings strongly suggest that Trichoderma spp., in combination with synthetic fungicide at the MIC, could be used as an environmentally friendly alternative approach to control the growth of *F. oxysporum*.

**Keywords**: Synergistic effect, *Fusarium oxysporum*, synthetic fungicide, *Trichoderma spp*.

# Cytogenetical Analysis of *Trigonella foenum-graecum* L. and Evaluation of its Cytotoxic Sensitivity on *Allium cepa* Bioassay

**Group:** Biological Science **Project ID:** SRG-221240

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## Abstract

*Trigonella foenum-graecum* L. is a widely distributed plant in the Fabaceae family and holds a rich history in traditional medicine and food use. The aim is to assess the ability of *Trigonella foenum-graecum* seed extracts to influence genotoxicity using the *Allium cepa* root tip assay. The research aim is to investigate chromosomal abnormalities and karyotype analysis. *Trigonella foenum-graecum* seed extract is prepared and cultivated *Allium cepa* roots, roots undergo pretreatment, Fixation, preservation, slide preparation, and observation. Data analysis concludes the study. The cytogenetic examination of *Allium cepa* root meristem cells exposed to *Trigonella foenum-graecum* seed extract unveiled significant impacts on both cell division and chromosome stability. The root meristem, treated with different concentrations (20%, 30%, 40%) of the seed extract over varying durations (6, 24, 48 hours), demonstrated a concentration-dependent reduction in the mitotic index, indicating a noteworthy effect on cell proliferation. Analysis of cells in anaphase-telophase exposed to the extract revealed a diverse array of chromosomal aberrations. Quantification of stickiness, bridges, vagrant chromosomes, c-anaphase, multipolarity, and fragments indicated substantial deviations from the normal state. Particularly notable were the prevalent occurrences of stickiness and bridges, suggesting issues related to adhesion and chromosome segregation. The incidence of aberrations increased with higher extract concentrations, underscoring the concentration-dependent nature of the observed effects. The presence of micronuclei during interphase indicated genotoxicity, emphasizing the potential of *Trigonella foenum-graecum* seeds extract to induce chromosomal instability and disrupt the regular mitotic process in *Allium cepa* root meristem cells. This comprehensive assessment highlights the intricate cytogenetic consequences of the seed extract on cellular dynamics and genetic integrity. In conclusion, *Trigonella foenum-graecum* seeds extract exhibited concentration-dependent effects on *Allium cepa* root meristem cells, impacting cell division and chromosome stability. The observed chromosomal aberrations, including stickiness and bridges, underscore its potential genotoxicity, emphasizing concerns for genetic integrity.

**Keywords**: Genotoxicity, chromosomal aberrations, concentration, duration.

# Effects of Artemia Feeding Frequency on Survival and Growth Rate of Larvae of Mud crab, *Scylla olivacea*

**Group:** Biological Science **Project ID:** SRG-221242

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## Abstract

Feeding with a good and appropriate frequency will affect the survival rate of crab larvae, especially in the early stages which are the critical stages of larvae. The problem faced by crab cultivated related to the hatchery is that the survival rate is low. The aim of this study was to compare the different feeding regimes for the rearing of orange mud crab larvae. This study consisted of three treatments, namely Treatment A (Artemia feed 4 times), Treatment B (Artemia 4 times and formulated feed 2 times), and Treatment C (Artemia 6 times) each with three replications. The study was conducted in concrete-made Larvae rearing tanks with 4.5 tons of water volume and rearing tanks were used from Zoea 1 to crablet stages. Each larva-rearing tanks was stocked with newly hatched larvae at a density of 100 larvae $L^{-1}$. The result showed that treatment B performed better in zoeal survivability in different stages and crablet production compared to treatments A and C. The crablet production rate in treatment B was 3.55% whereas treatments A and C produced crablet at a rate of 0.06% and 0.11%. After 15 days of hatching Larval Stage Index value was observed 5.08 in treatment B, 4.75 in treatment A, and 4.85 in treatment C. The size of zoea in each stage was also found larger in Treatment B than two others. So, additional feed supply as formulated feed along with artemia feed might produce better result for larva rearing of mud crab and crablet production.

**Keywords**: Feeds, survivality, crablets.

# Phytochemical Screening and Evaluation of Antioxidant, Antimicrobial, and Cytotoxic Activities of Seaweed (*Dictyota dichotoma*) extracts

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## Abstract

Seaweed is the most widely used marine resource, which serves as an essential biological function across a range of scientific disciplines. Despite their importance, the bioactive characteristics of Bangladeshi seaweeds have received little or no attention. Brown seaweed *Dictyota dichotoma* is widespread in mild temperate to tropical regions, including Bangladesh. In the present study, *D. dichotoma* was collected from the St. Martin's Island and the phytochemical constituents and some bioactive properties (in vitro antioxidant, antibacterial and cytotoxicity) of its ethanolic extract were studied. The presence of phenolic substances, flavonoids, glycosides, steroids, tannins, coumarins, quinones, and photosynthetic pigments in the ethanolic extract was confirmed using phytochemical screening and UV-VIS spectroscopy at 190-1100 nm. In the well-known 2,2-diphenyl-1-picrylhydrazyl (DPPH) test, the extract showed only weak levels of free radical scavenging action (IC50 = 2695.543 3.63 g/ml). The extract displayed significant antioxidant capabilities, as evidenced by its total phenol content and total antioxidant capacity (18.109 0.056 mg GAE/g and 116.968 1.029 mg AAE/g, respectively). The ethanolic extract was reported to display negligible toxicity to brine shrimp larvae in a cytotoxicity examination using the brine shrimp lethality test (LC50 = 987.052 g/ml). An in vitro antibacterial assay using agar well diffusion method confirmed the presence of modest antibacterial activity only against Gram-positive *Staphylococcus aureus* (inhibition zone = 7.167±0.289 mm). The two Gram-negative bacteria (Klebsiella sp. and Staphylococcus aureus) that were examined showed no antibacterial activity. Accordingly, our results imply that the ethanolic extract of *D. dichotoma* has an intriguing chemical composition that may contribute to its bioactivity and serve as a source of novel, potent antioxidant and antimicrobial compounds, which merit further explanation.

**Keywords**: Brown seaweed, phytochemicals, antioxidant, antimicrobial, tannin.

# Evaluation of Potential Serological Cross-Reactions and Epitope Profiling of SARS-CoV-2 and Dengue Virus to Identify the Signature Mimicry Sites

**Group:** Biological Science **Project ID:** SRG-221244

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## Abstract

**Background**: The clinical resemblance of COVID-19 and dengue symptoms poses a significant diagnostic challenge. Moreover, SARS-CoV-2 and dengue can cross react with each other. **Objectives**: Our research focuses on assessing the suitability of SARS-CoV-2 antigens for serological testing while minimizing the risk of cross-reactivity with dengue antibodies. **Methodology**: We collected 210 serum samples from 179 patients and categorized them into four panels. Panels 1 and 2 comprised COVID-19-negative healthy donors (n=81) and dengue patients from before the COVID-19 pandemic (n=50), respectively. On the other hand, Panel 3 (n=19) included samples from individuals who tested positive for COVID-19 using RT-qPCR <14 days of symptom onset, while Panel 4 (n=60) consisted of samples from individuals who tested positive >14 days of symptom onset. **Findings**: We utilized previously developed and well-characterized SARS-CoV-2 spike-1 (S1), receptor binding domain (RBD), and nucleocapsid (N) immunoglobulin G (IgG) enzyme-linked immunosorbent assay (ELISA) methods in our study. We observed cross-reactivity between the RBD of SARS-CoV-2 and six dengue-positive sera. However, only one dengue-positive serum exhibited cross-reactivity with the S1 and N proteins of SARS-CoV-2. We found that co-immobilizing S1 and RBD in different ratios, with an 80:20 (S1:RBD) ratio, yielded optimal results, achieving an overall sensitivity of 96.2% while minimizing cross-reactivity with anti-dengue antibodies. **Conclusion**: Our findings indicate that SARS-CoV-2 RBD-based immunoassays are more prone to cross-reactivity with anti-dengue antibodies than S1 and N proteins. Furthermore, co-immobilizing S1 and RBD in specific ratios reduces the risk of cross-reactivity with dengue antibodies compared to RBD alone. This approach enhances the specificity of the immunoassay without compromising its overall sensitivity, making it particularly valuable in dengue-endemic regions.

**Keywords**: Sensitivity, ELISA, spike protein, cross-reactivity, Covid-19.

# Molecular Surveillance of Colistin Resistance and ESBL Producing *Enterobacteriaceae* Isolates from Aquatic Environment Sources of Industrial Sites in Savar Area

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## Abstract

**Background**: Antibiotic resistant bacteria and certain genetic traits often transmit among humans, animals, and the aquatic environment. One health approach is needed to address the problem. **Objectives**: The aim of this study was to address the occurrence, abundance and genotypic characterization of colistin resistant and ESBL producing *Enterobacteriaceae* from different aquatic sources in Savar area. **Methodology**: A total of 43 colistin resistant and 23 ESBL producing *Enterobacteriaceae* isolates were selected and purified subsequently. Representative isolates were subjected to antibiotic susceptibility test to determine their drug resistant pattern by Kirby-Bauer disc diffusion method. **Findings**: Eighty percent (80%) isolates showed multi-drug resistance against 8 different groups of antibiotics. The highest percentage of resistance was found against Ampicillin (98.6%), Tetracycline (80%) and Amoxicillin (70%). Minimum inhibitory concentration (MIC) range was 4 µg/ml for 10 isolates and <1024 µg/ml for 8 isolates. Among 12 representative ESBL producing *Enterobacteriaceae* isolates, 43% (n=5) isolates showed the presence of $bla_{CTX\text{-}M13}$ gene. The study indicates that industrial activity promotes the dissemination of antibiotic resistance which poses a considerable threat for ecological balance. Aquatic ecosystems are being increasingly identified as a sink for antimicrobial resistance (AMR). Further molecular surveillance of these isolates will contribute to understand the mechanism of resistance development of the microbes against various antibiotics. **Conclusions**: These findings might shed light on the impact of industrialization without adequate (effluent treatment plant) ETP on antibiotic resistance dissemination. The result of this study will be valuable in designing sustainable strategies to contain MDR in Bangladesh.

**Keywords**: *Enterobacteriaceae,* aquatic sources, colistin, ESBL, multidrug resistance.

# Epidemiological Characteristics and Socio-environmental Determinants of Dengue Transmission Risk in Savar, Dhaka: People's Perception and Clinical Manifestations

**Group:** Biological Science **Project ID:** SRG-221246

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## Abstract

**Background**: In Bangladesh, dengue fever is a recurring public health concern and the most prevalent mosquito-borne viral infection. Despite government efforts, dengue outbreaks continue to rise, and the level of knowledge and preventive practices related to the disease in rural communities remains unclear. **Objectives**: The objective of this study was to assess the knowledge and preventive behaviors regarding dengue among the rural community in Savar, Bangladesh. **Methodology**: We conducted a cross-sectional survey from August to September 2021, involving 401 participants using a multi-stage sampling technique in three rural areas of Dhaka. Data were collected through face-to-face interviews using a pre-tested structured questionnaire. The questionnaire included information on demographics, housing, surroundings, as well as knowledge, beliefs, and practices related to dengue. Multivariable logistic regression was used to identify factors associated with dengue knowledge and practices. **Results**: Among the surveyed participants (mean age = 33.47, age range = 18-75 years), over three fifths demonstrated good knowledge of dengue, with a mean percentage score of 66.15%. Factors strongly associated with dengue knowledge included higher education, travel to dengue-prone areas, and self-efficacy as measured by the Health Belief Model (HBM) construct. Despite having a moderate level of knowledge, just over half of the respondents (53.69%) reported engaging in dengue prevention measures. Factors influencing dengue prevention practices included age, gender, education level, occupation, housing quality, perceived susceptibility, and self-efficacy under the HBM construct. Notably, participants' knowledge had a significant impact on their dengue prevention practices. **Conclusion**: This study highlights the insufficient knowledge and preventive practices regarding dengue in the Savar region. There is an urgent need to bolster health promotion initiatives through awareness campaigns to dispel misconceptions and bridge knowledge gaps related to dengue.

**Keywords**: Dengue, knowledge, preventive practices, health belief, rural area.

# Association of Indoor Air Pollution at Home with Respiratory Disease Symptoms Among the Occupants

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## Abstract

The primary pollutant that poses the greatest danger among other criteria pollutants in Dhaka is particulate matter (PM). This investigation seeks to evaluate the quality of indoor air in Dhaka by specifically examining PM2.5 and PM10, as well as the respiratory symptoms related to these pollutants in residential settings. A portable air quality sensor was used to measure the concentrations of PM2.5 and PM10 in 18 residences located throughout Dhaka. A structured questionnaire was also administered to collect data on various sociodemographic characteristics such as age, gender, occupation, education level, marital status, family size, monthly income, and smoking habits. Home characteristics were also recorded, including the year it was built, the number of floors, the selected floor, the total area, the number of bedrooms, and the total number of years it has been occupied. Information about the ventilation system, such as the number of windows, the duration of window openings, and the duration of air conditioning on/off, as well as indoor activities such as cleaning, cooking, and smoking were also collected. The findings reveal that the average 24-hour mean concentrations of PM2.5 and PM10 in all homes exceeded the guidelines set by the World Health Organization (WHO). The average concentrations of PM2.5 and PM10 in 18 homes were determined to be 82.36µg/m3 (±58.01) and 87.54 µg/m3 (±61.21) respectively. Several factors were found to be significant contributors to the increase in PM2.5 and PM10 concentrations, including the daily duration of AC usage, number of smokers in the household, frequency of mopping (once every 1-2 days), use of mosquito spray, and daily cooking frequency. The concentration levels of these pollutants are significantly influenced by factors such as the frequency of ventilation, cleaning, and cooking activities.

**Keywords**: Air pollution, PM2.5, PM10, home, dhaka city.

# Assessment of the Accumulation of Heavy Metals from River Water to Vegetables & Associated Health Risk in Dhaka

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## Abstract

**Background**: Industrial effluent discharge in river can contaminated river water with heavy metal &exert negative impacts on environment. As river water is most common water source for irrigating vegetables, crops in peri urban or urban areas of many countries including Bangladesh, heavy metal can be accumulated into plants & enter into human body through food chain. **Objectives:** The main objective of the study is to examine and detect presence of heavy metals in seasonal vegetables & assessment of their associated health risks. **Methodology:** This study was conducted to examine the uptake of heavy metal As, Cd, Co, Hg, Zn, Cr, Pb, Cu, Ni, Mn, Se in water of bangshi river, Soil of agricultural field on the bank of the river & different vegetables grown in Nolam village, savar, on the bank of Bangshi River micronutrient Ca, Na, Fe, Mg is also measured. **Findings:** Heavy metal concentration were determined in 2 leafy vegetables (Spinach, Pumpkin leaf),2 root vegetables (Potato, Radish),2 fruits vegetables (Brinjal, Tomato). The bio concentration factor from soil to plant & Daily intake metal of adult & children is also measured. Among all heavy metal Zn show the highest concentration 4201.5078µg/g where se showed the lowest concentration .01878µg/g. But most of the vegetables absorb heavy metal above their safe permissible value, suggested by FAO/WHO. All 3 types of vegetables average heavy metal concentration sequence were Leafy>root>fruit & the concentration were 205.38µg/g,84.91µg/g, 77.1µg/g respectively. We also found that soil heavy metal concentration was very high 3636.805µg/g. Daily intake metal level is higher in children than adult. **Conclusion:** Therefore, it can be said that if people consume vegetables from the studied site over a long period of time, they may become exposure to lifelong carcinogenic & non carcinogenic health risk.

**Keywords:** Heavy metals, health risk, vegetables, Bangshi river, Bangladesh.

# Molecular Identification of Forensically-Important Fly Species and their Applications in Bangladesh

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## Abstract

**Background:** Blowflies (Diptera: Calliphoridae) are common and cosmopolitan insect andusually metallic blue, green, or black in colour. They are forensically very important for their potential applications in medicolegal investigations. **Objectives:** There are diversified blowfly species in Bangladesh so molecular identification of two predominant species of forensically important blowflies is very important. **Methodology:** The adult flies with different morphological characteristics were trapped with rotten fish baits from nearby areas of the Department of Zoology building of Jahangirnagar University campus. In this study 28S ribosomal gene analysis was performed to confirm the morphological identification. Genomic DNA was isolated and purified by using standard methods from the adult flies. In molecular identification, fragment of 540bp of the 28S region gene was sequenced from two different adult specimens. **Findings:** The identified species were *Crysomya chani*and *Lucilia ampullacea* and the phylogenetic analysis showed that they are genetically close and monophyletic, which means that although they are genetically similar but the morphological appearance of these species can be distinguished. Both *Chrysomya* sp. and *Lucilia* sp. are morphologically slightly similar, and both are hairy maggot species, but they differ from each other in some of the morphological aspects. The sequencing results and phylogenetic analysis of the blow flies showed 95% similarity with two blowfly species from GenBank. **Conclusion:** Therefore, it might be a better tool to determine differences in the sequences of closely related species and useful for molecular identification.

**Keywords**: Molecular identification, blowfly, forensically important, applications, Bangladesh.

# *In Vitro* and *In Vivo* Evaluation of Arsenic Biosorption Kinetics of Isolated Indigenous Multi-Heavy Metal Tolerant Bacteria

**Group:** Biological Science **Project ID:** SRG-221250

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## Abstract

**Background:** Marker proteins have significant role in bacterial arsenic (As) transformation. Phylogenetic analysis and other bioinformatic analysis guide the evolutionary origin and As transforming potential of the bacteria. In addition, indigenous arsenic (As) tolerant bacteria cause significant transformation of soil As. **Objectives:** Hence, phylogenetic analysis and other bioinformatic analysis of As transforming bacterial marker protein following isolation of potential indigenous As tolerant indigenous bacteria were done. **Methodology:** A number of 10 marker genes in 20 bacterial species were selected for phylogenetic analysis. The most significant marker genes present in most of the species were selected for three-dimensional modelling. Bacterial isolates were screened from the As contaminated rhizospheric soils of Bangladesh following standard protocols. Then, their biosorption kinetics to As (III) and As(V) were measured. **Findings:** The results revealed that some bacterial genomes (*P. aeruginosa, E. coli,* and *K. pneumonia*) even featured up to five marker proteins. Among the isolated indigenous bacterial isolates, multiple isolates (F1, S1, K2, K3) showed significant tolerance and biosorption kinetics to As (III) and As(V), which may potentially transform a significant quantities of As. **Conclusion:** Hence, integration of the results of phylogenetic and other bioinformatic analyzes and As tolerance in the bacterial isolates could guide to explore the mechanism of how bacteria transform As at cellular and molecular levels.

**Keywords**: Arsenic transformation, phylogenetic, bioinformatic, bacterial isolates.

# Exploration of Nutritional Profile and Bioactive Compounds of High-valued Sea Urchin Bioresources in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221251

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## Abstract

The research was undertaken to investigate the population structures of sea urchins in the Bay of Bengal, and to determine their bioactive compounds and nutritional profiles. A total of 629 blue-black urchins (*Echinothrix diadema*) were collected from the Saint Martin's Island during July 2022–June 2023, and the mean weight and length was measured to be 233.03 ± 96.87 g and the 8.31 ± 1.38 cm. The relationship between the total body weight (TW) and the total length (TL) was estimated as $TW = 1.1843*TL^{2.4656}$ ($R^2$=0.8566). The Von Bertalanffy growth parameters such as asymptotic length (L∞), growth coefficient (K), growth performance (φ) and age were 11.55 cm, 0.74/yr, 3.10, 6.76 yrs, respectively. The total mortality, natural mortality and fishing mortality were 2.11/yr, 1.91/yr and 0.20/yr. The exploitation rate (E) estimated for *E. diadema* was 0.42. The recruitment pattern of *E. diadema* was observed to be continuous throughout the year with the highest peak was 28.0% in December. For biochemical studies, gonadal tissues of *E. diadema* were analyzed for their proximate compositions, bioactive components and organic compounds in dry matter basis. Based on the results, the mean values of nutrient contents for *E. diadema* were: protein - 59.16%, fat - 11.89%, ash - 7.30%, moisture - 1.54%, carbohydrate - 9.30%, and energy - 372.86 Kcal/g. The bioactive compounds such as phenolic, tannin and flavonoid contents were found to be 7.45 mg GAE/100 g, 1.75 mg TAE/g and 16.46 mg QE/g, respectively. The total antioxidant activity was 31.29%. GC-MS analysis of *E. diadema*extract revealed the identification of a total of 14 organic compounds. Based on the abundance, the major components present in the extract were Tetradecanoic acid (31.56%), N-hexadecanoic acid (23.58%), Erucic acid (15.50%) and Z,z-6,28-heptatriactontadien-2-one (15.30%). Overall, the findings obtained from the research project will not only facilitate to know the population structures, biodiversity conservation and aquaculture development of this important sea urchin species but also will greatly be helpful towards the development of pharmaceutical and nutraceutical products for therapeutics and human health benefits.

**Keywords**: Bay of Bengal, sea urchin, population structures, bioactive compound, health benefits.

# Genomic and Expression Analyses of Heavy Metal and Antibiotic Resistance Genes in Integrated Fish Farming System in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221252

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## Abstract

**Background**: Integrated Farming System refers to combined production of poultry, fish, or vegetables that meets the economic demand of such fast-growing people by maximizing production and minimizing costs. But transmission of antibiotic-resistant genes to human bodies through the food chain and environment of such farms is the most alarming health problem now-a-days. This initiative focused on the diversity and dynamics of the microbiome, metal resistance genes and antibiotic resistance genes at various levels of integrated farming. **Materials and Methods**: Around 33 samples (Feed (3), Chicken gut (6), Droppings (6), Water (6), Sediment (6), Fish intestine (6)) have been collected from 3 different farms in the Jashore region during the winter season where Colistin, Ceftriaxone, and Amoxicillin antibiotic solutions were used to screen the antibiotic-resistant isolates. Capillary sequencing was performed to identify the antibiotic-resistant isolates. Polymerase Chain Reaction (PCR) was to identify resistant genes such as *blaTEM* and *blaCTX-M*. 16S metagenomic analysis were performed using V3-V4 region and QIIME was used for taxonomical analysis. **Results**: A total of 61 isolates and 39 antibiotic-resistant isolates were found, where droppings contained the most resistant bacteria (19) and the most prevalent bacteria are *E.coli*, *Proteus mirabilis*, *Staphylococcus* spp, and *Pseudomonas aeruginosa*. Most *blaTEM* was found in chicken droppings and sediment samples (3) and most *blaCTX-M* gene was found in fish intestine (7), chicken gut (5). The observed species, Chao1, Shannon, Simpson, InvSimpson, and Fisher diversity (Alpha diversity) measures were significantly different ($P < 0.05$) among of 5 different sampling source More than 98% of the bacterial phyla in an integrated fish-farming environment are Acidobacteria, Actinobacteria, Bacteriodetes, Chloroflexi, Cyanobacteria, Firmicutes, Proteobacteria, Euryarchaeota (Archaea), and Verrucomicrobiota. **Conclusion**: This study suggests that minimal usage of antibiotics, proper handling of droppings, and regular monitoring and surveillance, probiotic usage alternative to antibiotics are some concerning points to ensure a safe farming system. However, RT-PCR of metal resistance genes is yet to be performed.

**Keywords**: Integrated farming, 16s metagenomics, alpha, beta, and antibiotics.

# Effects of Sesame Seeds and Cinnamon as Natural Antioxidants on Oxidative Stability and Sensory Attributes in Poultry Meatball at Refrigerated Storage

**Group:** Biological Science **Project ID:** SRG-221253

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## Abstract

The muscle tissue of slaughtered animal, meat and meat-based products is a highly perishable in nature due to oxidation and microbial decomposition. The objective of the study was to determine the antioxidative effect of cinnamon and sesame seed extract (CSE) on the stability of fresh poultry meatballs. The antioxidant properties of CSE were evaluated in raw chicken meatballs stored in the refrigerator in comparison to synthetic antioxidants like butylated hydroxyl toluene (BHT) and ascorbic acid (AA). Control (no antioxidants), 0.02% BHT, 0.05% AA, and 0.1% CSE were used as treatments to prepare the meatballs. The addition of BHT, AA, and CSE showed the highest stability of the poultry meatballs. The sesame and cinnamon-treated poultry meatballs showed the highest moisture content (6.17%) at 1$^{st}$ day and the lowest (5.10%) after 10$^{th}$ day's storage. It was found that the cooking loss of the control, AA, and CSE-incorporated sample was significant ($p < 0.05$) when compared among days 1, 5, and 10. In this study, when compared to BHT and the control sample, CSE extract-treated meatball showed more than 47% free radical scavenging activity. Moreover, CSE exhibited lower lipid oxidation than BHT, a greater a* (redness) value than the control group, and a lower b* (yellowness) value than the control and BHT samples. The h° (hue angle) value of CSE-incorporated samples was lowered, while the h° value of control samples was increased significantly. The incorporated BHT, AA, and CSE in fresh meat ball prompted a significant decline of TBARS and h° values and an increase of CIE a* (redness) and C* (chroma) values at refrigerated storage for 10 days as compared with the control ($p<0.05$). Therefore, the results can be concluded that CSE can replace the application of AA and BHT in the fresh meatball formulation due to highest antioxidant effects during refrigerated storage.

**Keywords**: Poultry meatball, antioxidant, oxidative stability, sensory attributes, shelf-life.

# Effects of Different Rearing Systems on Performance, Egg Quality and Serum Biochemical Parameter in Laying Hens

**Group:** Biological Science **Project ID:** SRG-221254

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## Abstract

The focus of extensive scientific research over the years has been on the laying hen rearing system, an external factor that impacts productivity traits and egg quality. This study aimed to assess the laying performance, egg quality, and serum biochemistry of Fawmi hens in various rearing systems - Free Range System (FRS), Conventional Cage-Rearing System (CRS), Deep Litter Rearing System (DLRS), and Semi-Intensive Rearing System (SIRS) during the summer. Indigenous Fawmi chickens (n = 100) were randomly allocated into different rearing system groups, within each system there were 5 replicates with 25 hens in each replicate. The experiment lasted between 22 and 33 wk of age. Hen-day egg production (P = 0.00) and egg mass (P = 0.00) were higher in the CRS but were similar in the NRS and FRS. Lowest egg weight (P = 0.02), yolk weight (P = 0.00) and yolk ratio (P = 0.01), and feed intake (P = 0.01) were observed from the FRS, whereas lowest feed conversion ratio (FCR) was recorded from the CRS (P = 0.01). Rearing systems had negligible effects on egg quality. Serum Ca (P = 0.04) and total protein (P = 0.03) levels were found to be higher in the CRS but were lower in the FRS. Serum levels of glucose (P = 0.01), cholesterol (P = 0.00), and triglyceride (P = 0.00) in the CRS increased com- pared with the NRS and FRS groups, whereas serum levels of high-density lipoprotein cholesterol (HDL-C; P = 0.01) in the CRS decreased. It can be concluded that under summer conditions, Fawmi chickens from CRS had an advantage in terms of productivity parameters, but exhibited higher levels of serum lipids and glucose.

**Keywords**: Fawmi chicken, egg production, serum biochemistry, rearing system summer conditions.

# Development of an Animal-Friendly Non-Surgical Castration Method for Improving Productivity in Bulls

**Group:** Biological Science **Project ID:** SRG-221255

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## Abstract

Castration or removal of testes are being performed largely as a key management tool of beef bulls to reduce male aggressive behavior and to improve meat quality. However, surgical castration of bulls has some major disadvantages including stress and wound caused by the surgery. The objective of the present project was to apply GnRH antagonist in bull to suppress the testicular testosterone secretion and aggressive behavior as an alternative of surgical castration. Two healthy bulls aged about 2-year-old was divided randomly into 2 groups. Treated bull received a long-acting GnRH antagonist (degarelix acetate; 4 mg/kg; subcutaneously) at 24 months. Control bull received the same amount of saline solution. Blood collection, body weight and scrotal circumference measurement were done biweekly from the date of injection until 3-month post injection. Serum testosterone was measured by using an enzyme-immunoassay (EIA). A decrease in testosterone secretion was observed soon after GnRH antagonist treatment, but a slight decrease in scrotal circumference was observed 1 month after GnRH antagonist treatment. There was no effect on body weight change after GnRH antagonist treatment. Because of budget limitation, we did the experiment only in 2 bulls. Further studies with more bulls are needed in order to propose GnRH antagonist application as an alternative of chemical castration.

**Keywords**: Castration, GnRH-antagonist, testosterone, meat, bull.

# Extraction and Characterization of Chitin Nanofibers from Shrimp Wastes using Super Mascollider Process

**Group:** Biological Science **Project ID:** SRG-221256

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## Abstract

Chitin is the second most biopolymer, after cellulose, and is found in the exoskeletons of shrimp and crabs, as well as in the cell walls of mushrooms. It is a semi crystalline biopolymer with a fibrillar shape that is nanoscale in size, and has outstanding mechanical properties. It is composed of nano-sized chitin nanofibers in an antiparallel pattern and has a linear structure with two hydroxyl groups and an acetamide group. The major barriers for extensive use of chitin nanofibers is the time and energy-consuming mechanical process needed for their extraction. Basically, nanofibers are strongly attached to one another by hydrogen-bonds so the individualization of the nanofibers without damage is tremendously hard. The proposed research consists in developing a simple and straightforward technique to accomplish the fabrication of chitin nanofibers from shrimp shells using Super Mascollider. A methodical approach of demineralization, deproteinization, and discoloration was implemented to successfully extract chitin from shrimp shells. A slurry was prepared using a dilution formula and subjected to mechanical processing being passed through a super mascollider (ultra-fine friction grinder) for fibrillation. After 20 passes, high viscous chitin nanofibers were generated. The matrix substances from the shrimp shells were eliminated, as confirmed by FTIR analysis. Microscopic images revealed that after fibrillation with 20 passes Super Mascollider, the nanofibers were distributed uniformly and the presence of massive particles was absent and the diameter of almost all fibers significantly decreased, resulting in a vast network of entangled fibers. This is further confirmed by FE SEM images. Chitin nanofibers slurry required approximately 50-70 minutes to dewater and with 20 passes taking longer due to increased fiber-fiber entanglement. Subsequently, chitin nanofibers sheets were effectively produced from the slurry. The use of chitin nanofibers as reinforcement has the potential to improve the mechanical properties of composite materials and can be applied in a wide range of applications namely tissue engineering, electronic devices, bio-fertilizer and cosmetics.

**Keywords**: Shrimp shells, chitin, nanofibers, dewatering time, nano sheet.

# Chemopreventive Activity Investigation of the Mangrove Plant *Avicennia officinalis* Associated Endophytic Fungi in Mice

**Group:** Biological Science **Project ID:** SRG-221257

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## Abstract

**Background:** The Sundarbans, declared as the world heritage sited by UNESCO is the home of almost 329 plant species with 50 of them are considered as true mangrove species. Endophytes of the mangrove plants of the Sundarbans represents an important source of anticancer drug discovery. **Objectives:** Present investigation was done to investigate the chemo-preventive activity of endophytic fungi from the bark of *Avicennia officinalis.* **Methodology:** Bulk fermentation of endophytic fungi *Aspergillus fumigatus* isolated from *A. officinalis* was done to produce crude extract. The extract was tested for in vitro brine shrimp lethality, and in vivo anti-inflammatory and chemo-preventive activity in mice. **Findings:** In the brine shrimp lethality bioassay, *A. fumigatus* extract showed cytotoxic activity with $LC_{50}$ at 109.3 µg/ml. In the carrageenan induced anti-inflammatory activity test at the doses of 50 and 100 mg/kg bw showed the inhibition of the mice paws inflammation by 35 and 42%, respectively whereas indomethacin (5 mg/kg) showed 72% inflammation inhibition. In the DMBA/croton oil-induced skin chemo-preventive assay on Swiss albino mice, extract at the doses of 50 and 100 mg/kg bw showed significant reduction of tumor incidence. Tumor burden and tumor appearance was delayed when extract was given continuously at the initiation and promotional stages of carcinogenesis as well. Serum biochemical parameters (SGPT, SGOT, urea, bilirubin, creatinine, total cholesterol, etc.) and antioxidant enzyme levels (i.e., GSH, SOD and CAT levels) mostly remained within the safety range & the lipid profile did not get influenced in all the experimental groups. **Conclusion:** Present investigation indicated that the ethyl acetate extract of the endophytic fungi *A. fumigatus* isolated from the mangrove plant *A. officinalis* from the Sundarbans has a potential chemo-preventive effect.

**Keywords**: Fungus, skin carcinoma, DMBA, brine shrimp, lethality, anti-inflammatory

# Evaluation of antimicrobial and Antioxidative Properties of Secondary Metabolites Produced by Endophytic Fungi Associated with Unexplored Mangrove Plants of Sundarban

**Group:** Biological Science **Project ID:** SRG-221258

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## Abstract

**Background:** Fungi residing in mangroves are considered to be an excellent reservoir of novel bioactive natural products. Due to the biodiversity and special ecological niches, Sundarban, is a rich source of biologically active compounds. **Objectives:** The objectives of the present study were to evaluate the antimicrobial and antioxidant activity of secondary metabolites of endophytic fungi isolated from mangrove plants *Amoora cucullata* and *Xylocarpus mekongensis*. **Methodology:** The plant parts were collected in sterile zip bag; surface sterilized, cut into pieces and cultivated the fungi on PDA medium. All the culturable endophytes were extracted with ethyl acetate to get crude extract. The crude extracts were tested for their antimicrobial activity using disc diffusion and broth dilution method and antioxidative potentials. **Findings:** A total of 22 endophytes were isolated where 12 were culturable. Morphological and molecular identification revealed that the isolated endophytes are Aspergillus, Penicillium, Talaromyces, Trichoderma and Mucor species. Among 22 fungal strains 11 isolates were active against at least one of the tested bacteria or fungi. The extract of strain XML-3 showed activity against all the tested bacteria and fungi. PACL-1 exhibited highest antibacterial activity against B. subtilis with zone of inhibition 20.4 mm. PACB-3 did not show activity against any of the tested microorganisms. PACB-1 and PACL-3 extract also showed antifungal activity against C. albicans and A. brasiliensis respectively. The extract of PACB-1 and PACL-1 presented potent antioxidant activity in DPPH free radical scavenging activity with $IC_{50}$ of 64.5 µg/mL and 80.7 µg/mL respectively. The extract of strain PACB-1 also contain highest amount of phenolic (260 µg/mg) and flavonoid (432 µg/mL) compounds. **Conclusion:** The results of present investigation revealed that the endophytes associated with mangrove plants of Sundarban area is a potent source of antimicrobial and antioxidative compounds.

**Keywords**: Biodiversity; symbiosis; *Amoora cucullata*; *Xylocarpus mekongensis*; DPPH.

# Exploration of Antidiabetic and Diuretic Activities of Selected two Medicinal Plants of Sundarbans Targeting Pure Compounds Identification and Molecular Docking Study

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## Abstract:

**Background**: Bangladesh has a rich flora of medicinal plants. The demand of medicinal plants for the manufacture of traditional medicines is rising day by day. **Objectives**: The study was designed to investigate the *Lumnitzera racemosa* and *Eclipta alba* for its phytochemical constituents and pharmacological activities (diuretic and antidiabetic). **Methodology**: The extracts were fractionated using *n*-hexane (non-polar), ethylacetate (medium polar) and water (polar). The diuretic and antidiabetic activity of the two extracts were assessed using Swiss Albino mice. *In silico* study was performed among reported eight (08) compounds of *L. racemosa* against 1V4S (human glucokinase) protein. **Findings**: Phytochemical analysis of *L. racemosa* indicated the presence of carbohydrate, reducing sugar, glycosides, tannins, alkaloids, proteins, flavonoids, gum, saponin, steroids and acidic compounds and *E. alba* showed the presence of tannin, flavonoid, saponin, gum, steroid, alkaloid and terpenoid. In the diuretic activity assay using Swiss Albino mice, none of the fractions of *L. racemosa* and *E. alba* showed diuretic activity but *n*-hexane 500 mg/kg of *E. alba* exhibited little diuretic activity compared to the standard Frusemide. Antidiabetic activity was assessed by measuring oral glucose tolerance test (OGTT) using Swiss Albino mice. In OGTT, water fraction 500 mg/kg of *L. racemosa* and *E. alba* showed blood glucose lowering activity compared to the standard Glibenclamide. We had performed *in silico* study among reported eight (08) compounds of *L. racemosa* against 1V4S (human glucokinase) protein. Myricitrin showed good docking score (-8.4 kcal/mol) compared to the standard glibenclamide (-8.5 kcal/mol). **Conclusion**: From our observation, we supposed that Myricitrin might be a potential source of drug leads for hyperglycemic related disorders.

**Keywords:** *Lumnitzera racemosa, Eclipta alba,* diuretic activity, antidiabetic activity, molecular docking.

# An Approach for Making a DNA Ladder in Order to Meet the Demand of Bangladesh

**Group:** Biological Science **Project ID:** SRG-221260

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## Abstract

**Background:** DNA ladder is essential in routine molecular analysis as it is utilized as a reference to determine the sizes of unknown DNA fragments. DNA ladders are required for each run of agarose or acrylamide gel electrophoresis in every molecular biology lab that handles DNA. Its use is growing significantly day by day in our country like other countries. To the best of my knowledge, we still can't produce even a single drop of DNA ladder in our country, but every year we purchase a huge amount of DNA ladder from abroad and spend a lot of foreign currency in this regard. **Objectives:** The objective of the project is to produce DNA ladder on a large scale at a low cost, simply and quickly. **Methodology:** *Shigella dysenteriae type 1-specific* bacteriophages's DNA was used as a raw material for the production of DNA ladder. **Results:** Fromthe research project, we were able to cultivate and enrich a huge number ($\sim 10^9$ pfu/mL) of *Shigella dysenteriae type 1-specific* bacteriophages in laboratory condition. From these bacteriophages, we were able to extract genomic DNA and eventually, digest the bacteriophages' DNA with several restriction enzymes for using the phage DNA as a molecular ladder. **Conclusion:** Even though the study was little, but we were very much successful in producing a significant number of *Shigella dysenteriae type 1-specific* bacterio-phages in laboratory condition. We were able to cut the bacteriophages' DNA with several restriction enzymes for using the phage DNA as a molecular ladder. In conducting the project, we faced some difficulties such as purifying phage, separating phage particles' DNA from host bacterial DNA, need more restriction enzymes etc. In future, we hope we can overcome these difficulties and then will be able to produce DNA ladder commercially.

**Keywords**: DNA Ladder, molecular marker, bacteriophage, restriction digestion.

# Prevalence of Respiratory Symptoms and the Role of Dietary Antioxidant on Respiratory Health among Sawmill Workers in Bangladesh: A Cross-sectional Study

**Group:** Biological Science **Project ID:** SRG-221261

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## Abstract

**Background:** Respiratory diseases impose an immense health burden worldwide. Workers are more prone to respiratory diseases as they are continuously exposed to dust particles. **Objectives**: The objective of the study was to explore the prevalence of respiratory symptoms of sawmill workers and the correlation of blood markers with respiratory diseases. **Methodology**: This study was carried out among sawmill workers, containing 50 workers in each group. Data were collected by face-to-face interviews with questionnaires. Lung function tests were done by spirometer and oximeter. Having respiratory problems, blood was drawn to analyze biomarkers such as ESR, CRP, and IgE. **Findings:** Respiratory symptoms such as breathlessness, coughing, sneezing, chest tightness, and allergy symptoms were significantly ($p< 0.05$) higher as compared to the control group. Lung function test parameters such as FVC, FEV1, PEF, FEV1%, PEF25, PEF75 and, PEF2575 were significantly ($p< 0.001$) decreased among mill workers. The forced vital capacity in percentages (FVC %) was low for the sawmill (62.16±14.63), but high (72.74±15.81) in the control group. Moreover, the FVC% value was decreased who were exposed to dust for around 31 to 40 years, whereas FVC% increased (71.56±10.35) in less than 1-year exposure period. Furthermore, blood markers such as ESR and CRP was not found significantly. On the other hand, augmented IgE level was shown significantly ($p< 0.05$) among sawmill workers. **Conclusion:** Three factors such as, not being habituated to using masks, longer time exposure to dust particles, and family history of respiratory problems are responsible for abnormal lung function.

**Keywords**: Sawmill workers; respiratory symptoms; spirometry; FVC; blood biomarkers.

# Assessment of Defensive Effects of Probiotics Against Multidrug Resistance Pathogenic Bacteria on the Model Organism *Caenorhabditis elegans*

**Group:** Biological Science **Project ID:** SRG-221262

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## Abstract

Antimicrobial and multidrug resistance (MDR) pathogens are a growing threat worldwide, including Bangladesh. Therefore, we need to find out alternative treatment strategies to combat with the MDR pathogens**.** The research project was conducted for the isolation and identification of probiotics from local yogurt, and investigates their antimicrobial activity against pathogenic multidrug resistance bacteria *in vitro* and *in vivo*. Nine different yogurt samples were collected (S1, S2, S3, Sw, M, Tt, T, B, C) and cultured in the selective MRS agar media for enumerating LAB colony. Among 9 samples, 15 isolates were tested for biochemical characteristics. Ten (10) out of fifteen (15) isolates were identified as LAB which were then purified by subsequent culturing in MRS broth and MRS agar media. All the LAB isolate were subjected to acid test at a pH-3.5. Among them Sw, M, Tt, B1, B4, C2 showed >50% survival capabilities in that acid test used for further analysis. Antibacterial effects of these six isolates were investigated against *Staphylococcus aureus*, *Salmonella typhi* and *Pseudomonas aeruginosa* in vitro to identify whether these isolates were probiotics or not. The ability to acidic pH tolerance and antibacterial activity against the three pathogenic bacteria were used as restrictive criteria for probiotic potential. Isolates Sw, M and Tt showed strong antibacterial activity against *P. aeruginosa* and *S. aureus.* Except isolates M, all of the tested isolates showed antibacterial activity against *S. typhi*. The lifespan assay showed that LAB increase the lifespan, among them Sw and M ($P < 0.05$) significantly increased the lifespan of *Caenorhabditis elegans*. Primarily, the finding of this research project is that the 6 isolated probiotics have the potentiality to defense against multidrug resistance bacteria in vitro. Their molecular characterization and in vivo defensive effects against MDR bacteria need to be assessed using model organisms *Caenorhabditis elegans.*

**Keywords**: Probiotics, lactic acid bacteria, antimicrobial resistance, *Caenorhabditis elegans*.

# Determination of Pesticide Residues in Raw and Cooked Vegetables and Fruits by Gas Chromatography

**Group:** Biological Science **Project ID:** SRG-221263

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## Abstract

**Background:** The applications of pesticides in agriculture purposes have increased in food production, high food quality and reduced insect-borne diseases. However, their continuous use has a negative impact on the environment and their presence in food poses a potential health risk due to their biocide activity. **Objective:** In this study, a simple, cost-effective, fast and robust gas chromatography method was developed for the simultaneous determination of multiclass pesticide residues in fruits and vegetables collected from selected bazars of Tangail town, Tangail, Bangladesh. **Methodology:** The vegetables and fruits samples were analyzed with QuEChERS extraction technique by GC coupled with FTD for the determination of pesticide residues. The method performance evaluated with standard calibration method with linearity ranging from 1-500 ug/kg and with correlation coefficient 0.99. The average recovery was between 80% and 105% with relative standard deviation (RSD below 2%) for all the investigated pesticides. **Findings:** Acetamiprid, cypermethrin, and lambda-cyhalothrin pesticides have been observed in 30 fruit and vegetables samples. Pesticides residues were detected in about 81% sample whereas 20% samples were above the maximum residue level set by European Commission. The most frequently found pesticides were acetamiprid and cypermethrin. The highest concentrations were found in boroi (Acetamiprid 5.39 mg/kg), tomato (Cypermethrin 4.21mg/kg), cucumber (Cypermethrin 5.90 mg/kg), and spinach (Acetamiprid 4.22 mg/kg). **Conclusion:** This finding will help to the achievement of risk reduction measured of pesticides and will protect consumer health.

**Keywords:** Pesticides, fruits, vegetables, Gas chromatography, food safety.

# Development and Evaluation of Inactivated Lumpy Skin Disease Vaccine for Cattle

**Group:** Biological Science **Project ID:** SRG-221264

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## Abstract

Lumpy skin disease (LSD) is a deadly viral infection of cattle caused by the lumpy skin disease virus (LSDV), has devastating economic impact. As there is no treatment for the virus, so prevention by vaccination is the most effective method of LSDV control. So, development and evaluation of LSD killed vaccine from the most prevalent stain was the purpose of this study. To detect genetic makeup and molecular epidemiology of local LSDV isolates, this investigation included continuous collection of samples from suspected cattle. A total of 157 sample matrix were collected from the suspected animal and 172 serum sample was collected randomly. DNA extraction and PCR was done for all the collected samples. For the amplification of the virus, firstly all the cell culture facility and Chorioallantoic membrane (CAM) inoculation protocol was developed at Animal Biotechnology Division Laboratory then the LSDV was successfully isolated in embryonated chicken egg and also in MDBK cell line followed by verification as LSDV by PCR. In this investigation, 69 out of 157 samples were tested positive (43.28%) for LSDV Sequencing and analysis has completed for fourteen positive samples and submitted to NCBI. Furthermore, all samples from the five research areas had almost identical sequences, indicating that a single strain is most likely circulating across the country. From ELISA study, the highest seroprevalence was reported in the Natore region, with a prevalence rate of 64%. Sylhet and Naogaon followed closely with a seroprevalence rate of 34% and 31%, while the lowest seroprevalence was reported in Dhaka at 27%. Further inactivation of amplified LSDV and evaluation is necessary to develop a killed vaccine which may be useful for preventing the huge economic losses by this disease.

**Keywords:** Embryonated chicken egg, MDBK cell, sequencing, ELISA.

# Collection, Grading and Evaluation of Bovine Cumulus-Oocyte-Complexes for Invitro Maturation

**Group:** Biological Science **Project ID:** SRG-221265

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## Abstract

Increasing dairy cattle production can play a vital role to ensure national food security where invitro embryo production (IVEP) is one of the most efficient ways to accomplish this. Thus, the efficient collection and grading of oocyte, is one of the important criteria on the success of IVEP of embryos. Cattle ovaries were collected from BDR market slaughterhouse, Shamoli, Dhaka. During collection left and right ovaries were identified and recorded and after necessary processing the ovaries were categorized as type I: ovaries without corpus luteum (CL), type II: ovaries with corpus luteum. Then, length width and weight along with follicular parameters of ovaries were recorded. The results from the parameters shown that there was no significant ($p<0.05$) difference in the parameters between left and right ovaries except length. The length (cm) was distinctly higher in case of right ovaries (2.30±0.04) compared to left ovaries (2.14±0.06). The collected COCs were higher in case of left ovaries (with a mean of 2.43 per ovary) compared to right ovaries (with a mean of 2.31 per ovary). The ovaries were categorized as type I: ovaries without corpus luteum (CL), type II: ovaries with corpus luteum. In this case, length and weight were significantly ($p<0.05$) increased but at the same time total number of observed follicles, aspirated follicles were significantly ($p<0.05$) decreased in type II compared to Type I. As corpus luteum is an extra cellular material within the ovary and its length, width and weight made the differences. Further study is required in large number of samples along with more parameters of analysis. The COCs found are all grade C and grade D which are not suitable for maturation. Thus, in this study evaluation, categorization and grading of ovaries by means of different parameters were done which is the primarily steps for *in vitro* maturation (IVM).

**Keywords:** Cattle, ovary, follicles, oocyte, maturation.

# High throughput transcriptome analysis for better prawn health management in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221266

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## Abstract

**Background**: *Macrobrachium rosenbergii* is an important farmed prawn species in Bangladesh. Acute hepatopancreatic necrosis disease (AHPND) is a bacterial disease caused by *Vibrio parahaemolyticus*, triggering substantial economic losses in the prawn industry. **Objectives**: a) the transcriptional changes of significant genes caused by vibrio infection were studied, b) identification of molecular biomarkers for *vibrio* infections. **Methodology**: To get a better understanding, the prawn was infected with the Vibrio by injection. Prawns were challenged in aquariums with 3 treatment and control groups. Aquaria were randomly divided into different sampling time points. We chose the prawn gills and hepatopancreas for RNA extraction after 48 hours of infection. The cDNA was prepared and quality assured using a bioanalyzer; subsequently, NGS library was prepared for RNA-seq using Illumina NovaSeq. **Findings**: A total of 186.4 million reads were obtained and assembled into 198,321 contigs with an average length of 296 bp. The assembled contig contained 15632 known unigenes. Comparative genome analysis between control (healthy) and infected prawns showed 273 DEGs after infection. Among them, 199 genes were upregulated, and 74 genes were downregulated. The quality of the RNA-Seq was validated by expression analysis of 7 immune-related genes using qRT-PCR, and the results were consistent with the RNA-seq data. Gene ontology analysis showed that these DEGs are mainly associated with biological functions such as antigen processing, complement cascade, antibody activation, and phagocytosis pathway. The protein-protein interaction network of the DEGs suggested that many complicated mechanisms are involved in this infection. Besides, we found that immune-related gene expression is severely downregulated in stressed conditions, which may explain why stress-conditioned infected prawns died early. **Conclusion**: We identified many DEGs and pathways under stress. These genes and pathways involved immune responses mainly. The DEGs and enriched pathways involved in bacterial infection at different doses differed.

**Keywords**: Prawn, infection, NGS, RNA-Seq, DEGs.

# Characterization of Histopathological Changes in Stinging Catfish (*Heteropneustes fossilis*) Pathogenic Infection with Virulent *Aeromonas hydrophila*

**Group:** Biological Science **Project ID:** SRG-221267

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## Abstract
**Background:** Disease outbreaks caused by bacteria, fungi, viruses, and parasites have posed a growing threat to catfish aquaculture in recent years. *Aeromonas hydrophila* is an opportunistic pathogen that is common in the aquatic environment, varying the concentration from 1 colony forming unit (CFU)/mL in groundwater to $10^8$ CFU/mL in home sewage. *Aeromonas* infection causes skin ulcers, hemorrhage, abscesses, exophthalmy, ascites, hemorrhagic septicemia, and visible infection symptoms in the gastrointestinal system, liver, and kidney. **Objectives:** The study was focused on to establish a infection model in Fisheries Biotechnology Division, infect the H. fossilis fish with virulent A hydrophila and observe the changes of internal organs of artificial infected fish. **Methodology:** We used the bacterial concentration at $10^6$ to three groups and distilled water in control group. The bacterium was injected near the dorsal fin of deep muscle. **Findings:** Fish mortality with virulent *A. hydrophila* was significantly higher than control fish group. Histopathological observation showed different changes in the tissues like necrosis, inflammation and edema in the studied organs. Microscopic observation showed destructive tissues including bacterial cells in the studied stomach, liver, intestine and gills. Normal arrangement of the tissue layers was observed in the internal organs. The results showed that the injected strain of virulent *A. hydrophila* is capable to invade and caused internal changes in the organs. **Conclusions:** The findings of this experiment will help to evaluate the mortality rate in the aquaculture farm and will help to take the remedy measures immediately.

**Keywords**: Disease outbreaks, opportunistic pathogen, bacterial concentration, microscopic, internal organs.

# Functional Characterization and Production of Bacteriophage-Encoded Endolysin with an Eye to Assessing its Utility as a Potent Antimicrobial Agent Against Urinary Tract Infection (UTI) and Skin Infection

**Group:** Biological Science **Project ID:** SRG-221268

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## Abstract

Antimicrobial resistance (AMR), particularly multidrug-resistant (MDR) pathogens, is a leading cause of death worldwide. Bangladesh is a major contributor to AMR owing to its poor healthcare standards, along with the misuse and overuse of antibiotics. Phage therapy, an alternative to traditional antibiotics, can tackle bacterial infections by using bacteriophages. Phage-encoded proteins, such as endolysins, have broad lytic activities against Gram-positive and Gram-negative bacteria. This study aims to investigate the antimicrobial effects of phage-derived endolysin against MDR pathogens causing urinary tract infections (UTI) and skin infections. In this research, Endolysin-encoding phage genes have been selected. The codon-optimized gene has been commercially synthesized, cloned and expressed in E. coli BL21 (DE3) strain. Expression was induced, and proteins were extracted from the cells by using lysis buffer and sonication. The presence of the target protein was confirmed by using SDS-PAGE. Initially, the activity of the protein (crude extract) against selected ATCC strains has been assessed using well diffusion method. In addition, pathogenic bacteria were isolated from UTI patients' urine, and species were identified using 16S rDNA sequencing using universal primers. Antibiograms were performed to investigate resistant conditions using the disk diffusion method against five well-known antibiotics, following Clinical and Laboratory Standards Institute (CLSI) guidelines. However, the purification and evaluation of the antimicrobial activities of purified endolysin protein against MDR pathogens are still in progress.

**Keywords**: Endolysin, antimicrobial peptide, bacteriophage, gene, codon.

# Genetic Engineering of Rice for a New Phosphate Fertilizer System and Weed Suppression

**Group:** Biological Science **Project ID:** SRG-221269

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## Abstract

Production of sufficient rice is the key to ensuring food security in the country. The excessive production cost of rice is one of the significant constraints. High yields depend on the continuous input of orthophosphate fertilizers. Phosphorus fertilizer is expensive and subsidized. Engineering plants to outcompete weeds and microorganisms for limiting resources is a promising way to reduce the requirement for phosphate. Phosphite is an alternative to phosphate. However, Plants cannot metabolize phosphite. Therefore, the objective of the project was the overexpression of a bacterial PnD gene in a local rice cultivar through genetic transformation so that they can use phosphite instead of phosphate. To construct the expression cassette, the bacterial PnD gene was subjected to codon optimization through multiple bioinformatics tools. The sequences are then synthesized and then PCR amplified with adaptor primer supporting the PCR product directional cloning into the p-TOPO™ vector. With Directional TOPO™ cloning technology, the PCR products are purified, and it was added to the provided topoisomerase charged vector. Following the incubation in ice, the resultant product was transformed into E. coli. Clones were then sequence verified and were prepared for the construction of expression vector through LR reaction. The resulting correct clone will be used to generate transgenic rice followed by transformation to the Agrobacterium. Phosphite use as a dual fertilizer and herbicide may mitigate the overuse of phosphorus fertilizers and reduce eutrophication and the development of herbicide resistance, which in turn will improve the sustainability of agriculture.

**Keywords:** LR reaction, agriculture, TOPO™ cloning, PnD gene, bioinformatics.

# Identification and Molecular Characterization of Hyacinth Bean (*Lablab purpureus* L.) Diseases Associated Fungi in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221270

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## Abstract

In Bangladesh, fungal infection is a devastating crop problem. root rot, rust, white mold, alternaria leaf spot and anthracnose are the important fungal diseases of bean. Collection, Isolation, morphological identification and conservation of different fungi species that involve to cause devastating fungal diseases of hyacinth bean in Bangladesh. Collections of diseased root, pod and leaf samples of bean, pathogen isolation, fungal DNA isolation and quantification, primers and PCR analysis, gel electrophoresis, sanger sequencing and data analysis. Fungi were isolated from diseased leaf, root and pods samples of hyacinth bean. Then sample was surface sterilized by using 20% Clorox. Sterilized samples were placed on water agar plate kept in growth chamber at 25°C. After three days, mycelium growth on samples was isolated and put on PDA containing plate and kept at 25°C. After purification, isolate of fungus was preserved in PDA containing slant at 20°C. Fungal DNA were isolated from pure culture according to the fungal DNA isolation kit protocol. Fungal DNA Barcoding primers (ITS, TEF1 and TUB2) were validated through PCR and Gel electrophoresis. Using these three selected fungal DNA barcoding primers isolated DNA were amplified by PCR. The amplified PCR products were visualized with the help of agarose gel electrophoresis. After the fidelity check, PCR products were purified and sent for Sanger Sequencing. Through Bioinformatics analysis of sequencing data, we will be identified the causal fungal species from targeted collected disease samples of hyacinth bean. Microscopic observation of morphological structure of fungal isolates have been done. Proper fungi identification aids in better fungal diseases management of hyacinth bean. Its helps farmer to minimize their production loss due to fungal diseases.

**Keywords**: Gel electrophoresis, PDA, PCR, sanger sequencing, primers.

# Nutritional Analysis, Isolation, Purification and Characterization of Bioactive Compounds of Different Solvent Extracts of Cambodian Basil (*Ocimum basilicum* L) and their Antioxidant Properties and Medicinal Uses

**Group:** Biological Science **Project ID:** SRG-221271

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## Abstract

In this study, the nutrient contents such as moisture, protein, carbohydrates, fat, ash, and crude fiber were found to be 87.53%, 3.50%, 4.96%, 1.80%, 1.46%, 0.75% and 90.22%, 2.80%, 3.58%, 1.52%, 1.28% and 0.60% in Cambodian Basil and Bangladeshi basil, respectively. Antioxidant activity of water, methanol and ethanol extracts of Cambodian Basil and Bangladeshi Basil were determined by TLC method and all extracts of Cambodian Basil showed strong antioxidant activity. Phytochemical screening showed the presence of Alkaloids, Tannins, Saponin, Flavonoids, Cardiac Glycosides, Carbohydrates, Proteins and Amino Acids in water, methanol and ethanol extracts of Cambodian Basil and Bangladeshi Basil. The phytochemical compounds present in water, methanol and ethanol extracts of Cambodian Basil showed the strong antioxidant activity other than Bangladeshi Basil. The phytochemicals present in all the extracts of Cambodian Basil and Bangladeshi Basil may be useful to prevent different types of diseases. From TLC analysis, two phytochemical compounds were found to be present in water extracts of both Cambodian Basil and Bangladeshi Basil whereas other three phytochemical compounds present in Cambodian Basil and another four compounds present in Bangladeshi Basil. In methanol and ethanol extracts, five phytochemical compounds were found in both Cambodian and Bangladeshi Basil.From the spectrophotometric analysis, three same bioactive compounds with wavelengths 663 nm, 409 nm, and 227 nm were identified in methanol extracts of Cambodian Basil and Bangladeshi Basil, respectively. In GC-MS analysis, 8 and 11 compounds were identified in methanol extracts of Cambodian Basil and Bangladeshi Basil, respectively and among these compounds, three compounds namely Dodecane, 1-fluoro-, n-Hexadecanoic acid Dodecanoic acid, 1,2,3-propanetriyl ester were found in both Cambodian and Bangladeshi Basil which may be useful for the preparation of essential drugs in pharmaceutical industries. Further detail study is needed for the purification of unknown phytochemical compounds and their other biological study.

**Keywords**: Basil, antioxidant activity, phytochemical compounds, GC-MS.

# Study of the Genetic Diversity and Population Structure of Silurid Cat Fish (*Mystus cavasius*) using Molecular Analysis

**Group:** Biological Science **Project ID:** SRG-221272

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## Abstract:

Catfishes order siluriformes includes many economically important species throughout the world. Silurid catfish, *Mystus cavasius* is an ecologically and commercially important fish. This fish species is widely distributed in ponds, canals, beels, floodplains, streams and rivers of many south-Asian countries including Bangladesh. This species is a very popular food fish in Indian subcontinent for its taste and high market value. Many fish farmers are also culturing this fish species in their aquaculture ponds for making more profit. Mortality of fingerlings of this particular fish species is reported to be very high in aquaculture system due to disease outbreak causing huge monetary loss of fish farmers. On the other hand, hatchery-reared individuals often have lower genetic diversity that may shrink the genetic variations of natural populations. Healthy genetic diversity is important for populations to adapt to their environments and resist diseases as inbreeding and lower genetic diversity may make individuals more vulnerable to disease. To date, there have been few genetic diversity studies focused on this species. The aim of this study therefore was to investigate patterns and levels of genetic diversity and genetic differentiations of *M. cavasius* from sites collected from four localities in Bangladesh. A 561bp fragment of the mtDNA control region was used to assess genetic diversity and population differentiation of *M. cavasius* populations. Levels of haplotype diversity (0.801-0.962) was high and only low to moderate levels of nucleotide diversity ranging from 0.70% to 1.03% were detected in the sampled populations. Significant pairwise $F_{ST}$ values between population pairs were also observed in most pairwise comparisons with the exception being between the Mymensingh and Comilla hatchery populations. The current study can provide a baseline for future utilization and conservation of this important commercial species.

**Keywords**: Genetic subdivision, control region, haplotype diversity, pairwise $F_{ST,}$ siluriformes.

# Estimation of Growth Overfishing of The Endangered Yellowtail Catfish, *Pangasius pangasius* through 'Chai' Fishing

**Group:** Biological Science **Project ID:** SRG-221273

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## Abstract

Desi "pangas" (*Pangasius pangasius*) is a highly nutritious and delicious fish, rich in omega-3 and omega-6 fatty acids and lipid content. Once abundant in the rivers and estuaries of Bangladesh, this species has seen a significant decline in population. One major cause of this decline is the overfishing of *P. pangasius* using "*Chai*." The study aimed to assess the extent of production loss and recruitment hindrance due to "*Chai*" fishing. Data were collected through semi-structured questionnaire interviews with randomly selected "*Chai*" fishermen between March and July 2022 and CPUE at ten sampling stations in the Meghna River Estuary (MRE) were documented. The study showed an average CPUE of 97.51±56.65 Kg/haul for "*Chai*" fishing. Predictions indicated that if fingerlings were spared from "*Chai*" fishing, production could have increased significantly: 2,63,099.81 MT after 2 years and 6,67,329.22 MT after 5 years. The study also considered natural mortality rates, ranging from 10% to 90%, and projected production estimates. With a 90% natural mortality rate, production after 2 and 5 years would have been 26,309.98 MT and 66,732.92 MT, respectively. Reducing the number of "*Chai*" fishers by 60% (assuming 60% natural mortality), could potentially increase *P. pangasius* production by 63,143.96 MT and 1,60,159 MT after 2 and 5 years, respectively, contributing BDT 3,472.93 crore and BDT 16,015.9 crore to the economy. "*Chai*" fishing, popular in the MRE, yields high catches with minimal effort. However, this practice, combined with other environmental factors, threatens *P. pangasius* recruitment. To prevent the potential extinction of this commercially important catfish, it is crucial to halt this illegal activity. Encouraging "*Chai*" fishermen to pursue alternative income generation activities could help eliminate this unlawful practice. This is the first study which documented that ending "*Chai*" fishing can revive the natural *P. pangasius* population, ensuring sustainable production and economic contribution the country.

**Keywords**: *Pangasius pangasius*, chai fishing, natural population, endangered.

# Detection of the Association of IL-27 & IL-33 Gene Polymorphisms with Breast Cancer Risk in the Bangladeshi Population

**Group:** Biological Science **Project ID:** SRG-221274

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## Abstract

**Background:** Breast cancer (BC) is the leading cause of death among Bangladeshi women and its prevalence is increasing year after year. **Objectives:** We set out to conduct a genetic association study to determine the relationship between the *IL-27* and *IL-33* gene polymorphisms and BC risk. **Methodology:** The PCR-RFLP method was used to genotype *IL-27* (rs153109 and rs181206) and *IL-33* (rs1929992 and rs7025417) variants in 406 Bangladeshi women (218 cases+188 controls). The odds ratio (OR) was calculated by SPSS to detect the magnitude of association of these SNPs with Bangladeshi breast cancer patients. **Findings:** A significant ($p$<0.05) association of the *IL-27* rs153109 variant with increased BC risk was found in additive model 1 (OR=2.45, $p$=0.0002); additive model 2 (OR=2.80, $p$=0.0005); dominant model (OR=2.54, $p$<0.0001) over dominant model (OR=1.57, $p$=0.025) and allelic model (OR=1.69, $p$=0.002). This study also found a strong association between the *IL-27* rs181206 gene and a higher risk of breast cancer in additive model 1 (OR=2.29, $p$=0.0002); additive model 2 (OR=3.32, p=0.0003); dominant model (OR=2.48, $p$<0.0001); recessive model (OR=2.06, $p$=0.018); over-dominant model (OR=1.65, $p$=0.013) and the allelic model (OR=1.86, $p$<0.0001). Furthermore, the *IL-33* rs1929992 variant was associated with an increased BC risk in additive model 2 (OR=3.76, $p$=0.0006); dominant model (OR = 1.74, $p$=0.006); recessive model (OR=3.18, $p$=0.002) and allelic model (OR=1.76, $p$=0.0003). *IL-33* rs7025417 polymorphism, on the other hand, did not show any significant link ($p$>0.05) with BC in codominant model 1 (OR=1.19, $p$=0.424), codominant model 2 (OR=0.92, $p$=0.768), dominant model (OR=1.11, $p$=0.601), and over-dominant model (OR=1.22, $p$=0.310), recessive model (OR=0.83, $p$=0.490) and allelic model (G vs A: OR=0.999, $p$=0.997). **Conclusion:** This study discovered a strong link between the *IL-27* (rs153109 and rs181206) and *IL-33* rs1929992 variant and increased BC risk.

**Keywords**: PCR-RFLP, Rs153109, rs181206, rs1929992, rs7025417.

# Bioprospecting Stress Tolerant *Pseudomonas fluorescens* from Rice Rhizosphere for the Application as Biofungicide in Agriculture

**Group:** Biological Science **Project ID:** SRG-221275

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## Abstract

**Background**: Fluorescent Pseudomonads are an important group of plant growth promoting bacteria with antagonistic property against many other plant pathogenic bacteria and fungi. **Objectives**: This study aims to isolate and characterize *Pseudomonas fluorescens* from rice rhizosphere which can be used as bio-control agent against common rice pathogenic fungi. **Methodology**: Native *Pseudomonas fluorescens* has been isolated from rice rhizosphere and were identified through standard microbiological methods. Plant growth promotion traits of the isolates has been assessed. Antagonistic activity of the isolates against rice pathogenic fungi namely *Bipolaris oryzae, Rhizoctonia solani* and *Pyricularia oryzae* has been determined to select potential strain(s). **Findings**: In this study, thirteen (13) native *Pseudomonas fluorescens* isolates were characterized from the rhizosphere of field grown rice plant. Most of the isolates belong to two distinct cluster as determined by 16s sequencing. Almost all the isolates were found to pose the ability to produce plant growth promoting enzymes and compounds such as pyocyanin, siderophore, indole acetic acid (IAA) and volatile metabolites. The isolates were evaluated in terms of their antagonism against three major rice pathogenic fungi such as *Bipolaris oryzae, Rhizoctonia solani* and *Pyricularia oryzae*. Many of the isolates showed satisfactory growth inhibition against the selected fungal pathogens. The isolates also found to be able to survive for long period in rhizospheric soil and pose moderate resistance towards common antibiotics. Moreover, some of the isolates also survived for long period in solid biofertilizer formulation at both cold temperature and room temperature. **Conclusions**: The *Pseudomonas fluorescens* isolates characterized through this study can be suitable candidate to be used as biofertilizer in rice field both for growth promotion and disease resistance.

**Keywords**: *Pseudomonas,* rhizosphere, fungi, biocontrol, biofertilizer.

# Phenotypic and Genomic Characterizations of MDR *Pseudomonas aeruginosa* in the Presence of Vitamin E Isolated from Sewage Samples

**Group:** Biological Science **Project ID:** SRG-221276

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## Abstract

**Background:** *P. aeruginosa* poses challenges due to multidrug resistance; Vitamin E, especially tocopherol derivatives, inhibits its growth and shows promise against various bacterial infections.

**Objectives: (i)** Measure the growth rate of MDR P. *aeruginosa* in the presence of vitamin E, (ii) Quantify the biofilm formation and determine the antibiotic sensitivity of MDR P. aeruginosa in the presence of vitamin E. **Methodology:** Biofilm determination by crystal violet methods. Antibiotic susceptibility test by disc diffusion method. Growth of *Pseudomonas* in the presence of vitamin E by OD measurement. **Finding:** *Pseudomonas aeruginosa*, a bacterium displaying a rod-shaped structure and belonging to the Gram-negative classification, is recognized for causing nosocomial infections. In Bangladesh, the emergence of multi-drug-resistant *P. aeruginosa* has become a notable concern for public health. To explore the influence of vitamin E on the growth of *P. aeruginosa*, scientists observed that its effects varied depending on the specific strain of the bacterium. For instance, when exposed to 50 µl of vitamin E, around 40% of the *P. aeruginosa* strains exhibited resistance to ciprofloxacin. However, this resistant pattern increased to over 60% when the vitamin E concentration was raised to 100 µl. Similarly, different sensitivity patterns were noticed for aztreonam and colistin antibiotics at varying vitamin E concentrations. Notably, at 100 µl of vitamin E, some strains previously only moderately sensitive to colistin became sensitive to it. However, vitamin E did not significantly affect biofilm formation in the isolated strains. **Conclusion:** In conclusion, the effect of vitamin E on the growth of P. aeruginosa was strain-specific. However, the effect of antibiotic sensitivity depended on the type of antibiotic used. A few of the antibiotics showed more sensitivity at higher concentrations of vitamin E compared to other types of antibiotics. Lastly, no effect was observed on the isolated strains on the biofilm of vitamin E.

**Keywords:** *Pseudomonas aeruginosa*, Multidrug resistance, vitamin E, growth rate.

# Trans Fatty Acids in Fried Street Foods, Snakes Offered in Dhaka City and Rural Markets; Knowledge, Assessment and Awareness

**Group:** Biological Science **Project ID:** SRG-221277

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## Abstract

**Background:** Street-fried foods are very popular in Bangladesh. No work was conducted about trans-fat in these foods and its harmful effects on health in Bangladesh. **Objectives:** Find out consumers knowledge, attitude, and awareness buildup about trans-fat in various fired street foods and its harmful health effects among the people. **Methodology:** This is a structured questionnaire-based study. People of all ages who regularly consume various types of street foods were enrolled here. The face-to-face interview was used to collect data from 416 street food consumers in Dhaka city. The data was analyzed using SPSS software with a 95% confidence interval. **Findings:** Of the total respondents, 57% were male and 43% were female. Around 90% were between the ages of 20 and 40, and 50% of them liked to eat street fried foods regularly. A startling 88% of participants were unaware of the source of trans fat in street foods. Here 52.4% said they frequently ate street foods, while 24.52% said they did so occasionally. Our findings indicate that 72.6% of the population has experienced problems sometimes or in some way after consuming street foods. Surprisingly, our findings indicate that 86.06% of participants reported never attending any program about trans-fat. Almost 55.77% emphasized the importance of raising awareness and educational initiatives to disseminate information on trans fat's health risks. Additionally, 42.31% of participants suggested adding health education, further emphasizing the role of comprehensive educational programs in empowering consumers to make informed decisions about their food choices. **Conclusion:** Our results show that about 90% of participants are unaware of the dangers of trans fat. They need for awareness and health education. We hope this study will help to policymakers to take necessary action in the future.

**Keywords**: Fried foods, trans-fat, health risk, cholesterol, fat.

# *Staphylococcus aureus* - From Human to food or Vise versa? A Comparative Analysis and Forecasting Multidrug Resistant (MDR) Pattern of *S. aureus* Isolated from the Human and Food Samples in Dhaka city, Bangladesh

**Group:** Biological Science **Project ID:** SRG-221278

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## Abstract:

**Background**: The increasing prevalence of multidrug-resistant *Staphylococcus aureus* (MDR-SA) raises significant public health concerns in Dhaka City, Bangladesh. Understanding the transmission dynamics and antibiotic resistance patterns of *S. aureus* between human carriers and food sources is essential. **Objectives**: This study aimed to investigate the multidrug resistance patterns in *S. aureus* isolates from both clinical and food samples, shedding light on the potential bidirectional transmission. The objective was to evaluate the effectiveness of antibiotics, including Rifampicin, Vancomycin, and Erythromycin, in managing S. aureus infections. **Methodology**: A total of 160 samples were collected from hospitalized patients and food sources, followed by 10-fold dilution and isolation of S. aureus using Mannitol salt agar (MSA) and biochemical tests. Twelve antibiotics were employed to assess resistance profiles. Data were analyzed for the prevalence of multidrug resistance and antibiotic sensitivity. **Findings**: Among 80 clinical samples, 6 and 7 isolates displayed resistance to 5 and 6 antibiotics, respectively. In food samples, 11 isolates exhibited resistance to 5 drugs, and 4 isolates were resistant to 6 drugs. The analysis showed varied antibiotic resistance in both clinical and food samples. While Vancomycin and Rifampicin displayed high sensitivity in clinical samples, Vancomycin had markedly lower sensitivity in food samples. Erythromycin exhibited higher sensitivity in food samples compared to clinical samples. Overall, 20% of the isolates were MDR-SA. **Conclusion**: This study underscores the urgent need for enhanced surveillance and intervention strategies to combat antibiotic resistance in *S. aureus*. Bidirectional transmission of MDR-SA between humans and food sources highlights the importance of a One Health approach. This research provides insights into tackling this complex public health challenge and emphasizes the critical role of antibiotic stewardship and food safety measures.

**Keywords**: Multi-drug resistance, *Staphylococcus aureus*, prevalence, food safety, one health.

# Detection and Molecular Characterization of Indigenous Bacillus spp. Synthesizing Lipopeptides with Anticancer Activity

**Group:** Biological Science **Project ID:** SRG-221279

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## Abstract

**Background**: Cancer is the second-leading cause of death worldwide, with Bangladesh ranking sixth and on the rise. This problem is exacerbated by a lack of early cancer detection and financial constraints. *Bacillus* spp. possess antibacterial, antifungal, antioxidant, and anticancer properties, and have been used in cancer therapy for over a century. **Objectives**: The aim of the present study was, therefore, to isolate bacteria from soil microbiota synthesizing lipopeptides with cytotoxicity against different cancer cells. **Methodology**: A total of 90 soil samples were collected from different localities in Bangladesh, and following heat treatment at 80 °C, sixty-five (65) spore-forming *Bacillus* were screened out from 20 samples and seventy (70) samples were used to prepare metagenomic DNA. The biochemical properties of the isolates were determined to differentiate them at the species level, and total DNA was also prepared from them. Using specific primers for the *sfp*, *itu*, and *fen* genes, both individual and metagenomic DNA were used to detect the relevant genes. Molecular identification of the potential *Bacillus* isolates was performed by 16S rRNA gene sequence analysis, and cytotoxicity against the HeLa, Vero, and BHK-1 cell lines was performed. **Findings**: Among the investigated genes, surfactin (*sfp*) was the most prevalent. The presence of *itu*-synthetase gene was low, with only 2 out of 65 isolates and 1 out of 70 metagenomic DNA samples. The potential bacterial strains were identified as *Bacillus velezensis* BgSg and *Bacillus amyloliquefaciens* BgSp2, and were further selected to assess their anticancer properties and cytotoxicity towards normal cells. The extracted lipopeptides were able to destroy over 40% of the HeLa cancer cells and unaffected the Vero and BHK-1 normal cells. **Conclusion**: These potential bacterial isolates could be very potential in cancer treatment upon further preclinical and clinical trials.

**Keywords**: *Bacillus*, surfactin, iturin, fengycin, anticancer activity.

# Development of High Yielding and Salinity Tolerant Linseed (*Linum usitatissimum* L) Genotypes for Coastal Regions of Bangladesh

**Group:** Biological Science **Project ID:** SRG-221280

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## Abstract

**Background**: Linseed is a source of edible oil. Bangladesh has to pay money on imports of edible oils. Therefore, linseed in southern region is essential. **Objectives**: The project has been undertaken to increase linseed production through adaptation and up scaling of suitable linseed variety(s) in southern region of Bangladesh. **Methodology**: Screening of linseed genotypes: An in-vitro investigation was conducted to screen 43 linseed genotypes based on their response to salinity. Evaluation of linseed genotypes in Farmer's Field: Selected 14 linseed genotypes were evaluated in the farmers field of Pakhimara, Kalapara, Amtali, and Patuakhali using RCB design with three replications. **Findings**: It was found that salinity impaired normal germination of linseed. All genotypes subjected to screening test against salinity showed higher germination percentage and lower germination time under control compared to salinity treatments. Saline treatments cause reduction in germination but extension in germination time. Among the 43 linseed genotypes seeds which had 80% germination were observed in seven genotypes in all concentrations of NaCl solution i.e. control, 4dS/m, 8 dS/m, 12 dS/m and 16 dS/m. In five genotypes it was observed that more than 80% had germinated when treated with 12dS/m of NaCl solution. Evaluation of 14 linseed (*Linum usitatissimum* L.): the genotypes such V10 (BD-10710), V12 (LIN-N-18), V13 (BD-10697) and V1 (NILA) genotypes of linseed to find out the highest yielding genotypes and among the genotypes, the highest yield was recorded in V10 (BD-10710) (1268.80 kg/ha) with moderate days to maturity (104 DAS), moderate thousand seed weight (5.05 g), seeds per plant (670) and plant height (45.66 cm) might be considered better parents for future hybridization program. **Conclusion**: Among the 43 linseed genotypes 12 were selected to evaluate at farmer's field of Borguna, Kuakata and Patuakhali sadar. V10 (BD-10710) has the potentiality to release as a variety.

**Keywords**: HYV; Genotype; salinity; evaluation; linseed.

# Development of Eco-Friendly Periphyton-Based Organic Poly Culture for the Native Major Carps (*Labeo rohita, Gibelion catla, Cirrhinus cirrhosus*)

**Group:** Biological Science **Project ID:** SRG-221281

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## Abstract
The study was investigated to develop the eco-friendly periphyton based organic poly culture for the native major carps (*Labeo rohita, Cirrhinus cirrhosus* and *Gibelion catla*) from July 2022 to June 2023. The experiment was designed with two treatments namely $T_1$ (Periphyton substrate pond, ruhu- 40, catla- 20, and Mrigal- 20 /decimal) and $T_2$ (Non periphyton substrate pond, ruhu-40, catla-20, and Mrigal- 20 /decimal) respectively each having three replications. The impacts of fish grazing on the periphyton community were also assessed. Eight ponds were used, four of which were provided with kanchi poles (100 per pond, spaced 1 $m^2$ apart). There were no statistically significant differences in water quality between treatments. Zooplankton numbers were the same in both treatments. While there was clear evidence that periphyton was being exploited by the fish, Chlorophyceae being most affected, grazing was insufficient to cause significant reductions in total periphyton densities. The study revealed that highest survival and weight gain was found in periphyton substrate pond $T_1$ comparing with non-periphyton substrate pond $T_2$. Among three major carps' species like Rui, Catla and mrigal, highest survival of rui 94% and production of 4617 Kg/ha/6 months was found in $T_1$ comparing with $T_2$ (survival, 67% and 2088 Kg/ha/6months). The growth and yield of Catla was observed to be slower than rui probably due to same trophic level space and food competition. On the other hand, growth and production of mrigal was higher than catla due to no food and space competition like catla with rui. The total yield of three species in substrate pond were found to be 7258 kg/ha/6months comparing with non - substrate pond (3763Kg/ha/6 months). The experimental results showed that periphyrton substrate have had a positive impact on the growth, survival and yield of the native major carps.

**Keywords**: Eco-friendly, poly culture, carps, substrate, periphyton.

# Evaluation of Dietary Inclusion of Mango Kernel Meal on Growth Performance, Hematological Profiles, and Related Gene Expression of *Gebelion catla* Fingerlings

**Group:** Biological Science **Project ID:** SRG-221283

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## Abstract

The aim of the present study was to evaluate the efficacy of dietary supplementation of mango (*Magnifera indica*) kernel meal (MKM) on growth performance, hematobiochemical parameters and growth and immune gene expression profile of *Gebelion catla* fingerlings. A total of 200 *G. catla* fingerlings were randomly divided into four equal groups with three biological replications for a period of 90 days. Fish in $T_2$ showed significantly higher growth performances and a higher percentage of specific growth rate (SGR%) in comparison to the control group in $T_0$ ($p < 0.05$). However, no significant ($p > 0.05$) changes in SGR% were reported between $T_1$ and $T_2$ groups. Haematological analyses showed significant ($p < 0.05$) decreases in white blood cell (WBC) in $T_3$ compared to control $T_0$. Hb, WBC, and RBC levels were noticeably higher in $T_2$ among treatments. Furthermore, plasma glucose levels in the $T_3$ and $T_0$ groups were substantially different from those in the other groups ($p<0.05$), respectively. In evaluation of the plasma parameters (ALT and AST) revealed a significant difference in $T_1$ and $T_2$ group compare to control group. Growth hormone mRNA expression was not significantly different by dietary supplementation in the present study. Significantly ($P\leq0.05$) higher expression of early growth response 2B mRNA gene expression was detected at $T_2$ group than in other groups. The expression pattern of interferon γ and interleukin-1β mRNA transcript were significantly higher in $T_2$ group. Considering overall performance of the present study, we concluded that 10g/kg MKM supplementation diet could be effectively used as dietary supplements for better growth performance, blood constituents and immune status.

**Keywords**: Mango kernel, biometric indices, hematology, gene expression.

# Gene Expression Profile of Frozen Buck Sperm Supplemented with Melatonin

**Group:** Biological Science **Project ID:** SRG-221284

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## Abstract

The present study was undertaken to assess the effect of melatonin on freeze ability of buck semen and to evaluate the effect of melatonin on transcriptional profile of the selected genes in buck sperm. Ejaculates from two mature Black Bengal bucks were pooled after collection. Semen was extended with Tris-fructose-citric containing egg yolk using glycerol supplemented with different concentrations of melatonin (0, 10, 15 and 20µg). All treatment groups were kept in 5 °C for five days. The sperm motility, viability and total sperm abnormality were assessed at 5 °C for 1, 2, 3, and 4 days of storage. Inclusion of melatonin into diluent resulted decrease in percentages of dead spermatozoa, abnormal spermatozoa, and increase in motility at different days of storage periods as compared with control group. The results revealed that the progressive motility, live and abnormal sperm percentage was significantly higher in samples supplemented with high concentration of melatonin (20 µg) in comparison with the control. The antioxidants genes were up regulated in melatonin treated groups than the control. Therefore, it could be concluded that freezing of semen supplemented with melatonin improved semen quality, and transcriptional profile, which may maintain the post-thaw fertilizing ability of buck semen.

**Keywords**: Bucks, semen, melatonin, motility, gene.

# Conservation of indigenous buck semen for artificial insemination in doe at the Coastal region of Bangladesh

**Group:** Biological Science **Project ID:** SRG-221286

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## Abstract

**Background:** Semen preservation and artificial insemination (AI) are two methods used in the biotechnology of reproduction. **Objective:** The aim of present study was to determine the pregnancy rate of does using artificial insemination with chilled. **Methodology:** The semen was collected from bucks through artificial vagina method. The colour, odour, volume, viscosity, mass activity, consistency, concentration and individual sperm motility were analyses and recorded after collection from four pre-selected bucks. **Findings:** The colour and odour of all buck semen were creamy white to milky white and fishy smell, respectively. The pregnancy rate of does after using chilled semen of buck (B)-1, B-2, B-3 and B-4 were 30, 40, 30 and 20%, respectively. In this study, it was found that the pregnancy rate of doe in the natural service group was significantly ($P<0.05$) higher than that of artificial insemination (AI) groups. Among the AI groups, the pregnancy rate of doe in the case of B-2 buck chilled semen was significantly higher than that of B-4. **Conclusion:** It may be concluded that the individual progressive motility of sperm at 4°C freezing was gradually decreased and suitable for artificial insemination up to 72 h.

**Keywords**: Bucks, coastal area, semen, evaluation

# Epidemiology of Mycoplasmosis in Chickens in Coastal Region of Bangladesh

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## Abstract

**Background**: *Mycoplasma gallisepticum* (MG) is an important pathogen for poultry and is responsible for chronic respiratory disease in chickens and turkeys, which results in significant financial losses in the poultry industry. **Objectives**: The objectives of this study were to determine the seroprevalence of MG in commercial broiler, layer, and native chickens in the coastal region of Bangladesh. **Methodology**: A total of 1060 blood samples were randomly drawn from selected commercial broiler, layer, and native chickens during the period from June 2022 to May 2023. Indirect enzyme-linked immunosorbent assay (iELISA) and Rapid serum plate agglutination (RSPA) tests were performed to identify the presence of anti-MG antibodies. **Findings**: Out of 1060 samples, 62.26% and 58.96% indicated the prevalence of MG antibodies in the iELISA and SPA tests, respectively. Among them, 55.33% and 53.00% were observed in broilers, 64.14% and 59.48% in layers, and 67.78% and 67.22% in native chickens significantly ($P<0.05$) by iELISA and SPA tests. The highest seroprevalence of MG was (68.57%) at 0-21 weeks and lowest (50.77%) at above 61 weeks of age ($P<0.05$). In terms of seasonal variation, the highest prevalence was recorded significantly ($P<0.05$) at 61.82%, 64.35%, and 71.43% in broiler, layer, and native chickens in the winter season, and the lowest at 46.00%, 54.71%, and 62.00% in broiler, layer, and native chickens in the summer season. The seroprevalence of MG was highest (61.25%) in Pirojpur and lowest (55.83%) in the Patuakhali region. The seroprevalence of MG antibodies was highest (58.57%) at 2001-3000 sized flocks and lowest (46.67%) at 1001-2000 sized small flocks in broiler, and also highest (64.38%) and (69.09%) at large (3001-4000) scale flocks and lowest (54.000%) and (65.00%) at small (1001-2000) sized flocks of both layer and native chickens. **Conclusion**: To mitigate this illness in the indicated areas, farmers should use stringent biosecurity measures.

**Keywords**: Epidemiology, *Mycoplasma gallisepticum*, seroprevalence, serological test, poultry.

# Molecular Characterization of Hard Ticks of Livestock in Bangladesh

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## Abstract

**Background**: Tick-borne diseases (TBD) such as babesiosis, theileriosis and anaplasmosis cause significant economic impairment in livestock production. For controlling of these diseases accurate identification tick vectors is necessary. **Objectives**: Molecular identification and characterization of hard ticks of livestock in Bangladesh. **Methodology**: For this study, 800 ticks were collected from the cattle of selected areas of Barishal, Jhalokathi and Bhola districts of coastal region of Bangladesh. Ticks were collected using fine tip forceps and fixed with adhesive tapes, and then examined morphologically under stereomicroscope. For molecular detection of tick, PCR was done using mitochondrial 16S rDNA gene (mt-rrs) marker and phylogenetic analysis was performed by MEGA Software. **Findings**: Morphologically, two types of tick vectors were identified namely *Rhipicephalus* (*Boophilus*) sp. and *Haemaphysalis* sp. from animal body surfaces. Here, 350 *Rhipicephalus microplus* ticks and 450 *Haemaphysalis* sp. ticks were identified with different sex and stages of life. The 16S rDNA gene could could successfully detect 2 morphologically identified *Haemaphysalis* sp. in pcr. 458 bp was sequenced from pcr product. 2 samples were sequenced using both forward and reverse primer. BLAST search of the sequenced data revealed that morphologically identified 2 Haemphysalis sp. is *Haemaphysalis bispinosa*. Sequence data was submitted to genebank (OP349640). Phylogenetic analysis revealed *Haemaphysalis bispinosa* from Babugonj upazila of Barishal district is in same clade with *Haemaphysalis* of the ticks of India, Thailand and Malaysia. **Conclusion**: This study reports the current status hard tick vectors of the selected coastal regions. It is the first report on molecular identification of *Haemaphysalis bispinosa* ticks from Bangladesh. This pilot study will assist the national policy makers for controlling of vector borne livestock diseases of the area.

**Keywords**: 16S RDNA, phylogeny, haemaphysalis bispinosa, Barishal.

# Use of Probiotics for Safe Meat Production in Japanese Quail

**Group:** Biological Science **Project ID:** SRG-221289

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## Abstract

Safe meat production is an important aspect of avoiding human health hazards. The use of probiotics in poultry is an important tool to produce safe meat among several established biotechnological approaches. In this experiment, we studied the effects of probiotics to produce safe Japanese quail meat production. 150 Japanese quail chicks were reared for six weeks using various doses of probiotics (0, 0.5, 1, 1.5, and 2 g per litre of water). The chicks were randomly distributed into five treatment groups with three replications each. The number of birds in each replication was 10. After six weeks of rearing, we found significantly high body weight at probiotic concentrations of 1, 1.5, and 2 g per litre of water. The feed intake in various treatments did not differ significantly, but comparatively better feed conversion ratios were seen at probiotic treatment. Water quality was not significantly harmed as a result of the addition of probiotics to the water. The reason for this better growth performance is probably due to the multiple benefits of probiotics in poultry. Probiotics could have maintained gut health with better nutrient utilization and availability, which led to higher body weight gain in the quail. In future experiments, challenging the birds with diseases or comparing probiotics with antibiotic growth promoters is required to ensure the efficiency of probiotics.

**Keywords**: Feed efficiency, performance, probiotic supplementation, and water quality.

# Isolation and Charaterization of Abiotic Stress Tolerant Phosphorus Solubilizing Fungi from Agricultural Soils in Southwest Coastal Zone of Bangladesh for Development of Phosphorous Rich Organic Manure (PROM)

**Group:** Biological Science **Project ID:** SRG-221290

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## Abstract

Phosphorus (P) is the second most essential nutrient element required for plant growth and development. Its deficiency in the soil is one of the major constrains for crop production. Soils in the southwest coastal zones have very little amount of plant available phosphorus because of some abiotic stresses such as soil salinity. Soil fungi can help to enhance the available phosphorous level in soil by their solubilisation activities in stress environment. They contribute to fulfil the plants phosphorous requirement. So, this study aimed to isolate and identify potential phosphate solubilizing fungi from stressed affected areas to use them as bio-inoculants. Fungi were isolated by serial dilution technique under Class-II bio-safety cabinet in soil microbiology laboratory, Department of Soil Science, Patuakhali Science and Technology University. Ten fungal isolates were preliminarily selected based on phosphate solubilization index (PSI). Furthermore, fungal isolates having excellent phosphate solubilization efficiency were selected by their potentiality in broth medium containing insoluble tri calcium phosphate ($Ca_3$ $(PO_4)_2$). Interestingly, IsolatePSFI-2DUM (753.5mg $P^{-l}$) has marked phosphate solubilization ability followed by Isolate PSFI-4DUM (572.5mg $P^{-l}$), PSFI-4DAK (541.8mg$P^{-l}$), PSFI-6DAK (519.7mg$P^{-l}$) and PSFI-1DAK (416.2mg$P^{-l}$).

**Keywords**: Isolation, abiotic stress, phosphorous solubilizing fungi and biofertilizer.

# Utilization of Asian Watergrass (*Hygroryza aristata*) as Fish Feed: A New Gateway for Aqua Feed Development in Aquaculture Sector

**Group:** Biological Science **Project ID:** SRG-221291

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## Abstract

The price of commercial fish feed increased globally which threats aquaculture as well as food security of the poor all over the world and creates problem for sustainable aquaculture development. A research work was investigated using Asian watergrass as fish feed ingredient to reduce the fish production cost. The research was conducted in plastic tank (500L) in three treatments each with three replications. The Asian water grass, *Hygroryza aristata* is a floating aquatic macrophyte that grows in all the fresh water bodies and coastal wetlands are the best region for vigorous growth and production. Asian watergrass was collected and dried in the sun light properly and thereafter it was ground to small granules sized using crusher machine. These granules materials were used to formulate experimental diet of tilapia fingerlings adding with other local feed ingredients rice bran, mustard oil cake) including fish meal and vitamin premix those were collected from local market. The Asian watergrass was added at 0% ($T_0$) 10% ($T_{10}$) and 15% ($T_{15}$) in the formulated feed maintaining 30% protein and fed on tilapia fry for 49 days. Important water quality parameters such as water temperature (°C), transparency (cm), dissolved oxygen ($mgL^{-1}$), pH, salinity (‰), total alkalinity ($mgL^{-1}$), ammonia ($mgL^{-1}$), nitrate nitrogen ($mgL^{-1}$) and phosphate phosphorus ($mgL^{-1}$) were measured at seven days intervals that were suitable range throughout the study period. The growth parameters such as weight gain, SGR (Specific Growth rate, % $day^{-1}$), survival and FCR (Food Conversion Ratio) were evaluated and found no significant variation among the treatments. Though, the growth increments of the stocked fish showed slightly high in $T_0$ but not found any significant difference among the treatments, which indicate that adding 15% Asian watergrass in $T_{15}$ treatment in the formulated feed has no negative effect on the growth of tilapia fingerlings.

**Keywords**: Asian watergrass, feed ingredient, tilapia.

# Exploring the Role of Glioma Associated Oncogene Homologue 1 (GLI1) in Head and Neck Squamous Cell Carcinoma

**Group:** Biological Science **Project ID:** SRG-221292

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## Abstract

**Background**: Originating from the mucosal epithelium in the oral cavity, pharynx, larynx, head, and neck squamous cell carcinoma (HNSCC) accounts for approximately 5.47% of all cancers worldwide. Genetic heterogeneity and its potential clinical relevance to HNSCC must be addressed to develop better treatment regimens. **Objectives**: The hedgehog signaling pathway (Hh) is an intricate signal transduction cascade maintaining neoplastic stem cell functions and tissue regeneration. Preclinical studies provide strong evidence that deregulated Hh signaling confers more malignant features in HNSCC leading to poor prognosis. Glioma-associated oncogene homologue 1 (GLI1), a transcription factor of this pathway has shown the highest involvement in HNSCC progression. **Methodology**: In our study, we enumerated the expression of GLI1 in 15 HNSCC patient tumor tissue and blood by qRT PCR technique. TCGA dataset was analyzed and found increased expression of GLI1 in HNSCC patients compared to normal. **Findings**: GlI1 expression was increased with the grade of the tumor. In our patients, data showed that GLI1 expression was significantly higher in tumor tissue and blood compared to normal tissue and blood. **Conclusion**: From this study, we reasoned that GLI1 expression is strongly involved in tumor progression in Bangladeshi HNSCC patients. Further experiments like western blot, and gene knockdown studies should be done to confirm its role in HNSCC patients.

**Keywords**: HNSCC, GLI1, TCGA.

# Use of Antibiotics in Fish Culture and the Presence of Antibiotic Residues in Edible Fish: A Food Safety Concern

**Group:** Biological Science **Project ID:** SRG-221293

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## Abstract

**Background and objectives:** By inducing the promotional activities of aqua-medicine companies, the fish farmers have been using antibiotics injudiciously without knowing their necessity, effectiveness, or proper dose. Therefore, a study was conducted to investigate the use patterns of antibiotics and the presence of antibiotic residues in carp's fish cultured in the Rajshahi region. **Methodology:** This study was conducted by collecting data about the antibiotics used in the ponds through interviews with the farmers, investigating the bacterial pathogens in the ponds following culture isolation, morphological and biochemical techniques, and estimating the antibiotic residues in the fish using High Performance Liquid Chromatography (HPLC). **Results:** Interview data showed that 87.21% of farmers in the study areas used antibiotics regularly, of which 91.27% for treatment and 6.10% for both prevention and control purposes. Oxytetracycline, Doxycycline, Ciprofloxacin, Amoxicillin, and Levofloxacin were found to be the common antibiotics used by the farmers, of which Oxytetracycline (68.37%) was the most widely used. Moreover, 42.83% of the farmers consulted with the expert before using antibiotics, while 53.37% used antibiotics mainly through shopkeepers' consultation and their own experiences. The results of bacterial analysis showed that selected bacteria (Coliforms, *Salmonella*, *Vibrio,* and *Staphylococcus aureus*) in the samples were abundant in most of the study areas, whereas *S. aureus* was the most dominant bacteria in the study areas. Four antibiotic residues (oxytetracycline, doxycycline, and amoxicillin) were identified in the fish samples. Among the detected antibiotic residues, the levels of oxytetracycline and amoxicillin were nearest to the maximum residue limit (MRL) but didn't exceed the MRL recommended by the European Commission. **Conclusion:** The detected antibiotic residues in the fish were not so alarming, but the injudicious use of antibiotics could result in an increased level, which might be hazardous for public health. Thus, regular monitoring of MRL in farmed fish is essential.

**Keywords**: Pathogen, injurious use, oxytetracycline, residue limit, monitoring.

# Development of a Direct Organogenesis Protocol for Mass Propagation of Arabian date Palm (*Phoenix dactylifera*) using Female Offshoot Tips

**Group:** Biological Science **Project ID:** SRG-221294

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## Abstract:

**Background**: Recently Arbian date palm are being cultivated throughout the country but due to its dioecious nature, it is very difficult to propagate the female plants. **Objectives**: We aimed at the rapid direct micropropagation method of Arabian date palm using female shoots as explants. **Methodology**: (i) Explant preparation and sterilization using 2.0 % NaOCl (ii) Culture initiation and organogenesis using BAP, 2iP and 2,4-D (iii) Shoot multiplication and elongation using 2iP alone or combined with of BA or Kin (iv) Rooting using 1.0 IAA and hardening on cocopeat (v) Statistical analysis. **Findings**: We have used different concentration of plant growth regulators to initiate direct shoot growth without developing callus phages. The best white swelling response was found to be at the concentration of 2 mg/l 2ip + 1 mg/l NAA after three-weeks of inoculation for both cultivars. Every 5 weeks the explants were subculture in the same media for until 3-4 months to obtained nodular culture. However, about 50 % explants were contaminated with fungi, which was discarded. Every five weeks, the explants were subculture in the 2iP alone or combination with 2,4-D to generate shoot buds until 5 months. The 5 m/l 2iP alone showed the highest frequency of organogenesis to generate shoot buds. The maximum number of shoot buds per culture (5.0) and shoot length (3.5 cm) were found on 5 mg/l 2iP + 2 mg/l Kn supplementing medium. Later the explants will be cultured in the subsequent steps for more elongation and rooting that takes may be take another 12 months. Actually, date palm tissue culture is lengthy process, it usually takes more than two years from culture initiation to root regeneration before transferring to the soil bags. **Conclusion**: Within 1 year, we have optimized sterilization protocol for off-shoot explants, established the organogenesis and shoot multiplication. We also need one more year for elongation, rooting and hardening.

**Keywords**: Arabian date palm, *in vitro* reaeration, tissue culture, explants, off-shoots.

# Nutritionally Enriched Fish Production: Fish Oil Enrichment in Fish Feed and its Efficacy on Growth Performance, Proximate Composition and Fatty Acid Retention in Rui, *Labeo rohita* (Ham.)

**Group:** Biological Science **Project ID:** SRG-221296

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## Abstract

Presently, in aquaculture the effect of fish oil on growth performance and nutritionally improved Rui, (*Labeo rohita*) fish production is a big concern in Bangladesh. The objective of this project was to enhance growth performance and to produce nutritionally enriched Rui fish through fish oil-based feed for human consumption. A three months cage culture trail has been conducted with formulated feed using fish oil at the level of 0% (Diet-1, Control diet), 7% (Diet-2), and 15% (Diet-3) under three treatments with 3 replications. Water quality parameters and growth performance were determined and analyzed by slandered method. The water quality parameters were found at suitable level as was in a controlled condition and did not differ significantly ($p<0.05$). The growth performance parameters like mean weight gain (g), food conversion ratio (FCR) and specific growth rate (SGR%/day) of Rui has been affected with the treatments. All of the production parameters were better for $T_2$ than $T_3$ and $T_1$ treatments. The weight gain was significantly higher at the fish group fed diet containing 7% fish oil-based diet ($T_2$:156.15±2.76g) than the fish group fed diet with 0% fish oil-based diet ($T_1$:112.88±3.11g). The values of FCR were displayed significantly higher in the fish group fed FO0% (3.57±0.08) diet than the fish group fed FO7% diet (2.83±0.04). The specific growth rate (SGR) of fish fed FO7% (1.13±0.0) diet was significantly higher than FO15% (1.04±0.0) and FO0% (0.91±0.02) treatments. Moreover, the average daily gain (ADG g) was significantly higher in $T_2$ (1.74±0.03) group than $T_1$ (1.25±0.03) and $T_3$ (1.54±0.00) group. The result shown that the maximum growth was observed with 7% fish oil enriched diet at $T_2$. Based on this experiment, it could be concluded that the fish feed with 7% fish oil can effectively increase the growth and good quality Rui (*Labeo rohita*) fish.

**Keywords**: Quality, fish product, human, consumption.

# Development of Oven Dried Small Prawn and Compare its Quality with Sun Dried One: An Effort to Establish Small Cottage Industry

**Group:** Biological Science **Project ID:** SRG-221297

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## Abstract

The present study was to develop oven dried product and compare the chemical and organoleptic quality with sundried one during July 2022 to June 2023. Small prawns (*Macrobrachium lamerii, M. dayanum and M. malcomsonii*), the most available shellfish species at fresh and dried condition in Bangladesh was selected for the study. The species was collected (fresh condition) from the Shingra bazar of Shingra Upazila, Natore and brought into the quality control laboratory of Department of Fisheries, University of Rajshahi. Fresh species was processed and dried under sunlight (average air temperature was 40°C) and in the oven (55ºC). The time duration was 36±0.58 hour (sun drying) and 30±0.15 hour (oven drying). Organoleptic and chemical test were done. The color, odour, appearance, texture and overall acceptability of sundried small prawns were 6.6±0.81, 7.2±1.15, 6.67±1.12, 6.6±1.18 and 7.13±0.83 and in case of oven dried small prawns those were 7.8±0.78, 7.5±0.5, 7.73±0.79, 7.66±0.48 and 7.8±0.67, respectively. The lowest protein content was found 56.38±1.14 (sun dried) and highest protein content was 58.29±0.43 (oven dried). The lowest lipid content was found 9.3±0.50 (sun dried) and highest lipid content was 13.22±1.25 (oven dried). The lowest ash content was found 8.88±0.072 (sun dried) and highest ash content was found 11.09±0.42 (oven dried). The lowest moisture content was found 17.61±0.20 (oven dried) and highest moisture content was 18.22±0.67 (sun dried). The lowest fibre content was found 1.17±0.04 (sun dried) and highest moisture content was 1.25±0.115 (oven dried). The lowest carbohydrate content was found 0.44±0.19 (sun dried) and highest moisture content was found 4.2±0.15 (oven dried). The lowest pH was 7.09 (oven dried) and pH was 7.19 (sun dried). It was observed that all the organoleptic and chemical qualities of oven dried small prawns are highest than that of sun-dried small prawns.

**Keywords**: Oven dried fish, small prawn, sun dried small prwan, small cottage industry, chemical composition.

# Household Food Accessibility and Child Health: A Comparison of Small Ethnic Households and Mainstream Households at High Barind Tract in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221299

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## Abstract

Food security in Bangladesh is impacted by cyclical global challenges. Despite progress, there is still financial disparity and food insecurity necessitating more studies on food access and child health outcomes. The study aimed to compare food access between small ethnic and mainstream households in Bangladesh, focusing on child health outcomes and factors affecting poor food accessibility. A total of 400 households with at least one child aged 3 - 11 years were surveyed in Rajshahi district and assessed child illnesses, stunting, and household food access levels. Food access was determined using the food consumption score. Chi-square test was used to compare food access levels in households and binary logistic regression models were used to examine the effect of food accessibility on child health outcomes and the relationship between household food security and control variables. The findings revealed significant challenges in food access, with 11.5% experiencing poor access, 24.0% having borderline access, and 64.5% maintaining acceptable access. Results showed mainstream households with children aged 3 - 7 years had higher food security. Many children reported recent illnesses, and 20% were mildly stunted. Child age and household size are inversely related to recent illness in the 'All Ages' group. However, household food access levels were not significantly associated with mild stunting, except for income earners and maternal education. Food access levels varied across age groups, with larger households facing lower food security in the 'All Ages' group. More income earners and maternal education were positively associated with food security except for households with children 3 - <7 years. Additionally, having food stocks during non-harvest seasons was linked to better food security across all age groups of children. The study highlights the need for targeted nutritional interventions, especially for children aged 3 - <7 years, and suggests further research to understand the contributing factors to undernutrition in children.

**Keywords**: Food consumption, food security, illness, income earner, low height-for-age.

# Effect of Probiotic and Synbiotic on the Central and Peripheral Immune Organs of Broiler Chickens During the Postnatal Development

**Group:** Biological Science **Project ID:** SRG-221300

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## Abstract

**Background with Objectives:** Dietary supplementation of probiotics and synbiotics modulate the immune response in broiler chickens by positively affecting their commensal intestinal bacteria as microflora growth promoters. The study was aimed to study the postnatal development of immune organs, and the effect of probiotic and synbiotic on the postnatal ontogenesis of the following immune organs of broiler chicken in Bangladesh. **Methodology:** A total of 300 day old broiler chicks of three experimental units (control, probiotic (Pro.B®) treated and synbiotic (SynBac®) treated) was reared for 35 days. After biometrical study, the central (thymus and bursa of Febricius) and peripheral immune organs (spleen) were subjected for histomorphometrical study following standard routine staining technique. **Results:** Probiotic- and synbiotic-treated broilers had the higher body weight and lower feed conversion ratio (FCR) than the control broilers though they intake almost similar quantity of feed. Moreover, synbiotic-treated broilers showed better performance than the Probiotic-treated broilers. Post-hatch age had an influence on the growth of immune organs in broiler chickens. The biometric values of the thymus, bursa of Fabricius and spleen were increased with the advancement of post-hatch developing age. Probiotic and synbiotic had an influence on the postnatal growth of immune organs of broiler chickens. Probiotic- and synbiotic-treated broilers had the higher biometrical values (length, width, thickness and weight) of thymus, bursa of Fabricius and spleen than that of control broilers. Moreover, synbiotic-treated broilers had the higher biometrical values of immune organs than that of Probiotic-treated broilers. **Conclusion:** A positive correlation was observed between post-hatch age and biometrical values of immune organs in broiler chickens. Although morphology was almost similar to other birds, values for the biometric parameters were different from other bird species, and even from indigenous and Sonali chicken.

**Keywords**: Post-hatch development, biometry, thymus, bursa of fabricius, spleen, broiler chicken.

# Impact of Animal Welfare on Reproductive and Productive Performance in Dairy Cows

**Group:** Biological Science **Project ID:** SRG-221301

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## Abstract

A set of standard protocols for assessing the welfare of dairy cows in large scale intensive dairy systems in the developed world have been used extensively. Little attention has been paid to the use of similar welfare assessment protocols for small dairy enterprises in developing countries. We modified part of the standard assessment protocol and used it to assess aspects of the welfare of dairy cows in a field survey of 15 small farms in the Rajshahi division of Bangladesh. Welfare indicators selected were mainly those of health and economic importance, such as general appearance, lameness, disease condition, cleanliness levels, vaccination, ventilation, mastitis, feed quality and dystocia. The study included physical examination of 300 cows and use of a structured questionnaire to collect data on health and management practices and farmers' perspectives about animal welfare. Mean milk averaged across farms, was11.2L/d (range 7.5–14.9), duration of lactation, age of puberty, calving interval, gestation length assessment indicated that the impact of animal welfare on reproductive and productive performances of dairy cows were changed. Hygiene management was often poor, with soiling of body parts with faeces. The prevalence of lameness was less than has commonly been observed in larger, more intensive dairy farms, but mastitis, dystocia was commonly detected at the dairy farms. This suggests that floors and/or bedding to lie on were inadequate. Many farmers did not follow routine vaccination and deworming schedules and farmers were not generally aware of the concept of animal welfare. The study demonstrates some similar welfare issues to those that have been commonly identified in large, intensive units, but also some differences, in particular a failure to provide good floors, bedding, and basic health care.

**Keywords**: Animal welfare, impact, reproductive and productive performance, dairy cows.

# Assessment of the Health Hazard Originated via Pesticide from Dry Fish in Human through Animal Model

**Group:** Biological Science **Project ID:** SRG-221302

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## Abstract

**Background**: The use of chemical pesticides in developing countries, like Bangladesh and their impacts on human health and food security is a global concern. Bangladesh is an agricultural dependent country for the growing population demand for food security and food safety. **Objective**: We conduct this study to assess public health threats of commonly utilized pesticides including Profenofos and Cypermethrin in rat model. **Methodology**: Thirty Female Wistar Rats was divided randomly into five groups; and subjected to distilled water as control, Profenofos, Profenofos Q+Cypermethrin 50 mg/kg b.w, unknown insecticide contaminated dry Ribbon fish (30 mg/ rat) and dry Shrimp (30 mg/ rat) group daily for the next 15 days. Hematology and serum biochemistry assay were performed. **Findings**: Red blood cell (RBC) concentrations (TEC, Hb, PCV%) were reduced in rats exposed to Profenofos and Cypermethrin. Similar data shows in dry Shrimp and dry Ribbon fishes groups. The neutrophil and eosinophil percentage were increased in the Profenofos and Cypermethrin exposed rat groups and Shrimp and Ribbon fishes groups. We found that serum aspartate aminotransferase (AST) and creatinine were increased in the Cypermethrin andProfenofos exposed group in rats, whereas Shrimp and Ribbon fishes groups increased serum alanine aminotransferase (ALT). There was no change in Triglyceride or LDL (Low density lipoprotein) levels in Cypermethrin, Profenofos and Shrimp and Ribbon fishes groups. This data shows that insecticide contaminated fishes group and pesticide treated groups were similar results in hematology and serum biochemical test. **Conclusion**: It suggests that unknown contaminated dry fish have adverse effects on health hazard. However, this study highlights the importance of rigorous monitoring and testing of livestocks and agricultural products. In addition, strengthen research and extension in the fields of agro economy, organic farming, local universities and farmer associations.

**Keywords**: Health hazard, rat, dry fish, pesticide, serum.

# Effect of Foliar Application of Zinc and Boron on the Growth and Yield of Wheat

**Group:** Biological Science **Project ID:** SRG-221303

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## Abstract

To evaluate the effect of foliar application of zinc and boron on yield and yield components of wheat, the present experiment was conducted at Sher-e-Bangla Agricultural University Farm. The experiment consists of eight treatments- $T_1$= Control, $T_2$= RFD (without Zn and B), $T_3 = T_2$ + Zn-2 kg $ha^{-1}$ and B-1kg $ha^{-1}$, $T_4 = T_2$ + Zn-2 kg $ha^{-1}$ and B-1kg $ha^{-1}$ once foliar at 50 DAS, $T_5 = T_2$ + Zn and B twice foliar @ Zinc 2 kg $ha^{-1}$, B 1kg $ha^{-1}$ at 35 DAS & 50 DAS , $T_6 = T_2$ + Zn and B twice foliar @ Zinc 1 kg $ha^{-1}$, B 0.5kg $ha^{-1}$ at 35 DAS and 50 DAS, $T_7 = T_2$+ Zn and B once foliar application @ Zinc 1 kg $ha^{-1}$, B 0.5kg $ha^{-1}$at 35 DAS , $T_8 = T_2$ + Zn and B once foliar application @ Zinc 1 kg $ha^{-1}$, B 0.5kg $ha^{-1}$at 50 DAS. During the growing periods, significant increase was recorded in plant height, ear length, flag leaf leangth, number of spikelets per spike, number of effective tillers, number of filled grains per spike, thousand grain weight, grain yield (t/ha) for foliar application of zinc and boron as compared to both control treatments. Twice foliar application of zinc and boron with other RDF of fertilizers (T5) resulted in maximum plant height (79.46 cm), spike length (14.92 cm), flag leaf length (14.22 cm), number of spikelets per spike (15.86), number of effective tillers (4.80), total number of tillers (5.33), number of filled grain per spike (45.53), thousand grain weight (56.00), grain yield (2.51 t/ha), straw yield (3.01 t/ha and harvest index (45.55). The results shows that foliar application of zinc and boron ($T_5$) might increase grain yield and yield components of wheat, and thus is recommended to increase crop production.

**Keywords**: Booting stage, Effective tiller, harvest index, spikelet, yield components.

# Role of Calcium and Potassium in Reducing Lead Toxicity in *Amaranthus tricolor*

**Group:** Biological Science **Project ID:** SRG-221305

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## Abstract

*Amaranthus tricolor* is a popular leafy vegetable that is grown throughout Bnagladesh and different countries of the world which can be affected by Pb toxicity due to environmental pollution. Present study investigates the effect of Pb on growth and physiology and the role of Ca and K in alleviating Pb-induced damage. *Amaranthus tricolor* cv. BARI Data-2 plants were grown in the pot following CRD and imposed with 500 and 1000 µM Pb $(NO_3)_2$ (Pb) either alone and in combination with 3 mM $Ca(NO_3)_2$ (Ca) and 6 mM $KH_2PO_4$ (K). Plant growth decreased and leaves were discolored due to Pb toxicity. Plant height, fresh weight, and chlorophyll content decreased under lead stress. Reduction of relative water content designates the Pb-induced osmotic stress and physiological drought. When Ca or K was applied with Pb treated plants these parameters were improved, compared to Pb treated plants alone. The increase of lipid peroxidation / melodialdehyde (MDA) of Pb-affected plants indicates membrane damage and oxidative damage under lead stress. In contrast, the Ca and K supplemented Pb treated plants showed improved membrane properties. In *Amaranthus tricolor*, ascorbate content decreased but glutathione level slightly increased under Pb stress. Activity of ascorbate peroxidase, monohedyroascorbate reductase and dehydroascorbate reductase decreased under Pb stress and Ca and K supplementation with Pb increased their activities. The data of the present study showed that Pb stress adversely affected the growth and physiology of Amaranth. Exogenous Ca and K supplementation in Pb treated plants improved the antioxidant defense system, conferred water regulation, increased the photosynthetic pigment and finally increased the plant height and fresh weight of Pb affected plants.

**Keywords**: Environmental pollution, heavy metal, phytotoxicity, oxidative damage, antioxidant.

# Supplementation Effects of Calcium on Growth, Yield and Biochemical Constituents of Tomato under Salt Stress

**Group:** Biological Science **Project ID:** SRG-221306

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## Abstract

An experiment was undertaken at the net house of Agricultural Chemistry Department of Sher-E-Bangla Agricultural University, Dhaka, during October, 2022 to April 2023 to observe the influence of different levels of Ca (0, 10, 20 and 30 mM Ca) under four levels of salinity (0, 5, 10 and 15 dS $m^{-1}$) on growth, yield and biochemical constituents of BARI Tomato15 in Completely Randomized Design having two factors with three replications. The effect of different levels of salinity on the number of fruits $plant^{-1}$, length & diameter of fruits, single fruit weight, fruit yield $plant^{-1}$, content of total soluble solids, vitamin C, Na and K in fruits of BARI Tomato15 showed significant variation. Different levels of supplementing Ca had significant effect on growth, yield and biochemical constituents of BARI Tomato15. The interaction effect of different levels of salinity and supplementing calcium on plant height, number of branches, leaves and clusters $plant^{-1}$, number of flowers & fruits $cluster^{-1}$ fruits length & diameter and single fruit weight of BARI Tomato15 did not show significant variation, but fruit number & fruit yield $plant^{-1}$, content of total soluble solids (Brix), vitamin C, Na and K content in fruits were significantly varied. Here the highest values of plant height, leaves number $plant^{-1}$, fruits length & diameter and single fruit weight were recorded from 20 mM Ca at 5 $dSm^{-1}$ salinity and the highest values of flowers number $cluster^{-1}$, fruits number & yield $plant^{-1}$ also found from same Ca level (20 mM) at 10 $dSm^{-1}$ salinity but highest vitamin C obtained from highest Ca level (30 mM) with 10 $dSm^{-1}$ salinity combination treatment. On the other hand, the lowest values of above parameters and highest Na content in fruits were recorded from the interaction of no Ca application (0 mM Ca) with highest salinity (15 $dSm^{-1}$) level.

**Keywords**: Calcium; biochemical; BARI Tomato15; salinity; supplementation.

# Effect of Glyphosate Herbicide on Phosphorus Availability and Yield Attributes of Wheat

**Group:** Biological Science **Project ID:** SRG-221307

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## Abstract

A field experiment was conducted in Grey Terrace soils under Madhupur Tract Agro-Ecological Zone (AEZ-28) during 2022-23 to observe the effect of glyphosate on wheat growth applied before crop establishment to the soil. The experiment was tested by applying glyphosate 2 and 7 days before land preparation. The soils under two different phosphorus doses (minimum phosphorus and high dose of phosphorus) and three glyphosate doses (no glyphosate, recommended dose of glyphosate and high dose of glyphosate). Twelve treatments were studied in split-split plot design with three replications. The growth and yield parameters of wheat, weed biomass and P concentration were varied due to the plant back period, glyphosate and phosphorus doses applied to the soil before crop establishment. When glyphosate applied 2 days before, emergence, germination and plant growth was hampered in compared to 7 days before application. Application of high glyphosate dose with high P significantly reduce yield and yield contributing characters of wheat crops. The phosphorus concentration in clay loam soil was also the highest recorded in the high glyphosate combined with high P dose. When glyphosate was applied at the recommended dose 7 days before land preparation, the yield and yield contributing characters were not hampered compared with high dose of glyphosate. The key result from the experiment was the interaction of plant back period and high rate of glyphosate with high dose of P fertilizer, leading to a negative effect on wheat phenotypic and yield characters in clay loam soil. The interaction of recommended dose of glyphosate and phosphorus reduce the weed biomass and increase the phosphorus availability in clay loam soil, and thus reducing the total cost of production for wheat. However, most of the effects were observed at the initial stage of crop growth.

**Keywords**: Field experiment, terrace soil, phosphorus.

# Determination, Distribution and Probabilistic Health Risk Assessment of Heavy Metals in Soil, Water and Crops in the Adjacent Industrial Areas of Kushtia in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221308

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## Abstract

The study aims to determine heavy metals pollution in soil, water and crops collected from crop fields near the industrial area of the Kushtia district of Bangladesh to assess the probabilistic health risks. Atomic absorption spectroscopy (AAS) served to determine the concentrations of lead (Pb), cadmium (Cd), chromium (Cr), and copper (Cu) in soil, water and crop samples ($n$ = 90). In the case of a water study, only Pb concentration in water from the studied location ranged from 0.13 mg/kg – 0.18 mg/kg, which was higher than the permissible limits set by FAO/WHO. The mean Cd, Cr and Cu concentration in water from the studied location was lower than the detectable limit. In the case of the soil sample, the mean Pb. Cr and Cu concentrations in the soil from the studied location were higher than the permissible limits, indicating that the soil accumulate higher metals near industrial areas. In the case of the rice sample, the mean Pb and Cr concentration in rice grain from all of the studied locations was much higher than the permissible limits, indicating the rice grain accumulate higher Pb and Cr from contaminated field soils. The results also indicate that the contamination factor (CF) values indicating only Cu and Cr pose significant to severe contamination in field soil, while all metals pose low contamination in water and rice grain samples collected from studied sampling sites. The results of the study indicate that the contamination degree (CD) of the water and rice grain samples collected from different industrial areas in the Kushtia district was found to be low. However, the field soil samples collected from the same areas exhibited a moderate degree of contamination. A Pollution Load Index (PLI) indicates that the soil samples collected were contaminated with metals. Findings show that heavy metal concentrations are high in rice fields near the industrial regions, endangering the environment and consumer health.

**Keywords**: Heavy metals; ecological risk; health risk; contamination factor; food safety.

# Rice Farmers' Knowledge and Willingness to use Guttee Urea: a Climate Smart Adaptation Strategy

**Group:** Biological Science **Project ID:** SRG-221309

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## Abstract

**Background:** The use of Guttee urea has many advantages in rice cultivation; however, farmers are reluctant to use this technique. **Objectives:** The current study looked at the factors that influence farmers' knowledge and willingness to use Guttee urea in rice. **Methodology:** A face-to-face survey was used to collect data from 320 rice farmers from four (4) selective villages in Naogaon district of Bangladesh. Data were analyzed using descriptive statistics, multiple linear regression and binary logistic regression. **Findings:** The highest portion (55.3%) of farmers had a moderate level of knowledge to use Guttee Urea in rice whereas 44.1% of them showed their willingness to use Guttee urea in rice. The multiple regression coefficients model (Model 1) explained 57.9% variance that exists between the selected characteristics of farmers and their knowledge to use of Guttee urea. Besides, age of farmers, level of education, rice production, annual family income, organizational participation, extension contact, and motivation of farmers are statistically significant predictors in explaining knowledge of farmers. Moreover, the binary logistic regression model (Model 2) explored 16.8% variance existing between farmers' characteristics and their willingness to use Guttee urea in rice. In addition, level of education, land ownership status, organizational participation and extension contact of farmers are significantly important for the willingness of farmers to use Guttee urea in rice. In both models (Model 1 & Model 2), level of education, organizational participation and extension contact of farmers are identified as significant factors that influence farmers' knowledge as well as willingness to use Guttee urea in rice cultivation. **Conclusion:** Therefore, it can be concluded that these three characteristics of farmers are crucial to clarify their knowledge and willingness to apply Guttee urea in rice cultivation.

**Keywords**: Knowledge, willingness, guttee urea, farmers, rice cultivation.

# Bioconversion of Water Hyacinth into Mature Compost for Improved Stability and Bioefficacy

**Group:** Biological Science **Project ID:** SRG-221310

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## Abstract
**Background**: The rampant growth of water hyacinth (WH) poses a severe environmental threat, and clogging water bodies. **Objectives**: The study was undertaken to produce mature and stable compost from water hyacinth treated with cowdung (CD). **Methodology**: Bioconversion of WH with CD was conducted to produce a nutrient rich organic amendment. Composting of WH with CD was done at four combinations (WH:CD, $T_1$= 1:0, $T_2$=1:1, $T_3$=1:3, and $T_4$= 3:1; w/w). Prepared compost was analyzed for maturity as well as nutrient elements. Experiment was carried out to assess the effects of compost on germination and growth promotion of tomato. **Findings**: Optimum electrical conductivity (4.35 $mS/cm^{-1}$), bulk density (0.51 $gcm^{-3}$), and germination index (85.75) were observed in $T_3$ where WH:CD ratio was 1:3. For $T_3$, the C/N ratio decreased to 27.35 at day 7, and then further decreased to 15.11 at day 42. These results indicate that the bioconversion of WH led to a gradual reduction in the C/N ratio over the composting period, suggesting an increasing maturity of the compost and a transformation of the organic material into a more stable form for soil amendment. Organic C, P, K and Na content were also higher in WH compost amended with CD. WH in the ratio of 1:3 with CD was appeared as the best treatment. Considering the germination and growth promotion of tomato seed, WH with CD (1:3) produced the optimum germination and seedling growth. Application of CD amended WH compost at 10 t/ha yielded optimum seedling establishment, plant growth and development. **Conclusion**: WH amended with CD in the ratio of 1:3 can be a promising solution for the bioconversion of WH into mature compost for improved stability, bioefficacy, benefitting both waste management practices and agricultural productivity.

**Keywords**: Eichhornia crassipes, cowdung, compost, tomato seed, growth promotion.

# Effects of Different Land-Use Types and Biodiversity on Above-Belowground Carbon and Soil Nutrients Dynamics: A Direct Field Approach Investigation

**Group:** Biological Science **Project ID:** SRG-221311

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## Abstract

Although carbon (C) and nitrogen (N) content in soil regulate productivity as well as carbon sequestration in terrestrial ecosystem, types of land use and biodiversity effect on C and N content is scarcely reported. This effect was tasted in three different land use types (frequently cultivated cropland, single species woodlot and mixed species plantations) in Sher-e-Bangla Agricultural University by using stratified as well as random sampling method. The primary objective of our study was to ascertain the impact of frequently cultivated cropland, single species woodlot, mixed species plantations and plant diversity effect on soil C and N content. The results revealed that total C in top 20 cm soil depth was varied from 2.0 g kg-1 to 16.3 g kg-1 and the total N varied from 0.11 g kg-1 to 2.61 g kg-1. We found mixed species plantations contain higher C and N content compared to single species woodlot and frequently cultivated cropland. We also found that Shannon diversity, had significantly effect on soil C and N across all land use. Our result indicates that mixed species plantations with different plant had direct contribution to soil C and N storage. Hence, mixed plant abundance and diversity should be considered for improvement of soil quality at broad ecological context with a particular emphasis on C, N friendly species composition.

**Keywords**: Biodiversity, land use types, mixed species plantation, soil carbon, soil nitrogen.

# Role of Ascorbic Acid as a Seed Priming Agent in Alleviating Salt Induced Damages in Rice (*Oryza sativa* L.)

**Group:** Biological Science **Project ID:** SRG-221312

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## Abstract

Salinity is a brutal abiotic stress that affects crop productivity worldwide. Seed priming with bio-regulators has emerged as an effective approach to fight against salinity. Therefore, a study was designed to explore potential of seed priming by ascorbic acid on alleviation of germination and growth inhibition of rice seedlings under salt stress. This study included four levels ascorbic acid *viz*. i) 0 mM ($A_0$), ii) 0.125 mM ($A_1$) iii) 0.250 mM ($A_2$) iv) 0.5 mM (A3) for seed priming and four levels of salinity treatments: i) 0 dS $m^{-1}$ (S0), ii) 5 dS $m^{-1}$ (S1), iii) 10 dS $m^{-1}$ (S2), iv) 15 dS $m^{-1}$ (S3) NaCl. The researches of this project include lab (petri-dish) and pot experiment with laboratory analysis. Studies revealed that different levels of salinity have significantly reduced the germination and growth attributes like germination percentage, germination speed, germination energy, radical length, plumule length, plant height, plant fresh weight, plant dry weight, SPAD value and leaf relative water content of rice in dose dependant manner, where maximum reductions were recorded in 15 dS $m^{-1}$ (S3) NaCl treatment. However, under salt stress ascorbic acid primed seed showed higher germination percentage, germination speed, germination energy, radical length, plumule length, plant height, plant fresh weight, plant dry weight, SPAD value and leaf relative water content in contrast to respective salt stress. Among the doses of ascorbic acid 0.25 mM and 0.5 mM performed better than the 0.125 mM. Conclusively, our findings suggest that use of ascorbic acid as a seed priming agent with appropriate dose can enhance the tolerance of rice seedlings against salt stress.

**Keywords**: Salinity, priming, organic acid, germination enhancement, abiotic stress tolerance.

# The Influence of Drought and Waterlogging Stress on Growth, Yield and Yield Components of Selected Eggplant Varieties

**Group:** Biological Science **Project ID:** SRG-221313

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## Abstract

Climate change induced abiotic stresses like drought and waterlogging has large effect on production of eggplant. So, this study aimed to explore the influences of drought and waterlogging conditions on morphological, physiological and yield attributes of the eggplant. The experiment was laid out by two factors Randomized Complete Block Design (RCBD) with three replications and comprised of three eggplant varieties ($V_1$ = BARI begun-5, $V_2$ = BARI begun-7 and $V_3$ = Purple king) with three treatment combinations control as normal irrigation ($T_1$), drought stress for 8 days ($T_2$) and waterlogging stress for 8 days ($T_3$) after 45 days of transplanting. From the results it was found that both drought and waterlogging have significant effect on the morphological, physiological trait and yield of eggplant. Highest morpho-physiological and yield parameters were observed for control condition, whereas a low value observed for drought followed by waterlogging in case of different varieties. Among the varieties, BARI Begun-5 has been affected more with the stress conditions, whereas the Purple King revealed the reverse trend. It was found that purple king exposed higher plant height (36.52 cm at 65 DAT), leaf number (35), SPAD value (57.4 SPAD units) and showed its capability to provide a high fruit production under the control condition than in the drought and waterlogging condition. Consequently, due to more enduring competency purple king variety can be added in the existing cropping pattern at both drought and waterlogged prone areas in Bangladesh.

**Keywords**: Drought, waterlogging, growth, yield, eggplant.

# Comparative Physiology of Different Kenaf (*Hibiscus cannabinus* L.) Varieties Under Drought and Waterlogging Stress

**Group:** Biological Science **Project ID:** SRG-221314

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## Abstract

**Background:** Kenaf (*Hibiscus cannabinus* L.) is a promising fiber crop in Bangladesh. However, its suitability under water stress is hardly been studied by the researchers. **Objectives:** This study aimed at understanding the physiological mechanisms of. Kenaf responses and tolerance to drought and waterlogging. **Methodology:** The study was carried out using a single Kenaf genotype in a semi-controlled setting within the experimental greenhouse of the Agronomy Department at Sher-e-Bangla Agricultural University, Dhaka, from March 15 to June 30, 2022. The study employed two drought and two waterlogging treatments, each lasting 7 and 14 days, alongside a control treatment (adequately watered). The investigation monitored various growth parameters (i.e. plant height, root length, root-to-shoot ratio, stem diameter, fresh and dry weights of shoots and roots), physiological parameters (relative water content, proline content, SPAD reading, electrolyte leakage, chlorophyll *a*, chlorophyll *b*, total chlorophyll, chlorophyll *a*/*b*, carotenoid content), and oxidative stress markers (lipid peroxidation: MDA content, $H_2O_2$ content). **Findings:** The findings indicated that plant height, stem diameter, fresh and dry weights of shoots and roots, relative water content, SPAD reading, and both chlorophyll a and b significantly decreased under drought conditions. Conversely, root length, root-to-shoot ratio, proline content, electrolyte leakage, total chlorophyll, chlorophyll *a*/*b* ratio, carotenoid content, MDA, and $H_2O_2$ all substantially decreased under waterlogged conditions, in comparison with the control. In terms of trait correlations, only root length demonstrated a negative correlation with both the fresh and dry weights of shoots. **Conclusion:** This study revealed that that kenaf responds differently under various water stress conditions. Growth parameters and physiology sensitive to waterlogging followed by drought. This knowledge opens promising avenues for future research at the molecular level to customize stress tolerance parameters of *H. cannabinus* potentially leading to the development of more stress-tolerant varieties.

**Keywords:** Abiotic stress; climate change; drought; oxidative stress; waterlogging.

# Effects of Phosphorus and Potassium on Growth and Yield of Quinoa (*Chenopodium quinoa* Willd.)

**Group:** Biological Science **Project ID:** SRG-221315

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## Abstract

The project entitled "Effects of phosphorus and potassium on growth and yield of Quinoa (Chenopodium quinoa Willd.)" was conducted in Rabi season, 2022-23. The objective of the project was to compare the performance of phosphorus with potassium for maximum growth and yield of quinoa. There were sixteen treatments included in the experiment as the four phosphorus dose viz., i) 0 kg $P_2O_5$ $ha^{-1}$ ($P_1$), ii) 50 kg $P_2O_5$ $ha^{-1}$ ($P_2$), iii) 100 kg $P_2O_5$ $ha^{-1}$ ($P_3$) and iv) 150 kg $P_2O_5$ $ha^{-1}$ ($P_4$) in the main plot and four different potassium dose viz., i) 0 kg $K_2O$ $ha^{-1}$ ($K_1$), ii) 50 kg $K_2O$ $ha^{-1}$ ($K_2$), iii) 100 kg $K_2O$ $ha^{-1}$ ($K_3$) and iv) 150 kg $K_2O$ $ha^{-1}$ ($K_4$) in the sub-plot. The experiment was laid out in a Split-plot design having 3 replications. No significant variations observed among the four phosphorus doses for almost all the studied characters except leaves $plant^{-1}$ at 45 DAS, branches $plant^{-1}$ at 45 and 65 DAS and harvest index where potassium doses showed significant variation of plant height, leaves $plant^{-1}$ at 25 and 45 DAS, shoot weight $plant^{-1}$, branches $plant^{-1}$ at 45 DAS, inflorescence $plant^{-1}$, seed yield and harvest index. Application of 150 kg $P_2O_5$ $ha^{-1}$ ($P_4$) along with 150 kg $K_2O$ $ha^{-1}$ ($K_4$) resulted the highest seed yield (1.60 t $ha^{-1}$) that similar with $P_2K_3$ (1.33 t $ha^{-1}$) and $P_1K_4$ (1.27 t $ha^{-1}$). The lowest seed yield (0.72 t $ha^{-1}$) was found in $P_4K_1$. The yield increment of $P_4K_4$, $P_2K_3$ and $P_1K_4$ were 122.22, 84.72 and 76.39% respectively compared to the lowest yielder combination of $P_4K_1$. It can be concluded that quinoa responded differently for phosphorus and potassium where potassium found more essential than phosphorus. Application of 50 kg $P_2O_5$ along with 100 kg $K_2O$ $ha^{-1}$ can be recommended for quinoa cultivation.

**Keywords**: Fertilizer management, growth, yield, super food, quinoa.

# Effect of Sulphur, Zinc and Boron on Nutrient Uptake, Partitioning, Growth, Seed Yield, Oil Content and Oil Quality of Sunflower (*Helianthus annuus* L.)

**Group:** Biological Science **Project ID:** SRG-221316

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## Abstract

The incidence of micronutrient deficiencies in crops has increased markedly in recent years due to intensive cropping, leaching, and soil erosion. To view this point, an experiment was conducted at SAU from Nov 2022 to April 2023 to evaluate the influence of Sulphur (S) and micronutrients Zinc (Zn) and Boron (B) on sunflower (*Helianthus annuus*, cv. BARI Surjamukhi-3) for improving growth and yield. The experiment consisted of the following treatments, recommended dose of fertilizer (RDF) alone and RDF with S 20 kg $ha^{-1}$, S @ 20 kg $ha^{-1}$ + Zn 0.25% as foliar spray, S 20 kg $ha^{-1}$ + B 0.25% as foliar spray, S 20 kg $ha^{-1}$ + Zn 0.25% and B 0.25% as foliar spray, S 40 kg $ha^{-1}$, S 40 kg $ha^{-1}$ + Zn 0.5% as foliar spray, S 40 kg $ha^{-1}$ + B 0.5% as foliar spray, S 40 kg $ha^{-1}$ + Zn 0.5% and B 0.5% as foliar spray, S 0.25% + Zn 0.25% as foliar spray, S 0.25% + B 0.25% as foliar spray, S 0.25% + Zn 0.25% as foliar spray and B 0.25% as foliar spray, S 0.5% + Zn 0.5% as foliar spray, S 0.5% + B 0.5% as foliar spray, S 0.5% + Zn 0.5% as foliar spray and B 0.5% as foliar spray. The foliar micronutrients were applied at 30 days after sowing (DAS) and 45 DAS. The experiment was laid out in an RCBD design with three replications. The result revealed that foliar application of 0.5% S, 0.5% Zn, and 0.5% B with RDF showed higher growth and yield attributes. Based on the results, it was concluded that conjoint foliar application of 0.5% S, 0.5% Zn, and 0.5% B with RDF influenced to increase the growth, yield attributes, and yield.

**Keywords**: Sunflower, micronutrient, yield, sulfur, zinc, and boron.

# Impact of Land Use and Land Cover (LULC) Changes and Climate Change on the Spatial Distribution of *Parthenium hysterophorus* in Bangladesh

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## Abstract

Parthenium (*Parthenium hysterophorus* L.) is among the most noxious invasive alien plant species, which can threaten agro- and native ecosystems. The distribution of *P. hysterophorus* was measured in Bangladesh's agricultural lands, roadside, riverside, and fallow lands. Among 64 districts of Bangladesh, parthenium infestation is found in 28 districts. Maximum parthenium weed was found in the Jashore, Chuadanga, Chapainawabganj, and Rajshahi. The study also investigated the harmful effect of parthenium on native flora. The quadrates method (1mx1m) was used to collect the data on the distribution and population of this weed. A total of 26 weed species were recorded belonging to 10 different families. The data were recorded by absolute density ($m^2$), relative density (%), absolute frequency (%), relative frequency (%), and importance value (%) of parthenium and other associated weeds. The finding reveals that parthenium is the most dominant species compared to other associated flora. Using field surveys and maximum entropy (MaxEnt) modelling approach, the present study quantifies parthenium weed distribution under the current and two future climatic conditions (RCP 2.6 and RCP 8.5) in Bangladesh. The greatest weed abundance (30 plants $m^{-2}$) occurred at the Indian border area, suggesting possible spread from that country along the linking road systems. Under future climate conditions, parthenium weed distribution is predicted to expand, suggesting an increased threat to the agroecosystems of Bangladesh. The present study is the first attempt to model potential parthenium weed distribution in Bangladesh. The findings of this study can help land managers make judicious decisions towards future management.

**Keywords:** Invasive weed**,** weed ecology, MaxEnt, species distribution model, climate change.

# Agrometeorological Indices, Heat Use Efficiency and Productivity of Wheat Sown with Different Dates

**Group:** Biological Science **Project ID:** SRG-221318

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## Abstract

Wheat (*Triticum aestivum*) is a vital staple crop globally, contributing significantly to food security. Wheat sowing time plays a crucial role in determining crop growth and yield. Agrometeorological indices are valuable tools for understanding the impact of weather conditions on crop performance. This study aims to addresses the gap in knowledge by investigating how sowing dates interact with agrometeorological factors impacting productivity of wheat. So, a field experiment was carried out at the Sher-e-Bangla Agricultural University farm during the Rabi season (2022-2023) considering a Randomized Complete Block Design (RCBD) with 3 replications. The treatments included two types of wheat [BARI Gom 33 ($V_1$) and WMRI Gom-3 ($V_2$)] and five planting dates: 15 November, 25 November, 05 December, 15 December, and 25 December, designating $S_1$, $S_2$, $S_3$, $S_4$, and $S_5$ respectively. However, Variety $V_1$ performed better on 1000-grain wt. and grain yield per linear meter. Sowing times also caused variations on grain yield per hectare. The average grain yield per hectare was 2.60 t/ha in $S_4$ followed by $S_3$ (2.31 t/ha), $S_5$ (1.94 t/ha), $S_2$ (2.00 t/ha), and $S_1$ (1.81 t/ha). Moreover, $V_2S_4$ combination yielded 2.63 t/ha of grain. As we progress down the combinations, the grain yield gradually falls, with V2S5 having the lowest grain yield (1.73 t/ha). When wheat sown on December 15th, both cultivars reached maturity in 91 days, accumulating a GDD of 1566.6°C for maximum grain yield per hectare. However, the combinations with earlier sowing times ($S_1$ and $S_2$) tended to have lower grain and stover yields compared to the combinations with later sowing times ($S_3$, $S_4$, and $S_5$). This indicates that the later sowing times have provided more favorable conditions for higher grain and stover yields of wheat in Bangladesh.

**Keywords**: Wheat, Sowing dates, Meteorological indices, BARI Gom 33, WMRI Gom-3.

# Influence of Seedling Transplantation Methods and Seedling Ages on the Yield Performance of Short Statured SAU White Maize-3

**Group:** Biological Science **Project ID:** SRG-221319

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**Abstract**

The study was carried out at Sher-e-Bangla Agricultural University Farm during Rabi 2022-23 to evaluated the performance of varying transplanting method of a white maize composite variety (SAU White Maize 3. Seedlings of different ages (15, 20 and 25 days after sowing) were transplanted at varying soil moisture supply (Field capacity, DS; puddled condition, PC; saturated condition, SC; and waterlogged condition, WL). Data were taken on plant height, stem base circumference, lamina dry weight, cob distance from the soil surface, cob length, cob circumference, total dry weight, number of grains per cob, number of grain rows per cob, grain yield per hectare, 100-grain weight, and harvest index. Results showed that DS produced the least grain yield Whereas, the water-logged treatment with aged seedlings had the highest yield (6.597 t/ha), dry matter accumulation (126.88 g/plant), cob weight (80 g/plant) and soil moisture (14.52-meter reading). The corresponding values as were shown by the treatment DS, respectively were 5.035 t/ha, 96.39 g/plant, 60.45 g/plant, and 7.38 reading. All other parameters had similar responses to the varying soil water treatments and seedling age.

**Keywords:** Wheat, field capacity, water-logged, harvest index, composite variety, grain yield.

# Export Quality Potato Production Through Vermicompost Application: A Good Agricultural Practice

**Group:** Biological Science **Project ID:** SRG-221320

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## Abstract

**Background**: Good quality potato (*Solanum tuberosum* L.) is the main constraint for the improvement of export scenario in Bangladesh. Application of suitable organic manure *viz*., vermicompost along with required chemical fertilizers might be improved its export quality. **Objectives**: To find out the optimum level vermicompost for producing export quality potato. **Methodology**: A field experiment was conducted at Sher-e-Bangla Agricultural University, Dhaka-1207, during the period from November, 2022 to April, 2023. The experiment is comprised of two factors, *i.e.,* factor A: Potato varieties (3): $V_1$: BARI Alu-29 (Courage), $V_2$: BARI Alu-28 (Lady Rosetta) and $V_3$: BARI Alu-25 (Asterix); factor B: Vermicompost level (5): $C_0$: 0 t $ha^{-1}$, $C_1$: 2.00 t $ha^{-1}$, $C_2$: 4.00 t $ha^{-1}C_3$: 6.00 t $ha^{-1}$ and $C_4$: 8.s00 t $ha^{-1}$. The study was laid out in a randomized complete block design with 3 replications. **Findings**: The results showed that vermicompost could enhance yield and quality contributing parameters of potato. Some quality parameters studied in this experiment *viz*., dry matter, specific gravity, starch content gradually increased with increasing vermicompost levels on the contrary, total soluble solids decreased with increasing its level. Among the 15 treatment combinations, although BARI Alu-25 with vermicompost level 8.00 t $ha^{-1}$performed superior than other combinations in most of the parameters and it produced the maximum potato yield (31.33 t $ha^{-1}$), marketable potato yield (25.30 t $ha^{-1}$), chips potato yield (11.03 t $ha^{-1}$), French fries potato yield (5.71 t $ha^{-1}$), potato dry matter (23.01 %), specific gravity (1.093 g $cm^{-3}$) and starch content (17.12%), but the combination of $V_3C_4$, $V_3C_3$ and $V_3C_2$ also showed similar results on the basis of yield and quality contributing parameters. **Conclusion**: It may be concluded that potato growers may apply vermicompost 4.00 t $ha^{-1}$ along with recommended rate of other fertilizers for producing good quality potato without sacrificing yield

**Keywords**: Chips, dry matter, French fry, marketable yield, specific gravity, starch.

# Evaluation of Fresh and Frozen Semen and Effect of Storage Time of Oocytes on *In-Vitro* Maturation (IVM) and *In-Vitro* Fertilization (IVF) of Bovine Embryo

**Group:** Biological Science **Project ID:** SRG-221321

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**Abstract**

Among reproductive technologies most popular in Bangladesh is AI. Good quality semen has positive effect on successful fertility of cows. This study was conducted to evaluate quality of both frozen and fresh semen of bull and the duration time between ovary collection and processing in the laboratory on *in-vitro* maturation and fertilization. For the purpose of this study, both fresh and frozen semen were collected from CCBDF, Savar, Dhaka and bovine ovaries were collected from slaughter house. To assessment semen qualities, the parameters were evaluated such as sperm concentration $\times 10^6$/ml normal sperm, abnormal sperm, dead sperm, live sperm, total motility and progressive motility. The fresh and frozen semen were comparable and statistically significant ($p<0.05$). The abnormal sperm of fresh and frozen semen were 9.98% and 18.2% respectively. The live sperm of fresh and frozen semen were 88.43% and 68.04%respectively. The dead sperm of fresh and frozen semen were 11.8% and 46.3% respectively. The normal sperm of fresh and frozen semen were 87.3% and 65.09% respectively. The sperm concentration $\times 10^6$//ml of crossbred is $1370.00\times 10^6$/ml and $1223.00\times 10^6$/ml were fresh and frozen, respectively. The progressive motility of fresh and frozen semen was 75.26% and 44.32% respectively. The motility of fresh and frozen semen was 85.93%and 62.16%respectively. The average numbers of oocytes 72, 68 and 61% were collected in 6, 9 and 12 hr of storage time respectively. The average % of maturation rate at M-II stage were 71.5% at 6 hr, then 65% at 9 hr and 43.5% at 12 hr storage time, there was significant different ($P<0.05$) of storage time on maturation rate of bovine oocytes. It may be concluded that fresh semen quality better than frozen semen. But to avoid venereal diseases frozen semen better than fresh semen and storage time of ovaries was suitable in 6 hr for *in vitro* maturation and fertilization.

**Keywords:** Semen quality, oocytes quality, oocytes quantity, in vitro, maturation, fertilization.

# Comparative Biometrical Study of Reproductive Organ Between Indigenous and Crossbred Cow's Genotypes in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221322

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## Abstract

Genetic composition has a major impact on the biological efficiency of the application of reproductive technologies. Inadequate concrete information regarding the comparative analysis of indigenous and crossbred cattle's reproductive tract makes it difficult to choose the best genotype to make the artificial insemination program successful. Variations in the environment have distinct effects on different animal genotypes. The aim of this study was to biometric investigation of the reproductive organs of 100 numbers of dairy cows accessible in Bangladesh that differed in genotype (Local, Local×Holstein Friesian, Local×Sahiwal, and Local×Sindhi). Cows reproductive organs were taken from several slaughterhouses in Dhaka, Bangladesh, right after the animals were killed. Insignificant ($p>0.05$) differences were found in the genital tract of local cows when compared to the cyclic stage. In every genotype, the average length of the right ovary was found to be greater than the left. There were notable variations ($p<0.05$) in the morphometric values of the majority of reproductive tract characteristics amongst genotypically diverse cows when compared. On the majority of the genitalia parameters that were assessed, Local×Holstein Friesian had considerably higher values ($p<0.05$), followed by Local×Sahiwal, Local×Sindhi, and Local. The significant ($p<0.05$) longest right (27.15 cm) and left (28.17 cm) uterine horn was found in the Local×Holstein Friesian genotype. The length and width of the Local×Holstein Friesian were found longest (3.23 and 2.99), (5.23 and 4.65), (24.61 and 6.27), and (8.39 and 5.41) cm for the uterine body, cervix, vagina, and vulva respectively. In a nutshell, crossbred dairy cows have larger capacious genital tracts than local cows. Concerning clinical reproductive diseases, rectal examinations, transrectal ultrasounds, and the use of reproductive technologies in crossbred genotypes, the information gathered for this study can be highly beneficial.

**Keywords:** Cow, genotype, crossbred, slaughterhouse, measurement.

# Present Status and Quality Evaluation of Chicken Feed Manufactured in Registered and Unregistered Feed Mill at Dhaka Division of Bangladesh

**Group:** Biological Science **Project ID:** SRG-221323

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## Abstract

The study was conducted to know the present status, quality evaluation and determination of health hazardous elements in poultry feed collected from registered and unregistered feedmills at three upazilla namely Savar, Kaliakoir & Sreepur in Dhaka Division. Broiler starter, grower and layer feed were collected randomly from 5 registered & 5 unregistered feedmills. The feed samples were evaluated physically and subjected to proximate analysis: moisture, crude protein (CP), ether extract (EE) & ash. Chromium (Cr) & Lead (Pb) were also determined as health hazardous elements. Survey reports showed that 33% respondents were involved with solely on poultry farm business and remaining were engaged with poultry farming plus business, fish farming, crop production and others. Among the poultry farmers, 90% farmers reared only broiler, 8.34% only layer and 1.67% reared both. Farmers used 96.67% commercial feed and remaining used home-mix feed. Feed analysis reports showed that both the registered and unregistered feed possess the normal physical characteristics. Proximate analysis showed the significant variation in terms of moisture, CP, EE and ash within the groups and between registered and unregistered feed groups indicating comparatively lower quality of unregistered feed. In broiler feed (both starter & grower), mean value ranges between 10.45% to 11.35% moisture; 16.98% to 21.66% CP, 5.24% to 8.20% EE and 6.13% to 7.20% ash found both in registered and unregistered category. In layer feed, mean value of %M, %CP, %EE & %ash was 11.05% & 10.81%; 16.86% & 13.54%; 5.45% & 5.78%; 11.77% & 8.16% found in registered and un-registered category; respectively. The concentrations of Cr, & Pb were found to be below detection level in all types and both categories. This study suggests that registered feed possess nearly standard nutritional quality and the feed of all types and categories do not have any significant risk to public health.

**Keywords:** Commercial feed, home-mix feed, nutritional quality, feed mill, heavy metal.

# Characterization of Production Traits and Meat Qualities from Newly-developed Crossbred Chickens (Multi Color Table Chicken and Sonali) in Bangladesh

**Group:** Biological Science

**Project ID:** SRG-221324

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## Abstract

The experiment was aimed to evaluate the weight gain, feed intake, feed conversion ratio, proximate composition, pH, water holding capacity, and antioxidant attributes of newly developed native chicken (Multi Color Table Chicken; MCTC) compared to Sonali chicken. The day-old chicks were reared up to 8 weeks of age with a target weight of 1 kg body weight. The results reveal that daily weight gain, feed intake, pH, water holding capacity (WHC), and antioxidant capacity of MCTC were significantly higher compared to existing commercial chicken; Sonali ($p<0.05$). In terms of mortality, MCTC showed a lower mortality rate compared to Sonali ($p<0.05$). However, the proximate composition did not show any significant variation between MCTC and Sonali chicken. In conclusion, a newly developed native chicken; MCTC could be a great genetic stock for further breeding in the poultry sector with high value of quality traits that affect the producers as well as consumers.

**Keywords:** New native chicken, broiler, meat composition, production traits, seed stock.

# Dietary Administration of Red Seaweed (*Gracilaria tenuistipitata*) Extract to Produce Protective Immunity of Fish

**Group:** Biological Science **Project ID:** SRG-221325

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## Abstract

Seaweeds are considered as one of the important aquatic plants for the coastal ecosystem. Use of seaweed for the immunity enhancement of aquatic organisms would be one important approach. Research was designed to assess different doses of red seaweed extract (*Gracilaria tenuistipitata*) on Nile tilapia fish (*Oreochromis niloticus*) to evaluate the growth and hematological parameters. Ethanolic extraction of *Gracilaria tenuistipitata* (EXGT) was used for the experiment in glass aquarium. Total four treatments were applied including Treatment- 1 (Control, 0% EXGT), Treatment-2 (5% w/v EXGT), Treatment-3 (10% w/v EXGT) and Treatment-4 (15% w/v EXGT) each with three replicates for 8 weeks. Temperature, pH, TDS, $NH_3$, $NO_2^-$ and $NO_3^-$ showed no significant difference among treatments. Result showed that the growth was increased with increasing the percentage of seaweed extract. It was observed that mean weight gain was found highest in the highest percentage of seaweed extract. The highest weight gain was found in T-4 (15% EXGT) and the percentage of specific growth rate (7.29%) was observed in the same treatment. The lowest FCR 1.03±0.12 found in T-4 and highest was in control. Hematological parameter showed that blood glucose level was higher in T-1 than others treatments. Serum protein was found 7.5gm/dl in T-4 and lowest value was found in control. Spleen Somatic Index (SSI) percentage of experimental fishes was also found higher in T-4 and lowest one was recorded in T-1. Refractive index (RI) of blood serum was found better in T-4 fishes compared to other treatments. It can be concluded that feed supplemented with seaweed extract showed better growth performance and hematological parameters compared to control. Feed supplemented with brown red seaweed extract as a dietary supplement can be used for better immunity and growth performance of Nile tilapia.

**Keywords**: Seaweed, extract, fish, growth, immunity.

# Biology and Diversity of Lady Bird Beetle and its Interaction with Other Arthropods

**Group:** Biological Science **Project ID:** SRG-221326

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## Abstract

Lady bird Beetles (*Rodolia sp*.) are economically important insects. Larvae and adult both feed on phytophagous mites and Homopteran insects. In order to learn more about the biology of the lady bird beetle and how it interacts with other arthropods, experiments were carried out using a completely randomized block (CRD) design in the laboratory of the Department of Entomology at Sher-e-Bangla Agricultural University, Dhaka, from September 2022 to May 2023. The biology of lady bird beetles and its predation efficiency on Aphid (*Aphis sp*.) and Mango mealybug (*Drosicam angiferae*) were studied under laboratory condition. The eggs had an average length of 1.19±0.09 mm and an average width of 0.61±0.07 mm. With an average hatching time of 13.00±0.74 days, the eggs hatched in 12 to 14 days. The larval stage lasted 65±19.55 days. Pre-pupal and pupal stages ranged in length from 2 to 5 days and 3 to 8 days, respectively. The total duration from egg to adult was completed within 63 to 107 days. The adult beetle was initially orange in color but finally it gained red color. The dimensions varied from 5.13 mm to 5.23 mm in width and 7.77 mm to 7.76 mm in length. Ladybird beetle fed on aphid and mango mealybug. However, they fed at different rates on mango mealybug. They feed mostly during the day, but they do it at night as well. An adult ladybird beetle fed 0.19±0.03 adult aphid per day. In case of mango mealybug, the second instar of the ladybird beetle (*Rodolia* sp.) larvae was statistically more successful than the previous instars in nipping off the mango mealybug nymph and adult lady bird beetle was more responsible for nipping off the aphid.

**Keywords**: Lady bird beetles, aphid, mealybug, predation, hatching time.

# Infestation Intensity and Management of Onion Thrips

**Group:** Biological Science **Project ID:** SRG-221327

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## Abstract

Onion thrips, *Thrips tabaci*, is a leaf feeding insect pest causes considerable yield loss of onion in field during production. The experiment was carried to study the infestation intensity and to develop management practices against thrips in onion production system. Infestation intensity was studied from untreated plots of onion and seven promising formulated products such as Antario 32K, Fytomax, Fytoclean, Biotrin, Matrixine plus 5EC, Tracer 45SC (Spinosad) and Proclaim 5SG (Emamectine benzoate) were applied in treated plots as management practices. More than 80% leaf infestation was observed in the untreated control field. Among the treatments, Spinosad decreased 89.44%, 90.31% and 89.38% leaf infestation, and 92.14%, 91.18% and 86.52% total population of thrips over untreated control plots after first, second and third application, respectively. Biotrin also decreased 89.89%, 89.21% and 83.15% total population of thrips after first, second and third application, respectively. The highest bulb weight (50.33 g) and diameter (5.73 cm) was obtained from Spinosad treated plots which increased 384.50% bulb weight and 128.87% bulb diameter over untreated control plot followed by Biotrin having 45.47 g bulb weight and 5.47 cm diameter of onion bulb and increased 337.20% bulb weight and 128.87% diameter over untreated control. The highest bulb yield plot$^{-1}$ (13.57 kg per 7.5 m$^2$) was obtained from Spinosad treated plots which increased 415.97% yield over untreated plot. Biotrin produced 11.90 kg onion bulb per plot (7.5 m$^2$) and increased 352.47% yield over untreated control plot. Fytomax produced 10.56 kg onion bulb per plot (7.5 m$^2$) and increased 300.38% yield over untreated control plot. Other treatments also significantly increased bulb yield of onion over untreated control plot but their effectiveness was unsatisfactory. Considering leaf infestation intensity, thrips population and bulb yield Spinosad and Biotrin may be alternately used for the management of thrips in onion production system.

**Keywords:** Antario, Biotrin, Emamectin benzoate, Spinosad, *Thrips tabaci*

# Evaluation of Promising Varieties/Genotypes of Sunflower Against Major Insect Pests and Their Eco-Safe Management

**Group:** Biological Science **Project ID:** SRG-221328

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## Abstract

The experiment was conducted in the field of Sher-e-Bangla Agricultural University, Bangladesh from November 2022 to April 2023 with a view to find out the performance of three sunflower varieties viz. BRRI sunflower 2 ($V_1$), BRRI sunflower 3 ($V_2$) and Variety Mayabi ($V_3$) under four managements such as $T_1$= control; $T_2$= Yellow sticky board + alternative release of egg parasitoid *Trichogramma* spp. and larval parasitoid, *Microbracon* sp; $T_3$= Collect egg masses, larvae and destroy them + carbaryl 50WP @ 2gm/ L of water at the 10 days interval; $T_4$= Setup pheromone traps.+ Spraying Chlorpyriphos 2L @ 1.5ml/ L of water at the 10 days interval, using two factorials Randomized Complete Block Design (RCBD) with three replications. Insect populations for plants/plot were observed with clean observation and the highest number was recorded from $V_3$, $T_1$ and $V_3T_1$ and lowest from $V_1$, $T_4$ and $V_1T_4$ treatment combination. The highest leaves infestation was observed from $V_3$, $T_1$ and $V_3T_1$ treatments. Seed infestation by number was the highest in $V_3$ (20.97%) and $T_1$ (29.91%), $V_3T_1$ (36.65%), whereas the lowest in $V_1$ (14.61%), $T_4$ (10.55%) and $V_1T_4$ (8.85%). In consideration of yield contributing characters the maximum plant height in $V_2$ (168.6 cm) , $T_2$ (176.9 cm) and $V_1T_4$ (181.3 cm) treatment combination were recorded, while minimum in $V_3$ (158.3 cm) $T_1$ (150.4 cm) and $V_3T_1$ (180.2 cm) treatment combination. Similar results were also recorded on capitulum diameter, number of heads/plot, total number of seeds/head and seed weight. BARI sunflower 2 ($V_1$) had the highest seed yield, amounting to 1.50 kg/plot $T_4$ (1.64 kg/plot) and from and $V_1T_4$ (1.72 kg/plot) treatment combination were recorded while the lowest seed yield was recorded from $V_3$ (Variety Mayabi) $T_1$ and $V_3T_1$ treatment combination.

**Keywords**: Evaluation, varieties/genotypes, sunflower, insect pests and management.

# Incidence of Phytophagous Beetles and Caterpillars on Bottle Gourd and their Potential Management

**Group:** Biological Science **Project ID:** SRG-221329

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## Abstract

Red pumpkin beetle and Crambid snout moth caterpillar are important phytophagous pests of bottle gourd that damage the leaves and effects on yield. The study was conducted to evaluate the effectiveness of different management approaches combining neem cake with different bio-pesticides and chemical insecticides against the pests. The treatments Ripcord 10 EC, Coragen 18.5 SC, Karate 2.5 EC, Biomax 1.2EC, Biotrin, and Neem oil integrating with neem cake and an untreated control were used to control the pests in the experimental field of Sher-e-Bangla Agricultural University from March to June 2023. The results indicated that there were significant differences among the treatments and the lowest number of Red pumpkin beetle at vegetative stage (0.92) and at early, mid, and late reproductive stages (0.22, 0.17, 0.08, respectively) per 10 leaves of bottle gourd was found in the treatment neem cake + Karate 2.5 EC (Lambda cyhalthrin) ($T_3$). No Crambid snout moth caterpillar was observed in the treatments neem cake + Karate 2.5 EC ($T_3$), Neem cake + Coragen 18.5 SC ($T_2$), and Neem cake + Biomax 1.2EC ($T_4$) but the larvae was observed in the untreated control plots ($T_7$) (0.35/ 10 leaves) followed by Neem cake + Biotrin 0.5% AS ($T_5$), Neem cake + Neem oil ($T_6$), and Neem cake + Ripcord 10 EC ($T_1$) treated plots, respectively. The treatment neem cake + Karate 2.5 EC ($T_3$) also reduced the highest percent of leaf infestation. However, the highest number of fruit plant$^{-1}$ (8.67), single fruit length (39.83 cm), breadth (15.76 cm), weight (2.21 kg), yield (45.83 t ha$^{-1}$) and MBCR (5.76) was observed in Neem cake + Karate 2.5 EC ($T_3$) treatment. It can be concluded that Neem cake + Karate 2.5 EC was the most effective and economic management approach to control the phytophagous beetle and caterpillar on bottle gourd.

**Keywords**: Red pumpkin beetle, Crambid snout moth, management, neem cake, biopesticide, insecticide.

# Unraveling the Trait Association Between Seed Yield and Yield Related Parameters in Oil Yielding Brassica Genotypes

**Group:** Biological Science **Project ID:** SRG-221330

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## Abstract

The research was based on the evaluation of 13 genotypes considering morphological traits using randomized complete block design with three replications in the research farm of Sher-e-Bangla Agricultural University. The analysis of variance showed significant variation in all the traits. The phenotypic variances were higher than the genotypic variances, with little difference in all traits. High heritability estimates were observed for days to 50% flowering, days to maturity, number of secondary branches per plant, number of siliquae per plant, length of siliqua, number of seeds per siliqua and yield per plant. Correlation study revealed that seed yield per plant had a highly significant positive correlation with the number of secondary branches per plant, length of siliqua, number of siliquae per plant and thousand seed weight at both the genotypic and phenotypic level, while days to first flowering, days to 50% flowering, and days to 80% maturity showed significant negative correlation with yield at both the phenotypic and genotypic level. Path coefficient analysis found that the number of secondary branches per plant had the highest positive direct effect followed by plant eight, root length, thousand seed weight and days to 80% maturity had medium level direct effects towards yield, while days to first flowering, days to 50% flowering, shoot length, number of primary branches per plant, number of seeds per siliqua, length of siliqua and number of siliquae per plant had negative direct effects. Considering the morphological and genetic parameters, $G_1$, $G_6$, $G_9$, $G_{10}$ could be considered as potential genotypes for the future breeding program.

**Keywords:** Correlation, genetic advance, heritability.

# Drought Tolerance Mechanisms in Lady's Finger (*Abelmoschus esculentus* L.) Genotypes Based on Morpho-Physiological Dynamics

**Group:** Biological Science **Project ID:** SRG-221331

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## Abstract

Drought stress is one of the leading constraints to Lady's Finger (*Abelmoschus esculentus* L.) production globally. The investigation was performed in net house of Genetics and Plant Breeding Department at Sher-e-Bangla Agricultural University from July, 2022 to March, 2023 to find out the drought tolerant varieties of lady's finger. This study was done with nine lady's finger varieties and treatments viz. $T_0$ (control), $T_1$ (drought stressed) were applied to the varieties. Varieties and drought treatment influenced significantly in interaction of agro-morphogenic and physiological traits of lady's finger except plant height, first flowering, chlorophyll content and leaf area. The longest plant (106.83 cm) was recorded in genotype G7 (Bijli) while the shortest plant (72.87 cm) was found in okra genotype G4 (Sabuj Sathi). The highest fruit yield per plant (418.98 g) was recorded in G7 (Bijli), while the lowest141.86g yield per plant (141.86 g) was observed in the okra genotype G6 (Shanto). Phenotypic coefficient of variation was higher than the genotypic coefficient of variation for all the yield contributing traits. In correlation study, under non-stress condition significant positive association was recorded for fruit yield per plant of ladys finger genotypes with plant height (0.67), Leaf area (0.46), fruit length (0.57), fruit breath ( 0.41), chlorophyll content (0.57) and weight of per fruit (0.66) while under drought stress condition the significant positive association for plant height (0.63), Leaf area (0.63), fruit length (0.40), number of fruit per plant ( 86) and and weight of per fruit (0.72) at both te phonotypical level. In consideration of yield contributing characters and fruit yield G7 (Bijli) performed better under drought condition followed by G1 (Green Master), G2 (Nice Green), G3 (All Green), G4 (Sabuj Sathi), G5 (Orka), G8 (Kajol) and G9 (Hira).

**Keywords**: Lady's finger, drought, growth analysis and morpho-physiology.

# Isolation, Cloning and Functional Characterization of Plasma Membrane Ca2+ATPase Promoter OsACA5 from Rice Using Agrobacterium-mediated Transient Assay

**Group:** Biological Science **Project ID:** SRG-221332

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## Abstract

Plasma membrane $Ca^{2+}$ATPase helps in removing cytosolic calcium ($Ca^{2+}$) from the cell and have been shown to be provided plant stress responses but their promoter regions have not been well studied. In this study a 1.5 kb promoter region of OsACA5 was isolated, cloned and functionally characterized by using transient assay. The OsACA5 promoter harbored multiple stresses and hormone regulated cis-acting elements. The two constructs OsACA5::GUS and CaMV35S::GUS were agroinfiltrated into the leaves tobacco and results indicated that the upstream sequence of OsACA5 was a functional promoter. Upon Salt, PEG and cold treatment, GUS activity increased ~5-folds, ~3 and ~2-folds respectively which indicated that the promoter of OsACA5 is a stress inducible promoter. The OsACA5 promoter also showed GUS expression in response to hormonal treatments i.e. Auxin, ABA and MeJA. High GUS expression was observed in response to Auxin and ABA followed by MeJA. The quantification assay confirmed ~4, ~2 and 1.5 –folds increased expression of GUS activity in response to hormonal treatments. Overall, inducible nature of OsACA5 promoter could grant wide applicability in plant biotechnology.

**Keywords:** Abiotic stress, hormone, plant $Ca^{2+}$ATPases, promoter, transient assay.

# Morphological Characterization of Brinjal Against Shoot and Fruit Borer (*Leucinodes orbonalis*, Guenee) from Different Brinjal Genotypes Compare with Bt. Brinjal

**Group:** Biological Science **Project ID:** SRG-221334

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## Abstract

An experiment was carried out in Sher-e-Bangla Agricultural University using Randomized Complete Block Design with three replications to assess the variability, heritability, genetic advance, correlation, path coefficient and genetic diversity for fifteen yield and yield contributing features in 20 brinjal genotypes. The existing genotypes showed significant differences for all characters. The phenotypic coefficient of variation was higher than the genotypic coefficient of variation for all the characters. The highest PCV and GCV were found in percent of BSFB infestations. High heritability associated with high genetic advance and high genetic advance in percentage of mean were found in plant height, individual fruit weight, and percent of BSFB infestation, which suggested that phenotype-based selection would be effective. Character association revealed that fruit yield per plant had the most significant positive correlation with days of last harvesting ($r_g$ = 0.495, $r_p$ = 0.454), number of secondary branches per plant ($r_g$=0.356, $r_p$=0.315), leaf blade length ($r_g$ = 0.714, $r_p$ = 0.462), leaf blade width ($r_g$ = 0.674, $r_p$ = 0.498) and number of fruits per plant ($r_g$= 0.798, $r_p$= 0.787) in both genotypic and phenotypic level. Path analysis found that number of fruits per plant had the most positive and direct influence on yield per plant. The genotypes were classified into five groups. Clusters I, II, III, IV, and V each have three, three, four, six, and four genotypes. Cluster III had the highest intra-cluster distance (1.918), whereas the highest inter-cluster distance (95.69) was found between clusters II and V. The mean performance of the cluster revealed the highest number of fruits per plant (13.45) and yield per plant (0.71) found in cluster IV. Considering the genetic parameters, the genotypes G10 and G20 from cluster III, G11 and G8 from cluster II, and G5 and G18 from cluster IV might be used in future breeding programs.

**Keywords**: Brinjal, BSFB, characterization, diversity.

# Selection of Genetically Potential Breeding Lines derived from the Multi-Parent Advanced Generation Inter-Cross Populations in *Brassica rapa*

**Group:** Biological Science **Project ID:** SRG-221335

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## Abstract

Multi-parent Advanced Generation Inter-Cross (MAGIC) populations are an emerging type of resource for dissecting the genetic structure of traits and improving breeding populations. This was carried out using MAGIC (Multi-parent Advanced Generation Inter-Cross) populations derived from 45 double cross hybrids at Sher-e-bangla Agricultural University during 2022-23 to characterize, and evaluate MAGIC populations for selecting the promising early maturity and yield potential breeding lines. Three replications in randomized complete block design were used in the study. The analysis of variance revealed significant variation was existed among the populations for all of the eleven traits studied here. However, high heritability coupled with high genetic advance was found in days to first flowering, plant height, primary branches, secondary branches, siliqua per plant, seeds per siliquae and yield per plant, indicating inheritance of these traits controlled by the additive genes, whereas rest of the traits governed by non-additive gene actions. Correlation study revealed that yield per plant had a significant positive correlation with days to first flowering, plant height, primary branches, secondary branches, siliqua per plant, and harvest index. Except harvest index, all the traits had positive direct association with seed yield indicating that direct selection may be helpful. Among the double hybrids, DH-04, DH-12, DH-28, DH-29 and DH-43 showed the highest yield performance, while for the other yield-attributing traits, the hybrid DH-02 followed by DH-06, DH-23, DH-31 and DH-39 showed the best performance. The lines, viz. DH-01, DH-09, DH-15, DH-20 and DH-25 could be selected as they required the earliest duration for flowering and maturity. Overall, the double hybrid DH-01, DH-02, DH-04, DH-13, DH-15, DH-22, DH-29, DH-32, DH37, DH-44 and DH-45 manifested the desired heterotic effects on yield and contributing traits indicating the transgressive segregating superior breeding lines could possibly be obtained from these MAGIC populations for future breeding program.

**Keywords**: MAGIC Population, heterosis, hetitability, correlatiom, genetic advance.

# Effect of Different Drying Methods and Storage Condition on Quality Attributes, Biochemical and Antioxidants Activities of Mango Powder

**Group:** Inter-disciplinary group **Project ID:** SRG-221336

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## Abstract

Drying is a popular food preservation process that increases food preservation and security while reducing food waste. This research aimed to investigate the impact of various drying methods on the quality, biochemical attributes, and antioxidant properties of mango powder. Two drying techniques were examined: freeze drying (-50˚C) and hot air drying (60±2˚C). Freeze drying was found to produce mango powder of exceptional quality, while hot air drying was considered a more cost-effective and stable option. Freeze drying resulted in mango powder with a moisture content of 2.16%, making it easily rehydratable. The color characteristics of the mango powder were notably influenced by the drying methods, with freeze drying proving particularly effective in preserving the original color and enhancing overall product quality. To address stickiness and improve solubility, maltodextrin was incorporated, and it was observed that the addition of maltodextrin in appropriate proportions yielded positive results. In terms of sensory evaluation, the juice made from freeze-dried powder received the highest ratings from the panelists. However, for the juice made from hot air-dried mango pulp with maltodextrin up to 50%, no significant differences ($P>0.05$) were detected compared to the freeze-dried juice. This study underscores that, under suitable experimental conditions, it is feasible to obtain high-quality mango powder using different drying methods. Freeze drying emerged as the preferred technique, as it not only prevented color alterations but also preserved the essential characteristics of the mango powder. Furthermore, the addition of maltodextrin enhanced the product's attributes, making it a promising option for commercial applications.

**Keywords:** Freeze drying; hot air drying; maltodextrin; quality; mango powder.

# Effect of Nutrient Solution on Growth, Yield and Quality of Tomato in Hydroponic Culture in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221337

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## Abstract

An experiment was conducted at Sher- e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka-1207 to study the effect of nutrient solution on growth and yield of tomato cultivars in hydroponic culture. The experiment was consisted of two factors: Factor A: Three tomato cultivars viz; $V_1$ = Rani, $V_2$ = Extra profit and $V_3$ = Roma VF; Factor B: Four types of nutrient solution viz; $NS_1$= Rahman and Inden nutrient solution, $NS_2$ = ½ Rahman and Inden nutrient solution, $NS_3$ = ¾ Rahman and Inden nutrient solution and $NS_4$ = Hoagland and Arnon No. 2 nutrient solution. The result revealed that tomato variety $V_1$ (Rani) exhibited its superiority to other tested variety Extra profit and Roma VF in terms of fruit yield. $V_1$ (Rani) also showed the highest weight of fruits (110.95 g) and the maximum number of fruits per plant (26.33) than other tested varieties in this experiment. Significant differences existed among different nutrient solutions with respect to yield and yield attributing parameters of tomato. A yield advantages of 0.88 kg per plant, 2.03 kg per plant and 3.13 kg per plant over, $NS_2$ and $NS_4$ treated plot, respectively was found which was possibly aided by taller plant at harvest (150.70 cm), higher number of leaves plant$^{-1}$ (40.09), larger leaf area (595.95 cm$^2$), lengthier fruit length (4.46 cm), larger fruit diameter (4.21 cm), heavier individual fruit weight (105.21 g), higher number of flower cluster plant$^{-1}$ (18.78), higher number of fruit plant$^{-1}$ (33.89), higher fruit pH (4.75) and higher fruit brix (8.05) in the $NS_2$. Among the interactions, $V_1NS_2$ and $V_3NS_1$ were superior in most of the growth and yield attributing parameters along with fruit yield. From the result, it may be concluded that Rani cultivated with ½ strength Rahman and Inden nutrient solution seems promising for tomato production in hydroponic culture.

**Keywords**: Hydroponic, soilless, growth, yield, substrate.

# Effect of Plant Growth Regulators and Micronutrients on Growth, Yield and Quality of Brinjal

**Group:** Biological Science **Project ID:** SRG-221338

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## Abstract

Plant growth regulators added in small amounts alter plant development, and micronutrients supplied as foliar sprays have a significant impact on crop yield. The aim of this study was to investigate the effect of plant growth regulators (PGR) and micronutrients on growth, yield and quality of brinjal. The experiment included nine treatments with three levels of PGR, $G_0$ = no PGR, $G_1$ = 200 ppm $GA_3$, and $G_2$ = 100 ppm NAA, and three levels of micronutrients, $M_0$ = no micronutrients, $M_1$ = 200 ppm Boron, and $M_2$ = 200 ppm Zinc, each with three replications. The treatments showed significant effect on plant height, leaf area, number of branches, SPAD value, fresh and dry weight of whole plant, number of flowers, number of fruits, individual fruit weight and yield per plant, as well as quality traits i.e., ash, lipid and fiber content of brinjal. $GA_3$ treated plants performed better than NAA and no PGR treated plants and Zinc treated plants produced higher yields and quality than Boron and no micronutrients treated plants. Considering treatment combination of PGR and micronutrients, the highest leaf area (471.33 $cm^2$), SPAD value (52.95), number of flowers $plant^{-1}$ (65.33), number of fruits $plant^{-1}$ (58.38), yield $plant^{-1}$ (3312.8gm), lipid (0.35%) were observed from the treatment combination of $G_1M_2$ whereas dry weight of whole plant (158.80 g), individual fruit weight (67.33 g) and fiber (12.28 %) were observed from the treatment combination of $G_2M_2$ but in case of number of branch (14.00) and ash (8.44 %) were observed from the treatment combination of $G_2M_0$. Maximum parameter showed the lowest value from the treatment combination of $G_0M_0$. It may be concluded that $G_1M_2$ (200 ppm $GA_3$ + 200 ppm Zn) performed the best in producing higher growth, yield and quality attributes of brinjal than other treatments.

**Keywords:** Leaf area, fruit yield, fiber, ash, brinjal.

# Growth and Yield of Tomato as Influenced by Mulching and $GA_3$

**Group:** Biological Science **Project ID:** SRG-221339

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## Abstract

An experiment was conducted in the experimental field of Sher-e-Bangla Agricultural University, Dhaka during the period from October 2022 to April 2023 to find out the effect of mulching and GA; on the growth and yield of tomato. The experiment consisted of four levels of $GA_3$ such as 90, 110 and 130 ppm with control; three different types of mulches such as no mulch, sawdust and water hyacinth mulch. The experiment was laid out in a RCBD with three replications. Both $GA_3$ and mulch had significant influence on growth and yield contributing characters of tomato. At 75 DAT, the highest plant height (117.30cm), maximum number of leaves/plant (75.30) and highest yield (29.03 t/ha) were recorded from $GA_3$ spray at 130 ppm. At 75 DAT, the highest plant height (113.60 cm), maximum leaves per plant (67.00) and yield (28.11 t/ha) were recorded from water hyacinth mulch. The combined effect of 130 ppm $GA_3$ and water sawdust mulch performed the highest yield (31.89 t/ha) and lowest from GoMo. So, 130 ppm GA, with sawdust mulch may be used for higher yield of tomato.

**Keywords**: Mulch, gibberellic acid, growth, yield, and tomato.

# Impact of Locally Isolated Lactobacillus-Based Probiotic for the Control of Necrotic Enteritis in Broilers

**Group:** Biological Science **Project ID:** SRG-221340

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## Abstract

Necrotic Enteritis (NE) caused by *Clostridium perfringens* (CP) is one of the most important economic bacterial diseases in poultry. The disease multi-factorial disease is invariably associated with different predisposing factors. The present study investigated the effect of a Locally Isolated Lactobacillus-Based Probiotic (LILB) for the control of necrotic enteritis in broiler chickens. Day-old broiler chicks (n=150) were randomly allocated to the following treatment groups: 1) Non-challenged (NC); 2) Challenged (C); 3) Challenged + probiotic (C+LILB). Prior to placement, chicks in groups 2 and 3 received 0.25 mL of *Salmonella typhimurium* (ST) containing $10^5$ cfu of viable cells by oral gavage. Chicks in group 3 were treated with LILB in the drinking water at a concentration of $10^6$ cfu/ml. At 21d of age, all chicks in groups 2 and 3, were individually challenged with $5\times10^4$ sporulated oocysts of *E. maxima* by oral gavage. At 26d of age, chicks in groups 2 and 3, were individually challenged with $10^8$ cfu of CP. Body weight (BW) was recorded prior to challenge. The experiment was terminated at 29 days of age and the following parameters were evaluated: NE-associated mortality, CP lesion scores, CP concentrations in ileum, BW, and body weight gain (BWG). Chicks treated with LILB had significantly ($P<0.05$) higher BWG after challenge when compared to control challenge chickens. Total mortality was higher in the C group (48.8%) when compared to the C+LILB (12.7%). Even though there was no significant ($P>0.05$) difference in lesion score between C and C+LILB, group C+LILB had significantly ($P<0.05$) lower total number of cfu of CP recovered from the ileal mucosa and cecal content samples when compared to group C. These results imply that the Locally Isolated Lactobacillus-Based Probiotic was able to reduce the severities of NE, as a secondary bacterial infection, in an experimental NE challenge model.

**Keywords**: *Lactobacillus*, Necrotic enteritis, *salmonella*, coccidiosis, probiotic.

# Prevalence and Characterization of MDR gene of *Salmonella* in Raw Meat from Different Retail Market of Dhaka City, Bangladesh Considering Public Health Issue

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## Abstract

Zoonotic *Salmonella* is an important cause of human foodborne illnesses which is transmitted through contaminated foods such as meat, milk, and eggs. This study aimed to investigate the prevalence and characterization of multidrug resistant (MDR) gene of *Salmonella* in raw meat from different retail market of Dhaka city, Bangladesh. 200 raw chicken meat samples were collected from 20 randomly selected retail markets of Dhaka city and the isolated *Salmonella* species were identified based on their morphological, cultural and molecular characterization by polymerase chain reaction (PCR) using *Inv*A gene. The identified *Salmonella* species were then subjected to screen MDR characteristics phenotypically and the presence of tetracycline resistance gene (*Tet*A). *Salmonella* species were detected in 45 (22.50%) of the samples. However, the prevalence was constant across all of the sample markets ($p > 0.05$). Tetracycline, amoxicillin, and ampicillin resistance was phenotypically present in all isolates (100%); however, only 66.67%, 48.89%, and 42.22% of the *Salmonella* species tested positive for erythromycin, amoxycillin/clavulanic acid, and ciprofloxacin resistance, respectively. In contrast, approximately 87%, 53%, 51%, and 49% of the *Salmonella* species showed their susceptibility to gentamicin, meropenem, ciprofloxacin, and ceftriaxone, respectively. The *Tet*A gene, which causes antimicrobial resistance against tetracycline, was shown to be present in all phenotypically resistant *Salmonella* species. Overall, MDR *Salmonella* species emerged in the chicken meat along with the presence of tetracycline resistance gene which is a threat to human health. Therefore, the required actions must be taken to stop the spread of antibiotic resistance.

**Keywords**: Antimicrobial resistance, *Inv*A gene, raw chicken meat, *Tet*A gene, zoonotic *Salmonella.*

# Epidemiology and Genetic Characterization of *Clostridium botulinum* and *Clostridium perfringens* from Cooked Cereal Foods of Restaurant in Bangladesh

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## Abstract

The *Clostridium perfringens* and *C. botulinum* is a gram positive rod shaped bacteria that causes food poisoning in both animals and humans. The present studies were conducted to characterize these types of bacteria with epidemiological investigation. There were 200 cereal cooked food samples collected from Dhaka city and neighboring city corporation during the periods of between August 2022 and April 2023. The laboratory tests were conducted in the departmental laboratory. The samples were cultured in the broth media and showed turbidity for positive samples. Then cultured in solid media, the *Clostridium* showed green and grey white colonies in MacConkey and Blood agar, respectively. The TSI slant turned yellow due to acid production. The glucose and coagulase tests were positive. The 236 bp of the cpb gene of *C. perfringens* (beta toxin) was identified by PCR. The molecular prevalence of *C. perfringens* infection was 0.5% in Dhaka south city corporation in the rainy season. It was recorded from *Pilaw* of a well furnished restaurant. The *C. botulinum* was nil during the observation in laboratories works. So, hygienic management should emphasize to provide safe food for all.

**Keywords**: *Clostridium perfringens*, cereal cooked food, food poisoning, prevalence and Bangladesh.

# Sero-prevalence and Molecular Characterization of Circulating Foot-and-Mouth Disease (FMD) Viruses in Small Ruminants: Aspects of Risk Factors Assessment in Bangladesh

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## Abstract

Foot-and-mouth disease (FMD), a devastating endemic viral disease of even-toed ungulates causes huge economic losses across the world including Bangladesh. Sheep and goats together (small-ruminants) comprise the majority of the world's FMD-susceptible animal population makes these host-species a potential hidden-source of FMD infection for cattle in mixed-livestock systems, which further increases the risk of FMD virus (FMDV) dissemination through animal movement. However, the prevalence of FMD in small-ruminants has been completely overlooked in Bangladesh until today. Therefore, the current study aimed to investigate the regular basis of molecular epidemiology of the circulating FMDV specially the serotype O in small-ruminants. A total of 40 clinical samples (n=40, sheep, n=20 and goat, n=20) was collected randomly from in small-ruminants between October 2022 and June 2023 around Dhaka city, and subjected to identify the FMDV serotype O by RT-PCR technique. As a result, a total of 27.5% samples were found positive for FMDV serotype O, while in sheep the prevalence was 15% which was lower than the prevalence of 40% found in goat. The RT-PCR detected a total of 11 samples were tested for infection with FMD serotype O (though other serotypes have not been evaluated in this study), indicated that sheep and goats play crucial role in transmission-and-spreading of FMD virus in cattle in the same locality. The researchers previously demonstrated that the infection with multi serotypes of FMD viruses increased the severity of infection in cattle population that increased the mortality rates. Based on the data demonstrated in the above outbreak investigation in small-ruminants, it is recommended that farmers in Bangladesh should practice regular vaccination program to their small-ruminants against FMDV along with the cattle population to control the disease locally and good health management practices in the endemic area as well.

**Keywords**: Prevalence, circulating FMDV, small-ruminants, Bangladesh.

# Molecular Identificatin of Contaminating Mycoflora from Substrates of Oyster Mushroom (*Pleurotus ostreatus*) in Bangladesh

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## Abstract

Survey and laboratory experiments were carried out during the period of 2022-2023 to study the prevalence of contamination, morphological and molecular identification of contaminants fungi and different sterilization techniques of substrates of oyster mushroom in Bangladesh. Survey was conducted 30 farms of Savar, Dhaka revealed that oyster mushroom was the most cultivated popular species. Seed crisis and spawn contamination were identified as the main problem of farmers where 30% contamination occurred during incubation, 30% in summer and less than 20% in winter. 52.7% farmers conducted substrate sterilization through hot water for 1 hour. Rice straw (55.7%) and sawdust (21.6%) was mainly used as substrate. *Trchoderma, Rhizopus, Aspergillus, Penicillium, Alternaria, Fusarium, Chaetomium sp.* were found to be associated as contaminants where green mold was detected as the major one. Different types of fungus contaminants were found in contaminated spawn packets. Some were green colored, some were blackish, some were yellowish, some packets were brown, in some packet's incomplete colonization or lack of mycelium running. *Trichoderma* sp, *Penicillium sp* and *Aspergillus flavus* were detected from these contaminated spawn packets. Among these moulds, *Trichoderma* was found in most of the contaminated packets largely and significantly. Fungal contaminants are found to infect mushroom crops at different stages from spawn run period to maturation of fruiting bodies. These contaminants were peculiar in terms of their symptomatology on the substrates, disease cycle, epidemiological requirements, and yield losses. Most of these contaminants come from poorly sterilized substrates. These contaminants reduce yield and/or degrade the quality of fruiting bodies of the mushroom causing economic losses.

**Keywords:** Mycoflora, *Pleurotus ostreatus*, identification, characterization.

# Integrated Strategies for Disease Management through Innovative Land Arrangement in Combination of Rice Grown with Okra under Raised and Sunken Bed (RSB) Systems

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## Abstract

The underground water and water storage reservoirs are rapidly depleting due to nominal recharging by the rainfalls making water a scarce resource for irrigation resulting in poor crop growth and production. Water productivity (WP) in agriculture can be improved through crop diversification, proper land and water management techniques. Considering this, a field investigation was carried out in the central farm of Sher-e-Bangla Agricultural University, Dhaka, during 2022–2023 to study the crop response of rice (*Oryza sativa* L.) + okra (*Abelmoschus esculentus* L.) system to land configurations and irrigation regimes. Three raised-sunken beds (RSB) having ratios of 1:3, 2:3, 3:3 and two irrigation schedules viz. continuous standing water (CSW) and alternate wetting and drying (AWD) at 3 ± 1 day's interval for rice in sunken bed were tested. From the study, it was revealed that innovative land arrangement RSB systems gave the significantly effect on percent disease incidence and severity in rice and okra. The highest disease incidence and severity was recorded in sole rice/okra systems and the lowest in RSB-AWD systems. The moderate disease incidence and severity was recorded in RSB-CSW although which was statistically non-significant with RSB-AWD but significant with sole systems. Rice and okra yield was more under AWD irrigation than CSW irrespective of raised bed. Whereas the lowest yield was recorded in CSW-RSB systems. The AWD-RSB systems exhibited the highest water potentiality (WP). Such information will help in the planning of an innovative intercropping system of boro rice + okra in the field by changing the land configuration to the raised bed and sunken bed with the AWD irrigation system for management of diseases. However, its need to be further trail in different AEZs as field experiment.

**Keywords**: Water productivity, raised-sunken bed, AWD-RSB system, CSW-RSB system.

# Improving Drought and Blast Disease Tolerance in Rice (*Oryza sativa* L.) through Trehalose-Mediated Growth Enhancement

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## Abstract

The growth and productivity of rice plants are significantly reduced due to blast disease as well as drought. Proper management can ameliorate dysfunction in and improve the plant growth and productivity. Therefore, the present study was conducted to explore the protective role of the trehalose in helping rice seedlings to tolerate drought and blast disease. After 10 days of transplanting, the seedlings were pre-treated with 200 µM trehalose for next 3 days. Thirteen-day-old hydroponically grown seedlings were allowed to inoculation of *Pyricularia oryzae* spore suspension and for drought stress, nutrient solution was removed from the pot for 24 h. After inoculation of pathogen higher disease incidence and leaf infection observed. Compared to control, electrolyte leakage in both shoot and root increased after inoculation of pathogen and under drought condition. Therefore, leaf relative water content decreased by 47.58 and 50.18% under blast and drought stressed condition, respectively compared to control plant. Therefore, the growth and biomass of rice plants also decreased. However, the application of trehalose shoot and root electrolyte leakage reduced by 29.56 and 11.91%, respectively compared to blast infected plant only. Trehalose application also reduced shoot and root electrolyte leakage by 61.63 and 24.89%, respectively compared to drought stressed plant only. Thus, relative water content as well as growth and biomass of rice seedlings was improved. These results indicate the exogenous application of trehalose is a promising approach to improve blast and drought tolerance in rice plants.

**Keywords:** Rice, blast, drought, *pyricularia oryzae*, trehalos.

# Morphological Characterization and DNA Barcoding of Macro Fungi from Different Forest of Bangladesh

**Group:** Biological Science **Project ID:** SRG-221348

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## Abstract

Bangladesh forests provide highly diverse habitats for wild mushrooms that are utilized as food, medicine, nutritional supplements and minerals for humans. Though mushroom research and production have increased in the country, several different challenges still exist concerning the identification, preservation, and cultivation of wild mushrooms. In this study, we identify and describe diversity of Bangladeshi wild mushrooms, their distribution and ecology in respect of different forest region. A survey was conducted during July, 2022 to June, 2023 in six different forest locations under tropical moist deciduous forest regions of Bangladesh. The different surveyed areas were Rajendrapur, Gazipur; Potka 1, Sripur; Potka 2, Sripur; Uthulia range, Akhaliya, Angergara, Valuka, Mymensingh; Sontoshpur Rubber orchard, Fulbariya, Mymensingh and Modhupur. A total of fifty (50) samples were collected from surveyed areas. Among these samples, thirty-five (35) genera under twenty-three (23) families were identified. The detected genera were *Lactarius, Bondarzewia, Tricholoma, Lentinus, Leucopaxillus, Trametes, Lentinellus, Inocybe, Russula, Lactifluus, Clitocybe, Neolentinus, Entoloma, Macrolepiota, Gymnopus, Phellinus, Grifola, Albatrellus, Calocybe, Amanita, Hydnellum, Daedaleopsis, Ganoderma, Termitomyces, Marasmiellus, Hygrocybe, Cerioporus, Gloeporus, Inonotus, Lepiota, Auricularia, Fomes, Daldania, Cordyceps* and *Coprinellus*. Based on ITS sequencing one species was identified as *Agaricus bisporus*. The most frequent genus was *Russula* followed by *Lactarius, Ganoderma, Amanita, Trametes, Inocybe* and *Auricularia*. Collected samples were preserved as dried specimens in the Sher-e-Bangla Agricultural University Herbarium of Macro Fungi (SHMF). Nutrient elements present in wild mushroom species are needed to fulfill the future food, nutrition and health security challenge of the unstabilizing hunger of the world.

**Keywords**: Macrofungi, DNA barcode, nucleotide sequence, diversity, distribution, density, frequency.

# Effects of Oyster Mushroom (*Pleurotus ostreatus*) in Broiler Ration as a Natural Feed Additive

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## Abstract

The poultry industry is currently moving towards a reduction in the use of antibiotics due to antimicrobial resistance (AMR). Different alternatives are used to replace antibiotics for safe meat. The study aims to investigate the effects of oyster mushrooms (OM) on broiler performances and to analyze their cost-effectiveness. A total of 200 day-old Lohmann broiler chicks for 28 days were used. The chicks were randomly distributed into 5 treatment groups; $T_0$ (Control), $T_1$ (Basal diet+1.0% OM), $T_2$ (Basal diet+1.5% OM), $T_3$ (Basal diet+2.0% OM), $T_4$ (Basal diet+Antibiotic) having 4 replications with 10 chicks in each. In this study, live weight, survivability, and abdominal fat showed no significant ($P>0.05$) differences among the treatments. However, feed consumption (FC) and FCR showed significant ($P<0.05$) differences. The highest FCR was in $T_0$ (1.53) and then followed by $T_4$ (1.44), $T_1$ (1.39), $T_3$ (1.39), and $T_2$ (1.36) groups respectively. Significantly ($P<0.05$) the highest DP was noted in the $T_2$ (75.27%) and then $T_3$ (73.41%), $T_1$ (72.74%), $T_4$ (72.66%), and $T_0$ (71.62%) group respectively. A higher level of Hb (g/dl) and RBC (million/$mm^3$) was noticed in the $T_2$ group (10.62 and 2.16) and the lowest in the $T_0$ group (6.50 and 1.97). Significantly ($P<0.05$) lower concentration of glucose (mmol/L) was found in the 1.5% OM treated group i.e. $T_2$ (10.02) than in $T_0$ and $T_4$ groups. On the other hand, the antibiotic group (6.45) showed significantly ($P<0.05$) higher cholesterol (mg/dl) compared to other supplemented groups. The oyster mushroom supplemented groups had significantly ($P<0.05$) increased weight of liver and immune organs than the control and antibiotic-treated groups. Considering BCR, the control, and the antibiotic-treated group were significantly ($P<0.05$) more profitable than oyster mushroom-treated groups, but in food safety issues less profitable 1.0% OM as a feed additive is considerable for safe meat production.

**Keywords:** Antimicrobial resistance, broiler performance, immune organs, cost effectiveness.

# Effect of Lime, Fertilizer and Manure on Nitrogen and Phosphorus Availability and Rice Growth on Acidic Red Soils

**Group:** Biological Science **Project ID:** SRG-221350

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## Abstract

A study was conducted on the "Effect of lime, fertilizer and manure on nitrogen and phosphorus availability and rice growth and yield in acidic red soils". Boro rice was grown in the net house of Soil Science Department, SAU during 2022-23. The pot experiment was conducted in two acidic red soil with nine fertilizer treatments (2 acidic red soils x 9 fertilizer treatments x 3 replication= 54 pots). The highest boro rice grain yield was found in $T_3$ (RDCF + 2.0 g CaCO3 $kg^{-1}$ soil) treatment. The higher boro rice yields were observed in $S_1T_3$ and $S_1T_7$ treatment combinations where lime was applied with fertilizer or fertilizer plus manure. The post experiment soil of $T_5$ (70% RDCF + 5 ton cowdung $ha^{-1}$) treatment gave the highest soil organic carbon (1.10%) and total N (0.109%) concentration. The highest soil organic carbon was found in S1T8 (1.31%) treatment combination where 70% RDCF + 5 ton cow dung $ha^{-1}$ + 2.0 g Dolomite $kg^{-1}$ soil applied in soil-1. The highest soil pH value (7.9) was found in the soil of $S_2T_3$ where RDCF + 2.0 g $CaCO_3$ $kg^{-1}$ soil was applied in acidic red soil Bhaluka-2. The post-harvest soil available P concentrations increased more in both soils where lime was applied in combination with inorganic fertilizer plus manure. The highest P concentration was obtained from S1T6 treatment combination. The higher levels of total N was found in acidic red soil Bhaluka-1 with different fertilizer treatments because this soil was collected from rice cultivated area. The addition of inorganic fertilizer plus manure and lime performed better for increasing pH and available P of both acidic red soils of Madhupur tract.

**Keywords**: Lime, Fertilizer and manure, N & P availability, boro rice, soil pH.

# Yield Maximization and Nutrient Content of Selected Organic Responsive Aromatic Rice Cultivars (T. Aman Rice)

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## Abstract

A pot experiment was conducted at the Sher-e-Bangla Agricultural University, Dhaka during the period from June to October 2022 to investigate the effect of the different organic fertilizers on yield maximization and nutrient content of transplant aman rice varieties. The experiment was laid out in Randomized Completely Random Design (RCRD) with 2 factor and four replications. Factor A: Different rice varieties (03) viz: $V_1$: Chinigura, $V_2$: Kataribhog, $V_3$: Kalijira, and Factor B: Application of different organic manures (07) viz: $T_1$: recommended dose of fertilizer $pot^{-1}$, $T_2$: 100 g CD $pot^{-1}$, $T_3$: 100 g PM $pot^{-1}$, $T_4$: 30 g MOC $pot^{-1}$ $T_5$: 30 g CRMP $pot^{-1}$, $T_6$: 100 g VC $pot^{-1}$ and $T_7$: $T_4$+$T_5$ $pot^{-1}$. Experimental result revealed that in comparison to other rice varieties Kataribhog ($V_2$) performed better than other two verities under different organic manure/materials application. Among the organic treatments mustard oil cake ($T_4$), chitosan raw material powder (CRMP) ($T_5$) and their combination in the treatment $T_7$ ($T_4$+$T_5$) had significant positive responses in yield and yield contributing characters in all the verities compare to recommended fertilization inorganically and any other organic treatments. Chemical properties analysis was performed in post-harvest soils and found that no significant variation was found in total N content, organic carbon content and organic matter content and soil pH. Taken together our results indication that MOC and CRMP could be perform significant role to increase crops yield under organic agriculture. Finally, several field experiments in different locations need to be done to do a suitable conclusion about the doses of the materials/manures.

**Keywords:** Yield maximization, aromatic rice, organic responsive, nutrient content, aman rice.

# Economic Aspects of Applying Reproductive Technologies to Dairy Herds in Bangladesh

**Group:** Biological Science **Project ID:** SRG-221352

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## Abstract

Fertility performance is intrinsically linked to the quality of the animal environment, overall management and nutrition. We describe the use of dairy herd records, closed-circuit (CC) camera and ultrasonographic findings at veterinary fertility examinations to monitor and manage dairy herd fertility. After calving, a cow has to overcome a series of physiological hurdles before establishing a pregnancy. Timely artificial insemination (AI) with the help of CC camera and ultrasonography achieving the goal of herd fertility. In this study, we surveyed 10 local and 10 commercial farms based on using CC cameras and ultrasonography. In Bangladesh, artificial insemination (AI) is the nationwide use of reproductive tool. The successful AI depends on accurate timing of estrous and ovulation. CC camera helps to determine these two factors of AI. In our investigation, all farms used AI but using of ultrasonography was infrequent. On the other hand, very few commercial farms used CC cameras only for security purpose. We did not find any farm using CC camera for the reproductive purpose. Recent advances in ultrasonography can improve the diagnosis of reproductive tract patho-physiology but the clinical use of these methods in veterinary practice needs further evaluation. Development of new tool as on farm CC camera surveillance to exploit research findings are needed to ensure this knowledge is used to improve on-farm performance and create awareness to the dairy herd owners.

**Keywords**: Dairy cows, ultrasound, closed-circuit camera.

# Identification of Different Species of Ladybird Beetles in Winter Crops Under Different Locations of Dhaka Districts

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## Abstract

Ladybird beetles, an important beetle family renowned for their vital role in biological control and as universal predators, have yet to be extensively studied in terms of their geographic biodiversity in Bangladesh. To address this knowledge gap, a recent study focused on exploring the ladybird beetle fauna in the Dhaka district of Bangladesh. The study area was divided into four distinct localities: Savar, Keraniganj, Dohar, and Dhamrai. Throughout the winter season of 2022-23, collection surveys were conducted at fifteen-day intervals in these locations. Through meticulous identification of gathered specimens, the study identified a total of eight species spanning across five genera. These species include *Coccinella transversalis, Coccinella septempunctata, Coccinella californica, Coccinella fulgida, Menochilus sexmaculatus, Chilocorus nigrita, Cycloneda sanguinea,* and *Brumoides suturalis*. Analysis of the numerical data revealed that *C. transversalis, C. septempunctata*, and *Menochilus sexmaculatus* exhibited high levels of abundance, being collected from all surveyed localities. In contrast, the remaining species demonstrated moderate levels of abundance with the exception *of Coccinella fulgida* and *Brumoides suturalis* those were exclusively collected from the Savar locality. These findings emphasize the need for further investigation into the ladybird beetle fauna in Bangladesh. By expanding our understanding of these fascinating creatures, we can unlock valuable insights into their ecological significance and contribute to their conservation.

**Keywords**: Ladybird beetles, winter crops, *Coccinella transversalis, Coccinella septempunctata.*

# Selection of Potential Sesame (*Sesamum indicum* L.) Genotypes for Yield and its Contributing Traits for Hybridization Program

**Group:** Biological Science **Project ID:** SRG-221354

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## Abstract

Sesame is an important oilseed crop that belongs to the Pedaliaceae family. Seeds contain about 50% oil, 25% protein with long shelf life. The sesame production is still lower than other oilseed crops in the country. Therefore, the present study was carried out in RCBD with 3 replications at Sher-e-Bangla Agricultural University to know the genetic variability and character association based on 12 characters of 43 sesame genotypes. Analysis of variance exhibited significant differences for most of the characters except number of capsules per plant. The phenotypic variance and phenotype coefficient of variation were more than the respective genotypic variance and genotypic coefficient of variation for all the characters. High broad base heritability together with high genetic advance in percent of mean was observed for NSBP (90.06%), TSW (99.31%) and SYP (97.89%) while moderate heritability for DFF (59.81%). In the contrary, the lowest heritability was found for NCP (10.79%) followed by PH (21.16%). The significant positive correlation with seed yield per plant was found for plant height, days to 50% flowering, days to 80% maturity, number of primary branches, number of capsules per plant, number of seeds per capsule, height of first capsule and 1000-seed weight. Path co-efficient analysis revealed that plant height (0.856), days to 80% maturity (0.227), number of primary branches per plant (0.467), number of secondary branches per plant (0.441), capsule length (0.258) and number of seeds per capsule (0.213) had the positive direct effect on yield per plant whereas, internode length (-0.799) followed by number of capsules per plant (-0.370) and days to 50% flowering (-0.198) had the negative direct effect. Based on mean performance, heritability and interrelationship, genotype $G_6$, $G_{12}$ and $G_{36}$ for seed yield per plant, and $G_{26}$, $G_{27}$ and $G_{37}$ for early maturity could selected for further improvement.

**Keywords**: Genetic variability, correlation, path analysis, heritability, yield, sesame.

# Genetic Characterization and Mutagenic Divergence Analysis of PPR Virus Circulating in Sylhet Division of Bangladesh

**Group:** Biological Science **Project ID:** SRG-221355

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## Abstract

Peste des petits ruminants (PPR) virus is one of the causes for significant small ruminant's death in Haor areas of Sylhet, Bangladesh. This study was conducted to analyze phylogenetically the mutagenic divergence of PPRV in small ruminants circulating in haor areas of Sylhet region with associate risk factors. A total of 95 small scale households were visited and the data were collected using a standard questionnaire for risk factor analysis. In the study, the samples were collected from 135 PPR suspected small ruminants and seven samples were commercially sequenced to determine the genetic variation of F and N genes of PPR virus. We considered the several risk factors viz. educational status, vaccination history, age group, feeding and housing system, season and history of previous infection. Overall prevalence of PPR disease was 47% in small ruminants although in Goat 56% and in Sheep 33%. The prevalence of PPR disease were found higher in primary educated owners (23%), non-vaccinated animals (20%), age group (3-12 Months, 23%), free grazing system (22%), extensive free housing system (23%), rainy season (27%) and history of non PPR infected animals (26%). Our PPRV isolates belonged to Lineage IV and formed several sub-groups within the lineage IV with previous Bangladeshi isolates. Our field isolates were also closely related to PPRV/China/Tib/07 and PPRV/IND/TN/VM/2014 isolates and the genomic diversity (for N gene 0 to 0.063 and for F gene 0.004 to 0.049) was found in circulating PPRV from the previous Bangladeshi isolates indicating slow mutation of both N and F gene of PPRV. It may be the one cause for vaccine failure against PPR disease in Bangladesh. This study will be helpful to understand the current situation of PPRV with related risk factors in haor areas and will be also helpful to control the disease.

**Keywords**: Peste des petits ruminants (PPR) virus, small ruminants, disease and prevalence etc.

# Unravelling the Effect of Long-Term Traditional Fertilization on Tea Garden Soil Properties and Tea Leaves Quality in Greater Surma Valley of Sylhet

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## Abstract

Soil acidity is one of the major soil degradation events throughout the world and the long-term application of nitrogenous fertilizers is thought to be a main cause of soil acidity. In the present experiment, we collected soil and tea (*Camellia sinensis* L.) leaf samples from five representative tea gardens in Bangladesh and evaluated soil nutrient pools and biochemical properties of tea leaves. Results showed that there is a negative relationship between soil pH and the amount of applied nitrogenous fertilizers. Moreover, continuous application of traditional fertilizers over twenty-five years promoted not only the deficiency of phosphorus (P) and mineral-based cations such as potassium (K+), calcium (Ca2+), magnesium (Mg2+) but also upsurged manganese (Mn2+) and alluminium (Al3+) toxicity in soils, which suppressed the yield and quality of tea. Crucially, the tea leaf production remained almost similar (average 1079.77 kg ha-1) from 1995-2015, while the application doses of fertilizers such as Urea, TSP and MoP increased by 24.69%, 18.92% and 16.67%, respectively in garden soils. However, the pH value of soil declined up to 24% from 1992-2020 in the tested gardens. Consequently, the availability of K+, P, Ca2+ and Mg2+ decreased by 56%, 25%, 55%, 49%, respectively in those tea garden soils. In addition, the quality of tea leaves was severely affected as evident by the reduced levels of total flavonoids, polyphenols, soluble solids, vitamin C, vitamin B1 and vitamin B2 concentration. Moreover, the free radical scavenging activity (DPPH), caffeine and tannin concentration were increased in tea leaves, which indicated that tea plants were potentially being stressed. Therefore, this study concluded that long-term application of traditional nitrogenous fertilizers can be an important regulator of lowering garden soil pH, which reduces native soil nutrient pools and thereby reducing the yield and quality of tea leaves.

**Keywords**: *Camellia sinensis,* nitrogen fertilization, soil pH, nutrient pools, yield.

# Adoption and Dissemination Pathways of Selected Adaptive Cropping Technologies by the Farmers in Climate Stressed Haor Areas

**Group:** Biological Science **Project ID:** SRG-221357

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## Abstract:

Boro is the main crop of more than 70% cultivating areas in the Haors often being damaged by different types of hazards induced from climate change. So, the adoption adaptive Boro rice technologies to the climate change becomes important drivers of agricultural development for the Haors in Bangladesh. The objectives of the study were to determine which features of the cultivating modern Boro rice varieties regarded as adaptive in Haor context and their extent of adoption. Data were collected from 135 randomly selected farmers from a list of 422 Boro rice growers in five villages of Kulanj union under Derai upazila using pre-tested interview schedule during May to June, 2023. Results revealed that the growers of BRRIdhan28, BRRIdhan67, BRRIdhan58, BRRIdhan36 and BRRIdhan101 were 82% 48%, 47%, 35%, and 31% and area coverage were 89%, 3%, 5%, 2% and 1%, respectively. The shortest duration of BRRIdhan28 was the most appreciating adaptive feature, as it facilitated farmers in harvesting the variety well ahead of flash flood occurrence. While cold tolerant feature of BRRIdhan36 for which no injury occurred in seedlings after transplanting was appreciated by few farmers. Moderate duration but higher yield of BRRI dhan58 was considered as the variety for Kanda lands. BRRIdhan101 was found tolerant to bacterial leaf blight, early maturing and the highest yield producer among all modern rice varieties cultivated in Haor areas. It was also found that farmers' age, level of education, family size, farm size, annual income and media contact were significantly associated with the adoption of the adaptive Boro rice varieties. In conclusion, to minimize climate change induced hazards, risks and vulnerabilities in Boro rice production, adaptive varieties having duration shorter than BRRI dhan28 but more than 7.0 t/ha yield need to be innovated, integrated and diversified with other cultivating modern varieties.

**Keywords**: Adaptive, coverage, farmers, Boro rice.

# Ecotoxicological Effects of Microplastics on Fish

**Group:** Biological Science **Project ID:** SRG-221359

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## Abstract

Microplastics (MPs) have been recognized as an emerging aquatic pollutant receiving major concern due to their detrimental effects on aquatic life. The current study examined the bio-concentration of three common MPs polymers: polyvinylchloride (PVC), polypropylene (PP), and polyethylene terephthalate (PET), and their toxic effects on physical and behavioral response, growth, hematology, and histology of gills, liver, and intestine in Nile Tilapia, *Oreochromis niloticus*. A total of seven diets were formulated including a basic diet for control. Thereafter, *O. niloticus* were subjected to a 21-day dietary exposure to MPs by assigning them to six treatment groups: $T_1$ (4% PVC), $T_2$ (4% of PP), $T_3$ (4% of PET), $T_4$ (8% of PVC), $T_5$ (8% of PP) , $T_6$ (8% of PET), and control (0% of MPs). Results showed several abnormalities in physical and behavioral responses in MPs-exposed fish. Lower growth performance and high mortality were evident in *O. niloticus* exposed to MPs, indicating a dose-dependent relationship in the growth and survival rate. Bioavailability of PVC, PP, and PET by gills and gut was recorded without a specific trend, where the elevated dosage raised the uptake of all three MPs in their respective tissues. Noteworthy erythrocyte degeneration referred to cytotoxicity and potential stress imposed by MPs, whereas the alternations in hematological parameters were possibly the result of blood cell damage, also indicating a means of defense against MPs toxicity. Histopathological changes in the gills, liver, and intestine confirmed the degree of toxicity and associated dysfunctions in *O. niloticus*. Overall, the present study disclosed the bioavailability and the toxic effects of PVC, PP, and PET MPs in *O. niloticus*, also revealing that *O. niloticus* was more sensitive to PET-MPs as supported by growth, hematology, and histological assessment.

**Keywords:** *Oreochromis niloticus*, bioavailability, erythrocyte, cytotoxicity.

# Potentiality of Tricho-compost for Soil Amendment to Sustain Soil Fertility and Tomato Yield

**Group:** Biological Science **Project ID:** SRG-221360

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## Abstract

In Bangladesh, farmer using huge amount of chemicals often overdoses, more frequencies and even mixing of two or more chemicals as cocktail formulation to achieve better yield. Application of compost fertilizer along with eco-friendly disease management options would be the only way to overcome the situation. Therefore, the current project was conducted at horticultural farm in Sylhet Agricultural University, Sylhet-3100, Bangladesh to study the soil fertility, growth and yield of tomato influenced by tricho-compost and trichi-leachate. This experiment mainly focuses on the growth and yield of tomato by using tricho-compost and tricho-leachate based on reducing of chemical fertilizer and pesticide. The experiment consisted of five treatments: T1: Farmers' cultural practices (Full dose of fertilizers); T2: Tricho-compost @ 10 t/ha + full dose of chemical fertilizer + foliar spray of Tricho-leachate @ 20ml/L water at 15 days interval; T3: Tricho-compost @ 10 t/ha + chemical fertilizer 75% + foliar spray of Tricho-leachate @ 20ml/L water at 15 days interval; T4: Tricho-compost @ 10 t/ha + chemical fertilizer 50% + foliar spray of Tricho-leachate @ 20ml/L water at 15 days interval; T5: Tricho-compost @ 10 t/ha + chemical fertilizer 0% + foliar spray of Tricho-leachate @ 20ml/L water at 15 days interval. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The results of this study explored that the use of tricho-compost and tricho-leachate with 100%, 75% and 50% of recommended chemical fertilizer showed higher growth parameters and yield attributes of tomato compared with farmer's cultural practices. Meanwhile, it might be concluding the combination of tricho-compost, tricho-leachate and upto 50% reduction of recommended chemical fertilizer might be used for tomato cultivation. Despite limited research on the effect of tricho-compost and tricho-leachate on crops, the present report would assist the researchers to get a better understanding of the impact of tricho-compost and tricho-leachate on plants, and to adopt strategies to overcome the hazardous effects of chemical fertilizers and pesticides on natural ecosystem and crop production.

**Keywords**: Tricho-compost; trichi-leachate; chemical fertilizer; pesticide; tomato.

# Evaluation of Phytotoxic Activity of Wild Turmeric (*Curcuma aromatica* Salisb.) and Satkora (*Citrus macroptera* Montr.): Potential Approach for Ecofriendly Weed Management

**Group:** Biological Science **Project ID:** SRG-221361

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## Abstract

Synthetic herbicides are widely used by farmers in Bangladesh to manage weeds, despite their negative health and environmental impacts. The use of plant residue with phytotoxic activity is an environmentally weed management approach. The Laboratory and Field of Horticulture, Sylhet Agricultural University, Sylhet, evaluated the phytotoxic potential of two medicinally significant plant species, Wild turmeric (*Curcuma aromatica* Salisb.) and Satkora (*Citrus macroptera* Montr.) against two monocot [Barnyard grass (*Echinochloa crus-galli*) and Jungle grass (*Echinochloa colonum*)] and two broad leaf dicot [Smart weed (*Polygonum hydropiper*) and wild amaranth (*Amaranthus graecizans*)]. In laboratory experiment, test plants were grown in Petri dishes for 2 days and growth of seedlings were compared with control seedlings. Experiment was carried out in CRD and SPSS software was used to analyse the data. Wild turmeric and Satkora extracts significantly reduced growth of all test plants compared to the control and at 0.3 g DW extact/mL, all tested plants except barnyard grass had completely inhibited. Comparing $I_{50}$ values, root and shoot growth of all the tested plants were more sensitive to Wild turmeric than Satkora, except jungle grass. In the pot experiment, Satkora and Wild turmeric extract significantly inhibited the seedling growth of all test plants and at highest concentration (20g DW/Kg soil), suppressed shoot growth by 63.44-75.56 and 69.57-80.43%, respectively while root growth was inhibited by 69.27-81.36 and and 69.57-85.53%, respectively. It was evident that growth inhibitory effect of Wild turmeric was more pronounced than Satkora. Wild turmeric had higher total phenolic and flavonoid content (185.7±0.10 g/100g and 4.5±0.07 µg/g DW) than Satkora (142.1±0.12 g/100g and 2.78±0.05 µg/g DW), potentially explaining its stronger inhibitory effect as these compounds cause phytotoxicity. Therefore, using crude extracts or bioherbicides from Wild turmeric and Satkora leaves could be a viable option for sustainable weed management.

**Keywords**: Weed, plant residue, wild turmeric, satkora, eco-friendly, bioherbicide.

# Land Suitability Assessment for Black Pepper in the North-Eastern Part of Bangladesh using GIS and Satellite Remote Sensing

**Group:** Biological Science **Project ID:** SRG-221362

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## Abstract

Land suitability assessment is crucial for sustainable management of agricultural land. A study was undertaken to evaluate the land resources for sustainable production of black pepper in the Sylhet Division of Bangladesh utilizing geographic information system and remote sensing technique. The aim of this research was to determine the suitable lands for black pepper production using phenological datasets from remote sensing and geospatial datasets of soil-plant biophysical properties. Sentinel-2 satellite images were processed to obtain layers for land use and land cover (LULC) as well as the normalized difference vegetation index (NDVI). Data from the Shuttle Radar Topography Mission (SRTM) were used to generate the elevation layer. Other vector layers of edaphic and climatic parameters were processed in ArcGIS 10.8® software for the respective raster layers. Finally, suitability classes were determined using spatial analysis of reclassified raster layers of all parameters. The results of the study showed that only 22,748 hectares of land (1.85% of the total land) were in the highly suitable category. The proportions of moderately suitable, marginally suitable, and not suitable land categories for black pepper cultivation in the Sylhet Division were 28.92%, 35.82% and 33.41%, respectively. The developed land suitability classification system would be a valuable tool for land use planners, policy makers and scientists for further extension of black pepper cultivation in the study area with a view to increasing its production.

**Keywords:** Black pepper, land classification, suitability, evaluation, geo-spatial technology.

# Effects of Dietary Supplementation of *Ocimum sanctum* Leaves on Growth Performance, Hematologic Profile, Carcass Characteristics and Physicochemical Attributes of Garole Meat

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## Abstract

**Background**: Garole is a precious breed of sheep that has excellent generic potential. Meat quality is heavily influenced by genetic variation and nutritional factors. *Ocimum sanctum* belonging to the family Lamiaceace is extensively known for its medicinal assurances. It is also known as Holy Basil & Tulsi. **Objectives**: The experiment was conducted to investigate the effect of *Ocimum sanctum* leaves on growth performance, hematologic profile, carcass characteristics, and physicochemical attributes of garole meat. Methodology: Twelve (N =12) garole around 9.02±0.5 kg of live weight was randomly selected & divided into four groups these are Control ($T_0$), Treatment 1 ($T_1$) group, Treatment 2 ($T_2$) group, Treatment 3 ($T_3$) group. Dietary treatments consisted of *Ocimum sanctum* leaves 1% for $T_1$, 1.5% for $T_2$, and 2% for $T_3$ with a balanced diet. **Findings**: The *Ocimum sanctum* supplementation positively influences these parameters, indicating its potential as a natural dietary supplement to enhance the meat quality of Garole sheep. The results demonstrate that significant ($P<0.05$) body weight differences were observed between the four groups. Significantly higher daily gain was found in T3 group than T2 group and lower daily gain was found in T0. Similarly, significantly higher feed efficiency ($P<0.05$) was found in T3 group than other groups. The dressing percentage of garole carcasses was 46.60%, 47.88%, 47.93% and 47.98% respectively in $T_0$, $T_1$, $T_2$ and $T_3$ group on the basis of live weight. $T_0$ had a significantly high pH than all treatment group meat. However, all parameters were nonetheless within normal range when compared to the findings of other studies. Longissimus dorsi and semitendinosus muscle found no significant difference between meat quality attributes. **Conclusion**: It can be concluded that dietary supplementation with *Ocimum sanctum* leaves has significant positive effects on the growth performance, hematologic profile, carcass characteristics, and physicochemical attributes of Garole meat.

**Keywords**: Herbal supplement, meat quality, hematological profile, garole.

# Molecular Detection and Characterization of Multi-Drug Resistant *Klebsiella spp*., *Escherichia coli* and *Staphylococcus spp*. from Bovine Subclinical Mastitis in Sylhet District of Bangladesh

**Group:** Biological Science **Project ID:** SRG-221364

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## Abstract

Subclinical mastitis (SCM) exerts a considerable economic burden on the dairy industry, hindering Bangladesh's progress towards milk self-sufficiency. The aim of this study was molecular detection and characterization of the common bacteria responsible for SCM in dairy cows. Cultural and biochemical techniques employed for the primary isolation and identification. Molecular detection and characterization of the organisms from the isolates were performed using Polymerase Chain Reaction (PCR) methods. The multi-drug resistance (MDR) profile was determined using the disc diffusion method. A total of 325 milk samples were gathered from apparently healthy individual dairy cows. Through Modified White Side Test (MWST), 211 samples tested positive for SCM and the prevalence of SCM in Sylhet district was determined to be 64.49%. The rates of *S. aureus, E. coli,* and *K. pneumoniae* in primary isolation were 31.07%, 53.23%, and 47.69%, respectively. PCR results indicated prevalence rates of 20.62% for *S. aureus*, 53.23% for *E. coli,* and 43.38% for *K. pneumoniae.* Among the upazilas, Zakiganj displayed the highest prevalence of all three bacteria at 70%, 60%, and 45% for *E. coli, K. pneumoniae,* and *S. aureus,* respectively while South Surma reported a *K. pneumoniae* prevalence rate of 59.09%. Kanaighat exhibited the lowest prevalence of *E. coli* at 26.92%, and Jaintapur had the lowest prevalence of *K. pneumoniae at 23.33%.* Similarly, the prevalence of *S. aureus* in South Surma was the lowest, at 9%. All the organisms showed MDR patterns which revealed that *S. aureus* displayed 100% resistance to ampicillin, amoxicillin, and cefuroxime, *E. coli* exhibited 100% resistance to ampicillin, amoxicillin, tetracycline, ceftazidime, and cefuroxime, while *K. pneumoniae* showed 100% resistance against amoxicillin, ceftazidime, and tetracycline. The findings of this study highlight bovine SCM as a significant reservoir of MDR bacterial infections, underscoring the need for a nationwide SCM monitoring initiative to ensure food safety.

**Keywords**: SCM, MWST, Isolation and identification, PCR, MDR patterns.

# Molecular Detection of Virulence Genes and Multidrug Resistant (MDR) *Salmonella spp*. from Migratory Birds in Sylhet Division of Bangladesh

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## Abstract

Virulent and multi drug resistance (MDR) *Salmonella* spp. is a foremost cause of foodborne diseases and had serious public health concern globally. The present study was undertaken to identify the pathogenicity and antimicrobial resistance (AMR) profiles of *Salmonella* spp. recovered from migratory birds at three districts in Sylhet, Bangladesh. A total of 135 fecal and cloacal swab were collected from several upazilas and conventional culture method used for detection of *Salmonella*. The overall prevalence of *Salmonella* spp. was found 39.26%. Which was confirmed by polymerase chain reaction (PCR) with *inv*A gene. Other virulent gene also confirmed namely agfA (15.09%), and sopE (22.64%). Surprisingly, a diverse phenotypic and genotypic AMR pattern was found in migratory birds even though antimicrobials were never used on them. Phenotypically highest resistance was recorded to tetracycline (100%) and lowest to amoxycillin/clavulanic Acid (11.32%) followed by ampicillin (60.83%), cefixime, sulfamethoxazole-trimethoprim and azithromycin (45.28%), and streptomycin (43.40%) and ceftriaxone (22.64%). However, All the isolates were sensitive (100%) to levofloxacin, gentamicin, ciprofloxacin, and colistin sulphate. Unexpectedly MDR was found 81 %. When screening with PCR resistance gene was identified blaTEM and blaSHV 94.34% and 49.06% respectively whereas, str (A) 55%, sul1 79% and tet (A) 100%. The research findings anticipate that virulent and MDR *Salmonella* spp. are roaming in the settlements of migratory birds, which can easily anchor to the human and animal population and in the food chain. As a result, we urge that these birds be monitored by a national AMR monitoring program in order to reduce and limit the risk of antibiotic resistant gene (ABR) spreading.

**Keywords**: Migratory birds, virulence genes, resistance gene, resistant, MDR, MAR index.

# Occurrence and Distribution of Dieback of Citrus Crops at Sylhet Region

**Group:** Biological Science **Project ID:** SRG-221366

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## Abstract

Globally, citrus stands as a prominent fruit crop infected by many diseases. Among the diseases, citrus decline, commonly known as 'dieback' is also known as 'chlorosis' or neglectosis is not a specific disease but a syndrome expressing many disorders in the plant leads to decline in productivity, reduced productive life and poor fruit quality. To address this concern, a comprehensive survey was carried out within the citrus orchards of the Sylhet region in Bangladesh. The primary objectives were to assess the prevalence and severity of this disease affecting various citrus species as well as orchards and explore the diversity of pathogens responsible for this ailment. In this study, sixty citrus orchards and seventeen citrus species were critically observed to collect data on the infection of diseases. Notably, there was a remarkable disease occurrence and severity disparity across these distinct species. Among the observed citrus species, BARI kamala-1 exhibited the highest incidence of die-back, followed closely by lime and BARI satkora-1, across all three surveyed districts. Conversely, the lowest disease incidence was consistently recorded in China lemon across all districts. This disease incidence and severity pattern was observed consistently throughout all three districts. Furthermore, through detailed morphological, biochemical, and sequencing analyses using ITS1 and ITS4 primers, *Colletotrichum gloeosporioides* was conclusively identified as the prominent pathogen across all citrus species. The study is a valued addition to the literature of citrus research and contributed significantly to the management of citrus disease.

**Keywords**: Die-back**,** incidence, severity, *Colletotrichum,* Sylhet.

# Identification and measurement of the levels of pesticides, insecticides and heavy metal residues in locally grown cultivars of Garlic, Zinger, Turmeric, Spinach, Red Spinach, Cauliflower and Tomato, and assessment of its toxicological impact in Swiss alb

**Group:** Biological Science **Project ID:** SRG-221367

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## Abstract

**Background:** Food adulteration may have serious toxic effects on health including kidney damage, hepatotoxicity, cardiovascular diseases, cancers, neurological disorders, etc. Therefore, the determination of the existence and the levels of potential adulterants in such as pesticides, preservatives and heavy metals are very important. **Objectives:** To investigate the qualitative and quantitative determination of pesticides, and heavy metals in locally grown cultivars of Zinger, Turmeric, Eggplant, Red Spinach and Malabar Spinach. **Methodology:** The samples were collected from the agricultural field of Chittagong and Mirpur areas of Bangladesh. The amount of heavy metals (Arsenic, Cadmium, Cobalt, Selenium, Chromium and Lead) was determined using Inductively Coupled Plasma-Mass Spectrometry and Atomic Absorption Spectrophomemetric analysis and the presence and amount of pesticide was determined by using Uv-Visible Calorimetry, HPLC, and LC-MS/MS analysis. **Findings:** Our study resulted that the amount of Arsenic, Cadmium, Cobalt, Selenium, Chromium and Lead in all the samples were below the detection limit (5 µg/kg) and pesticide residue was undetected in the analysis of the above samples. **Conclusion:** Our study demonstrated the absence of pesticide residues and the presence of very negligible amount of heavy metals which was undetectable.

**Keywords**: Food adulteration, pesticide, heavy metals, food contamination, food safety.

# Expression and Characterization of Homeostasis Gene/S of Hilsa Shad, *Tenualosa ilish* in Diverse Habitats of Bangladesh

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## Abstract

The anodromous hilsa shad, *Tenualosa ilisha* has a great market demand for its taste, flavor and culinary properties, contributing high socio economy of Bangladesh. The production of hilsa fishery has not been production at target in Bangladesh due to several natural and man-made barriers. Lots of researches has been recorded for hilsa fish in the world including Bangladesh in different fields and these scattered researches are not sufficient for the sustainable production and management of natural stock of hilsa fish in Bangladesh and it is more essential to study genetics. For this, based on salinity, two different populations such as freshwater (Chandpur) and marine (Kuakata) were considered for this study where salinity was found 0.985 ppt and 19.98 ppt in fresh and marine habitats respectively. Recently whole genome of hilsa shad has been sequenced but identification and characterization of the sequence has not yet been done. Therefore, first time, three important homeostatic genes such as AQP3a, ATP6VIA, and Foxi3b genes from genomic DNA were identified and characterized *in silico*. Partial sequences of these three homeostatic genes were confirmed by PCR assay where the length sequences of AQP3a, ATP6VIA, and Foxi3b genes were detected approximately 917 bp, 903 bp and 888 bp respectively. These three genes of hilsa shad were sequenced from two populations and till now nucleotide sequences were retrieved only from marine population and are working to retrieved nucleotides on freshwater fish. RNA was extracted from freshwater population and is working on marine population as well. Therefore, few finishing activities of this research are still working. It is needed more research using different approaches of genetic study using more populations. However, this finding produces important insights into the genetic characterization of hilsa shad which could be regarded radix knowledge for hilsa aquaculture endeavors.

**Keywords**: *Tenualosa ilisha,* AQP3a, ATP6VIA, foxi3b, identification, characterization.

# A Laser-Inscribed, Micro-Channeled Acrylic Device for Low-Cost, Speedy Antimicrobial Susceptibility Test

**Group:** Biological Science **Project ID:** SRG-221369

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## Abstract

**Background**: The traditional disc-diffusion or well-diffusion-based antimicrobial resistance testing's (AST) are expensive, laborious, time-consuming, and not portable. Alternatively, microfluidic AST is appealing, but complex in fabrication. **Objectives**: Therefore, this project aimed to fabricate a laser-inscribed, micro-channeled acrylic device (LIMCAD) for low-cost, speedy, and colorimetric AST to facilitate rapid and authentic antimicrobial prescription. **Methodology**: The devices with eight opened micro-channels were formed by laser inscribing. The channels were initially loaded with semi-solid agar material, then microbial culture, incubation, antibiotic, and PrestoBlue™ dye. The assay turned the color of dead cells into blue from pink (live cells). Antimicrobial sensitivity increases with increasing blue zone. **Findings**: A novel microfluidic strategy with a laser-inscribed, micro-channeled acrylic device (LIMCAD) for low-cost, fast, colorimetric, and multiple antimicrobial sensitivity testing (AST) has been developed; which is capable of replacing the Petri-plate-dependent ASTs. The multi-channeled LIMCAD can execute multiple ASTs in a single run and is interoperable with both disc and well-diffusion-based ASTs. Notably, the LIMCAD allowed researchers to test a single antimicrobial compound against several bacteria (such as *E. coli, K. pneumoniae, S. aureus, P. aeruginosa,* and *P. mirabilis*), which is challenging to achieve with the Petri-plate-based ASTs. The LIMCAD-based multiple AST of sixteen antibiotics against multidrug-resistant *E. coli* (isolated from the urinary tract-infected patient) unveiled that Nitrofurantoin, Cefixime, Ceftriaxone, and Chloramphenicol became intermediately sensitive; whereas, Azithromycin, Tetracycline, Erythromycin, and Amoxicillin were on the edge of resistance by dropping their efficiency. The LIMCAD-based AST is two times faster and seven times more inexpensive than standard approaches. The outputs of the LIMCAD-ASTs were further validated by experiments with the conventional disc and well-diffusion-based ASTs, which showed a positive correlation with the LIMCAD-ASTs' performance. **Conclusion**: LIMCAD-AST is anticipated to streamline AST practices in clinics, hospitals, and research laboratories by reducing costs, time, and operation, while also playing a decisive role in proper antibiotic prescription.

**Keywords**: Microfluidic device, antibiotic susceptibility test, sensitivity, microbes.

# Design and Development of IoT based Nuclear Radiation Monitoring System

**Group:** Engineering and Applied Science **Project ID:** SRG-222370

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## Abstract

Nuclear technology is being more widely used in the power sector, medical treatment, industrial sector, educational sector, and research field. It is essential to take precautionary measures to protect radiation workers from being exposed to unwanted radiation levels. To mitigate the problem, it is important to monitor nuclear radiation remotely, which can assist in regular activities like area monitoring, source handling, inspection, and maintenance, as well as post-accidental recovery. The study demonstrates a nuclear radiation monitoring system (NRMS) that is employed for acquiring and storing environmental radiation data remotely around nuclear facilities in Bangladesh. A prototype of the NRMS has been developed for detecting and monitoring the ionization radiation level using an Internet of Things (IoT)-based technique. The system consists of a Geiger Muller (GM) detector with a high-voltage power supply, a signal conditioning unit, and a NodeMCU. Radiation data is detected and acquired by the detector, and it is counted, processed, and transmitted to the server through a Wi-Fi network using NodeMCU. An Android application for smartphones has also been developed to retrieve the radiation data from the web-based database server to display the radiation exposure dose. The developed NRMS has exhibited good stability of measurement compared to a standard survey meter and has involved not only acquiring the radiation data but also distributing the acquired data to the cloud server through the internet. The distributed radiation data can be monitored and stored for future use in any nuclear emergency response and preparedness system. This proposed system is beneficial to ensure the safety of human workers from unwanted radiation exposure by assisting them with remote monitoring of radiation levels in hazardous locations where human presence should be limited.

**Keywords**: Nuclear technology, IoT, geiger muller detector, NodeMCU, cloud server.

# Surface Modification and Characterization of Carbon Quantum Dots (CQDs) for Solar Cell Application

**Group:** Engineering and Applied Science **Project ID:** SRG-222371

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## Abstract

Carbon quantum dots (CQDs) have great potential to harvest solar energy through photovoltaic effect and therefore, CQDs are modified to obtain better performance. In this project, CQDs were synthesized and functionalized to control their sizes for harvesting different wavelengths of light coming from the sun. Candle soot was prepared and treated with an aqueous strong acid mixture to develop carboxylic acid, hydroxyl, and epoxide groups on the surface of CQDs and thus control their sizes and stabilized them. Carbonaceous materials were obtained from orange peel and sugarcane straw by calcinating their washed and dried samples. The absorption intensity of the prepared CQDs was found 2.0 and several absorption peaks were obtained in a broad range of wavelength. This result indicates that the sizes of the CQDs are different, and they can absorb different wavelengths. Unfortunately, there was no sharp absorption peak observed which can reveal the meaningful optical properties of the prepared CQDs. The dispersibility of CQDs in their colloidal solutions is a vital marker for harvesting solar energy. CQDs were remaining dispersed for different time depending on the reaction conditions and later they were settling down gradually. This observation implies that CQDs were functionalized with several carboxylic, hydroxyl and/or epoxide groups for which the individual CQDs were remaining dispersed due to the electrostatic repulsion. On the other hand, CQDs settled down after different times due to their inadequate carboxylation. Sample containing candle soot : HNO3 (1:3) was remaining dispersed for more than a week. The CQDs were settling down through forming large particles for aggregation. Samples obtained from orange peel and sugarcane straw settled down a few hours later. As size control is tough, further study is required to find an easily manageable method, appropriate precursor materials, and effective stabilizers to obtain suitable CQDs for solar cell application.

**Keywords**: Photovoltaic effect, candle soot, functionalization, sonication, carboxylation.

# Synthesis of Gamma Irradiated Inorganic Nanoparticles for Visible Light-Induced Photocatalytic Degradation of Textile Dyes

**Group:** Engineering and Applied Science **Project ID:** SRG-222372

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## Abstract

This research focuses on synthesizing and characterizing $Co_3O_4$ nanoparticles using an ionizing radiation technique. The precursor $Co(OH)_3$ was chemically synthesized from $Co(NO_3)_2{\cdot}6H_2O$ through a solution precipitation technique in an alkali medium. The $Co(OH)_3$ precursor was then exposed to a $^{60}Co$ gamma radiation source at a dose of 30kGy with a dose rate of 10kGy/hr to obtain $Co_3O_4$ nanoparticles. The synthesized $Co_3O_4$ nanoparticles were subjected to various characterization techniques. FTIR spectra analysis of raw $Co(NO_3)_2{\cdot}6H_2O$, $Co(OH)_3$ precursor, and $Co_3O_4$ nanoparticles revealed distinctive absorption peaks for the $Co_3O_4$ nanoparticles. X-ray diffraction analysis exhibited different characteristic diffraction angles ($2\theta$) values, lattice spacing, and crystal size for the $Co_3O_4$ nanoparticles. SEM images of raw $Co(NO_3)_2{\cdot}6H_2O$, $Co(OH)_3$ precursor, and $Co_3O_4$ nanoparticles displayed distinguishable surface morphologies. Additionally, the thermogravimetric analysis provided insight into the decomposition behaviour of the $Co(OH)_3$ precursor. The characterization data indicated that the ionizing radiation-synthesized $Co_3O_4$ nanoparticles possessed similar properties to those synthesized using conventional methods. Furthermore, the ionizing radiation-synthesized $Co_3O_4$ nanoparticles demonstrated an efficient photo-catalytic effect in the degradation of textile dye. Therefore, this study shows the successful synthesis and characterization of $Co_3O_4$ nanoparticles using an ionizing radiation technique, highlighting their potential application in photo-catalysis for the degradation of textile dyes.

**Keywords**: Ionizing radiation, precipitation, nanoparticles, photocatalysis, dye degradation.

# Analysis and Treatment of Industrial Waste Effluents by Chemical and Radiation Techniques

**Group:** Engineering and Applied Science **Project ID:** SRG-222373

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## Abstract

**Background:** Bangladesh is facing the environmental pollution problem particularly industrial pollution. The effect of industrial pollution is large and the country is affected badly in a socio-economic way. **Objectives:** The aim of this research is to investigate the physico-chemical properties of industrial waste effluents then develop methods for the treatment of the collected samples. **Methodology:** Chemical and radiation methods were used for this research. Chemical agents such as bleaching powder, potassium permanganate, potash alum, calcium carbonate, naphthalene, vinegar and urea were used for the treatment of industrial waste effluents. Gamma radiation of varying doses was exposed to the industrial waste effluents. Biopolymers were also used in this investigation. Then total dissolved solids, pH, electrical conductivity, and salinity of the effluents were measured. **Findings:** The pH, electrical conductivity (EC), total dissolved solids (TDS) and salinity of the collected industrial waste effluents (Savar area, Dhaka) were found to be 8.60, 4.52 µs/cm, 2.25 g/L, and 8.90%. Potash alum (0.1% to 1.0% by weight) was used for the treatment of industrial waste effluents. It was found that using 0.5% alum, the pH, EC, TDS, and salinity of the treated samples were found to be 5.01, 2.65 µs/cm, 1.33 g/L, 3.00%. Similarly, using 0.5% potassium permanganate, the pH, EC, TDS, and salinity of the treated samples were found to be 4.20, 2.12 µs/cm, 1.25 g/L, 2.76%. Water Hyacinth as a bio-sorbent and biopolymer sodium alginate, gelatin, and shagu starch were used for the treatment of textile waste effluent. It was found that water hyacinth and biopolymers reduced pH, TDS, EC, and salinity in textile waste effluents. Gamma radiation of varying doses from 5 kGy to 30 kGy were used for the treatment of industrial waste effluent samples. It was found that 20 kGy dose performed the best results. **Conclusion:** In conclusion, potash alum, permanganate, water hyacinth, alginate biopolymer and gamma radiation have the potential to treat the industrial waste effluents.

**Keywords**: Pollution, environment, industrial effluents, wastewater treatment, chemical.

# Non-Destructive Characterization and Classification of Egg by Computer Vision and NIR Spectroscopy

**Group:** Engineering and Applied Science **Project ID:** SRG-222374

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## Abstract

The computer vision and NIR spectroscopy techniques have drawn attention as a quick and non-destructive method for assessing the qualities of agricultural products. The objective of this project was to develop and implement a real-time Imaging and Spectroscopy technique to classify and characterize eggs from surface appearances. A computer vision system was developed to classify eggs using color features (RGB, HSV, Hue and Chroma, Gray, and L* a* b*) extracted from egg images. The similar quality classification was investigated from the spectra obtained by Vis-NIR spectroscopy. Three different eggs types (Type-1: Chicken egg, Type-2: Duck egg and Type-3: Quail egg) were considered. Total 36 images of all types were captured and analyzed using Statgraphics software. The classification accuracy was obtained 100% for types 1 and type 3 whereas 88% for type 2 considering 22 features extracted from digital images. The same were carried out considering only 3 features (out of 22) namely, RGB which gave 100% classification accuracy for all three types of eggs. As there were no discernible transmission peaks in the 400-540 nm, only the spectra around 550-785 nm were chosen for analysis as there was a clear difference between the average spectra of normal eggs. Various pre-processing (smoothing, normalization, normalization with smoothing etc) and classifiers (linear discriminant analysis-LDA, Support Vector Machine-SVM, Quadratic Discriminant Analysis-QDA etc.) were applied to find the classification accuracy. It was observed that overall accuracy (%) of the classification models were within the range from 85% to 99% based on preprocessing and classifiers. Although the inherent variability exists among egg samples, the proposed computer vision technique and NIR spectroscopy proves the potential to differentiate egg varieties using simple image features and spectral responses from the surface. The developed CVS and NIRS could be applicable to facilitate the real-time quality evaluation of other food items.

**Keywords**: Preprocessing, classifier, chicken egg, duck egg, quail egg.

# Neural Network Model for Predicting Potato Size Using Two-Dimensional RGB Image

**Group:** Engineering and Applied Science **Project ID:** SRG-222375

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## Abstract

Potatoes are a widely consumed and adaptable food item around the world. In the year 2022-23, the production of potatoes in Bangladesh is 1.2 million tons. Measurements of potato volume for size grading are crucial for many industrial agricultural applications. More effort, expense, and risk are involved in grading operations since the worker needs to be an expert in each commodity feature and maintain consistency. This research aims to make an integrated Artificial Neural Network (ANN) model for predicting the weight and volume of an individual potato using an image processing technique for better performance in sorting and using in potato processing industries, which surpasses human or traditional grading methods in terms of precision and consistency. The integrated image processing and ANN-based model predicts the weight and volume of the potato from a 2-dimensional image taken from a smartphone camera. The procedure involves image segmentation and feature extraction, such as maximum size, perimeter, roundness, short edge diameter, and volume estimation to provide a real-time potato volume forecast. The Multilayer Perceptron (MLP) network went through a process of trial and error in order to determine the optimal topology, the number of hidden layers, and the number of neurons located in the MLP network's hidden layers. The final ANN models produced results that demonstrated an encouraging level of accuracy (greater than 92.6%). Furthermore, the suggested method for grading potato size produced 95% accuracy, 90% precision, and 98% recall. For data analysis, pandas, NumPy, and Matplotlib libraries are used. Regarding prediction accuracy, the suggested model beats out current neural networks, making it a potentially valuable and dependable solution for industrial grading.

**Keywords**: Machine vision, depth image processing, ANN, MLP, potato grading.

# Production of Biodiesel from Waste Cooking Oil using Calcium Oxide (CaO) Nanocatalyst

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## Abstract

Biodiesel is an environmentally friendly fuel and a good substitution for the fossil fuel. However, the purity of this fuel is a major concern that challenges researchers. In this study, a calcium oxide (CaO)-based catalyst has been prepared from local waste eggshells by the calcination method and tested in production biodiesel. The eggshells were powdered and calcined at different temperatures (700, 750, 800, 850 and 900 °C) and periods of time (1, 2, 3, 4 and 5 hr.). The effect of calcination temperature and calcination time on the structure and activity of the solid catalyst were examined by X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), and Brunaure-Emmett-Teller (BET). The optimum catalyst performance was obtained at 900 °C and 3 hr. The characterization tests revealed a crystalline phase of CaO, a specific surface area 12.5 m2/gm and good distribution of the active component. The effects of different transesterification reaction variables on the catalyst performance were also investigated. The highest conversion, 96.11% was obtained at 30:1 methanol-to-waste cooking oil molar ratio, 65°C, 3 wt.% catalyst loading and 3 hr reaction time. Additionally, durability of CaO was examined. It was found that high activity and durability were obtained by washing with n-hexane. It found that the use of eggshell as a heterogeneous catalyst for biodiesel production provides a cost-effective and environmentally friendly way of green fuel production. Properties of boidiesel such as density, flash point and heating value were studied to determine an overview of its property parameters.

**Keywords**: Biodiesel, waste cooking oil, transesterification, FTIR, sustainable energy.

# Engineering of Lactate Assisted Rutile ($TiO_2$) Nanostructure for Photocatalytic Organic Pollutants Degradation

**Group:** Engineering and Applied Science **Project ID:** SRG-222377

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## Abstract

The development of $TiO_2$-based rutile nanomaterials with enhanced photocatalytic activity is being worked on more and more within this framework. Due to its distinctive properties, such as superior structural stability, high specific surface area, improved wide range of ultraviolet (UV) radiation absorption, high density of surface hydroxyl groups, and significant ability for further surface functionalization, the current work aims at providing a selection of synthetic approaches suitable for large-scale production of rutile $TiO_2$-based photocatalysts. Synthesis of $TiO_2$ nanoparticle as reported known method reported by *Kamal et al*. We slightly modified the typical reported methods. Firstly, 6ml of Ti $[OCH\ (CH_3)_2]_4$ was dissolved in 100 ml of ethanol ($CH_3\ CH_2OH$) and the solution was stirred continuously for 1 h at room temperature. After stirring, 100 ml of deionized water was added suddenly to the above-prepared mixture. The resultant solution was aged for 3 h, then centrifuged, washed several times with deionized water and ethanol and dried at room temperature. The preparation of the $TiO_2$ rutile nanoparticles was then completed by calcination of the precipitated particles at 450 ℃ for 3 h in air and confirmed by powder XRD analysis. The phase purity and crystallinity of the nanomaterials were determined by X-ray diffraction (XRD) recorded at room temperature using X-ray diffractometer for 2Θ in the range of 10 to 90˚ with the step of 0.05using Cu-Ka radiation (wavelength: 1.54056 Å). Different compositional of nanostructure well preparation which are shown in XRD peaks clary indicate rutle are highly pure and crystalline in nature. Surface morphology characterized by scanning electron microscope (TEM) show surface are rough and uniform in particle size. This surface roughness is very important for catalytic dye degradation and catalytic activities monitoring at 660 nm for methylene blue and 220 nm for 4 Chlorophenol using a UV-vis absorption spectrometer.

**Keywords:** Large scale, high purity, uniform rutile, pollutants, photocatalytic activity.

# Development of Calcium Phosphate based Materials Utilizing Commercial/Household Waste for Treatment of Wastewater

**Group:** Engineering and Applied Science **Project ID:** SRG-222378

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## Abstract

Today's widespread presence of contaminants in water bodies are the repercussions of harebrained discharge of assorted toxic entity such as dye, salts, surfactants, heavy metals and mineral oils etc. Every year, a myriad number of organic dyes are being produced and used worldwide. Industries like textile, leather, pulp-paper, pharmaceuticals, cosmetics, food etc. have been exploiting organic dyes in their manufacturing process. Hence the objective of this project was: To synthesize calcium phosphate based material (hydroxyapatite) from common household/commercial waste To exploit the synthesized material for the treatment of wastewater, i.e. dyestuffs The principal focus of this study was to monitor the adsorption efficacy of hydroxyapatite (HAp) for removing Congo Red (CR) dye from aqueous solution. HAp was synthesized utilizing chicken eggshell as a precursor of Ca source. Solid state synthesis method was implemented which comprised calcination at 950°C (E-HAp950). XRD analysis confirmed the formation of bi-phasic HAp with 15.5% of b-TCP. Elemental composition was evaluated by XPS and EDX analysis. FESEM analysis revealed the particles are of plate and spherical shaped also confirmed by the TEM images. DLS particle size, zeta potential, BET surface area and point of zero charge were also evaluated. Adsorption efficacy of E-HAp950 for removing CR was evaluated by batch adsorption experiment. Maximum adsorption capacity (qmax) was found to be 9.64 mgg-1 which was best explained by the non-linear fitting ($R^2$ = 0.98) of Langmuir isotherm. Adsorption kinetics profusely followed pseudo second order kinetic model ($R^2$=0.999) with qe (experimental) being very much closer to qe (calculative) for this model. Thus, hydroxyapatite prepared by utilizing eggshell waste through solid state method has the potential to remove toxic dyes.

**Keywords**: Hydroxyapatite, congo red, adsorption, isotherm, kinetics.

# Development of Highly Sensitive Graphene-Based Sensor for Electrochemical Detection of Glucose

**Group:** Engineering and Applied Science **Project ID:** SRG-222379

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## Abstract

Diabetes is a highly prevalent chronic illness that is linked to elevated blood glucose levels. Over the past few decades, diabetes has affected millions of people. In this study, highly monodispersed copper nanoparticles supported on a reduced graphene oxide (rGO/CuNPs) catalyst were synthesized by using a waste lithium-ion battery. The as-prepared rGO/CuNPs catalyst was utilized for non-enzymatic detection of glucose. The chemical composition and morphological properties of rGO/CuNPs were characterized by X-ray photoelectron spectroscopy (XPS), transmission electron microscopy (TEM), and energy-dispersive X-ray spectroscopy (EDS). Furthermore, the crystalline property of nanoparticles was investigated by X-ray diffraction spectroscopy (XRD). The electrochemical detection performance of the developed catalyst was investigated using cyclic voltammetry (CV), differential pulse voltammetry (DPV), electrochemical impedance spectroscopy (EIS), and chronoamperometry in 0.1 M phosphate buffer solution (PBS) at pH 7.4. The proposed rGO/CuNPs modified electrode shows excellent electrocatalytic activity toward glucose oxidation with a wide linear detection range from 0.10 mM to 13 mM and a high sensitivity of 52 μA $mM^{-1}$ $cm^{-2}$. It also has good anti-interference ability, repeatability, and stability. Based on the findings, rGO/CuNPs have demonstrated exceptional sensing capabilities and can be effectively employed to detect glucose in serum samples; furthermore, they are viable for both practical and clinical implementations.

**Keywords:** Graphene, Glucose, sensor, electrochemical detection, nanoparticles.

# Integrated Biorefinery to Produce Tissue Paper and Fermentable Sugar from Corn Stalk

**Group:** Engineering and Applied Science **Project ID:** SRG-222380

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## Abstract

**Bangladesh** produces tissue paper from imported pulp since wood is scarce. Research and manufacturing both seek alternative materials. **Objective**: The objective is to produce tissue paper from fibers and fermentable sugar from fines of corn stalk pulp. **Methodology**: Corn stalks were fractionated using soda-AQ. The pulp was bleached with chlorine dioxide. Bauer McNett classifier was used to fractionate the pulp. The fibers were used to make tissue paper, and the fines were converted to glucose. **Findings**: In cornstalk, the stalk fraction contains more cellulose than the pith fraction. The α-cellulose content of pith was 2.79% lower than fiber. Corn stalk produced 46.6% pulp at 150 °C for 2 h with 14% alkali charge and 0.1% AQ. When fractionated with 200 mesh net, unbleached pulp retained 93.85%, and bleached pulp 93.55%. Tissue paper was made with fibers. In terms of bulk and water absorption, tissue paper pulp differs greatly from other types of paper. The bulk of refined unbleached and bleached pulp increased from 4.96 cc/g to 5.28 cc/g and 4.56 cc/g to 4.72 cc/g, respectively. As expected, pulp without fines absorbed more water than pulp with fines. The porosity of pulp sheet without fines had a lower porosity than the pulp sheet with fines. After removing fines, the tensile index of unbleached pulp increased to 77.12 N.m/g and for bleached pulp, to 63.54 N.m/g. A cellulase enzyme was used to convert cellulosic fines from bleached and unbleached corn stalk pulp into monomeric sugars. Cellulose conversion and glucose yield increased from 89.52% to 93.05% and from 57.52% to 75.03% for unbleached pulp and 91.27% to 96.65% and from 65.74% to 76.94% for bleached pulp, respectively. **Conclusion**: Corn stalk pulp could be a supplement fiber source of tissue paper. Sugars produced from the fines can be used for biofuel production.

**Keywords**: Corn stalk, tissue paper, soda-AQ pulping, glucose, non-wood pulp.

# Efficiency Enhancement of Copper Indium Gallium Diselenide (CIGS)-Based Solar Cell Using V2O5 as BSF Layer using Spin Coating Method

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## Abstract

**Problem Statements**: Efficiency enhancement of Copper Indium Gallium Diselenide (CIGS) based solar cell using $V_2O_5$ as BSF layer using Spin coating method. **Objectives:** To prepare ZnSe, CIGS and $V_2O_5$ thin films from their respective powder form using novel thiol-amine cosolvent and fabricated CIGS solar cells. **Methodology**: Ethylenediamine and 1,2-ethanedithiol will be mixed to make the thiol-amine solvent. Thereafter, ZnSe, CIGS and $V_2O_5$ powder will be dissolved in the solvent system. Then, CIGS and $V_2O_5$ ink will be spin-coated on ZnSe film surface and annealed by low-vacuum chamber for preparing solution-processed ZnSe/CIGS solar cell. **Findings**: Copper indium gallium selenide (CIGS)-based solar cells have unveiled better performance such as device performance, environmentally gentle nature, and reduced cost than hydrogenated amorphous silicon. In this work, we suggested a novel CIGS-based solar cell (FTO/ZnSe/CIGS/$V_2O_5$/Cu) structure, where FTO, ZnSe, CIGS, $V_2O_5$ used as a window, buffer, absorber, back-surface field (BSF) layer, respectively. At first, I have prepared ZnSe, CIGS, $V_2O_5$ films using spin coating method via thiol-amine co-solvents. Then, using the solar cell capacitance simulator one-dimensional simulation software, the effects of the presence of the BSF layer, the thickness, bulk defect density, acceptor density of the absorber layer, buffer layer thickness, interfacial defect density, device resistance, and operating temperature of the device have been explored in detail using these experimental data. The simulation results revealed that only a 1 μm-thick-CIGS absorber layer with $V_2O_5$ BSF and ZnSe buffer layers in this structure offers an outstanding PCE of 31.86% with a $V_{OC}$ of ~0.9 V. **Conclusion**: All of these outcomes of the CIGS-based suggested structure offer an understanding pathway for fabricating high-efficiency solar cells in a near future.

**Keywords:** CIGS solar cell, back surface field, buffer layer, absorber layer, efficiency.

# Development of Polymer Based Tough Medical Adhesive with Antibacterial Properties

**Group:** Engineering and Applied Science **Project ID:** SRG-222382

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## Abstract

Available commercial bioadhesives have multiple shortcomings like weak adhesion strength and poor biocompatibility with high price, thus greatly reducing clinical applications. In order to overcome these shortcomings, we developed a new adhesive named DOTAGEL by crosslinking gelatin (GA), dopamine (DA), and tannic acid (TA) in an unoxidized environment. DOTAGEL (DA+TA+GA) has increased adhesive strength, biocompatibility, antibacterial property, and wet surface adhesion since it contains TA, a natural and antibacterial cross-linker abundant in hydroxyl groups with the capability of non-covalent bonding in an unoxidized environment, and dopamine hydrochloride, a mussel-inspired biomaterial containing both the amine and catechol groups for amide bonding and hydrogen bonding with TA and GA. The cross-linking among 20%(w/v) GA, 0.2%(w/v) DA, and 20%(w/v) TA is done by centrifugation at room temperature. Two different acids, hydrochloric and acetic acid, are used for tuning the pH of the medium which led to two different samples named DOTAGEL/AA and DOTAGEL/HCL. The amount of cross-linking as well as mechanical and biochemical properties like adhesive strength, degradation rate, antibacterial property, stickiness are tunable by the pH of the gelatin medium. DOTAGEL/HCL showed almost twice the adhesion strength compared to previously reported gelatin-tannic acid-based adhesives. The novelty lies not only in increased wet surface adhesion strength but also in the single-step fabrication process of the adhesive in the acidic medium. Additionally, cyclic adhesiveness is found in the adhesive due to reversible chemical bonding, and hence, reusability is a special characteristic of the adhesive along with its self-healing capacity. This research led to the formation of a tunable antibacterial adhesive, which is a prerequisite for rapid wound healing, specifically for body parts like the elbow, ankle, or neck. Furthermore, this adhesive has a wide range of possibilities for controlled drug delivery at wound sites and other biomedical applications.

**Keywords**: Antibacterial adhesive, wet adhesive, tannic acid, dopamine, gelatin.

# Development of Mechanically Tough and Self-Healable Hydrogels for Biomedical Applications

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## Abstract

Tough hydrogels are frequently used in biomedical engineering. However, extraordinary self-healing efficiency is hardly observed in mechanically strong hydrogels, which often limits the applications of hydrogels in biomedical engineering. We have presented an approach to utilize a special type of graphene oxide-based N,N′-methylenebisacrylamide (MBA) crosslinker (GOBC) for the simultaneous improvement of toughness and self-healing properties. The GOBC has been prepared from graphene oxide (GO) by surface oxidation using a modified Hummers' method. GOBC was incorporated in a conventional polyacrylic acid (PAA) hydrogel matrix, to investigate the mechanical and self-healing properties of the prepared hydrogels using Universal Testing Machine (UTM). Additionally, the incorporation of $Fe^{3+}$ ions produced PAA-GOBC-$Fe^{3+}$ hydrogel which has an enhanced mechanical toughness comprised of GOBC cross-linker. In the mechanical characteristics of PAA hydrogels, the combined action of GOBC and ferric ions was visible here. Tensile strength, elongation at break, and toughness were improved when a small amount (0.2 mol%) of ferric ion was introduced to PAA-GOBC hydrogel. The self-healing efficiency of hydrogels is strongly dependent on the contact time of cut hydrogels as well as on the composition of GOBC. The PAA-GOBC-$Fe^{3+}$ hydrogel with a modulus of about 0.57 MPa exhibited about 90% stress healing efficiency after 40 h contact time of cut hydrogels. Whereas, in the same condition a PAA hydrogel has no self-healing property at all. The properties of PAA hydrogels were considerably improved by the crosslinking agents GOBC and metal ions. In damaged PAA hydrogel, the crosslinking approach can restore about 92% of the tension and strain. The material's unusual mixture of strong and weak bonding is what gives it its exceptional capacity for self-healing. With this simple process of production including great mechanical toughness, it is anticipated that the practical uses of such hydrogel-based soft materials will expand in biomedical engineering.

**Keywords**: Cross-linker, hydrogels, self-healing efficiency, mechanically tough, biomedical engineering.

# Fabrication of Low-Cost Energy Storage System Utilizing Waste Electrolytes

**Group:** Engineering and Applied Science **Project ID:** SRG-222384

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## Abstract

The rapid worldwide economic growth and population rise have resulted in different environmental issues with a shortage of fossil fuel energy. Different waste liquids are emerging as environmentally friendly electrolytes for the energy storage devices. The pivalic acid (PA), a waste liquid, have demonstrated efficient electrolyte in the supercapacitor devices. It is non-volatile, non-flammable and has low toxicity for the environment. However, the efficiency of PA as electrolyte for energy storage device is yet to be explored. In this work, supercapacitor device was prepared with PA and biomass derived activated carbon nanosheets (ACNS). Electrochemical properties of the fabricated supercapacitors were investigated using cyclic voltammetry, galvanostatic charging-discharging, and electrochemical impedance spectroscopy measurements. The specific capacitance, specific energy, specific power, and the coulombic efficiency values of supercapacitor were calculated. The maximum operating voltage of 1.2 V was obtained in the combination of ACNS and PA. The ACNS has demonstrated significant improvement in the specific capacitance with PA compared to the conventional electrolytes. At the current density of 1 A $g^{-1}$ the ACNS achieved a specific capacitance of 156 F $g^{-1}$ with 0.5 M PA. It was observed that the current density has a significant impact on the charge storage ability of the capacitors. With increase in current density, both the charging and discharge time decreased, indicating a decrease in the charge's storage capacity. Significant improvement in the performance of the ACNS was observed in mixed electrolyte of PA and ascorbic acid (AA). The addition of 0.01 M AA in 0.5 M PA enhanced the energy density of ACNS to 15 Wh $kg^{-1}$ at a power density of 300 W $kg^{-1}$. This study is expected to widen the applications of waste electrolytes for valuable functional materials. The PA is expected to be used for practical capacitor devices in near future.

**Keywords**: Supercapacitor, waste-electrolyle, pivalic acid, activated carbon, energy storage.

# Developing an Inexpensive Biosensor for the Rapid Determination of Organophosphate Contamination in Agricultural Runoff in the Haor Ecosystem of Sylhet Division of Bangladesh

**Group:** Engineering and Applied Science **Project ID:** SRG-222385

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## Abstract

**Background**: Developing an enzyme biosensor from natural resources to quantify the leftover organophosphate in agricultural runoff would be a cheap solution in the perspective of Bangladesh. **Objectives**: Bacterial esterase and lipase enzymes produced under ambient conditions would be suitable for Ion Selective Enzyme Electrode (ISEE) biosensors for the determination of organophosphates. **Materials and Methods**: The culture media was prepared for inoculation for isolation of effective bacterial strains with the help of Rhodamine B and olive oil. Tw20 agar medium was used to selectively isolate bacterial strain that degrades the Tw20 oil thus indicating their ability to biodegrade lipid with the capability to degrade organophosphates. **Findings**: A total number of 24 bacterial strains were screened for their ability to produce the expected enzyme (i.e., lipase). All bacterial strains were checked for their purity and were subjected to conventional identification processes based on their morphology and biochemical reactions. Three methods with three different media were used to do the screening: Tween 20, Rhodamine B and Tributyrin Agar (TBA) methods. The application of Tween 20 media has identified 10 of the 52 bacterial isolates to be lipase producing. Through use of Rhodamine B 22 strains were positively identified for lipase production. Finally, through the TBA method 10 isolates of the same samples were tested positive for lipase production. One isolate from a bacterium showed plastic degrading capability which is another indication of breaking eater bonds in it. The process was monitored using an H+ ion selective electrode since one of the byproducts of the degradation process was organic acid. The above study shows that finding the right species of lipase producing bacteria is well capable of degrading the ester bond in organophosphate thus quantifying the amount of it in agricultural runoff. **Conclusion**: From the finding of the current study, it can be concluded that the samples from the food-waste dumping area can be used for biocatalysts that help determine the amount of chemicals in different places.

**Keywords**: Rhodamine B, organophosphates, PETE degradation, enzyme electrode, biosensors.

# Fabrication of Nanostructured ZnO Thin Films with Controlled Surface Properties by Modified Silar Method for Optoelectronics Device Application

**Group:** Engineering and Applied Science **Project ID:** SRG-222386

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## Abstract

The deposition of ZnO nanoparticles onto soda-lime glass (SLG) and indium tin oxide (ITO) substrates was carried out using the modified successive ionic layer adsorption and reaction (SILAR) approach, with the addition of an $NH_4Cl$ electrolyte in the precursor solution. Various characterization techniques have been employed to explore the structural, electrical, and optical properties of ZnO thin films that were synthesized. The polycrystalline ZnO phase with preferential development along the (002) crystallographic plane was validated through the structural study using X-ray diffraction (XRD). The optical bandgap of the synthesized ZnO thin films exhibited in the range of 3.17 – 3.23 eV. The scanning electron microscopy (SEM) analysis initially revealed the presence of densely packed spherical ZnO grains. However, with the gradual increase in the amount of ammonium chloride, these grains underwent a transformation into flower-shaped nanoparticles. The ZnO film was produced using a solution containing 0.6 ml of NH4Cl with a concentration of 0.1 M. The resulting film exhibited a rather consistent and uniform shape on both SLG and ITO substrates. The ZnO thin films that were produced exhibited photocatalytic properties, as evidenced by the reduction of absorbance at around 594 nm and the discoloration of methylene blue dye over a duration of 1 hour. The findings of our work indicate that the addition of $NH_4Cl$ electrolyte in precursor solutions has a notable influence on the physical characteristics of ZnO films. This observation holds potential advantages for the field of optoelectronic research, particularly in the context of device processing.

**Keywords**: SILAR, ZnO, Optoelectronics, nanoparticles, deposition.

# New Emerging Contaminants and Their Mitigation from Urban Wastewater by Nano-Photocatalyst

**Group:** Engineering and Applied Science **Project ID:** SRG-222387

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## Abstract

Water recycling is being considered as a strategic solution in many water-scarce countries or regions. However, a great variety of biological and chemical emerging contaminants (EC) have been ubiquitously detected in water environments. Traditional water treatment processes may remove a wide range of biodegradable contaminants, however persistent contaminants are a source of worry. Number of antibiotics and textile dyes are frequently found in contaminated water as a chemical contaminant, which also poses a risk to the general public's health. Therefore, it would be economically viable to develop a 'one-stop' solution rather than multiple unitsto simultaneously remove antibiotics and dye from contaminated water, thereby producing safe water for reuse or recycling. The goal of this research is to remove ciprofloxacin (CIP) and methylene blue (MB) from aqueous solution using a $CuWO_4@TiO_2$ nano-adsorbent under neutral conditions. A two-step hydrothermal process was used to synthesize the yolk-shell adsorbent: first, nano $CuWO_4$ was synthesized, and then the nanomaterial was coated with TiO2. The structure and morphology of the synthesized adsorbent was examined by using Xray diffraction (XRD), X-ray photoelectron spectroscopy (XPS) and scanning electron microscopy (SEM). Finally, the synthesized adsorbent was used to remove CIP and the doses were optimized using response surface methodology (RSM) by adjusting three independent variables: Adsorbent dose (mg/L), CIP concentration (mg/L), and reaction time (min). The analysis of variance (ANOVA) was chosen the quadratic model as a significant model. This mathematical model fit the experimental data satisfactorily, with $R^2 = 0.9948$ and lack of fit = 0.1657 ($P > 0.05$). At 10 mg/L CIP, 245 mg/L adsorbent, and a 12-minutes reaction time, complete removal of ciprofloxacin was achieved. The optimum value was also completely removing MB in three minutes. This research gives an affordable, safe, and long-term demonstration of removing antibiotics and dye from aqueous solution.

**Keywords**: Ciprofloxacin, RSM, $CuWO_4@TiO_2$, methylene blue.

# Production of Cellulose Nanofibrils from Paper Waste and Elucidation of Its Functional and Barrier Properties for Sustainable Packaging

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## Abstract

Cellulose nanofibrils (CNF) have emerged as a sustainable, green bio-economic priority due to their abundance, high surface area, excellent mechanical properties, and the abundance of hydroxyl groups that can be chemically modified. However, this abundance of hydroxyls makes them hydrophilic limiting their application and to overcome these limitations, the available hydroxyl groups are chemically modified to hydrophilic-hydrophobic properties. CNFs with different levels of fibrillation were produced by controlling mechanical energy and was chemically modified by acetylation to preserve the integrity of the original morphology and native crystalline structure without compromising its mechanical strength. CNFs showing the optimum reactivity were used to make films by solution casting to evaluate their barrier properties. The air resistance of CNF films was analyzed using the Gurley porosity method using the TAPPI T460. The water vapor transmission rate (WVTR) was determined using the ASTM E96 wet-cup method at 23 °C and 50% RH. The films were impermeable to the air flow and show improved vapor resistance as the WVTR decreased with the higher fibrillation and acylation. The acetylation increased the hydrophobicity of the CNF films, which was confirmed by measuring the water contact angle. Oil and grease resistance was evaluated using the TAPPI kit test for oil and grease resistance (TAPPI T559) and all the films passed the highest kit rating. The tensile strength of the CNF films increased with the increase in fibrillation and decreased as acetylation increased, whereas the elongation increased with both the fibrillation and acetylation. In sum, this research develops new pathways to enhance the chemical reactivity of CNFs by manipulating the extent of fibrillation and, consequently, the barrier properties of the CNF films, thus providing sustainable packaging materials for industrial use.

**Keywords**: Cellulose nanofibrils, chemical modification, WVTR, TAPPI kit, packaging materials.

# Fabrication of Novel Quaternary Nanohybrid Material from Kaolinite' $TiO_2$' $Al_2O_3$ and Chitosan for the Removal of Model Azo Dyes Methylene Blue and Remazol Red

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## Abstract

**Background:** Textile effluents containing residual dyes pose a significant environmental threat, necessitating efficient removal methods. This study addresses this concern by investigating a novel nanocomposite, TP (Kaolinite, $TiO_2$, and $Al_2O_3$), for degrading the cationic dye Methylene Blue (MB) and the anionic dye Remazol Red (RR) in industrial wastewater. **Objectives:** The research objectives involve evaluating TP's efficacy compared to the quaternary nanohybrid QP (Kaolinite, $TiO_2$, $Al_2O_3$, Chitosan), which yielded lower results in MB degradation. So, nanocomposites were synthesized with varying Kaolinite, $TiO_2$, and $Al_2O_3$ proportions, and validated. **Methodology:** A series of nanocomposites containing varying proportions of Kaolinite, $TiO_2$, and $Al_2O_3$ were synthesized through sonication followed by calcination at 600 °C for 4 hours. Comprehensive characterization using FTIR, XRD, FE-SEM, EDS, and UV-Vis DRS techniques validated successful fabrication. Photocatalytic degradation experiments under solar irradiation included kinetics, mechanism investigations, and recyclability assessments. **Findings:** Findings revealed that the ternary nanocomposite K65T30A5 (65% kaolinite, 30% $TiO_2$, 5% $Al_2O_3$) efficiently removed 97.6% of MB and 90.6% of RR within specified timeframes and conditions. The composite demonstrated adsorption contribution and established a photocatalytic degradation mechanism involving active free radicals. The kinetics of photocatalytic degradation followed pseudo-first-order rate kinetics for both dyes. The nanohybrid material exhibited consistent efficiency over four cycles, highlighting its reusability. Comparative analysis positioned K65T30A5 as superior to existing counterparts in terms of photocatalytic degradation. **Conclusion:** This study underscores the potential of K65T30A5 for efficiently removing both cationic and anionic dyes. The nanocomposite's innovative fabrication method coupled with promising performance and pronounced reusability, positions it as a valuable tool for mitigating hazardous dyes in industrial effluents. The environmentally sound solution distinguishes K65T30A5 from conventional catalysts, emphasizing its significance for sustainable effluent treatment.

**Keywords:** Effluents, photocatalytic, degradation, nanocomposite, sustainable.

# Amine Functionalized Metal-organic Frameworks for Heavy Metal Removal from Water

**Group:** Engineering and Applied Science **Project ID:** SRG-222390

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## Abstract

Metal-organic frameworks (MOFs). are an advanced class of porous materials that have received much attention due to their excellent porosity and facile functionalization. There are several potential applications of MOFs, particularly in heavy adsorption for water purification. Therefore, adsorptive removal of pollutants from water over MOFs are very suitable for water purification. In this work, ZIF-8 and NH2-ZIF-8were successfully produced by a simple method, and are characterized by XRD, FTIR, SEM, and BET techniques. The XRD studies reveal that the synthesis was successful. The presence of various functional groups is observed by FTIR. The results highlighted by this work have shown that the NH2- functionalized Zn-MOFs adsorbents show effective (nearly 100%) removal of Pb(II). However, some further characterization techniques are required as well as some more efficient applications are required to be done in order to complete this work as mentioned above.

**Keywords**: Adsorption, heavy metal, metal-organic frameworks, porous materials, water purification.

# Development of Poly (NiPAAm-co-HEAA-co-MAPTS) Terpolymer/Silica Hybrid Hydrogel for Drug Delivery Applications

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## Abstract

A Hybrid Hydrogel was developed by cross-linking silica nanoparticles with a terpolymer, intended to investigate loading and release profile of an antibiotic ciprofloxacin. The terpolymer was synthesized from free radical copolymerization of three monomers *N*-isopropylacrylamide (NiPAAm), hydroxyethyl acrylamide (HEAA) and 3-methacryloxypropyl-trimethoxysilane (MAPTS) using 2,2- azobisisobutyronitrile (AIBN) as an initiator. The hybrid hydrogel was prepared by mixing poly (*N*-isopropylacrylamide-co-*N*-hydroxyethylacrylamide-co-3-methacryloxypropyltrimethoxy silane) terpolymer (*p*NHS) and aqueous suspension silica nanoparticles at different ratios. The characterization of synthesized hydrogel was performed by Fourier transform infrared spectroscopy (FT-IR), differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), field emission scanning electron microscopy (FE- SEM) and also the swelling behavior was checked in water. Ciprofloxacin was loaded onto the hydrogel for the study of drug delivery application. The biocompatibility of the hydrogel was examined using cytotoxic effect analysis in Vero cell line and antimicrobial test was performed in a gram-positive and gram-negative bacterium where both studies show successful biocompatibility. The cytotoxicity test showed 95% survival of the cell. Optimum drug loading efficiency was also investigated and it was found to be 62%. Finally, in vitro release profile was checked and a release of around 70% was observed.

**Keywords**: Hybrid hydrogel, terpolymer, silica nanoparticles, drug delivery, biocompatibility.

# Development of a Chitosan/Graphene Oxide/Aminopropyl-trimethoxy-silane Composite for the Removal of Organic Dye from Industrial Wastewater

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## Abstract

The textile dyeing and washing industry plays a significant part in the socioeconomic development as well as the ecological aspects of Bangladesh. A significant amount of wastewater created by these industries is released directly into the water body, which itself contains a variety of organic dyes of varying concentrations. There are several various types of treatment methods available for the elimination of these organic dyes, including biological, physical, and chemical processes. Congo red is selected as a model dye in this study because of its adverse impact on environmental aspects. Sorption of this Congo red dye by using an ecofriendly adsorbent like Chitosan-Graphene oxide-3-aminopropyltrimethoxysilane [CS-GO-APTMS] has been studied. Two types of composites [CS-GO-APTMS (2-Step) & CS-GO-APTMS (1-Step)] has been reported here following two procedures. The utilization of this polymer material may lessen our dependency on other adsorbents such as activated carbon that contribute to greenhouse gases generation. Both the composites have been characterized with the help of X-ray diffraction (XRD), Energy dispersive spectroscopy (EDX), Fourier transform infrared spectroscopy (FTIR), Thermogravimetric analysis (TGA), Scanning electron microscopy (SEM) and Diffraction scanning calorimetry (DSC) analysis to provide a comparative study between them and to identify that the CS-GO-APTMS (1-Step) could have been shown to have better performance as an adsorbent than the CS-GO-APTMS (2-Step), which will be further proved by an adsorption experiment. The adsorption capacities will be measured by utilizing UV-Vis spectroscopy. The impact of several parameters (pH, contact time, adsorbent dosage) on the adsorption capacity will also be measured. Finally, adsorption isotherms will be calculated to determine whether the adsorption followed the uniform monolayer adsorption or the non-uniform multilayer adsorption.

**Keywords**: Biocomposite, adsorbent, wastewater treatment.

# Slow Invariant Manifold Analysis of Laser with a Saturable Absorber (LSA) Model

**Group:** Engineering and Applied Science **Project ID:** SRG-222393

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## Abstract

Slow invariant manifolds have a significant potential in the theory of dynamical systems. Numerous dynamical systems have a slow-fast structure, in which the dynamics of the system move slowly but the trajectory of the system from any initial point rapidly relaxes toward the slow invariant manifold. The asymptotic dynamics of the system occur on this slow invariant manifold, which allows us to minimize the size of the system and lower the computing cost. This project's goal is to investigate how differential geometry may be used to a dynamical model of Laser with a Saturable Absorber (LSA). In this study, we use a newly developed technique called the flow curvature approach to a dynamical mitotic model of LSA. This technique illustrates the applications of differential geometry in the slow-fast dynamical system. According to the Flow Curvature Method, we estimate the solution or trajectory curve of the dynamical system as a curve in Euclidean space and use that estimate to calculate the curvature of the trajectory curve analytically known as the flow curvature manifold. This manifold is given information on the dynamics of the related system since it contains the time derivatives of the velocity vector field. On the other hand, if the system is singularly disturbed, geometric singular perturbation theory may provide us with a slow invariant manifold by asymptotic expansions. First, numerical simulations are used to evaluate the slow-fast dynamical behavior from a mitotic model of LSA. The dynamical model of LSA is then subjected to the Flow Curvature Method. This flow curve approach takes advantage of the trajectory curve's curvature property to produce a manifold that shows the slow manifold. By employing the Darboux invariance theorem, we can then demonstrate the slow manifold's invariance quality. The slow manifold, on the other hand, is also established using the traditional Geometric Singular Perturbation Theory, which employs asymptotic expansions, and the invariance property is demonstrated using Fenichel's invariance theory.

**Keywords:** Slow-fast model, slow manifold, analytical equation, darboux theory, flow curvature.

# Prevalence of Pesticide Residues in Leafy Vegetables Retailed in Dhaka City, Bangladesh

**Group:** Engineering and Applied Science **Project ID:** SRG-222394

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## Abstract

**Background**: The presence of pesticide residues in fresh produces is a worldwide public health concern. The study was undertaken to analyzed and quantify the amount of pesticides in fresh products. **Objective**: The study was carried out to determine the amount of residue of two commonly used pesticides (e.g. diazinon and fenitrothion) in the most commonly consumed eleven leafy vegetables, namely red amaranth, stem amaranth, spinach, lamb's quarters, water amaranth, Indian pennywort, coriander leaves, onion sprouts, cabbage, bottle gourd leaf, and green amaranth, collected from Dhaka's local market. **Methodology**: A Reverse Phase-High Performance Liquid Chromatography (RP-HPLC) technique for simultaneous detection and quantification of (diazinon and fenitrothion) in leafy vegetables was developed and validated in accordance with the International Conference on Harmonization (ICH) criteria. **Findings**: All 11 green vegetables were negative for fenitrothion residue, indicating they are safe to consume. Diazinon was found in red amaranth (0.02mg/kg), green amaranth (0.04mg/kg), lamb's quarters (0.02mg/kg), indian pennywort (0.03mg/kg), onion sprouts (0.02mg/kg), and green pea (0.02mg/kg), all of which were above the maximum residue limit (0.01mg/kg). Among 11 leafy vegetables tested, 54.5% (6 vegetables) were found contaminated with diazinon the presence of diazinon residue exceeding MRL in vegetables is detrimental to humans and other living organisms. However, 45.5% (5) of the vegetables tested negative for pesticide residues. **Conclusion**: Thus, these approaches can be used to identify several pesticides in a variety of food products at the same time.

**Keywords**: Pesticides residues, diazinon, fenitrothion, leafy vegetables, liquid chromatography.

# Bio Based Green Oxide Materials for Renewable Solar Harvester

**Group:** Engineering and Applied Science **Project ID:** SRG-222395

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## Abstract

Here we present a comprehensive density functional theory (DFT) based ab initio study of copper bismuth oxide CuBi2O4 (CBO) in combination with experimental observations. The CBO samples were prepared following both solid-state reaction (SCBO) and hydrothermal (HCBO) methods. The P4/ncc phase purity of the as-synthesized samples was corroborated by Rietveld refinement of the powdered X-ray diffraction measurements along with Generalized Gradient Approximation of Perdew–Burke–Ernzerh of (GGA-PBE) and the Hubbard interaction U corrected GGA-PBE+U relaxed crystallographic parameters. Scanning and field emission scanning electron micrographs confirmed the particle size of the SCBO and HCBO samples to be ∼250 and ∼60 nm respectively. The GGA-PBE and GGA-PBE+U derived Raman peaks are in better agreement with that of the experimentally observed ones when compared to local density approximation based results. The DFT derived phonon density of states conforms with the absorption bands in Fourier transform infrared spectra. Both structural and dynamic stability criteria of the CBO are confirmed by elastic tensor and density functional perturbation theory-based phonon band structure simulations respectively. The CBO band gap underestimation of GGA-PBE as compared to UV vis diffuse reflectance derived 1.8 eV was eliminated by tuning the U and the Hartree–Fock exact exchange mixing parameter $\alpha_{HF}$ in GGA-PBE+U and Heyd–Scuseria–Ernzerhof (HSE06) hybrid functionals respectively. The HSE06 with $\alpha_{HF}$ = 14% yields the optimum linear optical properties of CBO in terms of the dielectric function absorption, and their derivatives as compared to that of GGA-PBE and GGA-PBE+U functionals. Our as-synthesized HCBO shows ∼70% photocatalytic efficiency in degrading methylene blue dye under 3 h optical illumination. This DFT-guided experimental approach to CBO may help to gain a better understanding of its functional properties.

**Keywords**: Density functional theory, $CuBi_2O_4$, hybrid functional, photocatalytic performance, dye degradation.

# Numerical Simulation of Nano-Assisted Thermal Ablation for Cancer Treatment Planning using Force Field System Based MRI Compatible Cryoprobe Array

**Group:** Engineering and Applied Science **Project ID:** SRG-222396

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## Abstract

Thermal ablation is an emerging method for cancer treatment, which is a minimally invasive cryosurgical technique to eradicate cancer cells/tissues by using extreme cold heat circulating through a cryoprobe without damaging the surrounding non-cancerous tissue. One of the critical factors is to impede its successful outcome due to the use of inappropriate cryofreezing methods that will not fully destroy the target tumor tissues, resulting in thermal therapy failure. Additionally, the surrounding healthy tissues may suffer from serious damage due to excessive ablation. To address these challenges, the employment of injected nanoparticles offers great promise and new opportunities to increase the efficacy of cancer treatment in combination with thermal therapy. Such nanoparticles can generate and specifically enhance the heating capacity at the tumor region due to favorable physical and/or chemical properties. In these studies, we develop a computer simulation that incorporates a simplified mathematical description of nano-assisted thermal ablation therapy. More specifically, two-phase thermo-fluid model is applied for the MRI compatible $LN_2$-cryoprobe array inserting into the biological tissues. The bioheat transfer model is used to predict the thermal characteristics of the biological tissue freezing. Computerized planning method, namely force-field analogy method is preferred to find out the optimal MRI multiprobe array. The conjugate model equations are solved using the finite volume method. The numerical results are focused on analyzing the thermal evolution of cancerous/non-cancerous tissue with optimization. The physical analysis emphasized tissue temperature histories by addressing several essential factors (e.g., fatal temperature, cooling rate, etc.) and further discussed with graphical representations. These numerical investigations may be favorable for optimizing the design of MRI cryoprobes and the procedure of nano-assisted thermal ablation for cancer treatment planning.

**Keywords**: Thermal ablation; cryoprobe array; two-phase flow; bioheat transfer; FVM.

# Analysis and Improvement of Neutronic Characteristics, Fuel Cycle and Spent Fuel Quality of VVER-1200 Reactor (Rooppur Nuclear Power Plant)

**Group:** Engineering and Applied Science **Project ID:** SRG-222397

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## Abstract

VVER-1200 is a pressurized water cooled and water moderated generation 3+ reactor with a capacity of 3200 MWt and a lifetime of 60 years is being under construction in our country (Bangladesh) at Rooppur Nuclear Power Plant (RNPP). Analysis and improvement of the neutronic behavior of the VVER-1200 reactor are the goals of this project effort. The detailed neutronic calculations were done using MCNP6.2 and ENDF/B-VII.0 nuclear data library. It is found that the k-inf at the BOL of maximum enriched (4.95wt%) assembly is 1.416 and minimum enriched (2.0 wt%) assembly is 1.1525. To adequately reduce the excess reactivity, 30 integrated fuel burnable absorber (IFBA) rods are required for the highest enriched (4.95wt%) assembly. If the enrichment is less than 3.0wt%, IFBA rods are not required to decrease the excess reactivity. Control rod of $B_4C$ is able to decrease the excess reactivity of 4.95wt% enriched assembly if it is inserted more than half (300 cm) of axial height of the assembly. Control rod worth for fully inserted CR at beginning of Life (BOL) is 85.5 pcm/cm and the value decreases almost linearly to 57.4 pcm/cm at End of Life (EOL). Control rod worth linearly decreases with the burnup. For 300, 350 and 375 cm inserted control rods CR worth at BOL 7.2, 32.7, 85.5 pcm/cm and at EOL 4.9, 23.1, 57.4 pcm/cm. Fuel enrichment had a significant impact on $\beta_{eff}$, while the presence of IFBA rods had a negligible effect. For 3.0% and 4.95% enriched fuel assemblies the difference of $\beta_{eff}$ is 10.8% at 16 GWd/t burnup. Assembly with higher enrichment has negative Fuel Temperature Coefficient (FTC) for longer period during burnup. Influence of IFBA on effective delayed neutron fraction and FTC is not significant but it is softening the spectrum at BOL. The content of Pu in spent fuel increases with decreasing the enrichment. Core of VVER-1200, which are the combination of different enrichment, maintain criticality, flat power peaking and negative FTC.

**Keywords**: VVER-1200, $UO_2$, Control rod, burnable absorber, plutonium, spent fuel.

# Deep Learning-Driven Automated Diagnosis of Neurodegenerative Diseases Using Image Memorability

**Group:** Engineering and Applied Science **Project ID:** SRG-222398

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## Abstract

**Background**: Predicting human memorability in images is vital for applications such as education and advertising. However, existing deep learning methods often overlook spatial structural information, prompting the need for novel approaches. **Objectives**: The objectives encompass exploring the application of Graph Convolutional Networks (GCNs) and Graph Attention Networks (GATs) for image memorability prediction. **Methodology**: The methodology involves extracting object-centric features using deep Convolutional Neural Networks (CNNs), constructing graphs to represent spatial relations between objects, and iteratively enhancing a baseline GCN model. The proposed GEMM is trained using graph embeddings of object representations to predict image memorability. **Findings**: Our research introduces the Graph Embedded Memorability Model (GEMM) to predict image memorability, focusing on capturing spatial structural information within images. Utilizing Graph Convolutional Networks (GCNs) and attention mechanisms, our model leverages object-centric features extracted by deep Convolutional Neural Networks (CNNs) and constructs graphs to represent spatial relations between objects. Through extensive experiments on three datasets (LaMem, SUN memorability, and FIGRIM), GEMM consistently outperforms existing state-of-the-art models, achieving Spearman's rank correlations of 0.71 on LaMem, 0.69 on SUN memorability, and 0.59 on FIGRIM. The model demonstrates remarkable generalization across diverse datasets, highlighting its robustness and effectiveness in predicting image memorability. Comparative analyses with baseline GCN, attention-guided GCN, and existing models underscore GEMM's superiority. The attention mechanism significantly enhances edge connections in the graph, contributing to improved model performance. Furthermore, ensembling GEMM with AMNet further boosts accuracy, establishing a new state-of-the-art in image memorability prediction. GEMM introduces an innovative approach by incorporating spatial structural information using GCNs and attention mechanisms, demonstrating superior performance, generalization across datasets, and robustness. This contribution addresses existing limitations in image memorability prediction, showcasing the model's efficacy in capturing intricate relationships within images. **Conclusion**: GEMM sets a new standard in image memorability prediction by adeptly capturing spatial structural information. Its consistent outperformance across diverse datasets and synergistic ensemble with AMNet underscore its efficacy and mark a significant advancement in the field.

**Keywords**: Image memorability, convolutional networks, attention networks, deep learning.

# Cardiac Wall Elasticity Interaction Framework for the Cardiovascular Abnormalities in Coronary Revascularization Based on Digital Imaging Correlation

**Group:** Engineering and Applied Science **Project ID:** SRG-222399

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## Abstract:

Coronary arterial elasticity is one of the major hemodynamic characteristics for cardiovascular blood flow simulations in coronary main arteries due to heart systole and diastole conditions. However, it is still tricky to measure hemodynamic factors in multiple stenosed coronary main arteries with deformable arterial walls due to excessive computational methods in Womersley blood flow conditions. In this study, we describe central hemodynamic features for instance the velocity magnitude (VM), pressure gradient difference, wall displacement and wall shear stress (WSS) along with various coronary luminal areas in the fluid-structure interaction (FSI) method based on coupled momentum method (CMM). A computational procedure for solving the FSI along with the CMM problem is presented to determine patient-based cardiovascular flows. The purpose of this study is to explore the hemodynamic main properties of different degrees of the diameter of stenosis (DS) with multiple serial stenoses (MSS) in pulsatile flow conditions. We set up a comparison of computational fractional flow reserve (cFFR) results in coronary rigid and elastic walls with published clinical results. We have observed that the three cFFR produced are almost similar but FSI-CMM and clinical results are the same.

**Keywords**: CCTA, CFFR, WSS, Velocity magnitude, Non-invasive, DS.

# An Stochastic Optimization Technique for Optimal Composition of Cattle Feed

**Group:** Engineering and Applied Science **Project ID:** SRG-222400

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## Abstract

One of the most common applications of linear programming is in determining the optimal composition of cattle feed which is similar in most respects to the diet problem. This problem concerns the mixing of a number of raw materials in such a way that a cattle feed is obtained which satisfies certain specified nutritive and other requirements with minimum cost for the input quantities of the raw materials. If the requirements for the mixture are known, then the problem can be solved directly by LP. But in practical life, it may happen that the cattle feed which is prepared using the solution given by LP does not satisfy the requirements. Because the nutritive content of the inputs is not constant, but varies considerably. In this project, we will show that these variations can be taken into account by means of a stochastic procedure under chance constraints. Reformulating the stochastic problem as deterministic nonlinear equivalent under chance constraints, we will solve the problem in a computerized method by using a mathematical programming language (AMPL). It will be shown in this project that in our case the chance-constrained programming problem gives rise to a non-stochastic programming problem which is linear in the objective function and quadratic in the constraints. We will also show the simulation results for random variations of different constraints such as protein constraint to get better result. Our model will help the decision maker to take the best composition that minimizes the total cost of cattle feed satisfying the required probability of the protein content. Also, our computer-oriented algorithm is an effective technique to compute different types of optimization problems which will reduce the computational time for large scale problems.

**Keywords:** Stochastic optimization, cattle feed, cost minimization, nutrient requirement, optimal planning

# Conversion of Hazardous Tannery Solid Wastes into Biofertilizer: An Eco-friendly Approach

**Group:** Engineering and Applied Science **Project ID:** SRG-222401

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## Abstract

The use of biofertilizers is a successful strategy for enhancing and sustaining soil nutrient economy, hence lowering the usage of chemical fertilizers for productive and sustainable agriculture. The processing of one metric ton of raw hides and skin results in roughly 80% solid waste, of which approximately 60% is untanned solid waste. Limed fleshing accounts for 50-60% of all untanned solid waste, posing an environmental burden to the leather industry. The disposal of these fleshing wastes releases considerable methane, which has three times the negative impact on global warming as carbon dioxide. After fat extraction, the collagen-containing residue can be co-digested with household waste for 75 days to generate organic fertilizer. Co-digestion breaks down collagen peptide links, allowing nitrogen and other nutrients to be released and absorbed by plants. In its basic form, organic fertilizer comprises 11.3% N, 43.2% C, and 2.25% S. Other nutrients, such as P and K, were supplied to maintain the right organic fertilizer ratio. The presence of several nutrients in it is confirmed by chemical and thermal investigations. As a model plant, the fertilizer was applied to spinach growth. After one month, growth parameters such as leaf size, weight, and plant weight were compared to commercial organic fertilizer, revealing that fertilizer made from leather fleshing residue after fat extraction exhibited 8% greater growth than commercial and 21% higher growth than control plant. This work is an example of a waste-to-wealth strategy in which waste materials were incorporated into the main form of economy, as well as an example of a circular economy in the leather sector.

**Keywords**: Biofertilizer; tannery solid wastes; plant growth; waste-to-wealth; circular economy.

# Feasibility Analysis of Floating Solar Power Plant in Bangladesh: Challenges and Recommendations

**Group:** Engineering and Applied Science **Project ID:** SRG-222403

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## Abstract

The installation of large-scale photovoltaic (LSPV) power plants is a solution to mitigate the national energy demand in Bangladesh. However, the land crisis is one of the key challenges for the rapid growth of ground-mounted LSPV plants in Bangladesh. The per unit cost of energy from ground-mounted PV systems is rising as a response to numerous difficulties, particularly for large-scale electricity generation. To overcome the issues with land-based PV, the floating photovoltaic (FPV) could be a viable solution. To the aspirations of the Sustainable and Renewable Energy Development Authority (SREDA), this article has investigated the feasibility of constructing a floating solar plant at Hatirjheel Lake in Dhaka, Bangladesh. The lake is an excellent spot to build an FPV plant due to its geographic location and climatic conditions inside the capital city. In this paper, the design of the plant and tariff are carried out using the PVsyst simulator. It is found that the optimum cost of energy for the plant is $ 0.0959/KWh, which is lesser than the currently operational ground-mounted PV plants in Bangladesh. Additionally, the projected 6.7 MW plant can meet 12.5 % of the local energy demand. Furthermore, the FPV plant is capable to cut off 6685 tons of CO2 annually. A reduction in power costs and environmental protection would assist the government of Bangladesh in achieving the sustainable development goals and electricity generation target of 6000 MW from solar photovoltaics by 2041 as well.

**Keywords**: Floating PV plant, solar energy, case study, PV power, sustainable energy.

# Experimental Investigation on the PV Power Degradation for Different Dust Deposition at Different Solar Power Plants in Bangladesh

**Group:** Engineering and Applied Science **Project ID:** SRG-222404

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## Abstract

This research comprehensively analyzed the impact of dust deposition on photovoltaic (PV) power generation in various solar power plants across Bangladesh. The study addressed three primary objectives: i) characterize and analyzed dust using Scanning Electron Microscopes (SEM) from diverse power plants, ii) develop an indoor experimental setup for testing PV module performance using collected dust, and iii) conduct a comparative investigation of the dust's effect on PV output parameters and degradation rates across different solar power plants in Bangladesh. The methodology involved systematic steps to achieve the outlined objectives. Initially, dust samples were physically collected from various solar power plants in Bangladesh to facilitate a comparative investigation of their effects on PV output power. Two representative PV modules, an 80W polycrystalline and an 80W monocrystalline solar panel, were obtained from a reputable solar manufacturer. Dust characterization was carried out at the University of Dhaka using SEM, establishing a crucial link between the characteristics of dust deposition and PV output power degradation. The experimental work involved the measurement of collected dust samples using a dust weight measurement machine. Various dust sample sizes, ranging from 1gm to 3gm, were prepared for each power plant's dust samples. Indoor experimental environments in the laboratory were employed to test these samples on poly and monocrystalline PV modules. A thorough comparative investigation was conducted to identify regional variations in dust effects on PV power plants, considering PV output power and degradation rates. The final phase of the research involved synthesizing findings into a comprehensive report, which was disseminated in relevant and reputed academic journals and public media. This research contributed valuable insights into the specific challenges posed by dust deposition in diverse solar power plants, providing a foundation for informed decision-making in the design and maintenance of PV systems in Bangladesh.

**Keywords**: Solar, photovoltaic, dust, power loss, renewable energy.

# Design and Development of Smart Ammonia-Pollution-Reduction Systems with Multiple Sensor Networks for the Application in Poultry Farming Shed

**Group:** Engineering and Applied Science **Project ID:** SRG-222405

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## Abstract

In Bangladesh, broiler chickens are raised in floor housing systems. Broilers are commonly kept in large flocks in the houses, where litter moisture content gradually builds up as the birds grow. High litter moisture content may result in elevated ammonia ($NH_3$) concentration which can be detrimental to the health of the chickens and farm workers. It is recommended that ammonia concentration is maintained below 10 to 25 ppm, depending on the relevant standard and jurisdiction. This research report has proposed design and development of smart ammonia-pollution-reduction systems. The proposed smart ammonia-pollution-reduction systems have been comprised of several sensor networks for sensing odor concentrations and controlling the ventilation, and a long-distant remote controlled robotic car for stirring the litter of the floor. The sensor networks monitor the real time concentration of ammonia inside the poultry shed and turn-Off/ON automatically the ventilation equipment at the threshold conditions and insist the poultry owner to drive robotic car from the outside of the shed by remote controller for stirring the litter to dry up for the reduction of ammonia concentration. After integrating the components, a wireless controlled robot has been created. The remote controller's microcontroller's program enables the user to move DC motors in various directions. Automatic light and fan controls were dependent on the humidity and temperature of the space. The spray nozzle was rotated 180 degrees by the servo under remote control. The ventilation system allowed the trapped gas to escape. It is supposed that the spread of bird illnesses has been greatly decreased because of the elimination of trapped gases from the bird feces on the floor. The success of the project showed a suitable technological automated system for monitoring and reducing the concentration of harmful ammonia and odor to improve the hygienic and healthy conditions inside the poultry farming sheds.

**Keywords**: Smart farming, sensor networks, poultry robot, farm ventilation.

# Real Time Intelligent Monitoring and Notification System for Smart Cold Storage

**Group:** Engineering and Applied Science **Project ID:** SRG-222406

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## Abstract

Cold storage is crucial for the economy of Bangladesh as it plays a vital role in preserving perishable products over extended periods. However, most cold storage facilities in Bangladesh are controlled manually, creating a risk of spoilage or contamination of preserved goods. Hence, it is essential to intelligently monitor storage systems to enhance the efficiency of cold storage. This project aims to develop real-time intelligent monitoring and control of a cold storage system using IoT and an Android application. We begin by creating a prototype cold storage chamber and installing essential sensors for gases, temperature, humidity, and light. Arduino UNO, NodeMCU, and Raspberry Pi are integrated to produce the smart IoT-based system. Then, real-time online data storage and a mobile Android application have been developed for intelligent cold storage monitoring. The efficacy of the proposed smart cold storage system is evaluated through comprehensive testing conducted on an interactive Android application. It exhibits the overall status based on parameters directly influencing the cold storage process, enabling users to gain quick insights about the operational status. It also facilitates the control of the exhaust fan to manage gas concentration. Additionally, real-time readings of all sensor data are displayed, aiding in making timely and informed decisions. The system provides a comprehensive overview of the cold storage process and empowers users with the tools needed to monitor and control key aspects effectively. It is anticipated that our system will assist cold storage authorities in reducing costs associated with labor and minimizing the risk of spoilage, contamination, or other safety hazards.

**Keywords**: Arduino UNO, NodeMCU, raspberry Pi, IoT, sensors.

# IoT-based Solar-Powered Smart Irrigation System using a Dual-axis Solar Tracker for Rice Field

**Group:** Engineering and Applied Science **Project ID:** SRG-222407

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## Abstract

Water management in irrigated agricultural fields remains a pressing concern in Bangladesh, primarily due to the lack of advanced irrigation facilities, resulting in inefficient use of irrigation water and escalating crop production costs. To address these challenges, this research focused on designing and implementing an innovative IoT-based solar-powered smart irrigation system, integrating soil moisture and weather sensing to regulate pump operations when soil moisture falls below the required level. Additionally, a dual-axis sun-tracking solar system was developed to maximize electricity generation by aligning with the sun's orientation. This study conducted a comparative analysis between a fixed-axis solar tracking system with a 24.95° tilt angle and a horizontal dual-axis solar tracking system with no tilt angle. The designed dual-axis solar tracker utilizes LDR sensors to accurately track the sun's position, aligning the solar panel (150 watts) perpendicular to the sun's rays, optimizing energy capture, which is then converted and stored in a 12V battery for operating the submersible pump (DC 12V, 150 watts). The research established a wireless sensor network (WSN) with IoT capabilities to facilitate real-time monitoring of pumping status and energy comparison. One substation was strategically placed in a paddy field, transmitting water level data wirelessly to the main station, where a microcontroller was employed to process and analyze the data, and a relay module automated the pumping operation. Simultaneously, the collected data was securely sent to cloud storage, employing the Thingspeak server. Farmers can access this data through smartphones, enabling effective water level monitoring in the paddy field. The integration of solar irrigation systems in Bangladesh showcases vast potential for sustainable solutions with reduced irrigation costs. This IoT-based solar-powered smart irrigation system holds promise for revolutionizing irrigation management practices, enhancing water use efficiency, and significantly contributing to the agricultural sector's productivity and prosperity.

**Keywords**: Internet of things, solar panel, smart irrigation, sun tracker, wireless sensor.

# Evaluating the Effectiveness of Nanoparticles and Different Wavelength to Enhance Yield of Rice Under Salt Stress

**Group:** Engineering and Applied Science **Project ID:** SRG-222408

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## Abstract

**Background:** Changing climate is hampering rice yield as more areas are becoming saline prone and less suitable for rice production. To ensure enough food rice production needs customization with mechanization, artificial light and nano fertilizer application in the near future. This needs careful assessment on different rice genotypes as the effects are genotype dependent. **Objectives:** Nanoparticles with their immense potential can enhance crop performance. In this study the effect of different wavelength and nanoparticles and their interaction effect was observed on different rice genotypes. **Methodology:** Six rice genotypes with differential salt tolerance capability were studied in five replications. They were grown in hydroponic solution in separate chambers for red, white, and blue light in 16h-light/8h-dark condition. Shoot, root length, chlorophyll-content was measured. Expression of salt responsive genes was analyzed in the nanoparticles treated plants. **Findings:** Germination index varied and showed differential growth pattern in white and red light. In general, red light exposure enhanced shoot and root growth. Salt tolerant rice showed better photosynthesis capability under blue light compared to red and white light. Photoperiod sensitive rice plants did not respond to the benefit of red light. The nano particle primed seeds were grown under salt stress and an increase in root length was observed in the nano particles stimulated plants. Vacuolar Sodium Hydrogen antiporter *OsNHX1* gene expression was also found higher in the nano particles treated root tissue. A specific dose and application method of the nano particles was identified for best performance. **Conclusion:** Depending on genotypes the usage of nano particles dose and application of light in the greenhouses can vary. Hence, we need to customize the light and nano fertilizer application in a genotype dependent way.

**Keywords**: Bangladesh, blue light, photosensitivity, light, rice genotype.

# Analysis of a Caputo Fractional Order SVEIHRP Model for COVID-19 Pandemic: A Case Study in Bangladesh

**Group:** Engineering and Applied Science **Project ID:** SRG-222409

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## Abstract

**Problem Statements:** Formulation ofa new SVEIHRP mathematical model for the dynamics of novel COVID-19 situation of Bangladesh in the frame of Caputo fractional order derivative (CFOD). **Objectives:** The main objective of this project is to develop a new SVEIHRP mathematical model for COVID-19 pandemic situation of Bangladesh using CFOD. **Methodology:** Here, we involve CFOD to formulate the model. We use next generation matrix approach for finding basic reproduction number (BRN). Routh-Hurwitz criterion, Ulam-Hyers and generalized Ulam-Hyers stability criteria has been applied for stability analysis. We perform the numerical simulation using fractional Adams-Bashforth-Moulton method and MATLAB code fde12.m**. Findings:** In this project, we consider all transmission way of corona virus and vaccination approach at a time. Here, we determine local and global stability for both of disease-free and disease-endemic equilibrium points of the SVEIHRP COVID-19 model theoretically and verified numerically. We demonstrate the existence and uniqueness for solution of model equations using Banach fixed point theorem. For numerical simulation, we use the data of COVID-19 cases of Bangladesh up to 2$^{nd}$ dose vaccination. Model's BRN confirm that on average 7 or 8 susceptible people has been infected by a single infected individual during 08/03/2020 to 30/06/2022. The numerical experiment shown that the speed of convergence of solution is slower than that of integer order model. From epidemical point of view, the result of this project is crucial, because it affects time needed to spreads COVID-19. Sensitivity analysis determine the relative importance of model's parameters. All above in this project, we provide a significant guideline for public health consultants who handling the raising situation of COVID-19 pandemic in Bangladesh. **Conclusion:** The result of this project will implement directly for controlling the COVID-19 pandemic of Bangladesh and it will help us to reduce the COVID-19 cases form our environment rapidly.

**Keywords:** COVID-19 model; CFOD; FABM method.

# Synthesis and Characterization of Zeolite And Silica-Alumina And Their Applications in Catalytic Co-Pyrolysis of Mixture of Lignocellulosic Biomass and Waste Polyethylene to Produce Biofuel and Valuable Petrochemicals

**Group:** Engineering and Applied Science **Project ID:** SRG-222410

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## Abstract

**Background:** Lignocellulosic biomass is a promising renewable energy source as it can be converted to biofuel. The produced biofuel can be used as transportation fuel. **Objectives**: The objective of this research is to synthesize zeolite X. Zeolite X is used on catalytic co-pyrolysis of polyethylene and sugarcane bagasse to produce biofuel. **Methodology:** The zeolite X is synthesized from coal fly ash by alkali fusion and hydrothermal method. A mixture of sodium hydroxide and acid-treated fly ash is milled and agitated in a beaker. The slurry is heated in a Teflon tube. The precipitates are filtered, washed and dried. **Findings:** The SEM image shows that the synthesized zeolite X is octahedral shape whereas the starting material coal fly ash exhibits spherical shape. The zeolite X is found effective in producing biofuel from co-pyrolysis of waste polyethylene and bagasse. The FTIR of bio-oil produced from bagasse shows presence of water and –OH group whereas oil obtained from co-pyrolysis of waste polyethylene and bagasse does not show water and –OH group. The NMR of bio-oil shows presence of aromatic compounds such as phenol, aldehyde and other compounds. However, oil from co-pyrolysis shows presence of mostly alkanes and alkenes. Aromatic compounds are not present in oil from co-pyrolysis. Thus, the heating value of bio-oil produced by co-pyrolysis is higher than bio-oil produced by only pyrolysis of bagasse. **Conclusion:** Zeolite X is synthesized from coal fly ash. The Zeolite X catalyst converted bagasse and waste polyethylene to bio-oil. The produced biofuel can be used as fuel.

**Keywords**: Sugarcane, zeolite, polyethylene, bagasse, bio-oil, alkali fusion.

# Vapor-Liquid Equilibrium, Structural and Dynamical Properties of Refrigerants in Industrial Refrigeration Systems

**Group:** Engineering and Applied Science **Project ID:** SRG-222411

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## Abstract

Air-conditioners and refrigerators, which cool and heat residential spaces and preserve food, are usually manufactured with vapor compression refrigeration systems, wherein refrigerants are working fluids. The hydrofluoroolefin (HFO) refrigerant HFO-1234yf and its blends with HFO-1234ze(E) are excellent alternative choices for refrigeration systems, considering environmental issues and system performance. Therefore, the present research project focused on the MD simulations of thermophysical properties and condensation of HFO-HFO blends; HFO-1234yf + HFO-1234ze(E). Moreover, the saturated vapor pressures and vapor-liquid densities of HFO-1234yf, HFO-1234ze(E) and their six binary blends with different compositions were computed using MD simulations applying COMPASS force field. The condensation rate of pure HFO-1234yf, HFO-1234ze(E) and the (HFO-1234yf + HFO-1234ze(E)) blends was higher at lower condensation temperatures. The vapor molecules went through a rapid phase transition to a subcooled liquid state during a particular time period, and the potential energy of the molecular systems was drastically reduced at this time. During condensation, clusters of molecules were initially formed, and they subsequently aggregated to develop a condensate droplet. The liquid density and isobaric heat capacity of pure HFO-1234yf, HFO-1234ze(E) and its six blends were predicted for the temperature range of 273.15 K to 298.15 K. On the other hand, the vapor pressures of the pure HFO-1234yf, HFO-1234ze(E) and their binary blends[A-F] were predicted at temperature ranges from 230 K to 330.15 K with an excellent agreement with available data. The vapor-liquid coexistence curves and critical parameters of pure refrigerants along with their blends were calculated using GEMC simulations.

**Keywords**: Binary blend, saturation pressure, vapor-liquid, critical parameters, MD simulation.

# Visible Light Induced Azo Dyes (Rhodamin B' Congo Red) Degradation using Z-scheme BiFeO3-gC3N4-microcystallinecellulose Photocatalyst: Synthesis' Characterization and Performance Evaluation

**Group:** Engineering and Applied Science **Project ID:** SRG-222412

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## Abstract

Photocatalytic process, an important scientific issue and research hot spot in recent years, has received enormous attention because of its low-cost, environmentally benign, and sustainable method for wastewater treatment. It is a promising technique mainly due to the use of solar energy as the light source. Various semiconductors have been widely studied so far that include $TiO_2$, ZnO, which are considered as first generation photocatalysts that uses UV lights. For enhancement of photocatalytic activity as well as using the visible light, researchers have started to use perovskite type material (e.g. bismuth ferrite) alone or in combination. In this research, a crystalline composite of pure bismuth ferrite ($BiFeO_3$) and graphitic carbon nitride ($gC_3N_4$) was successfully synthesized through hydrothermal process in the view to perform photocatalysis. The structure, morphology, and other properties of the composite were characterized by different techniques e.g., XRD, SEM, and FT-IR. Degradation of Rhodamine B (RhB), a notorious chemical extensively used in textile and food industries, was investigated using $BiFeO_3$-$gC_3N_4$ composite under visible light inside a locally designed reactor. The composite exhibited 4-6 times higher photocatalytic activity for RhB degradation compared to $BiFeO_3$ alone. About 95% degradation of RhB was found to occur using the composite. The maximum dye degradation was achieved in 120 min and at 4 g/l of photocatalyst dosing. The enhanced photocatalytic degradation performance of the composite was supposed to attained due to efficient separation of the photogenerated electron-hole pairs. Thus, a direct Z-scheme photocatalysis was responsible for the entire photocatalytic system. Based on the findings, the $BiFeO_3$-$gC_3N_4$ composite can be utilized as an efficient photocatalytic material for RhB degradation.

**Keywords**: Visible light; photocatalytic degradation; bismuth ferrite; rhodamine B.

# Fabrication of Metal- Graphene Oxide Based Poly (Acrylic Acid) Nanocomposite Hydrogels for Simultaneous Dye Adsorption and Photodegradation Under Solar Radiation

**Group:** Engineering and Applied Science **Project ID:** SRG-222413

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## Abstract

Dye contamination attracted significant attention due to its contribution to 20 % of worldwide water pollution. Different industries release untreated dye effluents that harm human health and the environment. Various methods have been applied to remove dye substances from industrial effluents, and simultaneous adsorption and photodegradation are the most potential techniques for researchers for their versatile dye treatment technique. The photocatalytic degradation and adsorption of Rhodamine B textile dye on novel charcoal-Zn-PAA hydrogel were tested. The hydrogel was synthesized by a simple and fast free radical polymerization method without any hazardous solvent. The synthesized samples were characterized by ATR-IR, TGA, and EDX analysis. After characterization, we found that incorporating zinc in the polyvinyl hydrogel surface was easier than other metal ions. Zn-charcoal-PAA hydrogel showed a maximum of 78.33% Rhodamine B degradation under direct sunlight irradiation and 88.10% under ultraviolet light irradiation. The results of this study suggest that charcoal-Zn-PAA hydrogel is very effective in treating industrial dye wastewater due to its intrinsic photocatalytic activity. In another study, Rhodamine B degradation was studied by charcoal-Fe-PAA hydrogel. The hydrogel was synthesized and characterized by the same procedure. The incorporation of Iron made the hydrogel surface more convenient for dye adsorption and showed a maximum of 86.9% Rhodamine B degradation under direct sunlight irradiation. The variable valence system of Iron facilitates dye adsorption on the hydrogel surface, ultimately enhancing the degradation performance. The results of this study also suggest that charcoal-Fe-PAA hydrogel is very effective in treating industrial dye wastewater.

**Keywords**: Zinc, iron, wastewater, sunlight, irradiation, rhodamine B.

# Utilizing Extended Tanh-Function Technique to Scrutinize Fractional-Order Nonlinear Model

**Group:** Physical-Science **Project ID:** SRG-222414

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## Abstract:

The nonlinear space-time fractional Cahn-Allen and space-time fractional Benjamin-Bona Mahony equations have significant applications in the fusion and fission phenomena of solitons, electromagnetic interactions, quantum relativistic atom theory, and signal processing. In this article, we examine the exact and analytical solitary wave solutions to the mentioned equation through the extended Tanh-function method over the Atangana beta derivatives. The recommended technique was extensively discussed by Malflit, W., which provides the exact solutions of fractional order nonlinear model in terms of Tanh-function. We have generated further new dynamical exact solitary wave solutions which are useful in optical signal distortion effects of light pulse propagation in a nonlinear optical fiber, the medium's intensity-dependent refractive index to the mentioned equation. The physical behaviors of the solutions are illustrated by depicting graphical representations of the solutions. The features of the established solution include kink, spike, periodic, antiperiodic, dark soliton, and so on with a wide range of free parameters. Graphically, the physical significance of the derived solutions for the definite values of the linked parameters is studied using 3D, contour, and vector form. The resulting outcomes are contrasted with those found in the literature, and it becomes clear that these mathematical techniques are more encouraging than those currently in use. To the best of our knowledge, this learning produces a novel form of acquired results that have not yet been achieved. It has been observed that the extended tanh function method is more practicable and easier to implement than the other method, and the strength of the stated equation is predictable, reliable, and computationally attractive. This method not only produces identical answers, but it also might reveal new answers that no other researchers have mentioned. The newly discovered solutions can be used by physicists or engineers to carry out more investigations into diverse circumstances.

**Keywords**: Non-linear equation, CA equation, BBM equation, beta derivative, solitary wave.

# Sustainable Solar Hydrogen Production Through Splitting of Water (Phase 2 Enhancement of $H_2$ production)

**Group:** Engineering and Applied Science **Project ID:** SRG-222415

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## Abstract

Harnessing the power of visible light through photocatalysis, green hydrogen production emerges as a cutting-edge solution for future global fuel demands, presenting a sustainable pathway to generate clean energy by utilizing renewable resources and minimizing environmental impact. The integration of advanced technologies underscores the pivotal role of green hydrogen in driving the transition towards a more eco-friendly and efficient energy paradigm. Silicon-supported zinc oxide (ZnO) was synthesized utilizing solid-state reaction methodologies, yielding a supported photocatalyst. Comparable catalytic efficiency was achieved in comparison to noble metal-supported catalysts in the realm of hydrogen (H2) production via water splitting. Enhanced photocatalytic activity for $H_2$ evolution was observed in the presence of supported silicon, explicated by the efficient instantiation of the interfacial charge transfer phenomenon. Under visible light irradiation, without the presence of electron donors, the estimated rate of $H_2$ production reached 648 μmol h−1. Following three consecutive cycles under analogous reaction conditions, no notable alteration in $H_2$ production was observed. The reduction in $H_2$ production during recycling experiments delineated the prevalence of a greater abundance of silicon hydroxide species compared to silicon hydride. The enhancement in $H_2$ generation could be realized through the stabilization and regulation of surface functionality on the silicon catalyst. This contribution holds promise for stimulating further investigation into the exploration of alternative non-precious metals for hydrogen generation.

**Keywords**: Photocatalyst, water splitting, hydrogen production, sustainability, green energy.

# Ultrasensitive Detection of *Escherichia coli* Bacteria with Electrochemical Biosensor

**Group:** Engineering and Applied Science **Project ID:** SRG-222416

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## Abstract

An accurate and cost effective platform for detection of *E. coli* bacteria is highly essential for the diagnosis of various bacterial borne diseases. Here, E. phage based electrochemical biosensor is developed for monitoring *E. coli*. To design the biosensor, E. phage is immobilized on the surface of AuNPs@PANI functionalized GC electrode. The proposed biosensor is characterized by fourier transform infrared spectroscopy, scanning electron microscope, cyclic voltammetry, and electrochemical impedence spectroscopy. Potassium ferrocyanide and potassium ferricyanide aqueous medium [Fe(CN) 6 ] 3-/4- incliding 0.1M KCl is used as a signal indicator for the detection of *E. coli*. The propsed E.phage biosensor exhibits a wide linear range of 10-10 8 CFU/mL with a limit of detection of 1 CFU/mL. The proposed whole cell biosensor provides high selectivity for the detection of *E. coli* bacteria in the presence of *S. typhi* and others. The developed biosensor displayed excellent recoveries in detecting *E. coli* in a mixture of negative control bacteria. Therefore, the proposed biosensor can serve as an effective tool for the monitoring *E. coli* in clinical and food samples.

**Keywords**: Electrochemistry, biosensor, physical chemistry, nanotechnology.

# Assessing the Energy Consumption of Ethnic Dwelling Units, Toward Integrating Renewable Energy for Sustainable Dwelling and Settlement Planning in Chittagong Hill Tracts

**Group:** Engineering and Applied Science **Project ID:** SRG-222417

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## Abstract

The research project undertook a comprehensive study to compare thermal comfort levels between vernacular andmodem architecture in the ethnic communities of Khagrachhari, Chittagong Hill Tracts. The primary objective of thisstudy was to explore ways to achieve long-term sustainability by examining regional architectural traditions and identifying energy-saving design ideas. The research involved a combination of field investigations, subjective questionnaires, and computer-aided modelling software to simulate heat conditions. The study focused on key thermal parameters such as air temperature (AT) and relative humidity (RH) differences between indoor and outdoor environments. Building data, including material profiling, plan, section, and elevation drawings, were gathered to model and analyzethe formal structure of ethnic house forms. Data analysis was conducted to test the built forms in the current settlementlayout to help suggest future modifications for reducing energy usage. The study outcomes could potentially create design guidelines for the local government engineering department to support the development of ethnic communities. The recommendations could also help maximize natural resources, and reduce reliance on artificial energy to create energy-efficient dwellings. The research findings could have a significant impact on urban settlements by encouraging reconsideration of building style and materials usage for lower energy consumption and less reliance on the national grid.

**Keywords**: Energy-efficient dwellings, CHT, ethnic architecture, renewable energy.

# Application of Geospatial Techniques for Landslide Risk Modelling: A Case Study of Cox's Bazar District in Bangladesh

**Group:** Engineering and Applied Science **Project ID:** SRG-222418

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## Abstract

The south-eastern region of Bangladesh is likewise susceptible to landslide risks on a frequent basis. The study investigates the level, extent, and attributes of landslide risk in some selected areas of Cox's Bazar district. The study primarily utilized a quantitative research method for the purpose of risk assessment, and a qualitative research strategy was utilized in order to construct an explanatory risk profile. A systematic review of forty different papers is performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standards in order to gain a knowledge of the nexus between hazards, exposure, vulnerabilities, and risks. After that, a weight based on the Analytical Hierarchy Process (AHP) was developed for the factors of vulnerability and hazard. A method known as multi-criteria decision making (MCDM) was used to build a hazard exposure map using 12 different factors, and a vulnerability index value was calculated for each union. The danger map demonstrates that the distance to faults, roads, and rivers, as well as the amount of rainfall, slope degree, and soil permeability, all rise as elevation, rainfall, and slope degree increase, and vegetation decreases. The vulnerability map, the unions that are located extremely far from the district center are in a very precarious position. The vast majority of the unions in Cox's Bazar districts are classified as either moderately or extremely vulnerable. In the end, the hazard map and the vulnerability map are multiplied together to produce the risk map. According to the map, the area in the middle of the district has a high-risk zone, while the area to the east contains a moderate risk level, and the area to the north contains a low risk level. Around 60% of the total area of the district is classified as either intermediate or high risk.

**Keywords**: GIS, AHP, Vulnerability, hazard map.

# Time Series Soil Salinity Mapping using Satellite Remote Sensing Data and in Situ Measurements

**Group:** Engineering and Applied Science **Project ID:** SRG-222419

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## Abstract

Coastal areas of Bangladesh are affected due to Climate change. Again, climate change is affected due to soil salinity across the rural coastal areas. It is a significant problem that has been increasing in the last four decades. The issue of soil salinity substantially hinders crop production in coastal areas of Bangladesh. Therefore, a soil salinity assessment is essential for proper land use planning in agricultural crop production. This research intended to determine soil salinity mapping using satellite remote sensing data. For this study, observed electrical conductivity (EC) data are collected from SRDI, Khulna and four soil salinity indices are extracted using Landsat (OLI) data from USGS Earth Explorer. According to the observed data of EC, the maximum and minimum values represent the month of May and October respectively for all of the sites. The determination of the correlation coefficient between the observed EC and satellite-derived indices is satisfactory beyond 61% for maximum cases. Also, Correlation coefficients fit better for the Jalma union than the Batiaghata union. The remote sensing indices from the SI model have better performance in our present study. We can conclude that the soil salinity indices that have been applied are good enough to determine the soil salinity from the Landsat imagery for the study.

**Keywords**: Soil salinity, climate change, electrical conductivity, satellite data, salinity indices.

# Recovery of Functional Food Antioxidants from Food by Products (Fruits and Vegetables)

**Group:** Engineering and Applied Science **Project ID:** SRG-222420

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## Abstract

**Background:** Food safety and security are the leading global concern to mitigate the global mandate for the population wide-reaching by fronting challenges for the reduction of post-harvest losses. Current research investigation showed that almost 42% of food by-products befall throughout food revolution. The bases of food by-products are innumerable. **Objectives***:* The main sources of food antioxidants are the fruits and vegetables as well as their by-products. Moringa oleifera is a plant which is known as super food, and also as nutritional dynamite. Unadventurously, it has been traditionally using for the remedy of diabetes, long-lasting inflammation, bacterial, viral, and fungal infections; joint pain, heart health and also for cancer prevention. Current research was focused to elicit the suitable method to identify the food antioxidants compound form moringa. **Methodology***:* Our current research was focused to determine the exact antioxidant activity of moringa oleifera leaves. Predictably, for the determination of antioxidant activity, DPPH methods s popularly used. Nowadays, science has established that the method is based on spectrophotometric detection and the natural colorful exact which contain bioactive substance or antioxidant, is not really so suitable for the determination of antioxidant activity or capacity. Considering, those factors current research was focused to use novel electrochemical detection methodology for the determination of its antioxidant activity and capacity. As well as, the research was focused to determine the effect of solvent during extraction on its performance. *Research findings:* It was well established that there was no significant difference of acetone and hexane on extraction of moringa oleifera leaves extract on antioxidant activity and capacity. The method is rapid and simple as like the lab in chip. *Conclusion and future research route*: Future research will be focused on the consequence of other solvents based on novel electrochemical detection technique as well as conventional methods.

**Keywords**: Food antioxidants, recovery, food by-products, novel electrochemical technology.

# Chemical Modification of Cotton Fiber for Improving the Economic and Environmental Aspects of Cotton Knit Fabric Dyeing

**Group:** Engineering and Applied Science **Project ID:** SRG-222421

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## Abstract

Cotton fiber is very popular and unparalleled in textile global market for its comfortability, hygienic nature and biodegradable properties. Technically, it is comprised with cellulose which contains large amount of hydroxyl group in its surface. These hydroxyl groups generate surface negative potential while emerging in water. Consequently, the dyeing of cotton fiber is problematic with the traditional anionic dyes such as reactive dyes. The current study explores the chemical modification of cotton fiber with commercial and readily available cationic agent (Albafic Eco®) in a facile method in order to suppress negative potential of cellulose facilitating higher dye exhaustion without any auxiliaries. In this study, 100% cotton knit fabric was treated with several concentrations of Albafic Eco® ranging from 0.1% to 1%. Subsequently, the modified cotton fabrics were dyed with three reactive dyes: Novacron Navy EC-R, Novacron Ruby S-3R, and Novacron Yellow S-3B without any salts. The highest dye exhaustion more than 95% was achieved with the fiber modified with 0.5% Albafix Eco® concentration. To get the optimum dyeing time, modified cotton fabric was dyed in different time variations (30-90 minutes). The peak utilization for all three dyes was obtained in 60 minutes of dyeing time. The dyeing procedure was carried out at various temperatures to identify the appropriate dyeing temperature. As for all three dyes, the highest dye utilization is observed at 60°C. Color fastness to wash of modified cotton was good with rating 4 for color change and 3/4 for color staining. Color fastness to perspiration was also good enough, with a color change rating of 4/5 and a color staining rating of 4. This study could be the example of a cost-effective way of dyeing cotton with reactive dye that has minimal negative impact on the environment and highest dyestuff utilization.

**Keywords**: Salt free dyeing, exhaustion, reactive dyes, cationic fixing, environment friendly.

# Dyeing of Jute Fabric with Natural Colorants Extracted from Green Turmeric: A Green Approach of Jute Dyeing in Cottage Industry

**Group:** Engineering and Applied Science **Project ID:** SRG-222422

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## Abstract

Synthetic dyes conquered the natural colorants due to its outstanding properties of color matching, high clarities, better serviceability and ease of processing despite its adverse effect on environment. Jute fiber, the golden fiber of Bangladesh, is commercially dyed with hazardous synthetic dyes (especially basic dyes) which plays an adverse role on the environment. To overcome this issue, an attempt is made to apply an ecofriendly natural colorant extracted from green turmeric for the jute fabric to boost up the sustainable and cleaner wet processing of our golden fibre. The extraction of natural colorants from green turmeric and consequent dyeing is described here. The extraction was done by facile boiling of green turmeric paste at 100$^{o}$C for 60 minutes in aqueous, acidic and alkaline media. After that, the GT residue was separated from the solution with the nylon strainer in an acidic medium. Subsequently, jute fabric was dyed with the extracted green turmeric in exhaust dyeing method. To investigate the effects of different synthetic mordants, mordanting of jute fabric were done with potash alum [$Al_2K_2(SO_4)_4$], ferrous (II) sulfate heptahydrate ($FeSO_4.7H_2O$), copper (II) sulfate pentahydrate ($CuSO_4.5H_2O$), stannous (II) chloride pentahydrate ($SnCl_2.5H_2O$), potassium dichromate ($K_2Cr_2O_7$) and tannic acid ($C_{76}H_{52}O_{46}$). The impact of temperature, dyebath pH, mordants, and dyeing period were intensively observed for the above dyeing to get optimum dyeing conditions. The optimum conditions for jute fabric dyeing with the green turmeric extract were found as the temperature of 80°C, dyeing period of 20 min, and dyebath pH 4. **C**opper (II) sulfate pentahydrate, stannous (II) chloride pentahydrate and potash alum could be used as mordanting agent to produce bright color. Color strength (K/S) and chromacity (c) were used to explain the results. It was found that different mordants**,** dyeing period, temperature, and pH had great impact on the color strength and chromacity of the dyed jute fabric.

**Keywords**: Jute fiber; natural colorant; green turmeric; mordants; exhaust dyeing.

# Proxy Measurement of the Sediment Flux by Means of Seismic Noise in the Presence of the River Siltation and River Bank Erosion

**Group:** Engineering and Applied Science **Project ID:** SRG-222423

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## Abstract:

This study addresses the challenge of proxy measurement of sediment flux during severe river flooding using seismic noise, particularly in the context of river siltation and bank erosion. The objective is to predict hydrodynamic parameters and siltation locations through a hydrodynamic model and calculate seismic noise power based on modeled river discharge. Primary data, including seismic noise, salinity, temperature, and river discharge, was collected from the Karnaphuli River. A 2D Saint Venant equation was employed for river modeling to obtain river discharge data. Time series analysis of seismic noise and siltation mapping was conducted based on the modeled river discharge. Hydrodynamic modeling variables, such as depth-average velocity, water surface deviation, river discharge, and deviation of settling velocity of silt loam and clay, were used to predict sediment flux, seismic noise power, and siltation locations. The distribution of model and predicted variables, except for the silt-loam settlement map, showed coherent similarities, indicating proportional relationships. Seismic noise power in the siltation area ranged from -0.15 to 0.2, correlating with sediment flux, settling velocity, and depth-averaged water velocity. The study experimented with varying initial river discharge, revealing proportional changes in hydrodynamic variables and predictions based on modeled sediment discharge. In conclusion, the predicted seismic noise power provides valuable insights, demonstrating its correlation with sediment flux, settling velocity, and water velocity. This research contributes to the understanding of sediment dynamics in river systems, particularly during flood events.

**Keywords**: Sediment flux, seismic noise, hydrodynamic modeling, river discharge, siltation.

# Towards a Sustainable Flood Forecasting Approach Using Supervised Machine Learning Algorithms and Remote Sensing Data

**Group:** Engineering and Applied Science **Project ID:** SRG-222424

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## Abstract

**Background:** Bangladesh's frequent flooding challenges its development, highlighting the need for improved flood forecasting and management strategies. **Objectives:** To enhance flood prediction accuracy in the Barak River basin using advanced remote sensing and machine learning techniques. **Methodology**: The study was conducted at Kanaighat SW 266 and Sheola SW 173 stations (2020-2022), utilizing Synthetic Aperture Radar imagery from Sentinel-1 satellite and precipitation data. Machine learning algorithms, particularly Random Forest, were employed to analyze the data and predict water levels and flood occurrences. **Findings:** In the study, a Random Forest model was utilized, demonstrating a strong correlation with actual water level trends and effectively identifying most flood peaks with minimal outliers. The performance metrics at Kanaighat SW 266 indicated training RMSE (Root Mean Square Error) and MAE (Mean Absolute Error) values of 0.98 and 0.53, respectively, with testing values at 1.09 for RMSE and 0.76 for MAE. Similarly, at Sheola SW 173, the training RMSE and MAE were recorded as 0.98 and 0.52, with testing values of 1.05 and 0.71. These results underlined the model's robust capability in predicting flood events, even with limited input parameters. However, the study acknowledged the potential for further enhancement in predictive accuracy. This improvement could be achieved through the adoption of more sophisticated machine learning algorithms and the expansion of the dataset through integration of multiple remote sensing sources. Additionally, socioeconomic surveys conducted alongside the technical analysis highlighted the urgent need for effective early flood warning systems. Such systems could play a crucial role in mitigating the impacts of floods and reducing associated damages, as indicated in the study. **Conclusion:** This research highlights the effectiveness of combining remote sensing with machine learning for flood forecasting in Bangladesh, significantly contributing to disaster preparedness and mitigation efforts.

**Keywords**: Remote sensing, flood forecasting, machine learning, radar, sentinel 1.

# Spectroscopic' Thermal' Electrochemical Properties and New Insights into the Substitution Reaction of Chromium (III) Complexes

**Group:** Engineering and Applied Science **Project ID:** SRG-222425

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## Abstract

**Background:** Chromium supplements of chromium(III) tris(metionate) (mer-[$Cr(me)_3$]), may enhance glucose metabolism and improve blood glucose and cholesterol levels in type 2 diabetics. **Objectives:** This project aims to validate or refute existing theories and identify alternative mechanisms for chromium(III) tris(metionate) (mer-[Cr(me)3]) impact on glucose metabolism and Type 2 diabetes treatment, determining whether they are beneficial or harmful. **Methodology:** (1) *Experimental Methods* - Various methods, including elementary analysis, atomic absorption spectroscopy, HPLC, UV-Vis, ATR-FTIR, EPR, Raman spectroscopy, ESI-mass spectrometry, and computational techniques, were employed to thoroughly characterize Chromium(III) tris(metionate) (mer-[Cr(me)3]). (2) *Computational Methods* - DFT calculations in Gaussian 16 optimized chromium(III) tris(metionate) (mer-[Cr(me)3]) geometries in gas and solvent phases. HOMO and LUMO energies were calculated using minimized high-spin geometries for ground state approximation. PCM evaluated the solvent (water) effect on complex structures and energies. **Findings:** Chromium (III) tris(metionate) (mer-[$Cr(me)_3$]) was synthesized and characterization by elemental analysis (% C, H, N, and Cr) and electrospray mass spectrometry (ESI-MS) data confirm the formation of the mer-[$Cr(me)_3$] complex. In particular, the ESI mass spectrum of mer-[$Cr(me)_3$] complex (Figures 1) shows a peak at m/z = 497.0976 (calc. m/z = 497.0780), corresponding to [$Cr(me)_3 + H^+$] for the Cr-52 isotope. In our work , the solid-state UV-Vis spectrum of the synthesised mer-[$Cr((me)_3]_0$ complex revealed two spin-allowed d–d transitions with absorption bands at 390 nm and 530 nm as shown in Figure 2. However, these studies have shown that the absorption spectra of Cr(III) complexes synthesis can have significant solvent and pH dependence change wavelength sifting. **Conclusion:** This study successfully synthesized and characterized tris-methioninatochromium(III) complexes ($Cr(me)_3$) using various analytical techniques. Theoretical and experimental vibrational frequencies matched closely, and thermal analysis revealed gradual structural changes during decomposition. The findings offer insights into potential protein interactions and oligomerization, warranting further in vivo studies.

**Keywords**: HPLC, UV-Vis, ATR-FTIR, EPR, Raman, ESI-mass spectrometry, DFT.

# Harvesting Natural Bioactive Compounds from Food-Waste Bacteria for their Therapeutic Activities against Neurodegenerative Disorders Including Stroke in Mice Model

**Group:** Engineering and Applied Science **Project ID:** SRG-222426

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## Abstract

**Background**: Impaired motor and cognitive functions are hallmark features of Parkinson's disease (PD). MMP9, p38 MAPK, and extracellular calcium have previously been implicated in PD. **Objectives:** The current study aims to understand the impact of TH treatment in mouse model of PD and its association with MMP-9 and p38 MAPK/ERK signaling. **Methodology**: Mice were induced with PD through intraperitoneal injection of rotenone, followed by oral administration of TH twice daily for 13 days. Behavioral assays assessed motor and memory functions, while brain samples were analyzed for oxidative stress markers. Enzyme-linked immunosorbent assays quantified p38 MAPK, p-ERK1/2, and cytochrome C levels. **Findings**: As the Golgi-Cox stain visualizes neurons, and H&E staining studied immune cell infiltration theoretical techniques such as Frontier Molecular Orbital Analysis, molecular docking, and molecular dynamics simulation were employed to understand TH's calcium ion channel specificity and MMP-9 inhibitory capacity. TH possesses potential inhibitory properties against MMP-9 along with N and L-type calcium channels. It improved motor function, although memory function was unaffected in mice with PD. When treated with TH, decreased immune cell infiltration in brain tissue and increased antioxidant properties were noted. Consequently, TH administration reduced cell death and enhanced dendritic spine density by titrating the brain's p38 MAPK and p-ERK1/2 concentration. **Conclusion**: TH inhibits MMP-9 and enhances dendritic spine density via p38 MAPK and ERK1/2, leading to improved outcomes in a mouse model of Parkinson's disease.

**Keywords**: Tolperisone hydrochloride, MMP-9, dendritic spine, p38 MAPK, ERK1/2.

# GPU Optimized Lattice Boltzmann Simulation of Convective Heat Transfer and Entropy Production of Two-Phase Nanofluids

**Group:** Engineering and Applied Science **Project ID:** SRG-222427

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## Abstract

This study investigated the convective heat transfer and entropy production in two-phase nanofluids using advanced computational simulations. The utilization of GPU-optimized lattice Boltzmann methods provided a high-performance framework for analyzing the complex behaviors of nanofluid flows, especially focusing on convective heat transfer mechanisms and entropy generation. Nanofluids, comprising nanoparticles dispersed in a base fluid, exhibit promising thermal properties for various industrial applications. However, understanding their heat transfer characteristics and associated entropy production is crucial for optimizing their efficiency. The lattice Boltzmann method (LBM) was employed due to its capacity to model complex fluid dynamics, especially when dealing with two-phase flows and nanoscale materials. The GPU optimization significantly enhances computational efficiency, allowing for intricate simulations of nanofluid behavior within convective heat transfer scenarios. The research investigates the impact of varying nanoparticle concentrations, sizes, and their dispersion on heat transfer characteristics, focusing on convective mechanisms. Additionally, entropy production, as a measure of thermodynamic irreversibility, is analyzed to understand the efficiency and limitations of these nanofluid systems. This involves exploring the relationship between convective heat transfer enhancement and the associated increase in entropy generation. The findings from this study offer insights into the intricate interplay between convective heat transfer, entropy production, and the nanofluid properties. Furthermore, the utilization of GPU-optimized lattice Boltzmann simulations demonstrates a powerful computational framework for studying and optimizing nanofluid-based thermal systems. The results obtained can be pivotal in advancing the design and efficiency of thermal management systems, especially in contexts where nanofluids play a crucial role.

**Keywords**: Heat exchangers, parallel computing, heat transfer, thermodynamics, nano and ferro fluids.

# Design and Development of a Compact High Gain Microstrip Patch Antenna for 5G Communication Applications

**Group:** Engineering and Applied Science **Project ID:** SRG-222428

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## Abstract

This research project responds to the surging demand for efficient 5G communication antennas by designing a novel compact dual-band Y-shaped monopole patch antenna with the primary objective of covering critical Malaysian 5G frequency bands while achieving high gain and wide bandwidth. The comprehensive research methodology encompasses design, simulation, fabrication, and testing to accomplish these goals. Findings reveal the antenna's success in achieving dual-band coverage from 3.20 to 4.60 GHz and 5.10 to 9.90 GHz, boasting a peak gain of 4.16 dBi and remarkable 92% efficiency across a 620 MHz bandwidth. This compact dual-band antenna offers a promising solution for 5G wireless applications, meeting stringent modern 5G communication requirements and laying a robust foundation for wireless technology advancement in the 5G era and beyond. The project's motivation stems from the rapid expansion of wireless communication and the increasing demand for faster, reliable connectivity in the 5G era, where the proposed compact high-gain microstrip patch antenna is tailored to meet the unique requirements of 5G communication applications, overcoming the limitations of traditional antenna designs, and ensuring efficient signal transmission over longer distances in high-frequency, high-data-rate 5G environments, making it ideal for integration into modern wireless devices and addressing the challenges of efficient 5G signal transmission in urban areas with signal-obstructing obstacles.

**Keywords**: 5G, wireless communications, patch antenna, FR-1, N77, radiation patterns.

# Deep Learning-based Hand Gestures Recognition for Non-touch Interface in Industrial Environments

**Group:** Engineering and Applied Science **Project ID:** SRG-222429

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## Abstract

In recent years, the focus on hand gesture recognition has increased significantly. This field of study remains significant importance in various domains such as sign language recognition, industrial settings, interfaces that do not require physical contact, and the development of robotic movement. However, different hand shapes, environmental situation and lighting conditions present a challenge for hand gesture recognition. Therefore, this paper proposes a deep learning-based hand gesture recognition technique that provides a reliable and efficient non-touch interface in industrial environments. In this instance, a dataset comprising of 10 distinct hand gestures (left, right, up, down, hi, bye, open, close, thumbs up, thumbs down) was generated and subsequently employed for the purposes of training and testing. This was accomplished through the implementation of preprocessing techniques and augmentation methods. We resized and scaling the input images for data preprocessing. Rotation (10 degree), horizontal flip (FlipIr), and brightness are considered in the augmentation process. The features are extracted using ImageNet and Regnet50v2, while the hand gestures are classified using Convolutional Neural Network. Experimental results show that the proposed CNN with ImageNet, CNN with resnet50v2 and CNN achieved 99.31%, 98.34% and 96.54% hand gesture recognition, respectively.

**Keywords**: Hand gesture, non-touch interface, neural network, deep learning.

# Development of Novel Ultrasensitive Magnetic Immunoassay Technique for the Detection of Biological Targets for Biomedical Applications

**Group:** Engineering and Applied Science **Project ID:** SRG-222430

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## Abstract

The ultrasensitive magnetic Immunoassay technique has many advantages. One is a high resolution of the immunoassay, which can be realized by utilizing the ultra-sensitivity of the VSM. A resolution of about 10 times better or more than the commonly used Immunoassay technique. In light of super para magnetism and other distinctive features of $Fe_3O_4$ marker widely employed for many biomedical applications. Due to its tendency to aggregate post-synthesis, the key challenge in this situation is to obtain and control the optimum particle sizes and morphologies. Stabilizers such oleic acid, citric acid, 3-amino propyl, tri-ethoxy silane, etc. can be used to solve this issue. Co-precipitation method was employed for synthesizing magnetite with various concentrations of oleic acid (OA) stabilizer. To make oleic acid-coated and naked IONPs, the precursors of ferric chloride anhydrous ($FeCl_3$ anhydrous) and ferrous chloride tetrahydrate ($FeCl_2.4H_2O$) was used and ammonium hydroxide ($NH_3OH$) was used as a reducing agent. The concentrations of OA used were 0.75, 1.0, 1.5, and 1.75% v/v. The produced $Fe_3O_4$ nanoparticles under all processing conditions were characterized using XRD, FTIR, VSM and TGA, Particle morphology and size was examined using SEM. The results have shown that, when compared to other additions, 1.75% OA offered the best coating and morphology. The typical size of naked IONPs was in the range of 60 nm. The average value of the crystallites was 11.09052 nm. The outcomes of VSM show that $M_s$ (saturation magnetization), $M_r$ (remanent magnetization), and $H_c$ (coercive force) were high in the uncoated sample and gradually drop up to 1.25% of oleic acid before increasing once again with 1.50% of the OA sample. The TGA results showed that 1.25% of the OA sample loses the most weight when the temperature rises steadily. The FeO bond was discovered to be present in every sample after FTIR analysis.

**Keywords**: Nanoparticles, synthesis, characterization, oleic acid, bio-nanotechnology.

# Personalized Home-based Physiotherapy and Rehabilitation Assistant

**Group:** Engineering and Applied Science **Project ID:** SRG-222431

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## Abstract

In the COVID-19 situation, many physiotherapy patients have been suffering to conduct their regular in-person clinic-based rehabilitation programs. In Bangladesh, the situation is even worse for especially elderly and seriously paralyzed/bone-broken patients due to unhygienic hospital condition and heavy traffic. Home-based rehabilitation programs are slowly, but surely becoming essential alternatives in this regard, which however needs stable and credible automated systems. Such a solution needs to involve physiotherapists in the process in order to monitor the progress of patients while providing effective patient-recommendations. In this proposal, we present a combined Computer Vision and AI-based solution for at-home personalized physiotherapy and rehabilitation programs. In the proposed work, a therapist can customize a personal rehabilitation plan for a patient, especially consisting of a set of recommended exercises. A patient is expected to perform these exercises at home in front of an available camera device (e.g., webcam, mobile camera etc.). Once the system receives user's exercise image/video, it first estimates the user's body pose with a preset pose-estimation method. Poses are fed to a Deep Neural Network to classify user's prescribed exercise followed by assessing the performed exercises. Exercise assessment report can then be forwarded to both the therapist and the patient for progress-monitoring purpose. Using this solution, patient can easily continue his rehabilitation program with a therapist without even paying a direct visit to him. In this way, patients and therapists, both are the expected beneficiaries in our solution. Our proposal is generic, and can be applied globally to solve the problems of in-person clinic-based rehabilitation programs.

**Keywords**: Physiotherapy, AI-monitor, rehabilitation, computer vision, at-home assistant.

# Design of Organic and Perovskite Solar Cells towards Higher Quantum Efficiencies using Semiconducting Thin Film Optics Simulation (SETFOS) Software

**Group:** Engineering and Applied Science **Project ID:** SRG-222433

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## Abstract

SETFOS is a simulation software focused to the design of optoelectronic thin-film-based technologies and to predict the organic and perovskite solar cell performances. The objective of this work is to make contribution in the efficient device fabrication after optimizing Organic and Perovskite photovoltaic device structures. The absorption module has been used to find the maximum light absorption in the devices with varying the layers of different thicknesses and different active materials. Prediction of device characteristics and fitting experimental data have been performed by the drift-diffusion module. By optimizing the absorbance and photocurrent in glass/ITO/PEDOT/P3HT : PCBM/Al photocell, we find that a thickness 100 nm is ideal for the P3HT:PCBM blend with 82% external quantum yield in the wavelength of 350nm which is in excellent agreement with experimental results. Changing the layers' thickness of the perovskite absorbers from 100 nm to 500 nm as well as the absorber layers of varying band gaps ($E_g$) Methyl ammonium lead bromide ($MAPbBr_3$) and Methyl ammonium lead iodide ($MAPbI_3$). Results from absorption and scattering module guided us to fix the layer thickness to 300 nm of $MAPbI_3$ perovskite device as its PCE is 13.19% and absorption is from 350 nm to 750 nm wavelength of light. We chose the wide band gap $MAPbBr_3$ of $E_g$ of 2.3 eV that absorbs only the photons of higher energies and the narrow band gap $MAPbI_3$ of $E_g$ 1.54eV that absorbs the lower energy photons to design a perovskite/perovskite tandem solar cell where PSC with $MAPbBr_3$ considered as the top and PSC with $MAPbI_3$ as the bottom cell that shows good absorption of light in visible region. For higher PCE, the choice of absorption layer and charge transport layer of optimized thicknesses is important. Our work provides a potential direction towards fabricating organic and perovskite solar cells.

**Keywords**: External quantum efficiency, drift-diffusion module, charge transport layer, power conversion efficiency, photovoltaics.

# Spatial Distribution of Absorbed Dose and Heavy Metal Concentrations in the Soil of Chandpur and Cumilla Districts of Bangladesh and Resultant Health Hazards

**Group:** Environmental Science **Project ID:** SRG-223434

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## Abstract

**Background**: Measurements of nuclear radiation and heavy metal concentrations are important for the safety assessment of the inhabitants and environment of a specific area. **Objectives**: The objectives of this study are to investigate the NORMs and heavy metal concentrations in soil samples collected from Chandpur and Cumilla Districts. **Methodology**: In this study, we performed sampling by systematic gridding from the unmeasured Cumilla and Chandpur districts. Radioactivity and heavy metals are measured by HPGe and atomic absorption spectrophotometry (AAS), respectively. Finally, ArcGIS was used for spatial distribution. **Findings**: The measured average value of the activity concentrations of $^{226}$Ra, $^{232}$Th and $^{40}$K were 27.30±5.41, 46.09±7.88 and 362.50±48.10 Bq.kg$^{-1}$, respectively. There was no trace of $^{137}$Cs or any other anthropogenic radionuclides in these locations. Radium equivalent activity ($Ra_{eq}$) and representative level index ($I_{\gamma r}$) have also been measured and found with the average value of 121.12±23.71 and 0.88±0.17 Bq.kg$^{-1}$, respectively. Absorbed dose rate and annual effective dose were found 55.57±10.78 nGy.h-1 and 0.07±0.01 mSv.a-1, respectively. The cancer risk was also estimated as excess of lifetime cancer risk (ELCR) for adult with an average value of 0.24±0.05. All the measured values are within the acceptable limit. The results of heavy metal analysis showed that Ni and Cu exhibited the highest concentrations and Cd exhibited the lowest concentrations. The mean concentrations of Ni and Cu were found to be 1.359 and 0.800 mg/kg, respectively. The maximum concentration of Ni detected in the soil samples was 3.081 mg/kg, which exceeded the safe limit set by regulatory agencies. **Conclusion**: After the measurement of all radiological and heavy metal parameters, the spatial distribution maps of the concentrations and absorbed dose-rate were made by ArcGIS.

**Keywords**: NORMs; Environmental radiation, ArcGIS, health hazards, effective dose.

# Comparative Study of Natural Radioactivity Content in Tiles Made in Bangladesh and Imported from Abroad

**Group:** Environmental Science **Project ID:** SRG-223435

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## Abstract

Tiles are the most common decorative building materials used in Bangladesh. For the safe use of tiles at home and workplace it is required to select tiles properly on the basis of radiation dose due to radon and gamma emission. Among various tiles available in the market, 25 different types of tiles were collected for this experiment. Collected tiles are then ground and stored in sealed cans for secular equilibrium. To measure gamma activity due to the radionuclides $^{226}$Ra, $^{232}$Th, $^{40}$K, High Purity Germanium (HPGe) detector was used. To store radon gas emitting from tiles, a big box was used. The activity concentration was then measured by a radon detector (RadonEye) by placing it inside the box. It was observed that $^{226}$Ra, $^{232}$Th, $^{40}$K activity varies from 45 – 89 Bq/Kg, 77 – 110 Bq/Kg, and 321 – 694 Bq/Kg. The radium equivalent activity varies from 198.32 – 280.46 Bq/Kg which is less than the recommended value of 370 Bq/Kg set by UNSCEAR. The activity concentration of radon varies from 31 – 71 Bq/m$^3$. This is lower than the 300 Bq/m$^3$ recommended by ICRP. The radon exhalation rate varies from 0.179 – 0.409 Bqm$^{-2}$h$^{-1}$. To assess radiological hazards associated with the tiles samples air absorbed dose rate, internal and external hazard index, gamma index, annual indoor and outdoor effective dose rate, and dose due to radon were also calculated. Though the estimated values for both external (gamma) and internal (radon) hazards are below the recommended values, they may be safe for adults. As children have thinner skin and breathe more air due to high breathing frequency, they may receive more radiation than adults. Moreover, because of their developing bodies and long-life expectancy post-exposure, they are at a greater risk.

**Keywords**: Radionuclides, tiles, radon, tiles radiation, tiles health hazard, radon exhalation.

# Toxicity of the Novel Insecticide Emamectin benzoate and Lufenuron to Bees and other Pollinators : An Ecological Perspective

**Group:** Environmental Science **Project ID:** SRG-223436

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## Abstract

Beekeepers in Bangladesh are dependent on mustard for harvesting honey. Insecticides are often used indiscriminately on bee colonies that are brought into mustard fields for honey and pollination purposes. Therefore, attempts were made to carry out the assessment on the toxicity of emamectin benzoate 5 SG and the benzyl urea group insecticide lufenuron at 5% to workers bee *A.mellifera*. Toxicological risk assessments were conducted to determine the likelihood of how a given pesticide would impact honey bees, primarily considering the survival of adult bees exposed to the pesticide. However, larvae are also exposed to pesticides, as their diets can contain contaminated nectar and pollen collected by foragers. To understand the effect of pesticides on honey bee larvae, commercial formulations of emamectin benzoate and lufenuron were serially diluted from the recommended concentration. For acute toxicity, 25 µL of the desired concentration of pesticides in the diet was fed to the 4-day-old larvae. The mortality of larvae was monitored until the 7th day. For chronic exposure to larvae toxicity, residue-level concentrations of pesticides were exposed from the 2nd to the 5th days. Among the two pesticides tested chronically, honey bee larvae were highly sensitive to emamectin benzoate, killing more than 40% on the 5th day at 30 and 65 ppb. Assessing the risk of a pesticide to adult bees using the effects after exposure showed 20 percent mortality in emamectin benzoate 5 SG at 100 and 120 g/ha, while 130 g/ha caused 30.00 percent at 12 (Hours after Treatment) HAT, and it increased to 36.67, 40.67, and 53.30 percent, respectively, after 24 HAT. However, standard insecticides, lufenuron 5 EC at 650 ml/ha, caused increased mortality to 35.00 percent, respectively. The mortality increased as the time of exposure increased from 12 to 24 HAT. These results show that exposure of larvae to emamectin benzoate results in negative effects on the survival of bees, possibly compromising the dynamics of the colony and contributing to the decline of bee populations.

**Keywords**: Toxicity, emamectin benzoate, lufenuron, bees pollinators and ecological perspective.

# Silicate Slag and Organic Amendments in Tea Soil to Minimize Greenhouse Gases Production' Emissions and Influencing Soil Microbial Community Structure as Well as Tea Plant Growth Under Different Soil Moisture Contents

**Group:** Environmental Science **Project ID:** SRG-223437

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## Abstract

Experiments were conducted under Incubation and in tea planted potted soils to investigate the effects of soil amendments on young tea plant growth and GHGs emissions. Biochar, Vermicompost and Ca Silicate were applied in the selected potted soil one week prior to tea transplanting. The experimental treatments were designed with different combinations of NPK with Biochar, silicate fertlizer and Vermicompost at 100% and 50% field capacity soil water contents. Gas samples were collected from incubation and tea planted potted soils, which were analyzed in Gas Chromatograph. The 25% replacement of chemical fertilizer (NPKS) with biochar, vermicompost and Ca silicate enhanced tea plant growth parameters such as plant height, branches/plant, LAI, $CO_2$ assimilation, SPAD reading values and proline accumulation in tea leaves. The maximum fresh wt. was recorded in BT21 followed by BT18, BT8 and BT2 with biochar and Ca silicate amendments under 100% FC water contents. On the other hand, proline accumulation in fresh leaf increased under water stress condition. The maximum proline content was recorded in BT2 and BT18 clonal leaf followed by BT21 and BT8. Furthermore, soil amendments with biochar, vermicompost and Ca silicate significantly improved soil pH, redox status (Eh), soil organic matter, T-N, available P, available S and exchangeable $K^+$, however decreased $CO_2$ and $N_2O$ production rates as well as annual emissions of GHGs. Conclusively integrated application of biochar, vermicompost and Ca silicate with optimum chemical fertilizers (75% NPKS) could be a feasible strategy to reclaim acidic tea soils and sustaining tea growth productivity, while decreasing GHGs emissions.

**Keywords**: Biochar, vermicompost, Silicate fertilizer, fresh leaf, proline, GHGs, tea soil.

# Development of Molecular Biomarker through Identification of Heavy Metal Resistance Genes in Fish for Environmental Bio-Monitoring

**Group:** Environmental Science **Project ID:** SRG-223438

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## Abstract

**Background**: To date, only a few studies have focused on the impact of heavy-metal occurrences in the fish, their feed and environment but no specific investigation on the impact of pollution at gene level in Bangladesh. **Objectives**: The main objective is to to identify the putative candidate genes to investigate the effects of heavy-metal contamination in fish for bio-monitoring purposes. **Methodology**: Ø Sample collection and heavy metal analysis in natural source for screening purposes. Ø Experimental exposure for Cr deposition in Koi fish (90 days) and detection of deposition in gill, liver and muscle. Ø Molecular analysis (RNA expression and NGS) of all samples to detect heavy metal resistant genes. 4. Findings (170-200 words): The preliminary finding of this project observed the natural and experimental deposition of harmful heavy metals in fish body and their environment. In the present study, heavy metals were found in almost all samples (Water, Soil) of both rivers-Turag and Dhaleshwari including fish gill, liver and tissue samples which is as an indication natural contamination due to environmental pollution. Cr was observed higher than the recommended dose in water (3.87ppm) and gill (1.15ppm) and liver (2.26ppm) of Shing fish (Dhaleshwari River). Concentrations of Cd (13.58ppm) and Pb (40.26ppm) were highest in the gill of Koi fish (Turag River). As was present but below recommended level. In experimental condition, accumulation of Chromium (Cr) in fish increased with time and dose (Biomagnification). Deposition of Cr was highest in fish muscle (Bioaccumulation). Blood haemoglobin and glucose level shows decreasing trend with higher concentration of Cr (Haematogical effect). Protease activity also decreased with higher dose of Cr (Enzymatic effect). The Pearson correlation showed negative correlation of overall weight gain, SGR, FCR with Cr deposition in fish body. Primarily, RNA expression of Cr exposed fish tissue was higher than control for selected candidate genes indicating the effects heavy metals on fish genetics, may be due to environmental pollution. **Conclusion**: The specific biomarker candidate genes will be confirmed after NGS of most up-regulated or down regulated RNA expressed fish, exposed with toxic heavy metals.

**Keywords**: Molecular biomarker, heavy metal resistance gene, fish, biomonitoring.

# Eco-friendly and Sustainable Mosquitocide from *Lysinibacillus spp* Bacteria

**Group:** Environmental Science **Project ID:** SRG-223439

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## Abstract

With the increase in number of adverse outcome of pests in human life and environment, the need of new agents to combat against these pests is of dire need. Some bacteria are known to produce toxins against selective pests without damaging other natural components. Such pesticidal activity in bacteria has gained an immense attention in the field of research for new bio control agents. The main aim of this study was to isolate, identify and characterize bacteria from plant roots of *Citrus limon* and evaluate the presence of any pesticidal property within it. Characterization of isolated bacterial culture was established by morphological and whole genome sequencing approaches. The Gram staining and Biolog tests provided the identification of a rod-cocci shaped, Gram-positive and aerobic bacteria which might be either *Brevibacillus* or *Lysinibacillus* species on the basis of similarity distance data of other bacteria. Whole genome sequencing by using next-generation sequencing (NGS) approaches allowed genome analysis which revealed that strain BCSIR _*lysinibacillus*_1 was very similar to *Lysinibacillus sphaericus* and is phylogenetically related to *Lysinibacillu*s spp. Further, the genome data analysis reported that one of the biosynthetic gene clusters (BGC), Type III polyketide synthase (T3PKS) might be responsible for pesticidal activity while another BGC betalactone responsible for fengycin production, has antifungal and antimicrobial properties. Furthermore, for the evaluation of proteinase and lipolytic activity, the isolated *Lysinibacillus* spp. showed positive results for protease activity in casein and lipolytic activity only in soybean oil. Laboratory scale cell mass production was accomplished for in vivo analysis to observe pesticidal activity of *Lysinibacillus* spp. and quantified for further future analysis.

**Keywords**: Soil-bacteria, NGS, bio-larvicide, lipolysis, bioassay.

# Dissolving Pulp and Furfural Production from Jute Stick

**Group:** Environmental Science **Project ID:** SRG-223440

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## Abstract

**Background:** Bangladesh Jute Mills Corporation (BJMC) requested to study dissolving pulp from 15% jute fiber and 85% jute stick. **Objective:** To prepare rayon grade pulp and furfural by pre-hydrolysis soda AQ pulping process from a mixture of jute stick and jute fiber. **Methodology**: (1) Water pre- hydrolysis was carried out at 150 and 160$^{o}$C for 60, 90 and 120 min. (2) Prehydrolysed mixture was cooked by soda-anthraquinone process and bleached by $D_0(EP)D_1(EP)D_2$ sequences. (3) The reactivity of the dissolving pulp was tested. (4) The dissolved hemicellulose in the prehydrolysis liquor was converted to furfural by varying acid concentration (0.002N to 1.0 N $H_2SO_4$), temperature (150 to 180°C) and time (10 to 180 min). **Findings:** *Prehydrolysis*-The prehydrolysis yield slightly increased with increasing jute fiber proportion in jute fiber-stick mixture and decreased with increasing temperature and time. The prehydrolysis yield of 15% jute fiber and 85% jute stick mixture was 82.3% at the condition of 160°C for 60 min. *Pulping*-The overall pulp yield was 30.7% with kappa number 14.8 at the conditions of 18% alkali charge for 2 h cooking at 170°C. *Bleaching*-The pulp brightness was 82.3% in $D_0(EP)D_1$ and 86.7% in $D_0(EP)D_1(EP)D_2$. The α-cellulose content in bleached pulp was 94% with residual pentosan content of 4.64%. *Cold alkali extraction*-The purity of pulp increased to 95.26% from 94.05%. *Furfural yield*-The maximum furfural yield (60.5%) was obtained at the conditions of 0.1 N $H_2SO_4$ for 60 min at 170$^{o}$C. **Conclusion:** In soda-AQ process, 18% alkali charge was required to get pulp of 30.7% yield with kappa number of 14.8, and purity of 94.05% α-cellulose. The PHL contained 5.07% xylose, which was converted to furfural with high yield (60.5%).

**Keywords**: Jute, α-cellulose, prehydrolysis liquor, furfural yield, xylose.

# Isolation and Characterization of Microbiomes and Their Impact in Agar Formation within Agarwood Tree

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## Abstract

**Background:** Isolation of microbes from the agarwood tree is to find out the association of microbial agents in formation of sweet fragrant resin within it. **Objectives:** To identify the microbe susing molecular tools as well as to determine which factor is responsible for agar formation. **Methodology**: (1) PDA media was used to isolate the fungi from. (2) The cultured fungi isolated from the collected chips were sub-cultured onto PDA containing petridishes and incubated flowingly. (3) After 7days pure culture of fungi was identified using taxonomic tools and one specific fungus was inoculated within the agarwood tree. **Findings:** Identification of isolated fungi- (a) Total 12 fungi were isolated and identified from the agarwood tree in Moulovibazar. (b) These were identified (Morphologically) with taxonomic tools viewing under microscope. On the other hand, molecular technique was applied to identify the isolated fungi. Formation of agar within the agarwood tree- (a) Agaris formed within the tree after four months of inducement. (b) This fungus induced wood pieces gave sweet fragrance and brown coloration which indicates the formation of agar due to fungus inoculation. **Conclusion:** The quality of artificially extracted agar oil is not pure as through natural process. So, inoculation of isolated fungi within the tree is one of the most important biological techniques to get good quality agar oil.

**Keywords**: Agar oil, inoculation, bacteria, fungus, PDA.

# Development of Third Generation Material-Driven Lignocellulosic-Feedstock Biorefinery System: Chemical Modification of Alkali-Lignin

**Group:** Environmental Science **Project ID:** SRG-223442

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## Abstract

The intrinsic properties of unprocessed lignin make direct use of it in sophisticated applications challenging. New chemical properties must be introduced into lignin in order to overcome these drawbacks. In this work, a new method has been developed for continuous production of acetobrominated alkali-lignin with higher bromine contents by acetylation, benzylic bromination and the bromination in aromatic ring of the monolignols, concurrently. Scanning electron microscopy-energy dispersive X-ray spectroscopic study showed the bromine levels in the synthesized products were substantially higher in comparison to acetobrominated alkali-lignin made using conventional method, i.e., acetobromination of lignin using acetyl bromide in acetic acid medium. In contrast to conventional method, the new method dramatically increased the percentage of C-Br bonds, while the amounts of the aromatic rings' C-H bonds reduced, as an indication of the aromatic ring bromination along with increased acetyl group in the lignin structure, according to x-ray photoelectron spectroscopic analysis. $^{1}$H and $^{13}$C-Nuclear magnetic resonance spectroscopic studies also supported these phenomena by showing the decreased intensity of aromatic protons in the monolignols and the presence of acetate groups in lignin structure, respectively. Infrared spectroscopy, Field emission-scanning electron microscopy, UV-Vis spectroscopy, simultaneous thermal analysis and dilute solution viscometry were performed to evaluate the molecular properties of acetobrominated products. Plausible mechanism of the new acetobromination method has also been elucidated. Overall studies demonstrated the potential of new acetobromination method as a lignin modification tool for the commercialization of technical lignin.

**Keywords**: Alkali-lignin, acetyl hypobromite, photoelectron spectroscopy, electron microscopy, thermal analysis.

# To Scale-Up the Activity of Activated Carbon Based Sorbents for $CO_2$ Capture

**Group:** Environmental Science **Project ID:** SRG-223443

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## Abstract

Global warming is accelerated by air pollution. Carbon dioxide ($CO_2$) is the primary greenhouse gas contributing to global climate change. The development of solid sorbents, such as activated carbons, to capture carbon dioxide ($CO_2$) is currently driven by concerns regarding the reduction of global carbon emissions. The effectiveness of adsorption is frequently impacted by the preparation method and selection of source materials. Utilizing agricultural byproducts, such as corn cobs, for producing activated carbons for carbon capture is an economically viable approach. This study examines activated carbon production using corn cob biomass as a low-cost and readily available material. The activation process involved treating the biomass with KOH at two different ratios (1:1 and 1:3) and a temperature of 850°C. Adsorption experiments were conducted at time intervals of 5, 10, and 20 minutes, followed by a 60-minute desorption process at a temperature of 105°C. The adsorption rate initially increased from 5 to 10 minutes, gradually declining until reaching $CO_2$ saturation at 20 minutes. A steady decrease in the desorption of $CO_2$ was observed over the specified adsorption periods. The maximum adsorption was observed at 10 minutes for both MAC-1 and MAC-2. Conversely, the highest desorption was observed at 5 minutes in both samples. The activated carbon sample MAC-2 was prepared by adding solid KOH pellets directly to the biochar at a 1:1 activation ratio. This sample exhibited the highest $CO_2$ adsorption of 1.523 mmol/g or 0.067 g signifying the potential efficiency of corn cob for $CO_2$ adsorption.

**Keywords**: Adsorption, activated carbon, waste biomass, emission gas, chemical treatment.

# Fabrication of Environment Friendly Lead-free Perovskite Solar Cells

**Group:** Environmental Science **Project ID:** SRG-223444

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## Abstract

Renewable energy sources are the most intensely studied topic nowadays, as developed and developing countries across the world worrying about global warming due to pollution as well as limited sources of fossil fuels. Solar cells are the most popular renewable energy source as it uses solar energy and so many other benefits. Lead-free perovskite solar cells have emerged as a promising alternative to traditional lead-based counterparts, addressing environmental concerns and toxicity issues. In this study, a lead-free perovskite-based solar cell was fabricated using cesium iodide and stannic iodide and characterized their properties. FE-SEM showed a smooth, uniform, and large-grained perovskite layer. XRD revealed highly crystalline perovskite layers. All the physical and optical properties pave the way for high-performance solar cell fabrication. Perovskite solar cells based on these fabricated layers will be fabricated and tested for stability and high performances.

**Keywords**: Renewable energy, global warming, large-grain, solar cell, device fabrication.

# Utilization of Chrome Containing Leather Waste in Development of Metal Based Green Composite Material

**Group:** Environmental Science **Project ID:** SRG-223445

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## Abstract

In Bangladesh, a huge amount of solid wastes generated during leather processing, are dumped on land or river and cause critic environment and severe health problems. One metric ton of raw hide generates about 200 kg of finished leather, 200-250 kg of tanned solid waste, 200-350 kg of non-tanned waste and 100 kg is lost as wastewater. Leather processing generates a huge amount of chromium (Cr) containing wastes and one of them is chrome shavings (CS), which frequently end up in landfills. It may be harmful to the environment and human health due to the oxidation of Cr(III) to poisonous Cr(VI). Herein, CS and polyvinyl alcohol (PVA) are used for the preparation of flexible CS-PVA composite sheets, using CS as a skeletal and PVA as a cross-linker by a simple and facile technique. CS-PVA composite sheets are characterized by FT-IR, SEM, STA and UTM. FT-IR analysis of CS-PVA composite sheets indicated the existence of dominating peaks corresponding to collagen amide bands as well as PVA characteristic bands and it demonstrates the uniformity of the developed composite sheets. When the amount of PVA is increased, the tensile strength of CS-PVA composite sheets increases from 0.21 to 4.17 N/mm2. With increasing of the amount of PVA, the softness decreases from 6.47 to 3.7 mm and SEM shows decreasing of pores in the composite sheet. The addition of more PVA makes CS-PVA composite sheets more thermally stable. This facile method of preparing CS-PVA composite sheet, is low-cost and eco-friendly, having potential applications in various fields, including clothing, leather goods, decoration, packaging, footwear products, etc. as well as presenting promising platforms for effective utilization of industrial waste materials.

**Keywords:** Chrome shaving, polyvinyl alcohol, composite sheet, tannery waste, FTIR, SEM.

# Metagenomic Analysis to Understand the Microbial Diversity of Surface Water Quality in Dhaka City

**Group:** Environmental Science **Project ID:** SRG-223446

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## Abstract

**Background:** Surface water such as rivers and lakes is a major source of livelihood. High population density and improper sewage disposal along with uncontrolled industrialization constantly pollute these water sources. Every year people of Bangladesh suffer severely from various waterborne diseases. **Objectives: A** comprehensive metagenomic study has been conducted to understand the microbial community structure of two water bodies in Dhaka city namely Buriganga and Turag river. **Methodology:** The water sample from each location was collected aseptically and extract the metagenomic DNA. Whole genome sequencing (WGS) was performed for the environmental metagenomic study. **Findings:** A microbiome study of the two rivers showed that the phylum Proteobacteria, Firmicutes, Bacteroidetes, Actinobacteria, Spirochaetes and Crenarchaeota were found to be prevalent in both samples. The present result suggests that these are the most flexible phyla which may get enriched even under constant variation of climate, human interference, soil types and physicochemical water quality parameters commonly observed in any river ecosystem. In genera level, we found a prominent abundance of genera namely *Arcobacter, Geobacter, Hydrogenophaga, Limnohabitans, Comamonas, Cupriavidus, Azoarcus, Laribacter, Tolumnoas, Escherichia, Pseudomonas, Streptococcus, Megamonas and Flavobacterium*. The presence of many pathogenic genera such as Acinetobacter, Aeromonas, Escherichia, and Pseudomonas are of concern to human health. This is an indication of possible human interference, enhancing the load of pathogenic microbial communities. A variety of bacteriophages were identified, with amongst the highest relative abundance being Escherichia phage Bp4, Escherichia phage ECBP1, Pseudomonas phage PaMx74, Klebsiella phage KpV71 etc. in both the water samples. **Conclusion**: The metagenomic strategy employed in this study allowed us to identify a common microbiome as well as few unique signatures of microbial communities occurring in the two main rivers of Dhaka city namely Bruiganga and Turag which have a great contridution in our daily life and economy.

**Keywords**: Microbiome, NGS technique, Buriganga, Turag, pathogenic genera.

# Random Amplified Polymorphic DNA Analysis of Bacteria Isolated from Different Drainage System

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## Abstract

**Background:** Antibiotic resistance is a critical global health issue that demands understanding the resistance profiles of bacteria in varied environments. Laboratory drainage systems can harbor antibiotic-resistant bacteria, posing risks to personnel and the community. **Objectives:** This study aimed to – (1) Profile antibiotic resistance in diverse laboratory drainage systems, (2) Conduct antimicrobial susceptibility testing on bacterial isolates, (3) Construct a phylogenetic tree to analyze evolutionary relationships among isolates, (4) Identify patterns of antibiotic resistance, especially multidrug-resistant strains, (5) Explore the emergence and dissemination of antibiotic resistance in laboratory drainage systems. **Methodology:** Drainage samples from multiple lab settings provided bacterial isolates for analysis. The disk diffusion method tested antimicrobial susceptibility. Metagenomic studies were done through 16sRNA using Sanger sequencer, and a phylogenetic tree was constructed for evolutionary relationships among the isolates. **Findings:** The study revealed a spectrum of bacterial species, notably including Klebsiella pneumoniae and Proteus mirabilis. From these, 10 isolates and 12 antibiotics were selected for susceptibility testing, indicating varied resistance levels to common antibiotics like ampicillin, ciprofloxacin, and tetracycline. Multidrug-resistant strains were also identified, signifying an emergence of resistance in these drainage systems. **Conclusion:** Implementing stringent infection control and stewardship programs within lab settings is vital. Regular surveillance of resistance trends and resistance dissemination prevention strategies are crucial. Further research should explore genetic mechanisms and resistance gene transfer in these environments. Managing antibiotic resistance in laboratory drainage systems is key to personnel safety, halting resistant bacteria spread, and preserving antibiotic efficacy in healthcare settings.

**Keywords**: RAPD, Antibiotic resistance, antimicrobial susceptibility testing, phylogenetic tree.

# Assessment of *Escherichia coli* and Faecal coliforms in Drinking Water Sources in the St. Martin Island, Cox's Bazar, Bangladesh

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## Abstract

**Background:** St. Martin's Island, Bangladesh is a popular tourist destination with a thriving hospitality industry. However, the island is facing a serious problem of microbial pollution of its groundwater, which poses a major threat to public health. **Objectives:** This study aimed to assess the level of microbial pollution in groundwater at different sample sites on St. Martin's Island during the tourist season. **Methodology:** Groundwater samples were collected from 27 sample sites, including hotels, resorts, restaurants, schools, colleges, madrasas, local households, and mosques. Samples were analyzed for the presence of E. coli, fecal coliform, and total coliform bacteria using the membrane filter technique. **Findings:** The study found that high levels of fecal coliform and total coliform bacteria were present in groundwater at 70.37% and 55.56% of sample sites, respectively. This is above the tolerance levels set by the World Health Organization (WHO) and the Bangladesh Standard Value (BSV). The highest levels of fecal and total coliform bacteria were found in groundwater at sample site 11 (Nil Digant Resort), and sample site 12 (Hotel Atlantic) respectively. The north side of the island has higher concentrations of fecal coliform than the south side of the island. Additionally, the northwestern part of the island has the highest concentrations of fecal coliform. **Conclusion:** The findings of this study indicate that microbial pollution of groundwater is a serious problem on St. Martin's Island. The government of Bangladesh and other stakeholders need to take urgent action to address this problem through measures such as the construction of proper sanitation systems and the development of public awareness programs.

**Keywords**: Groundwater, *E. coli*, membrane filter technique, public awareness.

# Biochemical Analysis and Antimicrobial Activity of Haemolymph of Horseshoe Crabs with Occurrence' Habitat Distribution and Population Structure along the Coastal Area of Bangladesh

**Group:** Biological Science **Project ID:** SRG-223449

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## Abstract

This study was carried out at mangroves and saltmarsh area of Bangladesh coastline which is called a nursery, spawning & breeding ground of horseshoe crabs (HSC) for a period of July 2022 to June 2023 to reveal the species identification, biochemical composition, occurrence and habitat distribution with the morphometric variability in different sex. There were two types of species identified by using morphological and DNA barcoding system namely *Carcinocorpus rotundicauda* and *Tachypylus gigas*. Among them *C. rotundicauda* existence was 99% whereas T. gigus only 1%. Most of the *C. rotundicauda species was found in mangrove and saltmarsh area namely Naf river estuary, Rezukhal estuary, Sonadia, Maheshkhali and Dublarchar area of Khulna Sunderban.* T. gigus species was only found at sandy beaches of Cox's Bazar coastal area. The amino acid profiling and proximate biochemical composition of *C. rotundicauda* was done. The Haemolymph of Horseshoe Crab possess copper containing pigment which is able to quickly detect few nano grams of endotoxins. It has been possible to identify some proteins and peptides in the blood of Horseshoe crabs through bioinformatics analysis which can be used to treat serious diseases like SARs COP virus, cancer etc. The study revealed that the females of *C. rotundicauda* are significantly heavier and larger in size than males except for telson length. A positive allometry growth (b>3) was recorded in the relationship between length/width-weight (TL-BW, PW-BW, CL-BW) for both of the sexes while the length/width-length relationships (CL-PW, TL-PW, CL-TEL, TL-TEL) were recorded as a negative allometric growth (b<1) except CL-PW for females which express an isometric growth (B=1). Overall performance showed a strong correlation between all body parts of *C. rotundicauda*. The results are expected to be used as baseline data for the horseshoe crab management plan and action. Besides, follow up study on the relationship of horseshoe crab population growth are needed in developing strategies on monitoring, conservation and breeding of horseshoe crab.

**Keywords:** HSC, Antimicrobial, haemolymph, morphometric, occurrence.

# Effects and Mechanisms of Environmental Endocrine Disruptor' Atrazine on Male Germ Cells

**Group:** Environmental Science **Project ID:** SRG-223450

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## Abstract

This study investigated the possible mechanism of atrazine-induced germ cell apoptosis in prepubertal mice testis using histological, histochemical and molecular methods. The prepubertal mice were given a single dose of 500 mg/kg atrazine by gavage and killed at 3, 6, and 24 hours (h) after treatment. The results showed degenerative changes in the seminiferous tubules, including detachment and sloughing of male germ cells from the basement membrane to the lumen of the seminiferous tubules at 3 h, and the effects increased at 6 h and 24 h after treatment compared to the control group. A significant decrease in intratesticular testosterone (ITT) levels was found in the atrazine-treated group. Concomitantly, a significant increase in germ cell apoptosis was also observed in the atrazine-treated group compared to the control. In fact, the maximal apoptosis was detected at 6 h after treatment and the maximal reduction of testosterone level was at 6 h. To address whether atrazine suppressed testicular testosterone levels by affecting the hypothalamic-pituitary-testicular (HPT) axis, we analyzed the pituitary LHβ mRNA expression and serum LH level. The pituitary LHβ gene expression and serum LH level were significantly decreased in the treated groups. Therefore, the present observations essentially suggest the possibility that atrazine might have blocked LH secretion from the hypothalamus or pituitary. Then the LH stimulation of Leydig cells was decreased, thereby reducing the ITT level. Atrazine-induced diminution of the ITT level might cause an alteration of the physical structure of Sertoli cells, which in turn, might induce germ cell apoptosis.

**Keywords**: Atrazine, prepubertal mice, germ cell apoptosis, testicular steroidogenesis.

# Conservation Strategies on Declined Biodiversity at Gomti Riverine Wetland

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## Abstract

Bangladesh is rich in wetland biodiversity. The sustainability of people in riverine wetlands is highly dependent on biodiversity for their livelihood. Environmental threats alter the biodiversity of aquatic plants, fish, and birds in a wetland ecosystem. Subsequently, community people have suffered to lead their sustainable livelihood. The present study focuses on evaluating the current state of species distribution, causes of declining biodiversity, and conservation strategies in the Gomti riverine wetland of Comilla. Some species were recorded as critically endangered, such as *Chitala chitala, Channa marulius, Nymphaea nouchali*, *Gyps bengalensis, Alcedo atthis* and *Phalacrocorax fuscicollis.* The most vulnerable (25.3%), endangered species (21%), and critically endangered (11.33%) were recorded in the Bharella, Pir Jatrapur, and Sholanal rivers. The average percentage of critically endangered, endangered, vulnerable, and least concern species was 9.61, 16, 19.61, and 54.72 recorded in riverine wetland ecosystems, respectively. Agriculture and forest area decreased by 36% and 60%, respectively, in 2021 compared to 2013. Changes in land use land cover enhance endangered, critically endangered, and species vulnerability in the riverine wetland ecosystem. In this context, the government of Bangladesh should implement a policy according to the recommended guidelines for the immediate conservation of wetland biodiversity.

**Keywords**: Wetland biodiversity, conservation, vulnerable, endangered, ecosystem.

# Modulations of Shelf Circulations in the Ganga-Brahmaputra-Megna estuary in Response to Numerous River Discharges and their Impact on Mixed Layer Depth in the Northern Bay of Bengal

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## Abstract

Bay of Bengal is a continuum receiving multiple large rivers including the Mahanadi, the Godavari, the Krishna, the Kaveri, the Ganges, Brahmaputra and many more others. These river outputs are significantly influenced by the energetic shelf circulation system. The freshwater flux is caused by rivers results in lower salinities and shallower mixed layers. Multivariate empirical orthogonal function decomposition and heterogeneous correlation analyses are applied to numerous observational, reanalysis, and satellite datasets, including river discharge data, temperature, salinity, density wind stress curl and chlorophyll datasets collected from various sources, from the Copernicus Marine Environment Monitoring Service and ERA-Interim. It highlights that Classic estuarine two-layer circulation during monsoonal period is one of the significant consequences of river plume influence on continental shelf. Coriolis force monsoonal effect and buoyant river plumes are what makes this discovery so significant. The buoyant river plumes were primarily responsible for changing the vertical structure of shelf circulation during monsoon period. This study suggests that the strongest SSS variability appears off the mouths of the major rivers and to a lesser degree along the western boundary of the basin. The results show a large increase in surface salinity along the Bangladeshi coast especially in the eastern part in near future, which may affect the area of fresh water plume because precipitation also shows an influence in the inter-annual variation of circulation pattern and the region of fresh water plume. The fresh water plume will move from the northeast to the west due to the rapid decreasing precipitation and the accompanying wind stress curl in the eastern half of interannual precipitation data during the time period between 2016 and 2020. This study contributes to a better understanding of how oceanic forcing affects the rich marine habitats in the Bay of Bengal and the destiny of riverine materials there.

**Keywords**: Chlorophyll-a, surface current, freshwater flux, precipitation, wind stress.

# Assessment of Geomorphic Index Alteration and its Socio-Economic Impact at the Sugandha River in Babuganj Upazila, Barishal

**Group:** Environmental Science **Project ID:** SRG-223453

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## Abstract

River-bank erosion is one of the most frequently occurring natural hazards in Bangladesh. River-bank erosion predominantly affects Babuganj upazila in the Barishal district, located in the Sugandhya river bank (Sandhya reach). This study evaluates the influence of the Geomorphic Index (G.I.) alteration of four geomorphic indicators: sinuosity index, channel width, widening rate, and migration rate of Sugandhya River, as well as the socio-economic impact of river bank erosion in and around Babuganj Upazila. The Landsat satellite images of Sugandhya River (16 Km) were measured and evaluated these parameters across five distinct periods: A.D. 1980, A.D. 1990, A.D. 2000, A.D. 2010, and A.D. 2023 by Geographical Information Systems (GIS) and Remote Sensing (R.S.) techniques. Two comprehensive fieldworks were performed after the image analysis to assess the socio-economic impact of river bank erosion. Sinuosity ranges from 1 to greater than 2 in most places, indicating a meandering stream and the left bank more than the right bank, which is about 50 m/year to 32 m/year, respectively. The widening rate of the river dramatically varies from an average of -0.9 m/year during the period A.D. 1980 to 2000 (pre-sand mining) to an average of 25.8 m/year in the period A.D. 2000 to 2023 (post-sand mining and brickfield operations) and developed about 2.88 $km^2$ new channel bars. The widening rate in the Doarika bridge section is around 40m, making the Barishal airport region vulnerable. Dehergati, Rahamatpur, Rakudia and Kedarpur were among the worst affected regions by river erosion. About 47% of the agricultural land was lost, and the people migrating to nearby cities show a positive correlation with river erosion. This study would serve as a baseline for assessing the impact of human interventions on G.I. and sustainable river basin management.

**Keywords:** Geomorphic index, sinuosity, migration rate, socio-economic impact.

# Distribution of Major' Trace & Rare Earth Elements in the Surficial Sediments of Padma River' Bangladesh: A Geochemical Approach

**Group:** Environmental Science **Project ID:** SRG-223455

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## Abstract

The major, trace, and rare earth element (REE) compositions of sediments from the Padma River, Bangladesh have been examined using XRF and INAA analysis to determine their geochemical compositions, provenance, climate, weathering intensity and tectonic setting. The Padma River sediments from the region were remarkably comparable, demonstrating elemental depletion and pointing to a low geochemical maturation. Sediment samples are classified as arkose which are considered as chemically immature sediments, deposited under semiarid to semi-humid climatic conditions due to the weakening of Indian summer monsoon. The low CIA values (48.6–58.8), PIA (48.1–63.4) and Rb/Sr ratios of the river sediments suggest low intensity of chemical weathering in the source area. The Padma River is originated from the Higher Himalaya and the sediments derived from metasediments (Higher Himalayan Crystalline Series) as are evident by major, trace elements discriminate diagram and REE pattern. Most of the sand samples were derived from felsic source rock (granite) whereas some samples are plotted in the intermediate rock types (granodiorite) in the A-CNK-FM and discriminant function diagrams. High LREE enrichment and relatively flat HREE fractionation in chondrite-normalized EE patterns (LaN/YbN = 7.50-13.20) demonstrated felsic source origin. $TiO_2$ versus Zr plot shows that Padma River sediments have felsic to intermediate provenance. According to Log (K2O/Na2O) vs. $SiO_2$ discriminant diagram and La–Th–Sc, Th–Sc–Zr/10 ternary plot, the Padma River sediments were deposited in passive continental margin. The Padma River sediments have been compared with Yarlung Zangbo River (YZR), Brahmaputra-Jamuna River (BJR), Ganges River (GR) and Upper Meghna River (UMR), which results suggest that there is contrast among the sediments of different Himalayan Rivers in relation to provenance, weathering intensity and tectonic setting.

**Keywords**: Tectonic setting, weathering, geochemistry, provenance.

# Nutrient Dynamics in the River Systems of Seagrass Ecosystems to Climate Change Impact of the Bakhkhali Coast' Cox's Bazar' Bangladesh

**Group:** Environmental Science **Project ID:** SRG-223456

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## Abstract

The importance of seagrass ecosystems and their floral communities lies in their ability to act as a buffer between land and aquatic systems. Tidal variations in nutrient concentration and water quality in the seagrass ecosystems of the Bakhkhali Coast, Bangladesh were analyzed in this study. The aim was to work nutrient dynamics ($NO_3$-N, $NO_2$-N, $PO_4$-P, $SiO_3$ and $NH_4$-N)) at water samples of seagrass ecosystems by using an acid washed PTFE digestion vessel. Samples of ten different sites were subjected to a total digestion technique ($HNO_3$ – HCl – HF conc.) and analyzed for nutrient concentration by AAS (Atomic Absorption Spectrophotometer). Nutrient values in water samples were evaluated based on elemental background concentrations and the degree of nutrient dynamics was estimated for each site. The mean concentrations (mg/l) of nutrient in seagrass ecosystems found 0.03±0.02 for $NO_3$-N, 0.01±0.04 for $NO_2$-N, 1.42±0.02 for $PO_4$-P, 0.92±0.03 for $SiO_3$ and 0.36±0.01 for $NH_4$-N respectively. The hydrological parameter values, Temperature, pH, Salinity and DO were all favorable and within the acceptable range and ecological parameter values of the seagrass ecosystems including nitrite, nitrate, phosphate, silicate and ammonium were all tolerance level except silicate. The data obtained indicate that the seagrass ecosystem demonstrate various degree of nutrient concentration and can be used as indicators for the type and quantity of nutrient dynamics in marine ecosystems and regulates the rate of photosynthesis in seagrass ecosystems.

**Keywords**: Seagrass, PTFE digestion vessel, nutrient dynamics, marine ecosystem.

# Development and Evaluation of Novel Adsorbents for Simultaneous Removal of Dyes' Bisphenol A and Heavy Metals from Wastewaters

**Group:** Environmental Science **Project ID:** SRG-223457

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## Abstract

Industrialization has unleashed massive amounts of synthetic dyes, endocrine-disrupting chemicals, and metals into the environment, causing environmental concerns and necessitating diverse and effective cleanup procedures. Pristine and modified forms of beta-cyclodextrin (β-CD), magnetic graphene oxide (MGO), rice husk (RH), and coal fly ash (MCFA) were used to remove dyes (MB and MO), bisphenol A (BPA), and metals ($Cu^{2+}$ and $Pb^{2+}$) from simulated and actual wastewater. Chemical modification procedures were used to make citric acid (CA) crosslinked β-CD (CA-β-CD), MGO, RH modified with CA and NaOH (MRH), and CFA with NaOH (MCFA). Adsorbents were assessed for pollutant removal in simulated wastewater in single and binary systems, and the top two were tested in a real wastewater system. The CA-β-CD, followed by MGO and MRH, displayed strong adsorption affinity for anionic MO in acidic settings, cationic MB, BPA, $Cu^{2+}$, and $Pb^{2+}$ in alkaline conditions, while MCFA had the least influence. The CA-β-CD, followed by MGO and MRH, displayed extremely fast MO kinetics and reached adsorption equilibrium within 30 minutes of research. MB, BPA, and metals, in contrast, reached 90% adsorption equilibrium after 30 minutes and equilibrium after 60 minutes. Langmuir and pseudo-second-order models were found to suit adsorption kinetics and isotherm data well. In binary pollutant systems, all adsorbents outperform the single pollutant system. Furthermore, recycling the CA-β-CD and MRH after four consecutive cycles preserved > 90% of their initial adsorption efficiency for MB, $Cu^{2+}$, and $Pb^{2+}$ and around 80% for MO and BPA, whereas MGO and MCFA had the least effect. The efficiency of CA-β-CD and MRH was tested in real wastewater systems and found to be effective in eliminating contaminants based on desorption and regeneration and other tests. As a result, CA-β-CD and MRH with various adsorption sites have a high potential for use in the treatment of textile wastewater.

**Keywords**: Adsorbents, pollutants, single-component, binary, simulation, natural wastewater.

# Spatiotemporal Assessment of Seasonal Water Quality and Quantity of the Peripheral Rivers of Dhaka City Using Multispectral Satellite Images

**Group:** Environmental Science **Project ID:** SRG-223458

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## Abstract

The rapid growth in urbanization rate of Dhaka city has been creating an adverse impact on the water bodies in the surrounding four rivers or khals. The rivers are turning into dead swamps due to the excessive pollution and contamination by the surroundings. The study consists of Satellite Images Analysis and In-situ Water Parameters Collection by multi-parameters sonde to retrieve quantity and qualitative synthesis of Dhaka city's rivers water. Supervised classification approach has been used to retrieve the water bodies extend from 1977 to 2023 by six Landsat images. Conventional algorithm used to assess the spatial variation of chlorophyll-a concentration, trophic state index, Secchi depth and turbidity using seasonal Sentinel 2A level 2 data. The results showed that the extend of water bodies in the rivers were reduced about 10-16% dramatically from 1977 to 2023 due to the rapid urbanization in this region. The chlorophyll-a concentration from post-monsoon to pre-monsoon, increased in all rivers surrounded by Dhaka city, and shown mostly eutrophic to hyper-eutrophic status. As the trophic state index assessed based on the chlorophyll a concentration, all rivers show same results of trophic status. In case of Secchi disk depth, the SDD ranges from 0.7-0.8 m representing eutrophic status that were declined from post-monsoon to pre-monsoon in all of the rivers of Dhaka city, indicating the deteriorating water quality of the rivers through the four seasons. On the other hand, the turbidity values increased in all rivers surrounded by Dhaka city from post-monsoon to pre-monsoon and showing spatially very high turbidity values mostly more than 30NTU, addressing highly cloud water. The final output of this comprehensive study will play an important role to minimize the Dhaka city's rivers water degradation and will help take necessary measures and for reducing the pollution.

**Keywords**: Satellite images; spatial mapping; water quality; peripheral rivers; field verification.

# Development of Activated Carbon Materials from Natural and Agricultural Waste for Adsorption of Hazardous Dye from Textile Effluents

**Group:** Environmental Science **Project ID:** SRG-223459

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## Abstract

**Background:** The dyeing industries in Bangladesh use a huge quantity of colours and chemicals. After the dying process, they release significant amount of wastewater containing hazardous chemicals. **Objectives:** The present work has been intended to investigate the removal of hazardous dyes simultaneously from textile effluents using carbonaceous adsorbents prepared from natural wastes. **Methodology:** Physically and chemically activated carbon based adsorbents from sawdust and fish scale was synthesized and characterized. The prepared adsorbents show improved capacity for dye adsorption and has been employed for the removal of two textile dyes—Methylene Blue and Reactive Blue-250 which are cationic and anionic in nature respectively. **Findings:** Dye removal capacity was tested as a function of contact time, dosage of the adsorbent, initial concentration of dye and pH of the effluent. The dye removal percentage was found to be higher with the increase of the amount of dosage of the prepared adsorbents and at a certain amount of dosage, the maximum removal was occurred. Around 90-95% of dye removal was observed within 1 hour of contact time using the adsorbents. Besides, pH and initial concentration of the dye in effluent have a substantial impact on the dye removal percentage of the adsorption process. The applicability of the Langmuir and Freundlich adsorption isotherms in describing experimental data was investigated. The micro and mesoporous activated carbon prepared from sawdust and fish scale identified by Scanning Electron Microscopy (SEM) images indicated that such adsorbents with a large surface area have more dye adsorption potential whereas the variation in dye adsorption occurs due to variation in surface area. From the overall experimental data, maximum removal of 95.39% and 87.92% was found for Methylene Blue and Reactive Blue-250 respectively by sawdust, and 90.64% removal of Methylene Blue by using fish scale was achieved. **Conclusion:** Textile dye Methylene Blue and Reactive Blue-250 from the effluents were effectively removed simultaneously at room temperature by using low cost and natural source derived adsorbents from sawdust and fish-scale.

**Keywords**: Hazardous materials, ionic dyes, saw dust, fish-scale, adsorption isotherm.

# Screening of Airborne Metal Accumulating Capacity af Indigenous Plants Around Dhaka City

**Group:** Environmental Science **Project ID:** SRG-223460

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## Abstract

**Background**: Therefore, this study aims to determine the financial value of forests to our whole environment to make it simpler for people to grasp the significance of trees and forests. **Objectives**: To determine the amount of PM-associated trace elements and metal accumulation index (MAI), and to develop an Anticipated Performance Index (API) of the selected plant species by evaluating the Air Pollution Tolerance Index (APTI). **Methodology**: The APTI was calculated using the formula: A = Ascorbic acid content (mg/g), T = Total Chlorophyll Content (mg/g) P = pH of leaf extract R = Relative water content of leaf (%). **Result:** In our study, the air pollution tolerance index (APTI) was calculated for 10 different plant species. The selected plant species are *Shorea robusta* (Shal), *Terminalia bellirica* (Bohera), *Mangifera indica* (Aam), *Acacia auriculiformis* (Akashmani), *Artocarpus heterophyllus* (Kathal), *Polyalthia longifolia* (Debdaru), *Calamus rotung* (Beth), *Barringtonia acutangular* (Hijal), *Hopea odorata* (Telshur), and *Anisoptera scaphula* (Boilam). The Air Pollution Tolerance Index (APTI) in the foliage of the investigated plants ranged from 9.96 to 13.55. The study's results demonstrated that *C. rotung* exhibited the highest APTI while *T. bellirica* exhibited the lowest APTI value. The trend of APTI of plants collected at Bhawal National Park (control site) was *Barringtonia acutangula* (13.14) > *Shorea robusta* (12.63) > *Acacia auriculiformis* (10.64) > *Artocarpus heterophyllus* (10.44) > *Terminalia bellirica* (10.28). However, the trend of APTI of plants collected at Rathura was *Acacia auriculiformis* (11.07) > *Artocarpus heterophyllus* (10.63) > *Mangifera indica* (10.44) > *Shorea robusta* (10.23) > *Terminalia bellirica* (9.96). The trend of variation of APTI at BFRI was *Acacia auriculiformis* (12.20) > *Hopea odorata* (11.66) > *Mangifera indica* (11.38) > *Anisoptera scapula* (11.16) > *Artocarpus heterophyllus* (10.82). The trend of variation of APTI at Kaliakoir was *Calamus rotung* (12.63) > *Polyalthia longifolia* (12.05) > *Mangifera indica* (11.99) > *Shorea robusta* (10.45) > *Artocarpus heterophyllus* (10.82). **Conclusion**: Analysis of Metal Accumulation Index (MAI) Polycyclic Aromatic Hydrocarbon (PAH) and microbiological characteristics of selected tree species and collected dust samples are in progress.

**Keywords**: APTI, API, Metal accumulating index, i-tree, air pollution.

# A Quantitative Modelling of the Environmental Effects as Well as Damage and Loss of the Recent Flooding in the Northwestern Part of Bangladesh

**Group:** Environmental Science **Project ID:** SRG-223461

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## Abstract

Bangladesh is one of the country's most vulnerable to climate change because of its geographic exposure, low income, and greater reliance on climate sensitive sectors, particularly agriculture. People exposed to the most severe climate-related hazards are often least able to cope with the associated impacts due to their limited adaptive capacity and likely to become even more susceptible in future. It's a well-known fact that, all around the world, climate change is making rainfall more erratic and often far more intense. In Bangladesh, this reality rings especially true. Stronger downpours combined with rising temperatures melting the Himalayan glaciers that feed rivers around Bangladesh are leaving massive swaths of the country as easy prey for devastating floods. The purpose of this study is to quantify the impact of Sylhet flooding of 2022 on the income of the household. The study also aimed to quantify the damage, losses and other environmental impacts of the hazard. It was found that the mean income of the sample households dropped during flood and after flood. According to responses, more than one-third of the households increased their expense for non-food items such as transport, buying emergency supplies to survive in water-clogged situation. during the flood and decreased afterward. Using the dataset, regression analysis has been conducted to see the effect of household head and family issues on poverty which shows quite significant result. Sustainable development goals of 2030 focus on improving overall aspects related to environment and population around the world. This research will thereby help the policymakers to take necessary actions and plan mitigation strategies to reduce the poverty level.

**Keywords**: Flood, damage and loss, poverty, vulnerability, impact assessment.

# Assessment of Flash Flood Hazard for Different Return Periods and Flood Shelter Adequacy in Northeastern Region of Bangladesh

**Group:** Environmental Science **Project ID:** SRG-223462

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## Abstract

Due to its geographic location and subtropical monsoon climate, Bangladesh, especially the northeastern region, is susceptible to various types of flooding, which are becoming more frequent and intense, posing a greater threat. The study focuses on assessing the flood depth for various return periods and the adequacy of floods during large-scale floods in NE Bangladesh. A flood frequency analysis is carried out from Log-Pearson Type III distribution to predict peak flow for different return periods, followed by 1D Unsteady Flow simulation in HEC-SSP and HEC-RAS environments. The flood extent map is used to pinpoint necessary locations for flood shelters based on flood intensity. The study reveals that low-lying areas experience earlier arrival and prolonged floodwater inundation compared to elevated regions in each flood scenario. The Unsteady Flow simulation of the coupled 1D-2D hydrodynamic model provides maximum floodwater depth and velocity. These parameters have a greater value for larger flood return periods. The model performance assessment, carried out by replicating the 2017 flood event, shows a highly acceptable result, achieving an RMSE error of 0.41, making the model a tool to effectively and accurately assess inundation areas and water levels. The model showed an estimated discharge for Bhairab Bazar Station (SW273) on Surma-Meghna River in Kishoreganj showed 28278, 34755.602, and 42548.555 cumec for the 25, 50, and 100-year return periods, respectively. The flood extent map for different return periods shows different inundation areas for different return periods. The flood extent maps of the study area are used to spatially identify the required locations for flood shelters. The overlaying of existing cyclone shelter locations identifies the gaps and priority locations for future flood shelters. In conclusion, the model is effective and can be used in accurately estimating flood inundation areas and water levels for various return periods. The identification of priority locations can help policymakers to make a knowledge-driven decision to plan for future flood shelters.

**Keywords**: Flash flood, flood shelter, coupled 1D-2D, hydrodynamic model.

# Impact of Fishing Ban on the Trophic Ecology of Non-Targeted Co-Existing Species in Hilsa Fish Sanctuaries in Bangladesh

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## Abstract

**Background**: Temporal fish sanctuaries have been reported to increase fish population size, strengthen the food web dynamics, and enhanced trophic resilience. However, these sanctuaries can selectively favor specific target species and putting other co-existing species under ecological pressure, hence affect the ecosystem resilience. However, the ecological impact of fishing ban in riverine sanctuaries in Bangladesh are not known. Objectives: to investigate the physicochemical parameters and biological productivity of water, and the trophic niche of representative fish species. **Methodology:** The study was conducted in the Tetulia river and Baleswar river over two seasons. We used stable isotope as a proxy of trophic tracer. **Findings**: The physicochemical parameters of the two rivers were comparable, where, salinity and SPM were higher in the Baleswar river, and chlorophyll-a concentration were higher in the Tetulia river. However, the planktonic communities were nearly similar. The carbon isotope values (δ13C‰) of fish were more negative and ranged widely in Baleswer river due to the presence of diver organic matter sources including mangrove sources. The isotopic niche size (SEAc) indicated that the trophic niche of hilsa and other species differed in the two areas in terms of size and other characteristics. The hilsa trophic niche were larger in both the revers, courtesy to their anadromous nature. In the Tetulia river, isotopic niche of non-hilsa species were considerably smaller than hilsa. The isotopic diversity matrices indicated that the Tetulia non-hilsa fish community had less trophic plasticity and higher trophic specialization despite smaller niche size. **Conclusion**: Combinedly, the various trophic niche matrices and relevant Bayesian estimates suggested that hilsa could have reduced the trophic niche of other co-existing fish species. This study reiterated the importance of considering the overall community rather than particular target species of direct economic importance.

**Keywords**: Trophic ecology, fish sanctuary, isotope ecology, hilsa conservation, trophic niche.

# Growth Development Muscle Integrity and Nutritional Quality Dysfunctions Due to Cadmium Exposure in *Labeo rohita* Fish Species of Bangladesh

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## Abstract

Due to anthropogenic activities and rapid industrialization, aquatic cadmium pollution is becoming a serious problem in globally including Bangladesh. The bio-accumulation nature of cadmium causes deposition of Cd in different parts of fishes including muscle through ingestion of their different body parts and this has devastating impacts such as genetic, reproductive, neurotoxic, hematologic and biochemical effects on fish. Among the common carp, *Labeo rohita* is a widely consumed fish species in Bangladesh. So, in this study fishes were treated with eight doses 0.125, 0.025, 0.05, 0.1, 0.2, 0.4 and 0.8 mg/L of Cd with control for 30 days of cadmium exposure to assess accumulation, growth, morphology, histopathology and nutritional effects of fish muscle. Results stated that cadmium deposited in higher amounts in the muscle of fishes according to doses of cadmium. Growth rate in terms of weight and length gain was found lower in all cadmium treated fishes compared than control ($p<0.05$). Histopathological analysis indicated dystrophy of fish muscle with edema and necrosis. The Morphological data showed abnormal behavior with clinical abnormalities among cadmium treatment fishes. From nutritional point of view, macronutrients like proteins. fat content was found significantly lower with higher moisture content while micronutrients such as iron, zinc, cu were also found relatively low amount in cadmium exposed fishes. This finding also revealed that more saturated fatty acids (SFA) with less amount polyunsaturated fatty acids (PUFA) were present in fish muscle. Like fatty acids, total amino acids content increases to meet the anticipated energy needed in cadmium exposed fishes. So, finally it can be said that cadmium negatively affects the overall fish health and muscle nutritional quality which needs to be addressed for assuring food quality.

**Keywords**: Pollution, cadmium, fish, Bangladesh, histology.

# Microbial Quality Monitoring of In Pond Raceway System (IPRS) Environment through Metagenomics Approach

**Group:** Environmental Science **Project ID:** SRG-223465

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## Abstract

**Background**: In-Pond-Raceway System (IPRS) is intended for higher fish production, but the microbial population in that system unknown. **Objectives**: The objective of the study was to investigate the microbial community in water and sediment of IPRS metagenomics approach. **Methodology**: The Water and sediment samples were collected from In-pond raceway system (IPRS) located at Natore, Bangladesh. Sample was enriched in alkaline peptone water and DNA was extracted from overnight culture. The DNA was then used for 16S rRNA gene sequencing. The Data was analyzed using the Microbiome Analyst web-based tool. **Findings**: Based on the analysis, Firmicutes and Proteobacteria were the most prevalent phyla with a total of 3545 and 3856 operational taxonomic units (OTUs) found in sediment and water samples, respectively. The total 66 bacterial classes were found in the sediment and water sample where Clostridia were the most dominant class followed by Gamma-proteobacteria and Bacilli. Core microbiome analysis and circular cladogram also confirm the dominance of Clostridia, Gammaproteobacterial and Bacilli in both water and sediment samples. Phylogenetic analysis of top 20 bacterial species from both sediment and water samples based on their abundance was done where most of the species were common in water and sediment samples and did form similar clades. **Conclusion**: IPRS may harbor pathogenic bacteria including Clostridium species. Thus, good sanitation system should be maintained as well as quality fish feed should be used to feed the fish.

**Keywords**: Metagenomics, 16S rRNA, operational taxonomic unit, Gamma-proteobacteria.

# Deeper (Paleogene) Hydrocarbon Plays and their Prospectivity in Bengal Basin

**Group:** Environmental Science **Project ID:** SRG-223466

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## Abstract

This research aims to evaluate the hydrocarbon prospects at deep sequences and identify and characterize the reservoir qualities of the Tertiary Paleogene sediments in the North-Eastern part of Bangladesh. The Tertiary sedimentary successions exposed in the North-Eastern part of Bangladesh have been studied through rigorous fieldwork at Jaintiapur, Sylhet area, and in the laboratory by petrographic examination, Field Emission Scanning Electron Microscopy (FE-SEM) analysis and Energy Dispersive X-ray Spectroscopy (EDS) study. The sandstones exhibited massive or cross-bedded characteristics and were found to possess the highest reservoir quality. The reservoir quality was assessed by comparing the lower unit of the Bhuban Formation with the Renji Formation based on field data analysis. Notably, the limestone unit displayed a considerable presence of joints and fractures, indicating its potential as an excellent reservoir rock within the petroleum system of Bangladesh. Based on thin-section petrographic analyses, the sandstones derived from the lower unit of the Bhuban Formation and the Renji Formation exhibit similar characteristics. They are classified as medium to very fine-grained, with subangular to subrounded shapes and a high degree of sorting. These sandstones are considered texturally mature, with less than 3% matrix and are classified as sublitharenites according to the standard classification scheme. The limestone unit comprises skeletal grains, including Foraminifera and Ostracoda, and non-skeletal grains, such as Ooids, Pisoids, and Peloids. Renji Formation has undergone diagenetic changes due to physical, physicochemical, and chemical processes associated with burial. These changes, including compaction, pressure solution, cementation, replacement, recrystallization, alteration, and dissolution, have gradually affected the sandstones as they were buried deeper. These diagenetic processes have a significant impact on the reservoir properties of the sandstones. The research used ten 2D seismic and four well-log data from the Fenchuganj structure. The analysis identified highly potential zones within the 2000m to 3500m depth.

**Keywords**: Reservoir characterization, deep prospects, bhuban formation, petrophysical appraisal.

# Quantitative Assessment of Vegetation Loss and Land Surface Temperature Rise Due to Metro Rail Construction in the Dhaka City

**Group:** Environmental Science **Project ID:** SRG-223467

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## Abstract

This study meticulously examines the interplay between Land Surface Temperature (LST) and Normalized Difference Vegetation Index (NDVI) within a 500-meter buffer around MRT Line 6. Analyzing data spanning 2015 to 2023 from Landsat-8 OLI_TIRS, Rapid Eye, and Planet Scope satellites, the study uncovers a consistent and noteworthy negative correlation between NDVI and LST, indicative of vegetation's pivotal role in mitigating the urban heat island effect. In 2018, the mean LST recorded was 27.94°C, aligning with a significant relationship as the corresponding mean NDVI value reached 0.30. The earlier years, such as 2015, illustrated this negative correlation vividly, with a mean NDVI of 0.28 and a mean LST of 28.19°C, emphasizing the urgency of preserving green spaces amid rapid urbanization. Urban planning and environmental management implications are substantial, advocating for prioritizing green infrastructure and sustainable development. The statistical insights serve as a foundation for evidence-based policies, informing interventions for creating more sustainable, resilient, and liveable cities. Advanced geospatial technologies—ArcMap 10.5, Erdas Imagine 2014, and Google Earth Engine—proved instrumental in processing large-scale geospatial data, ensuring the robustness and accuracy of the results. In summary, this project sheds light on the vital link between urban greenness and land surface temperature, emphasizing the integration of green spaces in urban planning for climate-resilient and sustainable cities. Statistical findings, such as the mean NDVI of 0.30 in 2018, provide essential references for policymakers, urban planners, and environmentalists aiming to formulate evidence-based strategies for urban development and climate adaptation. Prioritizing the preservation and expansion of green infrastructure emerges as a crucial step toward mitigating the urban heat island effect, statistically improving the overall well-being of urban inhabitants.

**Keywords**: Metro rail, LST, NDVI, urban heat island, GIS.

# Assessment of Water Quality and Current Pollution Condition of the Shitalakhya River and its Impact on Groundwater of Adjacent Areas

**Group:** Environmental Science **Project ID:** SRG-223468

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## Abstract

The Shitalakhya river is economically vital due to its year-round navigation, which faces severe pollution from rapid urbanization and industrialization along its banks. This study assessed both river water and adjacent groundwater quality using samples of pre-monsoon and post-monsoon period from 20 locations along a 73 km stretch of the river spanning from Charsindur to Shitalakhya-Dhaleshwari confluence. Sample measurements included EC, pH, ORP, TDS, DO, BOD, and COD, major ions, pollutants (nitrate, phosphate), and 14 trace metals. Ion Chromatography, Atomic Absorption Spectrophotometer, and ICP-OES were used to analyze major anions, cations, and trace elements, respectively. DO levels in all surface water samples were far below the 6 mg/L minimum for thriving organisms. Both BOD and COD were found to increase towards downstream, BOD rose from 6.5 mg/L to 20.35 mg/L and COD rose from 17.5 mg/L to 42.5 mg/L over a distance of 35 km, showing worsening water quality due to increasing pollutant load. Ten of the pre-monsoon river samples contained phosphates which were potentially of industrial origin. Nitrates in river water exceeded the BD standard of 10 mg/L, peaking at 60 mg/L with high TDS and EC at 6 locations. Arsenic levels in river water mostly met the BD limits; however, lead, aluminum, and manganese exceeded safe levels. Aluminum levels in river water ranged 400-5000 ppb while the safe limit is only 200 ppb. Lead in river water varied between 50 and 80 ppb with 75% exceeding the BD standard of 50 ppb. Lead in all groundwater samples exceeded both WHO and BD limits, averaging higher than surface water. Besides, manganese contamination was found in 44% groundwater samples. Data and findings of this study helps in understanding the pollution scenario of the river in 2023. It highlighted potential surface water infiltration into adjacent aquifers, underscoring need for hydrogeological evaluation and risk assessment.

**Keywords**: Water quality, shitalakhya river, industrialization, pollution.

# Understanding the Sandbody Architectures and Reservoir Potentials of Mio-Pliocene Deep-Marine Deposits in the Southeastern Offshore Bengal Basin from Studying Subsurface Data and Outcrop Analogues

**Group:** Environmental Science **Project ID:** SRG-223469

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## Abstract

A proper understanding of the depositional architecture of marine successions is crucial for successful hydrocarbon exploration in offshore areas. For this understanding, outcrop analogues study is one of the effective methods for its wide range of vertical and lateral resolution that can overcome the shortcomings of seismic and well log-based study and fill the study gap. The present study aims to understand the depositional architecture and sandbody distribution of Mio-Pliocene successions exposed in the Nhila Anticline of CTFB as an outcrop analogue for hydrocarbon prospect evaluation and effective exploration activities in the southeastern offshore part of the Bengal Basin. To accomplish the study sedimentological data were collected by direct field observations and UAV (drone) photogrammetry. The datasets were analyzed in terms of facies and architectural elements. The facies analysis demonstrates four facies associations, namely FA1: slope floor deposits, FA2: mass transport deposits (MTDs), FA3: channel fill deposits, and FA4: lobe deposits. The architectural analysis provides four architectural elements within the studied deposits, including mass transport complexes (MTCs), toe-of-slope channel complexes, lateral accretion packages (LAPs), and sheet complexes. The facies associations and architectural elements together suggest that the studied successions were deposited in the toe-of-slope, in front of a canyon mouth. Within the deposits, sandbodies are distributed in different styles in different architectural elements. In terms of reservoir potential, sandbodies of sheet complexes represent the highest potential for their tabular form and extensive lateral continuity, whereas the sandbodies in mass transport complexes (MTCs) show the lowest potential for irregular, discontinuous, and disconnected nature and mud dominance. In between the highest and lowest potentialities, sandbodies in toe-of-slope channel complexes show an intermediate potential. The findings of the present study open a new frontier for future exploration activities in the southeastern offshore Bengal Basin.

**Keywords**: Depositional architecture, sandbody, hydrocarbon, outcrop analogue, anticline.

# Exploration of Heavy Metal Resistant Microbial Diversity and Heavy Metal Concentrations in Water and Sediment of Extended Area of Buriganga River: A Metagenomic Approach

**Group:** Environmental Science **Project ID:** SRG-223470

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## Abstract

Buriganga is the lifeline of a thriving metropolis Dhaka, the capital of Bangladesh. Pollution from various anthropogenic and natural sources has contaminated the Buriganga river's water and sediment. In this work, 11 samples from various places in the Buriganga river sediment were collected and 4 of the samples were analyzed by using whole-genome metagenomics to reveal the microbiome community. The sediment physicochemical parameters showed the pH and Electric conductivity (EC) range of the samples were 6.2 to 7.8 and 90 to 1110 µS $cm^{-1}$ respectively. The whole-genome metagenomics analysis revealed a diverse microbiome with Bacteria (Proteobacteria (46.65%) >Actinobacteria (24.78%) > Firmicutes (13.19%) > Bacteroidetes (6.65%)) dominating the microbial community, followed by a small proportion of Archaea, Eukaryotes, and viruses. The functional analysis of the pathways using KEGG revealed a higher abundance of pathways involved in energy metabolism, carbohydrate (starch and sucrose metabolism, pentose phosphate pathway, glycolysis, etc.), nucleotide (purine and pyrimidine metabolism), and amino acid metabolism, as well as various metabolic pathways for xenobiotic degradation (drug, benzoate, nitrotoluene, and other xenobiotics), two-component system (signal transduction), and membrane transport (ABC transporters). Several important antimicrobial resistance and heavy metal resistance genes were identified. Simultaneously, the concentration of heavy metals analyzed in the sediment with average dry weight in the decreasing order of Zn > Cr > Pb > Ni & Pb and Zn exhibited moderate contamination. While a higher pollution load of Sadarghat and Kholamora ghats was found. With this, 14 Bacillus species and 2 Microbacterium species were identified as heavy metal resistant from these sediment samples using cultural and molecular approaches. The present study revealed Cr and Cd strongly impeded active growth, the isolates showed tolerance to Pb even at the stock concentration (2400ppm). These findings represent valuable insight into the Buriganga river's microbial community and associated factors.

**Keywords**: Buriganga, metagenomics, microbiome diversity, heavy metal.

# Phenotypic and Genotypic Characterization of Indigenous Heavy Metal Tolerant Bacteria for Developing a Sustainable Biological Treatment of Industrial Effluent

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## Abstract

In Bangladesh, pollution of water with heavy metals like chromium, cadmium, lead is a major environmental issue. These toxic heavy metals affect the aquatic ecosystem, and also increases human and animal health risk. The sustainable solution to this problem is installation of a cost effective, eco-friendly effluent treatment plant in the industries and application of microorganisms with heavy metal bioremediation potential offers such approach. Aiming to develop a bioremediation agent suitable for application in effluent treatment, the current study analyzes the phenotypic and genotypic features of an indigenous heavy metal tolerant *Bacillus* sp. isolated from river water of Bangladesh. Whole genome sequencing was performed using illumina platform and was analyzed using different online software. Biosorption of lead and cadmium was assayed following method described by Oyewole *et al*., (2019). Reverse transcription PCR was conducted to investigate expression of heavy metal tolerant genes, *chrA* and *czcC*. Whole genome analysis identified the bacterium as *Bacillus subtilis* BDSA1 (BioSample no.: SAMN31620504) and predicted as non-pathogenic for human. Genes associated with tolerance to chromium, cadmium, copper, arsenic, nickel, cobalt, zinc and mercury were detected. Phenotypic expression of the genes *chrA* and *czcC* genes occurred only in the presence of cadmium and chromium, while no expression was observed in absence of any metal. *Bacillus subtilis* BDSA1 could absorb 44% of 200ppm cadmium after 7 days of incubation. Whole genome analysis also detected various antibiotic resistance genes present in the chromosome and in mobile genetic elements. Ability to absorb cadmium and to express heavy metal tolerant genes indicate to the potential of *Bacillus subtilis* BDSA1 as a heavy metal bioremediation agent, although cooccurrence of antibiotic resistance genes hinders the potential. Investigation into the expression of antibiotic resistance genes of *Bacillus subtilis* BDSA1 and their phenotypic trait are essential for favorable application of this bacterium. This is the first complete genome analysis of a heavy metal tolerant *Bacillus subtilis* from Bangladesh that paves the path to further comprehensive research.

**Keywords**: Heavy metal, bioremediation, *Bacillus subtilis.*

# Microbiome Structure and Functional Analysis of Agricultural Soils of Bangladesh to Screen Signature Microorganisms for Soil Health and Fertility: A Metagenomic Approach

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## Abstract

Microbial diversity is the major driving force of fundamental metabolic processes in dynamic environments like soil. To assess the microbiome diversity and composition and functional potential of different soils of Bangladesh, we collected 16 soil samples from around Dhaka city. The samples were collected based on three groups: agriculture soil, urban soil contaminated with hospital waste and urban grassland soil. Their physicochemical properties were estimated and three groups revealed distinct pattern in acidity, electric conductivity and soil texture. Based on metagenomic DNA concentration and purity, 6 samples (agricultural soil, n=2; hospital soil, n=3; urban grassland soil, n=1) were selected and sequenced through whole genome metagenome sequencing (WMS). The WMS data, once obtained, was mapped to 6682 distinct bacterial species, 81 archaeal genera and 52 viral genera through Kraken analysis. This study detected 6372, 6522, 6294 bacterial species in agricultural, hospital, grassland soil, respectively. Among archaeal genera, *Methanocella* (40%) was dominant in agriculture soil, whereas *Methanosarcina* and *Nitrososphaera* were dominant in hospital soil and grassland soil respectively. A total of 193 antibiotic resistant genes (ARGs) were found. Moreover, functional potential analysis among the soil samples showed significant variation ($p = 0.002$), where carbohydrate metabolism, xenobiotic metabolism and degradation, potassium metabolism, sulfur metabolism were higher in agricultural soil. In vitro analysis showed xenobiotic pesticide abamectin degradation potential was higher in agriculture soils. The highest xenobiotic degrading bacteria from respective soil samples were isolated and were presumptively identified as *Pseudomonas* sp. (41.7%), *Vibrio* sp. (29.2%), *Klebsiella* (20.8%). Due to the functional metabolisms of the signature microbes such as Nitrogen fixation, xenobiotic pesticide degradation and phosphorus solubilization, these may be employed in increasing soil fertility. This study thus generated the first kind of comprehensive soil microbiome analysis approach in Bangladesh which could provide useful development of potential biofertilizer for healthy agricultural soil.

**Keywords**: Soil microbiome, metagenomics, biofertilizer, bioremediation, fertility.

# Bacterial Bioremediation of Chromium and Textile Dye

**Group:** Environmental Science **Project ID:** SRG-223473

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## Abstract

**Background**: Cr (VI) being used in various activities of industries and its improper treatment led to contamination of environment. **Objective**: This study aimed to investigate the heavy metal bioremediation potential of nine candidate bacteria out of a total of 35 bacterial isolates. **Methodology**: Bacteria was isolated and assayed by standard bacteriological methods. Chromium concentrations were determined by Diphenyl Carbazide and UV Vis spectroscopy methods. PCR was conducted using universal primers. Sequencing was carried out from external source. **Findings**: The isolates were identified as *Kuthia gibsonii, Acinetobacter schindleri, Pseudomonas aeruginosa, Exigubacterium sp., Rhodococcus sp., and Bacillus spp.* These isolates were tolerant to high concentrations of chromium ranging from 100-1000ppm. Through UV -VIS spectroscopy, the reduction potential was found to be highest for *Bacillus* species (78%) and lowest for *Kurthia gibsonii* (4.8%). In broth, none of the isolates were able to reduce Cr (VI) when concentration was 800 ppm or higher, although this concentration was tolerated in agar. Batch biosorption assay indicated that the selected isolates possessed both adsorption and reduction abilities, albeit to different extents. The ability of co-culture to reduce hexavalent Chromium demonstrated varying abilities in different environments. *Kurthia gibsonii, Acinetobacter schindleri* and *Pseudomonas aeruginosa* were observed to be good biofilm formers. **Conclusions**: This study has successfully identified nine potential bacterial candidates for the bioremediation of Chromium (VI) of which the genomes of two have been sequenced fully. Further research into the mechanisms adopted by these bacteria and genetic manipulation will help to formulate a single or mixture of isolates that can efficiently remove hexavalent Chromium from polluted water.

**Keywords**: Bacteria, bioremediation, environment, chromium, pollution.

# Spatiotemporal Variations of Microplastic Debris in the Surface Water Along the Middle Ground of the Bay of Bengal

**Group:** Environmental Science **Project ID:** SRG-223474

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## Abstract

The threat of microplastics (MPs) contamination has emerged as a significant concern since the advent of large-scale plastic production in the 1940s. The prevalence of microplastic in the environment has significantly increased as a result of its extensive availability and distribution. The present study investigates the spatiotemporal variations of microplastic debris in the surface water along the Middle Ground of the Bay of Bengal, which is a significant region for fishing and shipping activities. Nine sampling locations were selected in this area, and water samples were collected. The study aims to understand microplastics' types, abundance, and distribution, in this area. Microplastics were collected using plankton nets and separated through flotation in a NaCl solution. The collected samples were processed in the laboratory through drying, weighing, density separation, and wet peroxide oxidation. The result revealed that a total of 622 microplastic particles were identified from water samples collected from those locations. These microplastics exhibited various shapes, colors, and sizes. The most abundant types of microplastics were fibers (54%) and pellets (35%), followed by foam (6%), fragments (2.9%), film (2.1%), and sheets (0.3%). Transparent (39%) and white (35%) were the most common colors observed, while the rest were colored (26%), including red, yellow, blue, and black. The majority of the microplastics were small (<1mm) in size, followed by medium (1-3mm) and large (3-5mm). The dominance of fibers in the samples suggests the contribution of synthetic fabrics and fishing nets to microplastic pollution. The findings also suggest that anthropogenic activities and natural factors such as wind and current dynamics contribute to the presence and distribution of microplastics in the Bay of Bengal. The study provides insights into microplastics' abundance and distribution patterns in the Bay of Bengal middle ground, highlighting the need for effective management strategies to mitigate microplastic pollution in this ecologically important region.

**Keywords**: Bay of bengal, middle ground, synthetic fabrics, anthropogenic, management strategies.

# Transformation of a Very Low Value Water Hyacinth (Kochuripana) of Bangladesh Into a High Value Pharmaceutical Excipient Sodium Carboxymethyl Cellulose

**Group:** Environmental Science **Project ID:** SRG-223475

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## Abstract

**Background:** Sodium carboxymethyl cellulose (Na-CMC), a pharmaceutical excipient, can be formed by the etherification of natural cellulose. It might be produced from the cellulose obtained from water hyacinth (Bengali: Kochuripana). **Objectives:** Collection of cellulose of water hyacinth by several steps of chemical treatments and then chemical transformation it to Na-CMC by etherification reaction. **Methodology:** The collected water hyacinth was dried, powdered, delignified, bleached and acid hydrolyzed to obtain cellulose. It was then treated with isopropyl alcohol, sodium hydroxide and monochloroacetic acid at different reaction conditions to obtain Na-CMC. **Findings:** The initial cellulose extraction steps were; step-1: boiling of water hyacinth powder with 0.5 M sodium hydroxide (NaOH) in water (2 hours, 98°C) for delignification, step-2: bleaching with 15% hydrogen peroxide (1 hour, 70°C), step-3: treating with 2.5 M hydrochloric acid for hydrolysis (70-80°C, 1 hour) and step-4: filtration, washing with water till pH 7 and drying at 80°C. The optimized cellulose etherification reaction phases were, step-1: soaking of cellulose (2 gm) with isopropyl alcohol (IPA) (40 ml) with continuous stirring (1 hour, room temperature), step-2: addition of 30% NaOH (7.5 ml) with stirring (1 hour, room temperature), step-3: addition of mononchloroacetic acid (5 gm in IPA) with stirring (60°C, 3 hours), step-4: washing with ethanol, methanol and drying at 60°C. The FTIR spectrum of Na-CMC showed absorption bands at around 3300, 1300 and 1000-1100 $cm^{-1}$ for -OH stretching, -OH bending and ether group (C-O-C) vibration, respectively. The peaks nearby at 1600 and 1400 cm-1 were for carboxyl and carboxymethyls. The % yield, 130.66 and degree of substitution, 0.86 were also determined. The scanning electron microscopy showed somewhat smooth surface of produced Na-CMC. **Conclusion:** The study provided a clue to convert the low value water hyacinth to a high value Sodium carboxymethyl cellulose. Further studies are required for bulk synthesis.

**Keywords:** Water hyacinth, Na-CMC, pharmaceutical additive, bioprocessing, *pontederia crassipes.*

# Occurrence of Microplastics in the Surrounding Rivers of Dhaka City' Bangladesh

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## Abstract

**Background:** Microplastics (MPs) are considered emerging contaminants because of their potential to cause harm to humans and wildlife as well. In Bangladesh, microplastic research on freshwater environments is scanty. **Objectives:** The present study was done to assess the abundance and distribution of microplastics in two urban rivers, namely the Buriganga and Shitalakhya which surround Dhaka city. **Methodology:** Ten (10) water samples were collected from two rivers. The samples were first treated with the wet peroxidation method and then characterized and quantified according to color, shape, and size using a stereo microscope and a scanning electron microscope (SEM). Some microplastics visible to the naked eye were also isolated for polymer identification using the Attenuated Total Reflectance–Fourier Transform Infrared (ATR–FTIR) spectroscopy. **Findings:** The mean abundance of MPs in Buriganga River and Shitalakhya River was found to be 12.4 ± 2.9 p/L and 11.5 ± 2.8 p/L of water, respectively. The most frequent types of microplastic were microfilm (70.94%), followed by microfibre (15.76%) and microfragment (2.95%) and the predominant color was transparent (68.47%). The common polymer types were polyethylene terephthalate, polypropylene, polyethylene, polyvinyl chloride, and polystyrene. Based on the pollution load index (PLI), nearly all the sampling sites in the Buriganga River belonged to risk category IV, suggestive of serious contamination by MPs. However, one-way ANOVA results showed no significant differences in pollution levels between the five sampling sites ($F = 0.66$, $p>0.05$). The sampling points of the Shitalakhya River were found to fall between risk category III and IV, indicating medium to serious contamination. **Conclusion:** This study provides insights into the contamination levels and characteristics of microplastics in the Buriganga and Shitalakhya rivers. Further research is needed to find ways to reduce the abundance of MPs in freshwater niches.

**Keywords**: Microplastics, freshwater, buriganga, shitalakhya, pollution load index.

# Estimation of Coral Reef Communities of St. Martin's Island', Bangladesh based on FORAM Index

**Group:** Environmental Science **Project ID:** SRG-223478

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## Abstract

**Background**: Coral reefs at St. Martin's Island are the vital coastal ecosystems of Bangladesh. However, coral reefs are rapidly declining on this island because of various stressors, such as climate change and anthropogenic disruptions. FORAM Index (Foraminifera in Reef Assessment and Monitoring Index) can be used to monitor impacts which is due to poor water quality in a particular location and also some other impacts due to regional and global change issues. **Objectives**: The present research is concerned with the investigations of fossil coral reefs of St. Martin's Island and interpreting their paleoenvironment based on foraminiferal assemblages. **Methodology**: For steering the study, coral fossils were collected from the island at different depths. $^{14}C$ dating, water, and sediment quality assessments were done to identify the reef-associated foraminifera. **Findings**: The obtained results specify two sequences of coral development in the island. The first cycle started in 2058-1866 BP and the second cycle sustained from 1290-797 BP. Hallock's FORAM Index was calculated for these two cycles of coral development to have an idea of the water and sediment quality of the coral habitat. The obtained result shows that the value of the first cycle is 2.71and for the second cycle it is 1.74-1.94. **Conclusion**: Among the three functional groups of foraminifera, *Heterotrophic* were mostly abundant (>80%) followed by *Opportunistic* (6-10%) and *Symbiont Bearing* (2-9%) in both cycles.

**Keywords:** Coral reef, St. Martin's Island, foraminifera, paleoenvironment, FORAM Index.

# Effective Removal of Toxic Textile Waste (e.g. Dyes, Heavy Metals) from Aqueous Solution by Fish Scale Biochar

**Group:** Environmental Science **Project ID:** SRG-223480

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## Abstract

Wastewater treatment in Bangladesh is a major concern and solution has become challenging due to various unfavorable conditions. Inadequate technical knowledge causing difficulties in implementing advanced treatment methods. In this current investigation, hilsha fish scale biochar (HFSB) was prepared from *Hilsha hilsha* fish scale. The biochar of fish scale was prepared by pyrolysis at 600°C (N2 flow rate 100 ml/min) heating rate 10°/min. The morphology and surface structure of the adsorbent was characterized by FTIR, TGA, SEM, BET and XRD techniques. The parameters of the Methylene Blue (MB) dye adsorption experiments were conducted in batch process. In this batch adsorption process various experimental parameter such as dye concentration, pH, shaking time, and adsorbent dose were investigated. The specific surface area of HFSB was 46.58 cm2/g, the total pore volume was 0.1908 cm3/g and average pore diameter was 16.39 nm. It was found that, the adsorption of Methylene Blue dye on HFSB were strongly pH dependent and shown better results (almost 99 % removal) at acidic pH (pH - 6). The dye adsorption process of HFSB was examined by the linear pseudo-first-order (PFO), pseudosecond-order (PSO) and intra-particles diffusion (IPD) models. Where the PSO model confirmed a better agreement with high correlation coefficient (R2 = 1). The Langmuir, Freundlich and the Temkin isotherm model were also investigated. A good enough correlation coefficient value (R2> 0.98) proved that the isotherm parameters were perfectly fitted to the Langmuir and Freundlich model at 20°C. The maximum adsorption capacity was found to be 22.73 mg/g for HFSB. Overall, the research on the removal of methylene blue dye from wastewater using hilsa fish scale biochar has the potential to have a positive impact on both the environment and society, providing a sustainable solution for textile wastewater treatment.

**Keywords**: Fish scale, biochar, adsorption, methylene blue, kinetics.

# Effect of Pre-Harvest Bagging and $CaCl_2$ Application on the Quality of 'Mishribhog' Mango

**Group:** Environmental Science **Project ID:** SRG-223481

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## Abstract

**Background:** Mango fruits, being climacteric in nature, lose quality and have a limited shelf life when stored at ambient temperature. **Objectives:** The implementation of a pre-harvest management strategy is necessary in order to retain post-harvest quality, thereby mitigating crop losses. **Methodology:** This study assessed the effects of pre-harvest bagging, 2% calcium chloride ($CaCl_2$), 1.5% potassium sulphate ($K_2SO_4$), and 2% $CaCl_2$ + 1.5% $K_2SO_4$ + bagging on the post-harvest quality and shelf life of mango fruits at ambient temperature for 16 days. Fruits were sprayed three times at 30, 20, and 10 days and packaged in brown paper bags 20 days prior to harvesting. **Findings:** The results revealed that 2% $CaCl_2$ + 1.5% $K_2SO_4$ + bagging significantly improved fruit quality than control in terms of fruit firmness (3.45, 2.82 $kgcm^{-2}$), total soluble solids (12.63, 11.35 ºBrix), total phenol content (125.85, 82.51 mg/100 g), antioxidant activity (308.94,158.53 µmol/g), peroxidase (POD) activity (0.45, 0.39 $Ug^{-1}$), catalase (CAT) activity (0.28, 0.25 $Ug^{-1}$) and β-carotene (390.40, 273.27 µg/100 g); reducing polyphenol peroxidase (PPO) activity (2.43, 3.19 $Ug^{-1}$); delaying weight loss (12.38, 12.61 %). Consequently, 2% $CaCl_2$-treated fruits had higher ascorbic acid (14.25, 11.26 mg/100g), titratable acidity (0.41, 0.30%) while lower total sugar (9.21, 11.15%), respiration rate (12.53, 16.00 $mlCO_2kg^{-1}h^{-1}$), and ethylene production (22.27, 38.79 $\mu lC_2H_4kg^{-1}h^{-1}$) compare to the control at end of storage. **Conclusion:** These physio-chemical data suggest that 2% $CaCl_2$ + 1.5% $K_2SO_4$ + bagging may improve Misribhog mango fruit quality at storage.

**Keywords**: Mango, pre-harvest nutrients, phenolic compounds, antioxidant enzymes, decay incidence, storage.

# Design and Fabrication of an Automated Solar Powered Insect Light Trap

**Group:** Environmental Science **Project ID:** SRG-223482

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## Abstract

The use of chemical pesticides is a common practice in agriculture to control pests, it is dangerous for human health with the environment. Solar light trap can be an alternative renewable and environmentally friendly device. That's why, in this study an attempt was taken to fabricate an automated solar-powered insect light trap as an eco-friendly and cost-effective approach. In this project an automated solar powered inset light trap has been successfully fabricated for captured of insect in orchard and paddy filed. The trap was set at three height levels of 1 m, 1.25 m, and 1.5 m in the field. It was found that with the increase of light power and height of the trap, the number of insects was increased. Also, the white color bulb showed the most efficient result at 1.25 m height in all power treatments at the litchi orchard. Also, for paddy field the trap showed the most efficient result at a high 1.5 m from the ground level in the field. Some beneficial insects were also attracted by the trap these were ladybird beetle, water scavenger, giant water bug, ground beetle, rove beetle, and damsel fly. The optimum light power for trapping harmful and friendly insects was 5 W at 1.5 m height for white color based on the number of trapping harmful and friendly insects. It was found that an automated solar insect light trap is more effective and eco-friendlier than conventional light trap.

**Keywords**: Solar panel, automated light trap, insect.

# Strategies for Mitigation and Adaptation to Climate Change Impact in the Char land Ecosystem of Tista River Basin

**Group:** Environmental Science **Project ID:** SRG-223483

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## Abstract

Climate change poses a significant threat to vulnerable ecosystems, particularly in riverine regions like the Teesta River basin in northern part of Bangladesh, is home to unique char land ecosystems that are highly susceptible to the adverse effects of climate change. The study investigated the impacts of climate change on these char land ecosystems and explores potential mitigation and adaptation strategies. The study was conducted in the charland areas of Nilphamari and Rangpur district which fall under Tista River basin. A survey work was carried out to gathered information from 281 respondents in this area. The survey work was steered to collect data on key environmental parameters, socio-economic conditions, and local perceptions of climate change adaptation strategies. The study findings revealed a worrying trend of rising temperatures, changing precipitation patterns and frequent extreme weather events that negatively affect the fragile char land ecosystems. The research identified various strategies employed by local communities, governmental organizations, and non-governmental entities to address climate change challenges. Mitigation approaches include sustainable land use practices such as dredging of the rivers, afforestation, and renewable energy adoption, while adaptation strategies encompass resilient agricultural practices such as effective cropping pattern, flood and drought tolerant crop varieties, subsidies for the agricultural input products, water management techniques and community-based disaster preparedness initiatives. Through the analysis of the data, it was observed that the most effective cropping pattern for this area is: Maize>Fallow>Aman rice. The findings contribute to existing knowledge on climate change adaptation and provide policymakers and stakeholders with valuable information for formulating sustainable development strategies. Overall, the research underscores the urgency of implementing targeted climate change adaptation and mitigation measures to safeguard the delicate char land ecosystems and ensure the well-being and livelihoods of the communities relying on these lands in the face of ongoing and future climate challenges.

**Keywords**: Tista river, charland, adaptation, climate change, ecosystem.

# Mapping Land-Use Change' Shade Tree Diversity and Ecosystem Services Provided by Plainland Tea-Agroforests of Northern Bangladesh

**Group:** Environmental Science **Project ID:** SRG-223484

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## Abstract

Tea is an important beverage crop introduced in the plainlands of northern Bangladesh in the late ninety's; present tea area coverage, management practices, and ecosystem services need to be explored. The aim of this study was to explore area and land class changes to tea cultivation, shade trees planted along with tea, and soil carbon stored by the Tea-Agroforests (TAF) of northern Bangladesh. The land use and land cover change (LULC) classification were done by using Landsat images of the years 2004, 2013, and 2022. The diversity attributes were used to measure the shade tree diversity and soil collected from TAF was analyzed in the laboratory for soil carbon sequestration. The results from satellite image classification revealed tea cultivation in the studied area gradually increased from the year 2004 to 2022; a sharp increase in the tea area was recorded from the year 2004 to 2013. The waterbody mostly transformed into tea followed by the broadleaf tree area. The species richness of shade trees ranged from 1-8; the Margalef index ranged from 0-21.2. The Shannon diversity ranged from 0-1.93 which can be treated as very low species diversity. Betelnut was the most important tree followed by Indian gooseberry, mango, mahogany, and neem. The subsistence farmers mostly plant tree species that have commercial value for their products. The soil was acidic and the mean soil organic carbon content was 1.43%. The soil quality was better in larger tea gardens compared to the tea gardens of subsistence farms. Finally, it might be concluded that tea cultivation areas increased significantly over the period; appropriate management practices might ensure ecological services from the TAF of northern Bangladesh.

**Keywords**: Tea-Agroforests, LULC, land transformation, shade tree diversity, ecological services.

# Biochemical and Molecular Biomarkers of Emamectin Benzoate (EMB) Pesticide Exposure in Rabbit

**Group:** Environmental Science **Project ID:** SRG-223485

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## Abstract

**Background**: Emamectin benzoate (EMB) pesticide exposure affects the physiology of animal and human which in turn may be the issue of public health. **Objective:** i) To investigate appropriate biomarkers of EMB exposure in mice, ii) To assess the risk of EMB exposure by measuring the level of biomarkers. **Methodology**: Each of 50 female and 50 male mice of one month age were divided into four groups $T_0$ (control), and $T_1$, $T_2$, $T_3$ with 2.5, 5.0 and 10 mg/kg/day EMB respectively. After 12 weeks, intraperitoneal glucose tolerance test, intraperitoneal insulin tolerance test, serum creatinine, glycated hemoglobin and SGPT were measured. **Findings:** EMB exposure affected body weight gain both in male and female but the changes were significant in female. Intraperitoneal glucose tolerance test was performed by injecting 2.0 g glucose/ kg bw intraperitoneally and after 45 and 90 -minutes the blood glucose level showed non-significant change. Intraperitoneal insulin tolerance test was conducted by injecting 1.5 IU/kg insulin intraperitoneally. Blood glucose level at $45^{th}$ and $90^{th}$ minute were 6.0 and 6.32 mmol/l respectively for $T_3$ female mice compared to 3.98 and 4.40 mmol/l for control whereas no remarkable effect on male. EMB exposure had no significant effect on serum creatinine and glycated hemoglobin among control and treatment groups whereas significantly affected the SGPT level. SGPT values in $T_3$ mice of male and female were 59 and 74 U/L respectively compared to control (48 U/L). No gross changes were observed in liver and kidney. But in case of male, spleen had significantly lower weight and female had lower uterine weight in all treatment groups compared to control. **Conclusion**: Therefore, exposure in mice to EMB at suggested doses has sex dependent effect on insulin tolerance, SGPT level as well as spleen and uterus morphometry.

**Keywords**: Emamectin benzoate (EMB), biomarkers, mice, male, female.

# Production and Evaluation of Biochar Based Poultry Litter Compost and Its Efficacy on Okra Yield

**Group:** Environmental Science **Project ID:** SRG-223486

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## Abstract

**Background:** The intensity and concentrated activity of the poultry industry generate vast amounts of biodegradable wastes, which must be managed under appropriate disposal practices to avoid a negative impact on the health and environment. **Objective:** To investigate biochar-based poultry-waste-composting, one pilot-scale experiment was carried out to produce good quality compost using poultry litter (PL) and different bulking agents such as biochar, rice straw (RS), rice husk ash (RHA) and tea waste (TW). **Methodology:** For this experiment, 0.733 $m^3$ each of six square-shaped bins were used with dimensions, 0.95 m long, 0.93 m wide and 0.83 m height. Aerobic composting technology was used. To monitor the composting process and evaluate compost quality, some physicochemical parameters, phytotoxicity were measured. **Findings:** The composting period lasted 90−100 days. Experimental results showed that the final products had excellent physicochemical attributes (C/N: 17.26-22.41, GI: 119.18-137.77%, TKN: 0.97-1.38%, OM: 35.22-44.3%, TOC: 20.42-25.69%, pH: 7.05-8.12, EC: 4739-6456 µS/cm. To achieve good quality compost, poultry litter was used higher amount with bulking agent (RHA, TW and biochar) where the ratios was (60:15:10:15). Compost was free from phytotoxicity. Nevertheless, composting duration and bulking agents and their ratios are crucial factors that determine the quality of the final product. A full-scale compost unit was designed-based on the experimental results. For a typical small-sized poultry farm, having 1500-2000 number of poultry birds, a total area of about 10 $m^2$ is needed to compost the annually produced poultry waste. A field trial of okra cultivation was done with the produced compost and Okra yield (17.17 $tha^{-1}$) was significantly increased due to biochar-based poultry litter compost than others. **Conclusion:** It could be concluded that poultry waste could be managed by composting. This composting technology was suitable for small to medium scale poultry farmers. The compost could be used as alternative of cowdung for crop production.

**Keywords**: Poultry litter, biochar, compost, physicochemical, okra.

# Application of Melationin and Biochar for Sustainable Improvement of Drought Tolerance in Rapeseed and Mustard Genotypes

**Group:** Environmental Science **Project ID:** SRG-223487

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## Abstract

**Background**: As oil yielding crop rapeseed and mustard reduced their yield under drought condition which could be ameliorate by the application of melatonin and biochar. **Objectives**: The investigation was conducted with aimed to evaluate the enhancing role of melatonin and biochar for ameliorating the drought stress of rapeseed and mustard genotypes. **Methodology**: The experiment followedsplit plot design where, factor A: i) Well water ($T_1$), ii) Rainfed ($T_2$), iii) Rainfed+Melatonin ($T_3$), iv) Rainfed+Biochar ($T_4$) and v) Rainfed+Melatonin+Biochar ($T_5$) ; and factor B: BARI Sarisha-16, 17 and 18. Melatonin and biochar applied as 100 µM solution and 1 kg DM $m^{-2}$, respectively. **Findings**: It was observed that drought stress plot ($T_2$) showed lower performance in respect of yield and yield contributing traits, various water relations and physiological attribute compared to well water ($T_1$, control) condition. When the drought stressed plots treated with exogenous melatonin ($T_3$) and biochar ($T_4$) alone, gave somewhat better outputs compared to drought ($T_2$) environments. Overall, yield and yield contributing parameters such as plant height (cm), branches number $plant^{-1}$, and leaf area $plant^{-1}$ ($cm^2$), number of siliqua $plant^{-1}$, number of seed $siliqua^{-1}$, siliqua length (cm), test weight, yield $plant^{-1}$, and yield $plot^1$ were greater in $T_5$ treatments (Rainfed + Melatonin @ 100 µM + Biochar @ 1 kg DM $m^{-2}$). Soil moisture content, relative leaf water content and canopy temperature depression greatly enhanced due to combine application of melatonin and biochar ($T_5$) under drought condition compared to melatonin ($T_3$) and biochar ($T_4$) alone. Photosynthetic pigments chlorophyll a ($C_a$), chlorophyll b ($C_b$), total chlorophyll ($C_{a+b}$) and total carotenoids ($C_{x+c}$) were enhanced due to combine application of melatonin and biochar ($T_5$) under drought condition but proline content reduced as compared to drought ($T_2$), melatonin ($T_3$) and biochar ($T_4$) treatments alone. **Conclusion**: Drought stress plot ($T_2$) reduced their performance in various traits and combine application of melatonin and biochar ($T_5$) plays key role for ameliorating the drought stress on rapeseed and mustard.

**Keywords**: Biochar, *brassica*, drought, melatonin, mustard.

# An Appraisal of Ecological Influences of Rubber Dam on Fish Biodiversity and Aquatic Habitat: A Comparison Between Upstream and Downstream Environmental Impact Analysis

**Group:** Environmental Science **Project ID:** SRG-223488

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## Abstract

The main rivers of Dinajpur district are Dhepa, Punarbhaba, and Atrai, all of which have substantial impacts on the ecology and fisheries biodiversity of the surrounding localities. However, day by day rivers are losing their original characteristics. Besides this, the rapid expansion of agricultural, domestic, irrigation, and industrial activities resulting decreasing the riverine resources. In addition, during the dry season, most of the rivers in Dinajpur district are facing the problem of siltation leading to a thin flow of water in the dry season and floods in the rainy season. Furthermore, dam and dam-related operations can bring changes in the growth, spawning behavior, and overwintering condition of local fish populations as well as in the composition and abundance of food organisms. Considering the above mention causes, the present study had been undertaken to assess the effect of the rubber dam on fish habitat, limnology, and perceptions of the local fishing community toward the benefit of the dam. In this experiment different physico-chemical water quality parameters were measured fortnightly in four sampling sites of the both up and down streams of the study river. However, the characteristic features of stable physico-chemical conditions suggest that the study river is not presently under serious pollution threat. Though the status of study river ecosystem is not very encouraging. Some parts of the river are completely dried up during winter season. Different environmental problems were identified during sample collection in both sites such as use of fertilizers; unload of sand and anthropogenic disturbance. Moreover, in the study river fish migration hampers due to dam, so long term study should be conducted for the sustainability of the river and also for better management of the river. In addition, awareness raising and implementation of proper management technique in needed for saving the biodiversity as well as the ecosystem of the rivers.

**Keywords**: Water quality, plankton, Atrai river, benthos.

# Influence of Gender on Transgenerational Effects of Inorganic Arsenic in Postnatal Growth' Blood Profile and Organ Development

**Group:** Environmental Science **Project ID:** SRG-223489

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## Abstract

Arsenic can cross the placental barrier and affect the health of future generations. Males were more vulnerable than females to the negative effects of arsenic. Thus, the present study aimed to investigate the influence of gender on the transgenerational effects of $NaAsO_2$ in a mice model. Mice male lineage and female lineage were created for a total of 4 ($F_0$, $F_1$, $F_2$, $F_3$) generations. Then, body growth, organ development, and hematological & biochemical parameters were evaluated in all generations. It was observed that in $F_0$, body growth and organ development were influenced by sodium arsenite. In $NaAsO_2$-exposed females, WBC and neutrophils were increased and lymphocytes and platelet count decreased. Serum creatinine, uric acid, SGPT/ALT, total cholesterol, triglycerides, and alkaline phosphatase increased in $NaAsO_2$-exposed males. In $F_1$, body growth and organ-to-body weight ratio were higher, and organ weight decreased in females from all lineages. WBC and platelet counts were increased in females, and serum creatinine, SGPT/ALT, and alkaline phosphatase were increased in males from all lineages. In $F_2$, body growth, lung weight, and liver weight increased in males from all lineages except both exposed females. Interestingly, in the case of female-exposed males the WBC counts, neutrophils, and platelet counts, total cholesterol, triglycerides, and SGPT/ALT, were increased and serum creatinine, alkaline phosphatase increased in male-exposed females, and both exposed females. In $F_3$, there were no significant effects of $NaAsO_2$, except liver and spleen in both exposed groups. Results showed that only WBC significantly decreased in $NaAsO_2$-exposed mice and platelet counts were increased in all lineages. Interestingly, SGPT/ALT and alkaline phosphatase increased in males of all lineages with fewer exceptions. The study suggests that arsenic has sex lineage-specific transgenerational effects in mice and needs future research using human doses to understand the transgenerational effect in humans and their amelioration strategy.

**Keywords**: $NaAsO_2$, Transgenerational, gender, mice, postnatal growth.

# Studies on Foliar Application of NAA and $GA_3$ on Growth and Yield Attributes of Okra (*Abelmoschus esculentus* L.)

**Group:** Environmental Science **Project ID:** SRG-223490

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## Abstract:

**1. Background / Problems statements:** In Bangladesh management practices information about growth regulators to be used in Okra are insufficient. As a result, farmers do not get satisfactory yield and return from investment. **Objectives:** To find the effect of suitable dose of GA3, NAA and GA3 and NAA on growth and yield of okra. **Methodology:** Design of the experiment: RCBD Factor A: Three levels of GA3 (G) viz., G0 = (control) G1= 250 ppm G 2 = 350 ppm Factor B : Three levels of NAA (N) viz. N0 = (control) N1 = 250 ppm N 2 = 350 ppm. **Findings:** The growth regulators were sprayed after 40 days of seed sowing. The single effect of treatment N1 (250 ppm) and G2 (350 ppm) recorded significantly, highest yield (8.16 t /ha) and (7.62 t/ha) respectively. The combined effect of treatment N1G2 gave significantly the highest yield of (8.61 t/ha). Regarding different growth and yield characters such as plant height (143.00 cm), leaf number (36.38), plant fresh weight (29.14 kg), node number (29.14), internode length (6.85 cm), internode diameter (16.25 mm), fruit length (15.72 cm), fruit diameter (18.41 mm), fruit weight per plant (229.80 g) and total weight of per plot (2.58 kg) most of were significantly highest in the treatment $GA_3$ (350 ppm) than all other treatments. **Conclusion:** The significantly highest (8.61 t/ha) yield was obtained in N1G2 (N1=250 ppm + G2= 350 ppm) treatment. The lowest yield (6.81 t/ha) was recorded in treatment combination of N2G2 (N2= 250ppm + G2= 350 ppm).

**Keywords**: Ladies finger, plant height, node number, fruit length, yield.

# Effect of Irrigation on Taro (*Colocasia esculenta*) to Grow it in Degraded Soil Near Brick Field in Dinajpur

**Group:** Environmental Science **Project ID:** SRG-223491

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## Abstract

The proposed program an attempt has been made to know the effect of irrigation on taro to grow it in degraded dry soil near brick field. The objective of the present study was to utilize degraded soil in areas adjacent to brick filed and optimum irrigation for taro. The experiment was conducted in RCBD with 3 replications. Unit plot size was 2mx2m. Row-row distance 50cm and plant-plant distance 25cm. Treatments were $T_0$ (No irrigation or control), $T_1$ (One irrigation), $T_2$ (Two irrigation), $T_3$ (Three irrigation) and $T_4$ (Four irrigation). Data were analyzed by Statistics-10 software. There was a significant difference among treatments regarding the number of leaves/plant. The highest number of leaves/plant was observed in $T_4$ while the lowest from control. One, two and three irrigations showed statistically similar results regarding number of leaves/plant. Significant variations were observed among different irrigations regarding plant height at 60 days and 120 days after planting. At 60 days after planting the shortest plant (27.66 cm) was observed in control and the tallest plant (66.66 cm) was found in $T_4$. $T_3$ and $T_4$ gave statistically similar result. At 120 days after planting the tallest plant (87.66 cm) was found in $T_4$ and shortest plant was observed in $T_0$ and it was statistically similar to $T_1$. The highest number of cormel/plant was found in $T_4$ and it was similar to $T_3$. The lowest number of cormel/plant was observed in $T_0$. The maximum weight of cormel/plant (250 g) was in $T_4$ while the minimum (77.00 g) in $T_0$. $T_4$ produced the maximum weight of cormel/plot (9.87 kg) and the minimum weight of cormel/plot was found in control (3.10 kg). Yield of cormel/ha was maximum (20.57 ton) in $T_4$ and the lowest yield of cormel/ha (6.50 ton) was observed in control. There was significant difference among treatments regarding number of leaves/plant. One, two and three irrigations gave statistically different results regarding yield of cormel/ha (9.80, 17.50 and 19.40 ton respectively).

**Keywords**: Emergence, plant hight, cormel, leaf number, yield.

# Synergism of Biochar' Rhizospheric and Endophytic Bacterial Consortia on Rice (*Oryza sativa*) Varieties (BRRI dhan 28) to Ensure Sustainable Agriculture

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## Abstract

The pesticide-degrading endophytic and rhizospheric bacterial consortia and synergistic effects of biochar were employed to build biofertilizer to eliminate rice pesticide residues and minimize nitrogenous fertilizers. In Boro season 2023, HSTU, Dinajpur conducted an RCBD experiment with three replications and eleven treatments. T1: Recommended full N, P, K, and S dosages; $T_2$, 10 t $ha^{-1}$ biochar; $T_3$, $T_4$, and $T_5$: Biochar 10 t $ha^{-1}$+ ½ N & remainder RDF, 7.5 t $ha^{-1}$+ ½ N, and 5 t $ha^{-1}$+ ½ N, respectively. $T_6$: Biochar 5 t $ha^{-1}$+ $^{1/4}$ N & rest RDF + consortia (a), $T_7$: Biochar 5 t $ha^{-1}$+ $^{1/4}$ N & rest RDF + consortia (b), $T_8$: Biochar 5 t $ha^{-1}$+$^{1/4}$ N & rest RDF + Mixed (a+b) consortia (no pesticides), $T_9$: Biochar 7 t $ha^{-1}$, $T_{10}$ and $T_{11}$ are pesticide treatments using biochar 10 and 5 t $ha^{-1}$, $^{1/4}$ N and RDF, and Mixed (a+b) consortia. The treatment $T_{10}$ with Biochar 10 t $ha^{-1}$+ $^{1/4}$ N & rest RDF had the highest yield, plant height, no. of tillers per hill, panicle length, number of grains per panicle, root length, and filled grains per panicle. The mineral content of rice grains varied significantly among treatments, including moisture, Ash, protein, fat, fiber, β-Carotene, carbohydrates, Vitamin C, total phenol, and SPAD value (Chlorophyll). Maximum number was reported almost on consortia-treated plots with greater SPAD value on $T_{10}$ treatments, ensuring better yields with little stress and lowest total phenol. Bacteria-treated plots had better soil chemical characteristics than controls. However, element (Calcium, Magnesium, Potassium, Zinc, Iron, Lead, and Cadmium) concentrations varied most among treatments, with bacteria treated plots having 16.08-fold and 1.34-fold greater calcium and zinc concentration. The experiments concluded to use mixed bacterial consortia with biochar @10 $tha^{-1}$ which reduces the uses of nitrogenous fertilizers enhancing the sustainable rice crop production.

**Keywords**: Synergistic effects, biochar, consortia, pesticides, and sustainable agriculture.

# The Carbonaceous Pollutants in Dhaka city: Sources, Levels and Health Risks

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## Abstract

Carbonaceous pollutants are composed of carbon or rich in carbon. They are the key components of fine particulate matter (PM), one of the main pollutants responsible for poor air quality (accounting for 10%–50% of particle matter (PM) concentrations). The analysis of carbonaceous particles is an important area of investigation in the atmospheric environment. It is also important to understand the impact of atmospheric pollution on human health and regional and global climate change. In recent years, much research interest has been focused on atmospheric carbonaceous particles due to their influence on climate and health. To the best of our knowledge, there is no extensive investigation on the characterization, source identification, and impacts of carbonaceous aerosols in Bangladesh, especially in Dhaka city. As a result, this study determines the most recent pollution status and the essential air pollution mitigation techniques in the research area. However, from August 2022 to December 2022, we used a medium-volume air sampler to sample $PM_{2.5}$ aerosol samples every Sunday for a full day on the roof of the Science Building at Jagannath University in Dhaka city. Moreover, from January to March 2023, four days a week at the same location, fine aerosol samples were collected using a Size Segregation Aerosol Sampler. In this city, wintertime particle pollution was three times higher than monsoon or post-monsoon levels. According to the data, $PM_{2.5}$ pollution peaked 266.75μg/$m^3$ during the winter (Dry season), peaked 90.90μg/$m^3$ during the monsoon, and peaked 132.85μg/$m^3$ during the post-monsoon (heating season). Throughout the study period, the average concentrations of OC and EC in $PM_{2.5}$ were 7.60 μg/$m^3$ and 3.799 μg/$m^3$, respectively. At the sampling site (JnU), the concentrations of OC and EC varied between 1.544μg/$m^3$ and 0.533μg/$m^3$ to 13.817μg/$m^3$ and 12.097μg/$m^3$. All organic compounds present in the particle phase, or OC (average 7.60 μg/$m^3$), constituted the dominant fraction of carbonaceous aerosol. The data that has been analyzed provides an overview of the current status of Dhaka's air quality and pollution levels.

**Keywords**: Carbonaceous, aerosols, particulte matter, air quality, atmospheric.

# Metagenomic Approach to Understand the Impact of Climate Change on the Distribution and Transmission of Antimicrobial Resistance Genes (ARGs) Prevalent in Marine Microbiota

**Group:** Environmental Science **Project ID:** SRG-223499

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## Abstract

Understanding the microbial communities and their functional capabilities in the coastal region of the Bay of Bengal (BoB) is essential for effective conservation and management of the ecosystem facing significant environmental challenges. The purpose of the study was to explore the microbial diversity and functional potential of the microbial communities in the coastal region of the BoB in Bangladesh and to understand the interplay between environmental factors and microbial composition. In this study, a total of 20 water samples have been collected from 4 locations of Cox's Bazar and 3 locations of Saint Martin, including on-site detection of multiple physicochemical parameters Total dissolved solids, pH, salinity and temperature. After total DNA extraction, pooled DNA samples of Cox's Bazar ($S_2$) and Saint Martin ($S_1$) were also subjected to Shotgun Metagenome Sequencing to reveal the community composition and functional profiles using Kraken2, Bowtie2, and Samtools and R-studio for statistical analysis and data presentation. The analysis of Shotgun-Metagenome data revealed the most abundant phyla Proteobacteria in Cox's Bazar (94%) and Saint Martin (90%). Alpha-proteobacteria ($S_2$ = 52%, $S_1$ = 54%) and Gamma-proteobacteria ($S_2$ = 35%, $S_1$ = 33%) have been found as top two classes in both locations. Analysis for functional metabolic properties of microbial communities revealed the abundance of diverse metabolic function along with existence of drug-resistance genes against several classes of antibiotics like aminoglycoside, beta-lactam, quinolone, sulfonamide, tetracycline, trimethoprim, etc and also contained several virulence factors like adherence proteins, biofilm-forming proteins, exotoxins, immune modulation proteins and protein family, which is associated with human disease. The findings of this study will contribute to our understanding of the diversity and distribution of microbial communities in the coastal region and the functional capabilities of these communities, providing valuable insights for conservation and management of the coastal ecosystem in Bangladesh.

**Keywords**: Phylogenetic diversity, total microbiome, shotgun metagenome, functional potential, drug resistance genes.

# Mitigation Effects of Different Levels of Zinc on Growth' Yield and Antioxidative System in Maize (*Zea mays* L) Under Salt Stress

**Group:** Environmental Science **Project ID:** SRG-223500

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## Abstract

**Background:** Salinity is one of the key abiotic factors, limiting crop production worldwide. Maize cultivation in our country is increasing because of high yield potential as well as its high market demand for poultry feed. About 30-50% of net cropped areas remains fallow in rabi and Kharif-1 seasons, due to salinity. Thus, the production of maize severely affected by salinity in coastal regions in Bangladesh. **Objectives:** This work has been focused on the mitigation mechanism of salt-induced reduction in growth and yield of maize. Application of zinc in the fallow lands of the coastal regions might be the scholastic technique for improvement of maize production. **Methodology:** The field experiment was conducted in Botanical Garden of Jahangirnagar University. Based on the findings of screening, maize cultivar BHM-9 was selected as plant material. Four different levels (0,75,150 and 225 mM) of NaCl solution and two concentrations (10 mg/kg and 20mg/kg) of zinc sulfate were applied. Morphological parameters were recorded in the field at 20, 40 and 60 days after treatment. Yield parameters were recorded at harvest. The activity of APX, CAT and SOD was determined by the method of Nakano (1981), Aebi (1984) and Fridovich (1969), respectively. **Findings:** Morphological and physiological attributes of maize were improved by zinc under salinity. Total dry mass was improved by Zn supplementation. Proline content significantly increased under salinity as well as zinc supplementation. Salinity increased the activity of MDA content. However, Zn supplementation appreciably reduced this variable. The antioxidant enzymes (CAT, SOD and APX) activity were increased under salinity. Zinc and salinity interactions amplified the activities of antioxidant enzymes. The yield was increased by Zn application. The findings suggest that 20 mg/kg Zn concentration is the optimum concentration for alleviating the adverse effects of salinity in maize. **Conclusion:** Zinc could partially alleviate the adverse effects of salinity on maize modulating the antioxidant enzymes activities and proline content.

**Keywords**: Salinity, antioxidant enzyme, proline, dry mass, MDA.

# Assessment of Greenhouse Gas CO2 Emission and Fluorescent Dissolved Organic Matter (FDOM) Dynamics from Kaptai Lake

**Group:** Environmental Science **Project ID:** SRG-223501

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## Abstract

Kaptai Lake is the largest man-managed lake in Bangladesh with a unique environment. This research aimed to understand the carbon dioxide flux and sources of dissolved organic matter (DOM) in the Kaptai lake in term of hydrobiogeochemical studies. Six water quality parameters were tested in 48 samples of the lake which were within environmental quality standard. Among the heavy metals Pb, Cr, Co, Cu, Zn, and Ni, pose a risk to the health of organisms when concentrations are above a particular threshold. The EEM-PARAFAC modelling found the presence of peak A, T, Tuv from total 48 samples of Kaptai lake water. The fluorophore peaks displayed their three positions at Ex/Em = 270–290/ 335–375 nm (Peak T), 230–260/387–429 nm (Peak A), and 225–235/ 338–351 nm (Peak Tuv). Peak T and Tuv confirm the presence of protein-type components and Peak A is indicating the existence of humic-like terrestrial organic materials. The fluorophore intensity chronology of the samples was: Peak T > Peak Tuv > Peak A. The DOM indices, i.e., FI, HIX, BIX and $SUVA_{254}$ revealed the result that, the source of DOM components came from autochthonous sources. Furthermore, a 24-hour long monitoring of the carbon dioxide flux ($fCO_2$) ranges from 14016.92 to 81588.05 mmol $CO_2$ $m^{-2}d^{-1}$ (mean = 40515 ± 16195.45 mmol $CO_2$ $m^{-2}d^{-1}$). $CO_2$ exchange is lowest around 3:30 pm and highest at 9:00 pm and 5:00 am. So as per our estimation, Kaptai Lake acts as a source for anthropogenic CO2 emission.

**Keywords**: Carbon dioxide flux, partial pressure, dissolved organic matter, dissolved organic carbon, fluorescence spectroscopy.

# Understanding the Temporal and Spatial Changes in the Groundwater Arsenic Distribution in A Dynamic Hydrogeological Condition and Estimating the Arsenic Distribution in the Human Food Chain

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## Abstract

The presence of arsenic (As) in shallow groundwater in Bangladesh is well documented. However, there were limited studies on the temporal and spatial changes of arsenic distribution in the shallow groundwater and there were fewer studies on the presence of As in the human body. The objectives were to determine As in the groundwater, agricultural soil, vegetables and human nails, and to compare the As concentrations with a past study conducted in 2015. The study was conducted in Singair Upazila, Manikganj. A previous study was completed in the same area in 2015 and the current study collected samples from the same sampling locations. The study in 2015 had 40 groundwater samples, however, in 2023 it was possible to collect 13 samples since the municipal authority supplied most of the pre-sampled households at present. Despite having fewer samples, we were able to compare two sampling periods as we collected samples from the same tubewells. As concentrations in the groundwater were 0.54 ± 0.02 and 1.53 ± 0.13 mg/L for 2023 and 2015, respectively. On average about a 30% reduction was found for each sample. This reduction in groundwater As might be related to the change in the mode of drinking water collection. In 2015, all households used personal tubewell to collect drinking water and in 2023, most of the households got drinking water from the municipal supply line. As a result, the shallow groundwater was not disturbed intensively as before and the hydrogeochemical condition in the aquifer materials did not release As in the groundwater. To reduce As from the agricultural soil and consequently food materials and eventually in the human body, comparatively more time might be required. This study showed that in the As prone area, a central supply system of drinking water might reduce the groundwater As concentrations.

**Keywords**: Vegetables, arsenic reduction, hydrochemistry, municipal water, shallow aquifer.

# Investigation of Diurnal Changes in Dissolved Organic Matter Characteristics in the Freshwater of Bangladesh

**Group:** Environmental Science **Project ID:** SRG-223503

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## Abstract

Dissolved organic matter (DOM) is a crucial component carbon cycle and plays a vital role in biogeochemical cycles in the freshwater ecosystem. DOMs influence the bioavailability, transport, and toxicity of metals, trace elements, and other organic pollutants in lakes and rivers. This study aimed to assess water quality and daily-to-seasonal dynamics of the dissolved organic matter (DOM) from tropical lakes. A water quality multimeter analyzer was deployed to continuously record daily and seasonal variations of water quality parameters (pH, DO, EC, TDS and FDOM) of three lakes in Dhaka. Three-dimensional excitation-emission matrix (3D-EEM) fluorescence spectroscopy combined with parallel factor (PARAFAC) analysis was used to investigate the distributions of fluorescent components in DOM. Water quality parameters in both wet and dry seasons in three polluted lakes showed significant seasonal variations. Dissolved organic carbon (DOC) concentration varied between 4.94–13 mg/L and 3.99–12.71 mg/L in all three lakes in the wet and dry seasons, respectively. A lake's degree of pollution and organic matter content may be inferred from the state of the DOC in that lake water and an important factor in evaluations of water quality. The state of the DOC would normally suggest a relatively lower concentration of organic carbon in a low-polluted lake while increased DOC levels are the result of increased pollution inputs or excessive organic matter breakdown. EEM-PARAFAC analysis identified humic-like, fulvic-like, protein-like, and more tyrosine-like DOM components and their environmental dynamics. Tropical lakes are a complex ecosystem that is strongly interconnected with the terrestrial system. Various pollutant sources such as precipitation run-off, household wastewater, plant litter, and in situ plants increase the DOM concentration in the lake's ecosystem. This DOM is broken down by various photo-biogeochemical processes. These microbes such as bacteria, fungi, alga, and plankton use the DOMs as a nutrient source. Terrestrial DOM may provide inputs to the terrestrial humic-like component in the lake water. In contrast, the biological activity of plankton-derived DOM is the most likely source for the autochthonous humic-like component.

**Keywords**: Carbon cycle, water quality, pollution, PARAFAC, ecosystem.

# Impact of Landfill Leachate Pollution from Matuail and Hemayetpur Landfill Site on the Surrounding Environment

**Group:** Environmental Science **Project ID:** SRG-223504

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## Abstract

Dumping of solid waste in the non-engineered landfill is very common in the developing countries. Among the different disadvantages of this kind of landfilling, leachate is the major concern to public health, which is a toxic byproduct generated from the landfill; and can percolate to the ground water and consequently migrate in surface water. The present study endeavors to compare the leachate contamination potential of two major landfills of Bangladesh, named Amin Bazar and Matuail which are situated Dhaka city of Bangladesh and assessed the effects of leachate leakage on surrounding water body. This study, calculated the leachate pollution index (LPI) for the landfill sites of Bangladesh and found that the LPI of Matuail landfill site (19.81) is much higher which is comparable to some polluted landfill sites of India and Malaysia. The concentrations of several potentially toxic metals (Cr, Pb, Zn) found in the surface and ground water in the vicinity of the landfill sites were above the maximum permissible limit (MPL) values of department of Environment (DoE), Bangladesh and WHO. The present conditions of surface, ground water and agriculture products near the landfill site of Bangladesh are much frightening to the biota and local inhabitants. Hence, it is necessary to develop necessary mitigation options for landfill leachate pollution. The first approach for preventing the leachate pollution is segregating the waste at sources or dumping site before disposal. If the landfill site is properly controlled by segregating the waste at their source, then the different sort of waste could be managed in different ways, like composting for organic waste; recycling for electronic, paper, and plastic waste; and solidification/stabilization for the hazardous waste.

**Keywords**: Landfill, leachate pollution index, water contamination, health risk assessment.

# Evaluation of Ecosystem Pollution Integrating Chemical' Biomarker and Foraminifora Bio-Indicator Responses in the Cox's Bazar-Teknaf Coast of Bangladesh

**Group:** Environmental Science **Project ID:** SRG-223505

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## Abstract

**Background:** Foraminifera are also known to play an important role in marine ecosystems, as they are key contributors to marine sediment formation and are important food sources for a variety of marine organisms. The presence and abundance of foraminifera species in marine sediment samples can therefore serve as indicators of the overall health and biodiversity of marine ecosystems. **Objectives:** (i) To identify and classify foraminifera species present in the sediment samples using morphological techniques. (ii) To compare the diversity and abundance of foraminifera species in Cox's Bazar with those found in other marine ecosystems, both regionally and globally. **Methodology:** The sand samples were collected from the depths of 0.5 m - 1 m. Water quality parameters such as pH, DO and salinity were recorded. Foraminifera were studied using a stereo microscope. **Findings:** About 58 benthic Foraminifera species were identified of which 41 were perforated-calcareous hyaline,16 imperforate-calcareous porcelaneous, and 1 agglutinated. The study revealed that *Ammonia sp*. and their relatives, *Asterorotalia pulchella, Cibicides boueanus, Elphidium sp. and Nonionellinala bradoricaare* are much abundant in most of the samples where *Asterorotalia pulchella, Ammonia beccarii* and *Islandiellanor crossi* species are common in all study sites. The pH and DO levels indicate that the water is in good condition. **Conclusion:** The presence of foraminifera suggests that the marine environment of the Bay of Bengal is in good health. To enhance our comprehension of the variety of foraminifera in the Bay of Bengal, other beaches can be studied during different periods of the year.

**Keywords**: Foraminifera, bio-indicator, species richness, water parameters, pollution.

# Evaluating Aquatic Insects as Bio-Indicators of Contamination and Heavy Metal Pollution in the Dhaleshwari River, Bangladesh

**Group:** Environmental Science **Project ID:** SRG-223506

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## Abstract

**Background**: Aquatic insects constitute about 90% of all aquatic invertebrate species. They frequently serve as the focus of ecological study and environmental monitoring and evaluation. **Objectives:** This study aimed to assess the diversity of aquatic insects in the Dhaleshwari river in Savar region, Dhaka, Bangladesh. **Methodology:** Aquatic insects were collected year-round using a D-frame aquatic net with a 250µm mesh sieve from three sampling locations of Dhaleshwari river, including the Namabazar, Nayarhat, and the Savar Tannery Industrial Estate areas. **Results:** During the study period, 11675 aquatic insect individuals representing the four orders Diptera, Coleoptera, Odonata, and Hemiptera were gathered and identified. The order with the highest abundance was Diptera (62.01%), followed by Hemiptera (26.70%), Odonata (10.47%, and Coleoptera (1.82). The Culicidae family had the highest abundance (62.01%), followed by the Belostomatidae (15.33%), Gerridae (8.99%), Libellulidae (6.04%), Aeshnidae (4.23%), Nepidae (1.38%), Hydrophylidae (0.70%), Dytiscidae (0.66%), Curculionidae (0.46%), and Coenagrinidae (0.20%). The Culicidae family had more representatives among them in the Nayarhat area near the Dhaleshwari River and fewer in the Namabazar area. However, the representatives of the family Nepidae and Curculionidae were absent from the Namabazar area, whereas, individuals of the family Gerridae and Dytiscidae were absent from the Tannery estate area. The physicochemical parameters of water varied between the study areas. The samples of water, sediments, and insects that were collected are being analyzed to look for heavy metals. **Conclusion:** For a better knowledge of the diversity of aquatic insects as bioindicators of water quality in the studied areas, more research is required.

**Keywords**: Aquatic insect, dhaleshwari river, bioindicator, heavy metals.

# Urban Heat Island Effect and Building Density: A Geospatial Inquiry on Rangpur City Corporation

**Group:** Environmental Science **Project ID:** SRG-223507

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## Abstract

Urban areas are currently hotter than rural areas because of the urban heat island (UHI) effect. Despite being a growing metropolis, Rangpur metropolis corporation's UHI dynamics are still poorly understood. This research looked at the relationship between Rangpur's UHI intensity and building density. For comprehensive understanding, this study utilized Landsat imagery spanning over two decades (2003, 2013, and 2023) and employed advanced algorithms to derive three critical metrics: Land Surface Temperature (LST), Normalized Difference Vegetation Index (NDVI), and Normalized Difference Built-up Index (NDBI). The results revealed a compelling story and observed a distinct inverse correlation between NDVI and LST, highlighting the crucial role of vegetation in mitigating the UHI effect. Vegetation serves as an urban climate moderator by providing cooling benefits. In contrast, urbanized areas in Rangpur predominantly exhibited higher LST values, which were notably offset by the cooler temperatures of wetland zones. This underscores the importance of natural water bodies in regional temperature regulation. Delving deeper into Rangpur's unique urban fabric, this research made an intriguing observation. Despite the city's development, there was minimal bare land, and temperatures across green spaces and constructed areas were remarkably similar. This stands in contrast to bustling metropolises like Dhaka, where oppressive heat is palpable. Over the study period, Rangpur's temperature spectrum varied, reaching a high of 36°C in April 2022 and dropping to a chilly 17°C in February 2003. Additionally, study discovered a pronounced connection between areas characterized by high NDBI values (indicative of urban sprawl) and elevated LST, underscoring the significant thermal impact of densely constructed zones. Rangpur city corporation stands as a model of sustainable urban development, with a harmonious coexistence of urban infrastructure and green spaces. It offers valuable insights for future urban planning, showcasing the potential for ecologically balanced cities, and a more temperate climate compared to sprawling mega-cities like Dhaka.

**Keywords**: Climate change, LST, landsat imageries, NDVI, NDB, and UHI.

# Development of a Low-Cost Household Level Water Treatment System for Excess Iron and Manganese Removal from Arsenic Safe Groundwater

**Group:** Environmental Science **Project ID:** SRG-223508

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## Abstract

The presence of iron (Fe) and manganese (Mn) in the drinking water at elevated level is harmful to human bodies. This study investigated the potential use of rice husk ash as a biosorbent for Fe and Mn removal from an aqueous solution. Batch adsorption experiments were conducted with the influencing of different operational conditions namely time of contact (1-180 min), adsorbate concentration (1-50 mg/L), and adsorbent dose (5-100 g/L), at natural pH (7). Experiments showed that the maximum removal efficiency was found as 99% of Fe, 98% of Mn at 180 minutes. An increase in initial Fe concentration resulted in a decrease in the amount of Fe adsorbed per unit weight of rice husk ash. Same result was found for Mn. An increase in rice husk ash dose resulted in an increase in the removal percentage for both Fe and Mn. The highest monolayer adsorption capacity of 1.3815 mg/g for Fe and 1.8867 mg/g for Mn. Pseudo-second-order was the well-suited kinetics, where Langmuir isotherm could explain better for equilibrium adsorption data. Finally, this study indicates that rice husk ash could be a potential candidate for the removal of Fe and Mn form aqueous solutions.

**Keywords**: Adsorption, iron,manganese, rice husk ash, groundwater treatment.

# Impacts on Aquatic Life for Indiscriminate Exploitation of Baby Shrimp in the Coastal Rivers and Sea-Shore Region of Bangladesh: Assuring the Sustainability of Aquatic Biodiversity

**Group:** Environmental Science **Project ID:** SRG-223509

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## Abstract

Bangladesh's coastal regions, renowned for their rich biodiversity and economic significance, have undergone substantial ecological changes attributed to the traditional collection of marine shrimp fry. This practice has resulted in significant bycatch, often discarded, leading to a loss of aquatic species. This study presents a preliminary investigation conducted in the coastal rivers and seashore areas of the Khulna region. Monthly sampling was carried out using a 0.3 mm mesh nylon rectangular drag net, coupled with a 1.6×0.6 m bamboo split structure, for both Fixed Bag Net (FBN) and Push Net (PN), with collection of samples during full moon and new moon phases. The study encompassed multiple sampling sites in Satkhira and Khulna, shedding light on the catch composition of various species and groups, including baby shrimp, finfish larvae, crab larvae, and other zooplankton. Notably, the results revealed significant variations in the composition of shrimp species across different locations and sampling methods, with baby shrimp (P. monodon) accounting for 0.83% in Debhata, 0.60% in Shyamnagar, and 0.67% in Koira using the Fixed Bag Net (FBN). The predominant catch consisted of finfish larvae, crab larvae, and small organisms (abundant zooplankton). This study underscores the complexity of shrimp fry harvesting and its associated ecological consequences, emphasizing the imperative need for sustainable resource management in Bangladesh's coastal regions.

**Keywords**: Economic significance, ecological changes, coastal rivers, seashore, resource management.

# Coupling Root-Shoot Phenology' Carbon Sequestration' and Physiological Response to Environmental Factors of the Sundarbans Mangrove Forest

**Group:** Environmental Science **Project ID:** SRG-223510

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## Abstract

It is well known that mangrove trees dedicate a large portion of their biomass to their root systems, which contributes to the high net primary productivity (NPP) of mangrove forests. The production of fine roots (less than 2 mm in diameter) makes a significant contribution to the carbon cycle in forest ecosystems. In particular fine root production (FRP) comprises a large component of the NPP. Estimates of fine root production using ingrowth cores are strongly influenced by decomposed roots in the cores during the incubation period and should be accounted for when calculating fine root production (FRP). Objectives of this study was to determine fine root production by using ingrowth cores and estimation of fine root decomposition by using root litter bags. Here we aimed to estimate FRP by taking decomposed fine roots into consideration. We estimated fine root production and fine root decomposition at different time intervals and different calculation methods in the Sundarbans Reserve Forest (SRF). Ingrowth cores and root litter bag were installed and collected after 84, 145 and 214 days for decomposition 61 and 69 days. We calculated fine root production and decomposition by using Fujimoto's equation. By using Fujimoto's method, fine root production rate was estimated at 0.54 g $m^{-2}$ $d^{-1}$ in monsoon and 0.075 g $m^{-2}$ $d^{-1}$ in autumn and decomposition rate was at 0.0032 gm $d^{-1}$ in summer 0.0023 gm $d^{-1}$ in monsoon and 0.0017 gm $d^{-1}$ in autumn. Fine root production estimated higher in monsoon season because of freshwater discharge, salinity remain low in this season, nutrients remain high than autumn season. Though decomposition rate was higher in summer season than autumn season because of freshwater discharge, soil salinity, temperature and precipitation variation. Therefore, fine root production estimates vary with the timing of sampling, calculation method and presence of decomposed roots. Overall, the ratio of decomposition rate was lower than previous study of different countries mangrove which indicates high accumulation of carbon.

**Keywords**: Root biomass, below ground, root production, decomposition, mangrove community.

# Environmental Challenges Instigated by Irresponsible Disposal of Surgical Masks after the COVID-19 Situation: Evidence from Khulna Region, Bangladesh

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## Abstract

Using surgical masks as a vital preventive strategy has increased dramatically due to the COVID-19 epidemic. However, improper disposal of these masks creates serious environmental problems. Here, Examining the effects of surgical mask disposal on the environment in Bangladesh's Khulna region. The research shows that a sizable proportion of people in the Khulna district incorrectly dispose of surgical masks. Used masks are frequently dumped in public areas, drainage systems, and aquatic bodies, which causes pollution and contamination. In addition to harming the surrounding ecology, incorrect disposal could be hazardous to both people and wildlife's health. It may cause plastic pollution to food chain, endangering marine life and tainting water supplies. Moreover, the breakdown of surgical masks may cause the release of toxic compounds into the environment. A mixed-methods strategy is used in the research to collect both qualitative and quantitative data, through interviews, surveys, and field observations. The study investigates the disposal practices, awareness levels, and attitudes of the local population regarding the proper handling of surgical masks. It provides more convenient and accessible recycling and disposal options for surgical masks and developing biodegradable or compostable surgical masks. The report suggests a multipronged strategy that includes public awareness programs, enhanced waste management facilities, stronger laws and guarantee the availability of suitable disposal facilities. By making efforts to lessen the negative effects of surgical mask disposal on the environment, we can safeguard our planet for future generations.

**Keywords**: Surgical masks, COVID-19, environmental impact, plastic pollution, marine life, water contamination, polypropylene, recycling, biodegradable masks.

# Electrochemical Determination of Imidacloprid Pesticide from Rivers Water Adjacent to the Cultivated Land in the Western Part of Tangail District

**Group:** Environmental Science **Project ID:** SRG-223512

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## Abstract

The increasing use of neonicotinoid class of pesticide in agriculture cause harmful effect in environment and human health. In this project, we developed a novel electrochemical sensor for sensitive and selective determination of Imidacloprid (IMC) pesticide using Ag nanoparticles deposited on conductive polymer; polyvinylpyrrolidone (PVP) and Iron Oxide ($Fe_2O_3$) based nanocomposite. The in-situ Ag nanoparticle synthesis was conducted using a simple photo-reduction method, without the assistance of any dispense or reducing agent. The morphology study of the nanocomposite revealed that spherical shape $Fe_2O_3$ nanostructure and Ag nanoparticles nicely dispersed over the PVP surface. The high surface area containing PVP helps to reduce the self-aggregation of the $Fe_2O_3$ nanostructure and Ag nanoparticles. The electrochemical study was carried out at 0.1 M PBS solution and the highest catalytic performance was optimized at pH=7 using Ag@PVP/$Fe_2O_3$ modified glassy carbon electrode. The electrocatalytic investigation demonstrated irreversible diffusion-controlled kinetics via a two-step four-electron transfer reduction process to form hydroxylamine as a final product. Detection of IMC by linear sweep voltammetry (LSV) depicts a wide linear detection range (60.45 – 886.62 μM) with a sensitivity of 95.77 $\mu A \mu M^{-1} cm^{-2}$ and a detection limit 3.74 μM. The excellent sensing performance is likely related to the combination of merits of the three different components in the ternary nanocomposite. Moreover, during the IMC detection, the Ag@PVP/$Fe_2O_3$ based sensor electrode exhibited a unique anti-interfering ability in the presence of several common inorganic and organic interfering species. To validate the senor application in the real world, we checked the sensor stability, repeatability, and reproducibility and obtained results are satisfactory. Finally, the validity of the proposed sensor electrode and the accuracy of the applied electrochemical technique were evaluated by means of IMC recovery test from the rivers water collected from Dhaleswari and Lohajang rivers from different sampling points in Tangail district.

**Keywords**: Imidacloprid, PVP, $Fe_2O_3$, AgNPs, sensitivity, selectivity.

# Biogas Production Through Anaerobic Digestion from Hazardous Tannery Solid Waste and Measuring the Efficiency of Using Remaining Digested Waste as Fertilizer

**Group:** Environmental Science **Project ID:** SRG-223513

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## Abstract

Tanneries in Bangladesh grapple with significant environmental challenges related to the disposal of hazardous tannery solid waste, particularly chrome-tanned leather shavings containing 2.5-5% chromium. In response, this study explores the eco-friendly management of such waste through anaerobic co-digestion, aiming to produce biogas and assess the viability of using the remaining digested waste as fertilizer. Over a 40-day digestion period at room temperature, laboratory-scale bio-reactors were employed, incorporating varying proportions of leather shavings, cow dung, and sawdust at an 8% total solid concentration. The study evaluates reactor performance based on volatile solids destruction efficiency, gas yield, COD reduction rate, and methane yield. Leather shavings, with 40% moisture content and 92.5% volatile solids, exhibited a pH (4.51 ± 0.42) and C/N ratio (3.01) unsuitable for optimal biogas generation. Adjustments were made by incorporating cow dung and sawdust. Results revealed increased gas production with amended leather shavings and cow dung, although higher sawdust proportions reduced biogas generation. Volatile solid destruction ranged from 38.6 to 52%, total gas production from 443 to 1714 ml/kg, and methane yield from 53.8 to 71.8%. The COD removal rates varied among reactors, with R6 achieving the highest COD removal and biogas production. Chromium concentrations indicated unsuitability of slurry from reactors 1 and 7 as fertilizer due to elevated Cr levels. Plant growth experiments revealed varying plant heights and biomass, with $T_6$ and $T_1$ showing promising results for 10 t/ha and 15 t/ha, respectively. This study demonstrates the potential of anaerobic co-digestion for eco-friendly tannery waste management, emphasizing the importance of optimizing waste composition for efficient biogas production and safe fertilizer use.

**Keywords**: Environmental challenge, tannery, solid waste, chromium, waste management.

# Monitoring of Drinking Water Qualities in Respect of Ensuring the Sound Human Health at Coastal Fakirhat Upazila of Bagerhat District

**Group:** Environmental Science **Project ID:** SRG-223514

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## Abstract

Water is one of the most important constituents of the environment so top priority needed to be given to its sustainability. This study mainly carried out in the natural hazards prone coastal Fakirhat Upazila under Bagerhat district of Bangladesh to monitor the water quality and salinity concentration for being uses as drinking purposes in the vulnerable. Under the present investigation three important water quality parameters such as PH, TDS and EC were broadly measured collected from different water sources such as pond, deep tube well and supply water regard to use for drinking purposes. Water qualities estimated from all corners of ponds (East/West/North/South) and the variations by rain were also considered. The research study revealed that pH values ranged 6.4-89; 7.1-7.8 & 7.1-8.3 respectively for pond, deep tube well and supply water before rainy condition which reduced as 6.4-8.3, 6.5-7.3 & 7.3-7.4, respectively after occurring of rain. EC values (µs/cm) ranged 112-389; 275-1147 & 517-678 respectively for pond, deep tube well and supply water before rainy condition which reduced also after occurring of rain. TDS values (ppm) ranged 35-71 in pond water before rain and reduced as 28-67 after. TDS values (ppm) ranged 125-370 and 0.68-0.98 for deep tube well water and supply water, respectively before rain and reduced TDS was measured after rain both of the cases; which revealed the deficit of some minerals such as Ca, Mg & Zn also in supply water due to sucking from pond. Overall the studied water sources were not safe for fresh drinking in respect of three dimensional views of pH, EC & TDS. The water can be consumed only after proper treatment though will have the deficit of minerals such as Ca, Mg and Zn.

**Keywords**: Water quality, health impacts, coastal area, assessment.

# Spatio-Temporal Variation of Urban Air Quality and Its Relation with Meteorological Variables in Bangladesh: A GIS Approach

**Group:** Environmental Science **Project ID:** SRG-223515

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## Abstract

**Introduction*:*** Health risks from Particulate Matters (PM) pollution make it a major environmental issue in Bangladeshi cities. Besides capital district-level air pollution is rising day by day. **Objectives*:*** To examine the statistical link between air quality and meteorological data, creates a geo-spatial map of pollutants concentrations, and evaluates land uses and seasonal changes in Dhaka and Rajshahi. **Methodology*:*** In this study one-hour data were monitored across different land use regions in two major cities of Bangladesh, Dhaka and Rajshahi using Aeroqual S500 portable monitors and GIS Remote sensing technique use to measure Aerosol Optical Depth (AOD). **Findings*:*** The study reveal that Dhaka consistently experiences higher levels of PM pollution compared to Rajshahi, indicating poorer air quality. The variations in PM concentrations can be attributed to factors such as industrial activities, vehicular emissions, population density, and local meteorological conditions. Additionally, the analysis of $PM_{2.5}$ to $PM_{10}$ ratio provides insights into the composition of particulate matter in the air, highlighting the importance of understanding pollution sources and atmospheric conditions. The study also investigates the correlation between humidity and PM concentrations in both cities, revealing a negative relationship. As humidity increases, particulate matters concentrations tend to decrease. This shows how meteorological conditions affect air pollution and the importance of considering local climatic elements when building pollution control methods. Furthermore, the study also addresses transboundary air pollution, including Aerosol Optical Depth. Rajshahi, near West Bengal, has greater AOD levels than Dhaka, indicating the influence of transboundary pollution sources. **Conclusion*:*** Regional cooperation is needed to build air quality monitoring networks, share data, and coordinate plans with adjacent countries.

**Keywords**: Air pollution, seasonal variation, transboundary pollution, aerosol optical depth, particulate matters.

# Evaluation of Bias Correction Techniques for Precipitation: A case study for Agroecological Zone (AEZ) of Bangladesh

**Group:** Environmental Science **Project ID:** SRG-223516

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## Abstract

Climate change-induced agro and hydro-meteorological hazards in Bangladesh demand precise precipitation projections. The study addresses uncertainties by evaluating bias correction techniques in regional climate models. Assess and refine bias correction methods in regional climate models for enhanced precipitation predictions across diverse agroecological zones (AEZs) in Bangladesh, vital for climate resilience and sustainable development. The research spans 14 AEZs from 1990 to 2014, applying bias-correction methods (SCL, LOCI, EQM) to RCM (CMIP 6) rainfall simulations. Comparative analysis, utilizing RMSE, MAE, and PBIAS, evaluates spatial correction method performance, uncovering intricate variations across AEZs. The assessment reveals nuanced outcomes, underscoring the necessity for region-specific bias correction approaches. Each AEZ demands tailored correction methods due to distinctive climatic intricacies. A one-size-fits-all approach proves inadequate as terrain, vegetation, and geographic attributes significantly influence bias correction techniques' performance. Spatial intricacies identified underscore the dynamic nature of climate influences across distinct geographic areas. The study offers valuable insights into refining precipitation predictions, crucial for climate model accuracy. Recognizing limitations, it provides nuanced understandings for targeted strategies in refining precipitation predictions, essential for climate resilience and sustainable development. The study acknowledges the limitations of a uniform correction approach, highlighting variations in terrain, vegetation, and geographic attributes that significantly influence the performance of bias correction techniques. The research contributes not only to scientific understanding but also to practical implications for climate change adaptation. This research emphasizes employing region-specific bias correction techniques in RCMs for precise precipitation predictions. This tailored approach is crucial for effective climate change adaptation, fostering climate resilience and sustainable development.

**Keywords:** Precipitation, RCM (CMIP6), bias correction, evaluation, AEZ.

# Synthesis of New Core-Shell Nanocomposite Particles Using Ultrasonic Method Leads to Excellent UV-shielding Ability and Lower Catalytic Activity

**Group:** Environmental Science **Project ID:** SRG-223517

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## Abstract

$TiO_2$ coated $CeO_2$ nanocomposite particles have been successfully prepared by ultrasound irradiation method. Commercial $CeO_2$ nanoparticles was used as core material, whereas titanium tetra-n-butoxide was used titania precursor. $CeO_2$ nanoparticles were dispersed in ethanol by using a ball mill. Then titania precursor, with different amount of ethanol was added along with the addition of ammonia. Then the mixture was irradiated with ultrasound machine containing a probe at 70$^{o}$C for 1 hr. Prepared nanocomposite particles were characterized in terms of phase, shell thickness, compositions, surface charge, morphology and chemical sate of the elements by XRD, SEM, and FT-IR. Sol-gel synthesis of $CeO_2$-$TiO_2$ nanocomposites required 24 hrs, and $TiO_2$ was rarely found as a coated material. In contrast, the US method was found to synthesize $CeO_2$-$TiO_2$ core-shell nanocomposite particles within 1 hr. SEM results confirmed that the resulting $TiO_2$ coated $CeO_2$ particles are fairly unaggregated. Titania precursor loading was varied from $1.0 \times 10^{-3}$ mol to $10.0 \times 10^{-3}$ mol. It was found that very low titania precursor loading could not form core-shell, and very high titania precursor loading causes huge free titania nanoparticle formation. Therefore, optimum titania precursor loading was also studied in this research. XRD results showed that the phase of titania coated on $CeO_2$ was amorphous. The catalytic activities of uncoated and $TiO_2$ coated $CeO_2$ for the oxidation of organic compound were evaluated by the degradation study of methylene blue in air atmosphere at 403 K. The UV shielding ability and visible transparency of the nanocomposites obtained by UV visible spectroscopic measurements suggest that the core-shell materials can be used in sunscreen.

**Keywords**: Titanium oxide, cerium oxide, ultrasound, sol-gel, UV blocking.

# Photo-microbial Effects on DOM Dynamics Along with Trace Heavy Metals Solubility Due to Saline Water in the Coastal Vicinity of Bangladesh

**Group:** Environmental Science **Project ID:** SRG-223518

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## Abstract

Rising sea levels in low-lying coastal areas like Bangladesh lead to saline water intrusion into freshwater and soil, especially in deltaic regions, causing imbalances in soil nutrients and health. Fluorescent dissolved organic matter (FDOM) is a part of DOM in soil and water that glows when exposed to UV or visible light, revealing water and soil quality. This research aims to understanding the impact of sunlight and microbial effects on soil FDOM properties under different salinity levels for understanding the complex interactions between environmental factors and soil health. Fluorescence spectrophotometer was used to investigate the effect of sunlight on the soil fluorescence properties of dissolved organic matter (DOM) from the Sitakunda forest area (topsoil). Artificial seawater was prepared in the laboratory with a specific amount of different salt. The experiment was continued for 12 months' time duration. EEM-PARAFAC modeling identified three soil FDOM components such as humic acid, fulvic acid, and protein-like fluorophores. The results showed that as salinity levels increase, FDOM properties also rise, potentially due to microbial activity triggered by salinity, indicating a positive correlation between salinity and FDOM properties. Salinity exhibited significant associations with soil properties, including negative correlations with organic matter and total nitrogen, and a positive correlation with phosphorus. Fluorescence components displayed varying correlations with salinity and time. In total viable count (TVC) analysis it was found that bacteria decreased with increasing salinity and time period. Number of genus identified in 13 soil samples by biochemical test indicated that the diversity was similar in every 0% salinity soil sample but decreased in saline treated samples. By 16s rDNA gene sequencing 13 bacterial strains were identified. The findings will also help the policy makers by producing important results for establishing effective rules and action plans to ensure the sustainability of soil resources in coastal regions.

**Keywords**: Artificial sea water, dissolved organic matter, EEM-PARAFAC modeling, microbial growth, total viable count.

# Concentration of Arsenic in Water' Sediments and Indigenous Fish Species from Naturally Contaminated Rivers in Southeast Part of Bangladesh

**Group:** Environmental Science **Project ID:** SRG-223519

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## Abstract

The objective of this investigation was to measure the concentration of arsenic in water, sediments, and several fish species at multiple sites in the lower Meghna River during the periods of Pre-monsoon, monsoon, and post-monsoon. Ten stations were selected under the three districts of Chandpur, Laxmipur, and Noakhali where the Meghna River blows and falls into the Bay of Bengal. In each station, collected 10 indigenous fish species (*Mytus vittatus, Puntius sophore, Glossogobius giuris, Amblypharyngodon mola, Devario devario, Lepidocephalichthys guntea, Chela cachius, Gudusia chapra, Neotropius atherinoides, Apocryptes bato*), surface water (below 20 cm from surface level) and sediment in pre-monsoon, monsoon and post-monsoon. Total arsenic was estimated by atomic absorption spectrophotometry. The average concentration of total arsenic in surface water was 0.0117±0.003, 0.00184±0.0007, 0.00564± 0.0018 mg/l in pre-monsoon, monsoon, and post-monsoon of the Meghna River. The concentration of total arsenic was below the standard value of drinking water (0.05 ppm). The total arsenic concentration in surface water was lower in the monsoon compared to pre- and post-monsoon. The highest concentration of arsenic (0.178 mg/l) in water was observed in the station of S3 in the pre-monsoon. During the pre-monsoon, monsoon, and post-monsoon periods, the sediment's arsenic concentration was measured to be 3.619±.045, 4.58± 0.68, and 4.9426 ±0.60 ppm, respectively. The highest concentration of arsenic in sediment was measured in the S3 (5.91 mg/kg) in the monsoon season. The concentration of total arsenic in fish was found higher in pre-monsoon and lower in monsoon, respectively. Among the ten species, the highest concentration of total arsenic (1.674 mg/kg-S3) of fish tissue was found in the species of Apocryptes bato. The above 1 mg/kg of total arsenic in fish tissue was found in the species of *Mystus vittatus, Glossogobius giuris, Lepidocephalichthys guntea, Neotropius atherinoides* and *Apocryptes bato* in the season of pre-monsoon.

**Keywords**: Total arsenic, surface water, season, sediment, fish tissue.

# Occurrence' Characteristics and Risk Assessment of Microplastics in Mud Crab (Scylla serrata) from the Central Coast of Bangladesh

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## Abstract

There is growing concern across the globe over the existence of microplastics (MPs), their occurrence and their effects on the aquatic environment. However, knowledge about the exposure of MPs in the marine environment of Bangladesh is limited. This study was a first attempt to describe the occurrence, and spatial distribution of MPs in mud Crab (*Scylla serrata*) from three major coastal districts e.g. Feni, Noakhali and Lakshmipur along Bangladesh coast. A total of 45 crab samples were collected from the intertidal zone, and MPs were extracted using the density separation method and a stereomicroscope. Among the three districts, the lowest abundance (8.6 ± 5.4 items/individual) of MPs was found in Lakshmipur and the highest (20.13 ± 8.68 items/individual) in Noakhali. One-way Analyses of variance (ANOVA) showed a high significant ($p < 0.01$) difference among the three districts. Most of the identified MPs were fibers and violet in colour. The predominant MPs were found to be < 0.5 mm in size range. Domestic and municipal wastewater flow to river system and fishing activities may attribute to MPs in the study areas. This study delivers novel insight into coastal MPs pollution of the Bangladesh and can be used as baseline data for management of the productive coastal region that the policymakers can use to take appropriate management approaches.

**Keywords**: Occurrence, microplastics, risk assessments, mud crab, central coast.

# Determination of Bacterial and Planktonic Exposure to Heavy metals and Micro Plastic Pollution in the Sandwip Channel' Chittagong' Bangladesh

**Group:** Environmental Science **Project ID:** SRG-223521

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## Abstract

Sandwip Channel is recognized as a very important economic area in Bangladesh. A lot of pollution sources are identified in this estuary. The research has focused on the response of zooplankton to microplastic pollution, bacterial abundance, and algal response to heavy metal pollution. The research was conducted to measure related physico-chemical water quality parameters on the Sandwip Channel, so the research was focused on 24 different sampling stations of the estuary. The research covered about 08 months of sampling and observations. A 20 µm mesh-sized plankton was used to collect plankton. In the Coastal Plankton Laboratory, Department of Oceanography, NSTU the planktons were identified by using reference books. The isolated zooplanktons were digested by nitric acids, and filtered through 45 µm filter paper, and microplastics were identified under a light microscope. The identified microalgae are sorted and kept for further analysis. The bacterial colonies were cultured in nutrient and marine agar to identify morphological characteristics of bacterial colonies and count CFU. A total of 27 microplastics are found in a total of 867 individuals of copepods from the upper Sandwip Channel. So, one plastic particle was found in approximately (32.04±0.58) copepod individuals, and (0.03±0.001) plastic particles were found in one individual. There are no significant relations were found between algal abundance and heavy metal concentrations with the zooplankton and bacterial abundance in the Sandwip Channel. The total bacterial load (CFU) from the three sampling zones is 865 ± 34.5, 567 ± 24, and 432 ± 31. Finally, preliminary findings referred to several types of harmful plastic particles found in zooplankton. This is high time to monitor the water quality of the Sandwip Channel for better ecological management.

**Keywords**: Estuary, zooplankton, pollution, plastic, algal bloom.

# The State of Water Pollution in Bagerhat and Satkhira regions of the Sundarbans over the Past Decade

**Group:** Environmental Science **Project ID:** SRG-223522

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## Abstract

The salinity increase may induce a shift in the Sundarbans mangrove forest affecting the balance among ecology, community socio-economy, and livelihoods of the community. The study was conducted to evaluate the changes in water pollution of Satkhira and Bagerhat regions of the Sundarban in the past decade. In order to monitor sampling, seven different locations were selected at Bagerhat and Satkhira regions of the Sundarbans. The samples were analyzed for pH, EC, P, K, Ca, Mg, S and Na to determine the changes during the last era (2011-2023) following the standard methods generally practiced in the laboratory. In Bagerhat region the average value of pH and EC has increased 0.37% and 17.64% during the last decade. In Satkhira region the average value of pH and EC has increased 0.26% and 14.22%, respectively. Among the other elements of water, the average concentration of K, Ca and Na was increased 12.57%, 12.76% and 15.07%, respectively at Bagerhat region. The concentrations of these three elements were also increased 4.95%, 3.35% and 1.63%, respectively at Satkhira region of the Sundarbans during the past decade (2011-2023). The average concentrations of P, Mg and S were decreased 7.14%, 3.22% and 4.86%, respectively at Bagerhat region. The concentration of these three elements was also decreased 6.25%, 3.87% and 1.69%, respectively at Satkhira region of the Sundarbans during the last decade (2011-2023). The increased water salinity at Satkhira region is alarming. The decrease of P, Mg and S at both the regions may affect the forest health and bio-diversity of the Sundarbans.

**Keywords**: Salinity, mangrove forest, mineral status, water pH.

# Prevalence and Determinants of Food Insecurity Among Children in Natural Disaster-Prone Areas of Bangladesh: A Cross-Sectional study

**Group:** Environmental Science **Project ID:** SRG-223523

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## Abstract

The existing body of research on food insecurity in disaster-prone areas of Bangladesh is relatively scarce. The objective was to explore the potential associations between food insecurity (household and child) and various socio-demographic factors, socio-economic indicators, as well as disaster-related variables. The analysis involved the utilization of both univariable and multivariable logistic regression techniques to examine the data. In a sample of 2255 households with children, it was observed that 50.7% of these households and 65.6% of the children residing in these households experienced food insecurity. Children residing in rural areas, who are part of a joint family structure, exhibit lower educational attainment, have parents who are gainfully employed, experience a lower household income, allocate a smaller portion of their monthly budget towards food expenses, and own livestock, farm animals, or poultry, receive financial support from various institutional sources, both public and private, having household debt, face food supply instability in shops and markets due to natural disasters, and believe that natural disaster affects earnings are the main risk factors of HFI and CFI. Children who had fewer siblings lived in drought- or flood-prone areas, had lower crowding indices, owned land other than their homestead, had a homestead vegetable garden, and were spared crop loss and crop output due to natural disasters wer protected from HFI and CFI. The study suggests implementing a surveillance system to investigate food insecurity in Bangladeshi households with children in natural disaster-prone areas, highlighting the lack of comprehensive investigations in Bangladesh and the socioeconomic factors contributing to this issue.

**Keywords**: Food insecurity, households, children, disaster-prone, Bangladesh.

# Evaluation of Heavy Metal Contamination of Soil and Vegetables in Jessore and Potential Health Risk

**Group:** Environmental Science **Project ID:** SRG-223524

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## Abstract

**Background:** The high contents of heavy metals in foods are a major concern, mainly in agricultural products, especially vegetables. Therefore, the assessment of trace elements in agricultural soils, and vegetables is essential to evaluate the potential health risks associated with the toxic elements via consumption of the vegetables. **Objectives:** (i) To quantify the concentration of heavy metals in agricultural soils and agricultural products collected from different vegetable farm in different location in Jessore, (ii) To estimate the impact of human health risk caused by the daily intake of metals through contaminated vegetables using various health and environmental risk indices. **Methodology:** The vegetables samples of Brinjal, Cauliflower, Bottle gourd, Cabbage, Palwal, Chili, Broccoli, Bitter gourd, Radish, Hyacinth bean, and Tomato and soil sample of the respective fields were collected from different locations in Jessore. The sample were digested and estimated the Cr, Ni, As, Cd, Pb and other trace using an atomic absorption spectrometer. **Findings:** The mean concentration of Zn, Cu, Pb, and Cd in vegetables ranged from 1.028 to 5.697, 0.451 to 2.395, 0.244 to 0.253, and 0.007 to 0.028/ mg/kg, respectively. The concentration of DTPA extractable heavy metals in soil were varied. The concentration decreased in the order of Zn>Cu> Pb> Cd. All the concentrations are lower than the concentration recommended by WHO. It was found that among the all sample only in leafy part contained Pb. The highest amount of Zn was found in broccoli (5.697ppm) and the lowest amount of Zn was found in tomato (1.028ppm). The highest amount of Cu was found in chili (2.395ppm) and the lowest amount of Cu was found in radish (0.451ppm). **Conclusion:** The concentration of these metals were lower than the values given by WHO. These metals are not harmful to human beings.

**Keywords**: Bioaccumulation, concentration, impact, trace elements, environmental risk.

# Characterization of Soil and Water Surroundings of Paira Thermal Power Station of Kalapara' Patuakhali Coastal Environment in Relation to Salinity' Sedimentation and Nutrient Content

**Group:** Environmental Science **Project ID:** SRG-223527

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## Abstract

Coastal soils of Bangladesh received little attention and their characteristics are not well defined and fertilizer responses are hardly studied. A survey study indicated that the most of the farmers of the study area cultivated local T. Aman rice, aus rice and different Rabi crops with the use of chemical fertilizers like urea, TSP, MoP, gypsum and organic manure (cow dung) and found response to the fertilizers. About 100%, 95%, 55%, 45%, 25%, 1%, and 5% of farmer used urea, TSP, MoP, gypsum, Zinc and organic manure, respectively Studied soils were silty clay loam. The pH of these soils varied from strongly acidic to moderately neutral (2.70 to 7.24). Electrical conductivity in the top soils varied from 3. 26 to 27.86 $dSm^{-1}$. Bicarbonate and chloride content of soils ranged from 00.00 to 946 ppm and 96.53 to 960.50 ppm, respectively. The tested soils had a wide range of organic carbon ranged from 0.03 to 4.14%. of the study area. Total nitrogen content was observed in the range of 0.06 to 0.16 %. Available phosphorus (Olsen P) varied widely from 12.00 to 89.00 ppm. Available sulphur was observed high concentration of 46.00 to 584.00 ppm. Exchangeable potassium and sodium content of these soils ranged from 0.023 to 0.050 meq/100 g soil and 0.064 to 0.074 meq/100 g soil in the study area. Percent NaCl was found 2.60 to 14.80% in the soil samples collected. Most of the soils analyzed were excessive in sulfur and low pH indicates acid sulphate soil formation.

**Keywords**: T. aman rice, fertilizer, survey, rabi crops, electrical conductivity.

# Baseline Assessment of Toxic Elements in Dust and Tube Well Water at the Primary School Yard Around Payra Thermal Power Plants area in Patuakhali, Bangladesh

**Group:** Environmental Science **Project ID:** SRG-223528

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## Abstract

**Background***:* There is growing recognition that coal combustion ash residues from the Payra Thermal Power Plants are major contributors' for heavy metals contamination in dusts and tube well water at the primary school yards. **Objectives***:* To measure the concentrations of toxic compounds in soil dust and tube well water at the primary school yards and to assess the potential health risks of school children's due to the exposure to potentially toxic elements in soil dust and tube well water. **Methodology***:* Soil dust and tube well water samples were collected from the selected sites of Payra Thermal Power Plant using standard protocol. Trace elements were measured by using inductively coupled plasma mass spectrometer. **Findings***:* The concentration ranges of chromium (Cr), nickel (Ni), copper (Cu), arsenic (As), cadmium (Cd), lead (Pb), manganese (Mn) and zinc (Zn) in dust samples were 5.04-73.06, 18.26-313.2, 25.51-370.6, 4.83-36.30, 0.54-17.25, 8.60-187.9, 35.04-129.1 and 8.60-187.9 mg/kg, respectively and in water samples were 0.014-0.098, 0.012-0.304, 0.006-0.086, 0.012-0.25, 0.012-0.087, 0.015-0.097, 0.011-0.255 and 0.015-0.996 mg/L, respectively. Multivariate principal component analysis showed that Ni, Pb, Mn, Cu and Zn in dust samples mainly from anthropogenic sources while As from lithogenic or natural sources. Considering the potential ecological risk, dust samples from the Payra Thermal Power Plant area showed moderate to high ecological risk. The concentrations of trace elements in water samples were higher than the water quality guidelines and the mean WQI values ranged from 35.96 to 52.57, indicating "good" to "poor" groundwater quality. Ingestion exposure had a much higher ratio of hazard quotient to hazard index (HQ/HI) and carcinogenic risk values than inhalation and dermal contact exposure. **Conclusion**: The estimated non-carcinogenic health risks associated with the ingestion (oral) and dermal exposures of As, Cd and Pb, and carcinogenic health risks for the inhabitants related to ingestion of As surpassed the USEPA acceptable limits.

**Keywords**: Toxic metals, soil dust, water, health risk, coastal area.

# Isolation' Characterization and Identification of Aroxan-Degrading Nitrogen-Fixing Bacteria: An Attempt to Lay the Foundation for Potential Bioaugmentation Applications

**Group:** Environmental Science **Project ID:** SRG-223529

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## Abstract

Soil-dwelling microorganisms can become responsive to herbicides following treatment. Through their interaction, bacteria break down herbicides and utilize the remaining energy to boost their physiological processes. High concentrations of herbicides, such as the chemically toxic herbicide Aroxan, pose increasing risks to both humans and the environment by inhibiting photosynthesis in undesirable plants. In the present study, we successfully isolated, identified, and characterized herbicide-degrading Rhizo-bacterium from agricultural soil previously treated with Aroxan. The bacterium was identified through morphological and molecular methods, and its culture conditions were optimized at 35 °C for up to 72 h, with pH levels of 7 and 7.5, respectively. Soil samples were collected from Aroxan-treated soil, and the bacterial strain was isolated in the YEMA media, which was specific for *Rhizobium* sp. Spectrophotometric and High-Performance Liquid Chromatography (HPLC) analysis demonstrated significant degradation of Aroxan by the isolated strain, reaching a degradation rate of 99% and reducing the concentration to 8.82 µg/ml. The optimum pH and temperature for Aroxan degradation were determined to be 4 and 30 °C, respectively. Additional tests confirmed the strain's positive results for salt tolerance and resistance to certain heavy metals (Pb, Cu, Cd, and As), but susceptibility to Hg. The strain showed resistance to penicillin, amoxicillin, ampicillin, kanamycin, erythromycin, and susceptibility to gentamicin, ciprofloxacin, chloramphenicol, doxycycline, and kanamycin. The strain exhibited 49.3% DPPH free radical scavenging activity. Finally, the 16S rRNA sequencing revealed 98% similarities with *Rhizobium* sp. strain HRI101-4. These findings suggest that the *Rhizobium* sp. strain HRI101-4 holds promise as an effective tool for degrading Aroxan and preventing environmental pollution.

**Keywords**: Rhizo-bacterium, characterization, aroxan, degradation, HPLC.

# Impact of Salinity Intrusion and Climate Change on Sustainable Food Security: Strategies for Adaptation of Coastal Farmers in Bangladesh

**Group:** Environmental Science **Project ID:** SRG-223530

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## Abstract

Salinity intrusion is one of the leading environmental issues in the world, including Bangladesh. Coastal Bangladesh is facing a threat to sustainable food security due to the adverse effects of climate change and salinity intuition. The salinity intrusion problem has been increasing, particularly in low-lying coastal areas of Bangladesh, due to sea level rise, climate change, and upstream infrastructure development. The study was conducted at Protapnagar, Sreeula, and Kulya Union of Assasuni Upazila of Satkhira district, recognized as one of the most severely saline-affected regions. The main objective of this research was to assess the impact of Salinity intrusion and climate change on food security. Primary data was collected through questionnaires, Focus Group Discussion (FGD), in-depth interviews, and observations. A comprehensive set of 298 household structural questionnaires surveyed targeted coastal farmers. The findings revealed that exacerbating salt intrusion in coastal areas presents a significant challenge to ensuring food security. The increasing saline levels observed in surface water (146 mg/L) and groundwater (140 mg/L) within just five years have resulted in declining agricultural production (7.8%), reducing the feasibility of cultivating traditional rice types. Salt intrusion resulted in a transition towards the cultivation of salt-tolerant rice varieties and shrimp farming, affecting the sustenance of coastal farmers who are heavily dependent on agriculture and aquaculture. Furthermore, the infiltration of saline water has contaminated freshwater reservoirs, leading to an elevated incidence of waterborne illnesses among coastal communities. Immediate action is needed to increase adaptive capacity and resilience through encouraging saline-tolerant crops, integrated farming, and improved water management, supported by government financing, research, and disaster preparedness to offset the impact of salt intrusion on food security. The research findings can provide a foundation for making salinity and climate adaptation decisions in the coastal region and other comparable locations across the globe.

**Keywords**: Salinity intrusion, climate change, food security, adaptation practices, coastal communities

# Alleviating Cadmium (Cd) Pollution in Contaminated Soil through Phytoextraction Using Mustard (*Brassica juncea*)

**Group:** Environmental Science **Project ID:** SRG-223531

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## Abstract

**Background:** The development of various industrial pollutants, especially heavy metals, poses a serious environmental threat. Phytoremediation is a cost-effective way to remediate degraded soil and water. **Objectives:** A field experiment was to investigate the effects of heavy metals (Cd) on plant growth and various organ of mustard and their uptake by mustard were studied. **Methodology:** Phytoextraction was evaluated with the bioaccumulation potential of cadmium (Cd) from mustard (BARI Sarisha 17) during the period from December 2022 to March 2023. Cadmium ($CdCl_2$) was applied in amounts from 0, 25, 50, 100, 200 and 400 mg.kg-1 soil. Various concentrations of this metal (Cd) were measured in grains, roots, shoots, and leaves. **Findings:** The higher Cd concentrations resulted in significant decreases in shoot length (cm), SPAD, root fresh weight (g), shoot fresh weight (g), yield per pot (g) etc. The Cd-treated plant parts containing cadmium were in the following order: shoot > root > leaf > grain. Furthermore, bioconcentration factor, translocation factor and tolerance index measurements showed that BARI Sarisha 17 was suitable for phytoextraction of Cd in all treatments. Moreover, cadmium does not affect the normal number of pods recorded with BARI Sarisha 17. **Conclusion:** From this study, it was concluded that BARI Sarisha 17 can absorb and accumulate higher levels of cadmium without affecting biomass and grain production, indicating its potential for successful use as an oilseed crop and spice.

**Keywords**: Soil pollution, phytoextraction, cadmium, mustard, BARI Sarisha 17.

# Genetic Diversity Analysis by Molecular' Morphological and Genomic Methods of Exist and Endangered Medicinal and Economically Important Orchid Species in Bangladesh

**Group:** Environmental Science **Project ID:** SRG-223532

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## Abstract

**Background**: Orchids are very important plant in the floriculture and for their medicinal properties. Many orchids are threatened by extinction because of environmental degradation, human occupation of natural habitats and ethno-botanical reasons. **Objectives**: Maintaining the genetic diversity, to meet the commercial demand, conservation of wild, rare, endangered and economically important orchid species in Bangladesh is very important now. **Methodology**: Under this study various parameters were used for morphological and molecular marker analysis. DNA markers (RAPD) analysis methods were used for revealing genetic differentiation and genetic relationships. In vitro micropropagation techniques of various orchid species were also standardized under the research project. **Findings**: For morphological studies the extent of variability was measured in term of range, genotypic and phenotypic co-efficient of variance, heritability and expected genetic advance were observed for important phenotypic characters. Different morphological characters were estimated on the basis of overall means, range, phenotypic variance, genotypic variance, different types of coefficients of variability such as phenotypic coefficient of variability and genotypic coefficient of variability and all genetic components such as heritability in broad sense, genetic advance and genetic gain. Cluster analysis based on morphological characters showed that the ten orchid species were divided into three major clusters. According to the morphological study, *Cymbedium aloifolium* and *Pholidota imbricata* were the closest among the studied orchids. DNA was amplified by PCR technique and here the primer A-3 showed 100% similarity among the Aerides odorata, *Cymbedium aloifolium*, *Dendrobium aphyllum* and *Rhynchostylis retusa*. **Conclusion**: The genetic diversity and phylogenetic study of orchidaceae are directly connected to the effective study and proper use of the available resources and also more important to the production of improved-quality new varieties and therefore growth of the ornamental industry that could helpful for socio-economic development in Bangladesh.

**Keywords**: Genetic diversity, endangered orchids, *in vitro*, micropropagation, RAPD.

# Assessment of Opportunities and Challenges of Urban Forestry of Newly Developed Dhaka City

**Group:** Environmental Science **Project ID:** SRG-223533

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## Abstract

The study was conducted in newly developed Dhaka city like Purbachol from October 2022 to April 2023 to study the opportunities and challenges of urban forestry. Total 100 respondents were selected for survey using systematic random sampling method. The results revealed that high population densit and lack of free space and lack of awarness were the main obstacle for enhancing urban forestry. 80% rerspondents agreed to willingness of people to participate in tree plantation activities. 95% respondents seened that lack of open public space, widening the road and increasing land fragmentation were the main challenges of urban forestry development of newly developed Dhaka city.

**Keywords**: Opportunity, challenge, urban forestry, dhaka city.

# Environmental Impact of Flash Flood in Sylhet and Its Copping Mechanism

**Group:** Environmental Science **Project ID:** SRG-223534

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## Abstract

The project “Environmental Impact of Flash Flood in Sylhet and its Coping Mechanism” study was carried out in the Taherpur and Satak Upazilla of Sunamganj to know the impacts of flash floods and anthropological activities. Data from affected areas and sources of flash floods based on geographic information systems (GIS) were gathered in conjunction with in-person interviews conducted among local residents. Twenty-four locations in these areas have been recognized as the source of floodwater from places upstream that border India. While it is difficult to pinpoint exactly where, in India, people have speculated that the nearby Indian Hills of Assam and Meghalaya are the primary source of the water that causes flash floods in these regions. In addition, the researcher looks into how the issues may affect farmers' means of subsistence and any potential alternatives. Local resources, such as growing local rice cultivars and various oilseeds like mustard and ground nuts, as well as some vegetables, were advocated by the farmers once the flood waters subsided. Farmers also said that siltation happened and the quality of the soil declined as a result of flooding. Analyzing the soil, siltation, and water quality in this location is the investigator's goal. Other environmental indicators, such as pollution and soil degradation, will also be observed. Results from various groundnut demonstration trails were found encouraging. Investigators also looked a World Bank report on flash floods, which showed that 4.7 million people were affected by flash floods in six districts in this region in March, April, and May of 2017 mostly in northwest Bangladesh, affected 3.3 million people and flooded 684,000 hectares of cropland for an average of 27 days. Present study supported the report also.

**Keywords**: Flash, flood, environmental, impact, coping.

# Effect of Alkali Modified Sugarcane Bagasse Biochar on Growth and Yield of Tomato (*Solanum lycopersicum*) in Acidic Soil

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## Abstract

Soil acidification is one of the environmental factors that lower agricultural crop productivity and reduce biomass. A field experiment was conducted at the research field of the Sylhet Agricultural University; Sylhet to evaluate the influence of NaOH modified sugarcane bagasse biochar on growth and yield of Tomato under acidic soil condition. BARI Tomato-4 was grown following RCBD under 8 treatments with 3 replications: $T_0$ =Control (no amendment), $T_1$ =CF (Chemical fertilizers), $T_2$ =1% SBB (sugarcane bagasse biochar)+CF, $T_3$ =2% SBB+CF, $T_4$ =3% SBB+CF, $T_5$ =1% MSBB (modified sugarcane bagasse biochar)+ CF, $T_6$ =2% MSBB+CF and $T_7$ =3% MSBB+CF. $T_7$ had the highest tomato plant height (142 cm), while $T_6$ had the largest diameter of the plant stem (27.46mm) having no significant difference among the biochar treatments. $T_7$ was found to have the longest plant roots (41.67 cm) and there was significant difference between the treatments. $T_4$ was found to have the highest fresh root weight (21.77g) and also had the maximum leaf chlorophyll content at @45DAT, @60DAT and @75DAT with a value of 62.13, 60.40 and 53.73. The highest number of fruits/plot were produced in $T_4$ (89), followed by $T_7$ (86), while the lowest (33) was recorded in $T_0$. $T_7$ produced the highest yield/plot (3.91kg), followed by $T_4$ (3.85kg). The highest pH (7.23) and total N (2.56 %) were found in $T_7$ and $T_3$-$T_7$ showed significant differences compared to both $T_0$ and $T_1$. The highest organic C (2.31%), available P (56.43 µg/g) and exchangeable K (1.86 Meq/100) were found in $T_7$, followed by $T_4$. Biochar treatments showed significantly higher available phosphorus and exchangeable K compared to both $T_0$ and $T_1$. The study results suggest that alkali-modified biochar application could improve crop yield in acidic soils, which will ultimately be helpful in the development of sustainable agriculture.

**Keywords**: Acidification, plant growth, yield, biochar, organic C, available P, exchangeable K.

# Doped and Binary Heterojunction Photocatalysts; g-C3 N4 Quantum –dot/BiOBr, Single Layer g-C3N4/BiOBr and CdS/BiOBr for Energy and Environmental Applications

**Group:** Environmental Science **Project ID:** SRG-223536

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## Abstract

In this work, g-$C_3N_4$ was synthesized from some cheap precursor like Urea by a solvothermal method using an autoclave. The mixture of urea, sodium amide, and benzene was heated for 12 hours at 210 and finally, gC3N4 of pale-yellow color was found which was washed several times with water and ethanol and dried in a vacuum oven. In addition, metal- and non-metal-doped BiOBr and BiOBr-PCL composites, which acted as photocatalysts with excellent activity, have been successfully synthesized through a simple solvothermal method. Incorporating the nonmetal elements Boron (B), Vanadium (V), Manganese (Mn), and Cerium (Ce) into the crystal lattice greatly expands the photocatalytic activity, probably owing to the reduced energy band gap caused by the impurity energy level induced below the conduction band and the indirect utilization of long-wavelength visible light caused by up-conversion performance. The compounds have been synthesized by using $Bi(NO_3)_3.5H_2O$, cetyl-triethyl-ammonium bromide (CTAB), metal, and non-metal precursors. The bonding and the crystal structure of the composites have been confirmed by UV, FTIR, and XRD techniques, respectively. The photocatalytic activity of the materials has been studied over Methylene Blue (MB), a common organic dye pollutant in textile industries, under visible light. BiOBr and Ce-doped BiOBr composites showed 48% and 55.5% degradation in 300 min of visible light exposure, respectively. Doping with Boron (B) increased activity to 66.4%. For the BiOBr-PCL composite, activity has been calculated at 76%, which has increased to 83% for B-doped BiOBr-PCL. The synthetic products showed significant antibacterial properties.

**Keywords**: Hydrothermal, BiOBr composite, photocatalytic activity, antibacterial activity.

# Fabrication of Thin Film Based Composite Electrode for Sensing Arsenic from Aqueous Systems

**Group:** Environmental Science **Project ID:** SRG-223537

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## Abstract

A detailed kinetic investigation of As(III) oxidation was performed on gold surface within pH between -3.0 and -9.0. It was found that the As(III) oxidation on the gold surface follows a purely adsorption-controlled process irrespective of pH. The evaluated adsorption equilibrium constant decreased from 3.21 × 105 to 1.61 × 105 mol L-1 for acidic to basic medium, which implies the strong affinity of the arsenic species in the acidic medium. Besides, the estimation of Gibbs free energy revealed that an acidic medium promotes arsenic oxidation on gold surface. In mechanistic aspect, the oxidation reaction adopts a stepwise pathway for acidic medium and a concerted pathway for neutral and basic medium. From the substantial kinetic evaluation, it is established that a conducive and compatible environment for the oxidation of arsenic was found in an acidic medium rather than a basic or neutral medium on gold surface. Besides, in sensitivity concern, neutral and highly acidic medium is quite favourable for the arsenite oxidation on gold surface.

**Keywords**: PH Study, arsenic oxidation, Au electrode, kinetics, sensitivity.

# Allelopathic Effects of *Eucalyptus camaldulensis* and *Acacia auriculiformis* on the Growth Physiological and Biochemical Functions of Four Agricultural Crops

**Group:** Environmental Science **Project ID:** SRG-223538

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## Abstract

Allelopathy is a well-known mechanism of plant-to-plant interaction exerting adverse effects on ecosystem structure and functions. The allelopathy of eucalypts and Akasmoni are claimed as causes for the reduction of biodiversity and reduced productivity of adjoining crops. The present study aims to elucidate the claims *of Eucalyptus camaldulensis* and *Acacia auriculiformis* allelopathic effects on four agricultural crops. The experiments were conducted in petridishes using the lextracts and in soil using leaf powder and extracts of the donor species. The seeds of agricultural crops were treated with 25 mg/ml, 50 mg/ml and 100 mg/ml leachates of Eucalyptus and Akasmoni, and results were compared with the control experiments where seeds were treated only with distill water. The results showed that both Eucalyptus and Akasmoni suppressed the germination and growth of the tested agricultural crops, however, there is no significant differences in exerting the effects between the two donor species. Among the four tested agricultural crops, Mashkolai (Phaseolus mongo) was least affected showing more than 90% germination even under 100mg/ml leachate treatments. However, the species showed a significant reduction of shoot, root and biomass under the exposure of high concentration of ethanol and water extracts. Even though germination of Chola (*Cicer arietinun*) and Borboti (*Vigna unguiculata*) were significantly reduced, their other growth parameter was least affected in compared to other two agricultural crops. Arhor (*Cajanus cajan*) showed fairly good performances with respect to germination, shoot gowth, root growth and biomass both under ethanol and methanol extracts of Eucalyptus and Akasmoni. The elevated level of proline, hydrogen peroxide and MDA were found to be accumulated in the leaves of, *Cicer arietinum* and Vigna unguiculata and intermediate accumulations were recorded in *Phaseolus mongo* while least were found in *Cajanus Cajun*. Despite some limitations of the study, the findings have the implications for the policy makers, practitioners and development activist to decide whether to include the species in the agroforestry or plantation forestry in the country.

**Keywords**: Leaf extracts, inhibition, germination, shoot-root, chlorophyll, proline.

# Exploration for Radioactive and Rare Earth Element Containing Minerals in Geological Environment of Bangladesh

**Group:** Inter-disciplinary group **Project ID:** SRG-224539

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## Abstract

Exploration for radioactive and rare earth element containing minerals in the coastal environment of Bangladesh was conducted through the measurement of radioactivity from uranium and thorium content with environmental potassium presence. The objectives of the proposed research were to explore various radioactive and rare earth containing minerals from different geological environment, namely coastal, fluvial and tertiary sediments exposed in various locations of Bangladesh; and to determine the physico-chemical properties as well as potentiality of utilizing those radioactive and rare earth containing minerals. The geological field survey was carried out at the entire marine drive of approximately 100 km length (from Sabrang zero point to Diabetic point, Cox's Bazar) with a portable gamma-ray spectrometer and Individual Dose Rate Meter. Measurement was taken at 2-8-kilometer interval, from as many as 28 sampling points, and approximately 50 meters from the east and west side of the marine drive, totaling 52 data points. In addition, samples of more than 5 kgs from established heavy mineral deposits (namely Sabrang, Teknaf, Shaplapur, Inani, Cox's Bazar) were taken by hand auger system to obtain samples from 0-5 feet depth at each location. Measured data revealed specific zones of higher radioactivity along Cox's Bazar coast known to be the established heavy mineral deposits located at Teknaf, Shaplapur, Inani and Cox's Bazar. Uranium concentration was found in the range of 1.57-114.76 ppm, whereas thorium as 3.97-179.93 ppm. As environmental radioactivity parameter, potassium was found in the range of 0.38-2.67% with an average of 0.95%. The absorbed dose rates at these sampling areas were found to be 0.09-0.68 μSv/hr, averaging 0.23 μSv/hr. Heavy mineral percentage was determined to be in the range of 8.01-65.81% and associated dose rates were found to be directly proportional to the presence of radioactive elements in those heavy minerals.

**Keywords**: Radioactivity, uranium, thorium, coastal, placers.

# Participation of Women in Income Generating Activities for Improving their Livelihood

**Group:** Inter-disciplinary group **Project ID:** SRG-224540

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## Abstract

Flood and weather make the unfavorable situation for conducting income generating activities throughout the year in Haor areas. The main objectives of this study were to determine the existing livelihood status of women through seven livelihood indicators and to measure the extent of participation of women in income generating activities (IGAs). Also to identify the existing constraints that hinder women's participation in IGAs. Netrokona district under Haor region and from this district two upazila namely Netrokona Sadar and Atpara were purposively selected. Data were collected from randomly selected 100 women by using structured interview schedule during 15 February to 15 March, 2023. The livelihood situation of women is not satisfactory, majority (50 percent) of the women had medium livelihood status. On the other hand, 27 percent of the women had low and 23 percent had high livelihood status. The extent of participation of women towards income generating activities was focus variable. To measure the extent of participation of women, a four-point rating scale was used. Scores were 3, 2, 1 and 0 for 'frequently', 'occasionally', 'rarely', and 'not at all' participation, respectively. Women were classified into three categories, majority proportion 56 percent of the women had medium participation in IGAs compared to 10 percent having high participation and 25 percent had low participation in IGAs. The women faced a number of problems while participating in IGAs. Nineteen (19) problems were selected to measure the extent of women's difficulty. Majority (50 per cent) of the women had medium problems, 25 per cent had low problems and 25 per cent had high problems in participating IGAs. Inadequate finance and lack of appropriate IGAs are the most crucial constraints. Proper trainings could be a better option for women to participate in income generating activities for improving their livelihood in Haor region of Bangladesh.

**Keywords**: Livelihood indicators, flood, haor, climate change, trading.

# Improvement of Growth Performance Antioxidant Status and Gut Health in Broiler Chickens Through Dietary Supplementation of Phytogenic Feed Additives

**Group:** Inter-disciplinary group **Project ID:** SRG-224541

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## Abstract

The injudicious use of antibiotics as growth promoters in poultry ration has attracted grave concern worldwide. Currently, researchers are trying to replace/minimize broad-spectrum antibiotics with alternative natural feed additives in animal diets. This study was, therefore, conducted following a randomized complete block design to investigate the dietary effects of moringa leaf and turmeric rhizome supplements on growth performance, blood biochemical characteristics, and gut microbiota in broilers. A total of 160 day-old broiler chickens (Arbor acres) were randomly distributed into four groups with four replicates of ten birds each, including T0, control (basal diet); T1, turmeric rhizome powder supplement (0.25%); T2, moringa leaf powder supplement (1.5%); T3, a mixture of turmeric rhizome (0.25%) and moringa leaf powder (1.5%) supplement. Performance indicators such as weight gain, feed intake, and feed conversion ratio (FCR) were used to assess the response of broilers to feeding moringa and turmeric powder. Among all the dietary groups, the broilers fed with the mixture of turmeric (0.25%) and moringa leaf powder (1.5%) supplements resulted in the highest increase in body weight and weight gain with a relatively lower FCR. Serum cholesterol and low-density lipoprotein cholesterol levels significantly decreased when supplemented with moringa alone and the mixture of turmeric (0.25%) and moringa leaf powder (1.5%). Total serum antioxidant capacity was found to be higher in T3 than in other groups. The bacteriological investigation revealed that the broilers with added moringa leaf powder (1.5%) had the lowest E. coli count. Together, these findings indicate that combined supplementation of turmeric (0.25%) and moringa leaf powder (1.5%) to broiler rations improved growth performance, blood biochemical characteristics, and gut microbiota in broilers, suggesting that this herbal combination could be a potential substitute for hazardous synthetic growth promoters for organic poultry production.

**Keywords**: Feed conversion ratio, lipid profiles, gut microbiota, moringa and turmeric.

# Control of Papaya Mealybug Using Chitin Synthesis Inhibitor Molecules

**Group:** Inter-disciplinary group **Project ID:** SRG-224542

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## Abstract

The papaya mealybug, *Paracoccus marginatus* Williams and Willink (Hemiptera: Pseudococcidae) is a small polyphagous sucking insect pest that attacks several genera of host plants, including economically important tropical fruits, vegetables and ornamentals. Infestation of the mealybug appears as clusters of cotton-like masses on the above-ground portion of plants with long waxy filaments. Immature and adult stages of *P. marginatus* suck the sap of the plant and weaken it. The leaves become crinkled, yellowish and wither. The flowers and fruits drop off prematurely. The papaya mealybug has been identified recently in Bangladesh and within the last few years this insect pest spread throughout the country very rapidly and has become major concern to papaya growers in Bangladesh. A Laboratory bioassay was conducted to test the efficacy of chitin synthesis inhibitor molecules, buprofezin against papaya mealybug. Lab experiment revealed that significant mortality of papaya mealybug was recorded in buprofezin (Tacoma 40 SC) treated plants. Number of mealybug recorded in buprofezin treated plants was 4, 2 and 0.5 at 2, 4 and 6 days after treatments, respectively. While, number of mealybug recorded in control plants was 10, 9 and 9 at 2, 4 and 6 days after treatments, respectively. Therefore, use of chitin synthesis inhibitor molecules, buprofezin is effective to control papaya mealybug population, and this insecticide can be used in the farmer fields.

**Keywords**: *Paracoccus marginatus*, buprofezin, control, mortality.

# Response of Major Varieties of Rice and Wheat Against Lead (Pb) Contamination in Bangladesh

**Group:** Inter-disciplinary group **Project ID:** SRG-224543

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## Abstract

Pb toxicity in soil is increasing day by day due to heavy industrialization, increasing use of Pb-based batteries and poor recycling facilities. However, we have no preparation to fight against Pb toxicity in crop lands. Therefore, our crop production and food safety are at risk. Considering that, the present project was conducted to find out morphological and biochemical responses of major wheat and rice varieties against 800 ppm $Pb(NO_3)_2$ toxicity. From the investigation, it was evident that, none of our major rice and wheat varieties have tolerance to Pb toxicity, rather severely susceptible and affected by Pb toxicity through reduced morphological and biochemical responses. Among the wheat varieties, four varieties *viz.* BARI Gom 30, BARI Gom 31, BARI Gom 33 and Sonalika have found with gradient of responses for morphological traits, and none of the varieties were found with clear stand to be declared with Pb tolerance for all the traits. For biochemical responses, similar findings were also revealed, and none of the varieties demonstrated strong anti-oxidant defense mechanism, rather poor proline-defense system in them. Similar to wheat, prominent rice varieties were also found to susceptibility to Pb toxicity in both morphological and biochemical responses. None of the rice variety had shown consistent better response against Pb toxicity, but variable response to different morphological and biochemical traits. Biochemical mechanisms are not strong enough to scavenge the ROS molecules and oxidative damages. Henceforth, it can be concluded that, none our major rice and wheat varieties are tolerant to Pb toxicity, rather very much susceptible. Therefore, Pb tolerance in wheat and rice should be looked out from the related genetic resources of different strata to help breeders to develop Pb toxicity tolerant cereal variety to ensure food safety and well as food security.

**keywords**: Wheat, rice, pb toxicity, tolerant, susceptible, biochemical traits, morphological traits.

# Breeding for the Development of Zinc Biofortified Wheat Variety to Combat the Zn Deficiency in Millions

**Group:** Inter-disciplinary group **Project ID:** SRG-224544

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## Abstract

Wheat (*Triticum aestivum* L.) is a major cereal which contributes about 28% of the world's food demand and a great source of different micronutrients like Zn and Fe. A study was conducted using thirty wheat genotypes to select the superior genotypes having higher yield and Zinc content, and also to find out the association between Zn content and yield contributing traits. The genotypes were also further checked for the presence of Zn linked QTL using gene specific molecular markers (SSR). The results of analysis of variance (ANOVA) showed significant genetic variation for all of the studied traits. Maximum GCV and PCV were recorded for Zn and Fe content. PCV is higher than GCV for days to germination, flag leaf area, grain per spike and grain per plant. High heritability along with high genetic advance was recorded for chlorophyll content, plant height, shoot length, Fe and Zn content. Grain yield plant$^{-1}$ showed significant positive correlation with number of grain spike$^{-1}$, 100-grain weight. Zn and Fe content showed significant negative correlation with canopy temperature. The studied genotypes were grouped into 4 major clusters and cluster III is important for micronutrient content. Genotypes Pavan & DSN-76 for Fe content, DSN-117, Ning 3517 & BAW 897 for Zn content have been identified as superior genotypes. BAW 667 & BAW 897 found superior for both Zn content and yield. Molecular markers showing polymorphic band, indicating the presence of diversity among studied thirty wheat genotypes. Among the used markers, barc144 & gwm359 related QTL is found to be important for higher Zn content which is related to higher Zn content in BAW897 genotypes. The selected genotypes will be further used to as potential genetic material for development of Zn bio-fortified wheat variety.

**Keywords:** Wheat, variability, heritability, Zinc and iron content, molecular marker.

# Response of Morphological and Biochemical Traits of Wheat (*Triticum aestivum* L.) under Soil Moisture Stress

**Group:** Inter-disciplinary group **Project ID:** SRG-224545

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## Abstract

Soybean is a popular crop with many different uses (e.g. oil, milk, tofu, sauce, livestock feed, biodiesel, lubricants, etc.). Despite a strong domestic demand, Bangladesh produces a small amount of soybeans due to a lack of high-yielding and stress-tolerant varieties. In two experiments with thirteen soybean genotypes and three salinity levels, a completely randomized design (CRD) was used to examine the effects of salinity stress on germination, seedling, shoot, root, pod traits, and biochemical properties in hydroponic culture. When the plants were in the germination and vegetative (22-day-old) stages, three treatments—0 mM, 50 mM, and 100 mM NaCl—were applied. Reduced percent germination (6.5%), shoot length (65.7%), root length (31.1%), plant height (18.8%), number of trifoliate (46.5%), chlorophyll content (33.7%), shoot dry weight (47.9%), pod length (13.9%), and thousand seed weight (29.2%) are the examples of the traits that showed significant differences among the genotypes under saline treatments. The number of lateral roots greatly increased (30.6%) under salinity stress, although the dry weight of the roots dropped by 37.3%. Salinity also considerably changed the biochemical parameters by raising the quantity of proline (292%), hydrogen peroxide (55.8%), and peroxidase (82.4%). The correlation analysis showed a substantial positive association among biochemical parameters like proline, peroxidase, hydrogen peroxide, etc. Genetic analyses along with PCA, revealed that secondary lateral root diameter, root dry weight, and peroxidase had high heritability with high genetic advance and thus, these traits could be suitable indicators of salinity stress tolerance. The genotypes Lokon, H1H5-W1H5, MTD-176, MTD-6, Bragg, and BINA Soybean-02 were determined to be the most suited salinity-resistant genotypes based on all analyses. The findings of this study could be used to support future research on the development of salt stress-tolerant soybean varieties and the discovery of saline stress-tolerant QTL for soybean.

**Keywords:** Soybean (*Glycine max* L.), salinity stress, morphological traits, biochemical traits.

# Sustainable Production and Storage of Summer Onion Using Household Organic Mulches

**Group:** Inter-disciplinary group **Project ID:** SRG-224546

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## Abstract

An experiment was conducted to study the effects of varieties and household organic mulches on growth and yield of onion at the Horticulture Farm of the Department of Horticulture, Bangladesh Agricultural University, Mymensingh during the period from October 2022 to June 2023. The experiment consisted of three summer onion cultivars of Bangladesh viz. BARI Piaj 2, BARI Piaj 3 and BARI PiaJ 5, and five household organic mulches, viz. $T_0$ = Control (no mulching), $T_1$ = Vegetables wastes, $T_2$ = Cattle shed straw, $T_3$ = Leaf mulch (banana leaf) and $T_4$ = Water hyacinth. The two-factor experiment was carried out in Randomized Complete Block Design with 3 replications. Results revealed that the parameters under study showed significant variation between onion varieties and mulching. BARI PiaJ 5 gave the highest plant height, number of leaves, fresh weight and gross yield of bulb compared to BARI Piaj 3 and BARI Piaj 2. The effect of household organic mulches on yield were in order of $T_4>T_1>T_2>T_3>T_0$. Among the treatment combinations $V_3T_4$ gave the highest plant height (47.85 cm), number of leaves (14.01), fresh weight of bulb (52.87 g), percent dry matter content (13.13%), percentage of slitted bulb (10.33%) and gross yield of onion (18.24 t/ha). The highest percentage of dry matter content of bulb (13.13%) was recorded in $V_3T_4$ followed by $V_3T_1$ (12.54%). The lowest percentage of weight loss of bulbs (24.66%) was observed in $V_1T_1$ (Table 5). The result revealed that, water hyacinth with BARI Piaj 5 was shown to be more effective in increasing summer onion production and BARI Piaj 2 more effective in weight loss. Therefore, the combined application of water hyacinth along with BARI Piaj 5 was found to be better in respect of growth and yield and BARI Piaj 2 for storability of onion.

**Keywords**: Summer onion, household organic mulching, yield, storability.

# Development of Chitosan Bioplatform with Human Dermal Fibroblast Cell Adhesion and Proliferation for Real-Time Wound Healing and Monitoring

**Group:** Inter-disciplinary group **Project ID:** SRG-224547

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## Abstract

**Background:** In Bangladesh, chronic diabetic wounds face fatal consequences because of insufficient health care facilities. Hence, management of such chronic wounds bears great significance. **Objectives:** The present research is designed to develop HDF immobilized chitosan-based platform for label-free electrochemical monitoring of chronic wound. **Methodology:** 1% chitosan solution was prepared by acetylation and the chitosan membrane was achieved through drop-casting of chitosan solution followed by Glutaraldehyde crosslinking. The as fabricated chitosan substrate was functionalized with 0.1M RGD solution which was morphologically confirmed with SEM. The fabricated substrate was subjected to HDF cell adhesion and proliferation. **Findings:** The chitosan membrane was achieved after drop-casting on smooth surface in an airtight container and oven-dried for overnight. The aqueous stable chitosan membrane was achieved after 24 h of glutaraldehyde exposure. The freshly crosslinked membrane was functionalization with RGD after overnight self-assembling for enhancing cell adhesion and proliferation ability. The functionalization step was morphologically investigated with Scanning Electron Microscopy (SEM) and found the nanostructured of RGD on the fabricated membrane. The morphologically confirmed nanostructured surface was subjected to cell adhesion and proliferation assay. For this, the HDF cell was seeded at a density of 2.5×104 cell/ml and maintained aseptically in DMEM supplemented with 10% FBS and 1% pen-step providing 5% CO2 and 70% humidity. The confluent monolayered (80-90%) cell was subjected to cell adhesion on RDG functionalized surface and incubated for 1 to 4th weeks. The cell proliferation result revealed that cell growth increased at 3 weeks of incubation while cell death started from 4th week of incubation. Thus, the cell immobilized platform will be subjected to electrochemical characterization of cell proliferation. **Conclusion:** The aqueous stable chitosan membrane was successfully achieved. The RGD nanostructured was successfully assembled on the fabricated chitosan membrane. Finally, the HDF cell was cultured and maintained on chitosan membrane.

**Keywords**: Wound healing, chitosan membrane, glutaraldehyde, RGD, HDF cell.

# Detection of Blast and Bacterial Blight Disease Resistance Gene(s) in Some Indigenous and Cultivated Rice Varieties Using Gene Based Molecular Markers

**Group:** Inter-disciplinary group **Project ID:** SRG-224548

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## Abstract

In Bangladesh, bacterial blight (BB) and rice blast caused by *Xanthomonas oryzae* pv. *oryzae (Xoo)* and *Magnaporthe oryzae*, remain most devastating with no developed highly resistant rice varieties in Bangladesh. Considering the importance, molecular-phenotypic resistance screening and allelic diversity of 5 major BB resistant genes (*Xa4*, *xa5*, *xa13*, *Xa21* and *Xa23*) and 3 blast resistant genes (*Pi9*, *Pish* and *Pita2*) were determined in 85 rice genotypes using gene based molecular markers at Plant Pathology Department, Bangladesh Agricultural University, Mymensingh. Out of 85 studied rice genotypes, 54 carried *Xa4* gene, while 25 carried *xa5* gene and only 1 contained *xa13, Xa21* and *Xa23* genes. Besides, 42 carried *Pi9* gene, 17 had *Pish* gene and *Pita2* was in only 1. The genetic frequency range for 5 BB resistant genes was 1.18% to 63.53% and 3 blast resistat genes was 1.28% to 53.84%. The widely distributed resistant gene for BB and blast was *Xa4* (63.53%) and *Pi9* (49.41%) respectively. During phenotypic resistance screening program, the number of highly resistance, resistance, moderately resistance, moderately susceptible and susceptible genotypes against BB were 2, 13, 11, 5 and 30 respectively. Presence of two or three genes combination reduced lesion length, indicating the efficacy. Notably, *Xa4+xa5* and *Xa4+Xa21* combinations were found in 23 and 1 genotypes with moderately resistance to resistance phenotypic responses. The *Xa4+xa5+xa13* gene combination was found in 1 advanced line (BLB-P-003) displaying highly resistance, and the *Xa4+xa5+Xa23* gene combination was found in 1 local cultivar (Sete Pajam-2) also showing highly resistance reaction. Combining two or more BB resistant genes was more effective in providing resistance against *Xoo* compared to a single resistant gene found in this study. To conclude, BLB-P-003 and Sete Pajam-2 will be promising candidates for developing the resistant variety against BB disease of rice in Bangladesh. In addition, 14 rice genotypes used in this study contain two rice blast resistance genes, which can be suggested that these genotypes/lines could be used as sources of resistance genes in designing future breeding programs.

**Keywords**: Bacterial blight, rice blast, resistance gene, molecular marker, phenotyping screening.

# Development and Bioequivalence Study of Mouth Dissolving Tablets of Blimepiride

**Group:** Inter-disciplinary group **Project ID:** SRG-224549

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## Abstract

**Background:** The most common dosage form is an oral tablet, however when water is readily accessible or not, geriatric patients frequently have trouble swallowing conventional tablets. **Objectives:** This study's objective was to create solid dispersion (SD) based glimepiride mouth-dissolving tablets (MDT) for hospitalized or bedridden diabetes patients with mental disorder and stroke etc. **Methodology:** The solid dispersion of glimepiride was manufactured by solvent evaporation technique using eudragit at different drug polymer ratios. The micromeritics properties of powder blend were performed like tapped density, bulk density, angle of repose, Hausner ratio and powder compressibility. The MDT containing solid dispersion were made using two different formulas containing superdisintegrants e.g. ludiflash, and sodium starch glycolate by direct-compression method. Weight variation, friability, thickness, disintegration time, hardness and *in vitro* dissolution test study of newly prepared MDT were carried out. **Findings:** The experimental data of micromeritics indicated that the flow property of powder mixtures was good. Tablets containing ludiflash: Formulation coded- SE2-F1 was found to release 103.82% of the medication in whole within 15 minutes whereas market product 1 (MP1) and market product 4 were found to be slow in drug release throughout this time. Combination of sodium saccharin and lemon flavor effectively masked the bitterness and provided satisfactory sweetness level. Hardness and friability were also optimized in the formulations to produce tablets of acceptable physical stability. Furthermore, *in vitro* disintegration time, wetting time, modified disintegration time, oral cavity disintegration rate and water absorption ratio were found to meet acceptable limits and good standards for mouth-dissolving tablets. These findings imply that oral dissolving tablets containing superdisintegrants are capable of providing a medicine with an excellent bioavailability. **Conclusion:** According to the outcomes of our research, we can say that tablets that dissolve in the mouth may be a step toward making anti-diabetic drugs more effective.

**Keyword:** Ludiflash, crosspovidone, sodium starch glycolate, solid dispersion, micromeritics properties.

# IoT Based Smart Agricultural Crop Monitoring in terms of Temperature and Moisture

**Group:** Inter-disciplinary group **Project ID:** SRG-224550

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## Abstract

The agricultural industry has been transformed by the Internet of Things (IoT) revolution, which has brought about cutting-edge solutions to problems relating to crop monitoring and management. This article provides a thorough analysis of a smart agricultural IoT system created for effective crop monitoring of crop moisture and temperature. The objective of this research is to create a comprehensive system that can continuously track temperature and moisture levels in agricultural fields, giving farmers useful information for smarter crop management decisions. To continually monitor and analyses important environmental parameters impacting crop growth, the created system incorporates several Internet of Things (IoT) components, such as wireless sensors, actuators, and cloud-based data analytics. Temperature and moisture are the two main factors that determine the health, yield, and general quality of the crop. Real-time temperature and moisture data are gathered from various points inside the agricultural field by the use of wireless sensors. The information is subsequently processed and interpreted by sophisticated data analytics algorithms on a cloud-based platform. According to the study, IoT-based systems are more effective at gathering and analyzing data than conventional monitoring techniques. Farmers can therefore improve their decision-making processes and ultimately increase agricultural yield, sustainability, and economic consequences by utilizing IoT capabilities. Further research and development in this area could revolutionize global agriculture and help ensure food security in the face of shifting climatic circumstances and rising population demands as IoT continues to develop.

**Keywords**: Internet, things, precision, environmental, parameters.

# Cryopreservation of Immature and *In Vitro* Matured Abattoir Derived Black Bengal Goat Oocytes by Solid Surface Vitrification

**Group:** Inter-disciplinary group **Project ID:** SRG-224551

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## Abstract

**Background:** Cryopreservation of oocytes has important roles in preservation and management, low-cost movement of genetic resources, and dissemination of germplasm via *in vitro* embryo production and nuclear transfer procedures. **Objectives:** The study was aimed to investigate the cryopreservation of immature (GV) and *in vitro* matured (MII) Black Bengal goat oocytes by Solid Surface Vitrification (SSV). **Methodology:** Black Bengal (BB) goat ovaries were collected from local abattoirs and transported to laboratory in normal saline at 30-37°C. Cumulus oocytes complexes (COCs) were aspirated from 2-8mm surface follicles. The retrieved COCs were subjected to cryopreserve by SSV and/or culture for IVM and vitrified at mature MII stage. The vitrified-warmed oocytes were evaluated for their viability based on morphology, esterase enzyme activity and oolemma integrity by FDA staining. **Findings:** Results showed that recovery rate of vitrified oocytes ranged from 88 to 92%. The viability of vitrified MII stage oocytes was slightly, but not significantly, higher than those GV stage oocytes in both two time points i.e. immediately after warming and after culturing for 2 h. Additionally, treatment of oocytes with cytochalasin B slightly, but not significantly, improved the survival of GV as well as MII stage oocytes based on both morphology and FDA staining. Similarly, multi-step warming increased survival of GV as well as MII stage oocytes. Furthermore, when multi-step warming was used, GV oocytes had higher viability than MII oocytes, but not significant. Interestingly, there was no effect of cryoprotectant type on the viability of oocytes. However, the nuclear maturation rate of vitrified GV oocytes was significantly reduced in DMSO group (31.3%) and were similar in DMSO +EG (48.4%) and EG (51.1%) groups ($p<0.05$). **Conclusion:** In conclusion, BB goat oocytes, irrespective to nuclear stage, cytochalasin B treatment, warming steps and cryoprotectant used were successfully cryopreserved by SSV without compromising the viability of vitrified-warmed oocytes.

**Keywords:** Solid surface vitrification, cryopreservation, oocytes, black bengal goats.

# Perception and Awareness of Rice Farmers about Crop Insurance in the Northern Part of Bangladesh

**Group:** Inter-disciplinary group **Project ID:** SRG-224552

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## Abstract

Rice is the main cereal crop in Bangladesh, most of the people takes rice three times every day. So, rice is not only considered as food crop but also considered as political crops. It is important to produce rice in where it gives the maximum yield. The farmers of Bangladesh as well as the northern part are highly vulnerable due to low productivity, price instability and high risks involved in rice production process. Now-a days farmers are demotivated to produce rice due to losses in the last previous years. Crop insurance is recommended as a useful instrument for the farmers to manage the diverse crop related risk while covering the pertinent losses. This study investigated the factors influencing farmers adoption of crop insurance as a risk management strategy in Bangladesh. This paper has investigated the results of a survey of 300 farmers in the northern part of Bangladesh. Data were collected through structured questionnaires and the samples were selected purposively. Ten explanatory variables have been chosen based on extensive literature and logit model have been employed to analyze the determinants. The analysis has revealed that variables including awareness of crop insurance, perception of risk, risk experience, education, opportunity of extension education, and monthly income positively influence farmers' adoption of crop insurance. Whereas, variables such as farming experience, co-operative farming, and application of alternative risk management strategies has negative influence. This project has also examined the importance and effectiveness of crop insurance in the context of Bangladesh. The findings are expected to guide the government of Bangladesh, insurance companies, and the policymakers in implementing crop insurance in Bangladesh as well as it will play a vital role in motivating the farmers to produce rice without risks.

**Keywords**: Crop insurance, risk management, farmer's perception, awareness, rice farming.

# Identification of Toxicogenomic Biomarkers and their Functional Analysis Using Machine Learning and Integrated Bioinformatics Analysis

**Group:** Inter-disciplinary group **Project ID:** SRG-224553

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## Abstract:

Safety is the main issue for approving chemicals like drugs, pesticides, cosmetics etc. The emergence of toxicity during the late stages of drug or chemical development may necessitate a return to seed compound screening, because toxicity is often inherent to the basic structure and is thus difficult to be eliminated by minor modification. Therefore, it is an urgent need to identify safety biomarkers that enable prediction of potential toxicity and prioritization of candidate chemicals or drugs. We termed this safety biomarker as toxicogenomic biomarker (ToxB). In this regard, two sample t-test, Wilcoxon signed-rank test, and linear model for microarray data analysis (LIMMA) were used for the identification of primary stage toxicogenomic biomarker genes (ToxBGs). Then the common identified 2877 ToxBGs for all the statistical tests was considered as the second stage ToxBGs. These genes were validated using the machines learning (ML) approaches like linear discriminate analysis (LDA), Logistic regression (LR), Support vector machine (SVM), and random forest (RF). Among these ML approaches SVM outperform the other ML approaches with performances metrics accuracy = 0.9806, AUC = 0.9995, sensitivity = 0.9833, and specificity = 0.9722. Protein-protein interaction network analysis of the significantly enriched ToxBGs to the pathways and diseases were done using the string database and 10 hub ToxBGs (HToxBGs) for each of the significant pathways and diseases were discovered using cytoscape. A total of 90 HToxBGs for the 9 significantly enriched pathways and 70 of HToxBGs for the 7 significantly enriched diseases were discovered at the final stage of ToxBGs toxicogenomic biomarker gene identification. Finally, we declared 90 HToxBGs for pathway enrichment analysis and 70 of HToxBGs for disease enrichment analysis totaling 160 HToxBGs as the final stage ToxBG for measuring chemicals/drugs toxicity.

**Keywords**: Toxicogenomic biomarkers, safety assessment of chemicals/drugs, drug-induced liver injury, statistical and machine learning approaches, bioinformatics analysis.

# Strengthening Community Resilience for Reducing Disaster Risk through Climate Change Adaptation Practices: Learing with Coastal Communities in Bangladesh

**Group:** Inter-disciplinary group **Project ID:** SRG-224554

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## Abstract

**Background:** Coastal communities in Bangladesh have been threatened by climate hazards which cause large-scale loss and damages. In order to lessen the effects of climate change building community resilience by adapting local adaptation is the key. **Objectives:** This study aims to search for alternative strategies of climate change adaptation to enhance climate resiliency and reduce risks. **Methodology:** This study has been conducted on the basis of exploratory research and triangulation (Mixed) research of quantitative and qualitative method has been applied. Barguna, Patuakhali and Bhola district of Barisal division and Khulna, Bagerhat and Satkhira district from Khulna division has been selected as study area. FDG, KII and face to face interview method has been used as a data collection tool. **Findings:** During and after disaster respondents face several problems including disruption in livelihood activity, economic vulnerability, loss of infrastructure, disruption in education and also have negative impact on health. Among them damage in their agricultural sector (64.67%) and disruption in transportation and communication (74.67%) is more identical. Coastal communities deal with disaster through their local and indigenous practices among this stored dry food (72%) and heightening the surrounding (53.33%) are considered as mostly taken. There are some barriers the local community face while developing their resilience. Lack of vocational training and lack of skills, poor self-esteem also creates barriers in developing community resilience. The development of infrastructure (90.67%), proper distribution of relief and required rehabilitation support (81.67%) has been considered as very important to building community resilience. **Conclusion:** The result concludes that as the area is highly dependent on agriculture and fishing, there need a special consideration on disaster tolerance cultivation and along with locally grounded community solutions to ensure sustainable livelihood and integrated support is needed to build local community as disaster resilient.

**Keywords**: Adaptation, climate change, climate resilience, disaster, disaster risk, livelihood, risk reduction.

# Comparative Analysis and Effectiveness of Different COVID-19 Vaccines Among Bangladeshi Population

**Group:** Inter-disciplinary group **Project ID:** SRG-224555

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## Abstract

To reduce the rapid transmission and prevalence of COVID-19, vaccination programs are running throughout the world. Following vaccination, antibody titer produced in body is an important indicator of protection level. The main objective of this study was to measure the antibody responses indicating effectiveness of different vaccines by comparing their anti-spike antibody signal inhibition rates as well as measuring cytokine responses. A total of hundred individuals were recruited to measure their antibody responses against three different vaccines namely AstraZeneca, Pfizer-BioNTech and Sinopharm. Using SARS-CoV-2 Neutralizing Antibody ELISA Kit, inhibition rates of binding anti-Spike antibody were measured where the levels were expressed in percentages. The level of cytokines (IL-4 & IFN-γ) was estimated in pg/ml unit using a human IL-4 ELISA kit and IFN-γ ELISA kit. It was observed that all the three vaccinated groups had significantly ($p< 0.0001$) higher antibody titer compared to that of unvaccinated individuals. After second dose of vaccination, plasma anti-Spike antibody levels in Pfizer-BioNTech ($p< 0.0001$) and AstraZeneca ($p< 0.0001$) vaccinated individuals were significantly higher than those received Sinopharm vaccines among the age group of 15-29 years. There was no significant difference in antibody titre between Pfizer-BioNTech and AstraZeneca vaccinated individuals. It was observed that all vaccinated groups except Sinopharm had significantly ($p<0.0001$) elevated levels of IL-4 compared to the control group. The Sinopharm group had no significant difference ($p=0.1198$) in the IL-4 level with the control. The covid-19 patient group had significantly ($p<0.0001$) elevated levels of IL-4 compared to both the control and vaccinated group. The level of IL-4 in Moderna ($p=0.0441$), AstraZeneca ($p<0.0001$), and Pfizer-BioNTech ($p<0.0001$) vaccinated individuals were significantly higher than those who received Sinopharm vaccines. All vaccinated and covid-19 positive groups had significant differences ($p<0.0001$) in IFN-γ level compared to the control group. IFN-γ levels in Pfizer-BioNTech ($p=0.3713$) had no significant difference compared to the covid-19 patient group. So, Pfizer-BioNTech and AstraZeneca should use for mass vaccination in future with respect to Sinopharm.

**Keywords**: Spike protein, ACE2, neutralizing antibody, vaccine, ELISA.

# Diversity Antibiotic Susceptibility and Antimicrobial Ability of Endophytic Bacteria Isolated from *Ocimum sanctum*

**Group:** Inter-disciplinary group **Project ID:** SRG-224556

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## Abstract

**Background:** The emergence of antibiotic resistance in pathogenic microbes has generated an alarming condition causing a significant death in humans. Medicinal plants Tulsi (*Ocimum sanctum*) are well known to have antimicrobial activities. We hypothesize that the antibacterial activity of Tulsi is partly due to the presence of endophytic bacteria-derived bioactive compounds. **Objectives:** Here, we aimed to isolate and characterize culturable endophytic bacteria from Tulsi to decipher the diversity, antimicrobial abilities, and antibiotic susceptibility of the endophytic bacteria. **Methodology:** The isolated endophytic bacteria were characterized morphologically, biochemically, and genotypically. Genotypic characterization was performed by DNA extraction, 16S rRNA gene amplification by PCR followed by sequencing. An antimicrobial susceptibility test was performed through the disk-diffusion method and antibacterial efficacy was tested against 3 common pathogenic bacteria with the extracellular fraction of the endophytes through well-diffusion method. Antiviral potential of the endophytic bacteria was predicted using different in-silico tools. **Findings:** A total of 18 morphologically different bacteria were isolated from Tulsi. The genetic characterization showed that 50% of the bacteria were found to be *Bacillus* species. Of the endophytic bacteria, 6 were found to be multi-drug resistant and among them, 2 were pan-drug resistant. Eleven bacteria showed antibacterial activity against 3 different indicator strains. Potential bioactive compounds produced by these bacteria responsible for antimicrobial activity were predicted via different in-silico tools. The physiochemical and drug-likeness properties of these compounds were analyzed, and as a proof of concept, their ability to inhibit RdRp (RNA-dependent RNA polymerase) of HCV (Hepatitis C Virus) was assessed. Three of these compounds show notable inhibitory effects against RdRp of HCV. **Conclusion:** Tulsi-derived endophytic bacteria may serve as promising sources of antimicrobial therapeutics.

**Keywords**: Endophytic bacteria, tulsi, secondary metabolites, antimicrobial activity, antibiotic resistance.

# The Exploration of Antidiabetic Activity of Bottle Gourd (*Lagenaria siceraria*) Powder in *In-Silico* and *In-Vivo* Methods in Rat Model

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## Abstract

**Background:** Diabetes Mellitus has been a major global health concern, with an estimated 415 million adult cases in 2015 and an expected 200 million cases by 2040. Due to the ineffectiveness, side effects, and high cost of conventional drugs, medicinal plants grabbed the attention to treat diabetes as a natural product that is believed to be safe. **Objectives:** To investigate the antidiabetic potentialities of bottle gourd (*Lagenaria siceraria*) fruits in *in vivo* and *in silico* methods. **Methodology:** Fresh bottle gourd fruits were collected, dried, and powdered to perform the assays. To assess the antidiabetic activities in in vivo approach, Alloxan-induced diabetic rats were fed bottle gourd powder mixed food for 21 days, and blood glucose levels were measured at regular intervals. **Findings:** Obtained results were compared with Metformin as a standard drug. Different physiochemical parameters i.e., lipid profile, SGOT, SGPT, creatinine, urea etc. were also measured to obtain the safety profile of bottle gourd powder. For *in silico* study, ten compounds were selected from bottle gourd by extensive literature review. Molecular docking was performed step by step to measure the binding affinity of selected ligands with Human CYP3A4 (bound to metformin) protein and Human dipeptidyl peptidase-IV protein. In animal study, bottle gourd showed little activity to reverse the disease condition. But it has appeared to be safe for both the kidney and liver. In the molecular docking study, most of the targeted compounds showed better affinity toward selected protein compared to Metformin hydrochloride. In addition, most of the compounds were found free of toxicities. **Conclusion:** We, therefore, conclude that bottle gourd powder showed potential as an antidiabetic agent but further studies should be conducted on different extracts of *L. siceraria* to establish bottle gourd as a noble antidiabetic agent to treat diabetes mellitus.

**Keywords**: Antidiabetic, antioxidant, thrombolytic, anti-inflammatory, stabilizing activity.

# Analysis of the Effects of Food and Water Borne Carcinogens on the Cancer Patients of Bangladesh

**Group:** Inter-disciplinary group **Project ID:** SRG-224558

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## Abstract

**Background:** The consumption of bread processed by potassium bromate ($KBrO_3$), a 2B carcinogen might be one of the causes of various cancers in Bangladesh. **Objectives:** Determination of $KBrO_3$ in bread samples and bread consumption frequency in different cancer patients in our country. **Methodology:** The survey of cancer patients was conducted in different hospitals based on the questionnaires and from hospital depository. A standard curve was generated and the $KBrO_3$ in bread samples was measured by using SHIMADZU UV-1900 UV-vis spectrophotometer. **Findings:** A total of 198 cancer patients' data have been collected from different cancer hospitals; among them, kidney, thyroid, and gastrointestinal (KTG) cancer patients showed high frequency bread consumption history. Sixty percent of the KTG patients said they had frequent bread consumption whereas among the non-KTG cancer patients only 13% claimed that they had consumed bread frequently. The patients who participated in the survey are from the different districts of Bangladesh, hence the bread samples were collected from all over the country. One hundred and three bread samples were collected from 46 districts of eight divisions of Bangladesh, and $KBrO_3$ was detected in 35% of the bread samples. The highest concentration of $KBrO_3$ was 6.72 µg/g and 6.49 µg/g of bread sample, which were measured in the Dhaka and Chittagong divisions, respectively. The lowest concentration of $KBrO_3$ (1.61µg/g bread sample) was detected in a bread sample from Dinajpur district. However, 2 to 5 µg of $KBrO_3$ was measured in per gram of sample in most of the bread samples examined in this study. **Conclusion:** The concentration of $KBrO_3$ in bread samples examined in this study exceeded the FDA recommended value (>0.02 µg/g) which may have a significant impact on the health of Bangladeshi population.

**Keywords**: Potassium bromate, bread, spectrophotometer, consumption frequency, concentration.

# Integrated Bioinformatics and System Biology Approaches to Identify Molecular Mechanisms and Key Pathways for Autism Spectrum Disorder that are linked to the Progression and Severity of COVID-19

**Group:** Inter-disciplinary group **Project ID:** SRG-224559

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## Abstract

Autism spectrum disorder (ASD) is a complicated neurological impairment characterized by recurrent difficulties alongside COVID-19 and has emerged as a serious public safety issue triggered by serious pulmonary distress. In this study, using bioinformatics and systems biology approaches we attempted to determine how ASD promotes the frequency, development, and intensity of COVID-19 by changing molecular mechanisms and modifying genetics across both disorders. First, we obtained eight RNA sequencing datasets for ASD and COVID-19 from the NCBI GEO database and analyzed them in GREIN. Then we discovered 264 common differentially expressed genes (DEGs), and we created a PPI network with a gene regulatory network employing those common DEGs. After that, we identified 36 unique hub genes by using 12 methods of CytoHubba plug-in of Cytoscape. According to our findings, *CCL4, HLA-DRA, ITGB3, IL17A, IL1B, CXCL12, IGF1, ITGA9* were the most important hub proteins. Then the significant transcription factors were*, FOXC1, GATA2, YY1, NFIC,* and *USF2,* moreover the most vital post-transcription factors were mir-129-2-3p, mir-26a-5p, mir-325, mir-628-3p, mir-548d-3p, mir-548x-3p, and so on. Additionally, from the protein-drug network, we identified several drug-like compounds such as Minocycline, Etiprednol, Dicloacetate, and Rilonacept that were projected to be effective against ASD and COVID-19. Further, a number of substances were also discovered from the protein-chemical interaction, such as benzo(a)pyrene, valproic acid, methotrexate, and estradiol, which may control the hub gene activity levels at both the bio-regulatory level. Thus, our research uncovered a variety of innovative and distinctive therapy approaches that shed light on the connections between the susceptibility markers of ASD and COVID-19 patients.

**Keywords**: Autism spectrum disorder, COVID-19, gene ontology, transcriptional factors, hub proteins, and bioinformatics.

# Exploring Bioactivity and Bioactive Compounds of Cultivated *Corchorus spp*.: Focus on Potential Benefits in the Treatment of Obesity

**Group:** Inter-disciplinary group **Project ID:** SRG-224560

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## Abstract

Obesity is a major health challenge worldwide. Bangladesh has to spend a huge amount of foreign currency on the management of diseases related to obesity and lipid metabolism, despite its large indigenous resources of phytomedicine. It is urgent to utilize our own resources in order to make a self-reliant Bangladesh in every commodity. In line with the above, the present investigation has been designed to study the nutraceutical potential of cultivated jute in the management of obesity and its related health abnormalities, as jute is indigenous and nontoxic. In this regard, a comprehensive colorimetric and chromatographic phytochemical profiling of cultivated jute extracts by HPLC-DAD was conducted. The results found that cultivated jute contains a rich amount of total phenolics and total flavonoids. Among the methods used, continuous hot water is the best way to yield the maximum amounts of bioactive compounds from cultivated jute. The polyphenol profile, aided by HPLC-DAD, detected a plethora of bioactive compounds of different functional groups. An *in silico* chemico-biological interaction study using cultivated jute's phenolic compounds against the lipid hydrolyzing enzyme was conducted. The results showed that the studied compound fit well in the active site of the enzyme and yielded a strong inhibitory score against the cultivated jute's phytochemicals compared to the standard anti-obesity drug. The study has been further extended to lipid hydrolyzing enzyme inhibition activity *in vitro*, and results found that jute can potentially inhibit lipid hydrolyzing enzymes. Additionally, bioactivity profiling has found that jute contains a rich amount of bioactivity. The obtained results are useful in combating malnutrition and preparing herbal formulations from cultivated jute species against obesity and diseases related to dietary fat metabolism.

**Keywords**: HPLC-DAD; Chemico-biological interaction; lipid hydrolyzing enzyme; bioactivity, fat metabolism.

# Development of Citrus fruits Peel Enriched Bakery Products: A New Perspective on Disease Prevention and Health Benefits

**Group:** Inter-disciplinary group **Project ID:** SRG-224561

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## Abstract

Citrus peels- the waste by-product of the citrus factories is reckoned as a valuable functional food. While the pulp and juice are now used the most, the peel tends to be discarded. Citrus peels may provide a health benefit beyond the traditional nutrients they contain, as well as prevent diet related diseases e.g. metabolic syndrome, diabetes, coronary heart diseases, obesity, hypertension. Cookies are well known bakery products for their nutritious qualities, palatability, compactness, and convenience. Cookies often have a longer shelf life and are more resistant to microbial decomposition than cakes and bread because they contain less moisture. The objective of the current study was to create a low-calorie high fiber and antioxidant content product. A systematic experimental study design was conducted through Recipe Development, product preparation and proximate analysis of freshly prepared samples, sensory evaluation and side effect tests of the citrus peel enriched cookies. After several trials 5% replacements of all-purpose flour with freeze dried citrus peel powder was used in the final product (cookies) preparation. The newly developed cookies contain 250 % more minerals than the regular cookies, 250% more fibers than the commonly available cookies, carbohydrate content is reduced by 9.76 % and overall energy content is 8.36% lower than regular cookies. The organoleptic properties of the cookies have been assessed on its appearance, color, aroma, sweetness, hardness, crunchiness, mouth feel and overall acceptability. In 7 points hedonic scale the Malta peel cookies samples got higher acceptance value than the orange peel cookies in terms of all the organoleptic properties. After one month of preservation at the room temperature in a glass jar, the proximate composition of the cookies sample including ash, fiber, fat, and protein were decreased while moisture, carbohydrate, and energy were increased.

**Keywords:** Citrus-peel, low-calorie, fiber, cookies, chronic-diseases.

# 1st Training course on Numerical Model & Artificial Intelligence for Ocean Science (NMAI4OS)

**Group:** Inter-disciplinary group **Project ID:** SRG-224562

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## Abstract

The research training course on numerical modeling and artificial intelligence (AI) for earth and ocean science tackles a pivotal interdisciplinary challenge, emphasizing the need for versatile expertise. As dependence on numerical models and AI grows, there's a rising demand for adaptable skills to navigate and predict intricate phenomena in Earth and Ocean Studies. This research training aims to bolster interdisciplinary proficiency, focusing on elevating skills in numerical models and AI techniques for collaborative applications. The methodology integrates the Weather Research and Forecasting model alongside Grid Analysis and Display System (GrADS) tools. Analysis employs R programming and Python applications, ensuring seamless integration. Findings showcase a successful fusion of numerical models and AI, highlighted in case studies on tropical cyclones and diverse oceanic phenomena. Participants engaged with the WRF model, R programming, Python applications, demonstrating significant proficiency growth. Insights from a comprehensive survey reveal over 85% rating sessions as excellent, with more than 90% praising the high-quality course materials. The hybrid format, blending in-person and virtual components, achieved a 92% satisfaction rate, affirming the training's efficacy. Qualitatively, participants expressed enhanced comprehension of interdisciplinary approaches, particularly in tropical cyclones and oceanic phenomena. Feedback emphasized a transformative shift towards a holistic perspective in addressing intricate challenges. These insights underscore the course's success in fostering collaboration, knowledge exchange, and comprehensive skill development in dynamic realms such as tropical cyclones and oceanic dynamics. The course enhances proficiency in numerical models and AI through case studies focused on cyclones and oceanic phenomena, equipping participants with essential skills for advancing scientific applications.

**Keywords**: Interdisciplinary, WRF model, R, GrADS, python.

# Assessment of Carcinogenic Heavy Metals in Water Bodies and Associated Health Risk Around Payra Seaport Area Patuakhali

**Group:** Inter-disciplinary group **Project ID:** SRG-224563

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## Abstract

A study was conducted to evaluate the quality of groundwater for drinking and irrigation purpose with associated health hazards in terms of carcinogenic heavy metals in different unions around the Payra Seaport, Kalapara, Patuakhali. Thirty groundwater samples were collected from deep tube well from 12 unions. Temperature, pH, EC, TDS, major ion concentrations such as $Ca^{2+}$, $Mg^{2+}$, $Na^{+}$, $K^{+}$, $SO_4^{2-}$, $HCO_3^{-}$ and $CO_3^{2-}$; irrigation water quality indices like SAR, SSP, MHR, Kelly's ratio and toxic elements such as As,Cd, Pb, Ni, Fe and Mn were considered in this study for assessment of ground water quality. The pH indicated that most of the water samples were slightly alkaline in nature. The trends of major cations and anions were $Na^{+}$> $Ca^{2+}$> $Mg^{2+}$ > $K^{+}$ and $HCO_3^{-}$ > $CO_3^{-}$ > $SO_4^{2-}$, respectively. $Na^{+}$ and $HCO_3^{-}$ was the dominant cation and anion, whereas $K^{+}$ and $SO_4^{2-}$ was the lowest amount. Correlating the data with WHO and Bangladesh standard for drinking water concluded that the value of analyzed parameter of study area under permissible limit except for $Na^{+}$, $HCO_3^{-}$ and $CO_3^{-}$. The result of irrigation parameter (SAR, SSP, MHR, Kelly's ratio) showed that the groundwater of the investigated area is not suitable for irrigation purpose as majority of the samples grouped in unsafe category. However, except for Cd and Fe in few locations, the trace metals concentrations were within permissible limit. Analysis of health hazard for non-carcinogenic risk was determined by evaluating the chronic daily intake (CDI), the hazard quotient (HQ). The analysis of health hazard assessment concluded that the risk is acceptable for all metals except for iron and Cd in few locations. Concentrations of iron (Fe) for all samples implied a major threat with HQ above one.

**Keywords**: Groundwater, irrigation, drinking, water quality, iron.

# Nutritional Profiling and Human Health Risk Associated with Pesticide Residues and Heavy Metals Content in Commonly Consumed Rice Varieties in the South-Central Coastal Area of Bangladesh

**Group:** Inter-disciplinary group **Project ID:** SRG-224564

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## Abstract

Rice is the staple food in Bangladesh. This study, examined the proximate composition, heavy metal contents and its related health risks of commonly consumed rice varieties (Pijam, Swarna Bullet, BRRI Dhan-28, BRRI Dhan-29 and Chinigura) in Barishal district. Proximate composition and concentrations of heavy metals (Pb, Cd, Cr and Se) of rice varieties were determined by AOAC and ICP-MS method respectively. Health risks related to the metal intakes were evaluated in terms of EDI, and carcinogenic and non-carcinogenic risk by THQ and TR. The results show that proximate composition for the rice varieties was variable with ranges being 11.44-12.39%, 0.58-0.27%, 7.74-6.21%, 7.00-5.66%, 2.45-2.14% and 73.5.41-71.04% for moisture, crude lipid, crude protein, ash, crude fibre and carbohydrate content, respectively. EDI values of the metals were below the maximum tolerable daily intake. TTHQ through consuming the rice varieties was below 10 for both adult and child, suggesting that people might not have significant non-carcinogenic health risk but in the case of individual metal, the THQ values of Pb was above 1 of rice varieties Pijam, BRRI Dhal- 28 signifying that people both child and adult would experience significant health risks if they only ingest these metals from rice varieties but in case of Swarna Bullet THQ values of Pb and Se was above 1 which can cause significant health risks in children's. TR values for Pb, Cd were lower than $10^{-6}$ in all samples which are considered non-carcinogenic. But all of the TR values for Cr were higher than $10^{-4}$ which is carcinogenic. All TCR values were lower than $10^{-4}$, which is considered as no carcinogenic risk. The study revealed that some risks associated with rice consumption are not negligible and thus, more attention should be paid to abating and controlling the sources of metal pollution to attain food quality and safety.

**Keywords**: Proximate composition, EDI, THQ, TTHQ, TR.

# Effect of Aqua-chemicals in Aquaculture in Durgapur Upazila under Rajshahi District

**Group:** Inter-disciplinary group **Project ID:** SRG-224566

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## Abstract

The research was conducted in fish farms to find out different chemicals used in freshwater aquaculture activities in Durgapur upazila under Rajshahi district, Bangladesh. Data were collected from 120 fish farmers from Durgapur upazila of Rajshahi district through questionnaire interview, personal contact with fish farmers, market survey and focus group discussion (FGD) with Fish farmers, retailers of aqua Chemicals and representatives of pharmaceutical companies. A variety of aqua drugs and chemicals were used in aquaculture for pond management, oxygen supplier, toxic gas reducer, antibiotics and growth promoters. Forty different chemicals were used for different purposes. Saltose, Panvit aqua, Charger gel, Aqua boost, Megavit aqua, Orgavit aqua etc. were used as growth promoters. Mostly used growth promoter is Safegard (14.16%). Nine brand antibiotics, with the trade names of Renamox, Renamycin, Povin vet, Bactiab, Cotrim vet bolus, Tetracycline, Cotrim vet, Oxin WS, Fish cure, were used for treatment of diseases with the dosage of 30-45g/100kg fish, 35-50g/100kg fish, 3-4 ml/liter, 50-60g/kg body weight, 1 bolus/10- 15kgbody weight, 10-15g/100 kg body weight, 0.5-1mg/ kg body weight, 40-50mg/ kg body weight, 500-700/1000kg feed (3–5 days). Almost (98-100%) all the farmers were used inorganic fertilizers. Liming (140 kg/ hectare) was the most common treatment used by the farmers. Salt and potassium permanganate were also used. Lime and Zeolite were used for pond preparation and water quality management. Rotenone, phostoxin tablet, ripcord was used as fish poison of which rotenone was widely used (56.66%). The research also indicated some problems associated with the use of such chemicals due to lack of knowledge of farmers about the use of chemicals, appropriate dose, method of application and their indiscriminate use of chemicals.

**Keywords**: Aquaculture, chemicals, freshwater, fish farms, antibiotics.

# Technology Addiction: Effects of Electronic Game and Social Media Use on Academic Performance and Symptoms of Psychiatric Disorders Among School-Going Adolescents

**Group:** Inter-disciplinary group **Project ID:** SRG-224567

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## Abstract

**Background:** There is conflicting research regarding the negative effects of electronic gaming and addictive social media use on psychological disorders and academic achievement. **Objectives:** To examine the association between social media use and electronic gaming addiction and depression and poor academic achievement. **Methodology:** This investigation is cross-sectional. The selection process involved 800 adolescents enrolled in grades 9 and 10 across four public and private high schools in the Rajshahi City Corporation. The outcomes of interest were depression and academic performance. Social media use and electronic game addiction were exposure of interest. **Findings:** From the total sample, 9.3% and 28.3% reported that they were additive to electronic game and social media use. A significant proportion of the students suffered from depression (22.1%) and 22% of the students' average grade point was poor. Suffering from depression was associated with addiction to electronic games (adjusted odds ratio [aOR] =2.63; 95% confidence interval [CI] =1.56, 4.15) and social media use (aOR =2.45; 95% CI =1.22, 4.92). A significant association was observed between poor academic performance and addiction to electronic games (aOR =2.45; 95% CI =1.45, 4.15) and social media use (aOR =2.21; 95% CI =1.13, 2.95). In addition, medium academic performance was found to be 1.92 times more likely to be addicted to electronic games. **Conclusions:** Adolescents who are more likely to engage in addictive behaviors such as playing electronic games or using social media should be the focus of public health initiatives, as they are more susceptible to depression along with poor academic accomplishment.

**Keywords**: Social media, electronic game, adolescents, depression, academic performance.

# Development and Evaluation of CaFe-Conjugate Nano-Feeds as an Alternative to Antibiotics in Green Broiler (Antibiotic-Free) Production

**Group:** Inter-disciplinary group **Project ID:** SRG-224568

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## Abstract

**Background:** Commercial poultry farmers extensively utilize antibiotics without following withdrawal period guidelines and veterinary advice, therefore, an alternative to antibiotics in safe broiler production is essential. **Objectives:** a) Development of CaFe-nanoparticles-based feed additive. b) Adoption of NPs feed additives in broiler ration. c) Production of antibiotic and health-hazard-free broiler chicken. **Methodology:** The $CaFe_2O_4$ nano-feed additive was synthesized by co-precipitation and auto-combustion methods. The experimental birds were divided into 5 treatments $T_1$, $T_2$, $T_3$, $T_4$, and $T_5$, and were supplemented with $CaFe_2O_4$ at the concentration of 25, 35, 45, 60, and 0 µg/kg feed, respectively. CRD model was used in statistical analysis. **Findings:** Particle morphology of $CaFe_2O_4$ studied using FE-SEM and TEM revealed the estimated nanoparticles size about 50-60 nm and 30-40 nm, respectively. The XRD patterns for the prepared $CaFe_2O_4$ nanoparticles via the co-precipitation and auto-combustion methods showed peak consistency and the peak consistency was more accurate. Further, the saturation magnetization of the $CaFe_2O_4$ NPs prepared via the co-precipitation method (Ms) was 47.279 emu/g. Magnetic properties enriched CaFe-nanoconjugates were evaluated as feed additive animal model trials successfully. It was revealed from the findings that significantly ($P > 0.05$) the highest body weight as well as weight gain was achieved by the supplementation of 45 µg $CaFe_2O_4$ nano-feed additives per kg ($T_3$). On the other hand, the lowest body weight as well as weight gain was observed in the control group ($T_5$). The results also revealed that the superior FCR (1.34) was obtained from $T_2$ (35 µg/kg), whereas the worst FCR (1.5) was noticed for $T_5$ (control). Finally, it was revealed that the incorporation of CaFe-nanoconjugates in broiler ration elevated the production performances. **Conclusion:** It may be concluded that antibiotic-free broiler production is possible by supplementing the developed CaFe-nanoconjugates. Therefore, we believe this project will be beneficial for the country fellows by mitigating the SDGs.

**Keywords**: Nanoparticles, production performance, health hazard, SDG.

# An Investigation on the Genetic Influence of Comorbidity Risk Factors on SARS-CoV-2 Infections by using the Integrated Statistics and Bioinformatics Approaches and Drug Repurposing

**Group:** Inter-disciplinary group **Project ID:** SRG-224569

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## Abstract

**Background:** COVID-19 patients become more vulnerable when they suffer from comorbidity diseases including idiopathic pulmonary fibrosis (IPF), chronic obstructive pulmonary disease (COPD) and interstitial lung disease (ILD). **Objectives:** The main objectives of this study were to explore SARS-CoV-2 infections and multiple lung diseases (IPF, IDL and COPD) causing common key genes highlighting their common pathogenetic processes and repurposable drug molecules. **Methodology:** Different statistical and bioinformatics tools and databases were used for identification of differentially expressed genes (DEGs) between case and control samples, protein-protein interaction (PPI) network analysis of DEGs by using the STRING databases and Network Analyst to explore key genes (KGs) from DEGs. Then AutoDock Vina was used for exploring KGs-guided drug molecules. **Findings:** We detected 10 cDEGs (CXCR4, TNFAIP3, VCAM1, NLRP3, TNFAIP6, SELE, MX2, IRF4, UBD and CH25H) by the protein-protein interaction (PPI) network analysis, that are able to separate both SARS-CoV-2 and IPF patients from the normal/control patients. Then, we suggested the cHubGs-guided top-ranked 10 candidate drugs known as Vancomycin, Rapamycin, Tacrolimus, Tthiostrepton, Paclitaxel, Torin2, Digoxin, Astragaloside-IV, Radotinib and Oligomycin-A that would be effective against SARS-CoV-2 infections and IFP diseases both. Computationally, we confirmed that our proposed drugs are computationally more effective compare to the already published drugs. Secondly, **w**e identified top-ranked 11 cDEGs (*IL6, STAT1, CXCL8, TLR4, CXCL10, CCL2, JUN, IRF1, DDX58, IRF7, and ICAM1*) as both SARS-CoV-2 infections and lung diseases (IPF, ILD, COPD**)** causing hub-cDEGs by the protein-protein interaction (PPI) network analysis. Then, we detected these hub-cDEGs guided top-ranked 10 repurposable drug molecules (Rapamycin, Everolimus, Paclitaxel, Ivermectin, SCH-772984, Entrectinib, Nilotinib, Conivaptan, Radotinib, and Venetoclax) for the treatment against COVID-19 with comorbidity risks (IPF, ILD, COPD**)** by molecular docking simulations. **Conclusion:** Therefore, the findings of this study might be played a vital role in the treatment against SARS-CoV-2 infections in presence of IPF disease as a comorbidity risk.

**Keywords**: Comorbidity, transcriptomics profiles, hub-genes, pathogenetic processes, drug repurposing, integrated statistics and bioinformatics analysis.

# A Study on the Knowledge, Attitudes and Practices (KAP) toward Environmental Education: A Cross-Sectional Study of Secondary Levels in Bangladesh

**Group:** Inter-disciplinary group **Project ID:** SRG-224570

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## Abstract

**Background:** Environmental education plays a crucial role in developing a proper understanding of the environment and promoting sustainable practices. **Objective:** (i) To identify the knowledge, attitude, and practice (KAP) towards environmental education among secondary school students in Bangladesh, (ii) To compare the KAP towards on environmental education in both (Dhaka city vs Outside Dhaka city) areas, (iii) To examine factors contributing to changes in knowledge attitude and practice towards the environment among the respondents. **Methodology:** The target population for this study comprises students in grades 9 and 10 attending secondary level schools in Bangladesh. The sample design employed is a two-stage stratified sampling approach. In the first stage, two secondary schools within the Dhaka city corporation area and two secondary schools outside the Dhaka city corporation area will be selected. In the second stage, a systematic sample of approximately 75 students per stratum will be chosen. The questions will be categorized into five major domains: concern, knowledge, willingness to act, present and past behavior, and experience with nature. The analysis will involve statistical procedures to identify outliers, assess the distribution of variables, and conduct multivariate analysis. The data will be processed using the Statistical Package for Social Sciences (SPSS) version 23 software, and the R Project for Statistical Computing version 3.6.0 will be utilized for data analysis. Mathematical rules such as principal component analysis, Cronbach's alpha, ANOVA tests, and ordered probit models will be employed to analyze and interpret the data accurately. **Findings:** (a) Inadequate curriculum content, (b) Lack of awareness among students, (c) Insufficient teacher training, (d) Limited availability of resources, (e) Socioeconomic factors, (f) Lack of interdisciplinary approach. **Conclusion:** By investigating the knowledge and attitude-behavior of secondary school students, the study aims to shed light on the effectiveness of environmental education in raising awareness and fostering positive attitudes towards the environment.

**Keywords:** Environmental education, secondary school, stratified sampling, teacher training.

# Validation and Adoption of Climate-Smart Technologies (CSTs) for Increasing the Productivity of Shrimp Farming in the Coastal Ecosystem

**Group:** Inter-disciplinary group **Project ID:** SRG-224571

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## Abstract

The cultivation of shrimp in coastal aquaculture has increased over time. Farmers' propensity to adopt new technologies varies due to distinctions in cultures, awareness, preferences, and socioeconomic backgrounds. The climate-smart technology is relatively new concept for shrimp farmers in Bangladesh. The goal of this study is to fill in the gaps by looking into what makes people in Bangladesh accept climate-smart technologies (CSTs) and focused on the factors affecting the adoption of CSTs for increasing the productivity of shrimp. The study was carried out based on 200 shrimp-farming households from two Upazilas of Bagerhat and Satkhira districts of Bangladesh, which are known for their extensive shrimp farming. The respondents were selected by using simple random sampling. The logit model was used to identify the determinants of the adoption of climate smart technology for shrimp farming in the coastal areas. This study found the average number of family members involved in shrimp farming was 1.37 in Satkhira and 1.3 in Bagherhat and 14 climate smart technologies are available for shrimp culture. Polyculture shrimp farming is practiced by around 77% and 83% of farmers in Satkhira and Bagherhat, respectively which is one of the most chosen CSTs for shrimp production. Use net on the dike to protect post larvae and shrimp from escaping with the overflow of water is second most popular CSTs used by 63% and 57% farmers in Satkhira and Bagherhat respectively. More shrimp producers in Satkhira (56.00%) than in Bagerhat (68.00%) own a smartphone which is very much effective for new technology adoption. Farmers' climate-smart technology priorities depend on socioeconomic status, higher levels of education, more farming experience, income level, farming system, access to credit and smaller family size were all significant predictors. The policymakers and government should keep attention to education, experience in farming, insurance, advisories, and access to credit. Increasing literacy and availability of information in the coastal area will make it possible.

**Keywords**: Polyculture, aquaculture, logit model, farming system, access to credit.

# Impact of Climate Change on Agricultural Productivity: A Study towards Achieving Sustainable Food Security in Haor Areas of Bangladesh

**Group:** Inter-disciplinary group **Project ID:** SRG-224572

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## Abstract

**Background**: In the hoar area 6 months land remain under water as a result, the people living in areas remain unemployed which lead to food insecurity. **Objectives**: (i) To describe the food production system in Haor areas, (ii) To develop the methodologies towards achieving sustainable food security, (iii) To determine the impact of Climate change on household level food security. **Methodology**: The study used descriptive and inferential statistical tools to measure food security in households, understand socio-economic conditions, identify predictors of food insecurity, and develop policy implications. Data was analyzed using Direct Calorie Intake and Cross-tabulation analysis. **Findings**: In this study, 500 households consisted of a total of 2696 household members. The literacy rate is about 34% in haor area. More than 50% of the total population is engaged in agricultural activities. Rice with vegetables is regarded as the main food item for the Haor people, with an average per capita consumption of 544 grams per day. The average annual household expenditure on food and education was tk. 6539.8 and tk. 4968.44. Further, the expenditure on food items accounted for 66.9% of the total expenditure. By using the direct calorie intake (DCI) method, the per capita average intake of calories was 2104.02 kcal per day. The findings of the study revealed that most of the help was delivered in kind (wheat or rice) rather than in cash, and the beneficiary households under the program were about 32% and 22% more vulnerable to normal and severe food insecurity, respectively, than those households that did not get any help from safety net programs. **Conclusion**: The study found that purchase was the primary source of food items in households during normal and lean seasons. Seasonal changes affected food intake, with rice dominating meals, indicating nutritional imbalance.

**Keywords**: DCI, Cropping pattern, crop production, nutrition, health.

# Enhancing Salinity Tolerance of Strawberry: Approach of Minimizing the Effect of Climate Change for Crop Production

**Group:** Inter-disciplinary group **Project ID:** SRG-224573

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## Abstract

One of the major constraints to crop production is salt stress which has an impact on growth, yield and quality of strawberry. A pot experiment was conducted in in the Horticulture farm of Sher-e-Bangla Agricultural University, Dhaka to enhance salinity tolerance of strawberry plants. The experiment consists of 8 treatments viz $T_0$= Control, $T_1$= Salinity (8 dS/m EC), $T_2$= Potassium silicate 1000 ppm + No salinity, $T_3$= Humic acid 150 ppm + No salinity, $T_4$= Potassium silicate 1000 ppm + Salinity (8 dS/m EC), $T_5$= Humic acid 150 ppm + Salinity (8 dS/m EC), $T_6$= Potassium silicate 1000 ppm +Humic acid 150 ppm + Salinity (8 dS/m EC). The experimental results exhibited that potassium silicate and humic acid treatment significantly affected growth, yield and quality parameters of strawberry. Vegetative growth and yield parameters of strawberry plants were significantly inhibited under salinity stress. The highest plant height, number of fruits per plant, fruit yield per plant, vitamin C content, TSS, membrane permeability, and antioxidant activity were found from $T_6$ treatment. On the other hand, the lowest results in all parameters studied were found in $T_1$ treatments. The use of salt stress mitigating agents resulted in increased growth, yield and quality of strawberry. Therefore, potassium silicate 1000 ppm in combination with 150 ppm humic acid can be used to enhance salt tolerance ability of strawberry under salt stress.

**Keywords**: Abiotic stress, potassium silicate, humic acid, growth, yield.

# A Study on the Prevalence of Single Nucleotide Polymorphism (SNP) in LYPLAL, MBOAT7 and NCAN Genes in Bangladeshi Population and their Association with Nonalcoholic Fatty Liver Disease (NAFLD)

**Group:** Inter-disciplinary group **Project ID:** SRG-224574

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## Abstract

Non-alcoholic fatty liver disease (NAFLD) is a progressive liver disease affecting 37-69% of all persistent liver diseases and is responsible for 2.82% of liver-associated causes in Bangladesh. Strong association between the disease precipitation and SNPs in several genes were reported. The objectives of this research work are to identify the presence of SNPs in the MBOAT7 (rs641738), NCAN (rs2228603) and LYPLAL1 (rs12137855) genes in the NAFLD patients and correlate them with the disease occurrence. After obtaining ethical approval, 60 confirmed NAFLD patients and 30 healthy volunteers were recruited from BSMMU, Dhaka. Serum AST, ALT, total cholesterol, HDL, LDL, TG, and creatinine levels of the participants were determined by biochemical assays. To investigate the presence of SNPs, genomic DNA was extracted, the target sequences encompassing the SNPs were amplified by PCR and genotyped by sequencing. Till now 20 NAFLD cases and 15 healthy subjects target DNA have been genotyped by sequencing to determine the presence of the SNP (rs12137855) in LYPLAL1 gene. Differences in genotype and allele frequencies of LYPLAL1 rs12137855 was not significant ($P > 0.05$) between the studied NAFLD and the control group. Comparative clinical and demographic parameter studies revealed that age, mean body weight, body mass index, serum AST level, cholesterol level, total triglyceride level and creatinine were significantly higher in NAFLD patients with the variant LYPLAL1 rs12137855 genotype than the control group. Conversely, the serum HDL level was higher in the control group when compared with the variant LYPLAL1 rs12137855 in NAFLD patients. Between these two groups, no discernible differences were identified in serum AST and LDL levels. After obtaining the complete set of gene sequencing data we would be able to conclude whether LYPLAL1 gene is associated with the risk of NAFLD development in Bangladeshi population. This study may have crucial investigational and clinical implications as by early identification of high-risk groups by genetic testing it is possible to manage this reversible disease in a more effective way and lessen the socio-economic burden on people.

**Keywords**: Non-alcoholic, fatty liver, polymorphism, LYPLAL1, sequencing.

# Molecular Characterization and Detection of Zoonotic Linkages of Methicillin-Resistant *Staphylococcus aureus* (MRSA) Recovered from Dairy Farms and Human Interfaces of Sylhet District

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## Abstract

**Background**: Methicillin Resistant *Staphylococcus aureus* (MRSA) has drawn attention towards public health concern due to emergence of different life threating infection both in human and animals. **Objectives**: The study was conducted to reveal the MRSA prevalence in the dairy farms-environment-human interfaces with the alignment of One Health aspects. **Methodology**: This study was conducted in Sylhet Sadar through collecting a total number of 624 samples (equal number of raw milk and cow nasal swab, human nasal swab and environmental samples) from each farm. Upon molecular detection, the heat-stable toxins were identified through PCR followed by AST, and phylogenetic analysis. **Findings**: The overall prevalence of MRSA is 12.5%. Highest prevalence of MRSA has been detected in human nasal swab as 15.4% while lowest prevalence found in both cow nasal swab and environmental sample as 11.5% following 13.1% in raw milk. Farm wise prevalence also varies from 6.8% to 21.4%. Presence of different enterotoxin gene *sea* (47.4%), *seb* (33.3%), *sed* (25%) also identified in this study where each sample is harboured by at least one enterotoxin gene within MRSA. Only from two farms, four different types of samples including raw milk, cow and human nasal swab along with environmental sample were found to be MRSA positive. All MRSA isolates revealed totally resistance to oxacillin (100%), ampicillin (100%) and penicillin (100%) while highest sensitivity found in case of vancomycin (94.3%). These MRSA isolates from different sources were also dtected to show various degree of resistance to other common antimicrobial drugs as Meropenem (93.3%), Aztreonam (85.1%) Cefoxitin (78.5%), Cefatazidime (71.6%), Cefotaxime (74.3%), Tetracycline (66.2%). **Conclusion**: The study refers to a great public health concern toward One Health issue due to the higher prevalence of MRSA, virulent genes and their resistance against most of the antibiotics.

**Keywords**: MRSA, Super-antigenic, zoonotic, dairy cows, environment, human.

# Prevalence of Multidrug Resistant (MDR) Bacteria in Burn Patients and Efficacy of Radiation Sterilized Human Amniotic Membrane Grafts Against the Isolated Bacteria

**Group:** Medical Science **Project ID:** SRG-225576

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## Abstract

**Background:** Burns are the most debilitating injuries worldwide, and multidrug-resistant (MDR) bacteria are a major cause of burn patient morbidity and mortality, especially in developing countries like Bangladesh. **Objective:** This study aimed to identify MDR isolates from burn ICU patients and investigate the efficiency of radiation-sterilized human amniotic membrane grafts against MDR bacteria. **Methods:** Sixty-seven bacteria were studied. The antimicrobial resistance was tested using the disk diffusion method as recommended by CLSI. The assessment of resistance ($bla_{CTX-M}$, $bla_{VIM-1}$, and $bla_{VIM-2}$) and biofilm-forming (*alg*D, *pel*F, *psl*D) genes were detected through PCR. The antimicrobial effectiveness of human amniotic membrane (HAM) grafts against MDR isolates at different radiation doses was analyzed. **Findings:** Biochemical characterization identified six bacterial genera (*Pseudomonas, Acinetobacter*, *Staphylococcus*, *Klebsiella, Proteus, and Neisseria)* and confirmed them by 16S rRNA gene sequencing. Among the isolates, we detected *Pseudomonas* spp. (73.1%) to be the most prevalent bacteria. Most of the isolates showed multidrug resistance (MDR). Isolates were 100% resistant to Chloramphenicol, Ampicillin, Clindamycin, Moxifloxacin, Cefoxitin, and Ciprofloxacin. Isolates resistant to Gentamycin (81.8%), Amoxicillin (90.9%), Azithromycin (72.7%), Amoxiclave (90.9%), Tazobactam-piperacillin (63.7%), Ceftriaxone (85.7%), Levofloxacin (90.9%), Imipenem (72.7%), Cefepime (81.8%), Meropenem (63.6%) were also detected. High sensitivity was found only in Colistin (81.9%) and Polymyxin B (100%). PCR amplification of sequenced isolates indicated all have the beta-lactamase $bla_{VIM-2}$ gene. Only BI-25.3 had $bla_{VIM-1}$. No $bla_{CTX-M}$gene was found among the bacteria. All isolates carried the biofilm-forming gene *alg*-D. The rest of the isolates had *pel*-F, except for BI-41.5 and BI-49.4. *psl*-D gene was found in all the isolates except BI-49.4. We used sterilized human amniotic membrane grafts (HAM) at 5, 10, 15, 20, and 25 KGy radiation to test their antibacterial effectiveness against sequenced MDR strains. Unfortunately, no inhibitory zone was detected. More research and radiation dose optimizations are needed. **Conclusion:** Limited information on the prevalence of biofilm producers and MDR bacteria in burn units is available. According to the study, strict infection control and antimicrobial stewardship will be crucial to combat patient infection.

**Keywords**: Burn patients, biofilm, *Pseudomonas*, 16S rRNA gene, beta-lactamase.

# Investigation of Potential Materials for Thermoluminescent Sensors as Medical and Retrospective Dosimetry

**Group:** Medical Science **Project ID:** SRG-225577

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## Abstract

Different types of techniques have been developed to assess the magnitude of ionizing radiation. Many minerals and compounds show thermoluminescence (TL) properties but few of them can satisfy the required properties to be used in TL radiation dosimeter. In this study, key dosimetric properties of synthesized composite materials differencing from conventional one has been investigated as a TL material owing to its added advantages. To explore the dosimetric potentials of $LiZnBO_3$ and $LiCaPO_4$ were synthesized using modified solid-state reaction (SSR) technique. The structural properties of the synthesized composites were investigated by X-ray diffraction (XRD) and Fourier Transform Infrared (FT-IR) measurements. The FT-IR data shows that the functional groups are responsible for the peak intensity of both LZB and $ABPO_4$. A clinical Linear Accelerator (LINAC) was used to irradiate the samples with both electron (6 MeV) and X-ray photon beam (6 MV), with a dose range of 0.5 Gy to 8 Gy for both beams. The irradiated samples were readout for TL signal using a Harshaw-3500 TL reader with a fixed heating rate of 10°C/s. TL glow peaks for both photon and electron energy were comparable. Both had a linear response for 0.5Gy to 6Gy dose. The geometric factor ($\mu_g$) is found to be within the range of 0.42-0.52, which indicates the suitability of applying Chen's general-order formula to calculate kinetic parameters. The activation energy ($E$) is found in the range of 1.13 to 3.14 eV for 4 deconvoluted peaks of 6MeV electron beam irradiation and 1.82 to 2.16 eV for 3 deconvoluted peaks of 6MV X-ray photon beam irradiation. The frequency factor ($s$) also increases while activation energy increases for both electron and X-ray photon beam. All the obtained results confirm the potentiality of synthesized phosphor materials to develop a viable radiation dosimeter.

**Keywords**: Thermoluminescence, dosimeter, radiation, kinetic parameters, composite materials.

# Real-time Radiation Monitoring and Estimation of Radiological Risk on Public Around Large Hospitals of Bangladesh

**Group:** Medical Science **Project ID:** SRG-225578

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## Abstract

Radiation provides enormous advantage to people in the hospitals during diagnosis & treatment to patients. 96% public exposure in the USA contributed from the medical uses of ionizing radiation during diagnostic & therapeutic purposes to patient among man-made sources as per NCRP Report No. 160. The objective of the study is to monitor the real-time radiation around the large hospitals in Bangladesh and estimation of radiation risk on public. Radiation monitoring was performed by portable digital radiation monitoring devices & the devices were placed at 1 meter above the ground and monitoring points (MP) were marked out using the Global Positioning System (GPS) device. The real-time radiation dose rates around BSMMU, DMCH, Evercare Hospital, Mitford Hospital, NICRH, Popular Hospital, ShSMCH, Square Hospital, RMCH, KMCH were measured from 0.049-0.288 μSv/h (mean: 0.145±0.0121 μSv/h), 0.012-0.355 μSv/h (mean: 0.135±0.0093 μSv/h), 0.056-0.226 μSv/h (mean: 0.148±0.008 μSv/h), 0.089-0.266 μSv/h (mean: 0.133±0.007 μSv/h), 0.049-0.252 μSv/h (mean: 0.153±0.0114 μSv/h), 0.049-0.259 μSv/h (mean: 0.144±0.0115 μSv/h), 0.025 - 0.294 $\mu Sv.h^{-1}$ (mean: 0.145±0.0101 $\mu Sv.h^{-1}$) and 0.094 - 0.288 $\mu Sv.h^{-1}$ (mean: 0.153±0.0087 $\mu Sv.h^{-1}$), 0.049-0.278 $\mu Sv.h^{-1}$ (mean: 0.137± 0.008 $\mu Sv.h^{-1}$), 0.049-0.304 $\mu Sv.h^{-1}$ (mean: 0.139 ± 0.009 $\mu Sv.h^{-1}$), respectively. The excess life-time cancer risk (ELCR) on public who lives nearby the hospital's boundary were estimated and ranged from $0.355\times10^{-3}$-$2.09\times10^{-3}$ (mean: $1.05\times10^{-3}$), $0.087\times10^{-3}$-$2.57\times10^{-3}$ (mean: $0.983\times10^{-3}$), $0.406\times10^{-3}$-$1.64\times10^{-3}$ (mean: $1.071\times10^{-3}$), $0.645\times10^{-3}$-$1.93\times10^{-3}$ (mean: $0.964\times10^{-3}$), $0.355\times10^{-3}$-$1.83\times10^{-3}$ (mean: $1.084\times10^{-3}$), $0.355\times10^{-3}$-$1.88\times10^{-3}$ (mean: $1.043\times10^{-3}$),$0.181\times10^{-3}$-$2.13\times10^{-3}$ (mean: $1.051\times10^{-3}$) & $0.681\times10^{-3}$-$2.09\times10^{-3}$ (mean: $1.112\times10^{-3}$), $0.355\times10^{-3}$-$2.01\times10^{-3}$ (mean: $0.994\times10^{-3}$), $0.355\times10^{-3}$ -$2.20\times10^{-3}$ (mean: $1.005\times10^{-3}$), respectively. The ELCR on public around the large hospitals are higher than that of the worldwide average value ($0.29\times10^{-3}$). It is observed from the study that in every thousand people, one of them is at the risk of cancer caused by the scattered radiation exposure from the hospital without any knowledge of being exposed to ionizing radiation.

**Keywords**: Radiation, hospital, public, effective dose, ELCR.

# Synthesis of Silver Nanoparticles by using *Momordica charantia* Extracts and their Antibacterial Application Viability

**Group:** Medical Science **Project ID:** SRG-225579

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## Abstract

The objective of the present study is to establish a praiseworthy route for the low-cost growth of AgNPs by utilizing medicinal Bio-molecules present in the extracts of *Momordica charantia* highly available in Bangladesh. Besides, the study aims to evaluate the application feasibility of the synthesized AgNPs against some multidrug resistant strains' health harmful gram-positive and gram-negative bacteria. Silver nanoparticles (AgNPs) were created using a recently established green synthesis approach in response to the need for alternative antibiotic sources. Their antibacterial effectiveness against various pathogenic bacteria was then assessed. Biomolecules containing extracts of *Momordica charantia* were employed as the reducing agent for the synthesis of Silver Nanoparticles (AgNPs). The characterization of the synthesized Ag NPs was carried out using various techniques such as UV-visible (UV-Vis) spectroscopy, X-ray diffraction (XRD), energy dispersive X-ray (EDX) spectroscopy, transmission electron microscopy (TEM), thermogravimetry (TG), and vibrating sample magnetometer (VSM), and Fourier transform infrared (FT-IR) spectroscopy. We have successfully synthesized biomolecule-capped ferromagnetic AgNPs, with an average crystallite size of 18 nm, by employing *Momordica charantia* extract as a capping and reducing agent together with $AgNO_3$ solution as a precursor. The flavonoids and terpenoids present in the extract act as both reducing and capping agent. The antibacterial characteristics of the synthesized silver nanoparticles were evaluated using a range of Gram-positive and Gram-negative bacterial strains, including Escherichia coli (ATCC 25922), Bacillus cereus (ATCC 14579), and Staphylococcus aureus (ATCC 12228). 10, 15, and 20 □l suspensions of AgNPs exposed to each condition demonstrated notable antibacterial activity and followed a concentration dependency. These promising results suggest that the green produced biomolecules encased Ag NPs generated by *Momordica charantia* extract may have applications as an antibiotic against human infections.

**Keywords**: Silver nanoparticles, electron microscopy, UV-visible, gram-positive, bacteria.

# Antinutritional Antioxidant Content and Glycemic Index Value of Rice Varieties Cultivated in Haor Areas of Kishoregonj District

**Group:** Medical Science **Project ID:** SRG-225580

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## Abstract

Both in vitro and in vivo experiments were conducted in the Food Chemistry and Nutrition Laboratory of Department of Biochemistry and Molecular Biology, Bangladesh Agricultural University, from August, 2022 to June 2023 to select the best indigenous rice cultivar based on the chemical properties and Glycemic index value. The samples viz. Katari, Kalizira, Rata Boro, Lakhaiya, Topa Boro, Pijam and Zira were collected directly from farmers. Proximate parameters viz. moisture (%), ash (%), fiber (%), fat (%), protein (%) were estimated to quantify carbohydrate contents, which is necessary to determine Glycemic index value in in vivo. It was observed that Katari contained the highest carbohydrate (76.54 %) and Topa Boro was the lowest (67.14%) and Zira was the moderate (71.26%). Based on the popularity, Katari and Zira were selected to observe the glycemic index value in ten healthy individuals. From the in vivo experiment it was evident that Katari showed the lower glycemic index value (47.80) compared to Ziar (55.34). Antioxidant in terms of Total Phenolic Content (TPC) (µg GAE/mg) was observed for all the collected varieties and Topa Boro contained the highest amount (0.06 µg GAE/mg) and Katari showed the lowest (0.014 µg GAE/mg) TPC. On the other hand, for DPPH scavenging activities in terms of antioxidant (%) Topa Boro performed the highest (13.81%) and Kalizira was the lowest (4.75%), where Katari is the second scorer (9.21%). So, from the above result it is concluded that Katari rice may be considered as low glycemic index and high nutritious rice variety.

**Keywords**: DPPH Activity, TPC, GI value, indigenous rice and wet land areas.

# Detection of Foodborne Parasites in Street Vended Foods and Associated Risk Factors in Mymensingh City: An Insidious Threat to Food Safety and Public Health

**Group:** Medical Science **Project ID:** SRG-225581

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## Abstract

Street-vended foods are major sources of gastro-intestinal illnesses in Bangladesh. Microbial assessment of street foods mainly focused on bacteria, but detection of parasitic contamination is essential. Therefore, this study was designed to detect the prevalence of parasitic contamination in street foods in Mymensingh city and to identify the associated risk factors. Some commonly consumed street foods, e.g. snacks, fruit juices and spicy sliced fruits were collected from local markets to investigate the parasitic contamination. Parasitological examinations were done in the laboratory and a questionnaire was prepared to record the factors associated and then data were analyzed to identify the risk factors. A total of 180 samples of (4 markets X 3 replicates X 15 types) were examined, of which 68.3% (123/180) were contaminated with at least one or more different species of parasites. Thirteen (13) types of parasites (5 types of protozoa and 8 types of helminths) were identified in which protozoa were more prevalent (72%) than helminth infection (28%). Among the parasites, *Giardia sp* (72.8%,) were the most prevalent followed by *Entamoeba histolytica* (61.3%) *Balantidium coli* (47.2%), *Ascaris sp* (32.8%), strongyles (30.7%), *Enterobius vermicularis* (19.8%), *Blastocystis sp.* (18.7%,) *Strongyloides stercoralis* (12.4%), *Schistosoma indicum (*11.7%), *Spirometra sp* (10.6%), *Taenia sp* (8.3%)*, Fasciolopsis buski* (6.3%) and *Eimeria sp* (5.9%). Socioeconomic and demographic status of vendors and their food handling practices were investigated. Most of the vendors (51.7%) were belonging to the middle age group (31-50yr) and most of them (53.3%) have no formal education to read and write, only 11.7% taking anthelmintic. Most (85%) of the vendors were married and about 45 % of the vendors earn 10,000-20,000 taka per month. Most of the vendors (63.3%) use tap water for preparing foods, washing utensils and hands. About 76.7% of vendors do not cover their foods. Contamination of foods from street vendors with pathogenic parasites would increase the risk of disease to the population that consumes or works with these products.

**Keywords**: Street-vended foods, food-borne parasite, Mymensingh.

# Assessment of Vitamin B12 Folate and Homocysteine Levels Among Type 2 Diabetes Mellitus Patients on Long-Term Metformin

**Group:** Medical Science **Project ID:** SRG-225582

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## Abstract

**Background:** Metformin is the most frequently prescribed oral hypoglycemic agent in the treatment of Type 2 Diabetes Mellitus (T2DM). Long term metformin treatment causes reduced vitamin B12 and folate absorption in the gastrointestinal tract, essential for the remethylation of homocysteine (Hcy), and may lead to hyperhomocysteinemia associated with macrovascular complications in T2DM. **Objective**: To evaluate the Vitamin B12, folate, and homocysteine status in patients with type 2 diabetes mellitus on long term metformin. **Methodology:** According to inclusion criteria, 50 patients with T2DM on treatment with metformin for more than 6 months (Group-1) and 50 T2DM on treatment other than metformin (Group-2) were selected from OPD of BIRDEM hospital. With all aseptic precautions, 5 ml venous blood was collected from each study subject for estimation of *S. vitamin* B12, folate, and homocysteine. Collected data was checked, edited, and processed with the help of SPSS (24). **Results:** No statistical differences in the age, sex, BMI, or duration of diabetes were observed between the two groups. Duration of metformin therapy (years) in Group-1 was 5.73±2.11and the mean dose of metformin (mg/day) was 1356.00±359. Among Group-2, 21(42%) were on oral drugs other than metformin and 29 (48%) were on treatment with insulin. The biochemical analysis revealed, a significantly decreased level of vitamin B12 (233.46± 68.33 Vs 312.58± 85.05, P< 0.001) and increased homocysteine levels (µmol/L) (7.98±2.19 Vs 6.14±1.77, P< 0.001) in Group 1 than Group 2, whereas no statistical differences in the mean of S.Folate between the groups were found. It was found that S. homocysteine levels were significantly negatively related to vitamin B12 levels and significantly positively correlated with the duration of diabetes ($p$<0.001). Moreover, S.Vitamin B12 level was found negatively correlated with doses and durations of metformin use, but these were not statistically significant. **Conclusion:** The prevalence of vitamin B12 deficiency and hyperhocysteinemia is higher in diabetic patients with long-term metformin. So, screening of Vitamin B12, folate and homocysteine in diabetic patients with long-term metformin is necessary to reduce complications related to the disease process.

**Keywords**: Vitamin B12, folate, homocysteine, metformin, diabetes.

# Association of Genetic and Epigenetic Variation in FK506 Binding Protein 5 (FKBP5) in Patients with Type 2 Diabetes Mellitus

**Group:** Medical Science **Project ID:** SRG-225583

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## Abstract

**Background:** Type 2 diabetes arises from environmental factors and genetic predisposition. Similarities between metabolic syndrome and hypercortisolism hint at the involvement of genes like FKBP5, which influence glucocorticoid sensitivity and modulate steroid action on target genes through the GC receptor complex. **Objectives:** We investigated the association of single nucleotide polymorphism (SNP) of FK506- binding protein 51(FKBP51) of rs1360780 with T2DM and heathy adults. **Methods:** A case-control study conducted on 50 T2DM patients recruited from a diabetic center of a rural community, Sirajdikhan, a subdistrict of Munshiganj district. At the same time, 50 non-diabetic healthy controls age- and sex-matched with the patients were also recruited. All subjects underwent full history taking; thorough clinical examination; routine laboratory investigations and determination of FKBP51 gene polymorphism by conventional PCR. **Results:** The minor T allele of the rs1360780(C/T) SNP was associated with high risk of development of T2DM with an OR of 1.35 (95% CI: 0.68–2.6) and the heterozygous genotype (CT) with an OR 1.16 (95% CI: 0.49–2.7); however, they were statistically insignificant (p value >0.05). **Conclusion:** Our study did not confirm the presence of significant association between the FKBP51 rs1360780(C/T) polymorphism and T2DM. Further studies with higher sample size are needed to clarify the association.

**Keywords**: FKBP51, Type 2 diabetes, Bangladesh

# Isolation and Characterization of Potent Lytic Bacteriophages Infecting Multidrug Resistant Klebsiella pneumoniae Isolated from Patient with Neonatal Sepsis

**Group:** Medical Science **Project ID:** SRG-225584

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## Abstract

**Background**: *Klebsiella pneumoniae* **(**Kpn) is an opportunistic pathogen, and among a few difficult-to-treat pathogens, it is a leading cause of morbidity and mortality associated with multidrug-resistant infection worldwide. This study aims to isolate and characterize potent lytic bacteriophages capable of targeting ESBL-producing isolates of Kpn. **Methods**: Phenotypic and genotypic characterization of Kpn isolates was done by disk-diffusion and resistance-gene-specific PCR methods. Bacterial host-specific bacteriophages were screened and collected by Double-layer agar assay (DLA). Bacteriophages were characterized based on host range, temperature (4°C - 80°C), pH (1-14), one-step growth curve, optimal multiplicity of infection, and in vitro lytic ability and whole genome analysis. **Results:** Among 31 clinical strains, the presence of NDM-1(n=25), $bla_{TEM}$ (n=19), $bla_{CTX-M}$ (n=19), $bla_{SHV}$ (n=18) and $bla_{KPC}$ (n=6) were identified. Additionally, three lytic bacteriophages, Kpn_BP_3, Kpn_BP_7, and Kpn_BP_9, were isolated and characterized based on their competency to kill more than one clinical strain of kpn. All three phages can steadily survive (≈10^9PEU/ml and ≈10^8PFU/ml) until the temperature is 40°C and without any significant reduction from pH 5 to 9. The optimal MOI was 0.1 and 0.01, a short latent time of 10 min, 30 min, and 25 min with an average burst size of 85 PFU/cell, 73.074 PFU/cell, and 12 PFU/cell. Further, whole-genome analysis of two phages reported that Kpn_BP_7 and Kpn_BP_9 belong to class Caudoviricetes. Kpn_BP_7 was 170558 bp long, a member of the *Marfavirus* genus and *Marfavirus F48* species, and Kpn_BP_9 phage was 60450 bp long, reported as unclassified. Both phages did not harbor any lysogenic, toxin, or antimicrobial resistance genes. **Conclusion**: The isolated and established features of bacteriophages in this study can be a promising alternative solution to tackle the $3^{rd}/4^{th}$ generation of cephalosporin-resistant Kpn infection.

**Keywords**: Agar assay, multiplicity infection, one-step growth, caudoviricetes, genome.

# Value of Serum MACC-1 as a New Diagnostic Biomarker in Breast Cancer Patients

**Group:** Medical Science **Project ID:** SRG-225585

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## Abstract

Breast cancer is the leading cause of cancer-related death among females. The current study is one of the initial studies to evaluate the diagnostic value of novel serum MACC-1 markers in breast cancer patients. Various other serum biomarkers have been used for the diagnosis of breast cancer but this marker proved a good sensitivity and/or specificity. This cross-sectional study included 32 breast cancer patients and 32 normal healthy controls. Study subjects demographic, pathologic, and clinical information were recorded. Random blood samples were collected from the antecubital vein after aseptic precaution with 0.5% chlorhexidine gluconate. About 2.0 ml of venous blood was collected into a red screw-capped tube. Serum MACC-1 was assessed by ELISA reader by using the commercially available kit in the Department of Laboratory Medicine, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh. A double-antibody sandwich ELISA was conducted to detect serum MACC-1 using an ARCHITECT system according to the manufacturer's protocol. In this study, serum MACC-1 levels were significantly elevated ($p < 0.0001$) in breast cancer patients compared to the control group. The Mean serum MACC1 was elevated in BC patients (55.21 ± 14.75 pg/mL) compared with healthy controls (38.19 ± 11.42 pg/mL) ($P < 0.0001$). Also, the ROC analysis showed an AUC of 0.98, signifying a good discriminatory ability of serum MACC-1 marker for breast cancer Patients. At the cut-off value of optimal cut-off value (38.35 pg/ml, the sensitivity and the specificity of serum MACC-1 were 96.7% and 92.5%, respectively. The median age was 46.3 years and 40.2 ± 8.4 years in the control group ($p = 0.0001$). Therefore, this study showed that serum MACC-1 can be a potential biomarker for the diagnosis of breast cancer.

**Keywords**: Metastasis, colon cancer, breast cancer, diagnostic biomarker, ELISA, ROC.

# Inclusion of Disabled Individuals in Digital Services

**Group:** Medical Science **Project ID:** SRG-225587

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## Abstract

**Background** More than one billion people across the globe experience some form of disability. People with disabilities (PWDs) have to lead their lives with many challenges throughout their lives. **Objectives** The general objective of the study is to assess the current situation of people with disabilities (PWDs) in accessing digital health services and identify opportunities for creating inclusive digital health services for all. **Methods** The study utilized a concurrent mixed-method design, collecting both qualitative and quantitative data. The quantitative study involved a sample of 90 PWDs. **Findings** The survey on gender distribution reveals that 64.4% of respondents are male, while 35.6% are female. The surveyed population, reporting moderate disability levels across six domains, faced the most difficulty in life activities and the least in self-care. Regarding digital health services in Bangladesh for persons with disabilities (PWDs), 78.9% have basic digital skills, but only 21.1% possess advanced skills for health apps and telemedicine. Community perception shows 45.6% faced stigma in accessing digital health due to limited awareness. Barriers include 62.2% facing inaccessible digital platforms, 48.9% hindered by limited assistive technologies, and 41.1% citing inadequate digital literacy and training opportunities. The qualitative findings of the study on access to digital health services by persons with disabilities (PWDs) in Bangladesh provided valuable insights into their experiences and perceptions. Challenges such as the lack of accessible digital platforms and assistive technologies, stigma and discrimination, and inadequate policies were identified. However, there were opportunities for capacity enhancement and collaboration with various organizations to improve digital inclusion. **Conclusion** This study provides valuable insights into the challenges and opportunities for digital health inclusion for PWDs in Bangladesh. Based on the findings, the study recommends the development of inclusive digital platforms, specialized training for healthcare professionals, and active involvement of PWDs in advocacy and awareness campaigns.

**Keywords**: Disability, digital health care, health service, service barrier, Bangladesh.

# Lived Experience of People with Spinal Cord Injury in Bangladesh: A Cross-Sectional Study

**Group:** Medical Science **Project ID:** SRG-225588

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## Abstract

**Background** Spinal cord injury (SCI) is a life-threatening disorder that significantly impacts morbidity and mortality rates. This life-altering condition affects all age groups and gender, but predominantly affects young adults. **Objectives** This study aimed to investigate the community lived experience of individuals with SCI in Bangladesh. **Methodology** The research was conducted as a cross-sectional study in three divisions of Bangladesh, with a total of 90 participants. **Findings** The findings revealed that the majority of participants were male (64.4%) and belonged to the age group of 41-59 years (43.3%). Most of the respondents were married (75.6%), and the majority had received institutional education (77.8%). In terms of clinical diagnosis, paraplegia was the more common condition (63.3%) compared to tetraplegia (36.7%). The leading cause of SCI was trauma-related (66.67%), with road traffic accidents being the most frequent cause (58.33%), followed by falls from trees and construction work (33.33%). Among disease-related causes, degenerative factors accounted for 50% of cases. The study also assessed the severity of secondary conditions experienced by participants. Sleep problems were prevalent, with 42.2% reporting frequent sleep issues and 11.1% facing extreme problems. Bowel dysfunction affected 16.7% often and 15.6% severely. Urinary tract infections were moderate for 17.8% and severe for 7.8%. Sexual problems were notable, with 25.6% experiencing moderate issues and 15.6% having extreme problems. Muscle spasms and spasticity were reported by 27.8% often and 12.2% severely. Pressure sores and decubitus were observed in 6.7% often and 4.4% severely. **Conclusion** This research highlights the challenges they face, and the prevalence of various secondary conditions, and emphasizes the significance of collecting data to enhance the well-being and quality of life of people with SCI. The insights obtained from this study can aid policymakers, healthcare providers, and organizations in formulating better strategies to support and assist individuals with SCI.

**Keywords**: Spinal cord injuries, Bangladesh, experiences, community-based, challenges.

# Non-communicable Diseases (NCDs) Risk Factors and Access to NCDs-related Health Care Among the Women in the Coastal Region of Bangladesh: A Mixed Method Study

**Group:** Medical Science **Project ID:** SRG-225590

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## Abstract

**Background:** Non-communicable diseases (NCDs) are responsible for around 80% of mortality in low- and middle-income nations. **Objectives:** The study objectives were to determine NCD-related risk factors and understand access to NCD-related health care among women in the coastal region of Bangladesh. **Methodology:** It was a mixed-methods study done in the Khulna division among the women of the selected coastal areas. A qualitative study was conducted followed by the quantitative part. A total of 430 participants data were collected. Data from both qualitative and quantitative phases was triangulated. **Findings:** The study participants were in the age group of 40–49 years (36.29%), and 72.09% of them were married (72.09%). Regarding health conditions, 30.23% of participants reported high blood pressure, while 16.98% and 10.46% reported arthritis and diabetes, respectively. Smokeless tobacco use was 77.21%, whereas only 3.49% were current smokers. Abdominal obesity was observed in 56.52% of the participants. 48.37% of the respondents had a body mass index (BMI) within the normal range, while 33.25% were overweight. In terms of dietary habits, vegetables and fruit consumption are 59% and 30%, respectively. 11% of participants added salt to their meals. Healthcare narratives revealed low healthcare utilization, with frustrations over government hospitals treating symptoms instead of causes of NCDs, leading to mistrust in formal healthcare services. **Conclusion:** This study is expected to provide a comprehensive understanding of NCD-related risk factors and access to healthcare among women in the coastal region of Bangladesh.

**Keywords**: NCD, Women, costal region, Bangladesh.

# Evaluation of Preoperative Functional Magnetic Resonance Imaging (fMRI) of Hearing-Impaired Children before Cochlear Implantation: A Longitudinal Study

**Group:** Medical Science **Project ID:** SRG-225591

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## Abstract

**Background**: Around 760,000 Bangladeshi children face deafness, which affects their readiness for school due to inadequate language skills. Intervening early could help improve this predicament. **Objective**: To examine the application of functional magnetic resonance imaging (fMRI) for assessing auditory function in Bangladeshi pediatric cochlear implant candidates with residual hearing under sedation. **Methodology**: This longitudinal study enrolled 14 pediatric participants, both males and females, with residual hearing. A pre-tested structured questionnaire was used to gather socio-demographic characteristics, clinical data, fMRI, and Puretone audiometry reports during pre- and post-cochlear implantation surgery. Standard statistical analysis, including Pearson's correlation coefficient and linear regression, was conducted. **Findings**: Among the 14 participants, approximately 64% are male. The participants belong to the age group of 2 to 7 years (14 months to 87 months). The mean age of the participants is 52.57 months, with an SD (standard deviation) of 15.34. Notably, 42% of the participants had a history of prematurity at birth. And four (28.57%) participants needed NICU care after birth. Among participants, 12 were diagnosed with bilateral severe-profound sensorineural hearing loss, while 2 had profound sensorineural hearing loss in one ear or asymmetric hearing loss. Only one participant has a history of deafness in a close family member. fMRI effectively detected a significant level of A1 cortex activation in most of the participants before cochlear implantation surgery. A strong positive and significant correlation was found between post-cochlear hearing improvement and fMRI findings. Post-cochlear hearing improvement and fMRI findings were significantly associated with a linear regression coefficient, $R = 0.798$. And the model remained significant at $p<0.05$, $<001$. **Conclusion**: Functional MRI may serve as a useful tool for evaluating residual function in the primary auditory cortex (A1) of hearing-impaired Pediatric patients and potentially aiding in screening for cochlear implantation surgery eligibility.

**Keywords**: Functional MRI, pediatric cochlear implantation, auditory mapping, auditory cortex, children.

# Epidemiological Persistent Study of Ocular Lesion Associated with Dental Infection

**Group:** Medical Science **Project ID:** SRG-225592

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## Abstract

The association between dental infections and ocular lesions has been a subject of ongoing research and debate. While some studies have found a correlation between the two, others have not found a definitive link. This suggests that the relationship, if it exists, may be complex and influenced by a variety of factors. One possible mechanism by which dental infections could contribute to ocular lesions is through the spread of bacteria or other pathogens from the mouth to the eyes. This could occur through direct contact, such as rubbing the eyes after touching the teeth or gums, or through the bloodstream. Another possibility is that dental infections could lead to inflammation or other changes in the immune system that could make the eyes more susceptible to infection or disease. Epidemiological Studies Several epidemiological studies have investigated the link between dental infections and ocular lesions. These studies have generally been observational, meaning that they have not been able to prove cause and effect. However, they have provided some evidence that the two conditions may be associated. Limitations of Existing Research It is important to note that the existing research on the association between dental infections and ocular lesions is limited in several ways. Many of the studies have been small and have not controlled for all potential confounding factors, such as smoking and overall health status. Additionally, the studies have not been able to prove that dental infections cause ocular lesions, only that there is a correlation between the two. The present study dryness of eye was 89.9%, conjunctivitis was 88.1%, uveitis was 90.1%, more infection found in uveitis. Oral lesions were found oral ulcer 90.1%, Gingivitis 91.1%, periodontitis 85.1%, dental carries 91% In case of dental infection gingivitis are more. More research is needed to confirm these findings and to identify the specific mechanisms involved.

**Keywords**: Uveitis, conjunctivitis, gingivitis, periodontitis, dental carries.

# Diseases Pattern and Associated Factors Among the Rural Population in Bangladesh

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## Abstract

**Background**: Impoverishment leads to more illness due to poor living conditions and nutrition, causing financial hardships and long-term poverty, highlighting the importance of community-based health studies. **Objective**: To assess disease patterns and risk factors among rural populations and establish a Field Research & Practice Center for BUHS and Green Life Medical College. **Methodology**: This cross-sectional study in Chandina Upazila, Cumilla District, Bangladesh, involved 2609 participants from six villages. It utilized a mixed-method approach, combining quantitative and qualitative data collected through household surveys and focus group discussions. A semi-structured questionnaire recorded sociodemographic and clinical data, and standard statistical analysis was conducted using SPSS v.25. **Findings**: The survey included 592 households and 2609 individuals. The average household size was 5.9. Of the total population, 46.8% were females, and 53.2% were males, with diverse age groups represented. Marital status varied, with 54% married. Most villagers (81.7%) had formal education. The religious composition was 88.4% Muslim and 11.6% Hindu. Occupations included homemakers (35%), students (34%), and farmers (8.5%). Respondents cited around 50 different diseases during the interview, with varying prevalence rates: hypertension (5.7%), cardiovascular diseases (CVD, 5.4%), diabetes (4%), asthma (3.2%), and other conditions (below 2%). Thyroid disorders were most common among adults, while congenital heart disease and asthma were observed in children under 5. Skin and eye diseases affected 7.5% and 4.4% of villagers, respectively. Fewer suffered from pneumonia, diarrhea, and other communicable diseases. About half the population experienced musculoskeletal disorders, including low back pain (42.7%), and joint pain (35%), while injuries were rare. In the 19-59 age group, fever is more common. Literate and employed individuals experienced more illnesses than their counterparts, and those consuming pumped water seem to suffer more. People using hanging latrines appeared to have better health. Age and gender disparities were evident, with higher disease prevalence among older individuals and females. **Conclusion**: This research revealed a connection between disease patterns and a range of socio-demographic and economic factors, underscoring the importance of exploring these relationships further and proper management.

**Keywords**: Community-based health; field research; disease distribution; morbidity pattern.

# Modulatory Effect of *Rhus chinensis* and *Cinnamomum tamala* on GLUT4 Gene Expression and Screening of Antioxidant Activity in nSTZ Induced Diabetic Rats

**Group:** Medical Science **Project ID:** SRG-225594

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## Abstract

**Background:** *R chinensis* fruits and *C tamala* bark is widely used in traditional medicine for the treatment of various ailments including diabetes. **Objectives:** To evaluate antioxidant and antidiabetic impact via GLUT-4 gene expression, using methanolic extracts of *Rhus chinensis* and *Cinnamomum tamala* on nSTZ-induced type 2 diabetic rats. **Methodology:** Standard methods were used for phytochemical analysis and antioxidant assessment. Type 2 diabetes model was induced with Streptozotocin. The 28 days study involved 6 normal and 24 diabetic rats divided into five groups (n=6). Blood samples and tissues were collected for biochemical as well as molecular analysis. **Findings:** *R chinensis* fruits *& C tamala* bark showed remarkable contents of alkaloids, flavonoids, tannins, saponins compounds and significant antioxidant activity (IC50: 204.63, 206.72g/ml, respectively), whereas the IC50 of ascorbic acid was 41.44 g/ml. At the end of the 28 days study period the results showed that, *R chinensis and C tamala* metahnolic extracts (90%) significantly ($p<0.001$) reduced serum blood glucose level compared to the base line value. Moreover serum insulin level was increased significantly ($p<0.006$ & $p< 0.008$) when compared to the base line values by the both extracts treated groups. Molecular gene expression of GLUT-4 (Glucose transporter-4) - mRNA was also increased in adipose and muscle tissues more than two folds in *C tamala* treated diabetic rats compared to untreated diabetic model rats and *R chinenesis* treated rats. However, *R chinenesis* treated group increased GLUT-4 gene expression levels in adipose and muscle tissues only by 0.57% and 0.62% respectively whereas untreated diabetic model rats increased the same by 0.60% and 0.92%, respectively. **Conclusion:** The extracts of *Rhus chinensis* and *Cinnamomum tamala* effectively improved glycemic status in diabetic rats due to their antioxidants and phytochemicals, as well as insulin secretion and GLUT-4 gene expression.

**Keywords**: Antioxidant, glucose transporter, T2DM, insulin, natural products.

# Chemistry and Biology of *Glinus oppositifolius* and Some Locally Available Poly Herbal Formulations in Bangladesh

**Group:** Medical Science **Project ID:** SRG-225595

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## Abstract

**Background:** Diabetes is a major public health problem globally. There is a crucial need for the discovery and development of novel antidiabtic drugs. **Objectives:** To determine safety and efficacy of *Glinus oppositifolius (Go)* and some antidiabetic herbal formulations on nSTZ induced type 2 diabetic model rats. **Methodology:** Diabetes was induced by injecting streptozotocin. For 28$^{th}$ days experiment 72 rats were considered and divided into 12 groups (n=6), Group (i) NWC, (ii) DWC, (iii) gliclazide and group (iv to ix) treated with *Go,* and poly herbal formulations (PHF). Biological samples were collected for determine the different biochemical parameters. **Findings:** Results revealed that subsequent treatment with single plant (*G. oppositifolius*) and antidiabetic poly herbal formulations (Db, Ms, Cg, Dx & Ss) significantly ($p<0.001$) decreased fasting serum glucose level (FSG). Beneficial effect was observed in atherogenic lipids (TG & LDL-Cholesterol) and HDL-Cholesterol level. Significant ($p<0.001$) reduction in triglycerides level was found in *G. oppositifolius* and Dx groups. Total cholesterol level showed 7% reduction in *G. oppositifolius* and 13% reduction in Cg treated group. LDL-cholesterol level was non-significantly decreased (23%, 33% & 5% respectively) in Ms, Cg, Dx treated group. However, all of the antidiabetic polyherbal formulations (Db , Ms , Cg, Dx and Ss) exhibited 10%, 9%, 9%, 8% and 10% non-significant increase respectively in HDL level when compared to the base line value. Moreover, glycogen level was also increased significantly ($p<0.001$) in *G. oppositifolius* and Dx treated group. Serum insulin level was increased in Ms (10%), Cg (86%) and Dx (95%), treated groups respectively. Most of the poly herbal formulations contained an enormous source of phenolic compounds in acidic ($pH<7$) condition. **Conclusion:** The present study concludes that the *G. oppositifolius* extract and PHF effectively reduce FSG level and increased of hepatic glycogen content of T2DM rats with beneficial effect on atherogenic lipids.

**Keywords**: Type 2, diabetes mellitus, antidiabetic plant, poly herbal formulations, phenolic compounds, natural Products.

# Biomedical Waste Management Practices and Health Problems among the Healthcare Personnel of Tertiary Level Hospitals in Dhaka City

**Group:** Medical Science **Project ID:** SRG-225596

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## Abstract

**Background:** Biomedical waste has become worldwide emerging issue. There are many adverse and harmful effects of biomedical waste on the human beings including environment. **Aim of the study:** To ascertain the bio medical waste management practice and health problems among the health care personnel of selected tertiary level hospital in Dhaka city. **Methodology:** A cross sectional study was conducted in a selected tertiary level hospital in Dhaka city. A total of 271 health care personnel including 169 nurses, 12 medical technologists, 50 ward boy and 40 cleaners were selected for interviewing. **Findings:** The total respondents were including 61.6% female and 38.4% male. Most 62.4% of the respondents were nurses, followed by 4.3% medical technologists, 18.5% ward boys and 14.8% were cleaners respectively. Among the respondents, 53.5% had 5 years of working experience followed by 14.8% had 6-10 years and 7.7% had >20 years. Experience regarding the personal protective equipment during work in the hospital 91.5% showed positive attitude. It was found, 80.4% followed appropriate labeling for infectious wastes. In order to ascertain the status of knowledge Chi-square ($\chi 2$) analysis revealed a statistically significant association between knowledge on identification of the correct color code containers with respondents for disposal of biomedical waste ($P < 0.05$). Practice towards recap the used needles before disposing revealed that75.6% respondents had followed properly. It was also found that only 35.1% were vaccinated against Hepatitis B virus. To find out the health problems 6.3% were positive for Hepatitis-B and 4.8% for Hepatitis-C virus. Regarding attending regular training program on BMW management, it was found only 31.4% of nurses and 7.5% cleaners were received training on BMW. **Conclusion:** This study concludes that training of health workers regarding hospital waste management is an essential public health measure to reduce health hazards due to biomedical waste.

**Keywords**: Biomedical waste, management, attitude, practice, health problem.

# Antibiotic Resistance Patterns of *Klebsiella pneumoniae* Causing Infections in the Geriatric Population in Chittagong

**Group:** Medical Science **Project ID:** SRG-225597

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## Abstract

**Background:** *Klebsiella pneumoniae* (KPN) is a gram-negative bacterium linked to urinary tract infections (UTIs), pneumonia, septicemia, wound and soft-tissue infections. **Objectives:** In this study, the frequency of antibiotic resistance was investigated among KPN infected geriatric patients of Chattogram. Furthermore, their genomic diversity was checked. **Method:** Clinical specimens from geriatric patients were obtained from Chittagong Medical College Hospital, Bangladesh. AST, DNA extraction and PCR procedure were carried out in order to identify the prevalence and presence of MDR gene, TEM-1. Finally, whole genome sequencing was performed. ResFinder and Rstudio were used to analyze genomic data. **Results:** KPN isolates were resistant to cefuroxime, cefixime, and cefepime while being considerably susceptible to colistin, nitrofurantoin. MDR KPN isolates were more common than DDR or SDR isolates. MDR KPN was mostly found in tracheal aspirate and blood. TEM-1 was found in 28.2% of the strains. Whole genome analysis showed that the majority of the isolates had ESBL genes (CTX-M-15, multiple TEM and SHV) and carbapenemase genes (KPC, NDM, OXA). Moreover, it was found that maximum KPN genome was comprised of sequence type 11 (ST11) which caused an outbreak in China. **Conclusion:** *Klebsiella pneumoniae* (KPN) in geriatric population is extremely resistant to commonly used antibiotics. More than 40% isolates showed resistance. Proper policies should be planned to prevent AMR among geriatric population.

**Keywords**: Klebsiella, geriatric, antibiotic resistance, Chattogram, genome.

# Molecular Characterization of Multidrug-resistant Pseudomonas Aeruginosa from the Patients of Dhaka Medical College Hospital, Dhaka

**Group:** Medical Science **Project ID:** SRG-225598

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## Abstract

**Background**: *Pseudomonas aeruginosa* is a public threat due to its multidrug resistance (MDR), extensive drug resistance (XDR), and rapid development of intrinsic resistance against most antibiotics. **Objectives**: The objective of this study was to isolate and identify MDR *P. aeruginosa* antimicrobial resistance gene. **Methodology:** In this experimental study, samples were collected aseptically from patients admitted to DMCH (September 2022 to January 2023). *P. aeruginosa* was isolated following standard procedures. AST was done and interpreted according to the CLSI guideline, 2022. DNA extraction was done for further molecular studies. PCR was conducted to detect antibiotic-resistance genes. 79.17% were positive for ESBL encoding genes (blaPER-1, blaSHV, blaTEM, blaOXA-10) and 50% were positive for MBL encoding genes (blaNDM-1, blaVIM). **Findings**: A total of 355 samples- wound swab (28.17%), pus (22.82%), urine (29.58%), sputum (10.70%), endotracheal aspirate (ETA) (2.53%), and blood (6.20%) were collected aseptically from patients admitted to different wards of DMCH. Among them, 92 (25.92%) yielded growth of *P. aeruginosa.* They were prevalent in wound swab samples of burn and other surgical site infections (53.26%), followed by 15.22% *P. aeruginosa* which were found in pus samples. Other *P. aeruginosa* were yielded from urine (9.78%), sputum (8.70%), blood (7.61%), and ETA (5.44%) samples from severe burn and ICU patients. Out of the 92 *P. aeruginosa* 61 (66.30%) were resistant to the anti-pseudomonal cephalosporin- ceftazidime, 58 (63.04%) were resistant to to piperacillin-tazobactam combination, 27 (29. 35%) were resistant to imipenem and 6 (6.5%) were resistant to colistin. Thirty-five (38.04%) *P. aeruginosa* were MDR which were resistant to three or more antimicrobial categories, and 26 (28.26%) were extensive drug-resistance (XDR) which were non-susceptible to at least one agent in all but two or fewer antimicrobial categories. Only one *P. aeruginosa* was pandrug-resistant (PDR). 79.17% were positive for ESBL encoding genes (blaPER-1, blaSHV, blaTEM, blaOXA-10) and 50% were positive for MBL encoding genes (blaNDM-1, blaVIM). Conclusion: The MDR and XDR *P. aeruginosa* compromise an effective therapy. The current state of this study will help the health system to control and prevent infections from being spread by this bacterium.

**Keywords**: Bangladesh, ESBL, MBL, *Pseudomonas aeruginosa.*

# Oral Health Facilities in Dental Out Door on Govt. Hospital in Pandemic Covid Situation of Bangladesh

**Group:** Medical Science **Project ID:** SRG-225599

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## Abstract

The nation's first corona patient was discovered on March 8, 2020. The Covid-19 pandemic is the latest challenge in dental practice because SARS-CoV-2 is primarily spread by airborne droplets. In relation to the total number of patients identified, the death rate is 1.44. Of the population in the nation, 89 percent have received the first dose of the corona vaccine, 81 percent have received the second dose, and 40 percent have received the third dose. To access the work facilities, identify the Physical facilities available, determine the organization, Socio-economic character / factors of the upazila health complex on Pandemic Time of Bangladesh. This cross-sectional study was carried out at Dhaka Dental College & Hospital, Saturia Upazila Health Complex, Kustia Medical College & Hospital, BSMMU, DU Medical Center, and Paikgasa Upozilla Hospital from July 2022 to June 2023 by telephone triage. The government hospital's dental department was operational during COVID-19. There are no formal regulations about oral care during pandemic time period. Various groups have developed their own set of rules for doing their work. There was an outdoor dental appointment system in 28% of hospitals. 57% of patients used the dental department's telemedicine services. Three feet distance was maintained in the 90% hospitals in order to prevent corona during pandemic time period. In this study there was 71% of hospitals, emergency dental care was provided. Patients' satisfaction with the dental department's services is 42%. Due to the possibility of COVID-19 spreading and the consequences of the lockdown, the dental profession was forced to make some major adjustments to the way they operated. To ensure that dental health services remain accessible and effective, it will be essential for legislators, policymakers, healthcare professionals, and the community to work together continuously.

**Keywords**: Tickets, city corporation, sterilization, influenced, policymakers.

# Phenotypic and Molecular Characterization of Rapidly Growing Non-Tuberculous Mycobacterium (RGM) Isolated from Surgical Site Infection in A Tertiary Care Hospital of Dhaka City

**Group:** Medical Science **Project ID:** SRG-225600

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## Abstract

**Background:** Surgical site infections are one of the leading causes contributing to about 20% of all cases, thereby causing an increase in morbidity and financial burden. Proportions of causative organisms associated with SSIs have changed over the years with an increase in case reports of nontuberculous mycobacteria. **Objective:** The study was designed to detect NTM up to species level by phenotypic and molecular methods, to find out the antibiotic susceptibility pattern and to detect resistant genes by Whole Genome Sequence analysis (WGS) which would help to institute better prophylactic measures and timely and accurate therapeutic measures to reduce the morbidity and cost of treatment. **Methods:** Samples received from patients with SSI were simultaneously cultured for the isolation of NTM along with routine bacteriological examination. On isolation of NTM, identification was carried out by biochemical tests, WGS and further antibiotic susceptibility profile was determined by broth microdilution and disk diffusion method. **Results:** Out of 149 samples 84 samples samples yielded growth of organisms. NTM species was the most common SSI-causing organism isolated. Only rapidly growing NTM were isolated of which, most common isolate was *M. abscessus* (83.33%) followed by *M. fortuitum* (16.67%). All four of the *M. fortuitum* isolates (100%) were susceptible to the antibiotics and 100% resistant to Trimethorpim-Sulfamethoxazole. All 20 *M.abscessus* isolates were sensitive to Amikacin. One out of 20 *M. abscessus* isolates were intermediate susceptible and 19 of them were resistant to Ciprofloxacin. Linezolid susceptibility of *M. abscessus* isolates was, 80% sensitive and 20% intermediate susceptible. Sixteen of 20 *M. abscessus* isolates (80%) were sensitive and 4 of them (20%) were resistant to Clarithromycin. **Conclusion:** NTM are an important cause of SSI having delayed presentation, are difficult to diagnose and often not treated correctly. Identification and susceptibility testing is important as different species respond differently to antimicrobial agent.

**Keywords**: Hospital-acquired, mycobacteria, whole genome, sequence analysis.

# Investigation of Cannabinoids as a Possible Candidate for the Prevention of Experimentally Induce Cancer in Albino Mice

**Group:** Medical Science **Project ID:** SRG-225601

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## Abstract

Cancer is the second highest cause of mortality in the world. Cannabinoids are naturally occurring compounds found in *Cannabis sativa* plant. Cannabinoids inhibit angiogenesis and decrease metastasis in various tumor. So, the present study was conducted to observe the effects of EAC cells induced cancer and response of cannabis extract for the prevention of EAC cells induced cancer on albino mice. A total of 204 mice (average weight 20-25g) were randomly divided into five groups i.e group-1 (EAC induced only, n=12), group-2 (EAC induced after 3 doses of cannabis extract, n=48), group-3 (EAC induced after 7 doses of cannabis extract, n=48), group-4 (EAC induced after 14 doses of cannabis extract, n=48) and group-5 (EAC induced after 21 doses of cannabis extract, n=18). Mice of group-2, group-3, group-4 and group-5 were divided into four sub groups i.e T0 (control), T1 (5mg/Kg), T2 (10mg/Kg) and T3 (15mg/Kg) consisting of 12 mice in each. The effects of EAC cells induced cancer and preventive effects of cannabis extract on biochemical and hematological profile were observed. In biochemical profile, EAC significantly ($P<0.05$) increased SGPT, SGOT, alkaline phosphate and uric acid with increased period of observation. EAC significantly ($P<0.05$) increased WBC and neutrophil but significantly ($P<0.05$) decreased lymphocyte. After 3rd and 7th doses of extract injection did not show cancer preventive effect. After 14th doses, 7.14% tumor and fluid formation, no significant effect on biochemical and hematological parameters except SGPT, SGOT and alkaline phosphatase. EAC induced after 21st doses of cannabis extract injection, no tumor and acetic fluid formation, no significant effect on biochemical and hematological parameters like as normal mice. Histopathological study revealed that inflammatory cells in the lung, hepatocellular damage in the liver and no cellular changes were observed in heart, kidney and pancreas. Cannabis extract injection for longer period can prevent cancer.

**Keywords:** Cancer, cannabis, prevention, EAC, albino mice.

# Role of 18F-FDG PET/CT in Newly Diagnosed Cytology Proven Lung Adenocarcinoma Cases and Association with Serum Carcinoembryonic Antigen

**Group:** Medical Science **Project ID:** SRG-225602

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## Abstract

**Background**: Most patients with lung adenocarcinomas are diagnosed with advanced disease stage, which is clinically aggressive and has high metastatic potential. **Objective:** To determine the diagnostic value of 18 F-FDG PET/CT in newly diagnosed lung adenocarcinoma patients. To address the relationship between metabolic parameter of 18-FDG PET CT and CEA level. **Methodology:** Pathologically confirmed adenocarcinoma lung patient without prior surgery and treatment were included in this prospective analytical study after obtaining informed written consent. **Findings:** In our study twenty-two patients were included, two patients were excluded, one due to unavailability of histopathological report and other due to concurrent malignancy. Semi-quantitative estimation of FDG uptake was performed by calculating SUVmax value, corrected for dose administered and body weight (g/ml). In this study 80% were male and 20% were female among the study population. Smoking was found to be an important contributing factor in case of male patients. 40% patients had primary malignant lesion in right lung and 60% had left lung primary. The range of SUV max was in between 4 to 22. 15% patients were diagnosed of having stage I disease, 15% in stage II, 20% in stage III and maximum 50% patients were in stage IV. Serum CEA level were elevated in 60% patients and were in normal range in rest of the patients. Patients having stage III & IV revealed elevated CEA level than stage I & II**.** Patients having stage IV disease showed nodal, hepatic, cerebral and skeletal metastases. Treatment plan has changed in 70% of the patients after 18F-FDG whole body PET-CT scan. **Conclusion:** The study has revealed the diagnostic and prognostic role of 18F-FDG PET-CT in lung adenocarcinoma patients at pretreatment state. Serum CEA level can be act as a sensitive marker for evaluation of therapy response. Further study with large study population are necessary.

**Keywords**: 18 F-FDG PET/CT, Fluro D oxyglucose, adenocarcinoma lung, CEA, diagnostic value.

# Efficacy of Phage Antibiotic Synergy (PAS) Against Multidrug Resistant Shigella spp. and Shigella Like Organism (SLO)

**Group:** Medical Science **Project ID:** SRG-225603

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## Abstract

Gradual emergence of drug resistant capacity of bacterial pathogens is the burning question where phage-antibiotic synergy (PAS) has emerged as a promising strategy. This study aims to isolate bacteriophages specific to *Shigella* and *Shigella*-like organisms and evaluate their synergistic effect with the combination of antibiotics. The sub-lethal dose of azithromycin and tetracycline with a combination of $2\times10^8$ PFU/ml of phage lysates was used to justify the synergistic effect of phage and antibiotic against *Shigella* and *Shigella*-like organisms. Both spot plating assay and overlay plaque assay were used for this test. Two bacteriophages, designated as BGL_pha_Shiga001 and BGL_pha_Salmo001, were successfully isolated from sewage water samples, demonstrating efficacy against *Shigella* and *Salmonella*, respectively. In the spot plating assay, the combination of phage and antibiotic yielded more transparent plaques compared to those formed solely with phage lysate. Similarly, the overlay plaque assay showed larger plaques than expected under normal conditions, indicating a synergistic action between the phage and antibiotic solution. Transmission electron microscopy (TEM) observations confirmed the classification of the phages as T-series phages belonging to the *Myoviridae* and *Siphoviridae* families. Furthermore, restriction enzyme digestion verified the nature of both phages as DNA phages. Whole genome sequencing of the most effective phage, BGL_pha_Shiga001, revealed its classification under the T4 series, possessing a genome size of 169.81 kilobases with a GC content of 35.4%. Sometimes the individual action of antibiotic and phage is insufficient to control multidrug resistant *Shigella*. The combination of phage-antibiotic demonstrates the potential to effectively suppress *Shigella* through a synergistic mechanism.

**Keywords**: Antibiotics, shigella, multidrug resistant, bacteriophage, PAS.

# Screening and Assessment of Clinical Metabolic and Hormonal Parameters of Polycystic Ovary Syndrome (PCOS) Among Female Students of Jahangirnagar University

**Group:** Medical Science **Project ID:** SRG-225604

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## Abstract

**Background*:*** The most prevalent endocrine condition affecting fertile women is polycystic ovarian syndrome (PCOS) and environmental and genetic factors are known to affect the disease's pathogenesis. **Objective*:*** the study focused on the overall prospective of various complications that might be seen in undiagnosed females and screened young female students to increase more awareness for early diagnosis which can reduce the burden of clinical symptoms. **Methodology*:*** In this cross-sectional study, around 170 students in the age group of 18– 30 years participated from biological sciences faculty of our university. A premarital questionnaire-based (pre-KAP) screening has been done at first to understand more about the menstrual irregularities and other symptoms along with ultra-sound of the whole abdomen and measuring the serum testosterone concentration. **Findings*:*** The Pre-KAP study elaborated that all the participants had very little knowledge about PCOS and had no previous medical diagnosis. On the other hands, subjects were eager to learn more and we were able to create more awareness among them. We found about 46 students met the NICHD criteria for diagnosis of PCOS which is of 27.06% of the total participating population, and out of the 46 participants, 20 of them fulfilled the requirement for Rotterdam criteria. The serum testosterone level of the young females screened for PCOS fulfilling Rotterdam criteria was quite elevated with a value of 63.05± 4.10 ng/dl against equivalent control. Fasting glucose level were also measured and obtained the value 5.8±0.2 mmol/l. Our overall findings support the fact that during diagnosis of PCOS ultra-sound and serum testosterone measurement is confirming to avoid any misdiagnosis. **Conclusion*:*** Our diagnostic approach for PCOS which focuses on pre-liminary questionnaire-based investigation along with clinical test will be evidenced to be more effective in screening of young females in our country.

**Keywords**: Endocrinopathy, PCOS.

# Development of Rapid Molecular Detection Method and Genetic Characterization of Dengue Virus to Prevent Outbreaks in Dhaka, Bangladesh

**Group:** Medical Science **Project ID:** SRG-225605

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## Abstract

**Background:** Dengue is an emerging mosquito-borne flavivirus infection which is now endemic in about hundred countries with 4 billion people at risk of contracting the disease. **Objectives:** This study was conducted to determine molecular epidemiology of dengue outbreak in Bangladesh. **Methodology:** A total of 199 serum samples collected from probable dengue infected patients (from different clinics and hospitals in Dhaka and Savar) during large outbreaks in Bangladesh during January 2019 to December 2019. The serum samples collected were from patients who were suspected to have dengue infection. **Findings:** From 199 blood sample, 48 were positive for dengue virus by molecular detection technique termed as RT-PCR system and some samples were finally confirmed by nucleotide sequencing method. The phylogenetic analysis revealed that the partial amplicons (453 bp) of polyprotein isolated from dengue viruses were closely related with the previously reported reference polyprotein genes from dengue viruses. Study isolates, *JU-03-2022, JU-04-2022, JU-06-2022* and *JU-08-2022* were closely related (99% similarity) with DENV-1 isolated from Assam, India (MK994536 and MK796417). We also found that study isolates *JU-13-2022, JU-16-2022* had higher similarity with DENV-2 (MZ490511) from Eastern Uttar Pradesh and *JU-17-2022* with DENV-3 (MG053147) from Pune in India. About 58% isolates were from genotype 1, 28% from genotype-2 and 14% from genotype-3. In this study, dengue virus infection was seen all over the year with an increase in prevalence at monsoon season (June- September) with a percentage of 90% of cases. On the other hand, lowest incidence was in winter season with a percentage of 1%. The majority of patients enrolled in the study had severe symptoms (e.g. fever, joint pain, headache, muscle pain). **Conclusion:** In conclusion, dengue has become a consistent health burden in Bangladesh. In future, more studies focusing the molecular characterizations and evolution of dengue virus should be conducted.

**Keywords**: RT-PCR, Dengue virus, sequencing, clinical epidemiology, vaccine.

# Screening of Nerve Growth Factors and their Receptors Polymorphism in the Susceptibility of Lung Cancer

**Group:** Medical Science **Project ID:** SRG-225606

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## Abstract

**Background:** The neurotrophic growth factors (NGF, ProNGF) and their corresponding receptors (TrkA, p75NTR and sortilin) have been reported to play a role in lung tumorigenesis. **Objectives:** The primary objective was to investigate the association of alterations in genes encoding NGF and their receptors with the risk of lung cancer. **Methodology:** Nonsynonymous single nucleotide polymorphisms (SNPs) of nerve growth factors and their receptors were screened using in-silico approach. Disease causing deleterious SNPs were predicted using SIFT, PolyPhen-2, PredictSNP, PhD-SNP, PANTHER, and SNAP2. Mutational effect on structure and stability of protein were detected with Project HOPE Server and I-Mutant 2.0 respectively. **Findings:** In NGF (241 amino acid), 36 out of 268 nsSNPs were predicted to be deleterious. Mapping study showed that 34 out of 36 deleterious mutations were in the rel domain (128-237). Among 34 nsSNPs, 32 SNPs were found responsible for reduced protein stability. ConSurf web server found that out of 34 nsSNPs, 16 were highly conserved and buried and 9 were highly conserved and exposed. Project HOPE Server predicted that E132K, V163M, Q172R, I223F, V157M are bigger than the wild-type residue. Among them, E132K was responsible for disruption of both salt bridge and hydrogen bond, V163M was buried in the core of the protein, Q172R introduced an arginine which are very flexible and can disturb the required rigidity of the protein at this position. Mutants L211P, Q172E, V143A, V230A, W142R and W197R have significant effects on the functioning NGF rel domain. In Missense3D tool prediction, three nsSNPs were found to change structure and function. Both HOPE and Missense3D tools showed Q172R (rs1557933464) and Q172E (rs746593757) structurally and functionally important. **Conclusion:** Two structurally and functionally important nsSNPs: Q172R (rs1557933464) and Q172E (rs746593757) of NGF identified in this study may act as risk factors of lung carcinogenesis, that requires wet lab validation.

**Keywords**: Nerve growth factor, SNPs, protein stability, risk factors, lung cancer.

# Pharmacogenomics of Antipsychotic Drugs

**Group:** Medical Science **Project ID:** SRG-225608

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## Abstract

Antipsychotics e.g. haloperidol and risperidone used as schizophrenia medication show significant inter-individuality in responses. We investigated DRD2 (C957T) & DRD4 (VNTR) polymorphisms in fifty schizophrenic patients treated with either haloperidol or risperidone. Patients were stratified into three classes for each drug based on PANSS score at the beginning and after four to six weeks of treatment. For genotyping we used PCR, PCR-RFLP and Sanger sequencing following genomic DNA extraction from patients blood. We found weight gain in case of Risperidone and weight loss in patients of Haloperidol regardless gene and their variation. For both DRD2 and DRD4 we found exptrapyrimidial symptoms in both drugs. No significant association were found between DRD2 and DRD4 gene variation and responses of these drugs. These may be due to small sample size and variant number. Discovery of response affecting variants will help manage schizophrenia better by increasing efficacy and decreasing drugs side effects.

**Keywords**: Schizophrenia, antipsychotic drugs, haloperidol, risperidone, pharmacogenomics.

# The Effects of Demography and Ductal Size on the Severity of Pulmonary Arterial Hypertension in Children with Isolated Patent Ductus Arteriosus

**Group:** Medical Science **Project ID:** SRG-225609

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## Abstract

**Background:** Data regarding prevalence and severity of pulmonary hypertension in isolated Patent ductus arteriosus (PDA) is lacking in Bangladesh. We evaluated effects of demography and PDA morphology on the severity of pulmonary arterial hypertension. **Material and Method:** This cross sectional study was done at the department of Pediatric cardiology, NICVD over January 23 to June 23. Isolated PDA patients from different geographical location who admitted for device closure were investigated. Echocardiography and cardiac catheterization were used to measure ductal size and pulmonary artery pressure. Puilonary artery systolic pressure (PASP) of 30 mmHg and above and or mean pulmonary artery pressure (mPAP) > 20 mmHg was regarded as pulmonary arterial hypertension (PAH). **Results:** Eighty (80) PDA patients were evaluated The males comprised 42 % and female 60% . The mean age of the patients was 53.97 ± 50.70 months with a range of 7 months to 16 years. Most of the children were from plane land (83.7%), 10% from low elevation area and only 6.3% from intermediate high altitude area.The mean ductal size was 3.64 ± 1.25. Prevalence of pulmonary hypertension in isolated PDA was 77.5%. The mean pulmonary artery systolic, mean and diastolic pressure significantly higher in intermediate elevation area than low elevation and plane area ( p value 0.03, 0.04 and 0.01 respectively). Angiographic PDA type A and E was more frequently observed in plane area, while in intermediate and low elevation area types B and C were common. Moderate to severe pulmonary arterial hypertension observed in moderate and large size PDA than small PDA (p-<0.001). **Conclusion:** The prevalence of pulmonary hypertension in children with PDA is 77.5%. Moderate and large size duct presents with moderate to severe pulmonary hypertension. Children with intermediate altitude area are more prone to abnormal shaped duct with pulmonary arterial hypertension.

**Keywords**: Demography, ductal size, pulmonary hypertension, patent ductus arteriosus, children.

# Effectiveness of Smart Phone Application 'Diabetes Self-Care' for Self-Management of Diabetes Among Patients of Bangladesh

**Group:** Medical Science **Project ID:** SRG-225610

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## Abstract

**Background:** Diabetes-self-management is important to maintain normal glycemic control which might be easier using smart phone application. It is essential to generate evidence before the wider use of this application which is not yet reported. **Objectives:** This study was designed to assess the effectiveness of smart phone application on diabetes seven self-management components among patients of Bangladesh. **Methodology:** A randomized controlled trial was conducted in Dhaka district of Bangladesh. A total of 388 diabetic patients were selected in this study for the intervention and control group with a number of 194 in each group. Smartphone Application 'Diabetes Self-Care' installed in the smart phone of each patient of the intervention group and instructed them to use. No intervention was done for the control group. Data were collected by face-to-face interview using a semi-structured questionnaire at baseline and endline. Knowledge and adherence to the seven self-management components was measured and compared in the different groups before and after the intervention using t-test, McNemar's test and logistic regression technique. **Findings:** Endline status of intervention group showed significant ($p<0.01$) improvement in knowledge and adherence to self-management compared to the baseline status. Independent t-test between groups showed that knowledge (regarding seven self-management components, basic and technical knowledge of diabetes) improved significantly ($p<0.01$) more in the intervention group than the control group. Similarly, adherence to self-management components improved significantly ($p<0.01$) more in the intervention group than control group. **Conclusions:** The study showed a significant improvement and positive impact of the m-Health intervention by using smart phone application on patients´ knowledge and adherence on seven self-management components of diabetes. These types of interventions could be replicated for the self-management of diabetes and other non-communicable diseases.

**Keywords**: Smart phone application, diabetes self-care, self-management, diabetes.

# Association of Chronic Kidney Diseases with $NOS_3$ and MYH9 Gene Polymorphisms among Bangladesh Kidney Patients

**Group:** Medical Science **Project ID:** SRG-225611

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## Abstract

Chronic kidney disease (CKD) is a complex, irreversible pathophysiologic condition that might contributed by endothelial dysfunction. Mutationsin *NOS3, MYH9* genes could potentially cause CKD. The aim of this study was to investigate the association between CKD and *NOS3*, MYH9 polymorphism among the Bangladeshi kidney patients and comparison with controls. This study compared the genotype distributions of 110 CKD patients with 40 controls. DNA was extracted from the blood samples using FavorPrepBlood Genomic DNA Extraction Mini Kit. Genotyping was performed by the polymerase chain reaction-restriction fragment length polymorphism technique (PCR-RFLP). We found genotype frequency 13.64% of the CKD patients and 32.5% of the controls carried the TT genotype, that was 55.46% and 52.5% in TG genotype and 30.90% and 15% in GG genotype. The genotype frequencies *NOS3* are consistent with Hardy-Weinberg equilibrium ($p > 0.05$) in both groups. The patient carrying the TG genotype had 2.52 times more risk (OR = 2.52, $p = 0.042$) in comparison to the TT genotype for the development of CKD ($p < 0.05$), whereas the patient carrying the GG genotype had 4.91 times comparing controls ($p < 0.05$). In terms of the dominant model, patients with the TG+GG genotype were 3.049 times more likely (OR = 3.049, $p = 0.0108$) to develop CKD than controls ($p < 0.05$). In the recessive model, patients with the GG genotype had 2.54 times more risk (OR = 2.54, $p = 0.057$) than patients with the TT+TG genotype ($p > 0.05$). Patients with the G allele were 2.019 times more likely (OR = 2.019, $p = 0.008$) to develop CKD than patients with the T allele ($p < 0.05$). Our results indicate that the *NOS3* is associated with an increased risk of CKD in Bangladeshi population. It will be helpful for treatment selection of CKD patients.

**Keywords**: CKD; ESRD; SNP; PCR-RFLP; Endothelial dysfunction.

# Evaluation of the Modulating Effect of Epidermal Growth Factor Receptor Inhibitor Cetuximab in Carbon-tetrachloride Induce Hepatic Fibrosis in Rats

**Group:** Medical Science **Project ID:** SRG-225612

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## Abstract

**Background:** Liver fibrosis is a pathological condition, developed in almost all chronic liver injuries. Epidermal growth factor receptors (EGFR) have been considered to play a role in liver fibrosis and cirrhosis. **Objective:** We therefore examined the effects of the EGF receptor (EGFR) inhibitor cetuximab on liver fibrogenesis in a rat model induced by carbon tetrachloride ($CCl_4$). **Methods:** Ameliorative effects of cetuximab were investigated in carbon-tetrachloride ($CCl_4$) (50 mg/kg twice a week) induced liver fibrosis in rats. Twenty four male Long Evans rats were divided into four groups such as control, $CCl_4$, control+cetuximab and $CCl_4$+cetuximab. After two weeks of treatment with cetuximab (100 microgram/Kg), all rats were sacrificed and blood and tissue samples were collected. Plasma samples were analyzed for the biochemical markers for oxidative stress and inflammation. Histological staining on liver sections was performed for morphologic pathologies, and related genes expressions were done with RT-PCR in liver tissue. **Results:** The results indicated that cetuximab could significantly reduce the levels of alanine aminotransferase (ALT), aspartate aminotransferase (AST), malondialdehyde (MDA), nitric oxide (NO) and increase the levels of superoxide dismutase (SOD), glutathione (GSH), and catalase (CAT). Hematoxylin-eosin (H&E) and Sirius red staining showed cetuximab treatment improved fibrotic lesions and decreased inflammatory cells infiltration. Meanwhile, cetuximab treatment also significantly down-regulates the inflammation related genes expression such as IL-*6, TNF-α, iNOS, TGF-β* and NF-κB in the liver tissue. **Conclusion:** In conclusion, cetuximab possesses curative efficacy against liver fibrosis through its antioxidant, anti-inflammatory, and antifibrotic effects.

**Keywords**: Cetuximab, fibrosis, superoxide dismutase, inflammation, transforming growth factor-*β*.

# Feasibility and Cost-analysis of Loop Mediated Isothermal Amplification (LAMP) Method for Detection of Cervical Human Papilloma Virus Infection in District Setting of Bangladesh

**Group:** Medical Science **Project ID:** SRG-225613

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**Abstract**

Background: The feasibility and cost-effectiveness of the loop-mediated isothermal amplification (LAMP) method to detect cervical human papillomvirus infection have not been evaluated in Bangladesh. **Objective:** We aimed to determine the frequencies of cervical infection with HPV 16 and 18 subtypes by the LAMP method and compare its cost-effectiveness with PCR. **Methodology**: In Rangamati General Hospital, cervical swab was collected using the Diagene HC2 DNA sample collection device. We included women who were suspected to have HPV infection. Extraction was done by GF-II Viral nucleic acid extraction kit and finally, LAMP was done by using Lyo BST-DNA polymerase kit. **Findings**: Cervical swab was collected from 89 patients according to the inclusion criteria and 81 (91.01%) of these patients belonged to the tribal population and the rest, (n = 8; 8.98%) were non-tribal. The HPV positivity rate was 16.85% (n = 15; 95% CI:10.49 - 25.96). Of the 14 HPV-16 positive cases, 13 samples (92.85%) were from tribal women. The only HPV-18 positive case (6.66%) was a non-tribal subject. The difference in positivity rate by ethnicity was not statistically significant (p = 0.12). The majority of the infected patients belonged to the 31-40 years age group (46.66%, n = 7). The individual cost of detection of HPV infection by LAMP was 1100tk and, by PCR 2250tk. The PCR method was approximately two times more costly than LAMP. **Conclusion**: The LAMP method is cost-effective compared to PCR and feasible at the district level with minimum laboratory facilities.

**Keywords**: HPV, LAMP, PCR, Cost-effectiveness, feasibility.

# Effects of Global Warming-Implicated Thermal Elevation on Heat Shock Gene Regulations and the Consequent Impact on Cartilage and Bone Morphogenesis

**Group:** Medical Science

**Project ID:** SRG-225614

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## Abstract

**Background:** The earth's surface temperature is rising worryingly throughout the world, including Bangladesh. The regulation of heat shock genes is dependent on the environmental temperature. **Objectives:** Since bone formation is associated with the activity of heat-shock genes, hence the proposed study will identify heat-shock genes and their effect on bone growth. **Methodology:** In the proposed study, using the zebrafish animal model we will determine the effect of elevated environmental temperature on cartilage and bone formation through alcian blue and alizarin red staining, respectively. In addition, the regulation of heat-shock genes will be determined using RT-PCR analysis and/or next-generation RNA sequencing analysis. **Findings:** Global warming implicated thermal elevation is a global public health concern due to adverse outcomes on the biological system. The proposed study will identify the heat shock gene(s) whose regulation is affected by global warming-implicated thermal elevation in Bangladesh. Heat shock genes are essential elements of the stress defense signaling pathway, so, the identification of affected heat shock gene(s) and the extent of altered regulation (by elevated temperature) will support us to determine the molecular mechanism(s) by which global warming-implicated thermal elevation in Bangladesh affects the health of our population. The study also will determine the effects of global warming and associated altered gene regulations on cartilage and bone morphogenesis. Osteoporosis and osteoarthritis are common bone and cartilage disorders (respectively), affecting a significant population worldwide. For example, 25% population of age over 18 years old are suffering from osteoarthritis. Hence, the determination of the effect on bone and cartilage morphogenesis will help us to estimate whether osteoporosis and/or osteoarthritis conditions of patients are influenced by global warming-implicated thermal elevation in Bangladesh. **Conclusion:** The project will support our policymaker in achieving the sustainable development goal (SDG) in Bangladesh, e.g. will help to ensure healthy lives and promote well-being for all of all ages.

**Keywords**: Global warming, heat-shock genes, cartilage, bone morphogenesis, zebrafish.

# A Cohort Molecular Study to Identify the Signature Gene Mutation Responsible for Hyper-Triglyceridemia in Bangladeshi Population

**Group:** Medical Science **Project ID:** SRG-225615

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## Abstract:

Research on genetic factor influencing hypertriglyceridemia has been conducted worldwide, except Bangladesh, although it is the major cause of Coronary Artery Disease in our population. Therefore, in the current project we studied the genetic mutations in APOA5 (lowers triglyceride level), LPL (promotes triglycerides hydrolysis) genes of CAD patients. 50 individuals with abnormally high TG level (>400) treated at RMCH and 25 healthy individuals with normal TG were selected for this study. Their socio-demographic data were collected. DNA was isolated from their blood sample and amplified PCR products from APOA5 and LPL gene was sequenced to identify mutations. Their sociodemographic data indicates that, hypertriglyceridemia has no significant correlation with diet, food habit, and smoking or other socioeconomic factor. High TG level was found irrespective of all age groups, sex and all economic clusters. By bioinformatics analysis of the obtained sequences we could identify one interesting mutation in APOA5 gene. We found three high-TG patients carrying mutation at 1866 position of their APOA5 nucleotide sequence (1866G>A) which causes change in amino acid sequence in the protein at 558 position (558G>E). Due to this change Glycine is replaced by glutamic acid. As glutamic acid is highly polar and negatively charged with different properties, it certainly affects the structure of APOA5 protein. APOA5 is activator of enzyme lipoprotein lipase, which breakdowns TG and TG-rich particles through metabolic activity (catabolism). Therefore, this mutation in APOA5 gene will result in less functional TG metabolism in patients leading to high-TG level in blood, consequently aiding in developing Coronary Artery Disease (CAD). So far, no change was detected in LPL gene, may be due to little sample size. Results of the current study suggest the necessity of nationwide genetic study to obtain overall picture regarding the genetic factor influencing hypertriglyceridemia which ultimately will help in its early prognosis.

**Keywords**: Hypertriglyceridemia, artery disease, APOA5 gene, LPL gene, genetic polymorphism.

# Detection of Human Papillomavirus (HPV) - in Noninvasive Self-Collecting First Voided Urine Sample

**Group:** Medical Science **Project ID:** SRG-225616

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## Abstract:

**Background**: Cervical cancer is a major public health problem worldwide. In women, it is the fourth most common cancer and the second most common type of cancer in Bangladesh. . Human papillomavirus (HPV) is the almost only pathogen responsible for female cervical cancers. To prevent cervical cancer, women can be screened using various tests to identify those who have or are at risk of cervical pre-cancer. **Objective**: The objective of this study to find out a patient friendly non-invasive method of urine collection for testing HPV DNA from urine sample by RT-PCR method. **Methodology**: 50 First voided urine samples and 56 endocervical swabs were taken from female patients aged between 18 to 50 and were tested for HPV DNA by RT- PCR method. **Findings**: Out of total 56 endo-cervical swabs, 22(39.9%) samples become positive for HPV DNA of which 16 (72.72%) were positive for HPV-18, 5 (22.73%) were positive for HR-HPV, and only 1 (4.53%) was positive with multi variants HPV. 34 (60.71) samples were negative for HPV DNA in RT-PCR test. Among the 50 first void urine samples of the same patients 12 (24%) become positive for HPV DNA with HPV-18. Of these 12 HPV positive samples 9 (14%) were HPV 18, HPV-16 was 0 (0.00%), HR-HPV were 3 (6 %) and multi variety was 0 (0.00 %). Where HPV could not be detected in 38 (76%) samples by RT-PCR test. Among the 22 HPV DNA positive (endocervical swab) patients, there first void urine sample were positive for HPV DNA only 12 (54.55%). HPV-18 strain was most prevalent in both samples. **Conclusion**: HPV positive endocervical swab and first void urine samples of same patients have almost same Ct value in RT-PCR test which indicates viral load is almost same in endocervical swab and first void urine sample. So, First Void urine sample may be alternate to endocervical swab for HPV detection by RT-PCR test.

**Keywords**: Urine, endocervical swab, HPV, RT-PCR, non-invasive method.

# Outcome of End to Side and Side to Side Arteriovenous Anastomosis in Creating Radiocephalic Fistula of Patients Suffering From End Stage Renal Disease-A Comparative Study

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## Abstract:

**Background:** An arteriovenous fistula (AVF) is the best modality for hemodialysis (HD) access. The End-to-side (ETS) technique has been suggested in the literature to produce superior results to the Side-to-side approach; however, there is scarcity of evidence regarding comparison of these two procedures. Considering all these facts, the study aimed to evaluate the ETS and STS techniques and compare the outcomes of both. **Objectives:** To compare the outcome of End-to-side and Side-to-side Arteriovenous anastomosis in radiocephalic arteriovenous fistula. **Methodology:** A Prospective Longitudinal study conducted in Department of Urology, SSMC Mitford Hospital, for 12-months following ethical approval. A total of 100 End stage renal disease patients requiring permanent vascular access surgery for maintenance hemodialysis was enrolled. Among them 50 patients who had end-to-side AVF (Group A) and 50 patients who had side-to-side AVF (Group B). All the patients were followed up on third postoperative day, at 6th and 12th week after the operation. Data were analyzed by SPSS 24.0. **Findings:** At 6th weeks, it was observed that 78.4% patients of Group A and 48.6% of Group B showed maturation at 6th week. The difference was statistically significant ($p<0.05$) at 6th week, primary patency was present in 91.9% patients of Group A and 67.6% of Group B and at 12th week, 86.5% patients of Group A and 59.4% of Group B showed primary patency. Presence of primary patency was significantly higher in Group A than Group B ($p<0.05$). During follow up period regarding complications, in Group A, 5.4% of the patients had developed early thrombosis and 2.7% had Juxta-anastomotic stenosis whereas, in Group B, 24.3% of the patients had developed early thrombosis and 16.2% had Juxta-anastomotic stenosis. **Conclusion:** In the light of findings of this study, it can be concluded that End-to-side anastomosis is better than Side-to-side radiocephalic fistula.

**Keywords**: Haemodialysis, technique, patency, thrombosis, stenosis.

# Changing Scenario of Symptomatic Isolated Terminal Ileal Ulcers: Histopathological Molecular Diagnosis and Clinical Profile in a Tertiary Level Hospital' Dhaka

**Group:** Medical Science **Project ID:** SRG-225619

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## Abstract

**Background**: Isolated symptomatic terminal ileal ulcers are being many times encountered by the gastroenterologist with the large numbers of ileal intubation during colonoscopy procedure. **Objective**: The aim of the study was to investigate the etiology of isolated terminal ileal ulcers (ITIUs) in symptomatic patients during ileocolonoscopy at a tertiary hospital, Bangladesh. **Methodology:** It was a cross sectional, descriptive study performed on consecutive patients aged 18 years and above of both gender who underwent ileocolonoscopy for gastrointestinal symptoms between 1 January 2023 and 30 June 2023. Clinical, ileocolonoscopic, histopathological and molecular findings were analyzed to evaluate the etiology of isolated symptomatic terminal ileal ulcers. **Findings**: Out of 50 study population 76.0% male and 24.0% female.The majority (32.0%) of the study population belonged to age group of 31-40 years and the mean age of them 35.76 ± 15.24 years. In regards to the occupation of the respondents about 22% from Business, 18% from Housewife, 12% from agrilaborer, 6% serviceholder. The majority respondents were from other occupations (42%). With respect to the educational background 4% postgraduate, 10% tertiary-undergraduate, 22% primary education completed, 38% Secondary education completed, 12% Higher Secondary education completed, and about 14% are illiterate. The most common symptoms of respondent had weight loss (72.0%) and abdominal pain (70.0%). 44% patients suffered from fever, 42.0% diarrhea, 40.0% alternate Constipation with Diarrhea. 18.0% patients had anorexia and 16.0% patients had vomiting tendency. Ileoscopic examination revealed that out of 50 respondents 42(84.0%) had multiple ulcer and the remaining 8(16.0%) had solitary ulcer. Histological findings revealed that out of 50 respondents 37(74.0%) were non specific ileitis while 7(14.0%) had tuberculosis and 6(12.0%) had Crohn's disease. Among the patients 12% were Gene Xpert positive while 88% were negative. **Conclusion**: Specific diagnosis such as tuberculosis (14%), Crohn's disease (12%) were seen in this study. Common ileoscopic findings were non-specific ileitis (74%). No clinical presentation was significantly correlated with any specific etiology. A follow-up colonoscopy was recommended.

**Keywords**: Crohn's disease, tuberculosis, non-specific ileitis, gene xpert, colonoscopy.

# Radiological Safety Analysis due to Accidental Release of 137Cs' 131I' 133Xe' 85mKr' and 90Sr from TRIGA Research Reactor

**Group:** Physical-Science **Project ID:** SRG-226622

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## Abstract

From the commissioning of the TRIGA Mark-II Research Reactor of Bangladesh, it was required to ensure nuclear or radiological safety according to the guidelines of the local regulatory authority or followed by any international guidelines (IAEA or US NRC). It is always important to take protective actions not to commit enough radiological doses. Hence, the present study focused on the core inventory and radiological dose assessment due to a postulated TRIGA Mark-II research reactor accident at AERE, Savar, Dhaka, Bangladesh. Core inventory and source term of five major radionuclides ($^{137}$Cs, $^{131}$I, $^{133}$Xe, $^{85m}$Kr, and $^{90}$Sr) were analyzed using ORIGEN 2.1 code till December 2021 and these radionuclides were selected based on their high emission phenomena from a nuclear accident. The HotSpot 3.1.2 code was used for the dose calculation, and the dose values of TED and organ doses were calculated for an 80 km radius from the reactor site. Local meteorological data from the Bangladesh Meteorological Department (BMD) were used for the dose assessment and doses were calculated in six different seasons and their dominant directions. The assessed dose values are compared and it is shown that dose values in the rainy season are highest due to the rainout coefficient. The other five seasonal TEDE data show similar dose patterns and are also high enough to the permissible limit of dose values. Therefore, regardless of the time of year, if an accident occurs, it is necessary to immediately take necessary actions based on the local authority's emergency response plan.

**Keywords**: TRIGA Mark-II, Radiological safety, meteorological data, ORIGEN2.1, HotSpot3.1.2.

# Development and Characterization of Radiation Shielding Materials Based on Indigenous Raw Materials

**Group:** Physical-Science **Project ID:** SRG-226623

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## Abstract

**Background:** The current work has been conducted to look for low-cost, eco-friendly and locally available innovative alternative shielding material for the rapid expansion of nuclear industries. **Objectives:** In this view-point the analysis of radiation shielding efficacy of X-rays and relatively high energy ɣ-rays were done for the purpose of shielding design. **Methodology:** The X-ray and γ-ray attenuation efficacies of the prepared composites consists of raw beach sand (RBS), Magnetite-Ilmenite (M-I), inland sand (IS), dyeing sludge (DS), brick chip mixed with Madhupur-clay, cement as a binder and ordinary concrete (OC) were characterized and assessed using broad beam transmission geometry, GM detector. **Findings:** The Linear Attenuation Co-efficient (LAC) values of MI composite and RBS composite decrease from 1.6443$cm^{-1}$ to 0.1459$cm^{-1}$ and 1.4026$cm^{-1}$ to 0.1377$cm^{-1}$for 65 keV to 1250 keV respectively, which reveals the higher level of attenuation among the studied composites. The LAC data of ordinary concrete has exhibited a moderate level of attenuation (0.7189 $cm^{-1}$to 0.1314 $cm^{-1}$ for 65 keV to 1250 keV). The IS and DS composite showed the poor attenuation capacity, the LAC falls down from 0.5150 $cm^{-1}$ to 0.0974 $cm^{-1}$ and 0.5133 $cm^{-1}$0.0949 $cm^{-1}$for 65 keV to 1250 keV, respectively. The Mass Attenuation Co-efficient (MAC) & Effective Dose Rate (EDR) data with the increasing photon energy follows a similar pattern as LAC data. The sequences of Half Value Layer (HVL) of the composites are MI<RBS<OC<IS. The morphology study reveals that the finely structured clay-based MI and RBS composites have lower gray values at various pixel points. **Conclusion:** The present experimental observations would be useful for designing potential radiation shielding materials for medical imaging X-ray facilities based on the locally available cost-effective raw materials.

**Keywords**: Radiation Shielding, beach sand, gamma, neutron.

# Developing the Preliminary Site Selection Capabilities for the Disposal of Low and Intermediate Level Radioactive Waste (LILW) in Bangladesh

**Group:** Physical-Science **Project ID:** SRG-226624

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## Abstract

Radioactive materials have found diversified applications in Bangladesh in medicine, industry, agriculture, education etc. and contributing to the socio-economic development of the country. Bangladesh is operating a number of nuclear and radiological facilities such as a 3 MW TRIGA MARK II research reactor (RR), a radioisotope production facility, a semi-commercial food irradiation facility, several nuclear medicine and radiotherapy facilities, a radioactive waste management facility, etc. The use of radioactive materials and operation and maintenance of these facilities generate radioactive waste (RW). Besides, Bangladesh is going to be a nuclear power plant (NPP)-operating country with its first nuclear power plant to come into operation by 2023–2024. Significant amounts of RWs are also expected to be generated from the operation and the maintenance of the NPPs. Safe management of these RW is vital in order to ensure safety of the public, future generations and the environment from detrimental effects of ionizing radiation generating from these wastes. Disposal of RW in a safe and suitably designed facility is the ultimate solution of RW management problem. Selection of a suitable site is imperative for the construction of a disposal facility for RW. The selected site must have long-term stability and characteristics that provide protection to the people, as well as to the environment, and must be economically cost-effective. The present study is the continuation of an ongoing research activities intended for selecting a site appropriate for developing near-surface disposal facilities (NSDF) for the low and intermediate levels of radioactive waste (LILW) in Bangladesh. Benchmark selection process of a suitable site for disposal is based on conceptual planning, area survey, site characterization and site confirmation. Selection of appropriate criteria, collection of relevant data and screening the whole territory of Bangladesh based on these criteria to select a suitable site for the disposal of RW are in progress. Five main criteria namely; geology, hydrology, climatology, pedology and socio-economy sub-divided into fourteen sub-criteria were used for analysis. The 1:1000,000 scale layer data of were collected from different national and international organizations. Collected data were classified according to suitability criteria and processed to identify the suitable areas. Five main criteria sub-divided into fourteen sub-criteria were used in the GIS environment to prepare raster files and the analytic hierarchy process (AHP) method for weighting the sub-criteria. GIS software, in combination with the multi-criterion analysis (MCA) method, was used to generate a suitability map based on these data. Finally, areas such as the most suitable, suitable, moderately suitable, unsuitable and completely unsuitable were identified. In the preliminary analysis, six regions with an area of approximately 2,621.88 km2 was found to be the most suitable, and an area of about 19,867.14 km2 was found to be suitable. Further analysis using large-scale data, as well as site characterizations and site confirmation, is necessary to select the final site for the NSDF.

**Keyword**: Radioactive waste, disposal facility, nuclear power plant, GIS, site selection.

# Development of Glass Fiber Reinforced Polymer Composites for Furniture Applications: Effect of Gamma Radiation and Nanoparticles

**Group:** Physical-Science **Project ID:** SRG-226625

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## Abstract

The glass fiber reinforced polypropylene based composite materials for furniture application is becoming popular having excellent physical and mechanical properties, durability, cheap and easy-to-use. To evaluate the thermo-mechanical properties of glass fibers and enhancing the mechanical properties using radiation technology, developed a glass fiber/resin based composite for household application. In this work, glass woven fabrics were used as synthetic fiber reinforcements. The catalyst (initiator) methyl ethyl ketone peroxide (MEKP) and unsaturated polyester resin was used as a thermoset polymer matrix to fabricate glass/polyester composites via compression molding. The glass/polyester exhibited superior performance in terms of mechanical properties and moisture uptake behavior. Eight layers composite were developed and the composite laminates were exposed to gamma (γ) irradiation at a dose of 5 kGy to enhance their performance. Application of γ-irradiation to the composites demonstrated a positive impact on their performance. After γ-irradiation, it was revealed that tensile strength, bending strength, tensile modulus, bending modulus, and impact strength increased 13, 27, 15, 14, and 22% for the glass/polyester composites. The characterization of the composite samples was performed via moisture uptake in water and salt solutions, Scanning Electron Microscopy (SEM) analysis. The water uptake (%) improved slightly upon exposing γ-rays to composite samples. The SEM demonstrated a good adhesion in fiber with initiator and matrix and created a well bonding fibers with matrix, thus developed glass-fiber based composite material. Finally, it can be signifying that γ-irradiation can be a viable technology to enhance the performance by the dose of 5 kGy, subsequently to be developed glass fibers composite, which is a new finding for household/furniture applications.

**Keywords**: Glass fibers, thermosetting matrix, gamma-radiation, reinforcement, furniture application.

# Synthesis' Photophysical and Biological study of Pyrimidine Schiff Base Derivatives

**Group:** Physical-Science **Project ID:** SRG-226626

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## Abstract

The use of heterocyclic molecules with nitrogen and sulfur atoms in biology and synthesis has drawn a lot of interest. Biologically active chemicals and functional materials include pyrimidine, a six-membered heterocyclic molecule that is necessary. Schiff-bases are a significant family of chemical molecules with numerous biological applications. Pyrimidine moiety have been synthesized via a two-pot method from chalcone derivatives with guanidine hydrochloride under reflux in methanol. Chalcone derivatives were synthesized by *Claisen-Schmidt* condensation reactions of acetophenone with ortho-, meta- and para-hydroxy and their corresponding nitro group-functionalized benzaldehydes. Schiff bases are prepared by condensation of arylaldehyde with various aromatic amines in dry ethanol and the mixture was stirred at ambient temperature. The progress of reaction was monitored by TLC. On completion of reaction the product was separated as yellow-colored amorphous product which was filtered, dried, and recrystallized from methanol. The objective of this study is synthesis of pyrimidine ring via chalcone and their Schiff-base derivatives. The structural information of these derivatives was confirmed by analyzing their FT-IR, $^{1}$H, and $^{13}$C-NMR spectra, as well as, in certain cases, the literature. A density functional theory (DFT) computational study was undertaken to investigate the changes resulting from the replacement of the electron-donating hydroxyl groups with the corresponding electron-withdrawing nitro groups and with consideration of all of their possible *E*/*Z* and s-*cis*/s-*trans* geometrical and regioisomers. The structural flexibility of the pyrimidine ring, which may be altered to add various functional groups, accounts for the variety of biological activity exhibited by pyrimidine derivatives.

**Keywords**: Acetophenones, chalcones, condensation. DFT calculation, pyrimidine.

# Recycling of Waste Polyolefin to Manufacture New Composite Materials Reinforced with Jute Fibers

**Group:** Physical-Science **Project ID:** SRG-226627

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## Abstract

Polyethylene (PE) and polypropylene (PP) are the most widely produced and used plastic materials in the world. They are used in toys, straws, diapers, food packaging and containers, garbage bags, pipelines, cable wrapping, automobile parts, ship ropes etc. The plastic pollution produced by these PE and PP wastes can be used to create value-added goods such composite materials for usage in commercial, industrial, and residential applications. In this works, high density polyethylene (HDPE) based waste materials and jute fibers were used to make compression molded composites. HDPE based waste bottles and boxes were collected, washed, dried and mechanically recycled into granules. *Corchorus olitorius* jute fiber was purchased from the new market in Dhaka, dried, cleaned, and chopped into lengths of 1-2 mm to use as reinforcement in composites with waste HDPE. To increase the adhesion between the hydrophilic jute fiber and the hydrophobic waste HDPE matrix in the jute fiber-waste HDPE composites, benzoyl peroxide treatment of raw jute was conducted. Pre-alkalized jute fiber was subjected to benzoyl peroxide treatment after being alkali-treated. Treated jute was characterized by attenuated total reflection-fourier transform infrared (ATR-FTIR) analysis. Waste HDPE granules were also characterized by melting point and ATR-FTIR analysis and it is found that waste HDPE's chemical structures did not degrade. Tensile, impact, and water absorption tests were performed on each composite. In terms of tensile strength, elongation at break, impact strength, and water absorption evaluation, treated jute-waste HDPE composites showed significantly better results than untreated jute-waste HDPE composites. Therefore, jute that has been treated with benzoyl peroxide has better resistance to brittle deformation and fracture than untreated jute-waste HDPE composites. These findings lead to the conclusion that benzoyl peroxide modification of alkali-pretreated jute improves the physico-mechanical characteristics of the jute fiber reinforced waste HDPE composites.

**Keywords**: High density polyethylene, treated jute, composites, tensile strength, water absorption.

# Physicochemical Properties Analysis of Surface Water in Rangpur Region and Removal of Water Pollutant Using Magnetic Polymer Particles

**Group:** Physical-Science **Project ID:** SRG-226628

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## Abstract:

**Background:** The rapid industrialization and urbanization in Rangpur city have added extra waste, which is then dumped into the Shamasundori canal water through the drainage system. Water quality assessment in surface water and the removal of heavy metals from the water have become major concerns worldwide, including Bangladesh. **Objectives:** The sampling and analysis of research data on surface water quality in the Shamasundori canal, Rangpur city area are the goals of this study. Nano-polymer matrix composites have been created and modified, and tried to find out how these composites used to extract Arsenic from wastewater. **Methodology:** Twenty samples underwent comprehensive analysis for physicochemical parameters and trace metal presence using standardized methods. Magnetically doped P(S-DVB)/P-HEMA/$Fe_3O_4$ composite polymers is synthesized, electrochemical response of the materials is checked applying differential pulse voltammetry in an aqueous solution. **Findings:** The study revealed that among the various anions, cations, and trace metals $HCO_3^-$, $NO_2^-$, $NO_3^-$, $K^+$, Mn, Hg were the major contaminants in the water of Shamasundori canal. The anion chemistry of the surface water in the study area were found to decrease in the order of $NO_2^- > HCO_3^- > Cl^- > NO_3^- > SO_4^{2-}$. The major cations in the studied surface water were in the order of $Ca^{2+} > Na^+ > Mg^{2+} > K^+$. The concentration of other heavy metals; Copper, Lead, Zinc, Chromium, Cadmium and Arsenic were found within the acceptable limit for drinking water according to the proposed Bangladesh standards and WHO. The nanocomposite showed better arsenic removal efficiency from wastewater. **Conclusion**: The Water Quality Index emphasizes the importance of reducing contamination levels and enforcing environmental regulations in Shamasundori canal, Rangpur, Bangladesh. These findings emphasize the importance of authorities taking appropriate actions to decrease water contamination levels and implementing regular monitoring of contamination sources in the future.

**Keywords**: Heavy metal, Shamasundori canal, water quality index, nanocomposite, wastewater.

# Development of a Cost-Effective Atomizing Spray Deposition Technique for the Fabrication of Zinc Oxide-Based Perovskite Solar Cells

**Group:** Physical-Science **Project ID:** SRG-226629

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## Abstract

**Background**: The cost per efficiency of currently used Si-based solar cells is high. So, researchers are trying to find a cost-effective material to fabricate low-cost efficient solar cells. **Objectives**: Explore the use of the optimized optoelectronic properties in ZnO, NiO, and $CH_3NH_3AgX$ (X = Cl, I) by fabricating and evaluating efficient solar cells based on these materials. **Methodology**: The atomizing spray deposition method was used to deposit the perovskite thin films. NiO hole transporting layer was spin-coated on the perovskite film from a 0.5M nickel acetate [Ni $(OCOCH_3)_2.4H_2O$] solution at 4000 rpm for 30 s. **Findings**: A homemade atomizing spray deposition technique was used to deposit the thin film of ZnO, NiO, and $CH_3NH_3AgCl_3$ for the fabrication of ZnO-based $CH_3NH_3AgCl_3$ perovskite solar cells. ZnO film shows a hexagonal structure, and high absorption in the visible and ultraviolet regions with a band gap of 3.33 eV. NiO layer exhibits a cubic structure and a bandgap of 3.39 eV. $CH_3NH_3AgCl_3$ layer shows a tetragonal perovskite structure with a band gap of 2.4 eV. SEM analysis of ZnO, NiO, and $CH_3NH_3AgCl_3$ shows that all the films have smooth and homogeneous surfaces with nanocrystalline morphology. Cathodoluminescence analysis reveals that ZnO shows a near band edge emission at 3.35 eV with a broad green emission band at 2.50 eV. NiO film shows ultraviolet (3.50 eV), blue (2.77 eV), and green emission (2.31 eV). $CH_3NH_3AgCl_3$ films exhibit a pure green emission centered at 2.50 eV. The ZnO/NiO and ZnO/$CH_3NH_3AgCl_3$/NiO heterojunction solar cells were fabricated and their current-voltage characteristics were investigated. The forward current significantly increases when a $CH_3NH_3AgCl_3$ film is inserted between the ZnO electron-transporting layer and NiO hole-transporting layer. The results indicate that the $CH_3NH_3AgCl_3$ layer can be used to fabricate hybrid organic-inorganic solar cells and other optoelectronic devices with improved efficiency. **Conclusion**: NiO/ZnO and NiO/ $CH_3NH_3AgCl_3$/ZnO heterojunction solar cells of the same area fabricated from $CH_3NH_3AgCl_3$ exhibit a much higher current density under the same forward bias.

**Keywords**: Zn-based perovskite solar cells, NiO HTM, spray pyrolysis, sollar cells.

# Biopolymer Extracted Nanocelluloses and Smart Fibers for Future Technology

**Group:** Physical-Science **Project ID:** SRG-226630

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## Abstract

Nanocellulose (NC) is of increasing interest for a range of applications relevant to the fields of material science and biomedical engineering due to its renewable nature, anisotropic shape, excellent mechanical properties, good biocompatibility, tailorable surface chemistry, and interesting optical properties. These tiny NC fibers have huge potential in many applications in textiles, smart electronics and water purification and regeneration. Different biodegradable polymers such as banana fiber (BF), coconut coir, jute, bamboo etc. are used for the preparation of NCs, which is ultimately used to prepare nanocomposites. In this study BF is used as a test material for preparing nanocellulose. Alkali treatment is applied to the BF surface to improve its mechanical properties. Treatment is carried out by dipping small bunches of fibers in the cellulose nanofibers were prepared by the double-acid hydrolysis of BFs. Finally, the NC suspension was obtained by stirring the solid fraction with required amount of water. The newly generated suspension is dispersed into ethanol or absolute alcohol into a safe as well as clean glass vessel. The properties of this NC are characterized by using FTIR, SEM, XRD, to optimize its properties to fabricate smart filter. The surface morphology and distribution of NPs in the NCs is studied by using scanning electron microscope where the size of banana fiber is cellulose reduce into nano-sized particles. The structural properties of the NCs are studied by FT-IR and X-ray diffraction analysis.

**Keywords**: Natural fibers, noparticles, biocompatible materials, mechanical properties, scanning electron microscope.

# Green Synthesis and Investigation of Metal-Polymer Nanocomposites for Biomedical and Nonlinear Optical Applications

**Group:** Physical-Science **Project ID:** SRG-226631

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## Abstract

**Background:** The future of sustainable nanoscale science and technology depends on appropriately addressing environmental and societal concerns. The goal of this research work was to first create stable, greener metal nanoparticles by using a method that is safe for the environment, and then to add those nanoparticles as a nano-filler to a polymer matrix. **Objectives**: To synthesize silver nanoparticles (AgNPs) via a green technique using *Azadirachta indica* leaf extract and to fabricate silver nanoparticles polyvinyl alcohol (AgNPs/PVA) nanocomposites using the solution casting method. **Methodology**: *Azadirachta indica* leaf extract was prepared using deionized water and added to $AgNO_3$ solution to prepare AgNPs. Further, the prepared AgNPs solution was added dropwise to the PVA solution to form AgNPs/PVA nanocomposites. **Results:** The UV-visible spectroscopy analysis showed that surface plasmon resonance peaks varied from 425 to 436 nm depending on the silver salt concentration. Structural analysis revealed that AgNPs exhibited face-centered cubic crystal structure with preferential orientation along the (111) plane, and the average crystallite size was ~ 20 nm. Transmission electron microscopy analysis showed that synthesized AgNPs are spherical in shape and the average particle size was ~27 nm. AgNPs showed good antibacterial activity against both gram-positive and gram-negative bacteria. Further, the formation of AgNPs/PVA nanocomposite was confirmed by UV-visible spectroscopy which exhibited a strong absorption peak ~ 420 nm. The XRD pattern of AgNPs/PVA nanocomposites revealed an amorphous phase, indicating that the AgNPs had been appropriately incorporated and distributed throughout the PVA matrix. The surface morphology of AgNPs/PVA nanocomposites showed that spherical AgNPs were distributed uniformly onto the host PVA matrix. **Conclusions:** This study presents the synthesis of AgNPs/PVA nanocomposites in an environmentally friendly way. These nanocomposites might exhibit enhanced antibacterial properties and might be useful in biomedical applications like bandages, burn and wound dressings, antibacterial gloves, food and water storage containers, etc.

**Keywords**: Greener silver nanoparticles, PVA, PVA/AgNPs nanocomposites, surface plasmon resonance, antibacterial activity.

# Development of Electro-Mechanical Technique for Probing the Single Cell-Like Lipid Vesicles for Biomedical Application

**Group:** Physical-Science **Project ID:** SRG-226632

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## Abstract

We reveal the role of electric filed-induced tension and the mechanically-induced tension on the rupture of cell-like giant unilamellar vesicles (GUVs) under various conditions. The GUVs were prepared using a combination of negatively charged lipid DOPG and neutral lipid DOPC in physiological environment. Vesicles were observed using an inverted phase contrast microscope connected with a CCD camera. The average time of rupture, probability of rupture, and the rate constant of rupture were calculated using the statistical analysis of many 'single GUVs'. The pore edge tension of membrane is intricately linked to membrane stability and plays a crucial role in the mechanisms that enable membrane resealing after pore formation induced by electrical and mechanical tension. We determined the pore edge tension from the fitting of the tension-dependent logarithm of rate constant of rupture of GUVs using Arrhenius equation. The values of pore edge tension increase with sugar concentration in physiological buffer, such as 9.6 ± 0.3 and 16.2 ± 0.1 pN for 40 and 300 mM, respectively. The high concentration of anionic lipids (70 mol%) reduced the pore edge tension significantly. An increasing trend of the pore edge tension with cholesterol content was obtained; specifically, the values of pore edge tension were 11.9 ± 0.9 and 16.2 ± 0.4 pN for 15 and 40 mol% cholesterol, respectively. The inclusion of elevated levels of anionic lipids in the bilayer led to a reduction in membrane stability. Conversely, increased sugar concentration in the buffer and higher concentrations of cholesterol in the membranes were found to enhance membrane stability. We posit that the outlined procedure holds potential for determining pore edge tension in research contexts exploring pore formation induced by ultrasound, optical illumination, osmotic swelling, and peptide interaction. This suggests the broad applicability of the technique described in this report.

**Keywords**: Pore edge tension, giant unilamellar vesicles, lipid membrane, kinetics of rupture, activation energy.

# Synthesis and Characterization of Metal Oxide Nanoparticle Decorated Molybdenum Disulfide Nanoflower for Energy Storage Applications

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## Abstract

In this research project we intend to syntheses metal oxide nanoparticle deposited molybdenum disulfide nanomaterials via an economic and simple that can be used for the fabrication of energy storage devices. In this work, $Co_3O_4$ decorated $MoS_2$ nanoflower ($MoS_2/Co_3O_4$) has been successfully synthesized by a simple hydrothermal method. A combined experimental and theoretical investigation was performed to comprehend the effect of $Co_3O_4$ on the structural, optical, and electronic properties of $MoS_2$ nanoflowers. A number of characterization techniques have been used to study the surface morphologies, structural properties, chemical constitution, and optical properties of the nanocomposites including, FE-SEM, TEM, XRD, XPS, and UV-VIS spectroscopy. Flower-like structures of $MoS_2$ and $MoS_2/Co_3O_4$ have been observed from the FE-SEM and TEM images. The Rietveld refinement of the X-ray diffraction (XRD) pattern was used to estimate the various structural parameters of the nanoflowers which also confirms the phase purity of the $MoS_2$ nanoflower. X-ray photoelectron spectroscopy (XPS) results revealed strong electronic interaction between Mo–S and Co–O in the nanocomposites. The optical bandgap of the as-prepared samples was estimated using diffusive reflectance spectra and was found to be varied between 1.44 eV to 1.27 eV nanostructure due to the incorporation of $Co_3O_4$ nanoparticle. To fully understand and validate the structural, optical, and electrical characteristics of the samples, density functional theory (DFT) calculations were carried out. DFT results revealed that the Mo-4d and Co-3d orbital-orbital interactions occur due to the incorporation of $Co_3O_4$ into $MoS_2$, leading to a decrease in the band gap. Moreover, a charge redistribution occurred between $MoS_2$ and $Co_3O_4$ interface, creating more active sites for electro and opto-catalytic reactions. Among the results, the red shift of the optical absorbance spectra is the most obvious one enabling our synthesized nanocomposite to absorb in the near-infrared range. This study will offer a new insight into the fabrication of transition oxide-based hetero-interface influenced $MoS_2$ functional devices for diverse applications.

**Keywords**: Energy storage; $MoS_2$; metal oxide nanoparticles; nanocomposite; $Co_3O_4$.

# N-carbamoylethyl Pendent Derivative of a Hexamethyl Macrocycle and its Metal Complexes: Characterization' Antibacterial' Anticancer and Antioxidant Studies

**Group:** Physical-Science **Project ID:** SRG-226635

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## Abstract

**Background:** The chemistry of macrocyclic ligands and their different metal complexes has attained a remarkable focus on their application in various sectors of modern science. The macrocyclic compounds are also important due to their use as analytical, therapeutic and pharmacological agents. **Objectives:** (a) Synthesis and characterization of N-carbamoylethyl pendent derivative and its metal complexes. (b) Biological activity studies of the synthesized compounds. **Methodology:** The newly prepared compounds were characterized by some physical methods (color, melting point, solubility etc), microanalysis (C, H, N & S etc.), spectroscopic methods (IR, UV-VIS, NMR, MASS), conductometric, magnetochemical and X-ray crystallography. Bilogical activities of these compounds were performed as per standard procedure. **Findings:** A new N-pendent macrocyclic ligand tet-am and its four cadmium(II) complexes were prepared and characterized successfully. It is important to note that, the structure of the N-pendent ligand tet-am with carbamoylethyl arms was established by the X-ray crystallographic study. **Conclusion:** This study reveals that the concerned N-pendent carbamoylethyl derivative ligand, tet-am undergoes facile complexation with cadmium(II) when react with different cadmium(II) salts. The reactions are found to yield octahedral or square pyramidal complexes. It was also interesting to note that these Cd(II) complexes show remarkable biological activities.

**Keywords:** Macrocycle, N-pendent derivative, metal complexes, biological activities**.**

# Catalytic Effect Evaluation of Functionalized Ammonium based Ionic Liquids on Mannich Reaction: Synthesis' Characterization' Computational Study

**Group:** Physical-Science **Project ID:** SRG-226636

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## Abstract

The amino-alkylation of CH-acidic compounds recognizes as the most important C-C bond-forming reactions to form $\beta$-amino carbonyl compounds in presence of catalysts. Typically, Ionic Liquids (ILs) involve a combination of heterocyclic organic cations with inorganic or organic anions, considered as “designers’ solvents”, can be used as catalysts and alternative less toxic solvents for Mannich reaction. No product observed when the reaction was carried out without catalyst. The solvents can be recycled at least four times and found maximum (yield 85-95%) Mannich products with trace amount of ILs. Inatypicalreaction, benzaldehyde, aniline, cyclohexanone, and ILs as catalysts and solvent were stirred at room temperature (25$^{\circ}$C) in a round-bottomed flask. 2-(Diethylamino) ethanol, N-Methyldiethanolammine, 2-(Methylamino) ethanol was used as cation and 3-methylbenzoate, 2-methylbenzoate, lactate, salicylate, 2-chloropropanoate, o-nitrobenzoate, butyrate used as anion for ILs. ILs thus synthesized was characterized with IR, NMR and Mass spectroscopy and confirmed. The most characteristics feature about these noble ILs is their reusability i.e. these could have been reused several times in a particular chemical reaction. N-Methyldiethnolamine m-toluate, [N-MDEA][m-T] showed greater extent of catalytic activity with slight changes. ILs used for Mannich catalysts, could be a good alternative for traditional organic solvents. Theoretical behaviors of new ILs were explored by Computational Simulations using DFT (B3LYP) method with 6-311G (d,p) basis set at Gaussian 09 platform. Conceptual study on the geometry, thermochemistry, molecular electrostatic potential, vibrational spectroscopy analysis and also numerous properties of the synthesized ammonium based ILs were performed with the process. These notional evaluations will reveal and forecast the competent ILs for several types of applications with maximum outcome. Computational screening and application the findings for ADMET calculation provides the binding parameters to understand the exert properties.

**Keywords**: Mannich product, ammonium ionic liquids, theoretical investigation, recyclability, ADMET evaluation.

# Study of Ionic Liquid Doped Tertiary Ammonium Iodide Based Gel Polymer Electrolytes for Dye Sensitized Solar Cells (DSSCs) Application

**Group:** Physical-Science **Project ID:** SRG-226637

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## Abstract

Performance-limiting issues in conventional liquid and solid electrolytes for DSSCs drive the exploration of gel polymer electrolytes (GPEs), addressing stability, conductivity, and compatibility challenges. This study has aimed to investigate the impact of Methylpropylimmidazolium iodide (PMII) on PAN-based GPEs and optimize conductivity and limiting current density for DSSC appication. A series of gel polymer electrolytes (GPEs) composite for dye-sensitized solar cell (DSSC) application has been prepared using a polyacrylonitrile (PAN) conducting polymer plasticized with a mixture of ethylene carbonate (EC) and propylene carbonate (PC) and tetrapropylamonium iodide (TPAI) salt doped with varying compositions (6%, 8%, 10% and 12%) of Methylpropylimmidazolium iodide (PMII) room temperature ionic liquid (RTIL). The prepared GPEs have been characterized using two electrochemical techniques: electrochemical impedance spectroscopy (EIS) and linear sweep voltammetry (LSV). The EIS results indicate that the GPE containing 10 wt % PMII has the lowest bulk impedance, Rb, and the highest ionic conductivity at room temperature, which follows Arrhenius rule over the studied temperature range. The activation energies, Ea, have been found to decrease with the increase of PMII percentage, with the lowest value observed for the GPE containing 10% PMII. On the other hand, the LSV graphs have been used to estimate various parameters, such as the limiting current density (Jlim), the apparent diffusion coefficient of triiodide ion (D*I*3-) and the exchange current density ($J_0$) for GPE systems. The GPE material with the highest conductivity exhibits the highest values of Jlim, D*I*3- and $J_0$. This study establishes the superiority of the GPE with 10% PMII, demonstrating enhanced conductivity and superior limiting current density. The findings will contribute to optimizing electrolyte formulations for improved efficiency and stability in DSSCs.

**Keywords**: Performance-limiting issues in conventional liquid and solid electrolytes for DSSCs drive the exploration of gel polymer electrolytes (GPEs), addressing stability, conductivity, and compatibility challenges.

# Synthesis and Characterization of Glucofuranose Ethers and Esters: Comparative Antimicrobial and Molecular Docking Study

**Group:** Physical-Science **Project ID:** SRG-226639

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## Abstract

Sugar-fatty acid esters (SFAEs, especially sucrose- and glucose-based ones) have dominated the chemical industries for more than 50 years. In comparison to other carbohydrate products, SFAEs serve essential roles in a variety of industries, including the food, pharmaceutical, and cosmetic industries. In this context, initially, 3-*O*-butyl-1,2-*O*-isopropylidene-α-D-glucofuranose and 3-*O*-heptyl-1,2-*O*-isopropylidene-α-D-glucofuranose (seprilose) were prepared from available D-glucose in just three economical steps. Unimolar hexanoylation of 3-*O*-butyl-D-glucofuranose indicated selectivity at the C-6 position with the formation of 6-*O*-hexanoate in 86% yield. The presence of a butyl group at the C-3 position might help with the higher selectivity at the C-6 position. Similarly, unimolar decanoylation of seprilose furnished 5,6-di-*O*-decanoate and 6-*O*-decanoate, indicating higher reactivity of the C-6 OH group. To compare biological tests, octyl and decyl ethers of 3-*O*-butyl-D-glucofuranose and seprilose were also prepared. All the synthesized compounds have been well characterized using 1D and 2D spectroscopic techniques. An *in vitro* antimicrobial test and Prediction of Spectra for Substances (PASS) analysis of all the ester and ether compounds indicated that these compounds are more susceptible to fungi than bacteria. The compounds showed better inhibition against *A. niger* than *A. flavus*. In this respect, molecular docking, ADMET (absorption, distribution, metabolism, and excretion – toxicity), and drug-likeness properties were studied, followed by structure-activity relationships. Several of the synthesized compounds found in the current investigation have a variety of potential biological functions. The research findings could contribute to the development of bioactive sugar-based agents in the near future.

**Keywords**: ADMET, Antimicrobials, drug-likeness, glucofuranose, PASS analysis, sugar fatty acid esters.

# Synthesis, Biological Evaluation, Anticancer and Computational Studies of Benzylidene Derivatives for New Antimicrobial Agent(s)

**Group:** Physical-Science **Project ID:** SRG-226640

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## Abstract

**Background:** Carbohydrate derivatives have been under investigation for many years. Some of the most clinically effective antimicrobial agents currently used are monosaccharide esters. **Objectives:** By conducting a direct method to synthesize a selective series of derivatives of Methyl 4,6-*O*-benzylidene-α-D-glucopyranoside (MBDG) derivative (**1**) and obtained the MBDG derivatives (2-8) in a higher yield. **Methodology:** Employing the techniques of FTIR, $^{1}$H-NMR, $^{13}$C-NMR spectroscopy, and elemental analysis, we characterized the structures of the newly synthesized compounds. Additionally, all the synthesized compounds were subjected to antibacterial activity screening against specific human pathogenic bacterial microorganisms and antifungal activity assessment against distinct plant pathogenic fungal microorganisms. **Findings:** The study exposed that the acylated products proclaim moderate to suitable antimicrobial activities. In this context, the optimized molecular structures have been examined by the B3LYP/6-311G (d, p) method using DFT. In addition to optimized molecular structures, researchers studied stability arising from hyper conjugative interactions and charge delocalization using natural bond orbital analysis. Furthermore, the HOMO-LUMO gap and molecular electrostatic potential (MEP) were theoretically examined. We obtained the thermodynamic functions (Gibbs free energy, enthalpy, entropy, and heat capacity) of the MBDG and its derivatives. To reinforce this observation, molecular docking studies were conducted on the UDP-3-O-(R-3-hydroxymyristoyl)-N-acetylglucosamine deacetylase (LpxC) enzyme, revealing significant binding affinities and the presence of non-bonding interactions. Furthermore, a 300 ns molecular dynamics simulation process was executed to observe the behavior of the complex structure formed by the LpxC under in-silico physiological conditions. This investigation aimed to analyze the stability over time and revealed a stable conformation and binding pattern within a stimulating environment of MBDG derivatives. *In vitro* effect against Ehrlich ascites carcinoma (EAC) cells, by MTT colorimetric assay, showed 23.97% of cell growth inhibition with an $IC_{50}$ value of 1101.34 µg/ml. **Conclusion:** After all, the current study might help develop new multidrug-resistant antimicrobial medicines based on MBDG.

**Keywords**: Methyl 4,6-*O*-benzylidene-α-D-glucopyranoside, DFT, molecular docking, dynamics.

# Design and Analysis of Millimeter-Wave Antennas for the Fifth-Generation (5G) Wireless Communication Applications

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## Abstract

The fifth generation (5G) cellular technology is a promising technology that brings the opportuneness and mobility of communications to high-speed interconnections in wireless communication devices. As a vital component of the communication system, the design of an antenna is challenging since there are more particular requirements for the 5G mmWave antenna than its low-frequency band counterpart. As the mmWave antenna used in high-frequency 5G networks is small, it is very difficult to design an appropriate antenna for smart devices and base stations. Therefore, mmWave antenna design and analysis for 5G wireless communication applications have been conducted in this research project. A circular patch antenna is initially chosen as a conventional planar antenna structure due to its low profile and ease of fabrication. A technique that added different types of slots and slits in the patch. Moreover, the full ground plane has been reduced to a partial one. It has been revealed that the addition of slot and slit, and modification of the ground plane enhances the working bandwidth of the antenna and reduces the ground plane dependency. Theoretical and measured results confirmed that the proposed antenna with a Miki Mouse-shaped patch and the partial ground plane can support multiple resonant modes, and overlapping these closely spaced resonances leads to achieving an operating band ranging from 27 GH to 35 GHz. This working band is sufficient to cover the mmWave spectrum for newly commissioned 5G cellular technology. The designed antenna also achieved good gain and radiation efficiency and exhibited nearly directional radiation patterns, making it very suitable for 5G wireless communication applications.

**Keywords**: Wireless communication, 5G, mmWave, antenna, radiating patch.

# Design, Synthesis and Evaluation of Antimicrobial and Antioxidant Activities of Coumarinyl Carbothioamide Derivatives with in Silico Molecular Modeling and Pharmacokinetic Predictions

**Group:** Physical-Science **Project ID:** SRG-226642

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## Abstract

Coumarin and their derivatives are the most important compounds which are used in different medicinal application due to their chemical versatility as well as structure. In this present study concentrate on the synthesis and characterization of coumarin derivatives and their carbothioamide derivatives containing thiosemicarbazide moiety. In first step newly syntheses compounds 1a**,** 1b and 1c are coumarin derivatives of bromine and chlorine. In second step these were react with thiosemicarbazid and syntheses new compounds 2a**,** 2b and 2b are coumarin thiosemicarbazone derivatives and characterized on the basis of their spectral data (IR, $^{1}$H NMR, $^{13}$C NMR, DEPT, HMBC and HSQC). The synthesized compounds were tested *in vitro* antimicrobial activity assay against gram positive & gram negative bacterial and fungal strains. Compound 2c showed the highest zone of inhibition (17.0 mm) against *E. coli* bacteria and also highest (23 mm) against *T. harzianum i*n fungal strain. Compound 2b showed second highest zone of inhibition (21.0 mm) against *T. harzianum i*n anti- fungal assessment. *In silico* docking studies the molecule was performed for the highest antifungal active compound 2c against target protein receptor 5JBO PDB which is a co-crystals of *T. harzianum* and showed satisfactory result. *In silico* ADME prediction were performed for the synthesized compounds and found all the synthesized compounds follow Lipinski'srule of five and Veber's rule which significantly in favor of oralbioavailability.

**Keywords**: Coumarin thiosemicarbazone derivatives, antimicrobial activity, antifungal activity, molecular docking, ADME prediction.

# Design, Synthesis, Biological Evaluation and DFT Analysis of 2-[N-2-(aryl methylidene) Hydrazin-1-yl]-4 phenyl-1'3-thiazole Derivatives with in Silico Molecular Docking and ADMET Predictions

**Group:** Physical-Science **Project ID:** SRG-226643

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## Abstract

**Background:** Schiff bases with heterocyclic compounds directly bonded with nitrogen and sulfur are recommended as phenylthiazole derivatives (PTD); which have been attracted recently by the scientific community for investigation due to their synthetic diversity and therapeutic relevance. **Objectives:** (a) Synthesis and characterization of substituted thiosemicarbazone derivatives and arylidene thiazole analogs. (b) Studies of biological activities and molecular docking of the synthesized compounds. **Methodology:** (a) Synthesis of thiosemicarbazone: Ethanolic solution of thiosemicarbazide and substituted aldehydes is heated with reflux at $80^0$C temperature with stirring until the completion of the reaction. The reaction mixture is pour into a vessel containing ice to form precipitate. The obtained precipitate was filtered, washed with *n*-hexane and finally recrystallized from methanol. (b) Synthesis of arylidene thiazole analogs: Thiosemicarbazone is dissolved in 10 mL of acetone with phenacyl bromide and is allowed to reflux at $60^o$C with stirring. The formed product will be filtered, washed and finally recrystallized from methanol. **Findings:** In this study thiosemicarbazone derivatives; compound 1a**,** 1b and 1c were synthesized and characterized. Moreover, schiff base derivatives; compounds 2a**,** 2b and 2c were also synthesized and characterized. *In silico* ADMET predictions of synthesized compounds showed that the solubility values of all compounds are ranging from –5.10 to –6.03 which are in-between the limit of standard range (0.5 to –6.5). ADME predictions of the synthesized derivatives are also showed that all the synthesized compounds follow the Lipinski's rule and Veber's rule. **Conclusion:** All synthesized compounds were characterized on the basis of their spectral data. It was visualized that all synthesized thiazole derivatives (**2a**, **2b**, **2c**) significantly exhibited anti-bacterial and anti- fungal activities. *In silico* study revealed, all the synthesized compounds follow the Lipinski's rule of five and Veber's rule which are significantly in favor of oral bioavailability.

**Keywords**: Synthesis, thiazole derivatives, characterization, molecular docking, ADMET predictions.

# Fabrication of Functional Hydrogel for Selective Removal of Dyes from Water

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## Abstract

Removal of unwanted chemical species from aqueous media keeping useful chemicals intact is a demanding task in advanced waste water treatment process. In this project, a cationic hydrogel gel has been prepared for selective removal of an anionic dye from a mixture of cationic and anionic dye solution. The hydrogel was prepared by polymerization of a cationic monomer [2-(Acryloyloxy)ethyl] trimethyl-ammonium chloride (DMAEA-Q) solution in presence of photochemical initiator, α-ketoglutaric acid (AKG) and cross-linker, N,N'-methylenebisacrylamide (MBAA). After preparation, the gel was soaked in water to attain the equilibrium swelling state. The cationic poly-(DMAEA-Q) gel was employed for adsorption of methyl red (MR) dye from its aqueous solution as well as a mixture solution of MR and methylene blue (MB) dye. A significant amount of MR dye was adsorbed selectively from both the solutions at acidic and neutral conditions. The adsorption efficiency of poly-(DMAEA-Q) hydrogel for anionic MR dye was found to be ~51% for MR solution only and ~98% for the mix dye solution of MR and MB at an equilibrium time of 72 hours at pH 2.7. At pH of 6.7, the gel was capable of adsorbing ~46% from MR solution only and ~94% from the mix dye solution of MR and MB. At high pH (11.9), significant dye adsorption was not noticed in both the cases due to the similar cationic nature of the adsorbent gel and the MR dye. Importantly, the dye-adsorbed hydrogel can be separated easily from the aqueous solution after absorption of MR dye and the adsorbed MR dye can be regenerated by a simple treatment with sea water. The recyclable hydrogel and the selective removal of dyes outlined in this project would be beneficial for targeted removal of harmful chemicals from industrial effluents which would further lead to design a cost-effective and eco-friendly effluent treatment plant.

**Keywords**: Recyclable materials, adsorption, waste-water, water pollution, effluent treatment plant.

# Reparation and Characterization of Transition Metals/Cellulose-Base Composites for Photodegradation of Organic Dyes

**Group:** Physical-Science **Project ID:** SRG-226645

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## Abstract

**Background:** Scarcity of clean water is a widespread issue, and pollution continues to exacerbate the situation day by day. Thus, it has become imperative for us to take action to control water pollution. Semiconductor photocatalysis emerges as a promising solution to play a pivotal role in addressing this challenge. **Objectives:** The purpose of this research is to evaluate the photocatalytic performance of pure $TiO_2$ powder and its composites with cellulose in varying compositions to find out the suitable composite with high activity in the removal of MB dye. Moreover, we aimed to study the role of cellulose as a supporting material in the composite photocatalyst. **Methodology:** In this study, anatase $TiO_2$ nanoparticles (NPs) were successfully synthesized using a hydrothermal method with titanium isopropoxide as a precursor. The resulting $TiO_2$ NPs, as well as $TiO_2$-cellulose composites, were characterized using FTIR spectroscopy, thermogravimetric analysis (TGA), X-ray diffraction (XRD), scanning electron microscopy (SEM), diffuse reflectance spectroscopy (DRS), and UV-Vis absorption spectroscopy. **Findings:** $TiO_2$/cellulose composites were prepared successfully by dispersing $TiO_2$ and $\alpha$-cellulose powder in aqueous medium. The successful incorporation of $TiO_2$ with the cellulose structure was confirmed by the FTIR spectra. Thermal analysis shows that the composites are stable in oxygen atmosphere up to about 270 $^{o}$C. From UV-Vis DRS data (Tauc plot), the band gap energies of the composites were evaluated and showed very similar results to pure titania. The dye removal efficiency of $TiO_2$ increases by combining $TiO_2$ with $\alpha$-cellulose powder. The composite with 55% $TiO_2$ shows better performance than pure titania. **Conclusions:** In this study, it was revealed that cellulose fiber, which is biodegradable and inexpensive, can be applied in a large scale as a supporting material for semiconductor photocatalysts to enhance the degradation efficiency.

**Keywords**: Water treatment, dye removal, photocatalyst, semiconductor, composites.

# Transition Metal Carbonyl Compounds Bearing Heterocyclic and Two Electron Donor Ligand: Synthesis, Structure and Reactivity

**Group:** Physical-Science **Project ID:** SRG-226646

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## Abstract

**Background:** Tin and germanium containing low-valent bimetallic carbonyl clusters have attracted considerable interest because of their use as precursors for the preparation of active bimetallic nanoparticles. **Objectives:** To synthesize bimetallic complexes with germanium ligands from the reaction of electron precise triosmium imidoyl cluster $[Os_3(CO)_9(\mu_3\text{-}^2\text{-}C{=}N(CH_2)_3(\mu\text{-}H)]$ (**1**) with $Ph_3GeH$. To understand how cluster fragmentation is prevented during the incorporation of organo germanium into the coordination sphere of imidoyl metal carbonyl clusters. **Methodology:** All the reactions were carried out under a dry nitrogen atmosphere using standard Schlenk techniques. IR spectra were recorded on a Shimadzu FTIR 8101 spectrophotometer, and NMR spectra were recorded on a Varian Unity Plus 500 spectrophotometer. Crystallographic data was collected on a Rigaku Mercury 375R/M CCD (XtaLAB mini) diffractometer using graphite monochromated Mo-Kα radiation. **Findings:** The reaction of electron precise triosmium imidoyl cluster $[Os_3(CO)_9\{\mu\text{-}\eta^2\text{-}C{=}N(CH_2)_3\}(\mu\text{-}H)]$ (**1**) with $Ph_3GeH$ at 110 $^oC$ temperature gives mono-sustituted $[Os_3(CO)_9(Ph_3Ge)\{\mu\text{-}\eta^2\text{-}C{=}N(CH_2)_3\}(\mu\text{-}H)]$ **2** and $[Os_3(CO)_8(Ph_3Ge)\{\mu_3\text{-}\eta^2\text{-}C{=}N(CH_2)_3\}(\mu\text{-}H)_2]$ **3**, di-substitute $[Os_3(CO)_6(Ph_3Ge)_2\{\mu_3\text{-}\eta^2\text{-}C{=}N(CH_2)_3\}(\mu\text{-}H)_3]$ **4**, and tri-sustituted $[Os_3(CO)_6(\mu\text{-}GePh_3)_3\{\mu_3\text{-}\eta^2\text{-}C{=}N(CH_2)_3\}(\mu\text{-}H)]$ **5** and imidoyl removed cluster $[Os_3(CO)_9(\mu\text{-}GePh_2)_3]$**.** Compounds **2** and **3** are isomers of each other resulted from the rearrangement of $GePh_3$ ligands relative to the imidoyl ligand about the cluster polyhedron. The $GePh_3$ ligand lies in an equatorial position, in the plane of the $Os_3$ triangle. Compound **4** is doubly coordinated, where both the $GePh_3$ ligands are terminally coordinated. Compound **5** is bridgingly coordinated by three $GePh_2$ ligand. Compound **6** is also bridgingly coordinated by three $GePh_2$ ligand but in this compound the imidoyl ligand is absent. Controlled experiment shows that upon heating **2** rearranged to **3** by ligand migration, **4** and **5** formed from **3** and **4** respectively by ligand addition. **6** formed from **5** by the loss of imodoyl moity. **Conclusion:** The Os–Ge bimetallic clusters described in this study should be useful precursors forthe preparation of new genre of bi- and polymetallic heterogeneous catalysts.

**Keywords**: Osmium, germanium, imidoyl moiety, bimatalic, catalysts.

# An Aspect of Sandor-Smarandache Function

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## Abstract

The Sandor-Smarandache function, denoted by $SS(n)$, is a newly introduced Smarandache-type arithmetic function, which involves binomial coefficients. Sandor gave the expression of $SS(n)$ when $n \geq 3$) is an odd integer, and left the remaining cases as difficult problems. In the current literature, the expressions of $SS(n)$ are found only for limited cases. This study finds some new expressions of $SS(n)$, starting from the function $SS(6m)$. Also, four tables of values of $SS(30m)$, $SS(210m)$, $SS(2310m)$ and $SS(30030m)$, calculated on a computer, are important outputs of this research.

**Keywords**: Sandor-smarandache function, binomial coefficient, diophantine equation.

# Determination of Adaption to Climate Change of Wheat Crops in Bangladesh and its Impact on Productivity

**Group:** Physical-Science **Project ID:** SRG-226648

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## Abstract

Climate change's impact on crop production is a global concern. This paper explores at measuring the technical efficiency of wheat production under changing climate areas of Bangladesh. The employed farm level cross sectional data taken from 460 and 290 farmers using purposive random sampling technique from three district Rangpur, Dinajpur, Thakurgoan northern region in Bangladesh. The study considered two successive years 2020 and 2021 as normal and drought year respectively on the basis of farmers' opinion and information collected from meteorological station. The empirical results of technical efficiency model showed that the effects of size of land, seed kg, fertilizer costs and Irrigation cost were significant in the production of wheat for drought year. Household size and farming experience had negative effects on technical inefficiency of farmers which indicates that technical inefficiency decreases with the increase of these factors in both normal and drought years. The mean technical efficiencies were 76 and 50 percent in normal and drought years respectively which indicating that farmers were 25 percent more efficient in normal year than drought year. Now, research to assess the rainfall, temperature variability and its effect on wheat production over the last fifty-five years revealed the trends of ups and downs which victimized by different climatic elements. The correlation coefficient indicated strong positive relationship among productivity of wheat and average seasonal rainfall, temperature. Hence, the investigator recommends strengthening agricultural research and extension services to farmers, including education and training to develop effective adaptation strategies to climate change.

**Keywords**: Wheat, technical efficiency, climate change, rainfall, temperature.

# The *In Silico* Screening with Quantum Calculations and Machine Learning Against Dengue Virus by the Natural Product Nano-composition of Green Tea

**Group:** Physical-Science **Project ID:** SRG-226649

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## Abstract

**Background:** The most widespread mosquito-borne pathogen of significant worldwide concern is the dengue virus, which affects between 50 and 100 million people around the world. **Objectives:** The goal of this research is to identify any - present in green tea that inhibit the spread of the dengue virus. **Methodology:** A molecular docking strategy is used to connect phytochemicals to proteins with the PDB IDs 4lcy and 5xc6**.** Gaussian 9.0 computes QM-based geometry optimizations and chemical reactivity. SWISS-MODEL for pass prediction and ADMET characteristics, while PyMOL was used for alignment. MD simulations were run in the Linux environment using Maestro-Desmond. **Findings:** The extraction of green tea leaves has been shown to yield a rich brew of phytochemicals. After a very thorough molecular docking experiment, it was found that Hit-1 ((+)-Catechin), Hit-3 ((-)-Epigallocatechin (EGC)), and Hit-4 ((-)-Epicatechin gallate (ECG)) all had binding affinities scores of -7.8 kcal/mol (> 6.0 kcal/mol), -7.8 kcal/mol (>6.0 kcal/mol), and -9.0 kcal/mol (> 6.0 kcal/mol), respectively, against NS2. Hit-1, Hit-3, and Hit-4 were shown to have -9.1 kcal/mol, -7.4 kcal/mol, and -7.2 kcal/mol competitive affinities, respectively, toward NS3. Each of the three compounds named above can be analyzed with the help of the Lipinski rule. The hazardous potential has been demonstrably reduced, as evidenced by positive ADME and Toxicity profiles and pass prediction results. The MD simulations trajectory exhibited, the RMSD, RMSF, SASA, and rGy values, as well as the ligand-protein interactions, were all within the allowable ranges. This was the case both for the values themselves and for the relationships. **Conclusions:** It's encouraging to see that Hit-1, Hit-3, and Hit-4 have potential as dengue vector control agents. Therefore, green tea may open up new avenues for the study of dengue treatments.

**Keywords**: Molecular docking, MD simulation, ADME, Quantum mechanics and Toxicity.

# Cubic Copper Oxide Nanoparticles Synthesis by Hydrothermal Method and Heat Transfer Assessment of CuO-Water Nanofluids

**Group:** Physical-Science **Project ID:** SRG-226650

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## Abstract

Currently, industrial and other heat management is a crucial problem. Objective of this paper is to synthesis of spherical copper oxide (CuO) nanoparticles (NPs) via the chemical precipitation method, as well as experimental forced convective heat transfer coefficient (HTC) measurement of low concentration CuO–Water/PVP nanofluids (NFs) in laminar flow, and compared with the base fluid. The precipitation reaction was performed at room temperature in a beaker. In the beginning, CuO NPs were synthesized using copper acetate monohydrate [$Cu(CH_3COO)_2.H_2O$] as a precursor and sodium hydroxide (NaOH) as a reducing agent, and then characterized using various techniques of ultraviolet-visible spectroscopy (UV–vis), X-ray diffraction (XRD), and transmission electron microscopy (TEM). The product's characteristic UV–vis peak at 426 nm ($\lambda$max ) indicated primarily the formation of CuO NPs. An XRD pattern of the product revealed crystallinity of CuO. TEM analysis revealed the spherical shape of synthesized CuO NPs with an average particle size of about 8 nm. Then, 100 mL of CuO–Water NFs were formulated at the concentration of 0.1, 0.2, and 0.3 vol% by adding the required CuO NPs to water with the aid of 2 wt% of polyvinylpyrrolidone (PVP) as a surfactant and ultrasonication. Next, the stability of the prepared NFs was assessed by time-lapse sedimentation observation, zeta potential ($\zeta$), and dynamic light scattering (DLS). Finally, the HTC of CuO–Water NFs was experimented utilizing a vertical shell and tube heat transfer apparatus and a computer-based data recorder to compute the forced convective HTC of NFs in laminar flow at a Reynold number (*Re*) of 400. The obtained results indicate that adding only small amounts of CuO NPs to water can significantly increase the HTC, which is encouraging for industrial and other heat management applications.

**Keywords**: Spherical **c**opper oxide nanoparticles; TEM; CuO–water NF; shell and tube heat exchanger; convective HTC.

# Nonenzymatic Amperometric Detection of Nitrite at Cobalt based Supramolecular Polymer Modified Glassy Carbon Electrode

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## Abstract

Nitrite ions are well known inorganic micropollutant that are hazardous and also responsible for various diseases, in case of infants, adults and also in case of newly born child [1]. Several methods have been reported for the determination of nitrite such as chromatography, capillary electrophoresis. Electrochemical methods are preferable over other methods for the detection of such analysis because they are complex, relatively less sensitive, less accurate and expensive. Since nitrite is electrochemically active, so it can be detected with electrochemical techniques such as CV, DPV and EIS. To overcome complexity and serious problems about the nitrite sensor, the objective of the present work is the determination of the best possible way to synthesize Co(II)-based metallo supramolecular polymer (polyCo). In this research work, The Co(II) metal and the bisterpyridine ligand were complexed 1:1 to create the polyCo. The produced polymers 1:1 complexation and bundle morphology were verified by the UV/vis titration and SEM. EDS confirmed the presence of the Co ion in polyCo. The molecular weight of the polyCo was found to be 4.24 x $10^4$ Da. The produced polyCo/GCE electrodes electrochemical characteristics were investigated in 0.1 M PBS (pH 7.0). We determined the unit less charge transfer coefficient (α) to be ≈ 0.0642, suggesting the irreversible nature of the oxidation process, by examining the experimental characteristics of polyCo/GCE. The concentration of nitrite has been determined by measuring the well-defined oxidation peak of nitrite at +0.8 V at the polyCo/GCE modified electrode. The concentration variation using DPV techniques showed linear ranges between 2 μM – 1000 μM, with a determined LOD of 0.2953 μM for the DPV. Therefore, based on the results, polyCo may be utilized to create an inexpensive and efficient environmental pollution detector.

**Keywords:** Metallo-supramolecular polymer, Electrochemical detection, nitrite, CV simulation, Amperometry.

# Acetyl-CoA Carboxylase Inhibitory Activity of Phenyl Oxadiazole Compounds (POC): Design' Synthesis' Drug-likeness Properties Evaluation and Mode of Action Studies as Broad Spectrum Antibiotics

**Group:** Physical-Science **Project ID:** SRG-226652

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## Abstract

**Background:** Small molecule heterocyclic compounds have received much interest in the field of medicinal chemistry due to their wide applications. Therefore, a series of new phenyl hydrazones and their corresponding 1,3,4-oxadiazoles were synthesized and evaluated for their *in vitro* antimicrobial activities. **Objectives:** Here we focused on the synthesis and biological properties evaluation of phenylhydrazones and phenyl-1,3,4-oxadiazoles as ACC inhibitors. The *in vitro* bactericidal and fungicidal activities of synthesized were measured against four bacterial and two fungal strains. **Methodology:** A series of phenylhydrazones and their corresponding phenyl-1,3,4-oxadiazoles were prepared using a facile, straight-forward reaction from a methyl benzoate and hydrazine hydrate followed by the condensation with substituted aldehydes, which on cyclization using acetic anhydride under reflux condition yielded phenyl-1,3,4-oxadiazoles. *In vitro* bactericidal properties were screened against two gram-positive *e. g. S. aureus* and *B. subtilis*, and two gram-negative *e. g. E. coli* and *P. aeruginosa* bacteria, and fungicidal properties were screened against *T. harzianum* and *A. niger* fungi. **Findings:** The desired phenylhydrazones and phenyl-1,3,4-oxadiazoles were synthesized successfully with a yield of 46-87% and 62-85%, respectively, and characterized using FT-IR, $^{1}$HNMR and mass spectral techniques. *In vitro* bactericidal screening results revealed that all the compounds exhibited significant activities against all tested bacterial strains. Among the phenylhydrazone analogues, *N*-(4-nitrobenzylidene)-benzohydrazide showed the highest inhibitory activities against *S. aureus* (IZD 17 mm) followed by *N*-(4-fluorobenzylidene)-benzohydrazide against *B. subtilis* (IZD 16 mm). While among the phenyl-1,3,4-oxadiazoles, *N*-[4-acetyl-2,5-(phenyl)-[1,3,4]-oxadiazole showed highest activity against *S. aureus* (IZD 15 mm) followed by *N*-[4-acetyl-5-(phenyl)-[1,3,4]-oxadiazole-2(2,4-dimethylphenyl) against *E. coli* (IZD value of 13 mm). According to the *in vitro* fungicidal screening results, *N*-[4-acetyl-2,5-(phenyl)-[1,3,4]-oxadiazole exhibited the highest activities against *T. harzianum* ( IZD 11 mm). **Conclusion:** The results obtained would help in the design and synthesis of new phenylhydrazones and 1,3,4-oxadiazoles to find a lead as a potential ACC inhibitor for infectious disease treatment.

**Keywords**: Phenylhydrazone, 1,3,4-Oxadiazole, bactericide, fungicide, ACC inhibitors.

# Synthesis of Visible Light Driven Bifunctional g-C3N4 Modified ZnO for the Simultaneous Oxidation and Removal of Arsenic

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## Abstract

Water pollution by arsenic is an alarming problem worldwide. Photocatalytic removal of arsenic by simultaneous oxidation and adsorption is one of the most efficient techniques. In this work, g-$C_3N_4$/ZnO composite photocatalyst was synthesized using simple hydrothermal method and arsenic oxidation and removal by adsorption was carried out using this photocatalyst. Synthesized photocatalyst was characterized using various characterization techniques like X-Ray diffraction (XRD), FTIR and UV visible spectrophotometric method. The photacatalytic activity of g-$C_3N_4$/ZnO was evaluated under visible light and UV irradiation. Various parameter that influence the photocatalytic oxidation and adsorption of As(III) was optimized. XRD analysis revealed that ZnO exists as wurtzite form. The FT-IR spectra reveal the presence of -OH, C-N and Zn-O group in the photocatalyst. The optical studies were conducted with UV-visible absorption which indicated that the bandgap of g-$C_3N_4$/ZnO was decreased due to coupling. Photocatalytic oxidation of arsenic solution of different concentrations shows that about 93.4% of arsenic was removed for 10 ppm and 79.5% of 20 ppm within 4 hrs in visible light irradiation. Similar efficiency was also observed in the case of UV irradiation. During oxidation, around 60% of arsenic was removed from 30 ppm arsenic solution by adsorption onto catalyst surface. It was found that photocatalyst shows higher adsorption of arsenic in presence of light than in dark indicating oxidation is suitable for arsenic removal. Investigation of the effect of pH confirms that neutral pH is suitable for arsenic oxidation and removal. Study of arsenic oxidation mechanism substantiates that photogenerated hole and superoxide radical play an important role for arsenic oxidation. Since photocatalytic oxidation and removal of arsenic is possible under visible light, this work could be a potential low cost and environment friendly solution for arsenic remediation from aqueous solution.

**Keywords**: Photocatalyst, arsenic, oxidation, adsorption, mechanism.

# Numerical Simulation on MHD Fluid Flow and Heat Transfer through a Rotating Curved Rectangular Duct with Electromagnetic Effects

**Group:** Physical-Science **Project ID:** SRG-226654

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## Abstract

Due to ample physical applications in geophysics, astrophysics, engineering and industry e.g., MHD generators, MHD flow meters, Metallurgy, MHD flow control, Jet printers' propulsion, scientists have paid considerable attention to study rotating curved duct flows with magnetic effects. In this study, a spectral-based numerical study is performed for the study of MHD flow through a rotating curved rectangular duct with electromagnetic effects. This study examines the impact of electromagnetic parameter, Hall, and ion-slip currents on two-dimensional flow of viscous, incompressible fluid in a rotating system. Numerical calculations are carried out for the Dean number $Dn$ = 1000, the Grashof number $Gr$ = 100, the Taylor number, $0 \leq Tr \leq 3500$ with $\delta$ = 0.1, $Pr$ = 7.0, $m$ = 0.01, $\alpha$ = 0.01 for the Magnetic parameter $0.0 \leq M \leq 20.00$. After a comprehensive survey, three branches of asymmetric steady solutions are obtained for M = 0.5. Then, we investigated for M = 2.5, 5.0, 7.5, 10.5, 12.5, 15.0, 17.5, 20.0 on each of the three branches and it is found that the asymmetric branches gradually shrink which becomes symmetric with the increase of M. It is found that the flux decreases as M is increased. The asymmetric/symmetric 2- to multi-vortex solutions are obtained for $0.5 \leq M < 10.5$, while only symmetric 2-vortex solutions for $M \geq 10.5$. Results show that the linearly stable zone steadily grows with rising M. The unsteady solutions are obtained as *chaotic→ multi-periodic→ steady-state→ multi-periodic; chaotic; chaotic→ multi-periodic→ steady-state; chaotic→ multi-periodic→ steady-state* and finally *steady-state* for various values of *M*. The effect of M on unsteady flow is found to reduce the tendency for frequent flow transitions. Convective heat transfer is also calculated. It is found that the hall parameter accelerated the flux and axial velocity while the ion-slip parameter accelerated the flux but no significant effect on the secondary flow and axial flow distribution.

**Keywords:** Curved duct, MHD flow, unsteady solution, dean number, magnetic parameter.

# Unsteady Natural Convection in an Initially Stratified Air-filled Trapezoidal Cavity with Stratified Side Walls

**Group:** Physical-Science **Project ID:** SRG-226655

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## Abstract

This project focuses on studying the transient behavior of natural convective heat and fluid flow in a trapezoidal cavity subjected to a heated bottom surface, cooling from top and thermally stratified inclined surfaces. Because of the unrevealed transitional effect of 2D valley-shaped trapezoidal cavity with differentially heated walls with initially stratified fluid, the study in this project has been aimed to observe the transition to a chaotic flow in the cavity with differentially heated walls with initially stratified air based on 2D numerical results. The Finite Volume (FV) method-based Navier-Stokes solver Fluent 17.0 is utilized for the numerical simulation of the natural convective flow within the cavity. To solve the governing equations, the FV method is employed in conjunction with the SIMPLE scheme. The viscous terms are discretized using a second-order central differencing method, while the advection terms are discretized applying a third-order realistic QUICK scheme. The study considers with a Prandtl number is set to 0.71, an aspect ratio of 0.5, and a large array of Rayleigh numbers ranging from $10^0$ to $10^8$ is considered. The research examines how the Rayleigh numbers affect the flow structures and transitional phenomena within the cavity. The transitional flow reveals several supercritical bifurcations. These include a changeover from symmetric to asymmetric states known as a Pitchfork bifurcation, and a shift from a steady-state to a periodic state referred as a Hopf bifurcation. The Pitchfork bifurcation happens between Ra values of $10^5$ and $2 \times 10^5$, while the Hopf bifurcation happens within the range of Ra values from $4.7 \times 10^5$ and $4.8 \times 10^5$. To examine the flows during the changeover to chaos Power spectral density (PSD), limit points, limit cycles, trajectory in phase space and the largest Lyapunov exponent are used. The flow phenomena within the cavity are measured and verified.

**Keywords**: Trapezoidal cavity, transitional flow, natural convection, stratified fluid, finite volume method.

# Reactivity Study of Acetyl Substituted Five Membered Heterocycles with Group VIII Metal Carbonyls

**Group:** Physical-Science **Project ID:** SRG-226656

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## Abstract

Fused aromatic rings compounds containing heteroatoms within the ring enclosure offers a rich and diversified chemistry when reacted with group VII and VIII metal carbonyls. Especially nitrogen, phosphorus containing heterocycles with substituents such as oxygen, sulfur, selenium, or tellurium are of special interest. Therefore, the reactivities of such heteroatomic polycoordinating ligands with trimetallic carbonyl frameworks i.e. $Os_3(CO)_{12}$ and $Ru_3(CO)_{12}$ is worth investigating. New types of bonding modes with the subsequent C-H and N-H activation are expected. Inspired by the previous literature precedence, we investigated the reactivity 2-acetylpyrrole with triruthenium dodecacarbonyl. All the reactions were carried out under normal atmosphere unless otherwise noted. Reagent-grade solvents were dried using appropriate drying agents and distilled prior to use by standard methods. Products were separated in the air by precipitation followed by filtration. The reaction of $[Ru_3(CO)_{12}]$ with 2-acetylpyrrole in benzene at 80℃ for 2 h furnished two binuclear compounds $[Ru_2(CO)_6(\mu\text{-}\kappa^2\text{-N-}C_6H_6NO)_2]$ (1) and $[Ru_2(CO)_6(\mu\text{-}C_6H_6NO)\ (\mu\text{-}\kappa^2\text{-N-}C_6H_6NO)]$ (2) in 43 and 38 % yields respectively. 1 is a binuclear compound where the 2-acetylpyrrole ligands symmetrically chelate along the Ru-Ru bond acting as three electron donor and other equatorial positions are occupied by three CO ligands at each Ru center. In 2 the 2-cetylpyrrole ligand shows two different coordination motifs. In one side of the cluster, pyrrole N is coordinated to a Ru center acting as one electron donor while permitting the acetyl-C=O group to coordinate to the second Ru center as two electron donor. In the second motif, pyrrolyl N acts as three electron donor connecting both the Ru centers as seen previously in 1. In conclusion, the reaction of $[Ru_3(CO)_{12}]$ with 2-acetylpyrrole furnished two binuclear compounds. Both the compounds 1 and 2 follow 18-electron rule and are saturated compounds. The versatile ligand 2-acetylpyrrole showed two different coordination motifs namely donating 3 and (2+1) electrons in reactions with $Ru_3(CO)_{12}$.

**Keywords**: Heteroaromatic, 2-acetylpyrrole, ruthenium dodecacarbonyl, trimetallic.

# Synthesis, Characterization and Catalytic Behavior of Low Valent Transition Metal Saccharinate Complexes

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## Abstract

Transition metal saccharinate complexes have already been employed to catalyze certain types of organic transformations such as cyclopropanation of nucleophilic alkenes with methyl diazoacetate and intramolecular carbenoid C–H insertion of □-diazo esters. Our principal objective was to synthesize new rhenium-based metal saccharinate complexes that can be used as catalysts or pre-catalysts in organic transformations. To achieve this goal, we have examined the reactivity of saccharin (sacH) towards the labile dirhenium complex $[Re_2(CO)_8(NCMe)_2]$. This reaction was conducted in toluene at room temperature using standard Schlenk techniques under nitrogen and the products were separated in the air by TLC plates coated with of silica gel. Three rhenium complexes bearing a sac ligand was isolated from this reaction: the dinuclear $[HRe_2(CO)_8\{\mu\text{-}(N,O)\text{-}sac\}]$ (1), which contains a bridging sac ligand coordinated to both rhenium centers using the nitrogen and ketonic oxygen atoms, and the mononuclear compounds $[Re(CO)_5\{\kappa^1\text{-}(N)\text{-}sac\}]$ (2) and $[cis\text{-}Re(CO)_4(NCMe)\{\kappa^1\text{-}(N)\text{-}sac\}]$ (3), both of which contain a sac ligand bonded to rhenium using only the nitrogen atom. Complex 3 contains a labile MeCN ligand and reacts with 4,4′-bipyridine (4,4′-bpy) at room temperature to yield $[Re(CO)_4\{\kappa^1\text{-}(N)\text{-}sac\}]_2(4,4'\text{-}bpy)$ (4) in which two $[Re(CO)_4\{\kappa^1\text{-}(N)\text{-}sac\}]$ units joined by the 4,4′-bpy ligand. The molecular structures of 1-4 have been established by X-ray crystallography, and the bonding in compound 1 has been examined by electronic structure calculations. Further investigations to explore the catalytic properties of both the mono and dirhenium complexes are currently going on in our laboratory.

**Keywords**: Carbonyls; DFT; rhenium complexes; saccharinate; X-ray structures.

# Synthesis of New Quaternary Ammonium Compounds having Cyclic Head Groups as Surfactants: Experimental and Theoretical Investigation of Solution Properties

**Group:** Physical-Science **Project ID:** SRG-226658

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## Abstract

Three quaternary ammonium surfactants having cyclic head groups named TDMAPB (Tetra-decyl-dimethyl-amino-pyridinium bromide), CDMAPB (Cetyl-dimethyl-amino-pyridinium bromide), and ODMAPB (Octa-decyl-dimethyl-amino-pyridinium bromide) has been synthesized and characterized. The solution properties including other electronic properties of these surfactants have been estimated theoretically for further application in various industries. Surfactants have been synthesized using a facile synthetic procedure and purified by recrystallization. The computational calculations were carried out using Gaussian-09 software. The structural analysis, band gaps analysis, chemical hardness, IR and UV-Vis spectral study have been investigated by using the density functional theory (DFT) method with the B3LYP functional and LANL2DZ basis set. The three new quaternary ammonium surfactants having cyclic head groups such as the pyridinium head group have been synthesized with a high yield of 76%. It has been found that the dihedral angle between the hydrophobic tail and hydrophilic tail of the newly synthesized surfactants is $79^{o}$ whereas in the CPB the similar dihedral angle is $71^{o}$. A similar bond distance between the bromine and the surfactant molecule is observed. The band gap (HOMO-LUMO) of synthesized surfactants is higher than reference CPB surfactants indicating more stability. From the calculated UV-Vis spectroscopy, it has been found that the $\lambda_{max}$ of synthesized surfactants are red-shifted and the molar absorptivity coefficient is higher compared to commercially available CPB. Calculated spectra of surfactants and the reference CPB. The calculated results are quite consistent with the experimental IR data. Synthesized quaternary ammonium surfactants having 4-Dimethylaminopyridine head group and hydrophobic tail having C-14, C-16, and C-18 tail group. The synthetic procedure is very simple and the separation process is convenient. Electronic properties reveal that the synthesized quaternary ammonium surfactants have greater stability than the corresponding CPB. The stability is due to the introduction of the N, N-dimethyl group in the para position of the pyridinium head group.

**Keywords**: Cationic surfactants, facile synthesis, pyridinium head group, HOMO-LMO gap, molar absorptivity coefficient.

# Developing a Green Method for Extraction and Synthesis of Organic Compounds

**Group:** Physical-Science **Project ID:** SRG-226659

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## Abstract

Sub critical water is an excellent solvent for extraction of natural products. The critical temperature and pressure of subcritical water is 200□C and 20.2 MPa. Having low dielectric constant and high ion product water under near critical conditions became a suitable solvent for hydrolysis and extracted organic compound even without any additives. The main objectives of my present work to extract valuable compounds by using subcritical water and establish green technique for compounds extraction have been characterized by IR, NMR and other spectroscopic methods. This research focuses on the extraction of organic compounds in subcritical water (200□C and 20.2MPa) with the assistance of stainless-steel autoclave. The plant Centella asiatica is locally known as Thankuni in different region all over Bangladesh belongs to the family of Apiaceae and genus Centella is a small herb and an important member of medicinal plants. This plant has attracted the attention of the chemists for its medicinal value. Centella asiatica whole plant was purchased from the local market at Savar New Market in Dhaka. Centella asiatica plants were dried in absent from sun light. The Centella asiatica plants were grind in a grinding machine to an average particle size and extracted by sub critical water. The extract was subjected to thin layer chromatography. Total three compounds were isolated from the fractions. The extraction yields of Asiatic acid and Quercetin analogous using subcritical water at 200 $^{0}$C and 20.2 MPa were higher than extraction yields using conventional liquid solvent extraction with methanol or ethanol at room temperature while the subcritical water extraction yields were lower than extraction yields with methanol or ethanol at its boiling point temperature. Bioactive components Quercetin analogous and Asiatic acid was extracted from Centella asiatica using subcritical water as an extraction solvent.

**Keywords**: Sub-critical water, *Centella asiatica*, asiatic acid, quercetin, chromatography.

# A Solvent-free Green Approach for the Syntheses of some Prenylflavones Under Microwave Condition for the Screening of their Antimicrobial Activity

**Group:** Physical-Science **Project ID:** SRG-226660

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## Abstract

A distinctive feature of the prenylated polyphenoles is the possession of biological activity such as insecticidal, anti-fungal, antioxidant, and anticancer properties. Prenyl- as well as soyisoflavones also has potential for the complementary and/or alternative chemoprevention therapies against long-term health problems associated with menopause. Due to their diversified activities isoflavones have been receiving considerable attention in the fields of medicine, food supplements, agrochemicals and cosmetics in recent years. Different chalcones were synthesized using cross aldol condensation reactions. The Pd(0)-catalyzed coupling reaction of 6-iodotetraalkoxyisoflavone, which was obtained from the oxidative rearrangement of 3′-iodotetraalkoxychalcones, with 2-methyl-3-butyn-2-ol under microwave (MW) irradiation afforded 6-alkynylisoflavone. The tosyl- and benzoyl-protected alkynyl-tetra-alkoxy-isoflavone udergoes acid catalyzed dehydration with *p*-TsOH.$H_2O$ under MW irradiation afforded targeted flvones and ioflavones. An excellent regioselectivity was achieved in the case of MW dehydration compared to conventional heating (CH) in prenylaion reactions. The biological screening of the prepared compounds was performed against one gram negative bacteria *(Escherichia coli)* and one gram positive bacteria (*Staphylococcus aureus*), using ciprofloxacin as a standard reference. The antibacterial screening revealed that the compounds A-03, A-07, A-08, A-11 and A-13 showed moderate activity. Rest of the compounds showed no activity against all organisms at the said concentrations. As per chemical structural features there were mainly two different types of compounds synthesized under the study area. It is obvious that structural variation brings about the bioactivity and, of course, structural modification of molecules alters the biological activity in a regular trend. Without exception this has been reflected in the case of the synthesized precursors of varying their structural moieties.

**Keywords**: Isoflavone, anticancer activity, microwave condition, green chemistry, chalcone.

# Synthesis, Characterization of Oxomolybdenum (VI) Complexes Containing Various Organic Ligands and their Possible Catalytic Studies on Different Organic Substrates

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## Abstract

The transition-metal complexes with coordinating amino bis(phenolato) ligands have been recognized a key role to design the different potential catalysis and their biological studies over past decades. The principal aims of the proposed project was to design and synthesize the potential ligands and their molybdenum (VI) oxo complexes. The findings of this project are summarized here, a tripodal tetradentate aminobisphenol ligand precursor, H3L1 [6,6'-(((2-hydroxy-2-phenylethyl)azanediyl)bis(methylene))bis(2,4-di-tert-butylphenol)]was synthesized and characterized and used to synthesize new dioxomolybdenum(VI) complex [MoO2(L1)] (1) with the available starting precursors such as [MoO2(acac)2] and [MoO2Cl2]. The another cis-dioxomolybdenum(VI) complex [MoO2(L2)(H2O)] (2) containing the tridentate hydrazone-basedligand (H2L2 = (E)-4-(tert-butyl)-N'-(2-hydroxy-3-methoxybenzylidene)benzohydrazide) has been prepared. All experiments were accomplished under ambient conditions. Complex 1 and 2 were also characterized by via IR, 1H NMR spectroscopy analysis and the solid-state molecular structure of 1 has been determined by X-ray single crystal analysis. Few more characterization processes are still going on especially mass analysis and the process of recrystallization of complex 2 to grow a nice single crystal for molecular structure. The structure of complex 1 is a distorted octahedral coordination sphere under O3N coordination environment. The both complexes were exhibited moderate to good catalytic oxygen atom transfer (OAT) reaction with PPh3 in the presence of deuterated dimethylsulfoxide used as an oxidant at 50 °C. The catalytic activities of complex 1 and 2 have been primarily evaluated for various oxygen atom transfer (OAT) reactions, namely, sulfoxidation and epoxidation reaction of various substrates with tert-butyl hydroperoxide (TBHP) or aqueous H2O2 as the terminal oxidants. Such catalytic studies are currently under investigation and will be finished all the necessary experiments in the near future. Furthermore, from the preliminary results, both compounds are also less active in the epoxidation and comparatively good yields for the reaction of sulfoxidation was observed.

**Keywords**: Tripodal, aminobisphenol, oxo-transfer, oxidant, sulfoxidation.

# Adsorption of Sparfloxacin onto Graphene Oxide in Aqueous Solution: Kinetic, Equilibrium and Thermodynamic Studies

**Group:** Physical-Science **Project ID:** SRG-226662

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## Abstract

Pharmaceutical pollution poses a significant danger to global health. Due to their high solubility in aqueous medium, antibiotics are extremely difficult to remove. This study successfully synthesized graphene oxide (GO) as an exemplary adsorbent material for the removal of sparfloxacin from aquatic environments. The synthesized GO particles were characterized using Ultraviolet-visible (UV-Vis), Fourier transform infrared (FT-IR), X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), Scan electron microscopy (SEM), Transmission electron microscopy (TEM), Energy dispersive X-ray (EDX), Particle size, and Thermogravimetric analysis (TGA) techniques. The surface area of GO was determined to be 32.25 $m^2/g$ using the BET technique. GO's $pH_{pzc}$ value was estimated to be 2.5. The adsorption behaviors of sparfloxacin onto GO were examined in terms of the variation in adsorption time, medium pH, adsorbent quantity, sparfloxacin concentration, salt concentration, and solution temperature. The pseudo-second-order kinetic model provided a superior fit to experimental kinetic data than the pseudo-first order and Elovich models. Experimental isotherm data supported the Langmuir isotherm model, which had a maximal absorption capacity of 1,428.57 µmol/g at 25ºC. After five adsorption/desorption cycles, a regeneration investigation determined that the adsorption efficiency of GO was greater than 90%.

**Keywords**: Graphene, sparfloxacin; dimethylformamide, kinetics, thermodynamics.

# Investigation of Iron doping effect on Copper-Zinc-Tin Sulfide (CZTS) Thin Film for Solar Cell Applications

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## Abstract

As a promising candidate as absorber layer in thin film solar cells, the $Cu_2ZnSnS_4$ (CZTS) material has earned a great interest over recent years for the production of low-cost solar cells due to its direct and tunable band gap energy, high optical-absorption coefficients and also due to the abundance and the non-toxicity of all its constituents. To solve the problem the expensive and vacuum based synthesis or deposition techniques, simple and low-cost methods have been applied for the preparation of this material. In this work, a simple and easy technique was applied for the preparation of the layer, which is spin coating process. Normally $CuCl_2.2H_2O$, $ZnCl_2$, $SnCl_2.2H2O$ and thiourea were used. For making a solution MEA (mono-ethanolamine) and 2-methoxyethanol were also used. Monoethanolamide was used as a stabilizer here. CZTS is used as an absorber layer because of its optical and elemental property. It has a direct band gap of 1.5 ev and absorption co-efficient is 104 $cm^{-1}$. The XRD pattern shows the kesterite structure corresponding to the planes of (112) and (220). In this work, after the deposition of thin film layer, XRD and UV-Vi's analysis were done. Some differences are also shown in this work. That is, Zn was replaced by a different concentration of Fe. Due to the presence of d-6 electronic configuration within $Fe^{2+}$, Fe shows spin magnetic moment per ion is 3.33μB. For CFTS the estimated band gap is 1.87 eV, which is near the band gap of CZTS. Different measurements or calculations were done from the XRD and UV-Vi's analysis, like lattice constants, band gap measurement, absorption co-efficient etc. So, CZTS thin film solar cell shows the properties which are very effective. It can be predicted that CZTS and similar CFTS thin film solar cells will be used as a effective alternative of sources of energy in our future days.

**Keywords**: Thin film, absorber layer, optical properties, X-ray diffraction, band gap.

# Synthesis, Structural and Infra-red (IR) Spectrum Analysis of Kagome Lattice Compound, MgxFe4-x(OH)6Cl2

**Group:** Physical-Science **Project ID:** SRG-226664

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## Abstract

The magnetism in solids has received a lot of interest since ancient times because of scientific and technological importance. The advancement in the field of magnetism has started from the studies of strongly correlated electron system in which the collective interaction between the electrons is treated by quantum mechanical effect and provide the opportunity to find novel states of matter. The geometrical frustration which is supposed to arise due to lattice geometry of the crystal for which the coupling between the lattice and the spin makes it difficult for a system to gain lowest possible energy states has been playing a central role to induce such novel states of matter. The competition between the lattice frustration and the exchange interaction in the frustrated system results unconventional ground states like spin liquid, spin ice, spin nematic, and spin-glass, etc. Geometrical frustration is usually found in 3D-pyrochlore lattice, triangular lattice, and Kagome lattice geometry. The Kagome lattice is suitable to understand the noble states like spin liquid in solids because of having large degenerate ground states in compared to other lattice geometry. Considering the importance of understanding the Kagome lattice geometry, current research has been emphasizing the Kagome lattice antiferromagnet, $Mg_xFe_{4-x}(OH)_6Cl_2$ compound. Geometrically frustrated Kagome lattice antiferromagnets $Mg_xFe_{4-x}(OH)_6Cl_2$ has been successfully synthesized using hydro-thermal reaction at inert atmosphere. The structural characterization has been done with X-ray diffraction (XRD) technique which was analyzed by Rietveld based refinement technique called Rietan-FP. The present compound crystal in rhombohedral structure with space group R-3m. The derived structure shows early signs of geometrical frustration which is the source of large degeneracy in the ground state of the Kagome lattice.

**Keywords**: Geometrical frustration, antiferromagnet, kagome lattice, degeneracy, refinement.

# Synthesis of Semiconducting Nanoparticles by Hydrothermal Method for Renewable Energy

**Group:** Physical-Science **Project ID:** SRG-226665

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## Abstract

Semiconducting nanoparticles were synthesized by hydrothermal method within a self-designed stainless-steel autoclave, sealed and heated at various temperatures. X-ray diffraction analysis revealed the single-phase monoclinic structure of ZnO and CuO nanoparticles. Crystallite size increased from 10.08 to 37 nm along with elevated growth temperature from 100ºC to 150ºC for ZnO. XRD analysis measured single-phase monoclinic structure of CuO nanoparticles with an average grain size of 25, 33, and 66 nm at 105, 120, and 150$^0$C temperature respectively. Fourier Transform Infrared spectroscopy identified representative bands of CuO nanoparticles at 609.51 & 507.28 cm$^{-1}$, 519.15 & 605.65 cm$^{-1}$ and 518.85 & 611.43 cm$^{-1}$ for synthesis temperature of 105, 120 and 150 $^0$C respectively. UV-Vis spectroscopy identified broad characteristics absorption bands of ZnO centered at 373 nm, 365 nm at growth temperature 100 ºC and 150 ºC respectively which was considerably blue-shifted. UV-Vis spectroscopy determined a broad characteristics absorption band of CuO nanoparticles near about 300 nm for three different temperatures. CuO nanoparticles prepared at highest temperature (150 $^0$C) exhibited most transmittance among the three. By using Tauc plot, Bandgap was calculated of 1.55, 1.60 and 1.88 eV for three samples prepared in 105, 120, and 150$^0$C respectively. Bandgap was also calculated of 3.60 & 3.05 eV at growth temperature 100ºC and 150ºC for ZnO. Electrical properties of CuO nanoparticles exposed that resistivity decreases by increasing temperature which was in accordance with well-known semiconductors. Impedance analyzer revealed that dielectric constant and Q-factor of CuO nanoparticles were increased along with increasing temperature. Shape and size of CuO nanoparticles were varied with preparation temperature. Adding temperature of NaOH and $CuCl_2.2H_2O$ solution had an important influence on shape and size of CuO nanocrystals. Due to wide bandgap and electrical properties of ZnO and CuO nanoparticles can be used in electronic devices, including renewable energy applications.

**Keywords**: ZnO and CuO nanoparticles, autoclave, optical properties, resistivity, bandgap.

# Nanocatalyst Based on Silver Nanoparticles and Produced Braphene Oxide Suing Plant Sources of Bangladesh

**Group:** Physical-Science **Project ID:** SRG-226666

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## Abstract

The utilization of silver nanoparticles (AgNPs) decorated reduced graphene oxide (rGO) nanocatalysts for wastewater water treatment is an effective technique. But the chemical fabrication of such nanocatalysts is a crucial drawback and the implication of the biogenic approach could be a promising alternative. Therefore, in this study, we focused on using plant sources in Bangladesh to fabricate nanocatalysts based on silver nanoparticles and reduced graphene oxide through a one-step process and applied them to wastewater treatment. In a typical procedure, GO, $AgNO_3$ and pre-treated solid support will be mixed with an aqueous extract of *Piper chaba* stem by sonication then the mixture will be heated on a thermostat. It found that *Piper chaba* stem extract effectively and simultaneously reduces the $Ag^+$ ions and GO to form AgNPs/rGO nanocomposite as confirmed by X-ray diffraction and ultraviolet visible spectroscopic analysis. The anchoring of AgNPs on rGO was confirmed by scanning electron microscopy analysis. An identical synthetic route was employed for the fabrication of AgNPs/rGO nanocomposite on a treated loof obtained from nature as a solid support. The resultant AgNPs/rGO nanocomposite and AgNPs/rGO/solid support showed excellent catalytic efficiency toward the reduction of 4-nitrophenol to 4-aminophenol using sodium borohydride as a model reaction for the reduction of organic dyes. In addition, the AgNPs/rGO/solid support exhibited good reusability with a conversion of 4-NP of 97% in the $5^{th}$ cycle. The merit of this fabrication lies in its low cost, use of non-toxic chemicals, use of agricultural waste, less processing effort, and ease of reproducibility. The synthesized nanocatalysts may have excellent catalytic efficacy with rapid recyclability in wastewater treatment that helps to contribute significantly to the effluent treatment plants (ETP) of dying and chemical treatment industries in Bangladesh for reductive degradation of organic pollutants.

**Keywords**: Nanoparticles, nanocatalyst, green synthesis, solid supports, wastewater.

# Syntheses of Zinc (II) and Cobalt (II) Complexes with O.N. S Donor Biogenic Heterocyclic Ligands and their Bioactivity and Insulin Mimesis Screening

**Group:** Physical-Science **Project ID:** SRG-226668

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## Abstract

The synthesis and characterization of new metal complexes with antimicrobial agents are of great importance for understanding the drug-metal ion interaction and for their potential pharmacological use. In this research, there are five new Zn(II) and Co(II) complexes $[Zn(PTC_2]$,$[Zn(Cou\text{-}3\text{-}COO)_2]$,$[Zn(Ind\text{-}3\text{-}COO)_2]$, $[Co(pic)_2(H_2O)_2]$, and $[Co(2\text{-}GB)_2]$ have been synthesized and their structure was determined by FT-IR, UV-Vis, and $^1H$ NMR spectroscopic measurements. The bioactivity evaluation of the Zn(II) and Co(II) complexes and their corresponding ligands were also determined. The complexes of Zn(II), $[Co(pic)_2(H_2O)_2]$ and $[Co(2\text{-}GB)]^{2-}$ adopt tetrahedral, octahedral, and distorted octahedral structure respectively in which the corresponding ligands coordinate to Zn(II) and Co(II) center in bidentate fashions but the ligands coordinate to Co(II) center of the complex $[Co(2\text{-}GB)]^{2-}$ in tridentate fashions. The complexes are stable in amorphous state and in an aerobic solution. The $[Zn(PTC)_2]$,$[Zn(Cou\text{-}3\text{-}COO)_2]$ complexes are effective against all tested gram-negative and gram-positive bacteria but ineffective against *Staphylococcus* and *E.Coli*. $[Co(2\text{-}GB)_2]^{2-}$, $[Zn(Ind\text{-}3\text{-}COO)_2]$ and $[Co(pic)_2(H_2O)_2]$ complex is effective against all tested gram-negative and gram-positive bacteria. The results were also compared with commercially potent bactericide ciprofloxacin. The complexes $[Zn(Cou\text{-}3\text{-}COO)_2]$,$[Zn(Ind\text{-}3\text{-}COO)_2]$, $[Co(2\text{-}GB)_2]^{2-}$ and $[Co(Pic)_2(H_2O)_2]$exhibit very low activity against the fungus *Aspergillus niger*but shows good activity against *Saccharomyces cerevisiae*, *Penicillium chrysogenum* and*Neurospora crassa*. The complex $[Zn(PTC)_2]$ is very effective against *Penicillium notatum*.

**Keywords**: Metal complexes, spectroscopy, antibacterial, antifungal, ciprofloxacin.

# Synthesis of New Aromatic Azo Compounds and their Antimicrobial Studies

**Group:** Physical-Science **Project ID:** SRG-226669

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## Abstract

**Background:** Aromatic azo compounds show significant biological activities, such as antibacterial, antiviral, antifungal and antiproliferative. Besides these, the type of compounds is broadly used in cosmetics, food, textile and pharmaceutical industries as colorants or additives. **Objectives:** i) Biologically significant azo compounds synthesis, ii) Antimicrobial screening of the synthesized products, iii) Improvement of medicinal raw materials. **Methodology:** i) Synthesis of the designed Azo-compounds, ii) Purification by Column chromatography, iii) Spectroscopic characterization techniques, iv) Disc diffusion method for antimicrobial susceptibility tests (AST), v) Analysis of the spectroscopic and antimicrobial data. **Findings and Conclusion:** Herein, we designed several aromatic azo compounds and successfully synthesized them. We synthesized fourteen azo compounds and found them in high yield and good purity. Currently, antibacterial screening is being investigated of these compounds. Consequently, this research might contribute to design and develop physiologically significant antimicrobial compounds. Finally, this project might play an important role in the improvement of public health and also the pharmaceutical sector in Bangladesh.

**Keywords**: Azo compound, biological, antimicrobial, medicinal.

# Synthesis, Characterization and in silico Study of Thiazole Incorporated Coumarin Derivatives: A potential Dengue Virus Inhibitors

**Group:** Physical-Science **Project ID:** SRG-226670

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## Abstract

**Background:** In tropical and subtropical regions, the pathogenic dengue virus (DV), the fastest-growing viral disease spread by mosquitoes, poses a serious threat to global health. Due to the lack of a specific drug, vaccine, or antiviral against the DENV virus, dengue fever is a serious disease that requires further research and development. **Objectives:** To design, synthesis and in silico study of coumarin derivatives containing thiazole core which usually shows less cell toxicity and the highest tolerance to human health with specific targeting to virus-cell that show effective activity at low concentration without side effects. **Methodology:** The coumarin derivatives containing thiazole core were synthesized according to the literature and conventional methods. The reactants were specifically be chosen or designed to improve substantially the absorption, tissue uptake, and intracellular mobility. The quantum chemical studies for the molecular structural analysis of synthesized compounds were performed using GAUSSIAN 09 suit of the program. **Findings**: In this research, a number of thiazole incorporated new coumarin derivatives have been synthesized and the structure of all the newly synthesized compounds were established on the basis of FT-IR and $^{1}$H NMR spectroscopic techniques. In addition, the molecular docking studies and quantum chemical calculations by density functional theory (DFT) with B3LYP/6-311++G(2d,p) basis have been studied here. Interestingly, all of the ligands exhibited low binding free energies i.e., strong inhibitory interactions with the active sites of dengue virus (PDB ID: ID: 4OIG). According to molecular docking studies, (*E*)-3-(2-(2-(4-chlorobenzylidene)hydrazinyl)thiazole-4-yl)-2*H*-chromene-2-one (L1) and *E*)-3-(2-(2-(3-nitrobenzylidene)hydrazinyl)thiazole-4-yl)-2*H*-chromene-2-one (L2) exhibits the best binding affinity of -8.9 kcal/mol and -8.6 kcal/mol with dengue virus. These results are also strongly supported by quantum chemical investigations. **Conclusion**: In the present work, five coumarin derivatives have been synthesized and investigated by DFT and molecular docking study to assess their binding affinity towards the dengue virus.

**Keywords**: Molecular docking, Binding affinity, HOMO-LUMO, DFT calculations, and chemical reactivity descriptors.

# Investigation of Compound Target Material to Generate Higher Efficient Particle Beam from Laser-Plasma-Interaction

**Group:** Physical-Science **Project ID:** SRG-226671

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## Abstract:

Laser drivn particle acceleration has a great prospect in modern science and technology. Therefore, the prospect of proton acceleration from the rear surface of the solid compound material like silicon dioxide $SiO_2$ target while it exposed to an ultra-intense ultra-short laser pulse has been investigated through particle-in-cell (PIC) simulation. Both the amorphous and crystalline structures are studied. A good improvement might be achieved, as well as an improved beam quality. Furthermore, crystalline structures were found to generate higher energetic protons than amorphous structures.

**Keywords**: Proton beam, particle accelerator, silicon dioxide, laser, PIC simulation.

# Analyzing the Security System Through Matrices in Cryptography

**Group:** Physical-Science **Project ID:** SRG-226672

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## Abstract

The networks security has become one of the most important issues to secure data over the internet and cryptography is a technique which can be used to secure data. A symmetric cryptosystem known as a "Hill cipher" has several advantages for delivering secret messages. It appears to be the first polygraphic encryption that makes use of linear algebra; operations are carried out on a square matrix to encode and decode exchanges of information. This project presents an improve security system in respect to traditional approach, which creates keys using a square matrix of row four and column four *(4×4)*. The system compares the time required to encode and decode the message using the upgraded Hill cipher algorithm and the classical Hill cipher algorithm.

**Keywords**: Encryption, decryption, symmetric key, hill cipher, cryptography.

# Optimization of Convective Heat and Mass Transfer of Bio-Nanofluid Through a Porous Medium with The Presence of Magnetic Field: A Numerical Study

**Group:** Physical-Science **Project ID:** SRG-226673

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## Abstract

Nanotechnology applications in bio-mechanics, such as medicine, drug delivery, and cancer therapy, have brought attention to investigating bio-nanofluid flow, such as blood with nanoparticles. This study numerically investigates tapered arteries addressing the transient simulation of non-Newtonian bio-nanofluid through a porous stenosis artery in the presence of a magnetic field. The mathematical model in this study has been developed containing conservation of mass, momentum, and energy equation incorporated with ferro-hydrodynamic (FHD) and magneto-hydrodynamic (MHD) principles. The Darcy-Forcheimer mathematical model has been utilized to characterize the porous medium. The non-Newtonian rheology of nano-biofluid has been described using the power-law viscosity model. A parametric study has been considered to study the effects of the stenosis intensity and the magnetic field strength on the flow velocity, temperature, and wall shear stress. The results of a nanoparticle addition, porous medium, and an external magnetic field on the flow of bio-magnetic fluid (blood) through a stenosed bifurcated artery have been investigated. Numerical solutions are found utilizing the finite volume method based on a non-uniform grid structure. The effects of the magnetic number, the magnetic source position, the vascular obstruction ratio, the slip parameter, and the power-law index on the flow and temperature fields have been discovered with illustration. In the presence of a point magnetic source, a disturbance in the flow is observed along the centerline of the arterial channel. The streamlines exhibit a deflection and curvature around the magnetic source, indicating the influence of the magnetic field on the fluid motion. The velocity magnitude decreases near the source. The isotherm graph behaves like a non-uniform temperature distribution along the centerline, suggesting heat transfer variations due to the magnetic field effect. This disturbance highlights the significant impact of magnetization on the flow behavior and heat transfer characteristics.

**Keywords**: Bio-fluid, nanofluid, drug-delivery, numerical simulation, finite volume.

# Synthesis and Characterization of La0.9Sr0.1Fe0.7-xCuxMo0.3O3 (x=0.0' 0.05' 0.1' 0.15' 0.2) as Electrode Materials for Solid Oxide Fuel Cells

**Group:** Physical-Science **Project ID:** SRG-226674

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## Abstract

The material performance is a crucial issue in the current fuel cell technology, and for this reason we have studied a new series of LSICMo family which can be used as electrode giving a high performance in a particular application. In the present project, we have studied on the synthesis and structural characterization of $La_{0.9}Sr_{0.1}Fe_{0.7-x}Cu_xMo_{0.3}O_3$ (x=0.0, 0.05, 0.1, 0.15, 0.2) samples are successfully made by the standard solid state reaction method. The powder samples were annealed at 850$^oC$ and pallet samples were sintered at 1150$^oC$ for holding time 3 hours. Powdered samples have used in X-ray diffraction (XRD) and pallets were used for dielectric measurement, resistivity measurement and scanning electron microscope (SEM) analysis. The analysis of the XRD data shows the structural phase change of Cu doping in $La_{0.9}Sr_{0.1}Fe_{0.7-x}Cu_xMo_{0.3}O_3$ (x=0.0, 0.05, 0.1, 0.15, 0.2). Beyond the orthorhombic symmetry, the structure exhibits cubic symmetry up to 13% Cu doping. The unit cell parameter increases with increasing percentage of Cu doping. SEM images show a dense (<90%) non-porous material important for the electrolyte. The SEM provided us that the grain size of solid oxide matrix phase as well as the $CuMoO_3$ phase decreased with increasing the Cu substitutions. According to the Thermogravimetric analysis (TGA) analysis during heating process, the weight loss after 600°C by 0.32 wt % and 0.26% when cooled. The particle size is analyzed and it showed that the increasing Cu concentration leads to a decrease in particle size and the diameter range of the material (LSICMo) ranges from 0 to 2.5 μm. Another synthetic route can be used to reduce the particle size. Characterizing the key features of new materials is important to determine the need to develop experimental fields leading to green energy fuel cell applications. The project findings contribute to realizing the sustainable development technology.

**Keywords**: Electrodes, SOFC, XRD, SEM, TGA.

# The Agreement Between the Novel Exact and Numerical Solutions of The Nonlinear Models

**Group:** Physical-Science **Project ID:** SRG-226675

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## Abstract

Nonlinear models (NLMs), being an important topic in mathematical physics, have attracted a lot of attention in the international research community because they have numerous uses in human life. These NLMs are typically implemented to illuminate various complicated natural phenomena. NLMs have been seen in fluid mechanics, optical physics, signal processing, plasma physics, acoustic waves, traffic flow, atomic physics, mathematical physics, nuclear energy, and other applications. That's why we consider the Mikhailov-Novikov-Wang (M-N-W) integrable equation. In this project, we acquire exact solutions (ESs) and numerical solutions (NSs) of the M-N-W integrable equation. Primarily, we use the modified (G′/G)-expansion method (MDG/GEM) and adomian decomposition method (ADM) to find new ESs and NSs of the M-N-W integrable equation. This present project work is mainly concentrated on finding new ESs and NSs for a broad class of the M-N-W integrable equation using the MDG/GEM and ADM, respectively, and making a comparison between these two kinds of solutions. Additionally, using recent scientific instruments, the two-dimensional, three-dimensional, and contour plots are displayed, as well as comparison plots between graphs of analytical and numerical solutions of the M-N-W integrable equation. NLMs have appeared in a wide variety of engineering, physics, and applied mathematics; hence, it is natural to expect that this project should have broad applicability.

**Keywords**: ADM, MDG/GEM, Integrable equation, exact solutions, numerical solutions, nonlinear models.

# An Analytical Approach to Control the Damage Caused by Sudden Waves in the Sea

**Group:** Physical-Science **Project ID:** SRG-226676

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## Abstract

The simplified modified Camassa-Holm (SMCH) model is widely recognized in the fields of plasma physics, bio-mathematics, and optical fibers. In this study, we have explored the SMCH model implementing the improved Bernoulli sub-equation function (IBSEF) method to obtain novel traveling wave solitons. Our investigation has yielded broad-ranging analytical solutions for the SMCH equation, including hyperbolic, trigonometric, and exponential solutions. Furthermore, we have analyzed the impact of wind and friction on water waves by employing the free parameters of the obtained solutions which can play a crucial role in nature. These findings hold significant relevance to the study of natural phenomena. Moreover, we have discussed the parametric effects of the obtained solitons on the wave profile of the system, revealing kink, bright, and dark-type solitons. Our findings suggest that the IBSEF method is reliable and can be used in future studies to determine different and novel soliton explanations of various nonlinear evolution equations encountered in mathematical physics and engineering.

**Keywords**: SMCH model, IBSEF, kink wave, rogue wave, nonlinear evolution equations.

# Facile synthesis and characterization of 3-arm star poly (methyl methacrylate)–block–poly(2-hydroxyethyl methacrylate) copolymer

**Group:** Physical-Science **Project ID:** SRG-226677

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## Abstract

Background: Star block copolymers has a variety of applications, including drug delivery, cosmetics and coatings etc. To synthesis of such copolymer with a facile method is still a challenge. Objective: To synthesize and characterize of 3-arm star poly(methyl methacrylate)-*block*-poly(2-hydroxyethyl methacrylate) copolymer using a multifunctional initiator by atom transfer radical polymerization (ATRP). Methodology: At first tri-arm $(PMMA\text{-}Br)_3$ was prepared by ATRP using a tri-functional initiator with core-first method. Finally, $(PMMA\text{-}b\text{-}PHEMA\text{-}Br)_3$ three arm star block copolymer was prepared by ATRP of 2-hydroxyethyl methacrylate (HEMA) using $(PMMA\text{-}Br)_3$ as macro-initiator at 65 $^oC$. The structure and properties of the block copolymer were characterized by IR, GPC and DSC analyses. Findings: $(PMMA\text{-}b\text{-}PHEMA\text{-}Br)_3$ three arm star copolymer was prepared by ATRP of 2-hydroxyethyl methacrylate (HEMA) using $(PMMA\text{-}Br)_3$ as macro-initiator (Mn = 37,618, Mw/Mn = 1.31) at 65 $^oC$. 0.35 g of block copolymer was obtained after the copolymerization of HEMA for two hours. The molecular weight of the block copolymer was 82,483 ($M_n$ = 82,483) which was more than twice than that of the molecular weight of macro-initiator $(PMMA\text{-}Br)_3$ (Mn = 37,618). This result indicated that the copolymerization of HEMA was proceeded successfully by macro-initiator $(PMMA\text{-}Br)_3$ to obtain $(PMMA\text{-}b\text{-}PHEMA)_3$ star block copolymer. The structure of $(PMMA\text{-}b\text{-}PHEMA)_3$ was characterized by IR analysis and compared with that of macro-initiator, homopolymer PHEMA. The TGA thermogram of $(PMMA\text{-}b\text{-}PHEMA)_3$ block copolymer was displayed and compared with that of PMMA and PHEMA. The decomposition temperature of block copolymer was in the range of 330-450 $^0C$. Conclusion: $(PMMA\text{-}b\text{-}PHEMA\text{-}Br)_3$ star block copolymer was successfully prepared by atom transfer radical polymerization using a tri-functional initiator. The structure and thermal properties of the copolymer were characterized by IR, GPE and DSC analyses.

**Keywords**: Copolymer, polymethylmethcrylate, polyhydroxymethylmethacrylate, block, star.

# Synthesis of Polypyrrole Coated Iron Oxide Magnetic Nanoparticles for the Removal of Hexavalent Chromium from Water

**Group:** Physical-Science **Project ID:** SRG-226678

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## Abstract

An alternative way for the coating of polypyrrole (PPy) polymer on hydrophobic magnetite ($Fe_3O_4$) nanoparticles is reported here for removal of hexavalent chromium, Cr(VI) ions from aqueous medium. Oleic acid (OA) coated iron oxide magnetite ($Fe_3O_4$) particles were prepared by the conventional coprecipitation method in presence of $FeCl_3 \cdot 6H_2O$ and $FeSO_4 \cdot 7H_2O$ iron precursors. Then OA-$Fe_3O_4$ hydrophobic nanoparticles are oxidized using Lemieux-von Rudloff reagent to convert OA into hydrophilic azelaic acids ($HOOC(CH_2)_7COOH$ modified magnetic nanoparticles (AA-$Fe_3O_4$). Finally, a polypyrrole (PPy) polymer coating was formed by a seeded oxidative polymerization of pyrrole in presence of AA-$Fe_3O_4$ nanoparticles as seed. The average size of PPy/$Fe_3O_4$ nanocomposites is 12.33 nm and are almost spherical in shape. The surface composition is confirmed by Fourier transform IR (FTIR) and thermogravimetry (TG) analyses. X-ray Diffraction (XRD) study confirmed the formation of highly crystalline $Fe_3O_4$ nanoparticles and the crystallinity retained after the surface modification. pH dependent adsorption study suggested that the Cr(VI) ion adsorption is highly pH dependent and the maximum amount of adsorption is obtained at pH 2.0. The adsorption results indicated that isotherm fitted best with Langmuir model and the maximum adsorption capacity approached to 173.22 mg $g^{-1}$ at 323 K. Different thermodynamic parameters are calculated and the results indicate that the adsorption process is spontaneous and endothermic. The kinetics study shows adsorption of Cr(VI) followed pseudo-second-order rate process and the process is controlled by chemisorption. The prepared PPy/$Fe_3O_4$ nanocomposites would be promising adsorbents for the removal of Cr (VI) ions from wastewater.

**Keywords**: Rudloff oxidation, conductive polymer, polypyrrole, magnetic nanoparticles, chromium (VI) separation.

# Synthesis of Nanocomposite Materials from Tannic Acid and Metallic Bismuth for Radiation Shielding' Antibacterial and Catalytic Applications

**Group:** Physical-Science **Project ID:** SRG-226679

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## Abstract

Facile synthesis of functional composite materials is highly desirable for electronics, engineering, biotechnological and catalytic applications. Here, bismuth and tannic acid (TA) based composite particles were prepared by using a simple *in situ* aqueous reduction of $Bi^{3+}$ ions. TA is a naturally occurring polyphenols, which acted as a reducing and stabilizing agent for Bi particles. Glycerin is a co-reducing agent that assisted to reduce $Bi^{3+}$ions. The synthesis and structure of Bi/TA composite particles were confirmed by Fourier's transform infrared, UV-vis spectroscopy and X-ray diffraction study. Dynamic light scattering study showed the hydrodynamic average diameter of synthesized particle was 300 nm. Thermogravimetric analysis demonstrated that the Bi/TA composite contained 55% of bismuth. The catalytical activity of synthesized Bi/TA composite particles were assessed for reductive degradation of azo dyes namely congo red, methyl orange, methylene blue and irect red (81). The catalytic efficiency was five times higher than that our bismuth/silk fibroin nanocomposite particles. Synthesized Bi/TA composite particles can also be used as coating material for different artificial and naturally abundant fabrics. The modified fabrics can be used as a raw material for designing high energy radiation shielding garments and devices. In near future, we will investigate the antimicrobial potentials of synthesized nanocomposites.

**Keywords:** Nanocomposite, catalysis, shielding, azo dyes, antimicrobial.

# Synthesis, Crystal Structures, Characterization and Properties of Non-linear Optical (NLO) Materials of Transition Metal Oxyfluorides Containing Chiral Organic Ligands

**Group:** Physical-Science **Project ID:** SRG-226680

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## Abstract

**Background:** The design of transition metal compounds crystallizing in NCS space groups has attracted researchers' attention due to their structural diversity and functional properties. **Objectives:** Synthesis, determination of crystal structures, characterization and properties of metal oxyfluorides containing ligands. **Methodology:** Compound was grown using slow evaporation method. Crystal structure of material was determined by SCXRD. Crystal structure of compound was solved and refined using SHELXS-97 and SHELXL-97, respectively. Compound was also characterized by IR and UV–vis diffuse reflectance spectrum and TGA. NLO properties were measured by SHG measurements. **Findings:** Two-dimensional chain structures of vanadium fluoride consisting of asymmetric polyhedra of $d^0$ transition metal cations and 3-methypyrazole ligand were grown by slow evaporation method. SCXRD analysis suggests that compound crystallizes in space group, I4 (No. 79). The compound exhibits characteristic bands arising from vibration of V–F, V–O, and V–N bond in the IR spectra. The compound reveals a band gap of 3.05 eV, which is obtained from distortion in octahedral environment of $V^{5+}$, and the larger content of electron-rich fluorides in the asymmetric polyhedral. TGA data indicated that connection of 3-methypyrazole linkers to $V^{5+}$ centers is important to maintain structural backbone. The compound exhibiting an NCS structure shows SHG efficiency of two times that of α-$SiO_2$ and is nonphase-matchable. **Conclusions:** The chain structure of vanadium fluoride compound was obtained. The structural distortion for octahedral of $V^{5+}$ cation and presence of higher contents of fluorides are attributed to band gap.

**Keywords**: Slow evaporation, crystal structure, second-harmonic generation, asymmetric polyhedra, band gap

# Microwave Assisted Phosphane (Ph3P) or NH4OAc Catalyzed Synthesis of 5-Arylidene Rhodanine Under Solvent Free Condition and Screening of their Antimicrobial Activity

**Group:** Physical-Science **Project ID:** SRG-226681

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## Abstract

**Background:** Star block copolymers has a variety of applications, including drug delivery, cosmetics and coatings etc. To synthesis of such copolymer with a facile method is still a challenge. **Objective:** To synthesize and characterize of 3-arm star poly(methyl methacrylate)-*block*-poly(2-hydroxyethyl methacrylate) copolymer using a multifunctional initiator by atom transfer radical polymerization (ATRP). **Methodology:** At first tri-arm $(PMMA\text{-}Br)_3$ was prepared by ATRP using a tri-functional initiator with core-first method. Finally, $(PMMA\text{-}b\text{-}PHEMA\text{-}Br)_3$ three arm star block copolymer was prepared by ATRP of 2-hydroxyethyl methacrylate (HEMA) using $(PMMA\text{-}Br)_3$ as macro-initiator at 65 $^oC$. The structure and properties of the block copolymer were characterized by IR, GPC and DSC analyses. **Findings:** $(PMMA\text{-}b\text{-}PHEMA\text{-}Br)_3$ three arm star copolymer was prepared by ATRP of 2-hydroxyethyl methacrylate (HEMA) using $(PMMA\text{-}Br)_3$ as macro-initiator (Mn = 37,618, Mw/Mn = 1.31) at 65 $^oC$. 0.35 g of block copolymer was obtained after the copolymerization of HEMA for two hours. The molecular weight of the block copolymer was 82,483 ($M_n$ = 82,483) which was more than twice than that of the molecular weight of macro-initiator $(PMMA\text{-}Br)_3$ (Mn = 37,618). This result indicated that the copolymerization of HEMA was proceeded successfully by macro-initiator $(PMMA\text{-}Br)_3$ to obtain $(PMMA\text{-}b\text{-}PHEMA)_3$ star block copolymer. The structure of $(PMMA\text{-}b\text{-}PHEMA)_3$ was characterized by IR analysis and compared with that of macro-initiator, homopolymer PHEMA. The TGA thermogram of $(PMMA\text{-}b\text{-}PHEMA)_3$ block copolymer was displayed and compared with that of PMMA and PHEMA. The decomposition temperature of block copolymer was in the range of 330-450 $^0C$. **Conclusion:** $(PMMA\text{-}b\text{-}PHEMA\text{-}Br)_3$ star block copolymer was successfully prepared by atom transfer radical polymerization using a tri-functional initiator. The structure and thermal properties of the copolymer were characterized by IR, GPE and DSC analyses.

**Keywords**: Knoevenagel condensation, microwave assisted synthesis, rhodamine, catalyst, green chemistry.

# Role of NiO on the Synthesis' Thermal and Photoluminescence Properties of Poly(Ani-co-Py)/NiO Composites: Application as Photo Catalyst for Organic Dye Removal from Waste Water

**Group:** Physical-Science **Project ID:** SRG-226682

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## Abstract

**Background**: The photocatalytic capacity of copolymer based metal oxide composites like poly(Ani-co-Py)/NiO composites towards removal of organic dye methylene blue (MB) for the waste water treatment under sunlight irradiation is still a challenging and promising work. **Objectives**: To synthesize poly(Ani-co-Py)/NiO composites for photo catalyst and application as supercapacitor along with thermal and photoluminescence properties study. **Methodology**: A composite of co-polymer of polyaniline (PANI) and polypyrrole (PPy) was successfully synthesized by progressively varying the loading of NiO (0.25-3.00)wt% via a facile chemical oxidative polymerization approach. **Findings**: Both FTIR and UV-visible data revealed the interaction of NiO with Poly(Ani-co-Py). The incorporation of NiO in poly(Ani-co-Py)/NiO composite was further confirmed by photoluminescence data. Thermal degradation property was studied by DSC. Both glass transition temperature ($T_g$) and melting temperature ($T_m$) data for the composites from DSC were found slightly increased than the bare poly(Ani-co-Py), indicate the desired interaction which is an evidence of higher withstand capacity under heat. FESEM images showed the spherical shape and nano-range grains of diameter 50-120 nm for all composite samples. EDX data shows clear peaks for Ni that confirmed the incorporation of NiO in poly(Ani-co-Py)/NiO composites. The prepared composites exhibited better photocatalytic performances than copolymer alone. The poly(Ani-co-Py)/NiO composites also showed good supercapacitor performances. **Conclusion**: The excellent photocatalytic degradation ability of the prepared composites towards organic dyes which may open windows of new horizon of wastewater treatment.

**Keywords**: Copolymer, composite, photoluminescence, morphology, photocatalytic degradation, organic dye.

# Evaluation of Sundarban Estuarine Ecosystem with Particular Reference to its Water Quality and Diversity of Phytoplankton with Advanced Techniques and its Conservation

**Group:** Biological Science **Project ID:** SRG-211008

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## Abstract

In the present research project, 16 water quality parameters together with the qualitative study of the estuarine plankton were studied. The mean pH of the study area (7.27) is typical for the estuarine habitat. Nazrul-Islam (2003) reported Bay of Bengal value 8.0-8.3 and an estuarine value 7.9. The soil pH of Sundarban area has been reported as 6.9-7.0 (Islam-Nazrul 2003). The mean TDS (579.5 ppm) and the electric conductivity of water (9.45 mS/cm) also supports the studied habitat as estuary (Nazrul-Islam2003). The difference between the air and water temperature is 3.5 °C, maintaining the water temperature always lower than the air temperature. This might be a fact for the turbulant and well mixed water of the estuarine habitats. The water transparency value of the study area varied within the limit of maximum and minimum by10.41 cm and a mean transparency of 47.5 cm actually shows a moderate loading of silt in the studied habitats. Stations located in the shallower parts of the studied estuarine habitats showed a mean water depth of 3.22 m, while there were at least two stations which were very deep. Still the transparency values did not show much difference among them. The salinity value of the studied stations was calculated as 11.78 ppt and should be closer to a value recommended for the mesohaline area. A mesohaline habitat should contain around 18±5 ppt (McLusky 1974). Regarding the two vital dissolved gases dissolved oxygen (DO) and carbon dioxide ($CO_2$), it could be said that $CO_2$ concentration is poor in the area (mean 0.99 mg/L), sea water usually contains nearly 10 mg/L (APHA 1988). Mean DO 5.44 mg/L shows also a low value and indicates that the productivity and phytoplankton growth is inadequate. The habitat can therefore be said as carbon limited. The primary productivity of the area is also affected by the low concentration silicate (SRS) 1.64 mg/L, while usual river water concentration of this vital nutrient is around 13 mg/L. Silica plays a significant role in the development of diatom growth, a major estuarine and oceanic producer in the phytoplankton community, since the body wight of diatom contains >50% silica. Two other soluble nutrients like nitrate nitrogen and phosphate (SRP) showed a mean concentration of 0.62 and 0.29 mg/L, respectively. The concentration range showed a most common occurrence of these two nutrients in eutrophic water. But under the current situation mobilization of these nutrients might be slow in the ecosystem. The mean phytoplankton biomass as chl-a concentration of water (4.76 µg/L) and phaeopigment (2.14 µg/L) clearly indicates a condition of low productive grazing food chain existence with a minimum activity of zooplankton grazing. The mean alkalinity of the studied habitats (5.07 meq/L) is about 25% higher than the Karnafully estuary (3.8 meq/L).

**Keywords**: Phytoplankton, alkalinity, silicate, mobilization, productivity.

# Molecular Characterization and Antimicrobial Potential of Probiotics over Multidrug Resistant Gut Microflora

**Group:** Biological Science **Project ID:** SRG-211016

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## Abstract

Multidrug resistance (MDR) poses a global health threat, demanding innovative solutions. Probiotics, particularly lactic acid bacteria (LAB), hold promise in addressing this impending crisis due to their safety and potential health benefits. This study aimed to isolate and characterize probiotic strains from both homemade plant-based fermented foods (kanji drink and rice kanji) and commercial dairy-based probiotics (sweetened and probiotic yogurt). The samples were deemed safe for consumption, free of indicator microorganisms and hemolytic activity. They exhibited a diverse microflora with substantial microbial counts (>$10^6$ CFU/ml), including yeasts and various LAB species namely *Lactobacillus curvatus, Leuconostoc mesenteroids, Lactobacillus delbrueckii ssp lactis, Lactobacillus plantarum,* and *Lactobacillus delbrueckii*. The LAB isolates, both single and in mixed consortia, displayed a time-dependent increase in auto-aggregation, ranging from 21% to 71% after 5 hours of incubation. Isolate SW2 exhibited the highest auto-aggregative capability (65%). Co-aggregation studies revealed varying degrees of co-aggregation between probiotic LAB and pathogens, with some isolates showing stronger interactions (YD3, SW1, and SW2). Mixed consortia from sample TT demonstrated the highest co-aggregative ability with all tested pathogens. The isolates demonstrated good tolerance to simulated gastric and intestinal conditions, as indicated by their non-significant reduction (only 1-2 log) in the bacterial count after 180 minutes of treatment. These findings indicate that LAB isolates can withstand harsh GI conditions, highlighting their suitability as probiotics. Antimicrobial profiles of the LAB isolates were evaluated using radial streak method and turbidimetric microtiter plate assay against four MDR diarrheal pathogens and six labstrains of foodborne pathogens. LAB isolates SKY1, SW1, SW3 and TT1 exhibited the highest antimicrobial activities; while pathogens DP2 showed the most sensitivity. The antimicrobial activity of the mix consortiums correlated positively with auto-aggregative capability but negatively with co-aggregative capability, although these correlations were not statistically significant. Consumer acceptance tests, using a nine-point hedonic scaling, favored commercial yogurts over homemade kanji, with sweetened yogurt receiving the highest scores. Overall, the results indicate that the LAB isolates used in this study exhibit potential probiotic traits. Further research is warranted for their mechanisms, safety, efficacy, and use in probiotic supplement development.

**Keywords**: Antimicrobial activities, labstrains, potential probiotic, probiotic supplement.

# Nutrient Optimization for Meat Type Japanese Quail

**Group:** Biological Science **Project ID:** SRG-211048

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## Abstract

This study was conducted to observe the growth rate of meat types Japanese quail by nutrient optimization (energy and protein). Experiment was done for a period of 42 days with a number of 500 chicks. Birds were divided into nine dietary treatment groups each having 50 birds per treatment. The dietary groups were; T1= ME 2800 kcal/kg and protein 22%, T2= ME 2800 kcal/kg and protein 23%, T3= ME 2800 kcal/kg and protein 24%, T4= ME 2900 kcal/kg and protein 22%, T5= ME 2900 kcal/kg and protein 23%, T6= ME 2900 kcal/kg and protein 24%, T7= ME 3000 kcal/kg and protein 22%, T8= ME 3000 kcal/kg and protein 23%, T9= ME 3000 kcal/kg and protein 24%. The experimental diets were consisted of broiler starter (0-14 days) and hand mix feed (15-42) days). Quail growth performances, dressing parameters, meat yield, and internal organ development such as liver weight, heart weight, gizzard weight, and profitability were tested in this experiment. Results showed that, at the end of the experiment higher body weight and body weight gain were observed in treatment T8 and T9. Higher feed intake was in group of T8 whereas, better FCR was found in T9 group compare with others. There was higher dressing percentage in T5 group of birds than other groups of birds. The highest breast meat and thigh meat yield were in T9 group compare with others. High quality protein with adequate amino acid balance is one of the most important prerequisite for quality diet. The dietary protein requirement of quail is influenced by metabolizable energy contents and the ingredient used in diet formulation. It is concluded from the results that higher energy and protein content in feed gives quail more heavily. It is suggested that energy and protein content in quail feed should be 3000 kcal/kg and 24%.

**Keywords**: Nutrient optimization, dietary treatment, dressing parameters, meat yield.

# Checklist of sea shells recorded along the coast of the Bay of Bengal

**Group:** Biological Science **Project ID:** SRG-211076

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## Abstract

The coastal zone of Bangladesh is filled with rich and unique biodiversity. Seashells (e.g., Molluscs) is the second largest phylum of animals, next to the arthropods. The exploitation of the mollusk resources could have a direct benefit to the poor as well as the national economy. Identification of economically viable populations, i.e. standing crops of these mollusks around the coast of Bangladesh is an important first step. In the present study, seashell mollusk samples were collected from intertidal or subtidal habitats at locations across the southeastern coastal region of Bangladesh, namely the Kuakata coast. All specimens were cleaned and immediately fixed with 90-100% ethanol, and transferred to the laboratory for further processing. They were observed closely by the necked eye and sorted into major faunal groups. A laboratory study was conducted in the wet laboratory and Marine Fisheries Science laboratory of the Faculty of Fisheries BAU, Mymensingh, Bangladesh. From our study, it was found that about 38 hard-shelled mollusks were identified from the coast of Kuakata. Among them, bivalve is the most commonest, and then the gastropods. *Codakia tigerina* species are available on the coast and it covers about 40% of all hard-shell mollusks. Some other common bivalves are *Donax faba*, *D. cuneatus*, *C. punctate*, *Atactodea striata*, *Fulvia laevigata,* etc. are important. Among the gastropods *Cypraea annalus, C. tigris, Olivia caerulea, Mitra mitra* etc. are important. The seasonal dynamics of the abundance, size distribution and percentage of marketable size, the present level of exploitation, and use if there be any, are essential prerequisites for the establishment of a sustainable mollusk fishery for the export market.

**Keywords**: Subtidal habitats, faunal groups, hard-shell, mollusks, fishery.

# Analysis of Various Drinking Water Samples from Restaurants in Sylhet Town to Detect the Coliform Bacteria by Most Probable Number (MPN) Method

**Group:** Biological Science **Project ID:** SRG-211300

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## Abstract

Cryptosporidiosis is one of the common zoonotic infections for livestock and also for humans. It is caused by oocysts of the protozoan parasite Cryptosporidium spp. In this research, we analyzed the proportion of Cryptosporidium sp. in buffalo (Bubalus bubalis) in the Sylhet Division of Bangladesh. A pre-tested questionnaire was followed to identify risk factors for Cryptosporidium infections. Primary identification was performed by modified Ziehl–Neelsen staining and molecular detection was employed with conventional and Nested Plymerase Chain Reaction (nPCR). A total of 315 fecal samples were analyzed microscopically for Cryptosporidium oocysts by the modified Ziehl–Neelsen stain. Out of the 43 primary screened samples, 29 were confirmed as positive by nPCR. The overall prevalence of Cryptosporidium in the Sylhet Division was 9.2%. The prevalence is significantly higher in young animals compared to older animals, with a prevalence of 20.7% in calves less than one year of age. Calf diarrhea is significantly associated with Cryptosporidium infection. The study found that 31% of diarrheic calves are infected with Cryptosporidium sp. The presence of Cryptosporidial oocysts in buffaloes indicates that they may contribute to the contamination of waterways and rivers, potentially leading to infection in humans. The research sheds light on the potential zoonotic risk associated with Cryptosporidium-infected buffaloes. Understanding this risk is crucial for protecting the health of individuals who come into contact with these animals.

**Keywords:** Cryptosporidium, Ziehl–Neelsen staining, nested PCR, prevalence, buffalo.

# Detection of Vitamin D in Fish to Combat COVID-19

**Group:** Biological Science **Project ID:** SRG-211300

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## Abstract

COVID-19 has been an alarming issue in our country as well as in the whole world. The disease is highly contagious, and we know very little about it. Vitamin D has a significant role in combating COVID-19 disease. Low D is a predictor rather than just a side effect of this infection. It was recommended to have above 50 ng/mL D in serum, which can be achieved by 250 µg (60 ng/mL) of dietary vitamin D supplement to combat COVID. On the other hand, the Dietary vitamin D supplement for a healthy adult is only 15µg. Identifying cheap natural sources of vitamin D supplements is necessary to combat COVID. This study was designed to know the vitamin D concentration in fishes Pangas (*Pangasius pangasius*), Silver carp (Hypophthalmichthys molitrix), Thai Sharputi (*Barbodes gonionotus*), and Rui (*Labeo rohita*) by HPLC-UV detection. 48 fish samples were collected from the two fish markets of Mymensingh district, where 144 samples were analyzed (one fish, three samples- intestinal fat, muscle fat, and muscle). This study revealed that muscle fat has the highest vitamin D among all three sources. Intestinal fat ranked second and then muscle as a source of vitamin D. Basing on the average fish consumption rate in Bangladesh (62.58 g/person/day) the presence of vitamin D in the intestinal fat is 4,2, 9, and 1.5 times higher than the daily preventive dose in Rui, Silver carp, Sharpunti, and Pangas, respectively. Muscle fat in Rui, Silver Carp, Sharpunti and Pangas contain 33, 178, 712, and 11 times higher than the daily preventive dose, respectively. In the muscles of Rui, Silver carp, Sharpunti and Pangas, vitamin D concentration is 1, 1, 1.5, and 1.5 times of the daily preventive dose to combat COVID-19, respectively. All four fishes contain vitamin D over the daily preventive dose in all three parts of the body examined. Either whole fish or examined parts of the fish are recommended as a source of vitamin D. All four fish species are excellent sources of vitamin D to combat COVID 19. This study also revealed that only 10% of people (surveyed) have knowledge of the beneficial role of vitamin D to combat COVID. It is necessary to popularize fish as a cheap source of vitamin D to battle COVID as well as a healthy population. To achieve these, a new guideline in the diet for corona-infected and suspected persons need to set up by the respective stakeholders.

**Keywords:** COVID-19, Predictor, vitamin D, intestinal fat, preventive dose.

# Mathematical Modeling of Mediators of Azithromycin Resistance in *E. coli* in Diverse Environments

**Group:** Biological Science **Project ID:** SRG-211012

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## Abstract

**Background:** Various environments can act as the reservoir of Azithromycin resistance and enhance transfer of resistance features. **Objectives:** The present study was conducted to determine the diversity of azithromycin resistant *E. coli* in different environments and draw a statistically significant relationship between resistant phenotype and source. **Methodology:** *E. coli* was isolated from BGLB broth on EMB agar. Isolated *E. coli* was confirmed by PCR targeting species specific primers. Antibiotic resistance was assessed by disc diffusion assay. Statistical analysis was carried out using appropriate software. **Findings:** A total of 383 environmental and clinical samples were collected. The prevalence of 197 *E. coli* was determined and found to be 100% in human, 67.5% in animals, 49.23% in prawns, 30.58% in soil and 27.88% in water. Approximately, 70 (36%) were multidrug-resistant (MDR). A total of 33.94% of the isolates were resistant to Azithromycin. Human isolates showed the highest level of Azithromycin resistance when compared to other hosts. An overall association between source and multidrug (MDR) *E. coli* was determined by statistical analysis. It was observed that MDR *E. coli* was associated with their sources ($\chi 2 = 29.853$, $p = 0.001$). Humans (51.67%) and animals (51.85%) carried more MDR *E. coli* than other environments. The findings of the present study indicate that humans can act as a reservoir of macrolide/ Azithromycin resistance as a strong correlation was found between antibiotic prevalence and human source. **Conclusion:** An awareness about the indiscriminate use of Azithromycin and the importance of the completion of dosage regime must be created if a stop is to be exerted on the creation or persistence of the possible reservoirs.

**Keywords**: Antibiotic resistant, diffusion assay, multidrug, indiscriminate use, dosage regime.

# Response of Different Herbicide Combinations with Allelopathic Potential Plant Extracts on Weed Management and Yield Performance of T. Aman Rice

**Group:** Biological Science **Project ID:** SRG-211030

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## Abstract

Boiled extract of allelopathic crops have the potential to control weeds successfully, particularly when integrated with reduced herbicide doses. Two field experiments were conducted to evaluate the effect of allelopathic boiled extract of sorghum and mustard crop residues combined with reduced doses of herbicide (Granite 240 SC) in T. *aus* rice. In first experiment, treatments consist of two factors viz. variety (3)-BRRI dhan48, BRRI dhan98, Binadhan-21and application of boiled extract with reduced rate of herbicide (5)-Control, Recommended doses of herbicide at post emergence, 80% recommended doses of herbicide at post emergence + sorghum crop extracts, 70% recommended doses of herbicide at post emergence + sorghum crop extracts, 60% recommended doses of herbicide at post emergence + sorghum crop extracts. Second experiment also consists of two factors e.g. variety (3)-the same variety used in the experiment 1 and application of boiled extract with reduced rate of herbicide (5)- same as the experiment 1 with the extract of mustard. It was noticed that herb weed species were more susceptible to crop residues than grass weed species. In this respect, the highest growth inhibitions (79.80%)was observed in controlling Panilong (*Ludwigia octovalvis)* by the treatment of 80% recommended doses of herbicide at post emergence + sorghum residues extracts. Among the rice variety, BRRI dhan98 showed superior performance in respect of yield contributing characters and yield. In case of reduced rate of herbicide and boiled extract application, boiled extract of sorghum and mustard with reduced rate of herbicide (80% of recommended) as post emergence was the best for T. *aus* rice cultivation. From the findings of our study it can be concluded that the studied crop residues extract and reduced rate of herbicide showed positive effect on weed growth, yield contributing characters and yield of T. *aus* rice.

**Keywords**: Allelopathy, weeds, post emergence, herbicide, yield.

# The Effect of Traditional Processing Methods on Nutritional Composition and Anti-Nutritional Factors in Perole (*Vigna unguiculata* L) seed, a wild Cowpea Grown in Bangladesh

**Group:** Biological Science **Project ID:** SRG-211026

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## Abstract

The study was conducted to investigate the effect of traditional cooking process: boiling and pressure cooking on the proximate composition, macro elements and ant-nutrient: phytate content of Perole (*Vigna unguiculata* L.) cowpea seeds. This research showed that heat processing amounted to loss of nutrients; this may be due to leaching during heat application. There was drastic reduction of anti-nutrients content of boiled and pressure cooked peroles and this probably is because the anti-nutrients are heat labile. The Boiled Peroles (BDP) had the lowest values of crude protein (17.09%), crude fat (2.46%) and crude fibre (1.71%) while Pressure Cooked Peroles (PCP) had values of crude protein (18.93%), crude fat (2.54%) and crude fibre (1.88%). There was comparable value of ash content in all the samples except for BDC with the least. Boiling had significantly higher moisture content than others. The decreasing order of anti-nutrient factors in treated cowpeas is: RWC > PCC > BDC. This result inferred that boiling is an adequate processing for drastic reduction of the anti-nutrient factors (phytate) in perole. On the other hand, the macro elements composition of perole showed that heat processing amounted to loss of nutrients; this may be due to leaching during heat dec application. Boiling and pressure cooking had increased the amount of this macro element content when compared with the raw sample. Therefore, it could be concluded that the heat treatments (boiling and pressure cooking) had significantly reduced that anti-nutrient factors in peroles. More research should be conducted into ways of reducing anti-nutritional factors, improving in-vitro protein digestibility (IVPD) and improving cowpea proteins and on combination of heat treatment with germination to reduce the anti-nutrient factors in grain legumes.

**Keywords:** Perole, pressure cooked, proximate composition, macro elements, phytate.

# Molecular Markers Assisted Screening of Tomato Leaf Curl Disease (ToLCD) Resistant Cherry Tomato in Bangladesh

**Group:** Biological Science **Project ID:** SRG-211009

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**Abstract**

Cherry tomato [*Solanum lycopersicum* (L.) var. cerasiforme Mill.] is a type of small round tomato believed to be an intermediate genetic admixture between wild currant-type tomatoes and domesticated garden tomatoes. The tomato plant is susceptible to many diseases, among which tomato leaf curl disease (ToLCD) is the most disastrous one, which is caused by tomato leaf curl virus (ToLCVs), which is whitefly *(Bemisia tabaci*) transmitted geminivirus (family Geminiviridae, genus Begomovirus). In this context, the current investigation was carried out to confirm ToLCV resistant cherry tomato varieties through molecular analysis of ToLCV resistant Ty genes. Sixteen different cherry tomato varieties were collected from different sources and maintained in the greenhouse in a controlled environment. A polymerase chain reaction (PCR) was conducted to confirm the presence of Ty 1, Ty 2, Ty 3, Ty-3a, Ty 4 and Ty 5 genes. According to the PCR study, ToLCV resistant genes such as Ty-1 to Ty-5 were found to be present in all tomato varieties, which were also confirmed through sequence analysis using the NCBI-BLAST search tool. During winter season, seeds were sown in the botanical garden and morphological characteristics were noted at different stages of plant growth, such as vegetative growth, flowering and fruiting stages, etc. The majority of the varieties showed leaf curl symptoms as well as bacterial wilting. To confirm the tomato leaf curl disease and its causal agent, genomic DNA was isolated from the young leaf samples, which were analyzed at the molecular level to confirm the presence of the viral coat protein gene and replication associated gene. The majority of them were susceptible to tomato leaf curl disease, as revealed by the PCR results. This study suggests that Ty genes of the cherry tomato varieties are not showing resistance against ToLCV.

**Keywords**: Tomato, virus resistant, PCR, ToLCV, genomic DNA.

# Evaluation of sunflower genotypes for drought tolerance based on morpho-physiological and biochemical traits

**Group:** Biological Science **Project ID:** SRG-211050

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## Abstract

Drought stress has become a key challenge acting as a crop production limiting factor in the climate changing scenario. Sunflower has the capability to survive under stress condition than other oilseed crops to some extent, but it is sensitive to drought stress from flowering to grain filling stage due to inadequate availability of soil moisture. Therefore, this study was undertaken to screen six sunflower genotypes for drought tolerance based on morphological, physiological, and biochemical traits. To fulfill this purpose, two experiments were conducted in the Plant Physiology Laboratory and Net House of Department of Crop Botany, Bangladesh Agricultural University, Mymensingh. Firstly, a germination test was done with six sunflower genotypes under three drought levels (Polyethylene glycol induced); 0 % PEG (control), 10 % PEG and 20 % PEG. Based on the performances of germination, vigor index and morphological traits, four genotypes were selected for seedling growth study in pot culture under four drought levels (80 % FC, 70 % FC, 60 % FC and 50 % FC). Tolerant genotypes exhibited minimum relative reduction of morpho-physiological properties and increased value of leaf proline content compared to sensitive ones, at vegetative stage under drought stress. Among the genotypes, Hysun 33 and Hysun 36 was found drought tolerant while Big sunflower appeared as drought sensitive based on morpho-physiological and biochemical attributes. The drought-tolerant sunflower cultivars found in this study could be recommended for the experimentation field trial at naturally drought affected areas of Bangladesh with different levels of drought condition. The findings of this study will be helpful for the breeders for the selection and breeding approaches to develop drought-tolerant sunflower genotypes for drought-prone areas of Bangladesh.

**Keywords***:* Drought tolerance, vigor index*,* physiological attributes, biochemical parameters.

# An investigation on the presence of Bovine Viral Diarrhoea virus in Bovine Semen used for Artificial Insemination in Bangladesh

**Group:** Biological Science **Project ID:** SRG-211051

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## Abstract

The study was aimed at the investigation of the presence of BVDV in the semen samples used for artificial insemination in Bangladesh. For this, a total of 76 semen samples were collected from two different farms of Bangladesh Agricultural University, Mymensingh. Viral RNA was extracted using Monarch® Total RNA Miniprep Kit, Newengland BioLabs® Inc. following manufacturer's instruction. Briefly, at first 300µl semen samples were taken in an Eppendorf tube centrifuged at 500g for 1 minute. Supernatant was discarded and lysis buffer was added to lyse the cells. The samples were placed in gDNA removal column and centrifuged at 16000g for 30 sec. The column was discarded and equal volume 95% ethanol was added to the sample and mixed well. The sample was transferred to a RNA purification column and centrifuged @ 16000g for 30 sec. The follow through was discarded and RNA wash buffer was added to clean the column. DNase 1 and DNase 1 reaction buffer was added on the top of the column. The column was kept at room temperature for 15 minutes and RNA priming buffer was added to the column and centrifuged @ 16000g for 30 sec. The column was washed with RNA wash buffer for twice. Finally, RNA was eluted in 50µl nuclease free water. Oligonucleotide primers from 5'UTR of virus genome (PF1 5′-ATGCCCTTAGTAGGACTAGC-3′ and PR1 5′-CTCCATGTGCCATGTACAG-3′) were used for RT reaction and subsequent PCR amplification. The PCR samples were analyzed in 1% (W/V) agarose gel in Tris acetate-EDTA buffer. The amplified cDNA products were detected in 1% agarose gel electrophoresis. After electrophoresis, the gel was stained with ethidium bromide and examined under UV light and photograph was obtained in gel documentation system. But none of the samples were positive for BVDV in our RT-PCR analysis. Our results indicate that semen samples from two dairy farms were free from bovine viral diarrhea virus contamination.

**Keywords**: BVDV, Semen, RT-PCR, diarrhea virus.

# Study of Fish Diversity and Livelihood Status of Fishermen in Atrai River, Naogaon Region, Bangladesh

**Group:** Inter-Disciplinary **Project ID:** SRG-211519

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## Abstract

The study was conducted to investigate the fish diversity and socio-economic profiles of the fishermen of Atrai River in Naogaon district in the Northern part of Bangladesh. Pertinent information was collected from forty five randomly selected fishermen from the study area who were directly involved in fishing in the rivers during the period of twelve months from July 2021 to June 2022. The data interpretations showed that 45 fish species under 8 orders and 17 families were recorded from the Atrai River during the study period. Cypriniformes was found as the most dominant order constituting 48% of the total fish population followed by Channiformes (6%), Sliuriformes(18%), Clupiformes (6%), Mastacembeliformes (6%), Perciformes (12%), Beloniformes (2%), Tenaodontifomres (2%).Fishes in this river are seriously affected by the various kinds of natural and manmade causes. Under this circumstance, a better understanding of the diversity and distribution of fishes in the Atrai River is urgently needed. In the study area the fishermen age range from 16 to 65 years. It was found that most of the fishermen (35%) illiterate though a small proportion completed primary level of education. Among them Muslims were 85% and Hindus 15%. About 47% of the fishermen had tin shed with bamboo house, while 35% and 18% of them had tin shed with tin and half building, respectively. Annual income of the fishermen ranged from 25000- above 55000 BDT and they had large family size (member above 7) constituted 30%. 75% percent of the fishermen used their own tube-well, while 20% and 5% used government and neighbors' tube-well, respectively. About 62% of the fishermen used kacha toilets and 23% semi paka toilets and 15% of the fishermen had no sanitary facilities. In the study area, 55% of the fishermen were far from power plants and the rest of them had (45%) access to electricity. Majority (45%) of the fishermen was 1-10 decimal land, while 17.5% had 11-20 decimal lands and 15% had above 40 decimal lands and significant proportion of fishermen depend upon village doctors (62.5%) for their health facilities. Forty five percent of fishermen were engaged in fishing as their main occupation, 40% in agriculture and 15% in daily labor.There were 4 types of nets, 7 types of traps, 4 types of spears and harpoons and 4 types of line fishing are found in this area. The study revealed that the fisheries production was not sufficient according to demand. Fishermen of Atrai River were mostly illiterate, poor income, lack of training exposure and lack of awareness about their health facilities and sanitation. It is therefore essential to provide the necessary institutional and organizational supports and extension services for increasing fish diversity as well as sustainable livelihood status of fishermen in Atrai River.

**Keywords**: Fishermen, health facilities, awareness, manmade causes, sanitary facilities.

# Perception of Fish Farmers on Environmental Degradation Due to Fish Farming

**Group:** Biological Science **Project ID:** SRG-221033

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## Abstract

Bangladesh, with its rich inland waters and river systems, has significant capture fishery and aquaculture potential. The favorable geographic position of Bangladesh comes with a large number of aquatic species and provides plenty of resources to support fisheries potential. The study was conducted to identify the present status of fish farming in Trishal upazila of Mymensingh district. The objectives of the study were to determine the perception of fish farmers on environmental degradation due to fish farming, explore the relationships between the selected characteristics of the fish farmers and their perception and problems faced by the fish farmers due to fish farming. Data were collected from a random sample of 100 fish farmers from a population of 700. A structured interview schedule was used for collecting data during September to October 2021. Pearson's Product Moment Coefficient Correlation (r) was computed to explore relationship of the respondents' selected characteristics and their perception. Trishal had a population of 419,308 people. Among them about 12000 people are fish farmers. According to office document there are 20,744 ponds in the study area. The total production of fish in Trishal upazila is about 42445 MT. The major commercial species which were commercially cultured by the fish farmers was Pangus. Shing, Tilapia, Rui, Mrigal, Pabda, carp etc. were also cultured in the study area. Results showed that 55 percent of the fish farmers had highly favorable perception and 45 percent fish farmers had moderately favorable perception on environmental degradation due to fish farming. It was evident from the correlation analysis that household size, fish farm size, annual income, communication behavior and knowledge about fish farming showed significant relationships while age, years of schooling, training received and use of ICT in fish farming activity had no relationship with the fish farmers' perception on environmental degradation due to fish farming. The findings indicated that the majority (61 percent) of the fish farmers faced medium problems, while 39 percent faced high problems. "Availability of cropland is decreasing due to fish farming." is the main problem due to fish farming. "Water quality is deteriorating day by day due to fish farming" and "Productivity of croplands are decreasing due to fish farming" related to fish farming were the second and third problem respectably. Thus, it can be concluded that the perception of the fish farmers in the study are was moderate to high and the problems were medium to high. Thus, DoF and other relevant organizations could take necessary actions to improve fish farming in the study area.

**Keywords**: Cropland, water quality, fish farming, environment degradation, productivity.

# Development of Eco-Friendly Periphyton - Based Organic Poly Culture for the Native Major Carps (*Labeo rohita, Gibelion catla. Cirrhinus cirrhosus*)

**Group:** Biological Science **Project ID:** SRG-221281

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## Abstract

The study was investigated to develop the eco-friendly periphyton based organic poly culture for the native major carps (*Labeo rohita, Cirrhinus cirrhosus* and *Gibelion catla*) from July 2022 to June 2023. The experiment was designed with two treatments namely T1 (Periphyton substrate pond, ruhu- 40, catla-20, and Mrigal- 20 /decimal) and T2 (Non periphyton substrate pond, ruhu-40, catla-20, and Mrigal- 20/decimal) respectively each having three replications. The impacts of fish grazing on the periphyton community were also assessed. Eight ponds were used, four of which were provided with kanchi poles (100 per pond, spaced 1 m2 apart). There were no statistically significant differences in water quality between treatments. Zooplankton numbers were the same in both treatments. While there was clear evidence that periphyton was being exploited by the fish, Chlorophyceae being most affected, grazing was insufficient to cause significant reductions in total periphyton densities. The study revealed that highest survival and weight gain was found in periphyton substrate pond T1 comparing with non-periphyton substrate pond T2. Among three major carps species like Rui, Catla and mrigal, highest survival of rui 94% and production of 4617 Kg/ha/6 months was found in T1 comparing with T2 (survival, 67% and 2088 Kg/ha/6months). The growth and yield of Catla was observed to be slower than rui probably due to same trophic level space and food competition. On the other hand, growth and production of mrigal was higher than catla due to no food and space competition like catla with rui. The total yield of three species in substrate pond were found to be 7258 kg/ha/6months comparing with non - substrate pond (3763Kg/ha/6 months). The experimental results showed that periphyrton substrate have had a positive impact on the growth, survival and yield of the native major carps.

**Keywords:** Eco-friendly, poly culture, carps, substrate, periphyton.

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