BOOK OF ABSTRACTS

International Conference on

Environment and Ecology

Make India Clean as well as Cleaning up Technologies

2 - 3 - 4 March 2015 • Kolkata

Organised by:

Foundation for Science and Environment, Kolkata
Scientific & Environmental Research Institute, Kolkata
Indian Institue of Ecology and Environment, New Delhi

in Association with:

Confederation of Indian Universities
The Global Open University, Nagaland
Indira Gandhi Technological and Medical Sciences University

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Wheat Straw Fibres as Environment Friendly Ingredient in Thermoset Composite

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The mechanical properties of the composite samples were influenced by temperature, time and applied pressure in the compression mould machine. Wheat straw fibres provided good strength in the composite at 40% weight fraction in the fibre-matrix mixture. The experiments provided the optimum conditions of 140^0C, 45 minutes of setting time and 27.58 MPa of applied pressure as the best suitable process conditions for manufacturing composite sheets. Water absorption rate was initially high for initial 24 hrs and then decreased as the time progressed further. After a time of 120 hrs, it remained constant and did not absorb any more water. Alkaline medium degrades the composite samples very quickly, and it was noted that 72 % swelling was observed in the composite samples in first 24 hrs. DSC test conducted on the composite samples showed the glass transition temperature (Tg) of material at 108^0C, and crystalline temperature 120 ^{0}C. Again, the melting temperature of composite was observed at around 131^0C. Temperature of 183 ^{0}C was observed as the degradation temperature of composite material. The composite of wheat straw and PF resin showed good mechanical properties tensile strength 18.76-24.93MPa, impact strength 18.31-25.31 kJ/m^2 at process conditions of 140 ^{0}C, 27.58 MPa pressure and 45 minute curing time.

Key words: Phenol formaldehyde, Wheat straw fibres, Composite, Tensile strength, Impact strength

Physico Chemical Parameters of Ground Water of Channapatana Taluk Ramanagara District Karnataka

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Attempt was made to access ground water quality status of villages of Channaptana Taluk. Ramanagara (Dist) KarnatakaWater samples from bore wells were analyzed to find out the suitability for drinking purpose. The physico-chemical parameters of water (pH, Temp., EC, TDS, TH., Ca, Mg, Cl, SO_4, PO_4, NO_3, Na, K, Fe, F, COD and BOD) were carried out. The analytical results indicated significant variations among analyzed samples with respect to their chemical compositions. Majority of samples do not comply with Indian as well as WHO standards for most of the water quality parameters. The results reveal that the overall water quality was found to be not for domestic purposes without prior treatment as more fluoride in drinking water. Ground water is the chief source of drinking water in rural areas. The quantity of drinking water in our country has been deteriorated due to the growth of urbanization, industrialization population and domestic activities, no improper disposal of waste water, due to draught and environmental conditions influence the quality of ground water.

Therefore it is necessary to monitor the quality of ground water in regular intervals to observe the suitability of water for a domestic use.

Key words: Ground water, classification, Water quality

Impaired Oxidative Metabolism in the Mozambique Tilapia (Oreochromis Mossambicus) under Sublethal 17α-Ethynylestradiol Exposure

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The potential environmental effects of the synthetic hormone, 17α-ethynylestradiol, used in family planning and hormone replacement therapy, have been the subject of numerous investigations. Biochemical alterations are considered as sensitive indicators of toxicity before hazardous effects occur in fish. Biochemical approach has been advocated to provide an early warning of potentially harmful changes in stressed fish. The present study was an attempt to evaluate the oxidative stress potential of 17α-ethynylestradiol on *O. mossambicus* fingerlings and adults exposed to sublethal concentration. Mozambique tilapia (*Oreochromismossambicus*; fingerlings and adult) was exposed to the sublethal concentration (30 ng l^{-1}) of estrogenic endocrine disrupter (17α-ethynylestradiol) for 14 days and allowed to recover in water free of test substance for 7 days. Biochemical contents (protein, free amino acids, cholesterol and glycogen) in the liver tissue were assessed on 7, 14 and R7 days. Liver exhibited a significant variation in the protein, free amino acids, cholesterol and glycogen levels as compared to control fish (fingerling and adult fish). The depletion of protein (except initial increase) and glycogen was observed in liver an indication of typical stress related response of the fish with 17α-ethynylestradiol. A significant increase in free amino acids and cholesterol level was recorded in the liver and might be due to xenobiotic induced lipid peroxidation and estrogenic activity, respectively. There was a significant recovery in all the above biochemical parameters, in all the tissues of fish (fingerling and adult fish) after a recovery period of 7 days. Alterations in the above parameters are due to 17α-ethynylestradiol induced alteration in oxidative metabolism and are a typical symptom of alteration in respiratory process.

Key words: Estrogen, protein, free amino acids, cholesterol, glycogen

Adsorption of Reactive Red 2 onto $ZnCl_2$ Activated Carbon Developed from Jatropha Husk, an Agriculture Solid Waste: Equilibrium and Kinetics Studies

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Over the next couple of decades, the demand for fresh water will increase all over the world owing to population growth and industrial development. Most of pollutant and their degradation products are becoming toxic for aquatic and terrestrial environment. For this reason treatment of wastewaters is one of the most important environmental issues. Nowadays thousands of dyes are prepared for printing and dyeing industries from coal-tar based hydrocarbons such as benzene, naphthalene, toluene, etc. During the past 35 years India has become a major producer of dyes and pigments to cater to the needs of not only the textile industries but also other industries such as paper, plastics, paints, leather, food, drugs and cosmetics. Reactive dyes are the most common dyes used due to their advantages, such as bright colors, excellent color fastness and ease of application. The presence of color will reduce aquatic diversity by blocking the passage of light through the water. Hence, the removal of dye from strongly colored reactive dye wastewater becomes environmentally important. A wide range of technologies have been developed to remove these dyes from wastewaters. Adsorption is an attractive, cheap, and effective method for the treatment of dye-bearing effluents. Activated carbon adsorption is the most popular physico-chemical treatment for the removal of dissolved organics from wastewaters. The various phenomena pertaining to decolorization and adsorptive efficiencies of carbon have been correlated and shown to be directly proportional to the activity of the carbon like coir pith, Neem leaf, rice husk, barley husk. The removal of color from these effluents is important and to be able to reuse water in the process. Furthermore, reactive dyes are highly toxic and should be removed before disposal.

Adsorption is an important wastewater treatment process and it is a cost-effective and user friendly technique for the removal of micro pollutants from water. Additionally, adsorption has been found to be superior to other techniques for water re-use in terms of the initial cost, simplicity of design, ease of operation and insensibility to toxic substances when conducted with activated carbons (ACs). Jatropha curcas is a shrub of significant economic importance because of its several potential industrial and medicinal uses. Bio-diesel is made from its seeds, generating a large volume of jatropha husk (JH). The objective of this work was to explore the feasibility of using the $ZnCl_2$ activated micro porous jatropha husk carbon (ZAJHC) as an adsorbent for the removal and recovery of dyes from water. Adsorption dynamics, equilibrium studies, effect of initial pH, and temperature were also investigated.

Key words: activated carbon, adsorption kinetics, isotherms, Jatropha Husk, Reactive Red 2

Removal of Acid Blue-83 from Aqueous Medium by $ZnCl_2$ Activated Jatropha Husk Carbon: Adsorption Dynamics and Equilibrium Studies

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Dyeing industry consumes large amount of water at its different steps of dyeing processes. The production of wastewaters is unavoidable, due to consumption of large volume of waters. Generally, the wastewater from textile industries contain residue of dyes and chemicals. The release of colored wastewater may present an eco-toxic hazard and begin the potential danger of bioaccumulation, which may finally affect man through the food chain.

Due to economic considerations it is very difficult to be treated using conventional treatment methods including biodegradation, advanced oxidation, photocatalysis, flocculation, coagulation, precipitation, membrane filtration, electrochemical techniques and ozonation. Among these techniques adsorption has been proved to be an excellent way to treat dye effluents, offering advantages over conventional processes. Also, adsorption provides an attractive alternative treatment, especially if the adsorbent is inexpensive and readily available.

The conventional methods for the removal of dyes using activated carbon (AC) are not cost effective in India. Different sources of adsorbent materials for ACs are coir pith, orange peel, saw dust, palm shell, pomegranate peel, bagasse pith, bamboo stem, corncob, avocado kernel, and rice husk.

Jatropha curcus is a multipurpose non-edible oil yielding perennial shrub and is a drought tolerant plant. Its seeds are used to produce bio-diesel. *Jatropha* husk (JH) constitutes nearly 80% of the dried vegetable. Lignocellulosic biomasses are attractive sources for the development of ACs in adsorption process. Huge volume of JH is generated in bio-diesel industries and it was used for the production of activated carbon by zinc chloride activation method.

The present research study was mainly undertaken to develop zinc chloride activated husk carbon (ZAHC) and evaluate its efficacy in the removal of toxic dye, Acid Blue-83.

Key words: adsorption, *jatropha* husk carbon, Acid dye, isotherms, kinetics

Leaching of Metals in Urban Runoff Sediments

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Rapid urbanization and the consequent changes to urban traffic densities affect the toxic metal build-up on road surfaces as well as the top layer of soil. In such cases, rainwater runoff accounts for quite a considerable contribution to the total runoff from land, and carries with it various contaminants from the road surfaces, built-up areas and other settlements which have tremendous impact on the receiving aquatic environment. In the present work, storm water during several major rain events were collected from 9 principal locations of Guwahati, India. The solid phase was separated from the liquid phase and investigated for the total contents of Cd, Ni and Zn as well as their leaching in acidic (HCl) media to work out the possibility of the release of these metals to the runoff under appropriate environment. Increase in the acid concentration enhanced the leaching of the metals from the sediments for all the metals.

Key words: surface runoff, metals, bioavailability, aqueous ecosystem.

Microencapsulation Technique in Pharmaceutical Sciences for Sustained Drug Delivery

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The process by which tiny particles or droplets are surrounded by a coating to give small capsules of many useful properties is known as Microencapsulation technique. The technique finds its wide application in the field of food science and technology for incorporating food ingredients, enzymes, flavors etc. in micrometric level. Poly vinyl alcohol, gelatin, ethyl cellulose and sodium alginate are used as coating materials. Most microcapsules are porous with dimension ranging from between a few micrometers and a few millimeters. In microencapsulation technique the solids, liquids, or gases are enclosed inside a micrometric wall made of hard or soft soluble film to prevent the degradation of pharmaceuticals and in order to reduce dosing frequency. Microcapsule is a relatively small sphere with a uniform wall around it. The microcapsule wall is sometimes called a shell, coating, or membrane whereas the material inside the microcapsule is referred to as the core, internal phase or fills. Lipids and polymer like materials, such as alginate, may be used as a mixture to trap the material of interest inside. The physical and chemical properties of the material to be encapsulated determine the technique of microencapsulation. Microencapsulation technique is used for sustained or regulated release of a drug into the body. This also prevents and decreases the toxic side effects for some drugs by preventing high initial concentrations in the blood.

Key words: Drug delivery, Microencapsulation, Pharmaceutical sciences

Effect of Ultrasonic Energy on Biomethanation of Water – Hyacinth

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Kinetics of biogas produced during the anaerobic degradation of water hyacinth (*Eichorinia crassipes*) has been studied in a batch reactor of 1 liter capacity. The microbiological aspects such as isolation of both methanogens and non-methanogens from the water hyacinth fermenting slurry and their identification have been carried out.Effect of slurry concentration,pH,and time on biogas generation have been investigated. The treatment of ultrasonic energy of 20 kHz to slurry had pronounced effect on biogas production.

Key words: Biogas, water hyacinth, anaerobic digestion, methane, ultrasonic

A Novel Approach to Modelling of an Aerobic Hybrid Bioreactor Treating Easily Biodegradable Substances

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Modelling of an aerobic hybrid bioreactor is done by a simple and fast method considering concurrent growth of both the suspended and attached biomass. Its main focus is on simultaneous uptake of easily biodegradable carbonaceous substances by the heterotrophic biomass present over the suspended and attached phase. The model applied the principle of external mass transport as per Fick's law, steady state carbonaceous substrate as well as biomass balance for both suspended and attached growths. Monod growth kinetic is followed for the utilization of carbonaceous substrate assuming no inhibition. The boundary condition for substrate uptake was considered for biofilm liquid interface and at attachment surface. The analytical solution is essentially done by Runge Kutta method and thus a computer programme is developed in FORTRAN language. The model has been examined with existing methods by solving a few sets of real data. It is found easier and faster than the existing methods and it can be extended to purely biofilm system also.

The concept diagram of a typical hybrid bioreactor i.e. integrated biofilm activated sludge process is shown in figure 1. The substrate concentration profile across the biofilm present in the hybrid bioreactor is shown in Figure 2.

Key Words: Hybrid bioreactor, activated sludge-biofilm modelling, Monod Kinetics, FORTRAN programme, model performance

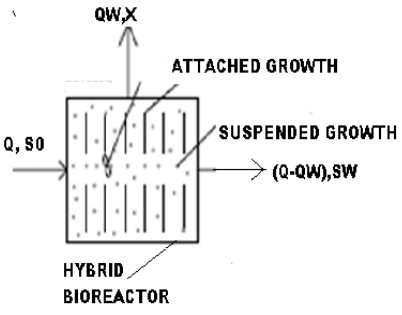

Figure: 1

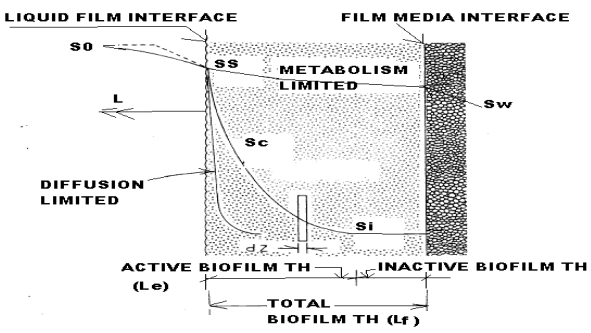

Figure: 2

Kinetic Behaviour of Activated Sludge Process Treating Composite Chrome Tannery Wastewater

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Chrome tannery wastewater causes serious environmental problems arising out of its high Chemical Oxygen Demand (COD), Bio-chemical Oxygen Demand (BOD_5), Nitrogen and Total Suspended Solids (TSS) together with significant chromium, sulphide and chloride. Therefore, treatment of composite Chrome tannery wastewater becomes difficult due to various toxic/inhibitory substances. Among different biological methods available for the treatment of composite chrome tannery wastewater, Activated sludge process (ASP) is a widely accepted biological system. The process design of the ASP reactor using rational approach always requires for realistic values of kinetic co-efficient related to substrate removal and biomass growth. In view of that, the kinetic behaviour of substrate (i.e. COD) removal and biomass growth must be established prior to applying a model. Moreover, the biodegradation potential of the concerned wastewater should also be estimated to take appropriate measures during treatment. The present study was undertaken to examine the treatability of the composite Chrome Tannery wastewater using an acclimated suspended biomass under batch mode of operation. The objective also included determining the kinetics co-efficient for the biodegradation, based on most favourable kinetic model. A laboratory Scale ASP reactor was employed for conducting the batch study on the performance of COD removal from a composite tannery wastewater and also for determining the kinetics coefficients. The results of several batch experiments highlighted the efficacy of the ASP system in treating composite Chrome Tannery wastewater, but experienced with an inhibition. Thus, the Haldane growth kinetic model was found best-fitting for biodegradation performance using mixed culture microorganisms. The batch study was performed under varying batch periods to determine five kinetics constants, viz. Ks, k, k_i, Y and k_d from the experimental data. The values of all the kinetics co-efficient are in a good agreement with the earlier kinetic studies on composite tannery wastewater.

Key Words: Activated sludge process, kinetic study, composite tannery wastewater, COD removal, Haldane kinetics, kinetics co-efficient

Fish Diversity and Drainage Mapping of River Siang in Arunachal Pradesh

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River Siang is the one of the major river of Arunachal Pradesh and also an important tributary of the mighty River Brahmaputra. The present study on fish faunal diversity of River Siang, East Siang district of Arunachal Pradesh was carried out from 2012 to 2014 in different seasons throughout the year. The present studied revealed that River Siang have good potential fish fauna. There were 90 species of fishes belonging 59 genera under 8 orders, 24 families had been recorded. Cypriniformes dominates the whole river.

An analysis of the drainage network of a part of River Siang was undertaken to reveal the role of drainage water activity of the area. A number of fluvial geomorphic anomalies have been identified in the area. A prominent annular pattern is observed in the central part of the area. The total length of River Siang in Arunachal Pradesh is 293.9 km. This study revealed that the development of topography and drainage system of the study area have been influenced by active subsurface geological structures.

Key words: Fish biodiversity, Drainage, GIS and Remote Sensing, East Siang, Arunachal Pradesh, India.

Innovative Use of Environmentally Waste Fly Ash for Detection of Hazardous Gases

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Fly ash is a coal product generated from coal fired thermal power plants. Large amount of fly ash is generally piled up on the nearby or surrounding land causing environmental problems & barren the surrounding area. Since disposal of fly ash is today's burning issue, it is essential to plan about the disposal of fly ash or reuse the ash for some applications. Recently, fly ash is being utilized for the preparation ceramic products, cement concrete, bricks. Still a search for innovative routes of utilizing fly ash is needed. Moreover, the presence of air pollutants like carbon monoxide & carbon dioxide, in huge concentration, is detrimental to the environment & adversely effect on leaving being. Therefore sensors, capable of detecting hazardous gases, are essential. Therefore, the objective of the present work is to deal with global environment protection issue wherein environmentally hazardous fly ash will in turn be utilized for detection of CO and CO2 gases.

Fly ash, an environmentally waste material, is collected from Parli-Vaijanath Thermal Power Plant from Maharashtra, India. Fly ash is cleaned and characterized by various techniques such as XRD, FTIR, and SEM/EDAX. Screen printed thick films, wherein fly ash is used as a main functional material, are deposited on glass substrate and are used as the sensors to detect hazardous gases like CO and CO_2.

FTIR reveals the presence of characteristic peaks due to T-O structure. SEM shows the spherical morphology of the fly ash particles and EDAX confirms the presence of various elements like silica and alumina in ash. The study shows that the fly ash thick film based sensor is sensitive to both, CO and CO_2, gases. The fly ash based thick film sensor can be operated at an operating temperature of 150^0C to sense CO gas. The maximum sensitivity for CO_2 gas is found to be at a working temperature of 200 ^{0}c. The fly ash sensor gives faster response (~120 s) to CO_2 than CO gas (~330 s). The study reveals that fly ash can be utilized in sensor field to detect CO andCO_2 gases.

Key words: Fly ash, thick film, Screen printing technique, gas sensor, XRD, FTIR, SEM/EDAX

A Comparative Study on the Weed Biology and Crop-Weed Competition in Robusta Coffee

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Coffee is a well-loved drink. Several characteristic of coffee make it good to man. Coffee is a perennial crop and shrub has dual function of maturing the berries and producing fresh wood. The coffee belongs to family rubiaceae and the genus *Coffea*. *Coffea Arabica* and *Coffea robusta* are species of coffee widely cultivated around the world. Weed vegetation consists of population of several weed species associated with a certain crop. This association is an organized complex with a typical composition and structure which is the product of interplay of several physical and biotic factors with time. Since weed control aims to efficiently reduce the competitive ability of weeds with crop plants, an understanding of the nature of basic association in the community and the changes that occur due to modification of the environment is essential. Weeds are often naturally adapted to a given environment and so may grow faster than the crop, especially since the crop species has been selected primarily for high yield much than high competitive ability. In this background a study was initiated at Regional Coffee Research Station, Chundale, Wayanad to make a comparative study on weed biology and crop weed competition in *robusta* Coffee. Observation on taxonomic, qualitative and quantities characters of weeds at 16 different locations were recorded. Observation based on taxonomic characters of weeds were significantly influenced by annual, broad leaved, weed propagation by seeds, majority of weeds dicotyledon characters, weeds leaf pattern erect in nature and most of the weeds deep rooted type. So the nutrient uptake of these weeds is more than when compared to the coffee plants. It is difficult to work with weeds for any time without some admiration, however grudging, for their persistence and irrepressibility. From the above results it can be concluded that weeds can lead to over 50% crop loss or total loss in the long run. Weeds lower quality by competing for nutrients and moisture, leading to production of either small or rugged beans. Some weeds are alternate hosts for coffee insect pests that affect coffee quality. Indiscriminate use of herbicides should be avoided to prevent residue accumulation. Weed slashing also would minimize water and nutrient by weeds. Hand weeding efficiency controls annual weeds having erect and upright growth while weeds growing prostrate rosette and horizontal get frequency cut/turn suited to wide row field crops of coffee. Mulching is very effective against most annual weeds and some perennial weeds.

Key words: coffee, weed vegetation, competition, mulching

Impact of Anthropogenic Disturbances on River Ecosystem and River Side Societies: A Case Study of River Churni, Nadia, West Bengal

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River Churni is one of the major rivers of district Nadia. It performs important role in geo-morphological, environmental, sociological and economic status of the district. Studies have been revealed that due to huge pollutional load from diffused sources, ecological condition of the river is in critical state. The degrading ecological condition casts some adverse impacts upon socio-economic condition of the river-side villages. The fishermen form the said arena has been compelled to squirm their occupation owing to the aforesaid degrading condition of the river. In this paper, seasonal variation of limnological parameters, present status of fish fauna and socio-economic structure of the riverside fishermen community are beaconed to compare the previous and recent conditions. Huge variations in the limnological parameters and presence of only 33 fish species in the river have been evident during the total stretch of the study. Comparing the result with the previous reports, about 61.35% fishermen are found to twitch their occupation since last 2 decades. To cope up with this problem, suggestions have been discussed in several awareness programmes, seminars at grass root level in the river side areas, conducted by the total research team. Though, it is also found that the actual development of the riverine ecosystem and socio-economic condition of the riverside communities can be conquered only by the proper interference of Governmental actions.

Key words: River Churni, ecological condition, limnological parameters, socio-economic condition

Hydro-Geomorphic Characteristics of Nanoi River Basin, Assam Using Remote Sensing and GIS Techniques

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Ever since the initiation of drainage over the surface of the earth, rivers have been dynamic entities causing geomorphological changes in land and hydrological regimes. Hydro-geomorphic processes play key roles in creating, modifying, or destroying aquatic habitat and act as ecological disturbances that shape ecosystem characteristics and dynamics. Within the broad regional context set by general patterns of climate, physiography (geology and topography), and vegetation, the combined influences of the hydrologic, geomorphic, and vegetation regimes dominate the variability of river systems. Hydro-geomorphic characteristics of a river, mostly in moist climatic areas, have been rendering fast growing impact to on a number of geomorphological forms and patterns. The Nanoi river basin, a part of reverine built-up plain of Brahmaputra valley composed of fine alluvial sediments, which has been washed by sheet flood causing river bank erosion and channel shifting almost every year due its hydro-geomorphic factors. The hydro-geomorphic characteristic of the river basin has caused serious geomorphic, hydrologic and environmental problem in the southern part of the Darrang district. The total length of the Nanoi River is 104.275 kilometer with the basin area of 959.460 sq. km. the topography of the stream is such that the valley is typical characteristics. The basin extending from 26^0 15/ 45.14// N to 27^0 04// 57.84// N latitude and 91^0 48// 59.66// E to 91^0 58// 42.536// E longitude. Flood is basically contains physical bases of flood occurrence. The relief and drainage regimes play dominants roles to create characteristics of environment on the land of the concern basin area. Hydrologic analyses were accomplished with 100 years of record from 1898 to 1998 using the log-Pearson Type III distribution for unregulated flows at gages. The intensity of the impact, the size of the area affected, and the frequency of occurrence together define the disturbance regime associated with particular hydrogeomorphic processes. Concepts of hydrology and geomorphology essential for restoration projects include variability in time and space, and the influence of local and downstream effects on channel processes. In addition, river restoration efforts need to be founded on an understanding of characteristics and functional relationships that structure aquatic habitat, the influence of routing on impact propagation, and the role of disturbance history and legacies on current conditions and restoration potential. Geographic variations of climate, physiography (geology and topography), and vegetation impart a strong regional character to river systems. Therefore, a detail investigation is required to cope with such type of hydro-geomorphic condition by using remote sensing and GIS technique. Geographical Information System and Remote Sensing are being increasingly used in evaluation of river morphometry and hydraulic characteristics to improve the quality and quantity of the research study of river basin area.

Key words: Hydrology, Morphology, Flood, Bank erosion, Environment, Channel characteristics

Utilization Isolation and Characterization of Micro Algae for Carbon Sequestration, Waste Water Treatments, Production of Anti-Microbial, Bio-Active Metabolites & Bio-Diesel in a Commercial Manner

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A simple unicellular Green micro algae species are collected and isolated from brackish and fresh water bodies of Tamilnadu state in India. These species have been evaluated for its potential use in the production of Biodiesel, Carbon Sequestration studies and they are isolated and identified by genomic DNA, 16S rRNA gene amplifications and sequencing techniques. The growth rate of these algae species have been estimated with Spectro Photometric measures. The Electron Microscope and Scanning Electron Microscope are used to examine their morphology. The Fourier Transform Infrared Spectroscopic studies are used to infer the presence of various functional groups in these algae species. The rate of carbon sequestration and the improvements to the quality of waste water is obvious with the growth rate determination of these algae bio-mass. There is an report on an improvement to the quality of waste waters with respect to p^H, conductivity, total hardness, calcium and magnesium hardness, total dissolved solids (chlorides, sulphates, phosphates, nitrates), Iron, Total Alkalinity (carbonate, bicarbonate, hydroxide alkalinities), Fluoride levels with respect to these micro algae species growth rate. It also revealed a reduction trend of the quality parameters indicates that the quality of waste water has been improved. All these findings revealed that the algae species identified are effective in treating the waste waters generated by human consumption and it proves its efficiency of removing nitrates and phosphates to the extent of 100% at an time interval of 6 days is remarkable, its carbon sequestration abilities, the extractive mechanism of lipids from which Bio-diesel production by trans esterification, the anti-microbial property, and the presence of bio-active compounds are still interesting aspects towards its commercial production. The micro algae has been identified as a the potential source to produce biofuels, the ability to produce high amounts of oil, efficiency in harvesting solar energy, adaptability to different climatic conditions and capability to produce valuable by-products makes algae as a potential source for renewable energy source and the production of renewable bio fuels from algal biomass by transesterfication process and its Characterization study reveals that algal based biodiesel is an effective commercial alternative source of diesel. This single celled green micro algae cultivated during the studies on carbon sequestration, the FTIR Spectra and PCR studies revels the presence of positive lipid content which also subjected to various bio-chemical protocols and revealed that it is a rich source of

antioxidant with anti-microbial active substances which caters as a rich source of natural healthy food supplement. The presence of Alkaloids, Saponins, Steroids, Flavonoids and Phenol compounds are verified, estimated by standard procedures, Spectro Photometric methods. These bio-active compounds and their presence supports that the micro-organisms (algae) could be functioned as a resource of natural medicinal derivatives and it finds as an alternative to medicinal plants most of them are endangered species. These medicinal extracts from the micro algae improve the immunity of humans and caters the demand of bio-active compounds serves as an alternative resource with sustainability. Some more work in this direction is needed for carrying out the purification, validation studies. This research enables an effective role for Carbon Sequestration Studies, Bio-diesel production, Waste Water treatement, Bio-active compound and Anti-microbial substances productions. The growth rate is reveled as 0.18 to 02 $gl^{-1}d^{-1}$ at 10-40% CO_2 conditions and the Lipid content is of 20-30% by the cultivated bio- mass. The Closed Bio-reactor, Flue gas supply systems, exposure to sunlight, fluctuations by indigenous designed solar submersible pump and the usage of LED bulbs, 3D during night duration are some special measures are to be patented. The pitch is subjected for acid activation and it proves as a good fine activated carbon in adsorbing the hazardous substances present in industrial waste waters.

Key words: Algae, Lipid, Biodiesel, Fuel properties PCR study, FTIR, Spectrophotometer, Phytochemical compounds.

Physico-Chemical Profile of Sukhana River in Aurangabad (M. S.), India

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The present study deals with comparative study of past and present senario water quality of Sukhana River, Aurangabad [M.S] India. The physico-chemical characteristics were studied and analyzed during January - December 1987 and presently January - December 2010. Seasonal variations in the past and present study of Sukhana River in Aurangabad [M.S] India were observed. The results revealed that the condition of this River has been increased in pollution year by year because year values are highly significant conform by f test (ANOVA). Parameter of Sukhana River are pH, Total solids, Total dissolve solids, Total suspended solids, DO, BOD, COD, Alkalinity, Total Hardness, Chloride, Nitrate and Phosphate are 6.94, 567.58, 470.41, 97.16, 1.45, 44.58, 92.41, 437.66, 487.83, 106.33, 0.24 and 138.75 respectively beyond the permissible limits according to WHO and ISI standards for drinking purpose.

Key wards: physico-chemical parameters, seasonal variations, ANOVA, Pollution.

Seasonal Variations and Biodiversity of Zooplankton in Harsool-Savangi Dam, Aurangabad, India

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The present study concerns seasonal variations, correlation coefficient and biodiversity indices of zooplanktons during January – December 2008 in the Harsool-Savangi dam, Aurangabad India. A total of 25 genera were recorded of which 10 were Rotifers, 8 Cladocerons, 5 Copepods and 2 Ostracods. Present study revealed maximum percentage wise compositions of Rotifers at north site 58.28 %, Cladocerons at south site 29.78 %, Copepods at east site 16.59 % and Ostracods at south site 4.20 %. Minimum percentage wise compositions Rotifers at south site 51.54 %, Cladocerons at west site 26.71 %, Copepods at north site 11.03 % and Ostracods at north site 1.36 %. Margalef's index (R_1) and Menhinick index (R_2) values (3.58 and 0.87) were found to be the highest at south site and lowest values (3.16 and 0.56) were found at north site. Simpson's index (λ) values (0.43) were found to be the highest at north site and lowest values (0.37) were found at south site. Shannon – Weiner index (H') values (1.06) were found to be the highest at south site and lowest values (0.94) were found at north site. Maximum species evenness was recorded at south site; minimum species evenness was recorded at north site. Maximum population density of Rotifers, Cladocerons, Copepods and Ostracods (799, 350, 163 and 18) were recorded at north site in summer and minimum (58, 35, 22 and 13) were recorded at south site in monsoon respectively.

Key Words: Zooplankton, biodiversity indices and percentage wise compositions.

Comparative Study of Synthetic Hormones Ovaprim and Carp Pituitary Extract Used in Induced Breeding of Indian Major Carps

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In present study during 2008- 2009 observed the spawning response of ovaprim compared with pituitary extract in Indian major carps, at fish breeding center at Jaikwadi, Paithan Dist. Aurangabad (M.S) India. Total ten trial doses of ovaprim were used in induced breeding and ten trial doses of Carp Pituitary Extract (CPE) used for induced breeding in Indian major carps i.e *Catla catla, Labeo rohita and Cirrhinus mrigala.* The percentage of fertilization ranged (88.11 - 97.94%) was found with ovaprim treatment. and (53.19 - 85.48%) with pituitary extract treatment. The percentage hatchling ranged (74.70 - 95.92%) with ovaprim treatment and (60 - 58.82%) with pituitary extract treatment.

Cyclic Changes in Ovarian Maturation and Histological Observation in Indian Major Carp Catla Catla [HAM]

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Annual reproductive cycle of female *Catla catla* was studied during the (January 2009 December 2009) through gross and histological studies. GSI was observed (13.00±9.30 %). On the basis of gross and histological studies, seven ovarian stages namely, i) immature/resting ii) regenerating iii) developing iv) maturing v) mature/gravid vi) regressing and vii) regressed were distinguished. Based on GSI studies, spawning seem to for a period (late June-early September). Histological studies revealed six stages of oocyte development namely i) chromatin nucleolar ii) perinucleolar iii) cortical alveolar iv) early vitellogenic v) late vitellogenic and vi) early germinal vesicle movement. The present studies describe the morphological and histological changes in the ovaries of *Catla catla*. The annual breeding cycle of the fish has been divided in to four stages in the following month of year i.e i) the preparatory phase (January – march) ii) pre spawning phase (April – June) iii) spawning phase (July – September) iv) post spawning phase.

Key words: *Catla catla* , Morphological, histological changes, GSI, annual breeding cycle.

Rogor Induced Histopathological Changes in the Gills of Freshwater Fish *Puntius Stigma* from Sukhana River, Aurangabad (M.S.), India

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Histological biomarkers of toxicity in fish organs are a useful indicator of environmental pollution. The histological effects of rogor, an organophosphate insecticide, on the gill tissues in *Puntius stigma* were determined. The fishes *Puntius stigma* were exposed to lethal concentrations at 96 hrs LC_{50} and sub lethal concentrations at (1/5, 1/10 and 1/15 ppm) of rogor for 30 days. The fishes shows severe histological changes in the gill lamellae such as bulging, epithelial hypertrophy, fusion of secondary lamellae, hemorrhage, curling of lamellae, swelling of pillar cells, swelling of chloride cells.

Key word: Rogor , Histopathological changes, gills, *Puntius stigma*

Effect of Organophosphate Insecticide (Rogor) on Protein Content of *Channa Striatus* from Sukhana River, Aurangabad (M. S.)

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The Pesticidal effects on biochemical parameters of fresh water fishes are well illustrated from the recent research in the field of toxicology. Among the major biochemical components proteins are of prime importance as they are determine nutritive value of fresh water fishes.

Activity of a few biomarkers have been investigated on fresh water fish *Channa striatus* exposed to three sub – lethal concentrations of rogor (1/5, 1/10 and 1/15 of 96hrs LC_{50} value). The alteration in protein contents of muscle, liver and kidney were investigated. The protein levels were found to be depleted in all the tissues after exposure to rogor over the control. Therefore the detailed result and observations are summarized in the present investigations.

Key words: Organophosphate insecticide, Sukhana river, rogor , *Channa striatus,* proteins

Some Aspects of Water Quality Parameters of Pardeswadi Lake, Waluj MIDC Aurangabad (M.S.), India

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Water quality focuses on the various aspects off the physico-chemical parameters of water by which state of the water body can early be observed. Measurements of various water quality parameters play the key role in detecting the status of pollution and suitability of particular water body for various aquatic organisms and agricultural products. The present survey / study was conducted to measure the various physico-chemical parameters of the water at Pardeshwadi Lake, at Ramrai Jogeshwari and Kamlapur in MIDC area, waluj Aurangabad, Maharashtra, India.
In waluj MIDC area, sterlite colgate & Palmolive, Cosmo films, arpika engineering, Solidar Remedies, NRB baring, Graware Polyester and Foster industries lays chemical mixed water and sewage in drainage and in open ground channels, in waluj, Jogeshwari, Ranjangaon, Shenpunji. Optic fiber plant of Sterlite industries lays down its sewage water in stream which flows by the side of crop field contains water from colgate and Palmolive and cosmo films and then joins to Pardeshwadi Lake and Pollutes the water of lake which make harzard for the health of people in the area.

Key Words: Physico-chemical Parameters, Pollution and Pardeswadi Lake

Appraisal of Physico-Chemical Parameters Pro-Authentication of Pollution Status of Ravivarpeth Lake Ambajogai Dist. Beed Marathwada Region (M.S.), India

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The present study deals with assessment of important Physico-chemical parameters of Ravivarpeth Lake at Ambajogai Dist. Beed in the midst of the geographical-co-ordination at 18-45' North Latitude and 76-10' East Longitude in Marathwada region [M.S] India [Asian continent]. The study was undertaken to confirm the status of water body. The imperative parameters were studied and analysed every month during January –December 2005. For this investigation three different sampling stations were selected as station A, B and C. The results construed that the conditions of Ravivarpeth Lake in different months showed fluctuations in physicochemical parameters reflected accordingly to the seasons, climate and the pollution load over the investigated water body.

Water Quality Assessment of Lower Dudhana Dam, At Selu, Dist. Parbhani (M.S.), India

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The present paper deals with the assessment of the water quality of Lower Dudhana Dam, At Selu, Dist. Parbhani (M.S) India. The good water quality always produces a good health of human beings than poor water quality. An analysis on the physic-chemical parameters of Lower Dudhana Dam was carried out during January 2013 to Dec. 2013. The use of water is mostly for irrigation, drinking and fishing purpose only. The monthly changes in physical and chemical parameters such as water temp., air temp., TDS, pH, Colour, Odor, TS, TSS, Electric Conductivity, Total hardness, Chlorides, Alkalinity, Phosphate, Sulphate, Nitrate, Magnesium, DO, BOD, COD and Fluorides were analyzed for a period of one year. All parameters were within the permissible limits. The present results indicated that the dam is non-polluted and can be used for Domestic, irrigation and fishing purpose.

Key Words: Physico-chemical parameters, Lower Dudhana dam, Monthly variations

Health Care Waste Management- An Emerging Challenge in India

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The management of healthcare wastes is receiving much attention owing to the multiple risks it rendered both to health in particular and the environment in general. The health care wastes (HCW) pose immense danger due to the inadequate waste disposal management practices in both the rural and urban sectors. Health and medical care waste is often mixed with municipal waste including domestic wastes and is finally disposed-off in residential waste landfills or improper treatment facilities. The two primary challenges to any waste disposal are primarily the technique of disposal and secondly the treatment methodology. (For example, incinerators)

Regulatory intervention by the government and health care agencies is very crucial to control and check the health care waste management especially for medical waste incineration especially in an ecologically friendly method failing which this is considered pollution for the environment and a simultaneous threat to health. This situation may be overcome with the help of an organized system of health care waste management to curb public health risks as well as occupational hazards among health care workers as a result of poor waste management.

This paper is an attempt to present a general overview of the current management practices of health and medical wastes in the hospitals in India with emphasis on the urban sector. The data is primarily secondary collected from reports and information regarding the generation, composition, segregation, transportation and disposal of health care and medical wastes is discussed. The pilot analysis is intended to be implemented as a full-fledged study in the city of Visakhapatnam and extrapolated to similar cities in India. The study also focuses on the impact of poor management of HCW to handlers, public health and environment.

Key words: Healthcare waste, health, medical waste, management, risk, treatment methodology

Prosecution against Environmental Crimes- A Legal Reprieve for Protection of Biodiversity and Environment

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The concerns and challenges of environmental safeguard and protection, with emphasis on the prevention and misuse coordinated by the pollution control strategies so as to protect the biome are myriad and often flak. Inefficiency and ineffective implementation that persist may be accounted for in varied dimensions, especially in the dynamic political, social and economic scenarios globally, especially with organisations, the ministry and the environmental activists per se raising a huge hue and cry one day only to be merged with the noises of the next.

The suggested and perhaps the best procedure to get the ball rolling for enforcement and implementation of standards that contribute to the sustainable development and environmental protection perhaps is the variant degrees of punishment depending on the nature and extent of the impact on the aspect of the environmental biodiversity by a specific individual, department, organisation or a cumulative mishap by the functional units including the Government. Accountability for a wrong committed, before it is given the face of a civil wrong or a environmental crime should be emphasised and this as in many other cases of implementation of regulatory policies allows for the prosecution against environmental crimes and looking for a legal reprieve for the protection of the biodiversity in specific and environment at large.

The paper is an attempt to study the punishment that might be rendered, the repercussions on the sentencing time and its implications.

Key words: Environmental Crimes, Sustainable Development, Environmental Protection

Effect of Tea Drinking on Dental Fluorosis and Role of Calcium Rich Food in Fluorotic Patients

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Tea (*Camellia sinensis var. assamica)* is an intensively managed perennial monoculture and important cash crops of Assam belong to genus Camellia and family Theaceae. Habitual consumption of large volume of poor quality tea for 4/5 times is very common among the rural population of Assam. This region lies within the geographical fluoride belt and fluoride occurs as minor constituent of ground water in all categories of hydro-geological settings. Tea plants absorb higher amount of fluoride from soil and therefore chronic toxic levels of fluoride consumption from tea beverages are possible. A study was carried out to find out the relationship between prevalence of fluorosis among the populations of tea garden belt villages of Golaghat district of Assam and fluoride ion concentration in drinking water as well as in tea beverages. Calcium tablets and calcium rich food (banana) was supplied to five severely affected fluorotic patients (3 children and 2 adults) for one month daily in the morning. Fluoride ion in urine (morning) was estimated before and after treatment with calcium foods. Pre-treatment urine fluoride content was recorded higher for adults than children and the controlled samples. Whereas, post-treatment was found higher in child patient than the adults. High positive correlation ($p < 0.001$) was found between fluoride concentration in water and urine, and tea drinks and urine. Study revealed that continuous intake of calcium rich food can help in minimum incorporation of fluoride.

Key words: *Camellia sinensis,* fluorosis, calcium, urine, drinking water etc.

Studies on Avifaunal Diversity and the Major Causes of Its Depletion in a Floodplain Wetland of District Nadia, West Bengal, India

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A two years study has been carried out in hansadanga beel, a floodplain wetland near the krishnanagar city of district Nadia, west Bengal. In this study, the distribution and diversity of some resident as well as migratory water bird population was taken into consideration along with some limnological propertiesof the water body. In recent years a decreasing trend is observed in the migratory water bird population density in winter months. The intense agricultural practices, pollution and a number of anthropogenic activities are the major causes of changing the water quality and habitat characteristics of this floodplain wetland.

Key words: floodplain wetland, avifauna, diversity, limnological properties

Effect of Land Application of Bio-methanated Distillery Spentwash on Soil Properties and Crop Growth- A Case Study in Bagalkot District, Karnataka

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Spentwash, an effluent of distillery is an environmental pollutant because of its high load of pollutants (pH, 2-4; BOD >40,000 mg/l; COD >100,000 mg/l & TDS >80,000 mg/l). But, however, after subjecting it to bio-methanation (primary treatment), its pollutant load gets drastically reduced and could be disposed off safely. The bio-methanated spentwash is a rich source of organic matter and plant nutrients and hence is useful as a resource in agriculture. With the consent of the Karnataka State Pollution Control Board, Bangalore, the distilleries in Karnataka are taking up land application of their treated spentwash in farmers' fields under the supervision of scientists of Agricultural Universities. A monitoring study was undertaken in Bagalkot district with an objective of studying the effect of land application of bio-methanated spentwash of a distillery on soil properties and crop growth. The treated spentwash was applied uniformly to the fallow lands in different farmers' fields during summer, 2012 at recommended rate (based on nitrogen requirement of crops) at least a fortnight before sowing/planting operations.

The analysis of soils collected before land application of spentwash and after harvest of crops revealed that there was no adverse effect of applied spentwash on soil characteristics. Although there was slight build up in soluble salts, all the soils recorded EC of less than 1.0 dSm^{-1}. An improvement in soil fertility status was observed as evidenced from increase in soil organic carbon and available nitrogen by about10 to 30%. The presence of good amount of biodegradable organics in the treated spentwash (BOD of 7500 mg/l) contributed for improvement in soil fertility. A substantial build up in potassium (K) status in soils (50 to 200% increase) was observed due to spentwash application. This was attributed to the high K content in spentwash (7150 mg/l). Since higher K status in soils has no negative effect on soil fertility, it did not affect plant growth. The farmers opined that the growth of crops in the spentwash applied fields was higher and they could get nearly 15 to 20 per cent higher yields, especially in sugar cane and maize crops. The analysis of ground water of the study area showed that the quality of water was not affected due to land application of spentwash. Hence, it could be concluded that the bio-methanated distillery spentwash can be gainfully utilized in crop production without polluting the environment.

Key words: Pollutant, soil fertility, soil organic carbon, potassium status, crop growth

Environmental Monitoring and Assessment in Antarctica

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The Larsemann Hills (Lat. 69°20′–69°30′S and Long. 75°55′–76°30′E) is an ice-free coastal oasis with exposed rock and low rolling hills. The Larsemann Hills contain hundreds of freshwater lakes of varying sizes, depth and biodiversity. An environmental study was being conducted at Larsemann Hills in East Antarctica to evaluate the Ambient air quality, Lake and Sea water quality, soil and sediment characteristics, Noise level, solid waste generation, handling and disposal practices, etc. Geographically, the study area (Bharti Island) is situated on Latitude 69° 24' 00.0" S and 76° 10' 00.0" E on southern part of the Earth. Air, water, soil and sediment samples were collected from various locations of different Islands/Peninsulas like Bharti Island, Fisher Island, McLeod Island, Broknes peninsula and Stornes peninsula.

The aim of this study is to assess the general characteristics, metal content, pesticide, radiation contamination and bacteriological analysis of water, soil and sediment. The air quality of different islands was also conducted to assess the level of particulate matter, oxides of nitrogen, sulphur dioxide, carbon monoxide and volatile compounds in air. The present work is aimed towards developing base line data for the local environmental settings and to evaluate the impacts of various activities on the environmental components during the construction work of third Indian scientific station, 'Bharti' in east Antarctica.

Key words: Antarctica, environmental monitoring, Air quality, water quality, environmental components

Removal of Hexavalent Chromium from Aqueous Solution - A Critical Review

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Hexavalent Chromium is considered to be highly toxic substance. It is one of the world's most strategic, critical & highly soluble metal pollutants having wide range of uses in the metals and chemical industries. Because of its carcinogenic, mutagenic and teratogenic characteristics, it has become a serious health concern. It can easily penetrate biological membranes and can affect lungs, liver and kidneys. It can enter into the environment from various natural & anthropogenic activities like chromite mining, electroplating, tannaries industries etc. It is a challenging task to clean the chromium-contamination because removal of Cr (VI) in aqueous solution is very difficult. This review explains various methods like adsorption, chemical treatment, ion exchange, membrane filtration and microbial treatment for removal of hexavalent chromium from aqueous solution. Among all these methods, adsorption and microbial method are found better technique to remove hexavalent chromium from aqueous solution.

Key words: Cr (VI).Chromium removal, Adsorption. Chemical treatment, Ion Exchange, Microbial Treatment

Site Surveys for Green Audit- A Case Study

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Environmental audit is done to assess the nature and extent of harm, or risk of harm, to the environment posed by an industrial process or activity, waste, substance or noise. It is about understanding the type of contamination or pollution and the harm it poses. The industries or Government and private organizations use the environmental audit system to determine the condition of a site and its suitability for use, or to advise what's required to make a site suitable for use.

The environmental quality of a site, greatly affects those that are associated with it. Environmental audits assess and recommend measures to reduce identified risks to the environment from a site. The parameters considered for the evaluation of any site for environmental survey as per the guidelines provided are Energy use, transport and greenhouse gases, Water use, Wastewater/effluent, Emissions, Waste management, Pollution prevention/hazardous and potentially hazardous substances, Major incident prevention and management, Contaminated land/soil and groundwater, pollution, Prevention, Land use and biodiversity.

Our campus is located in the heart of the city and activities on our campus affect the surrounding localities. So we undertook the survey of the campus of our college on some of the above parameters, like solid waste management, soil quality, water quality, air quality and noise quality on the site using standard procedures. We also calculated the green ratio of our campus and the results are presented in the paper.

Key words: Environmental Audit, environmental quality, survey

Environmental, Economic and Agricultural Surveys of an Ecologically Important Hamlet in *Gorubathan* Block, *Darjeeling* District, West Bengal

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Forest cover in the hill regions is essential to maintain environmental, economic and ecological balances. North Bengal accounts for 3,086 sq km (26 %) of the 11,876 sq km area of classified forests in the state, and for nearly 5,000 sq km (40 %) of all land under tree cover. *Kumai* is a Village (26.84^{o} N, 88.60^{o} E) in *Gorubathan* Block in Darjeeling District of West Bengal State, India. It is located 66 km. towards East from District head quarter Darjeeling, 16 km. from *Gorubathan*, 575 km. from State capital Kolkata. *Kumai* is surrounded by *Nagrakata* Block towards South, *Gorubathan* Block towards west, *Mal* Block towards South, *Reghu* Block towards North. The survey work was done in December, 2014 by visiting the *Khumani* Forest Village (established in 1949) of upper *Kumai* and the primary data were gathered through field survey and direct contact with common people and authorized centers of the region. Surveys on the demography, agriculture, livestock, water management, education, culture, health, waste management, disaster management, transport, biodiversity, human animal conflict were done in this area. Topographic map of the area was prepared by using the database of National Atlas and Thematic Mapping Organization (NATMO), Kolkata office. Demographic information was collected from the village area and the *panchayat*. Census report was collected from the local *Panchayat* Office. There are 115 houses in the village with total population of 724. Religious and social festival information was collected from the local people. Main religions are Kirat, Buddhist, Hindu and Christian. Information regarding the transport system was collected from the local transport office and syndicate. The main modes of transport are private car, Bikes and Tempos (good carriers). No bus service is available in the village area. Health and education information was collected from the local primary and high schools and the local sub health centre. Local medical treatment facilities are available in the sub health centre of *Jhalang* and *Kumai* tea garden hospital. For additional medical facilities, people used to visit the hospital of *Chalsa, Malbazar* and Siliguri. For primary education, there is a primary school (upto 4th standard) in the village (*Khumani* forest village primary school, established in 1957) with 4 teachers and 45 students. For higher studies, people used to visit *Malbazar* and Siliguri. Information on environmental activities like using sustainable agricultural practices and waste management policies is collected through surveys in the *Khumani* Forest Village. Main cultivable crops are rice, maize, tomato, potato, squash, rubber, banana, mango, cauliflower, cabbage, beans, radish, spinach, fenugreek leaves, leaf mustard etc. Main economic crops (cash crops) of the village are betel nut and large cardamom. The people of *Khumani* Forest Village usually practiced organic farming; cow dung is used as

manure. No pesticide and fertilizer is added to the fields. Irrigation is mainly done by rainwater and by constructing canals to channelize hill water. Network of pipeline distributes the water from the hills to the village houses. Houses have their own water collecting and storing unit from which they get the supply. Common livestock in the village area are cow, goat, chicken and pig. Honey bee rearing units are also observed in the houses. The common waste materials generated in the village are solid wastes, including plastic packets, paper boxes, plastic bottles, glass bottles, vegetable wastes etc. Solid wastes are usually collected in specific bins. Every house their own burning places where they used to burn all the solid wastes. Wood is used for house construction, burning and cooking purpose which is generally collected from the forest. Employment and migration patterns were studied by surveying the village houses. Only 4-5 persons are involved in government and private services, the rest are involved in local agricultural and business activities. Environmental activities of the local NGO (Water and Environment Conservation Committee) were documented. This NGO established in 2011 (with government registration) by the local inhabitants and 15 local villagers are currently operating the NGO. They used to conduct the afforestation programmes, mitigate soil erosion in the hills, manage plastic wastes and are also involved in rural developmental activities. Human animal conflicts were studied in the village area, as the area is periodically disturbed by the encroachment of elephant, rhinoceros and leopard. Mainly the elephants periodically destroy the agricultural fields and damage crops. Biodiversity of the region was documented by visiting the adjacent forest areas. Patterns of disasters in the area were observed. Darjeeling valleys are under rapid habitat destruction due to several anthropogenic pressures and developmental activities like hydro-electrical projects, development of roads, establishment of tea gardens, mining and quarrying, landslides, forest fire etc. These factors jointly have increased the fragility of the Himalayan Mountains, leading to an increase in the incidence of landslides in the region. *Jaldhaka* hydel power plant is just about 20 km. far from the *Khumani forest village*. Landslides, earthquake and flood are the main disasters occurring periodically in the village and adjoining areas. Local people are active for clearing roads after small landslides. For flood mitigation in the agricultural fields and village area, here is a big canal constructed in the village area, by which rainwater can be properly channelized during the monsoon period. In every phase of the survey work, pictorial documentation was done. In spite of being positioned in a diverse and sensitive ecological zone, the village is not adequately managed. There is an urgent need for implementing sustainable management systems in the areas for the betterment of the socio-environmental structures. Some of the possible management strategies have been suggested for maintaining the social, environmental, economic and ecological balance of the region. Perspectives of deforestation, landslides, biopiracy, climate change, ecotourism etc. are considered for maintaining the holistic approach of sustainable management proposals. Proper funds should be raised to conserve and manage these ecologically important zones of north Bengal, which should be one of the main focuses of future researches.

Key words: Darjeeling, North Bengal, Survey, Management, Biodiversity, Environment

Evaluation of an Optimal Median Lethal Concentration of Cupric Sulphate in an Indian Catfish, *Clarias batrachus* (Liinn.)

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Aquatic life is strongly influenced by physical properties of a water body. It is known that heavy metals as well as agro-pollutants are potentially harmful to the aquatic lives. It has been reported that heavy metals had a negative impact on all relevant parameters and caused histo-pathological changes in animals. Acute toxicity tests are rapid procedures used for measuring the concentration heavy metal, expressed as the median lethal concentration (LC_{50}), which will affect the animal. The median lethal concentration is defined as the concentration of a heavy metal or a chemical in the solvent which kills 50% of the test batch of the fish or the other living organism within a stated continuous period of exposure. There are different methods used in the determination of median lethal concentration. Therefore, this work was conducted to determine an optimal median lethal concentration of cupric sulphate in an Indian catfish, *Clarias batrachus* (Linn.) using different easy methods to arrive at a logical conclusion.

Key words: LC_{50}, Heavy metal, cupric sulphate, *Clarias batrachus*

Dye Removal from Aqueous Solution using Agricultural Waste Material: Modeling and Optimization using Artificial Neural Networks-Genetic Algorithm Technique

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Wastewater contamination, particularly the waste aqueous effluent containing dyes, is one of the most serious environmental problems of the present day. A clean and green technology is needed in removing the dye molecules from the water streams so that adverse effects of these pollutants on the environment can be reduced. Thus, in the present study, a clean and green technology i.e. biosorption was selected for the removal of Methylene blue (MB) dye from simulated colored wastewater. *Acacia arabica* fruit was selected as biosorbent in this study. The biosorbent characteristics were studied by using Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), and X-ray diffraction (XRD) analyses. The characteristic studies revealed that adsorbent is rich in cellulosic material which shows a strong tendency to attract dye molecules from aqueous solutions. The biosorption could be due to the involvement of various functional groups such as alcohols, aldehydes, ketones, carboxylic acids, amino acids, etc., in forming complexes or exchange ions for dye molecules in solution.

Batch mode experiments were conducted to study the effect of parameters such as temperature, solution pH, initial dye concentration and biosorbent dosage on dye removal efficiency. Rotatable single block central composite design was used to design the experimental runs. The experimental results revealed that dye removal increased with an increase in solution pH, and biosorbent dosage. These values decreased with an increase in initial dye concentration and temperature. The results also indicated the exothermic nature of the biosorption process. Interaction effect of these variables was also studied by ANOVA analysis. The combined effect of these variables on the percentage of dye removal was represented by mathematical model determined by artificial neural networks (ANN) method. The standard back propagation architecture with Levenberg–Marquardt (LM) algorithm was used in this study. The modeling efficiency of ANN model found to be very high. The model derived from artificial neural networks was optimized using genetic algorithm (GA) method. The hybrid ANN-GA optimization results showed that the optimum percentage of biosorption of Methylene blue of 98.46% was obtained at a temperature of 303.53 K, solution pH of 8.99, initial Methylene blue concentration of 25.048 mg/L, and biosorbent dosage of 0.21 g. This study revealed that the selected biosorbent exhibited high biosorption capacity and could be efficiently used for Methylene blue removal from the aqueous solution.

Key words: Biosorption, Methylene blue, artificial neural networks, genetic algorithm

Microfloristic Diversity in Relation to Anthropogenic Pollution of Pratap Sagar Pond, Chhatarpur (M.P.) 471001 India

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In present investigation microfloristic diversity which are used as indicator of anthropogenic pollution were reported from four stations of Pratap Sagar Pond. Total 27 genera and 43 species have been identified among these 18 species belonged to Chlorophyceae, 17 species to Cyanophyceae, 6 species to Bacillariophyceaeand 2 species to Euglenophyceae.The most pollution tolerant species of *Spirulina, Oscillatoria, Microcystis, Scenedesmus, Eudorina, Pendorina, Pediastrum*and, *Closterium*are listed. The pollution tolerant genera and species decreasing emphasis according to Palmar (1969). The microfloristic diversity indicates that the Pond was anthropogenically polluted.

Key words: Microfloristic diversity, Anthropogenic pollution, Nirmalya

Effects of Dispersal and Density of Leopards *(Panthera pardus pusca)* on Severity of Conflict around Gir PA, Western India

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The common leopard *(Panthera pardus fusca)* is a widely distributed large carnivore and has a very broad latitudinal range encompassing a diverse array of habitats from tropical rainforest to arid savanna, and from alpine mountains to the edges of the urban area, but reached their highest densities in riparian zone. According to the latest assessment of international union for the conservation of nature (IUCN)-Red List, the Leopard has been classified as "endangered" cat species under the category of least concern. In India it figures in the Schedule I of the Indian Wildlife Protection Act, 1972 and assumed to low warrant. In view of the world-wild down-ward trend in leopard numbers the IUCN urged intensive research on leopard likely Myre's (1976) recommended that it remain in Appendix 1 of CITES because its extensive hunting had declined its populations. One of the main reasons for this decline is the leopard human conflict. As currently, the leopards are quite common at unprotected lands they frequently clash with humans in agriculture fields. They also attack on domestic livestock regardless of abundant natural prey base and in return obtain humans dislike even some time they try to eliminate this predator by poisoning prey remains.

The objective is concerned about to know the status of LHC, abundance and dispersal pattern of leopard at boundary of the Gir PA.

Key words: Common leopard, Dispersal pattern, HR size, Leopard Human Conflict, & Resolution & conservation

Socio-Ecological Studies on Adopted Marine Fishing Villages in Selected Districts of Andhra Coast

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Agricultural productivity is declining, largely due to shrinkage of cultivable land and declining soil fertility responsible for the farmer's suicides in India. Under such circumstances, role of fisheries sector to fulfill growing demand for food is of paramount importance for nutritional security. GO/NGO subsidiary policies and excessive technological invasion in the fisheries sector had created an environment in which life has become physically and mentally unhealthy. Living resources are self-renewable, more so are the aquatic living organisms, especially fish, utilized rationally on a sustainable basis in harmony with the ocean environment. The recent developmental policies pressurized the traditional fishing system for the sake of export and countries economic growth lead to marine ecosystem crisis entangled fish and fisherman community in the south coastal districts of Andhra Pradesh. The paper manifests the buoyancy of fish and fisherman during the natural as well as anthropogenic calamities and recommends welfare of the traditional fisherman. The ecosystem stability and social life of marine fisherman is the ultimate analysis in this research.

Key words: fish; fisherman; eco-crisis; marine villages

Accumulation of Alanine during Aerial Exposure and Locomotry Activities through Partial Amino Acid Catabolism in *Channa Gachua*

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The freshwater snakehead *Channa gachua* is an obligatory air breather that resides in slow flowing streams and in crevices near river banks in Hazaribag, Jharkhand. In its natural habitat it may encounter bouts of aerial exposure during the dry seasons. In the laboratory the ammonia excretion rate of *Channa gachua* exposed to terrestrial conditions in a 12 hours:12hours dark: light regime was one quarter that of the submerged control. Consequently, the ammonia contents in the muscle, liver and plasma increased significantly, and *Channa gachua* was able to tolerate quite high levels of ammonia in its tissues. Urea was not the major product of ammonia detoxification in *Channa gachua* which apparently did not possess a functioning ornithine urea cycle. Rather, alanine increased fourfold to 12.6µ $molg^{-1}$ in the muscle after 48h of aerial exposure. This is the highest level known in adult teleosts exposed to air or an ammonia loading situation. The accumulated alanine could account for 70% of the deficit in ammonia excretion during this period, indicating that partial amino acid catabolism had occurred. This would allow the utilization of certain amino acids as energy sources and, at the same time, maintain the new steady state levels of ammonia in various tissues, preventing them from rising further. There was a reduction in the aminating activity of glutamate dehydrogenase from the muscle and liver of specimens exposed to terrestrial conditions. Such a phenomenon has not been reported before and could, presumably, facilitate the entry of α-ketoglutarate into the Kreb's cycle instead of its amination to glutamate, as has been suggested elsewhere. However, in contrast to mudskippers, *Channa gachua* was apparently unable to reduce the rates of proteolysis and amino acid catabolism, because the reduction in nitrogenous excretion during 48 h of aerial exposure was completely balanced by nitrogenous accumulation in the body. Alanine accumulation also occurred in specimens exposed to terrestrial conditions in total darkness, with no change in the total free amino acid content in the muscle. Exercise on land led to a decrease in glycogen content, and an increase in lactate levels, with no significant effect on ammonia and alanine contents in the muscle of *Channa gachua.* Hence, it was incapable of increasing the rate of partial amino acid catabolism to sustain locomotory activities on land. Alanine formation therefore appears to be a common strategy adopted by obligatory air-breathing fishes to avoid ammonia toxicity (not a strategy to detoxify ammonia) on land, but not all of them can utilize it to fuel muscular activities.

Key words: Aerial Exposure, Alanine, Amino Acid, Proteolysis, Glutamate Dehydogenase, *Channa gachua*

Effects of Environmental Pollutants on Complex Behaviour and Physiological Indicators Toxicity of *Channa Gachua*

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Environmental pollutants such as metals, pesticides, and other organics pose serious risks to many aquatic organisms. Accordingly, a great deal of previous research has characterized physiological mechanisms of toxicity in *Channa gachua* exposed to contaminants. In contrast, effects of contaminants on fish behaviour are less frequently studied. Because behaviour links physiological function with ecological processes, behavioural indicators of toxicity appear ideal for assessing the effects of aquatic pollutants on fish populations. Here we consider the many toxicants that disrupt complex fish behaviours such as predator avoidance reproductive and social behaviours. Toxicant exposure often completely eliminates the performance of behaviour is essential to fitness and survival in natural ecosystems, frequently after exposures of lesser magnitude than those causing significant mortality. Unfortunately, the behavioural toxicity of many xenobiotics is still unknown, warranting their future study. Physiological effects of toxicants in the literature include disruption of sensory, hormonal, neurological, and metabolic systems which are likely to have profound implications for many fish behaviours. However, little toxicological research has sought to integrate the behavioural effects of toxicants with physiological processes. Those studies that take this multidisciplinary approach add important insight into possible mechanisms of behavioural alteration. The most commonly observed links with behavioural disruption include cholinesterase (ChE) inhibition, altered brain neurotransmitter levels, sensory deprivation, and impaired gonadal or thyroid hormone levels. Even less frequently studied are the implications of interrelated changes in behaviour and physiology caused by aquatic pollutants for fish populations. We conclude that future integrative, multidisciplinary research clearly needed to increase the significance and usefulness of behavioural indicators for aquatic toxicology and aim to highlight specific areas for society. The details will be dealt in this paper.

Key words: Behaviour, Toxicology, Endocrine disruption, Neuro toxicology, *Channa gachua*

Effects of Diazinon on Surface Behaviour in an Air Breathing Fish *Channa Gachua*

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In the present investigation an attempt has been made to study the effects of diazinon on surface behavior in an air breathing fish *Channa gachua*. Pesticides in the aquatic environment can negatively affect the ecosystem. Although the aquatic environment is not the target of such pesticides but the wide spread use has of them led to some serious problems including toxic residues in grass and toxicity of non-target organisms such as fishes. The fish *Channa gachua* were acclimated for fore night before the experiments, they responded to the disturbance of adding the diazinon by remaining at the bottom of the aquaria for the first 20 min after the administration. There after the control fish showed normal activity this consisted of regular visits to the surface, hanging in the top 20 cm of the water column and swimming close to stainless steel net as though looking for an exit route. The behavior of the fish in the highest concentration (0.079 mg/L) was radically different. Although *Channa gachua* visited the surface as often as the controls, they spent almost all of the intermediate period by remaining still at the bottom of the aquaria. Consequently, the mean time of hanging was 50% lower than that of the control ones. The details will be discussed in this paper.

Key words: Surface Behaviour, Diazinon, *Channa gachua*.

Human Intervention and Fish Diversity of Karbi Angling District, Assam, India

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River with its tributaries is a unique type of ecosystem. River is the natural drainage system of the land mass of the earth which move continuously. Near the source, the river is small, straight and swift, while in downstream the velocity of water decreases and meandering of river begins in the plains. This paper is a study on the human intervention and its impact on the fish diversity of Karbi Anglong district of Assam. The district with dense tropical forest covered by hills and plains, is situated between $25^0$33/N to $26^0$35/N Latitude and $92^0$10/E to $93^0$50/E Longitude. There are numerous rivers and tributaries in this district. Such as, Kopili, Jamuna, Dhanshiri, Longnit, Amreng, etc. The present study was conducted during the period from April, 2013 to March, 2014. During the period of investigation the fishes were extensively sampled at each site on each visit with the help of local fishermen and identified in the field as per as practicable and unknown fishes were brought to the laboratory for taxonomic identification. Fishes were also collected from certain fish landing centers situated around. The present study recorded about 61 species of fishes belonging to 35 genera, 16 families and 7 orders from the rivers of Karbi Anglong district till date. As per IUCN (2013.2), 9 species are Vulnerable (VU) and 2 Endangered (EN). The present situation needs a serious work plan to maintain a balance between demand of fish resources, its regeneration, maintenance of environment and biodiversity conservation. The study recommends that human intervention should be minimizing to sustain the fish diversity.

Key words: Fish diversity, river, vulnerable, endangered and conservation.

The Remediation of Textile Waste Water Containing Copper (II) and Chromium (VI) Using Sorghum Root Biomass and its Equilibrium, Kinetic and Thermodynamic Model

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Heavy Metal toxicity in wastewater has always been a serious environmental concern because heavy metals are non-biodegradable have adverse health effects due to their accumulation in living tissues where they react irreversibly with enzymes and proteins thus causing various diseases and disorders. High concentration levels of Cu (II) and Cr (VI) comes from variety of industrial and technological sources viz. mining, dyeing, electroplating, refineries, paper mills etc. Biosorption of Copper (II) and Chromium (VI) ions from aqueous solution onto *Sorghum Root* powder have been investigated under batch mode. The effect of pH levels, adsorbent dosage, initial metal ion concentration, contact time, shaking speed and temperature on the biosorption of metal ions were investigated.The maximum biosorption capacity q_e for Cu(II) and Cr(VI) is 18.6 mg/g and 18.39 mg/g respsctively.The experimental equilibrium biosorption data were analyzed by the Freundlich, Langmiur and Temkin adsorption isotherm models. The Langmiur model gave better results than the other two models. The kinetic studies have indicated that the biosorption process of the metal ions on biomass followed well pseudo-second-order model. The thermodynamic parameters like Gibbs free energy (ΔG^0), enthalpy (ΔH^0)and entropy (ΔS^0)were also calculated and the values indicated that the nature biosorption process was exothermic, spontaneous and feasible . The results showed that sorghum root biomass has excellent adsorption properties and thus can be used as an effective ,green, sustainable and low cost bio-sorbent for removal of Cu(II) and Cr(VI) ions from textile waste water solution.

Key words: Adsorption, Adsorption Isotherms, Free Energy, Enthalpy, Entropy

Impact of Climate Changes on Environment

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Climate Change is a serious global environmental concern. It is primarily caused by the building up of Green House Gases in the atmosphere. Global Warming is a specific example of the broader term - Climate Change and refers to the observed increase in the average temperature of the air near earth's surface and oceans in recent decades. Its effect particularly on developing countries is adverse as their capacity and resources to deal with the challenge are limited. Scientific studies have shown that the global atmospheric concentrations of carbon dioxide, methane and nitrous oxide which are the most important greenhouse gases, have increased markedly as a result of human activities and now far exceed pre-industrial values. There are many indicators of climate change. These include physical responses such as changes in the surface temperature, atmospheric water vapour, precipitation, severe events, glaciers, ocean and land ice, and sea level. Climate change is impacting the natural ecosystems and is expected to have substantial adverse effects on environment. Climate change will also cause increased frequency of extreme events such as floods, and droughts. These in turn will impact food Security problems and water security. Therefore this requires continued effort of education and awareness rising to build resilience against future climate risk.

Key words: Climate change, greenhouse effect, global warming, ecosystem, Food security

Changes in the Water Solubles of Finished Leather Due to Fungal Infestation during Storage

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Finished leather and leather goods, stored under varying environmental conditions in warehouses, frequently become mouldy. The relative humidity plays an important role. The most common spoilage are formation of coloured inbleachable spots, mildewing and perforations due to degradation of leather components like water solubles, causing loss of durability, rendering them unfit for commercial purpose. It is, therefore, necessary to evaluate the extent of damage which is brought about by the fungi and their biochemical activities in relation to microclimatic conditions of storage. Many workers have discussed the role of fungi which brings the changes in physical and chemical properties of finished leather due to infestation but they were concentrated around the optimum mildew growing conditions (95-100% R.H. and 30°C temperatures).

During the present study the role of fungi on different ten types of finished leather, at different level of relative humidity and duration of storage at optimum temperature (28°C) has been investigated, which were found to decrease with an increase in R.H. Thus, during the present study three basic attempts were taken under considerations – (i) Qualitatively – what kind, (ii) Quantitatively –how many fungi inhabit the vegetable tanned sole leather of Buff and (iii) Estimation of changes in the quantity of water solubles due to infestation by fungi.

Key words: Finished leather, Relative humidity, fungal infestation, Climatic conditions, Water solubles

Study on Insecticidal Activity of Seed's Extracts Of*argemone Mexicana* against *Tribolium Castaneum* (Herbst, 1797) (Coleoptera: Tenebrionidae)

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The insect damages are rangingfrom 5-30% of the world's total agricultural production. The red flour beetle, *Triboliumcastaneum*is a major pest in human stored food and has been found in association with a wide range of commodities including grain,flour, peas, nuts, dried fruits and spices. Milled grain products are its preferred food. This insect causes substantial loss in storage because of its high reproductive potential and can breed throughout the year in warm areas. Usage of synthetic pesticides to control these pests is highly discouraged because of their adverse effect on human beings and environment. Hence in the present investigationthe extract from seeds of *Argemonemexicana* were tested as biopesticidesagainst 6th instar larvae of the *Tribolium castaneum*.100% mortality was observed after treatment with acetone extract at 1.6ml/kg wheat while 56.6±4.16larvicidal effect was observed after treatment with ethanol extract at the same dose 20.1±1.73. Adults emerged from those pupated were havingabnormalities. Only 50.6±4.35and 40.0±2.64larval mortality was recorded in chloroformand methanol extract respectively and from the remaining pupated, 23.3±2.08 and 16.6±1.52 adult emerged. Those treated at lower doses and having some adult emergence, were mostly having abnormalities. Thus the seed extract of*Argemonemexicana*have potentialas grain protectants. It may be conclude that seed extract of *Argemonemexicana*in acetone can be used to control the infestation of *Triboliumcastaneum*in wheat.

Key words: Triboliumcastaneum, Argemonemexicana

Evaluating Soil Fertility Status of a Selected Irrigated Farm for Sustainable Rice Production in Nigeria

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Rice requires adequate supply of nutrients to achieve the high yields necessary to feed the growing population in Nigeria. Rice, a staple food in Nigeria has been experiencing decrease in yield over the years. This study assessed the physico-chemical properties of soils in Patigi, one of the rice producing areas of Kwara State, Nigeria with a view to identifying limiting soil properties whose proper management can enhance improved rice yield. Primary data for the study were generated through soil laboratory analysis. Secondary data included map of Kwara State, and report of relevant organizations. Composite soil samples were collected from the four corners and centers of each of the forty (40) demarcated quadrats (100m by 100m) on irrigated rice field. The soil samples were treated and subjected to standard laboratory analysis. Sixteen soil properties that are essential for rice cultivation were analyzed using factor analysis. Factor loadings were selected in categories, such that ± 1.00-0.7 high; ± 0.69-0.50 medium; and ± 0.49-0.30 low. The simplified factor model presented sand (>80%), silt (<30%), organic matter (>2%), H^+(>2), K^+ (>2%), Mg^{++} (<5 cmol/kg), Ca^{++} (<7cmol/kg), and base saturation (>90) as leading soil properties of this area. Some other properties like clay, Available phosphorus, Water Holding Capacity, CEC, pH and Bulk density fall within medium and low groups. The study suggests intensive soil management to improve soil properties in the low group by applying appropriate fertilizer.

Key words: soil, quadrats, composite, physico-chemical, irrigated

Modulation of Physiological Activities, Active Constituents and Essential Oil Production of *Mentha Arvensis* L. Using Depolymerised Carrageenan, Triacontanol and 28-Homobrassinolide

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Carrageenan, an eco-friendly polysaccharide of red seaweed, has been frequently used as plant growth promoting substance in its gamma-irradiated form (IC). Triacontanol (TRIA) has been realized as a potent plant growth promoting substance for a number of agricultural and horticultural crops. 28-homobrassinolide (HBR) is one of the several brassinosteroids, the role of which in enhancing growth, productivity and quality of plants, via improving various physiological processes, has been established. Mint (*Mentha arvensis* L.) constitutes most important source of therapeutic agents used in the alternative systems of medicine. The essential oil of mint has wide applications in pharmaceutical, agrochemical and flavoring industries worldwide. A pot experiment was conducted to explore the individual as well as combined effect of the best foliar concentrations of IC, TRIA and HBR on growth, yield and quality of mint. Foliar application of IC, TRIA and HBR, applied individually on plants, significantly improved the plant attributes studied. However, combined application of the PGRs was more effective compared to their individual application. In comparison to other treatments and the control, the combination of three PGRs (80 mg L^{-1} IC + 10^{-6} M TRIA + 10^{-7} M HBR) proved to be the best for most of the growth, physiological, biochemical and agronomic parameters studied. Combined application of the tested PGRs excelled the control in per plant yield of menthol, L-menthone, isomenthone and menthyl acetate by 135.9 and 134.1%, 180.0 and 161.1%, 150.0 and 164.3% and by 225.0 and 187.5% at 100 and 120 days after planting, respectively.

Key words: Menthol, L-Menthone, Isomenthone, Menthyl acetate, Essential oil, Mint

Major Impact of Developmental Activities, Agricultural Mechanisation and Pollution on Environment

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In this era of competition, any country cannot get success without rapid development of its all sectors viz. agriculture, industry, mine etc. But this rapid development is heavily affecting natural environment. The paper on impact of developmental activities on environmental degradation furnished various development activities and their corresponding major impacts on environment. It also includes various emissions, discharges affecting environment and their sources. Some pollutants with their sources are furnished. Due to the developmental activities the public health is also affected. We have to control the environmental degradation for our better future.

Developmental activities impair environmental quality by overloading natural sinks with water and pollutants. The private and social costs of the use of the natural resources and the degradation of the environment may be taken into account for the sustainable development in the conventional accounts. Various emissions discharge like sulphur dioxide, nitrogen oxides are polluting environment heavily. The concentration of greenhouse gases is increasing which is presumed to raise the temperature of the earth in a long perspective. After-all all these factors are responsible for environment degradation which are responsible for serious public health hazards.

So for this reason, we all have to control this environmental degradation, which is not possible only by Governments legal restrictions. And this is possible only through active participation of general public and NGOs in the programme or eradication of pollution and preventing environment from degradation.

Agricultural mechanization basically means the replacement of people working in the production of crops with labour saving devices. The adoption of mechanized techniques for the production of food necessary has a dramatic effect on the environment. The same was discussed in this paper. In soil use of heavy machines and deep soil ploughs can leave behind a surface that is prone to erosion and structural collapse. Soil erosion can be controlled through the use of crop rotation. It is especially important to note that mechanization itself can be detrimental to soil quality and exacerbate soil erosion. Though irrigation it can cause change in the water table level in the soil,reduces the ground water supplies and increase incidence of the water borne diseases.
The problem of soil salinasation can be minimized through drainage techniques and also land levelling is important. Intensive use of fertilizer affects the entrophication of

streams, lakes and coastal waters. Particular attention must be paid in the appropriate amounts of fertilizer and approve techniques. For its application the application of pesticides of facts not only the quality of soils and water but also caused pollution of soil, contamination of surface, extinction of insects. The use of pesticides should be kept in a minimum. If there is clearly a case on economic grounds for their use then it is essential that the correct pesticide be used.

The removal of the labour constraint by mechanization will place constraints on other factors of production, usually land. Land resources can be over-used and stretched over a fairly long period of time before damage becomes apparent. Problems of erosion, sanitization, soil positioning and others will arise and bear witness to the fact that the land constraint has been binding all along. Furthermore, it is likely that the land resource may never regain its former long-term potential. We have reviewed many of these but there are others such as the effects of increased fertilizer use on long-term supplies fossil fuels. There are many approaches to study and quantify the environmental pollution. The paper furnished various types of environmental pollution, their causes and effects on public health. The cost of keeping the environment free of pollution naturally always comes up for consideration. It is generally conceded that the cost of controlling pollution, at the planning's stage, can be brought well within the amount allocated to cover the hidden uncertainties in every project.

There are various environmental legislation, acts, rules, notifications and amendments passed by State and Central Governments. Although laws can be made, shortcomings in their implementation call for continuing public pressure on all government and industry to make the laws work. Governments at all levels and industry in general, have the prime responsibility of abiding by the requirements of every law. But experience has shown, throughout the world that government and industry cannot, on their own implement environmental laws adequately.

But law enforcement cannot be effective without having public support, co-operation and movement, which often calls for changes in basic attitudes of thinking and assessment of relative values in order to break the accepted pattern of business and pollution as usual. This is especially true in the area of pollution control, which often calls for changes in basic attitudes of thinking and assessment of relative values, in order to break the accepted pattern of "business and pollution as usual". With their healthy scepticism, the organised citizen groups, in other countries, have already demonstrated a greater capacity to prod and stir government and industry to take appropriate action in time.

Key words: Degradation, Mechanization, legislation, amendments, pollution control etc.

Studies on Agronomic Practices to Mitigate Methane Emission under Different Methods of Rice (*Oryza sativa* L.) Cultivation

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In view of suspected danger of climate change associated with increasing atmospheric concentration of methane, there is a need to develop certain inexpensive strategies to mitigate methane emission from rice fields all over the world. However, no serious effort has been made in India to develop environment friendly and socioeconomically viable technologies which may be easily adopted by the farmers to reduce methane emission from the rice fields. Hence, an investigation was carried out on "Studies on Agronomic practices to mitigate methane emission under different methods of rice (*Oryza sativa* L.) cultivation" at ZARS, V. C. Farm, Mandya, UAS, GKVK, Bangalore.

Among the different methods of rice cultivation, SRI method recorded significantly higher water productivity (54.37 kg ha-cm^{-1}) as compared to aerobic method (46.64 kg ha-cm^{-1}) and conventional method (29.91 kg ha-cm^{-1}). This was attributed to the higher grain and straw yield of rice (8545 and 10073 kg ha^{-1}) as compared to other methods of rice cultivation like conventional (7050 and 8379 kg ha^{-1}) and aerobic method (6475 and 7833 kg ha^{-1}). Among different sources of nutrients, application of RDF (100 % N through neem coated urea) recorded significantly higher grain and straw yield (8487 and 9827 kg ha^{-1}) over other sources of nutrients. Whereas, the combination of aerobic method with RDF (100 % N through neem coated urea) recorded lower total methane emission (19.65 kg ha^{-1}) compared to SRI method with RDF (100 % N through neem coated urea) (23.55 kg ha^{-1}) and conventional method with RDF (100 % N through neem coated urea) (70.60 kg ha^{-1}).

This indicates that application of NCU under SRI method of rice cultivation reduced methane emission and production and leads to mitigate global climate change.

Key words: Methane emission, rice cultivation, mitigate, India

Resistance of Environmental Bacteria to Heavy Metals

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Heavy metals are widespread pollutants of great concern as they are non-degradable and thus persistent. These metals are used in various industries from which effluents are consequently discharged into the environment. Introduction of metals in various forms into the environment can produce numerous modifications of microbial communities and affect their activities. Although some heavy metals are essential trace elements, most can be, at high concentrations, toxic to all forms of life, including microbes, humans and animals. Heavy metals generally exert an inhibitory action on microorganism by blocking essential functional groups, displacing essential metal ions or modifying the active conformations of biological molecules. However, at relatively low concentrations, some heavy metal ions (e.g. Co^{2+}, $Cu^{2+,}$ $Zn^{2+}$and Ni^{2+}) are essential for microorganisms since they provide vital cofactors or metallo-proteins and enzymes Accumulation of metals in an aquatic environment has direct consequences on man and ecosystem. Heavy metal pollution of soil and wastewater is a significant environmental problem. Environmental friendly processes need to be developed to clean up the contaminated environment without creating harmful waste products and to reduce metal content. Different microbes have been proposed to be efficient and economical alternative in removal of heavy metals from water and waste water. The aim of the present study was to isolated heavy metals and antibiotics resistant bacterial isolates from waste water. In the present study, 2 bacterial isolates out of 25 isolates from waste water, having heavy metal and antibiotic resistance potential have been identified as *Bacillus lentus*, and *Bacillus licheniformis*, showed a wide range of resistance to different heavy metals such as lead, zinc and chromium. Moreover these isolates can be genetically engineered to reach better results in removal of lead, zinc and chromium. However, before exploiting the strain as an efficient biotechnological tool for lead, zinc and chromium detoxification further investigation needs to be carried out in laboratory scale.

Key words: *Bacillus, heavy metal, antibiotic resistance*

Effect of Depletion of Groundwater Table in Kolkata with Special Emphasis on Structural Distress

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This paper describes the depletion of groundwater table in Kolkata from the year of 1958 of 1999 and calculates subsequent subsidence on the basis of logarithmic theory in four different locations in Kolkata. Finally the structural damage due to depletion of Groundwater table has been illustrated with a case study of 60 years old building. One is based on the linear theory (considering elastic property of the material) and the other on the logarithmic theory. In the linear theory coefficient of volume compressibility (denoted as m_v) indicates the nature of soil towards compression and in the logarithmic theory compression index (denoted as C_c) indicates the same. The top 30 m. of the subsurface soil stratification in Calcutta generally indicates softer clayey soil in the first 15 m. having higher m_v values and relatively stiffer clayey soil between 15 m. and 30 m. having lower m_v values. Further below the compressibility of the layers diminishes due to increasing overburden pressure also. In the analysis section for subsidence in four different localities in Kolkata, firstly data of soil characteristics and properties in different layers and change in piezometric level or depth of water table from 1958 to 1999 are represented. Based on these data intergranular pressures for different layers are calculated and finally total subsidences in the said time span are estimated using the logarithmic theory. Due to groundwater depletion subsidence of soil stratum below the foundation occurs and consequently an additional stress (tensile) is generated in structural members connected with foundation. As concrete and brick both are weak in tension. If the structural members are unable to sustain the additional stress undergoes damages and cracks which is illustrated by a case study in this paper. Now a day's most of the multistoried building in Kolkata has equipped with submersible pump for their own water supply solution. So, additional stress due to depletion of groundwater table in long time should be taken into account.

Key words: Land Subsidence, Soil Consolidation, Groundwater.

A Detailed Analytical Study of Flood Management in Eastern and North-Eastern India and Bangladesh

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This paper studies the causes, features and management measures for floods in eastern and north-eastern India and Bangladesh. An exposition of the climatic, topographical, hydrogeological, riverine and other relevant features of the region, placed in the context of floods and flood management, is present in this paper. The paper is a sequel to Bhattacharya and Rahman (2008) and Rahman, Hossain and Bhattacharya (2007) and is a comprehensive study of floods and flood management in the area of interest. The ambit of the paper is north-eastern India, West Bengal and Bangladesh.

Identification of Rice Landrace with Cold Tolerance at Various Growth Stages through Phenotypic and Genotypic Analysis

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In this study, a rice landrace was screened for cold tolerance at different growth stage (seed germination, vegetative and reproductive stage) through phenotypic and genotypic level. In seed germination, it accounted for more than 80 per cent of survival rate under flooding. In cold screening, it was categorized as highly tolerant at 4°C after 8 days stress at phenotypic level and its association with cold tolerance at vegetative state confirmed at molecular level also with SSR markers. With SSLP markers linked with Ctb1 locus for booting stage cold tolerance, this landrace possessed gene sequence similar to that of reference genotype. Therefore, we state that this landrace after thorough screening at phenotypic level could be used in breeding programme for improving cold tolerance in locally adapted indica rice cultivars since this rice genotype has responded at significant level in cold tolerance at seed germination, vegetative and reproductive stage in the screening of phenotypic as well as molecular level.

Key words: cold tolerance, rice landrace, microsatelite (SSR) marker, seed germination, SSLP marker

Estimation of Carbon Storage in Harvested Wood Products in the Next 200 Years: A Sensitivity Analysis of Different Life Cycle Scenarios

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Carbon is sequestered and harvested in trees while it remains stored in harvested wood products for longer time to displace carbon dioxide emissions from fossil fuel combustion (Schlamadinger and Marland, 1998). Both the above mentioned processes have been recognized by UNFCCC and IPCC as an effective strategy for mitigating the increase of carbon dioxide in the atmosphere (Nunery and Keeton, 2010). There have been various studies to demonstrate methodologies to include the carbon stored in harvested wood products under national carbon accounting of various countries excepting India (Haripriya, 2001). Here we use a Monte Carlo simulation based life cycle analysis in twelve different scenarios to trace the fate of carbon bound in the products produced from a mature stand of 13515 *Dalbergia sissoo* trees in Saharanpur and Bijnor forest areas, Uttarpradesh state in the year 2009 for a period of 200 years, until most of the carbon is released back into the atmosphere. The sensitivity analysis has been carried out to find out the effect of change in terminal use and half life of the wood products keeping the decay rate constant.

Key words: Carbon Storage, Harvested wood products, Life cycle analysis, Sensitivity analysis.

Identification of Rice Landrace with Cold Tolerance at Various Growth Stages through Phenotypic and Genotypic Analysis

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Key words: cold tolerance, rice landrace, microsatelite (SSR) marker, seed germination, SSLP marker

Conservation of Rare, Endangered and Threatened Medicinal Plants of Western Ghats through Propagation

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India is one of the few countries in the world which has a rich wealth of medicinal plants. The Western Ghats is very rich in its medicinal wealth. The forests and hills of this region is treasure house of about 700 medicinal plants. Out of which many have become Rare, Endangered and Threatened (RET). Medicinal plants like *Rauvolfia serpentina, Premna integrifolia , Gymnema sylvestris, Gloriosa superba, Acorus calamus, Celastrus paniculata* etc. are in the verge of extinction. The massive conversion of forest land into human environment, over harvesting, over grazing, pollution, natural disasters and due to their peculiar plant characters like hard seed coat, seed dormancy etc have threatened the existence of these species. Hence conservation of these species is essential to minimize the future threat. Propagation plays an important role in easy multiplication and conservation of these medicinal plants. Propagation methods like seeds, cuttings, micro propagation needs to be standardized. A work was initiated to standardize the seed and vegetative propagation techniques in selected RET medicinal plants viz., *Celastrus paniculata, Embelia tsjeriam-cottam and Premna integrifolia.* All the germination parameters were found maximum in seeds treated with GA 400 ppm in *C. paniculata* and *E. tsjeriam-cottam*. In *P. integrifolia* GA 200 ppm was found the best pre-sowing seed treatment. In case of *C. paniculata* and *E. tsjeriam-cottam* root cuttings, all the root and shoot parameters were significantly higher in IBA 2000 ppm. All vegetative and root parameters recorded significantly higher values when the stem cuttings of *C. paniculata* were treated with 2000 ppm IBA. Very few efforts have been made on the propagation studies of these RET medicinal plant species. They are wild and multiply through natural mode of regeneration in forests which is a very slow process. There is a need to find out faster method of multiplication in these species.

Key words: RET, seed, vegetative, germination, IBA and rooting

Gen-Next Bio-Fuels – Economic and Highly Efficient

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Sustainability is a key principle in natural resource management, and it involves operational efficiency, minimisation of environmental impact and socio-economic considerations; all of which are interdependent. It has become increasingly obvious that continued reliance on fossil fuel energy resources is unsustainable, owing to both depleting world reserves and the greenhouse gas emissions associated with their use. Therefore, there are vigorous research initiatives aimed at developing alternative renewable and potentially carbon neutral solid, liquid and gaseous bio-fuels as alternative energy resources.

However, alternate energy resources akin to first generation bio-fuels derived from terrestrial crops such as sugarcane, sugar beet, maize and rapeseed place an enormous strain on world food markets, contribute to water shortages and precipitate the destruction of the world's forests. Second generation bio-fuels derived from lingo-cellulosic agriculture and forest residues and from non-food crop feed-stocks address some of the above problems; however there is concern over competing land use or required land use changes. Therefore, based on current knowledge and technology projections, third generation bio-fuels specifically derived from microalgae are considered to be a technically viable alternative energy resource that is devoid of the major drawbacks associated with first and second generation bio-fuels.

Microalgae are photosynthetic microorganisms with simple growing requirements (light, sugars, CO_2, N, P, and K) that can produce lipids, proteins and carbohydrates in large amounts over short periods of time. These products can be processed into both bio-fuels and valuable co-products.

Among the most formidable challenges to algal bio-fuels is the ability to harvest algae and extract intracellular lipids at low cost and with a positive energy balance. In this monograph, we construct two paradigms that contrast energy requirements and costs of conventional and cutting-edge Harvesting and Extraction (H&E) technologies. By application of the parity criterion and the moderate condition reference state, an energy–cost paradigm is created that allows 1st stage harvesting technologies to be compared with easy reference to the National Alliance for Advanced Bio-fuels and Bio products (NAABB) target of $0.013/gallon of gasoline equivalent (GGE) and to the U.S. DOE's Bioenergy Technologies Office 2022 cost metrics. Ultrasonic technologies require further development and scale-up before they can achieve low-cost performance at industrially relevant scales.

However, the advancement of this technology would greatly reduce H&E costs and accelerate the commercial viability of algae-based bio-fuels. The impacts of alternative harvesting and extraction technologies on the economic and financial feasibility of an algal farm are analyzed. Two harvesting technologies and three extraction technologies are compared as to their impacts on the revenues, expenses, and cost of production for an algal farm.

Analysis is completed using the Farm-level Algae Risk Model (FARM) to simulate the economic feasibility and probabilistic cost of algal lipid production for the farms with alternative technologies. The baseline scenario consists of a down flow open pond growth system, three phase de-watering step (settling, dissolved air flotation, and a centrifuge), hexane extraction and nutrient recovery using anaerobic digestion.

The net energy ratio (NER), defined as energy consumed over the produced energy, and greenhouse gases (GHG) for the baseline scenario are 0.7 MJ MJ^{-1} and -41.7 g $CO_{2\text{-eq}}$ MJ^{-1} respectively. Three alternative scenarios are also evaluated: 1) Improved microalgal productivity, 2) supercritical CO_2 extraction, and 3) no nutrient recycle. This research shows that supercritical CO_2 extraction is neither currently energetically- nor environmentally favorable and that nutrient recycle plays an integral role in achieving favorable NER and GHGs.

The study highlights on the systems level, two findings related to the NER; 1) the NER is minimally impacted with increased productivity and 2) increasing microalgae lipid content detrimentally affects the NER which is attributed to the reduction in the total energy that can be captured by the anaerobic digester.

This study also reviews the technologies underpinning microalgae-to-bio-fuels systems, focusing on the biomass production, harvesting, conversion technologies, and the extraction of useful co-products.

It also reviews the synergistic coupling of microalgae propagation with carbon sequestration and wastewater treatment potential for mitigation of environmental impacts associated with energy conversion and utilisation.

It was found that, whereas there are outstanding issues related to photosynthetic efficiencies and biomass output, microalgae-derived bio-fuels could progressively substitute a significant proportion of the fossil fuels required to meet the growing energy demand.

Currently, nearly all renewable energy sources (e.g. hydroelectric, solar, wind, tidal, geothermal) target the electricity market, while fuels make up a much larger share of the global energy demand (~66%). Bio-fuels are therefore rapidly being developed.

Key words: Harvesting, Extraction, Cost of production Microalgae, environment, process

Forecasting Environmental Factors and Zooplankton for Water Quality in Bakreswar Reservoir using Time-Series Seasonal Arima Model

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Reservoirs are artificial water bodies built by construction of a dam over a river. Reservoirs are the main source of drinking water supply to rural populations. These reservoirs may be created by impounding waters and unlike natural lakes, reservoirs and dams are engineered systems designed to serve specific purposes and provide the means to utilize water in a variety of useful and efficient ways. Thus a thorough knowledge of the ecosystem and its associated limnology is essential for proposing efficient management plans.

Key words: Reservoirs, water quality, environmental factors, zooplankton

Assessment of Airborne Respirable Particulates in Opencast Mining Area of Jharia Coal Field using a Grimm 1.109 Real-Time Portable Aerosol Spectrometer

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Airborne particulates of respirable range are common in the opencast mining area. Exposure of workers to these particulates has been reported to lead to adverse health effects. There are several commercially available direct-reading real-time aerosol monitors which are used in measuring work place particulates. One such real-time aerosol monitor is the Grimm 1.109 Portable Aerosol Spectrometer (Fig1). The Grimm measures particles by light scattering technology where scattered light signals are detected on a recipient diode. Signals are grouped, based on particulate size, by a multichannel size classifier. The Grimm has the capability to simultaneously measure particulates ranging in aerodynamic diameter of 0.22–32 mm in 31 channels. Cheng et al., (2008) used the Grimm 1.108 Portable Aerosol Spectrometer to monitor particulates and concluded that the Grimm provides precise measurements of particulate matter compared to reference gravimetric methods. The direct-reading instruments to measure particulates is better than the traditional gravimetric method. The advantages of direct-reading instruments are: they provide real-time data, they are simpler to use, and in the long run they are generally less expensive to operate when compared to costs associated with standard methods.

Most of the particles larger than 10 µm do not reach the alveoli, because they are retained in the upper airway and the tracheobronchial tract. On the contrary, the finer particles easily reach the alveoli, where they can be absorbed into the blood stream. Maximum alveolar deposition is reached for particles with diameter inferior to 0.1 µm . Therefore more emphasis should be given on study of physical and chemical features of fine particulates generated in the open cast mining area.

Key words: Grimm 1.109; PM_{10}; $PM_{2.5}$; Alveolic; Thoracic; Inhalable

A Comparative Study on Soil Quality of Conventional Vs. Organic Farming

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Soil is a fundamental resource base for agricultural production systems. Intensive farms, to achieve higher yields, apply various external agricultural inputs to agricultural production systems which include mineral fertilisers such as urea, ammonium nitrate, sulfates, and phosphates; organic fertilisers such as animal manures, composts, and biosolids; various other organic products such as humic acids and microbial inoculants, and pesticides including herbicides, insecticides, nematicides, fungicides, veterinary health products, and soil fumigants. All these products are applied with the ultimate goal of maximising productivity and economic returns. However, extensive application of external agricultural inputs to agricultural production systems leads to deterioration of soil quality. In this context the present study aims at analysing the soil quality of some selected conventional and organic agro-ecosystems of Dimoria Tribal Development Block, Kamrup, Assam, in order to assess the impacts of agrochemicals application in terms of its physic-chemical properties with special emphasis on heavy metal contamination. The assessment of soil quality requires quantification of critical soil attributes which includes the combination of chemical, physical, and biological characteristics that enables soils to perform a wide range of functions. The important soil quality indicators were investigated under different land use systems. In total 5 stations were selected. One station each from organic and conventional paddy fieldsand organic and conventional vegetable farms and one from natural forest representing control sample. Three soil samples at 0-15 cm depth were collected randomly from each station. Preparation of soil samples is based on the **ISO 11464 method** (Soil quality- pre-treatment of samples for physic- chemical analysis), and important soil physical and chemical parameters were analyzed using standard methods.Heavy metals **(** Cd, Cr, Cu, Ni, Pb, and Zn) of the soil samples were analysed using Atomic Absorption Spectroscopy (AAS). In AAS, for the determination of heavy metals Cd, Cr, Cu, Ni, Pb, and Zn the calibration is done by standard solution of each metal. The results of the various physic-chemical parameters and heavy metal concentration were assessed and compared with that of the control sample. The study reveals that most of the soil samples contain organic matter near-by or above 3%, which were moderate according to ICAR rating, 1997. In terms of NPK availability the soil status can be regarded as of moderate quality. The average contents of Cd, Cu, Cr, Ni, Pb, and Zn in surface soils (0-15 cm depth) ranges in the following order; Cd < Ni < Cu < Cr < Zn. However, not a single metal was detected in the control sample. The soils could not be said to be contaminated for now because metal content levels conformed to the world-wide background content of metals range in the soil. There are no significant differences between organic and conventional management for any of the soil physical and chemical properties measured. For the fields sampled, it can be concluded that there is little direct benefit on soil physical condition for organic farming practices but equally there is no detrimental effect.

Key words: Conventional farming, Heavy metals, Organic farming, Soil quality

Diomedicinal Propects of Unconventional Green Vegetables for Anemia Management

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The massive problem of iron deficiency leading to anemia has spread all over the world. Distribution of iron in five leafy vegetables viz. *Achyranthes aspera, Alternenthera sessilis, Amaranthus blitum, Cassia tora and Oxalis corniculata* were evaluated and the obtained amount of iron in them were compare with the other leafy vegetables. Future prospects of present work aims for eradicating anemia from the very root by increasing consumption of the iron rich green leafy vegetables.

Key words: Iron, Anemia, Green Leafy Vegetables.

Effect of Feeding Sweet Sorghum Green Fodder on Lipid Profile of Crossbred (HF x Deoni) Cattle Milk

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The feeding value of forage is defined as its capacity to promote animal production and depend upon its ability to supply nutrients to the animal. Green fodders are very important in dairying as it is a source of carotene, the precursor of vitamin A, and calcium. Nine crossbred cows (HF x Deoni) of about the same body weight and milk production were randomly divided into three groups of three animals each to study the different levels of maize and sweet sorghum green fodder on lipid profile of crossbred cow milk. Three diets were formulated with 100:0, 50:50 and 25: 75, maize: sweet sorghum ratio among green fodder on dry matter basis. Except green fodder variation, animals of all treatments were offered *adlibitum* sorghum straw and concentrate mixture according to their level of production. After an adoption period of one week the milk samples collected from the morning and evening milking at fortnightly interval and pooled for fatty acid analysis. For fatty acid profile the content of saturated fatty acids were increasing with increasing level of sweet sorghum green fodder (50.03 vs. 63.97) in the diet while amount of monounsaturated fatty acid showed reverse trend (45.35 vs. 33.04). Likewise the amount of polyunsaturated fatty acids found more in maize fed (100%) group i.e. 4.62 per cent following sweet sorghum fed (75%) groups 2.98 per cent. It was observed that Feeding of maize green fodder found beneficial to increase polyunsaturated fatty acids as compare to mixed fodder combination in the study.

Key words: green fodder, crossbred cows, polyunsaturated fatty acids

External Description of Embryonic Development of the Fresh Water Prawm *Macrobrachium Kistnensis* (Decapoda, Palaemonidae) Based of Percent Staging Method

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The embryonic development of freshwater prawn *Macrobrachium kisnensis* from Godavari River near Kaaygaon Toka Aurangabad was studied from August 2012-July 2013. The observations made on live embryos and the changes during the development of prawn *Macrobrachium kisnensis.* Live eggs were observed with a stereomicroscope and obtained descriptions of embryonic periods. Embryonic periods were determined by percent staging method, in which egg laying is defined as 0% and hatching as 100%. In this study development was divided into 10 periods, each representing 10% of the entire development time elapse between spawning and hatching. The prawn *M. kistnensis* has an incubation time of 27 days at 24ºC. Ten periods are described and illustrated.

Key Words: Embryonic development, percent staging, freshwater, *Macrobrachium Kistnensis*

Surface Water Bodies Inventory and Change Analysis in Mahendergarh District, Haryana

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Surface water bodies play vital role in maintaining the local environment.It is well known that surface water bodies have multifarious importance such as rainwater harvesting sites, local ecosystem maintainer, local micro-climate controller, habitation for birds and animals, bio-diversity, sites of medicinal plants and employment to local people. Increasing population, urbanisation, industrialisation, intensive agriculture practices and modern living standards have made surface water bodies under negligence. Thereis need to generate database on surface water bodies for further monitoring, planning and management of surface water bodies. Space technology comprising satellite remote sensing data and geographical information system (GIS) and global positioning system (GPS) plays vital role in mapping and monitoring earth features. In the present study, Survey of India (SOI) Toposheets 44P/15, 44P/16, 45M/13, 53D/3, 53D/4, 54A/1, 53D/7, 53D/8 on 1:50,000 scale for the years 1966-1973 and IRS-P6 LISS-III satellite data of May-June 2010 have been used for inventory and changes in surface water bodies in Mahendergarh district of Haryana.The surface water bodies have been mapped on Survey of India Toposheets and IRS P6 LISS-III satellite data in ArcGIS 9.3 software. Field visits have been done using handheld global positioning system (GPS) Garmin 72. Field information has been incorporated in pre-interpreted data and finalised the database.The interpretation of database shows that during the years 1966-1973, there were 577 surface water bodies with 443.44 ha areas in Mahendergarh district.Out of these 577 surface water bodies, 545 were ephemeral surface water bodies which covered 398.55 ha area; 31 perennial surface water bodies covered 22.29 ha area and 1 perennial wetland covered 22.60 ha area. During the year 2010, there were 650 surface water bodies with 386.06 ha area. Out of these 650 surface water bodies,471 ephemeral surface water bodies covered 283.90 ha area, 105 perennial surface water bodies covered 46.51 ha area, 73 new surface water bodies covered 34.23 ha area and 1 ephemeral wetland covered 21.42 ha area.The result shows that ephemeral surface water bodies decreased from 545 to 471 with 398.55 ha area to 283.90ha area respectively; perennial surface water bodies increased from 31 to 105 with 22.29ha to 46.51ha area respectively; 1 perennial wetland during 1966-1973 with 22.60ha area became ephemeral during 2010 with 21.42 ha area and 73 new surface water bodies with 34.23 ha area.Overall, there are increased in number of surface water bodies i.e. 577 during 1966-1973 to 650 during 2010 i.e. 73 surface water bodies while the area of surface water decreased from 443.44 ha during 1966-1973 to 398.55 ha during 2010 i.e. 44.89 ha area decreased. The database generated in the study may be used for further monitoring of surface water bodies, revival of dry surface water bodies, monitoring encroached area of surface water bodies, planning, management and development of surface water resource in the district.

Key words: Space technology, GIS, GPS, IRS-P6, LISS-III, remote sensing, **e**nvironment

Induction and Assessment of Quantitative Traits by Single and Combined Treatments of Gamma Rays and Ethyl Methane Sulphonate in Two Varieties of *Vicia faba* L.

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Food insecurity due to the increasing population and yield loss due to drastic changes in environmental conditions is posing a great threat throughout the world. Pulses are the major source of food in India. The current experiment was conducted to increase the yield and its attributing traits in two varieties of *Vicia faba* L viz., PRT-12 and Vikrant through mutation breeding. Seeds of two varieties of *Vicia faba* L. were treated with Gamma rays and Ethyl methanesulphonate alone and in combinations. The seeds were then sown to raise the M_1 generation. Meiosis of PMC's were observed in M_1 generation. Lower doses/concentrations of both individual and combination treatments of mutagens induced less meiotic abnormalities than higher doses/concentrations in M_1 generation The M_1 generation seeds were sown to raise the M_2 generation. Quantitative characters of both the varieties were studied in M_2 generation. Lower concentrations/doses of individual and combination treatments were found to increase the yield of both varieties but the higher one had negative effects. Variety Vikrant showed more positive responsive towards mutagens at lower doses/concentrations than variety PRT-12.

Key words: *Vicia faba*, Gamma rays, Ethyl methanesulphonate, Quantitative characters

Effect of Varied Environmental Factors on Growth of *Trichoderma* Spp.

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The use of *Trichoderma* genus as biological agents is becoming an increasingly important alternative to chemical control against pathogens. Hence, it is essential to consider the growth parameters affecting the bio-controlling agents. A series of abiotic growth parameters has an influence on the biocontrol efficacy of *Trichoderma*. In this study some important abiotic parameters to be considered are the effects of temperature, water potential and pH, different culture media with the aim to identify the growth response of *Trichoderma* species in varied growth conditions.

Six ranges of temperature from 15 to 40°C, five different pH ranges from 5 to 9, five ranges of water potential, six different mediums viz. Potato dextrose agar (PDA), Trichoderma selective medium (TSM), Cellulose agar medium (CAM), Special nutrient agar (SNA), Malt extract agar (MEA), Oat meal agar (OMA) were used to examine the growth of five species of *Trichoderma*. The linear growth was measured in mm after 3days incubation period and average growth of 10days incubation was calculated.

Results revealed that most favorable temperature was found in between 25-30 °C, second best temperature was 20°C, least growth recorded at 15°C and no growth was noticed at 40°C. All three species of *Trichoderma* grew well at water potential -0.9 and -2.3 Mpa. PDA media was found to be best among all six medium. Growth of *Trichoderma* species was seemed to be dependent on temperature, water potential, whereas pH was noticed as independent factor for all the studied species of *Trichoderma*.

Key words: *Trichoderma*, abiotic parameters, temperature

Characterization of Mosaic Disease in Ornamental Plants

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Hippeastrum stylossum has economical significance in the ornamental plants community. In the present study samples of Dutch Lily *Hippeastrum stylossum* plants were taken from 5 locations two from Meerut, three from New Delhi and disease symptoms recorded by visual observation. Result revealed that disease incidence of *Hippeastrum* mosaic disease was maximum in SBPAT University, Meerut (75%) while it was minimum at IARI Horticulture Garden (10%) by visual observation followed by Botany Garden, University of Delhi, New Delhi (25%), Sunder Nursery, Hauz Khas, New Delhi (40%) and Garden J.V College, Baraut (50%).Young seedlings of 20 plant species from different 7 families viz. *Amaranthaceae (Gomphrena globosa*), *Amaryllidaceae (Allium cepa, A. sativum, Hippeastrum stylossum*and *H.hybridum) Apocynaceae (Catharanthus roseus) Chenopodiaceae (Chenopodium album, C. Amaranticolor, C. Amaranticolor*and *C. Quonia) Cucurbitaceae (Cucumis melo,C. Sativus*and, *Cucurbita moschata), Leguiminosae (Phaseolus vulgaris* and *Vigna unguiculata)Solanaceae (Capsicum annuum, Datura stramonium, Lycopersicon esculentum, Nicotiana glutinosa, N. tabacum* and *N. tabacum*) were sap inoculated and maintained in the glasshouse. It was observed that systemic symptoms were produced only on *H.stylossum* and *H. hybridum* whereas, *C.album* and *C.amaranticolor* and *C.quonia* developed local lesions on inoculated leaves. The remaining 15 plants species were insusceptible.

Key words: *Hippeastrum stylossum*, ornamental plants, mosaic disease

Sensitivity to High Temperature Environments in Leaf Area and Total Chlorophyll Contents in Chickpea

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To investigate the sensitivity to high temperature environmentsin leaf area and total chlorophyll contents on chickpea cultivars viz. kabuli (Pusa 1088 and Pusa 1053) and desi (Pusa 1103 and Pusa 547) in earthern pots (30cm), an experiment was placed down under following treatments as; (a) Natural conditions throughout growing period as control (b) Poly covered hut conditions (Wooden structure of size 10x5x2 meter) throughout growing period as ±5°C elevated temperature conditions and (c) One set of pots was shifted to hut conditions to exposed under high temperature conditions after 30 days intervals viz. 30DAS, 60DAS, 90DAS and harvesting of the crop at different stages of growthand development at Agricultural Research Farm, Janta Vedic College, Baraut (Baghpat) in the year of November 2010 and 2011. The effect of elevated temperature quantified by analysis of leaf area and total leaf chlorophyll contents.

Result revealed that high temperature adversely affected the leaf area and total chlorophyll contents during different growth stages. The plants grown under continuous elevated temperature conditions 30.10% and 28.61% declined Leaf area (LA) than plants under continuous natural conditions in both years respectively, whereas more declined were recorded in the plants grown initially natural conditions upto 30DAS, then 30-60DAS elevated temperature and finally shifted to natural conditions till harvest (32.45% and 30.97%) in comparison to natural conditions. Pusa-1103 gave 13.86% more LA in comparison to Pusa-1088 followed by Pusa-1053 (9.53%) and Pusa-547 (3.1%) throughout the study.The plants grown under continuous elevated temperature conditions had produced 28.41% and 31.52% more total chlorophyll contents than the plants grown under natural conditions in the both years of the study respectively at the early stages of the crop growth and development. Pusa-1053 gave more significant result related to total chlorophyll contents than Pusa-547, Pusa-1103and Pusa-1088 throughout the study.

Key words: chickpea, high temperature, leaf area, chlorophyll

Effect of Triton Tx–100 on the Degradation Kinetics of Tricyclazole Fungicide from Artificially Contaminated Water by Colloidal MnO_2

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Tricyclazole [IUPAC name: 5-Methyl-1, 2, 4-triazolo (3, 4-b) benzothiazole] is a very popular and one of the most common pesticides employed for its fungicidal activity in the plantation of paddy rice. It is used to control rice blast disease, caused by the fungus pyricularia oryzae, in both transplanted and direct seeded paddy rice.This fungicide is advantageous over other rice blast fungicides because it provides long term protection during the entire growth period as it has long effectiveness which ruled out the requirement of multiple applications. In spite of advantageous and unavoidable uses the fungicide often contaminates the environment and cause public health problems due to their high toxicity and long persistence. Thus the treatment of pesticide is essential to eliminate or minimize its negative effect. In the present investigation the treatment of artificially contaminated water was carried out by using water soluble colloidal MnO_2 in acidic medium. The water contamination problem can also be reduced by making efficient and minimum use of pesticides. There has been increasing trend of economic use of pesticides by blending them with surfactants. Surfactants are formulated in pesticides to enhance the absorbing, emulsifying, dispersing, spreading, sticking, wetting, or penetrating properties of the latter. In the present work effects of different types of surfactants, viz., anionic, cationic and non-ionic on the degradation kinetics of tricyclazole by colloidal MnO_2were investigated.The anionic surfactant, sodium dodecyl sulfate (SDS) has been observed to be ineffective. On the other hand the reaction in the presence of cationic surfactant, cetyltrimethyl ammonium bromide (CTAB) could not be followed as well because it possesses positive charge opposite to that of colloidal MnO_2 causing flocculation and therefore could not be studied further. However, the addition of non-ionic surfactant, Triton X-100 (TX-100) accelerates the reaction rate.The catalytic effect of TX–100 on the degradation kinetics of tricyclazol by colloidal MnO_2 in $HClO_4$ medium have been thoroughly analyzed and discussed in the light of available mathematical model. The kinetic data have been used to calculate the different activation parameters for the oxidative degradation of tricyclazole by colloidal MnO_2 in the presence of non-ionic TX-100 surfactant and compared with those in the absence of the latter under similar conditions.

Key words: Tricyclazole; Degradation, Water Treatment, Manganese dioxide; TX-100

Distribution of Four-Horned Antelope in Kumbhalgarh Wildlife Sanctuary, Rajasthan

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Rajasthan, the largest state in terms of area, is located in the western part of India and has a rich biodiversity. Hills of Aravalli ranges run as a diagonal scimitar dividing the state into two distinct ecological regions. The north-west of the state encompasses the famous Thar Desert while a comparatively greener area with good vegetation comprises the south-east. This southern region has denser and mixed type of forests, which is appropriate as the habitat of many faunal species. Kumbhalgarh Wildlife Sanctuary lies approximately 80km in the north of Udaipur city. It lies between Districts of Rajsamand, Pali and Udaipur. This sanctuary has dry dense deciduous type of forest suitable for many mammalian species.

Four-horned Antelopes, more commonly known as Chousingha, are unique mammals, being the only bovids with four horns. Chousingha is found in Kumbhalgarh in good numbers. Based on the published information, the sanctuary is a home to many mammals that are listed in threatened category. These mammals belong to nine genera and seven families. These species are categorized into four groups, which were dominated by Carnivores with three species, of which one was endangered and two were vulnerable. The other group of threatened species was of Herbivores with one endangered and one vulnerable species, Insectivore group included two species of which both are in vulnerable category, while the Omnivore group incorporates two species of which both are vulnerable. Chousingha is a herboivore and is listed in the vulnerable category according to IUCN.

The literature suggests that *Tetracerus quadricornis* is endemic to the Peninsular India and Indus divisions of the Indian Subregion of the Asian Indomalayan Region and occurs only in India and Nepal. *T. quadricornis* weighs between 15 and 25 kg. The body length is 80-110 cm, with a shoulder height of 55-65 cm, and a tail length of 10-15cm. The hair is short, coarse, and thin, with sexually dimorphic brownish color above and lighter on sides. The insides of the legs are white along with the middle of the belly. Males are dull-red brown above, with white below, and have a dark stripe that runs down the front of each leg. Females typically possess a brownish-bay color. The horns are present only on males. They are smooth, short, and conical. The posterior set range from 80 to100 mm in length. The front two are typically 25-38 mm long, and sometimes only a raised black area of skin is present. The muzzle and outer surface of the ears are blackish brown. The hooves are small, split and rounded in the front.

Although studies have been carried out on various mammalian species in the past, but the reports on Chousingha from south Rajasthan are scanty and related to sighting notes. The IUCN also recommends for detailed scientific investigation to fill the gaps related to distribution, ecology and biology of chousingha as this will help in formulating strategies for conservation of the vulnerable mammal. It has been observed from the previous animal censuses that the number of this beautiful antelope is on the decrease. Therefore, the present study was planned to fill the gaps pertaining to the distribution and behavioral aspects of this animal. Present investigation is a part of afore-mentioned study being carried out on ecology and behavior of the Chousingha in southern Rajasthan.

The study site, Kumbhalgarh Wildlife Sanctuary, is a protected area of 610 km^2 in size, covering a diagonally shaped corridor from 73º15'E, 25º00'N to 73º45'E, 25º30'N. The highest elevation in the study area is 1074m. The forest type wise quantification shows a mosaic of thorn-mixed forest, dense dry deciduous forest, moist deciduous forest and semi dry deciduous forest. There are 42 species of mammals that belong to 35 genera and 20 families. The faunal variety is inclusive of some rare, threatened and endangered species. Data pertaining to distribution of chousingha was collected from July, 2013 to December, 2014. For the purpose of the study, all the forest blocks in the sanctuary were scanned on foot and bike. Study was carried out using the Random survey and line transects methods using Olympus binoculars and Nikon D5000 camera.

Kumbhalgarh Wildlife Sanctuary is divided into 28 forest blocks for the proper management of the protected area. Out of these 28 blocks the chousingha was found to inhabit only four blocks, namely, Jilwara, Ghane Rao, Kumbhalgarh and Aareth. The literature suggests that chousingha prefers the thorn-mixed forest with a hilly terrain. All these four blocks are rich in thorny shrubs and trees such as *Zizyphus mauritiana*, *Phoenix dactylifera*, *Anogeissus acuminata*, *Capparis decidua*, *Emblica officinalis*, *Dendrocalamus strictus*, *Lantana camara*, etc. These blocks also have the hilly terrain covered by grasses which is a perfectly suitable habitat of chousingha.

Key words: chowsingha, distribution, protected area, habitat preference, thorn-mixed forest, hilly terrain

Distribution of Grey Jungle Fowl and Aravalli Red-Spur Fowl in Mount Abu Wildlife Sanctuary, Rajasthan

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Rajasthan is the largest state with rich biodiversity, located in the western part of India. Hills of Aravalli ranges divide the state into two ecological regions –the Thar Desert on the north-west and a comparatively greener south-east. The southern region has comparatively denser and mixed type of forests, which are suitable for bird habitat. Birds like pheasants, partridges and quails are classified in Order Galliformes. Family Phasianidae, in which the jungle fowls are categorized, includes the game birds which have also featured as important food item of man from time immemorial. They have remarkable reptile like nesting habits, laying their eggs in depressions made in ground or in scraped together mounds of sand and humus.

The Grey Jungle Fowl is distributed in peninsular India while the Aravalli Red-spur Fowl is endemic to South Rajasthan. The male Grey Jungle Fowl (*Gallus sonneratti* Teminck, 1813) is characterized by the long arching sickle-shaped tail and well developed comb while the female lacks the sickle on tail and is also devoid of the comb. Dorsally, it has dull blackish feathers while the breast has a white streak and brownish grey abdomen. The genus *Galloperdix spadicea caurina* Blanford, 1898, commonly known as Aravalli Red-spur Fowl, is intermediate between Junglefowls and Partridges in appearance. The female has a partly ridge-like tail that is not laterally compressed, wings are short and rounded. The male lacks the wattle or comb but has a patch of brick-red naked skin around eye and has two to four distinct pointed spurs on both legs. Both the fowls are found in Mount Abu Wildlife Sanctuary in good numbers.

Although lot of studies have been carried out on various bird species, but studies on jungle fowls in south Rajasthan are scanty. Further, the IUCN also recommends for the detailed and scientific investigation to fill the gaps related to distribution, ecology and biology of these birds. Therefore, this investigation was proposed to have a complete knowledge regarding the Grey Jungle Fowl and the Aravalli Red-spur Fowl. Present paper is a part of study being carried out on ecology and behavior of the two fowl in southern Rajasthan.

Mt. Abu Wildlife Sanctuary (24°33'N-72°38'E) was established in 1960 in Sirohi district of Rajasthan State. The Sanctuary covers an area of 288km^2. This sanctuary has an elevation ranging from 300msl to 1722msl. It is very rich in floral bio-diversity with

xenomorphic sub-tropical thorn forests in the foot hills to sub-tropical evergreen forest at higher elevation. A variety of fauna, including some rare, threatened and endangered species are found in this sanctuary. Data pertaining to distribution of both the fowls in the sanctuary was collected from July, 2013 to December, 2014. For the purpose of the study, all the forest ranges in the sanctuary were scanned on foot. Study was carried out using the Random survey and lines transect methods using Olympus binoculars and Nikon D5000 camera.

The data shows that in Mount Abu Wildlife Sanctuary during July, 2013 to December, 2014, both fowls inhabited the shrub forest dominated by *Lantana camera*. The Grey Jungle fowl was most of the time found under or near *Lantana camera* and bamboo shrubs, which is probably its most favorable habitat. The other flora in the vicinity included Ram Bans, Gada-Palash and Karonda. The Red Spur fowl was also mostly seen under shrubs of *Lantana camera* only. Alternately, it was also seen on the bare rocky terrain of the study area. Generally we saw that birds moved around *Lantana camera*, probably in search of food as they were frequently scratching the ground, or roosting in the grassy patches and bamboo trees.

The present study shows that both fowls are distributed throughout the sanctuary area, although their numbers vary at places. The transects revealed that these birds frequented the area of Traver's tank, Tiger path, Chipaberi and Sunset point in the sanctuary as compared to other areas. We witnessed largest group size of Grey Jungle fowl at Traver's tank area of the sanctuary comprising of 6 individuals (2 males and 4 females) and minimum at Tiger path (3 in number including 1 Male and 2 females). In case of the Red Spur fowl, maximum members in the group were encountered at Chipaberi (8 in numbers 3males and 5 females) and minimum was at Sunset point (2 individuals, 1male and 1female).

As regards to the habitat preference of the fowls in Mount Abu Wildlife Sanctuary, the Grey Jungle fowl mostly preferred shrub and bamboo forested area. The Red-spur fowl preferred the rocky and shrub forest. It was observed that the fowls pecked frequently beneath and around the *Lantana* shrub in search of food. The literature also suggests that both species prefer to inhabit shrub-bamboo and rocky deciduous forest. This type of habitat is beneficial for the birds because it has the capacity to full-fill their requirements of food. The shrub of *Lantana* and bamboo also provide protection to these birds from their predators.

Key words: distribution, phasinids, habitat preference, Lantana, bamboo

Study on Some Behavioral Aspects of *Trapelus Agilis:* The Thar Lizard

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Reptiles evolved about 320-310 millions years back in pre-mesozoic era from the amphibian stock and were the first-vertebrates to take a leap outside the aquatic environment to the terrestrial environment. Lizards are a widespread group of squamate reptiles with more than 5600 species, ranging across all continents except Antarctica as well as most oceanic island chains. The *Trapelus agilis* complex is distributed on the Iranian Plateau and adjacent regions of southwestern Asia, as well as in the Caspian-Aral Basin to the north in the interior of Asia Rajasthan desert, which forms a major portion of the Thar Desert is the biggest desert in India and encompasses the districts of Jaisalmer, Barmer, Bikaner and Jodhpur. The Agamid lizard, *Trapelus* (=*Agama*) *agilis* inhabits the Thar Desert in the Western part of the Republic of India. This is a small sized lizard found in good number in the study area (Village Amar Sagar) located near the Desert National Park in the historic city of Jaisalmer. This area was selected for the field study because of its topographical features as well as plenty of active dens in this area. The field is rocky with patches of sandy soil. The vegetation of the area mainly consists of xerophytic thorny shrubs. The climate is extreme in winter as well as in summer. Maximum temperature in summer rises up to 50°C while it falls down up to 4°C in winter. The rainfall is scarce; average rainfall being 100 mm. the study site was regularly visited and direct observations related to behavior was noted. The road trampled animals were procured to study the morphological details.

In the present study, it was observed that there exists a distinct visual sexual dimorphism between the male and female individuals on the basis of colour, scale patterns, sizes of head, limbs and body and also in the habitats they occupy. The habitat of Thar lizards includes the cover of thorny shrubs and bushes and a distinct difference in habitat occupation between both the sexes. The male lizard always choses the thorny vegetation in the area and will occupy the top-most position on it. The female lizard is found on the ground in close proximity to its den. Agamas are chiefly insectivores. Their incisor-like front teeth are designed for quick cutting and chewing of their prey. But in case of scarcity of food, they may also eat grass, berries, seeds and even the eggs of smaller lizards. The male agama feeds on small insects by wait and watch technique, during the early hours of the morning and on larger sized insects during the noon and afternoon hours. Females selected the small sized prey in the vicinity of their dens. Males can ambush and forage on larger insects but do not chase their prey over long distances. These agamid lizards have shown an omnivorous diet in the study area.

With regards to thermoregulation, both male and female lizards show morphological and postural adaptations to regulate the body temperature during the summer periods and hibernation in winters. The temperature in summers rises to 50ºC during the peak hot hours of the day and it was observed that the female enters the den to avoid this heat. The male remains outside and hides under the bush. It lizard also adapts such posture so as to keep minimum contact with the substratum. As the male lizard remains outside it changes its body colour to the pale shade to reflect the heat.

The breeding season of these lizards is from May to July. The reproductive behavior reveals courtship, copulation, egg laying, hatching and care of hatchlings. Courtship is reflected by making push-ups by the male and changing its body colour to brilliant blue body with yellow tail. Few other forms of behavior like territoriality, ecdysis after their emergence from hibernation and avoiding the predators and strangers were also observed during the course of the study. The males of Thar Desert show typical territorial behavior and try to defend its territory by keeping other males out of it. They lash out with their tails and threaten each other with open jaws. The territory of the males overlaps with that of two or three female lizards. The desert Agama sheds off its old skin when it comes out of hibernation and this shedding-off of old skin is done in patches and in random manner. The male lizard reflects its escape behavior in response to predators and prefers to run away only when the risk is higher. It may also be aggressive at times. The female lizards try to refrain themselves from any confrontation and always took to their burrow even at the slightest danger.

Key words: agama, desert, sexual dimorphism, thermoregulation, territorial, behavior

Evaluation of Phytochemical and Antifungal Activity of *Citrullus Colocynthis* Seeds Solvent Extracts

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Plants are the richest resource of drugs of traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs. Medicinal plants have been found to be helpful in curing many diseases and have always promoted the search for different extracts from plants which could act as a potential source of new antimicrobial agent. Plant extracts and their constituents have a long history as an important source of secondary metabolites and antifungal agents, but their use in as fungicides, has been rarely reported. Phytochemicals have antioxidant or hormone-like effect which helps in fighting against many diseases including cancer, heart disease, diabetes, high blood pressure and preventing the formation of carcinogens on their target tissues. *Citrullus colocynthis* have proved to have several active chemical constituents like colocynthin, colocynthetin, cucurbitacins, cucurbitacines, cucurbitacin glycosides, flavonoids and flavone glycosides. The aim of this study was to assess the phytochemical constituents and in vitro antifungal activity of different solvent extracts from *Citrullus colocynthis* seeds. The fruits of *C.colocynthis* were collected at maturity between September and November from GKVK Bangalore. In the laboratory, seeds were dried under shade and powdered and used for all the analysis. The extractions were performed on the powdered seeds of *C.*colocynthis. Ten grams of the sample was extracted using 100ml of ethanol, methanol and hexane as solvents for 48 hrs, after 48 hrs the mixture was then filtered using filter paper (What man No 1). The filtrate is used for further assay. The Phytochemical Screening tests were carried out in the extracts using standard procedure to identify the constituents as described. For Antifungal assay, the fungal isolates were allowed to grow on a Sabouraud dextrose agar (SDA) at 25°C until they sporulated. The fungal spores were harvested after sporulation by a mixture of sterile glycerol and distilled water with a sterile glass rod. 100µl of the fungal spore suspension was evenly spread on the SDA using a glass spreader. Wells were then bored into the agar media using a sterile 6 mm cork borer and the wells filled with the solution of the extract and the plates were incubated at 25°C for 96 h and later observed for zone of inhibition. The effect of the extract on fungal isolates was compared with Amphothericin B and Miconazole at a concentration of 1 mg/ml. Minimum inhibitory concentration (MIC) was determined for the samples which showed greater zone of inhibition against the fungal isolates.

Alkaloids, Glycosides, Terpenoids, Tannins, Anthraquinone and Carbohydrates were seen present in all the 3 extracts. Saponins and phenols were absent in all the solvent extracts. Antifungal activity was checked for five different solvent extracts against 3 fungal isolates. The maximum zone of inhibition was seen against *Rhizopus spp*., by methanolic extract of the seed sample. Chloroform and diethylether extracts did not show much activity against the fungal isolates. The minimum inhibitory concentration was seen at 0.625mg/ml concentration for all the fungal isolates with the ethanolic extract. *Rhizopus* and *Aspergillus niger* showed mimimum inhibitory concentration at 0.625mg/ml concentration of the methanolic extract with a zone of 6mm and 7mm respectively. *Gliocladium* showed MIC value of 2.5mg/ml with the methanolic extract of the seed sample. The hexane extract showed less antifungal activity and the MIC value was 0.625mg/ml, 2.5mg/ml and 5mg/ml for *Rhizopus, Aspergillus niger* and *Gliocladium* respectively. Further purification of the compound and identification of the compound is required to find the active ingredient and its activity. The present study indicates the ability of plants to produce secondary metabolites as alternative medicines which have been used for ages in folklore medication and is making a comeback to treat various illness and also multiple drug resistant microorganisms.

Key words: *Citrullus colocynthis,* Bioactive compounds, Solvent extract, Antimicrobial activity, MIC.

Response of Marigold (*Tagetes erecta* L.) to Microbial Inoculation at Different P Levels for Xanthophyll Yield

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A field experiment was conducted at College of Horticulture, Mudigere, Chikmagalur district of Karnataka to study the response of marigold (*Tagetes erecta* L.) to the inoculation of Vesicular Arbuscular Mycorrhizal (VAM) fungi (*viz*., *Glomus fasciculatum, G. mosseae, G. Intraradices)* were tried at different P levels (*viz*., 60, 90, 120 kg ha^{-1}) were tried on plant growth, flower yield and xanthophyll yield of marigold. Marigold ranks first among the loose flowers production in India. Today, there is huge demand for natural colours of marigold, *Calendula, Hibiscus, Gomphrena, Petunia* etc., in the international market. Marigold is one such potential flower crops for natural colour extraction. It is being grown today as a commercially important source of carotenoid pigments. The principal pigment present in the flowers is xanthophyll, particularly lutein (80 - 90 %). Its carotenoids are the major source of pigment for poultry industry as a feed additive to intensify the yellow colour of egg yolks and broiler skin. The ground blossom meal (petal meal) or the extract, usually saponified for better absorption, is added to the poultry feed. Presently, in India marigold carotenoid is being done in Cochin (Kerala), Hyderabad (Andhra Pradesh), near Satyamangal forest (Tamil Nadu) and Telagi and Bangalore (Karnataka) and are regularly exported to Mexico, Peru, USA, Japan, Spain, Romania, The Netherlands, Turkey, Poland, Italy, Australia, Canada, Africa etc. Consequently large area in Karnataka, Andhra Pradesh and Maharashtra are under contract farming of marigold for xanthophylls extraction.

Mycorrhiza literally means 'fungus root'. The fungus obtains photosynthesis from plant, while the plant is able to utilize the network of fungal hyphae. The uptake of inorganic nutrients by plants is influenced by microorganisms in the rhizosphere. Mycorrhizae are one of such microorganisms that are involved in the uptake of vital plant nutrient element, phosphorus. It is an important plant macronutrient, making up about 0.2 % of a plant's dry weight. Mycorrhizae are important for plant P acquisition. In certain plant species, root clusters are formed in response to P limitations. These specialized root exudes high amount of organic acids (up to 23 % of net photosynthesis), which acidify the soil and chelate metal ions around the roots, resulting in the mobilization of P and some micronutrients. Considering its importance of marigold flower as a commercial flower crop, the study on effect of VAM fungi on the growth, yield and xanthophyll content of marigold, at different phosphorus levels was tried. The experiment was laid out in Randomised Block Design with two factors. There were 12 treatment combinations comprising three strains of VAM fungi with an un-inoculated control and three levels of phosphorus were tried in all possible combinations replicated thrice. The seeds were sown in the beds and the VAM fungi were inoculated in the nursery separately. Thirty days old healthy and uniform seedlings were used for transplanting in the plots (3.0 m x 3.0 m) with spacing of 60 x 45 cm and light irrigation was given immediately after transplantation. Initial root colonization by VAM fungi were recorded on the day of transplantation by staining root system with trypan blue. The fertilizer dose prescribed for marigold in transitional tract of Karnataka is 225:120:60

NPK per hectare. Nitrogen and Potassium were applied in the form of urea and muriate of potash, respectively. Phosphorus was applied according to the treatment levels in the form of rock phosphate. Half the quantity of nitrogen and full dose of potassium and P_1=60 kg, P_2=90 kg and P_3= 120 kg rock phosphate ha^{-1} *i.e.,* 50, 75 and 100 % recommended levels of phosphorus were applied after two weeks of transplantation. Remaining 50 % of nitrogen was applied after pinching *i.e.,* 40 days after transplantation as top dressing. Observations on various parameters were recorded systematically and analysed statistically. Xanthophyll content was estimated by AOAC method (Lawrence, 1990). After estimating the xanthophyll content from one kilogram of petal meal it was multiplied by the total petal meal yield/ha and expressed as kg ha^{-1}.

The xanthophyll yield was influenced by inoculation with *Glomus* fungi. Plants inoculated with *Glomus* fungi were recorded more xanthophyll yield than Uninoculated control. The influence of *Glomus* fungi on xanthophyll content was significant. The plants inoculated with *G. mosseae* were recorded significantly highest xanthophyll yield (18.13 g) followed by *G. fasciculatum* (17.48 g). The application of P influenced the xanthophyll content significantly. Among the P levels 90 kg ha^{-1} recorded maximum xanthophyll content (13.72 g) and minimum was recorded in P level at 60 kg ha^{-1} (10.09 g/100 g of petal meal). The interaction effect of inoculation of *Glomus* fungi and P-fertilization was significant. The xanthophyll content was increased with the increase in P levels up to 120 kg ha^{-1} in uninoculated control plants, whereas; in the inoculated plants the xanthophyll content was increased at P level 90 kg ha^{-1}. The plants inoculated with *G. fasciculatum* and given P at 90 kg ha^{-1} recorded significantly the highest xanthophyll content in marigold (22.03 g) compared to the same strain of *Glomus* fungi and uninoculated control plants applied with P at 120 kg ha^{-1} and least was observed in uninoculated control plants with given P at 60 kg ha^{-1} (10.75 g). The influence of *Glomus* fungi on xanthophyll yield was significant. The plants inoculated with *G. fasciculatum* were recorded significantly highest xanthophyll yield (22.71 kg ha^{-1}) and it was closely followed by *G. mosseae* (22.02 kg). The least xanthophyll content was recorded in *G. intraradices* (12.13 kg). The application of P influenced the xanthophyll content significantly. Among the P levels 90 kg ha^{-1} recorded maximum xanthophyll yield (18.11 kg) and minimum was recorded in P level at 60 kg ha^{-1} (7.99 kg). The interaction effect of inoculation of *Glomus* fungi and P-fertilization was significant on flower yield. The xanthophyll yield was increased with the increase in P levels up to 120 kg ha^{-1} in uninoculated control plants, whereas in the inoculated plants the xanthophyll yield was increased at P level 90 kg ha^{-1}. The plants inoculated with *G. fasciculatum* and given P at 90 kg ha^{-1} recorded significantly highest xanthophyll yield in marigold (34.49 kg) as compared to other species of *Glomus* fungi and uninoculated control plants applied with P at 120 kg ha^{-1} and least was observed in uninoculated control plants with given P at 60 kg ha^{-1} (7.25 kg ha^{-1}).

The conclusion of the present study reveals that, the xanthophyll yield of marigold plants inoculated with efficient VAM fungi and supplied with P at 90 kg ha^{-1} was comparable even better than the uninoculated plants supplied with P at 120 kg ha^{-1}. This indicates the possibility of reducing P fertilizer application by 25 % of the recommended dose to marigold by inoculation with a suitable strain of VAM fungi, *i. e., G. fasciculatum* and *G. mosseae*.

Key words: Marigold, VAM, xanthophyll, phosphorus, *Glomus fasciculatum, G.mosseae, G. intraradices*.

Biodiversity of Free Living Freshwater Protozoa in Surface Water from Mahrashtra

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Free living freshwater protozoa have been investigated in surface water from Aurangabad and Nasik, Maharashtra, India from July 2007 to June 2012. Total 485water samples were collected from different water bodies including ponds, lakes, tanks, and rivers, of whichprotozoa were recorded in 436 samples.The total of 12 genera and 17 species found were identified as 4 genera and 6species of Spirotrichea, 3 genera and 3 species of Litostomatea, 3 genera and 6 species of Oligohymenophorea, 1 genus and 1 species of Euglinoidea and 1 genus 1 species of Tubulinea.

Each species has been identified morphologically, compared with all previously described species and redescribed here.Shape and size of the cell, shape, size and position of macronucleus and micronucleus, length of AZM, number and position of contractile vacuoles and cerri were considered to identify the species. Month wise prevalence was recorded for all the described species of protozoa.

Key words: Ciliates, Freshwater, Prevalence, Protozoa.

Effect of Sources of Nutrients on Productivity, Profitability and Nutrient Uptake of Rice (*Oryza sativa* L.) under Different Methods of Cultivation

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In Karnataka, rice is grown over an area of 1.42 m ha with a production of 3.6 m t. The future increased demand for rice production has to come from rainfed lowland and flood prone ecosystem, which accounts more than 30 per cent of the total rice area in Asia. Hence, it is highly essential to improve the production of these ecosystems by implementing appropriate agro-technology in order to meet the ever growing rice demand of increased population pressure in Asia. A field experiment was conducted during *kharif* seasons of 2012 and 2013 at Zonal Agricultural Research Station, Mandya to study the effect of sources of nutrients on productivity, profitability and nutrient uptake of rice (*Oryza sativa* L.) under different methods of cultivation. The experiment was laid out in a split plot design with three different methods of rice cultivation as main plot *i.e.,* Conventional method, System of rice intensification (SRI) and Aerobic method and sub plot treatment as five sources of nutrients including both organic sources and inorganic sources and replicated thrice. Among the different methods of rice cultivation, SRI method of rice cultivation recorded significantly higher yield (8545 kg ha^{-1}) as compared to conventional method (6475 kg ha^{-1}) and aerobic method (7050 kg ha^{-1}). This was attributed due to higher nitrogen uptake (164.33 kg ha^{-1}), phosphorus uptake (48.06 kg ha^{-1}), potassium uptake (227.82 kg ha^{-1}) and resulted higher net return (. 94, 330 ha^{-1}) and B:C ratio (2.79). Among different sources of nutrients, RDF (100 % N through neem coated urea) recorded significantly higher grain yield (8487kg ha^{-1}), nitrogen uptake (157.48 kg ha^{-1}), phosphorus uptake (47.76 kg ha^{-1}) and potassium uptake (215.93 kg ha^{-1}) and intern resulted higher net return (.94, 534 ha^{-1}) and B:C ratio (2.88) over other treatment combinations.

Key words: Productivity, Economics, Nutrient uptake, Methods of rice cultivation, Neem coated urea

Influence of Integrated Nutrient Management Practices on Yield and Yield Attributing Parameters of Maize (*Zea mays* L.) under Rainfed Situation

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Maize (*Zea mays* L.) is an exhaustive crop, showing inconsistency in yields. Since prices of chemical fertilizers and cost of cultivation is increasing hence, there is a need for developing low cost technology on nutrient management which increases the efficient and judicious use of all the major sources of plant nutrients in an integrated manner so as to get maximum economic yield without any deleterious effect on physico-chemical and biological properties of the soil. A field experiment was conducted at Collage of Agriculture, UAHS, Navile, Shivamogga, Karnataka. during *Kharif* 2013 to find out the effect of nutrient management practices on maize under rainfed situation. The soil of the experimental site was red sandy loam, with neutral in reaction (pH 6.5) with electrical conductivity of 0.02 dS m^{-1}, bulk density of 1.45 gcm^{-3} and low organic carbon (4.2g kg^{-1}). Experiment was laid out in randomized complete block design (RCBD) with three replications and 10 treatments. The treatments consisted of 100 per cent RDF with FYM, poultry manure, vermicompost, biofertilizer and $ZnSO_4$. Application 100 % RDF + $ZnSO_4$ + poultry manure (N-equivalent of FYM) + *Azospirillum* + PSB recorded significantly higher grain and straw yield (69.50 Q ha^{-1} and 11.33 t ha^{-1}, respectively) over rest of treatments but it was on par with 100 % RDF + $ZnSO_4$ + different concentration of vermi-compost (N-equivalent of FYM) + *Azospirillum* + PSB (65.50 and 10.72). Significantly higher number of rows per cob (14.87), number of seeds per cob (466.00), test weight (30.16 g), cob girth (14.16 cm), cob length (16.71 cm) and cobs per plant (1.98) were recorded with application 100 per cent RDF + $ZnSO_4$ + poultry manure (N-equivalent of FYM) + *Azospirillum* + PSB over rest of treatments but which was on par with 100 % RDF+ $ZnSO_4$ + different combination of Vermi-compost (N-equivalent of FYM) + *Azospirillum* + PSB (13. 60, 455.67, 28.33 g, 13.27 cm, 14.93 cm and 8.00). The experimental findings have clearly showed that, use of poultry manure (N-equivalent of FYM) along with $ZnSO_4$ + *Azospirillum* + PSB one of the efficient sources of nitrogen in organic farming which is an efficient substitute for chemical fertilizer for higher crop yield and profitability of rainfed maize.

Key Words: RDF, Manure, Bio-fertilizer, yield and Test weight

Assessment of Seasonal Variation in Physico-Chemical Quality and Pollution Status of Kangsabati (Kasai) River, Purulia District, West Bengal, India

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Purulia is situated on the north of the Kangsabati (also variously known as the Kasai) river. Now, river has been subjected to massive degradation and pollution due to the enormous quantity of household as well as industrial wastewater inflowing the river. In the present paper an attempt has been made to investigate Physico-chemical quality of water and pollution level of Kangsabati River during six months (January, 2014 to June, 2014). For this investigation the water samples were collected from pre-selected sampling stations and status of parameters such as pH, temperature, turbidity, conductivity, DO, BOD, COD, total alkalinity, total hardness, chloride, phosphate, nitrate-nitrogen, iron, ammoniacal nitrogen, sodium and potassium were examined by standard methods. Present study revealed that pH (7.6 - 9.3), Turbidity (27.6 - 38.3 NTU), Dissolved oxygen (3.70 - 7.60 mg/l), Biochemical oxygen demand (6.24 - 9.8 mg/l), Chemical oxygen demand (68 - 148 mg/l), phosphate (0.23 - 0.70 mg/l), ammonia (0.38-0.96 mg/l) and potassium (61.8-154.8 mg/l) were observed beyond the permissible limits. The value of temperature (18 ^{o}C- 26^{o}C), conductivity (0.16 - 2.58 µmhos /cum), total alkalinity (103 - 154 mg/l), total hardness (86 - 184 mg/l) chloride (88.2 - 172.6 mg/l), Nitrate-N (0.26 - 0.78 mg/l), Nitrite-N (0.06 - 0.58 mg/l) Iron (0.18 – 0.26 mg/l) and sodium (78 - 138 mg/l) were under the permissible limits of WHO and BIS. Depending upon the value observed from this study, it was noticed that water of Kangsabati River is somewhat polluted due to discharges of industrial waste, domestic sewage and agricultural run-off, and various human activities in the catchments of the river, which need more efficient management and regular monitoring to improve the quality of this river.

Key words: assessment, seasonal variation, physico-chemical quality, permissible limit, pollution status

Deleterious Effect of ZnS Nanoparticles on Gills and Kidneys of Asian Dwarf Striped Catfish *Mystusvittatus* (Bloch, 1794)

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In the present era of hopping advancement of nanotechnology,there are high possibilities that the sewage from these industries, containing sulphide nanoparticles (1-100 nm), ends up into watercourses.ZnSnanoparticles (NPs) are one of such materials that can be found in the wastes of cosmetic, pharmaceutical and rubber industries.Due to enhanced surface photo-oxidation property of ZnS in its nanoparticle form, the dissolved oxygen content in water is found to reduce in a dose dependent manner from their normal values, when ZnS nanoparticles of different sizes are exposed to the water in various concentrations.This property is more prominent for ZnS nanoparticles with smaller sizes. Consequently under the exposure of ZnS NPs, fish are forced to live in an oxygen depleted atmosphere.

When living in a habitat with low level of dissolved oxygen, fish respond to hypoxia with varied behavioural, physiological, and cellular responses in order to maintain homeostasis and organ function in an oxygen-depleted environment.As oxygen levels decrease, fish may at first increase movements in an attempt to escape the hypoxic zone, but eventually they greatly reduce their activity levels, thus reducing their energetic (and therefore oxygen) demands. This pattern can be seen in Atlantic herring [1].Fish that reduce their activity levels under hypoxia include the common sole [2] the guppy, [3] the small-spotted catshark[4] and the viviparous eelpout [5]. Some sharks are found to ventilate their gills byincreasing their swimming speeds under hypoxia, bringing more water to the gills [6].The biggest challenge fish face when exposed to low oxygen conditions is maintaining metabolic energy balance, as most of the oxygen consumed by fish is used for ATP production through the electron transport chain [7]. Therefore, hypoxia survival requires a coordinated response to secure more oxygen from the depleted environment and counteract the metabolic consequences of decreased ATP production at the mitochondria. Therefore any change in behavioural, physiological, and cellular responses in fish must be studied systematically when fish are exposed to ZnS NPs, causing hypoxia.

Key words: Photo-oxidation; Photo electron spectroscopy; Hypoxia; Hepatic cells; Gill filament and lamellae; Renalhistomorphology

ZnS Nanoparticles Results in Follicular Atresia and Apoptosis in the Preovulatory Follicles of Ovary in *Mystusteengara* (Hamilton, 1822): A Menacing Concern for Aquatic Milieu

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The ZnS nanoparticles (NPs) have shown to exhibit some changes in the physicochemical parameters of the water bodies such as dissolved oxygen level, pH etc., which in turn determines the water quality and hence affects the aquatic fauna (Chatterjee*et al.,* 2014). The fishes being an integral part of the water bodies it is most likely that they will be affected by the consequences of the dissolved ZnS NPs. It has recently been emphasized that atresia can be related to the programmed cell death, apoptosis in order to maintain the tissue level homoeostasis in multicellular organisms (Hacker, 2000; Kennedy, 2002). Various factors such as cytokines, hormones, viruses, xenobiotics, radiation, oxidative stress and hypoxia can induce apoptosis, like atresia (Webb. *et al*, 1997). As ZnS NPs reduce the level of dissolvedoxygen content in water, fish are forced to face hypoxia in their habitat.So it is likely that the maturing oocytes will come across prescheduled follicular atresia followed by apoptosis under exposure to ZnS NPs.

The experiment was conducted withanaim to show that the ZnS NPs, when released into the water bodies from different sources, may end up in creating some physiological alterations and changes in the reproductive behaviour in the aquatic animals such as *Mystusteengara*. This is a popular food fish in eastern India and Bangladesh and hence any adverse change in its reproductive behaviour will create negative impact on the commercial food market. Therefore, systematic study is needed to monitor the hazardous effect of ZnS NPs on female reproductive system of *M. tengara.* Further, this work is also aimed to establish the fact that such NPs demandsproper treatment before they are released into the water bodies.

Key words: photo oxidative property, liver, maturing follicles, reproductive behaviour, industrial effluents, cleaner earth, safer future**,** aquatic fauna

Cultural Eutrophication in Relation to Phytoplankton in a Tropical Mangrove Dominated Estuary of Sunderban, North-East Coast of Bay of Bengal, W.B., India

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Eutrophication caused by excess nutrients (in particular nitrogen and phosphorus) from anthropogenic sources, or sources that result from human activities. Cultural eutrophication is the process that speeds up natural eutrophication because of human activity.The rapid human settlements, industry, intensive boating and tourist activities, deforestation and ongoing agricultural and aquacultural practices due to high human population density and rapid economic growth of the countries surrounding the Bay of Bengal make the coastal environment vulnerable to a range of anthropogenic stress factors .The River Hooghly receives huge amount of raw sewage through discharge of domestic, agricultural and industrial wastes which make this estuary vulnerable to anthropogenic perturbations. Primary production by coastal phytoplankton contributes almost 15% of global oceanic production. Ongoing climate change and anthropogenic activities are introducing stressors to the coastal environment, which affect the ecology and biology of phytoplankton. Elucidating the biogeochemical controls and feedbacks on primary production due to inadvertent fertilization, it is essential to understanding how coastal biota will respond to anthropogenically influenced changes and affect natural climatic variability in coming decades.

Key words: Sunderban, Mangrove, Tropical estuary, Anthropogenic source, Phyto plankton, Eutrophication.

Floral Diversity Index of Kolkata City

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Biodiversity refers to the variability of life forms in the matrix of the planet Earth. It is measured in term of species numbers, species being genetically and ecologically distinctive groups of populations. The image of biodiversity is reflected through various indices that are commonly used to describe community structure. We conducted a study on the floral diversity of Salt-Lake area during postmonsoon 2014 and computed the Shannon Weiner Species Index on the basis of the quadrate data. Also through development of questionnaire we documented the taxonomic diversity of the floral species in the same region during 2009 (through feedback from local people). ANOVA performed on these two data sets reveal significant temporal variation. These variations may be attributed to landscape modification in the Salt-Lake area of Kolkata in terms of development of shopping malls, housing complexes, road expansion etc. Floral diversity, being an important part and parcel of the smart city concept needs to be restored through proper policy, soil management and species selection. The species selection refers to plantation of selected species that survive and grow better in relation to soil characteristics of the proposed plantation site.

Key words: Biodiversity, Shannon Weiner Species Diversity Index, floral diversity, ANOVA, temporal variation

Mangrove Litter Based Fish Feed for Carp Culture: An Innovative Approach to Manage Aquatic Health and Resources

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The foundation of rural Indian economy stands on agriculture and pisciculture. The Indian sub-continent is blessed to have a large area of aquatic ecosystem. Management of this aquatic ecosystem through scientific methods can yield maximum benefit in terms of fishery. Fish production pace in the present century is facing retardation because of disease problem, environmental pollution, lack of protein rich floral based fish feed in the market and quality of the final harvested product. Fish feed being an important component of modern pisciculture practice needs development to boost up fish growth without hampering the ambient environment. The present paper is an attempt to develop and manufacture floating fish feed (for carps) from mangrove litter extract. The extract is rich in protein and several micro-nutrients essential for the growth of fishes. In this study we compared our fish feed with an available commercially fish feed (purchased from the market) and noted our product to be rich in astaxanthin, although the protein percentage is relatively lower than the commercially available fish feed in the market. It is expected that such floral based fish feed may upgrade the environment of culture pond in terms of DO (dissolved oxygen) level and organic load and may serve as the road map of sustainable pisciculture.

Key words: Pisciculture, fish feed, mangrove litter, astaxanthin, protein percentage

Study of Amylase Activity in Stored and Artificially Infested Maize Grains

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Seed samples (maize) were collected from different localities in Maharashtra. Eight fungal species were found associated with grains of maize varieties. The fungal species recovered on agar media and blotter paper were *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus niger*, *Aspergillus oryzae*, *Aspergillus terreus*, *Fusarium solani, Fusarium moniliformae* and *Penicillium* sp. Amylase activity was studied in artificially infested grains and compared with non- artificially infested grains of maize. In all artificially infested grains the activity was more than that in control condition.Maximum amylase activity was recorded in the grains which were artificially infested with *Aspergillus niger*.

Key words: Maize grains, seed borne fungi, artificial infestation, amylase activity.

Sustainability of Himalayan Environment and Pastoralism: Development of Stall Feeding System for Migratory Himalayan Gaddi Goats by Using *Salix Tetrasperma* Tree Leaves During Resource Scarce Season

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Migratory sheep and goat-rearing is very common in the economically weaker sections of society in the tribal hilly areas of Himachal Pradesh. The Gaddi tribe in the state extensively practise migratory pastoralism. They migrate with their animals from foothills of the Himalayas to high altitude alpine ranges during the summer months and to foothills and plains during the winter season. Though with the changing times and availability of diverse occupations a considerable decline has taken place in the number of pastoral nomads, yet this system is still one of the important occupation of a large Himalayan population. Himalayan pastoralism is considered by policy makers and forest officials as an environmental threat to Himalayas due to overgrazing and soil erosion. Because of decrease in availability of common grazing land, diversion of land for cultivation of crops and for industry and reluctance of younger generation to pursue the migratory system of rearing there is urgent need for developing stall feeding system utilizing the locally available feed resources of the region. And also during downward migration from August to April, because of inadequate feed resources there is stunted growth and overall animal production is very poor. Tree leaves which are available during this period can be utilized for improving animal production. In this regard, *Salix tetrasperma* which grows along the banks of rivers and streams in wet swampy places and leaves of which contain 13-19% crude protein (CP) can be explored for feeding animals.

Key words: Hill livestock; Transhumant grazing; winter feeding; Diet; Willow tree leaves; nutrient utilization

Leather Industrial Effluents: Chemical and Microbial Approaches to Reduce the Toxicity for Green Environment

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Leather industrial effluents are a serious environmental pollution and social concern in Bangladesh. The effluents contained pollutants can cause undesirable effect on the ecosystem. The physico-chemical and microbial approaches have been considered to reduce the toxic level before discharging effluents into the environment. The effluents were yellowish brown in color, having basic pH, very high values of TSS, TDS, TS, BOD_5, COD, SO_4^{2-}, Na, Ca, Cr, As, Cd and Pb. The effluents were treated with various doses of $FeCl_3$, $FeSO_4.7H_2O$ and Fe_2O_3 after settling and a subsequent filtration of raw effluents through sand-stone and saw-dust. The coagulants 150mg/L $FeCl_3$ 150mg/L $FeSO_4$ and 100mg/L Fe_2O_3 showed maximum removal efficiencies for majority of the parameters. The mean removal efficiency for all parameters were 91%, 89% and 85%, for the coagulants Fe_2O_3, $FeCl_3$ and $FeSO_4$, respectively, indicating that Fe_2O_3 showed the best removal performance among the coagulants. The present paper also carried out microbial treatment with bacterial species for the synthetic and composite untreated tannery effluents to remove heavy metal ions. The isolated bacteria showed resourceful tolerance against Cr, Cd and Pb. The results reveal that Cr removal efficiency was found 100% for the synthetic effluent. The bacterial isolate was identified as *Enterobacter species* by 16S rRNA sequencing and biochemical studies. It may conclude that a combine treatment approaches, i.e., physical, chemical and microbial processes could be promising in order to reduce pollution for green environment.

Key words: Leather industrial effluent, environmental pollution, treatment, Bangladesh

Effect of Temperature Variation on Agro- Biodiversity and Food Security: A Review

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Today, global warming is a major and controversial issue all over the world. It affects many aspects of life, agriculture, plant and animal biodiversity, environment and socio-economic well being Temperature stress (high and low) is one of the important environmental factors that may affect morphology, anatomy, phonology and plant biochemistry at all levels of organization. Global warming occurs because of heat-entrapment in the atmosphere by greenhouse gases (GHG). Those gases cover the atmosphere and hold the heat from the earth, thus increasing the earth's temperature. Plants, in particular, as sessile organisms, cannot move to more favorable environments consequently, plant's growth and developmental processes are substantially affected, by temperature variation. Since agricultural crops are greatly affected by climate patterns, the agro ecological sustainability of crops will be affected. Over the past few decades, acceleration in the human-induced changes in the climate of the earth has become the focus of scientific and social scrutiny. The gaseous composition of the atmosphere has undergone a significant change mainly through increases industrial emissions, fossil fuel burning widespread deforestation and burning of biomass as well as changes in land use and land management practices. This study will review the effects of temperature variation on the crop plants and their role in food security.

Key words: Global warming, Agro- biodiversity, Socio-economic, Sustainability, Temperature variation.

Waste Management: Alternative Ways to Protect Agro -Biodiversity

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Waste can defined as the material that are not prime products, and for the initial user, it has no further use in terms of his/her own purpose of production, transformation or consumption and the user wants to dispose it off. Wastes may be generated during the extraction of raw material, processing of raw materials into intermediate and final products, the consumption of final products and other human activities. In nut shell, waste is the term used for unwanted materials. For example municipal waste, waste water, waste milk in temples, radioactive waste, industrial waste etc. All types of waste can be broadly divided into two groups i.e. dry waste and wet waste. Infect the impact of waste in our life is manifold. It affects our Agro biodiversity, social and economical life, so there is a need to educate people and create awareness in society so that waste management can be done effectively and we can make this world beautiful and better place to live in. This research paper height lights the alternative ways to protect Agro biodiversity based on the age old golden theory of 4R', i.e. REDUCE, REUSE, RECYCLE and REENERGY.

Key words: Municipal waste; Radioactive waste; Industrial waste; Reduce: Reuse; Recycle Re-energy

Adverse Impacts of Changing Climate on Agro- Biodivesity Sector & Economic Perspective

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Agriculture is arguably the most important sector of the economy that is highly dependent on climate. A large body of scientific data and models has been developed to predict the impacts of the contemporary and future climate. Early research on agricultural impacts led to some rather dire predictions of adverse impacts of climate change on food production, and the public perception that climate change may lead to global food shortages continues today. Although state-of-the-art at the time, the early predictions involved relatively simple data and methods, typically estimating the effects of increases in average annual temperature on yields of a limited number of crops at a limited number of locations, and extrapolating the typically negative effects to large regions. Since the first IPCC Assessment Report was published in 1990, substantial efforts have been directed toward understanding climate change impacts on agricultural systems. The resulting advances in our understanding of climate impacts have come from the collection of better data, the development of new methods and models, and the observation of actual changes in climate and its impacts. Such knowledge is critical as we contemplate the design of technologies and policies to mitigate climate change and facilitate adaptation to the changes that now appear inevitable in the next several declares and beyond. This article briefly summarizes some of the key findings from the research on agricultural impacts of climate change, based on the recent IPCC Assessment Reports published in 2001 and 2007, and other recent work such as the recent US assessment published in 2002 and the CST report in 2004. In the remainder of this article, Substantial uncertainties that remain about actual and potential impacts of climate change on agriculture and its economic consequences are discussed precisely.. The paper concludes with some observations about linkages from impacts to policy.

Key words: Adaptation & mitigation; CO_2 levels; Economic impacts; Malnutrition & hunger; Environmental consequences; Weather biotechnology.

Oppressions from Climate to Agro-Biodiversity & Its Conservation Stratagem

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The authenticity of human-forced swift climate change presents an unprecedented challenge to the conservation of Agro biodiversity at this plant. Integrating responses to global environmental challenges is especially relevant because the adverse impacts of climate change can impose severe stresses on biodiversity resources that are fragile, vulnerable and already under stress and the people who depend upon them. The conservation, sustainable management and the use of biodiversity resources are key factors that can be effectively used to minimize the adverse impacts of global climate change. Efforts to understand and address the linkages between global climate change and biodiversity loss are both urgent and timely. As measures to address climate change and cope with its effects are increasingly deployed, it's also critical to analyze their possible benefits and risks to Agro biodiversity and ecosystem survives. There is urgent need to accessible information on the likely impacts of climate change on biodiversity. The threatening processes are currently affecting the population viability of may species and degrading key ecological processes that underpin the long term integrity of the landscape's ecology. A conservation plan that relies on accumulating small amounts of protected lands across the continent, employing a set of arbitrary conservation 'targets', will not be effective in mitigating the impacts of anthropogenic climate change on country's biodiversity. The foundation of climate change adoption conservation plan that relies on accumulating small amounts of protected lands across the continent, employing a set of arbitrary conservation 'targets', will not be effective in mitigating the impacts of anthropogenic climate change on country's biodiversity. The foundation of climate change adoption conservation strategy is to develop a whole-of-continent conservation plan that recognizes the importance of protecting and restoring those natural processes that have made species resilient in the past. There are strategies ecosystems, managing habitats of endangered species, creating refugees and buffer zones, establishing corridors for taking to account projected changes in climate and introducing plant varieties able to adapt climate change, maintaining viable populations of all extant species to maximize intra-species genetic diversity and thus options for local adoption, reducing all current threatening processes at the landscape scale across the continent, and finally protecting & restoring key large ecological processes.

Key words: Ecosystem; Agro biodiversity; CO_2; Drought; Erosion; Natural resources; Impact on agriculture; Fauna & flora; Sustainable management.

Biotechnological Advancement for Conservation of Agro-Biodiversity

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Biotechnology provides new options for collection, multiplication and short-to long-term conservation of plant biodiversity, using in vitro culture techniques. Significant progress has been made for conserving endangered, rare, crop ornamental, medicinal and forest species, especially for non-orthodox seed and vegetatively propagated plants of temperate and tropical origin. Cell and tissue culture techniques ensure the rapid multiplication and production of plant material under aseptic conditions. Cryoreservation of shoot tips is also being applied to eradicate systemic under aseptic conditions. Cryopreservation of shoot tips is also being applied to eradicate systemic plant pathogens, a process termed cryo therapy. Slow growth storage is routinely used in many laboratories for medium-conservation of numerous plant species. Today, the large-scale, routine application of cryopreservation is still restricted to a limited number of cases. However, the number of plant species for which cryopreservation techniques are established and validated on a large range of genetically diverse accessions is increasing steadily.

Key words: Mass multiplication; Protoplasts; Synthetic seeds; Anther culture

Automobile Technology: A Potential Source of Lead Poisoning in Agro-Ecosystem

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Automobile industry in India is growing rapidly. These revolutionary automobilization lead to production of enormous lead as a byproduct in the environment. When leaded gasoline is burned, it emits small particles of lead into the air, where they remain for extended periods of time. These lead particles will eventually fall out into soil and dust, creating a large amount of lead to continue to poison generations unless covered or removed. The dispersive nature of leaded gasoline and its long term effects, the ease with which lead enters the body after it is emitted by motor vehicles, and the vulnerability of at-risk urban populations, especially children, combine to make elimination of leaded gasoline. As a result is induces exploitation of lands, peoples and cultures, and other life forms. Due to which lead poisoning issue now become an environmental and public health hazard at global level. Moreover children and adults in virtually every region of the world are being exposed to unsafe levels of lead in the environment. In fact, different pathways such as air, food, water, dust and soil. Leaded gasoline is the major source of dispersing lead into the human environment. Environmental justice calls for the education of present and future generations which emphasizes social and environmental issues, based on our experience and an appreciation of our diverse cultural perspectives.

Key words: Automobile technology; Lead poisoning; Vulnerability; Environmental issues Agro-ecosystem

Nanotechnology in Agro-Ecosystem: Scope and Future Concerns

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Nanotechnology is the creation and utilization of materials, device, system, through the control of the properties and structure of the matter at the nanomatric scale (1-100 nm). Nanotechnology is emerging as the revolutionary technology in the recent time. Advances in materials science and chemistry have created significant progress in nanoparticle technology. Agriculture provides food for humans, directly and indirectly. With increase in world population, it became necessary to use the nanotechnology has many potential applications in agriculture such as enhancing the ability of plants to absorb nutrients, nano-fertilizers for slow release of fertilizers for plants, efficient herbicide delivery through nanocapsules, nano-pesticides, disease detection and control of plant diseases, nanosensors for plant pests detection and for soil quality and plant health monitoring. Nano smart dust and gas sensors can be used for quick assessment of levels of environments. This rapidly growing modern technology had already a significant positive impact on our lives, which has been projected to increase in the future. But safety, ethical, and regulatory issues related with application of manotechnology needs proper attention for utilizing the full potential of this technology.

Key words: Agriculture; Environmental pollution; Naneoncapsulation; Nanofertilizer; Nanotechnology

Bioremediation of Pesticides in Soil: An Utmost Need for Agrobiodiversity Conservation

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Bioremediation of pollutants is a new technology, which is focused on destroying or immobilizing toxic waste materials in eco-friendly manner. Pesticides are a common hazard around the world, as these chemicals are leaching into soils, groundwater and surface water and creating health concerns in many communities. The persistence of pesticides makes their removal and detoxification a more urgent undertaking. The bioremediation of pesticides can be divided into two broad categories: in-situ and ex-situ treatment. Both methods have significant advantages and disadvantages.

Key words: Bioremediation; Pesticide; Organic pollutants; Contamination; Micro-organisms

Influence of Season on Disease Incidence and Mortality Pattern of Black Bengal Goats in Their Home Tract

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The present study was conducted in Nadia district of West Bengal during January, 2010 to December, 2013 with the specific objective to study on influence of season on disease incidence and mortality pattern of Black Bengal goats in their home tract. The district Nadia is selected purposively. It lies between 22°52`30" and 24°05`40" parallels of North latitudes and 22°08`10" and 88°48`15" meridians of East Longitudes. The climate of district is characterized by an oppressive hot summer, high humidity all the year round and well distributed rainfall (annual average rainfall 1419 mm). Average daily maximum temperature is 31.8°C, and minimum temperature is 21.3°C during the period of study. Humidity is high throughout the year, average being 61.5% (minimum) to 92.9% (maximum). The study area is located in hot-humid zone having three distinct seasons, viz., summer (March to June), monsoon (July to October) and winter (November to February). Goat is one of the earliest discoveries of mankind in prehistoric times as a ready and easy source of meat. Goats play a vital role in the economy of poor dwellers living in diverse climatic conditions of India. Goats are considered as the fixed deposits for the poorest of the poor supplying fund as and when necessary by virtue of their ready market demand. A pilot study has been carried out, and accordingly a structured interview schedule has been constructed. The data has been collected through face-to-face interview and by direct observation method. This experiment was designed to collect information of goat flock and data pertaining to the occurrence of disease, mortality pattern of pre-weaning kids and adult goats. Morbidity was on the basis of observed clinical signs, owner's statement and some laboratory examinations. Suspected causes of mortality were clarified by taking history, clinical signs before death where showed, owner's statement, post-mortem examination and in some cases by laboratory tests. The incidence of still birth of Black Bengal goats was also recorded. Pre-weaning kid mortality was recorded after kidding till weaning up to 3 months of age. Disease incidence under field condition following extensive or semi intensive management system in Black Bengal goat kids was found to be more in winter (42.85%), followed by monsoon (39.56%) and summer (36.89%). The overall disease incidence of pre-weaning kids during pre-weaning stage was found to be 39.76%. Mortality under field condition following extensive or semi intensive management system in Black Bengal goat kids was found to be more in winter (15.58%), followed by

monsoon (10.98%) and summer (8.73%). The overall mortality pattern of pre-weaning kids during pre-weaning stage was found to be 11.76%. Disease incidence under field condition following extensive or semi intensive management system in adult Black Bengal goats was found to be more in winter (12.42%), followed by monsoon (11.60%) and summer (10.05%). The overall disease incidence of adult Black Bengal goats was found to be 11.35%. Mortality under field condition following extensive or semi intensive management system in adult Black Bengal goats was found to be more in winter (3.95%), followed by monsoon (3.31%) and summer (3.01%). The overall mortality pattern of adult Black Bengal goats was found to be 3.42%. Incidence of still birth of Black Bengal goats during the summer, monsoon and winter were 10.67%, 7.69% and 5.19% respectively. On the basis of results of current study, it can be concluded that diarrhea, pneumonia, goat pox, ectoparasites, anorexia and others are causes more mortality in Black Bengal goats in the three distinct seasons, *viz*., summer, monsoon and winter, so improved hygiene and good managemental practices should be taken in three seasons to reduce the occurrence of diseases. Mortality was associated with age groups, suggesting that more care and attention need to be paid in pre-weaning kids in three seasons. Mortality due to various diseases in pre-weaning kids and adults could be minimized by identifying the cause and giving proper treatment.

Key words: Black Bengal goats, seasons, disease incidence, mortality pattern

Mapping of Soil Nutrient Status in Two Blocks of Koraput District, Odisha using GIS Technology

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In India about 25 Mha and in Odisha 0.75 Mha of land covering 11 districts are affected with iron toxicity and iron toxic plant contains deficient level of N, P, K, Ca & Mg. Black soils in Odisha occur in parts of Kalahandi, Bolangir, Koraput (Kalimela), Ganjam (Aska), Puri (Balugaon), Angul and Padmapur area covering 0.96 Mha, usually contain more than 30 per cent clay with cracks in summer and swells on wetting. The sandy and coarse loamy coastal soils have Electrical conductivity 15-25 dS m^{-1} and are characterized by chlorides of Na, Mg, and Ca. The red, laterite and lateritic group soils in the state of Odisha constitute more than 75 per cent of the total land area. Various soil productivity constraints affecting the agricultural production in the state of Odisha includes low pH and low cation exchange capacity, low organic matter content and low available N & K status, deficiency of Ca, Mg & S as well as micro nutrients like Zn, B & Mo, inherent deficiencies and fixation of soluble P, toxicity of Fe, Al & Mn.

With this background, a study was undertaken in two blocks of Koraput district for mapping the secondary and micro-nutrients in agriculture soils during 2012-2014. Surface soils (0 to 30 cm) was investigated for Ca, Mg along with diethylene-triamine pentaacetic acid (DTPA)-extractable Zn, Cu, Mn, Fe and hot water extractable S and B in relation to some chemical properties in approximately 280 representative soils. Secondary data of soil nutrients from 2012-2014 and the digital boundary map of Koraput district were collected from State Soil Testing Laboratory and National Information Center respectively. Then the soil nutrient data were linked with the sampling spots' Geo-coordinates in the GIS software. The analyzed soil nutrient data (mean variation in available Ca and Mg were 2.68- 3.14 and 1.14 - 1.38 ppm, respectively and that of DTPA-extractable Zn, Cu, Mn, Fe and hot water extractable S and B were 0.48 - 1.26, 1.14- 3.25, 18.17- 20.36, 37.77 - 48.77 and 16.21 - 25.55, 0.44 - 0.57 ppm, respectively. The GIS maps were generated in the CSV (Comma Separated Values) format and were incorporated into the Arc-GIS software to prepare the Interpolated maps by giving low to high range values to expresses the soil nutrient status in different colour exhibits. The soil fertility maps show that most of these nutrient elements are either in low or very low concentrations and at some places it is data deficient. This study thus ascertains the level of nutrient depletion and can find ways for management of such nutrients in this area.

Key words: Arc-GIS, secondary nutrient, micro-nutrient, soil fertility maps

Plastic Waste Generation and Disposal Methods

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Because of wide market of plastic, disposal of plastic waste has drawn attention of environmentalist due to their non-biodegradable and anaesthetic views since these are not disposed scientifically and possibilities to contaminate soil and sub soil water because of leachates from landfilling processes. As estimated 70% of total plastic waste, about 5.6 million tonn per year is discarded in India. It is been observed that disposal of plastic waste is a serious concern due to improper collection and segregation system. Currently worldwide accepted technology for disposal of plastic waste is incineration which is not preferred in India due to emission of toxic gases like CO, Cl,HCl, Dioxin, Furans, Amines, Nitrides etc. Other alternatives like utilization in road construction, Alternative Fuel and Raw Material (AFR) in cement kilns, the new processes for disposal as well as energy recovery are plasma pyrolysis which generates gas only and thermal dissociation which provide gases as well as fuel grade oil having calorific value about 42 MJ/Kg. In the field of active research, this paper identifies the gap between the implementation of processes as well as new technologies for disposal of plastic waste.

Key words: Plastic waste, disposal, new technologies, India

Disposal Problem of Arsenic Sludge Generated During Arsenic Removal from Drinking Water

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Arsenic (As) causes acute and chronic toxicity, it harm the skin and associated with increase risk of cancer in the skin, bladder and kidney. It is very difficult to diagnose the early symptoms of arsenicosis so it depends largely on awareness with improving the quality of drinking water. There are several methods are available for removal of As from water. The most commonly used technologies are oxidation, co-precipitation, adsorption, absorption, coagulation, ion-exchange resin, lime treatment and membrane techniques. Now today the safe disposal of large quantity of As contaminated sludge generated from As removal water treatment plant which contain about 5-7 kg of arsenic per cubic meter due to risk of underground water contamination as arsenic has very high leaching potential. For safe disposal of solid hazardous waste of As requires treatment. A long term solution appears to solidification/stabilization (s/s) of As-sludge and using it for beneficial purposes like bricks and concretes etc. In the field of active research, this paper identifies the gap between the implementation of processes as well as new technologies for safe disposal of arsenic sludge.

Key words: arsenic, disposal, treatment, technologies

Plastic Waste to Electric Power Generation through Plasma Pyrolysis

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Since the duration of life of plastic products is relatively small, there is a vast plastic waste stream that reaches each year to the final recipient creating a serious environmental problem. Again, because disposal of post consumer plastics is increasingly being constrained by legislation and escalating costs, there is considerable demand for alternatives to disposal or land filling. Plasma pyrolysis is an innovative technology for transforming high calorific plastic waste into a valuable synthetic gas (syngas) by means of thermal plasma. The process developed is a drastic non-incineration thermal process, which uses extremely high temperature in an oxygen-starved environment to completely decompose input plastic waste into syngas, composed of very simple molecules viz: H_2, Hydrocarbons and CO. A 20 kg/hr. capacity plasma arc pyrolyser for treatment of plastic waste as well as energy rtecovery options from plastic waste has been indegeneously designed, developed, installed and studied its performance at the CSIR-Central Mechanical Engineering Research Institute, Durgapur. Research results and techno-economic study indicated that the developed plasma pyrolyser may be a useful way of plastic waste treatment for energy recovery.

Key words: Plastic waste, plasma pyrolysis, syngas, energy recovery

Fluoride in Groundwater and its Removal

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High fluoride concentration in drinking water causes dental fluorosis and skeletal fluorosis. Excessive fluoride concentrations have been reported in groundwater of more than 20 developed and developing countries including India. In India, the problem is common in places such as Andhra Pradesh, Tamilnadu, Karnataka, Kerala, Rajasthan, Gujarat, Uttar Pradesh, Punjab, Jammu & Kashmir and West Bengal. Various technologies are being implemented to remove fluoride from drinking water but still the problem has not been rooted out. The review of the paper is aimed to provide information regarding different fluoride removal techniques which are being followed in many places of the world. The fluoride removal has been broadly divided in two sections dealing with membrane and adsorption techniques. Under the membrane techniques reverse osmosis, nanofiltration, dialysis and electro-dialysis have been discussed. Adsorption, which is a conventional technique, deals with adsorbents such as: alumina/alumina based materials, clays and soils calcium based minerals, synthetic compounds and carbon based materials. During the last few years, layered double oxides and artificial recharging techniques have been of interest for fluoride removal. Such recent developments have been briefly elaborated in this paper.

Key words: fluoride, groundwater, removal, membrane and adsorption techniques, India

Socio-Economic Environmental Status of Rural Women with Reference to Vocational Training under CDTP Scheme – A Case Study

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Women are the backbone of the rural society. They play a crucial role in societal environmental management, as farmers, as stockbreeders, and as suppliers of fuel and water. They are the managers, and often, the preserver of natural resources. Development / upgradation of rural society invariably demands upgradation / improvement of rural women. The success of any rural development programme requires local resource based women friendly micro level planning followed by proper monitoring and evaluation. In order to include rural women as a component in the main stream of economic development in rural areas, it is essential to find out the area where the rural women need help and where they can contribute to the development activities.

This paper mainly highlights the status of engagement (Self / Wage) of women after getting skilled training. Based on the available database from different Polytechnics of Odisha under Community Development through Polytechnic (CDTP) Scheme, different scores in percentage were assigned to evaluate the status of women with respect to engagement of particular Polytechnic. The individual polytechnic acquiring score within 0 to <40 % have been categorized as 'poor', those with score 40 to <55 % as 'fair', 55 to <70 % as 'Moderate', 70 to <85 % as 'good' and 85 to <100 % as 'very good'.

Based on this methodology, the status of twelve (12) Polytechnics of Odisha was evaluated. Seven polytechnics registered under 'poor' status, three (3) polytechnics registered as 'fair' status, and two polytechnics were qualified as 'moderate'. It presents very dismal picture in respect of engagement/involvement of women for improvement of overall socio-economic environmental Status. This demands immediate attention and appropriate corrective measures.

Key words: women, socioeconomic, environmental status, skilled training

Diversity of House Dust Mites in Relation to Nasobronchial Allergic Disorders among Kolkata Population, India

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Mites are very diverse and wide spread groups of animals which can be found almost in all the habitats known on the earth. More than 48,200 species (Schauff, 2000) have so far been identified from the world, of those some are plant feeders, some are fungivorous, some are coprophagous, some are saprophagous and some are carnivorous, some are blood and lymph suckers while there are many whose feeding habits are still unknown. Among different groups of mites, house dust mites have earned a world wide interest among acarologists and entomologists in general and medical entomologists in particular because of their intricate association with human beings and this association is of great concern as certain species of mites play a significant role in public health. Kern (1921) and Cooke (1922) first of all pointed out the role of house dust in causing respiratory allergy and suspected the presence of distinct allergen in it. However, during sixties, it has been established that house dust mites especially belonging to the family Pyroglyphidae are a source of allergens that lay a significant role in different allergic disorders like allergic rhinitis, hay fever, eczema and in extreme cases bronchial asthma and affecting 12-20% of the population around the globe. The situation is worst in most of the less prosperous and developing countries with weak economic condition. In India, 10 million people suffer from asthma and another 15 million from other recurrent allergic diseases and it is increasing day by day. So, the present study was designed to inventories the house dust mite fauna in relation to nasobronchial allergic disorders among Kolkata population.

Key words: Mite, allergy, Kolkata, India

A Study on Stabilization of Organic Fraction of Municipal Solid Wastes (OFMSW) in a Three-Stage Anaerobic Digester

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Anaerobic Digestion (AD) of Organic fractions of Municipal Solid Waste (OFMSW) can be necessarily considered as the most apposite methodology, since it is capable of not only stabilizing a significant quanta of generated waste but also ensures the generation of biogas which is a non-conventional source of energy. Moreover, the process of AD involves treatment of the OFMSW within a small area compared to all the conventional processes. The generated solid sludge can also be utilized as a soil conditioner thereby asserting its efficiency over other conventional processes. In the present study, an attempt has been made to understand the performance of a three-stage lab-scale anaerobic digester treating organic fractions of municipal solid wastes under batch mode of operation. Household Fruit and Vegetables Waste (FVW) were primarily used as substrate for the reactor due to their easy availability and superior hydrolysis potential, as revealed from the characterization and hydrolysis study. The performance evaluation was based on the results of the different parameters, like pH, alkalinity, chemical oxygen demand (COD), volatile fatty acids (VFA) etc. The anaerobic digestion was conducted under mesophilic temperature regime for all the batches. The COD removal rate was observed to be satisfactory in all the chambers (hydrolysis, acidogenesis and methanogenesis) of the digestion system. The results of COD data from each batch study were used to determine the kinetic constant (k) for substrate utilization. The value of 'k' was observed to be 0.192, 0.492 and 0.792 day^{-1} for hydrolysis, acidogenesis and methanogenesis respectively. Despite significant COD removal, the biogas generation could not be monitored owing to some unavoidable instrumental limitations. However it was observed that there was a significant volumetric reduction of FVW (used up for the purpose of performing the batch operations), which eventually supported the need for Anaerobic Digestion (AD) for the treatment of Organic Fractions of Municipal Solid Waste (OFMSW).

Key words: organic fraction, Municipal Solid Wastes (MSW), three stage anaerobic digestion, batch study,COD removal

Responses of Fruit Crops Owing to Climate Change

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Climate change is unambiguous, as is it now obvious from observations on increase in mean air temperatures in many places around the world. Precipitation vagaries are also projected in varying amount depending on the world location. Contemporarily, atmospheric CO_2 could increase in the range of 550 to 850 ppm depending on emission scenarios. These changes will affect agriculture, requiring capricious degree of adaptation depending on location. Fruit production will be no exception. The impending effects of climate change are on chilling requirements, flowering time, frost risk, length of growing season, maturity/harvest time, and fruit quality which concerned various policymakers and growers. Other climate change effects includes increased incidence of pests and diseases. One of the main environmental factors influencing the productivity of woody fruit species is winter temperature and its clout on the plant's dormancy cycle. The aftermaths of a failure to satisfy the chilling requirement of woody fruit species have been identified in terms of erratic bud break, reduced quality and lower yields, and these phenomenon have been categorized in various perennial fruit species. Cold winter temperatures (<5°C) pose an obstacle to normal growth of banana. In fruit crops, alterations in the timing of flowering phenology could have crucial effects on production, due to the indirect influence of phenology on spring frost damage, pollination and fruit set efficacy. Global climate change is propelled by the rising concentration of greenhouse gases in the atmosphere, including carbon dioxide, methane and nitrous oxides. Indeed the most detrimental impacts of climate change are shown by the extreme vagaries, e.g. unprecedented snow or freezing leading to cold or chilling damage, severe flooding or extended drought leading to crop failure or reduced yield and recurrent typhoons visits leading to crop failure. Thus, the impact of climate change on horticultural systems has underscored the consequence of the reduction in winter chilling prompting to a consequent requisite for shifting in areas of production. Adaptation may also include modified management of fruit loads and canopy size, shift of cultivars for sustained fruit production.

Key words: Climate change, fruits, greenhouse gases, temperature.

Conservation through Community Participation-A Case Study of Chawandiya Wetland

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Conservation remains incomplete and unsustained without active community participation. It has a significant and vital role in conservation of nature and natural resources. Rajasthan is very well known for the conservation of vegetation as sacred groves. Bishnoi and gurjar communities of Rajasthan have their ethical and mythological association with conservation of plants and animals. The wetland of Chawandiya village (25^{0}19' N 74^{0}46' E) in Bhilwara district of Rajasthan is a sacred wetland having a temple of goddess Chawanda in its territory. The area of the wetland is approximately 200 Acres and the entire wetland is recorded on the name of the goddess in revenue documents. The land was donated to the temple by the ancient Rajput rulers of province of Mewar, at least 600 years ago. The village "Chawandiya" derives its name from the name of the goddess Chavanda. The wetland has a number of trees of *Acacia nilotica*, which serves as preferred habitat for many birds like storks, cormorants, ibis , herons and egrets. The wetland is surrounded by agriculture open farmland on three sides and human settlements on the fourth one. We studied the wetland of Chawandiya after we came to know about the presence a number of migratory birds here. The objective of the study was to know the effectiveness of the conservation by the community involvement, to know the role played by the local community in the conservation of natural resources, it's effect on birds and their population, the threats to the wetland and so as to birds and to present a model of conservation through community participation. The data pertaining to avian diversity was collected from year 2012 to year 2014 using point counts and line transect in winter season survey. All the birds documented were directly and indirectly dependent and associated with the wetland. Local people of the village including the priest family of the temple were interviewed to know the historical and other details of the wetland. Total 133 types of birds of 53 families were registered including both aquatic and terrestrial, out of which 52 were migratory and 81 were resident. The aquatic birds observed were Painted stork, Black headed ibis, Black tailed godwit, River tern, Alexandrine parakeet and Black redstart which are among the globally threatened category and conservationally significant. Most important aspect is the regular occurrence of breeding colonies of near-threatened Painted Storks for last few years. The trees of *Acacia nilotica* in between the wetland are used as the nesting site in a mixed colony with cormorants and egrets. Total recorded birds in and around the weltand were 1085 in year 2012, 1130 in year 2013 and 1422 in year 2014 with maximum number of near threatened Painted storks. The diversity of birds recorded were mixed populations of Painted storks, White

ibis, Eurasian spoonbill, Greater flamingoes, Great white pelicans, Grey and Purple herons, Egrets, Northern shovlers, Northern pintails, Common pochards, Gadwalls, Common teals, Ruddy shellducks, Comb ducks, Common coots, Little cormorants, Grey leg geese, Bar headed geese etc. The wetland and its surrounding farmland offer a variety of food options for the all types of birds. The villagers preserve the water for the birds and for cattle and do not use it even for the drinking for human beings and irrigation purpose. They don't allow fishing here so a stock of fishes has been maintained here for the fish eating birds. The wetland has water round the year and supports animal life and maintains vegetation also. Villagers are vigilant to keep the wetland free from hunting and poaching. Birds are secured and conserved by local people due to their ethical and spiritual values. Lack of support from local administration, growing *Prosopis juliflora* and *Ipomoea carnea*, approach of street dogs to the bird colonies, road construction (in year 2014) and sometime washing the clothes in the wetland are detected as the major pressing threats to the wetland and the birds. The place can be developed as a good bird watching and conservation location with a public private partnership mode. Now when the Painted Storks are no longer breeding in the paradise of the bird "Keoladeo Ghana National Park, Bharatpur" which is conserved by law, their breeding colonies can be regularly seen at Chawandiya. This suggests that the sacred places maintained by local people are effective modes of conservation through community participation.

Key words: Community participation, conservation, sacred, wetland

Host Preference and Effect of Temperature Regimes on *Chrysoperla Carnea* (Stephens) (Chrysopidae: Neuroptera)

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The effects of different temperatures on biology of *Chrysoperla carnea* were investigated underlaboratory conditions. The data were recorded on different temperatures i.e. 24±2, 26±2, 28±2, 30±2 and 32±2°C in the laboratory with 70±5% RH and the results revealed that the longest and the shortest larval and pupal period of *C. carnea* wererecorded as 14.25 and 12.15 days and 11.80 and 9.40 days at rearing temperature of 24 and32°C, respectively. The development period of *C. carnea* at 24°C was 29.15 days, whilethe same was 24.58 days at 32°C. Adult male and female longevity was more than doubleat lower temperature range than at the higher range. The longest oviposition period (50.09±1.15), the highest pupal recovery (94.55±0.45) and adult emergence (89.95±0.75), fecundity (892.56) and fertility (92.58) of eggs were recorded at the temperature of 26°Cindicating that this temperature regime is optimum for the *C. Carnea*.Third instar larva consumed significantly high number of prey than first andsecond instars. The per day consumption pattern of *C. carnea* larva varied from prey toprey depending on the larval age. The consumption by first instar larva is in theorder of *A. gossypii*>*S. cerealella*>*P. solenopsis* > *H. armigera* .Consumption of prey by second instar as in order of *A. gossypii*>*P. solenopsis*>*S. cerealella*>*H. armigera*. While consumption of prey by third instarlarva was in the order of *S. cerealella*>*A. gossypii*>*P. solenopsis* > *H. armigera*. Over all highest live weight of *A. gossypii*as a foodwas consumed by *C. carnea* larvae followed by *S. cerealella* eggs and *P. Solenopsis.*

Key words: Chrysoperla carnea, temperatures, biology

Forest Cover Mapping of Chandaka-Dampara Wildlife Sanctuary, Odisha using Remote Sensing & GIS Technique

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Chandaka-Dampara Wildlife Sanctuary is known for its splendour and pristine home to many species. It spreads over an area of 193.39 sq. Km on the upland of "Eastern Ghat's biotic region". It is a treasure house of biodiversity. The park is known for successful conservation of elephants which is the principal species here. It is also a home to a number of threatened species. It is located in north western fringe of Bhubaneswar in the state of Odisha. This sanctuary is known for it's wide range of floral and faunal diversity. The degradation of forest cover area is due to the biotic and abiotic pressures such as encroachment, illegal cultivation, illegal settlements inside forest and forest fires which are some of the key factors. Habitat management is thus very much essential for the protection and conservation of wildlife in any sanctuary. Forest density mapping & forest type mapping are very much essential for preparation of wild life management plans by the Forest and Wildlife Department. The conventional method that was adopted initially for preparation of wild life management plans took a long time; however, remote sensing and GIS technology has given a promising potential for preparation of input information in quickest possible time. Due to rapid increase of urbanisation of Bhubaneswar city and alarmic increase of industrialisation, forest areas are also encroached for various purposes such as agriculture, residents etc. Hence the richness of forest cover and wildlife are seriously affected. In the background, the present study has emphasized on the preparation of: i) Forest type map and ii) forest density map of Chandaka-Dampara Wildlife Sanctuary. The study area is classified into 17 number of forest and non-forest classes. The forest classes mainly includes sal, mixed species, scrubs, bamboo, teak etc. whereas non-forest classes includes settlement, agricultural land, wastelands, water bodies and road networks. The different forest species found are Kalicha (*Diospyros sylvatica*), Belo (*Aegle marleos*), Giringa (*Pterospermum xylocarpum*), Sunari (*Casia fistula*), Sal (*Shorea robusta*), Kumbhi (*Careya arborea*), Jamu (*Syzygium cumini*), Karanja (*Pongamia pinnata*), Teak (*Tectona grandis*), Sidha (*Lagerstroemia parviflora*); Bamboo (*Bambusa arundinacea*), and Kangada (*Xylia xylocarpa*). The Forest density maps show that 5.27 % is of agriculture land, 3.64 % is occupied by bamboos, 52.63 % is occupied by dry deciduous scrub forest, 0.2 % is of moist sal bearing forest, 21.81 % is of moist mixed deciduous forest, 0.54 % teak forest respectively. The values imply that there is serious concern on the conservation of forest cover of the study area particularly in respect of plantation programme where the largest mammal conservation like elephants are concerned. Elephant *(Elephas maximus*) is the keystone or flagship species in the Chandaka-Dampara wildlife sanctuary & they are mostly depends on bamboo species (*Bambusa arundinacea*). Inside the sanctuary only 3.64 % of bamboo forest is present. So bamboo plantation is a serious concern from conservation aspect.

Key words: Chandka-Dampara WLS, GIS maps, forest type, forest density

Experimental Establishment of Potential Triggering Factors for Auxospore Induction in Two Dominant Centric Diatom Species of Hooghly Estuary

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The auxospore is unique to the diatoms and in general the cell results from allogamous fusion. The major function of auxospores in the life of a diatom is to restore the size which progressively reduces with each generation due to the unique morphology of the diatom valves. Since auxosporulation is the "size-reduction" curtailing mechanism employed by the diatoms; knowledge on the physicochemical parameters which govern the process is of utmost importance.

The primary objective of the experiment was to narrow down the most potential triggering factors behind the induction of the auxospores of the dominant centric diatoms *Coscinodiscus* and *Chaetoceros* in the well mixed waters of the Hooghly estuary. The factors taken into considerations were salinity, pH, turbidity and chief plant nutrients which are mostly considered to be important behind the generation of any spores in phytoplanktons.

The primary samplings were performed at Kachuberia [21°51'39"N 88°8'37"E], Chemaguri [21°40'43"N 88°7'28"E] and Gangasagar [21° 38' 0" N 88° 5' 0" E] located in the Hooghly estuary and were mainly based on their clearly discernible physicochemical differences ranging from region with high riverine influence (Kachuberia) as mangrove impoverished zone, to brackish water regions and mangrove vegetation (Chemaguri) and marine dominated region (Gangasagar) with sparse mangrove cover.

Water samples for the estimation purposes were collected using the Niskin water sampler. For the estimation of phosphate, nitrate and silicate, the standard methods were followed. Salinity of the stock was estimated by following the argentometric titration method. The pH was measured using a Hach portable digital pH meter calibrated at pH 7 using buffer solutions from Merck. The water turbidity was monitored using a Systronics turbidity meter and recorded in nephalometric turbidity units.

The phytoplankton (diatom) sampling was performed using country boats and a handheld phytoplankton net (bolting silk no. 30, mesh size 20 µm) equipped with flow meter from different stations in the Hooghly estuary to ensure the least disturbance of the prevalent population of phytoplanktons and the concentrates were transferred into

25 ml TARSON polythene containers and 4% buffered formalin along with Lugol's iodine were used as preservatives. The samples were then analyzed under Olympus light microscopes, bright field microscopes and Magnus inverted microscope for their accurate and proper identification, using proper literature. All measurements were performed using standardized ocular micrometer and stage micrometer under high power objectives (x40).

All data statistical calculations were performed using the MS-EXCEL software but for the statistical analyses, the 'add-in' of EXCEL, the XLSTAT software was used and the principal component analysis tool of the data analysis package of the XLSTAT 12 was employed to deduce the Pearson correlation was performed at the 5% significance level. The current study dealt with the delineation of the ecological factors that might serve to be the key factors in the induction of the auxospores in the centric diatoms in a well mixed tropical estuary such as the Hooghly in the north east coast of Bay of Bengal. The species selected as the subjects of the experiment were *Coscinodiscus radiatus* Ehrenberg, *Coscinodiscus concinnus* Wm. Smith, *Coscinodiscus lineatus* Ehrenberg, *Coscinodiscus eccentricus* (Ehrenberg) Cleve, *Chaetoceros danicus* Cleve, *Chaetoceros lorenzianus* Grunow, *Chaetoceros curvisetus* Cleve *and Chaetoceros coarctatus* Lauder as these are the more ubiquitous species encountered along the stretches of the Hooghly estuary. The stock water sample collected had mean salinity value of 30.21 psu, pH at 8.38, turbidity at 270 NTU, dissolved nitrate-nitrogen at 22.14 μML^{-1}, dissolved phosphate-phosphorus 3.05 μML^{-1} and 103.82 μML^{-1} of dissolved silicate-silica. From that a salinity gradient was prepared by diluting the stock with Milli-Q water (the other considered parameters automatically formed a gradient with the dilution of the water). The basis of the preparation of the various salinity concentrations was to simulate the salinity zone encountered at the study sites from near coast to offshore. The salinity levels were checked by using a refractometer at every stage and other parameters were checked by following standard method mentioned earlier. Unfiltered, turbid and filtered, clear natural seawater were employed as the basic culture media for the two groups of the sets. The various experimental results as well as statistical data pointed towards salinity and turbidity rather than the more widely accepted parameters such as nutrients and pH to serve as potential triggering factor. When only salinity was considered, the auxospore induction appeared to be conservative and 15-22 psu was the range for optimal generation. The range broadened when turbid water was used and the species developed auxospores in 8-30 psu of salinity. The potential turbidity range was found to be 80 – 270 NTU depending upon the presence of auxospores.

The study and the results revealed out of the experiments are of immense ecological significance and the knowledge regarding auxospores always play the pivotal role in our understandings of the centric diatoms. This experiment shed important lights in the generation of auxospores and in well mixed estuaries, it might be induced generated among species near the confluence in drier periods and can extend too off shore as well during monsoon based on the results obtained.

Key words: Phytoplankton, Sexual Spores, Physicochemical parameters, Salinity, Hooghly Estuary, Bay of Bengal

Stem Biomass Estimation and Carbon Sequestration Potential by Silver Oak (*Grevillea robusta*) Stand of Koraput District, Odisha

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Carbon sequestration through forestry plantation has a huge potential in ameliorating global environmental problems such as atmospheric accumulation of carbon dioxide and related climate change. This paper presents estimates of stem biomass and carbon sequestration potential of a twenty year old silver oak (*Grevillea robuta*) stand on a 5.80 acre at Pungar village in mining prone area of National Aluminium Company, Damonjodi of Koraput district, Odisha. Over the years silver oak (*Grevillea robusta*) has been used as shade tree species in tea plantation to maintain soil moisture. Integrating shade trees in tea plantations is a low cost but effective carbon sequestration strategy. It is estimated that a twenty year old silver oak shade tree can sequester up to 41.8 mg/ha of carbon. Five random quadrates of 10×10 m^2 were taken in the plantation area and a total of 50 silver oak species of varied height and DBH (Diameter at Breast Height) were enumerated. Stem biomass was estimated for each individual by measuring DBH and tree height with the help of measuring tape and Range finder respectively. The DBH of the plants varies from 0.30 m to 0.80 m and height varies from 4 m to 18 m. The total stem biomass was estimated by taking number of trees per hectare. The average stem biomass of five quadrates was found to be 72.101 kg/h. The total estimated average stem biomass of the silver oak stand is 338.469 t/h. There is a significant relation between DBH-biomass and DBH-height within the stand. The average carbon stored in the stand is 169.23 t/ha and the rate of sequestration is 8.46 t/ha per year.

Key words: Silver oak stand, stem biomass, carbon sequestration, climate change

Behavioural and Ecological Aspects of the Pink Bollworm, *Pectinophora gossypiella* (Saund.) (Lepidoptera: Gelechiidae) in Laboratory Conditions

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The ecology and life cycle history of pink bollworm, *Pectinophora gossypiella* (Saunders) a monophagous pest infesting cotton was studied at fluctuating ambient temperatures and also on artificial diet. There was no much significant differences were observed in life-cycle. However, declining temperature had the influence on the life history which was evident in terms of extending the life-cycle period. This was supplemented with an increase in the duration of life-cycle, *viz.,* 39.70, 42.51 and 43.45 days during 30 ± 2 ^{0}C, 28 ± ^{0}C and 26 ± ^{0}C, respectively in the laboratory conditions. The larva passed through 5 stadia and showed geometric increase in the width of the head capsule at each moult. The moths which were fed with honey produced an average of 135.61 eggs as compared to 47.25 eggs when raised on water alone. There was a significant increase in the pupal weight when reared on artificial diet than on cotton bolls for two consequent generations. Sex ratio of the moths reared on artificial diet was in consonance (62.4:30.7 and 55.2:44.8) with those reared on cotton bolls (47.5:46.7). The artificial diet proved to be suitable in rearing pink bollworm across two generations without affecting its fecundity. Among the different foods offered, significantly higher adult longevity was recorded on honey with protein-x followed by honey alone and, followed by sugar syrup, fresh cotton flowers, water alone. The data on stadia specific larval periods would prove extremely useful for sampling in constructing models on population dynamics. Also, such analyses would facilitate to assess more accurately the impact and timing of various control tactics.

Key words: Pectinophora gossypiella, temperature, artificial diet

Effect of Zolpidemtartrate on the Life Cycle Duration of Forensic Fly (Diptera: Sarcophagidae) *Parasarcophaga Dux* Thomson, (1868)

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Duration of life cycle of some arthropods developing on dead body is normally used for the estimation of Post-Mortem Interval (PMI) in both land and water. In adaption to that it can easily used to prove that the victim has been moved from one place to another. This duration of life cycle is species specific. Many factors like temperature, humidity, and geographical place, body size of the corpse and time of a year are affecting and playing an important role on the life cycle of insects by accelerating or delaying the duration of life cycle. Use of pesticide, toxic material or sedative drugs for suicide or drug abuse can also play an important role on the development and life cycle of insects of forensic importance. So knowledge of drug used by the victim is very important not only in finding the death cause, but also in PMI estimation.

In this study ZolpidemTartrate as a sedative was used to determine the effect of this drug on the life cycle duration and length, width and weight of the maggot during the development of *P. dux*. Fresh meat containing different concentration of the drug 1ppm, 2ppm, 3ppm and 4ppm and control were feeding to the developing maggots.
The life cycle of *P. dux* was completed in 391 ± 2.67 hours, in the control while in the treated culture containing 1ppm, 2ppm, 3ppm and 4ppm it was completed in 422 ± 3.25, 447 ± 2.16, 465 ± 2.24 and 478 ± 2.75 hours respectively . It indicates that ZolpidemTartrate delays the period of development.

In the control culture the size of maggots, pupae and adult was bigger than the size in the treated culture, also in the treated culture maggot size in 1ppm culture bigger than 2ppm. The concentration of the drug also played an important role in the morphological parameter of deferent stages. When the concentration of the drug is high the life cycle was prolonged and the size of different stages was decreased.
The presence of sedative drug and in the tissues of corpse can affect the life cycle of the carrion flies which leads to the mistake in PMI determination; so the causes of death should be considered during the PMI determination.

Key words: Post-Mortem Interval, Sedative drug, ZolpidemTartrate, Parasarcophaga dux, Forensic Entomology.

Crude Electronic Waste Recycling is a potential Source for PolychlrinatedDioxins/Furans and Polychlorinated Biphenyles in India: Implications for Human Health Risk Assessment

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Electronic waste (e-waste) has emerged as a critical global environmental problem because of its massive production volume and insufficient management policy. Due to enhanced economic activities, rapid urbanization and improved living standards the metropolitan cities of India is generating complex composition of e-waste. Improper management of domestic e-waste and lack of proper handling of illegally dumped e-wastes from developed nations is further complicating the e-waste associated problem.Because the rate of e-waste accumulation is startling and the combinatorial effects of toxicants are complex we aimed to understand the surface soil (0-20cm) burden of Polychlorinated Dioxins and Furans (PCDD/Fs) and Polychlorinated biphenylsin the dump sites and e-waste sites of four major Indian cities: New Delhi in the north; Kolkata in the east; Mumbai in the west and Chennai in the south. Polychlorinated Dioxins and Furans and Polychlorinated biphenyls (PCBs) associated with the end-of-life-cycle of these chemicals have been observed from the crude e-waste (discarded electrical and electronic equipment) recycling sites. While levels of furans were higher in the acid leaching sites of New Delhi, dioxins were higher in crude e-waste recycling sites of Chennai. Interestingly polychlorinated biphenyls were very highest in a typically computer shredding/ dismantling site of Chennai.Incremental Lifetime Cancer Risk (ILCR) for dioxins and furanswere higher in children. Toxicity equivalentsand neurotoxic equivalents are strongly significant with Σ_{33}PCB concentrations in crude e-waste recyclingsoil (R^2 = 0.64-0.99; p< 0.01). Hence crude e-waste recycling is releasing PCDD/Fsand PCBs in soil and riskon public health and environment is implicated.

Key words: Electronic waste, Polychlorinated Dioxins, Furans, human health, environment, India

A Study on the Diversity of the Wild Silkmoths of Meghalaya, North – East India

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Abstract: A three year study (2011-2013) on the diversity of wild silk moths of the family Saturniidae from the state of Meghalaya revealed the presence of fifteen species of wild silk moths belonging to nine genera. Identification of the collected material was made using the available literature. Some species like *Antheraeaassamensis*, *Caligula simla* and *Samiaricini* are reared on their most suitable host plants to study various parameters like colour, size and weight of the different life stages.Out of the total 101 individuals collected, *Caligula simla* was found to be most abundant species with seventeen numbers of individuals followed by *Actiasselene* with fifteen numbers of individuals. The largest wingspan was observed in the moth *Attacus atlas* with a total wingspan of 24.2-24.9 cm.

Key words: Diversity, Saturniidae, Meghalaya, Wild silk moths, wingspan

Unfeasibility of Mining Projects in Reserved Area

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Unfeasibility of Mining Projects in Reserved Area
In the world of development,
There is a great damage only to environment,
Seeing all this, a question arises in my mind.
Why is that thinking so narrow?
Rights and duties, do we actually follow?

The development of society and protection of environment are said to be in race with each other. The aforementioned condition also applies to mining activities in reserved area, which should take place with sustainable development by protecting nature/ecology with or without mitigation.

The National Forest Policy of 1988 recognizes that the symbiotic relationship between the tribal peoples and the forests and is also intended to safeguard the customary rights and interests of tribal people. The impact of such development projects on the tribal's is not limited to the economic field but impinges on the social and cultural aspects. This right to healthy environment belongs to all as survival of the mankind depends on clean, healthful or pollution free environment. It is therefore required that a balance between the developmental needs and environmental degradation should be followed and in any case of failure, the environmental degradation should be upheld.

Therefore, through this paper the author seeks to delineate the contentious issue of the present act within the circumscribing limits of the legislative framework. The paper in its latter half makes concerted effort to propose structural solutions for the change argued and also emphasizes the significance of human rights in reference to the affected tribal communities.

Key words: Environment - Law - Mining - Reserved Area - Tribal community- Rights.

Standardization of Nutrient Management in Maize Based Cropping System on Yield Sustainability and Soil Fertility under Bhadra Command Area

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Field experiments were conducted to study the standardization of nutrient management in maize based cropping system on yield sustainability and soil fertility at the Agricultural Research Station, Kathalagere, Davanagere district, Karnataka during both *kharif* and *rabi* seasons on red clay loam soil. The investigation consisted two field experiments *viz*., "Study on system based nutrient management in maize based cropping system" comprising of maize + frenchbean - groundnut system with twelve nutrient management treatments replicated thrice in RCBD and another experiment on "Effect of different organic manures integrated with inorganic fertilizers in maize based cropping system" involving two cropping systems (maize + frenchbean - groundnut and maize + cowpea - groundnut), seven nutrient management practices (*kharif*) and two fertilizer levels (*rabi*) laid out with factorial RCBD and replicated thrice.

Results revealed that, significantly higher maize equivalent yield (108.93 q ha^{-1}) was recorded with application of 100 percent recommended N, P_2O_5 and K_2O + green leaf manuring (150 percent recommended FYM equivalent on N basis) to maize and 50 percent N and 100 percent P & K to groundnut followed by recommended dose of fertilizers for both the crops (105.46 q ha^{-1}). Improvement in soil organic carbon and available nutrients after harvest of groundnut was due to application of 100 percent recommended N, P_2O_5 and K_2O + green leaf manuring (150 percent recommended FYM equivalent on N basis) to maize and 50 percent N and 100 percent P_2O_5 and K_2O to groundnut. Similarly, highest gross returns, net returns and B:C (Rs. 70,806, 41,239 ha^{-1} and 2.39, respectively) were recorded with the application of 100 percent recommended N, P_2O_5 and K_2O + green leaf manure (150 percent recommended FYM equivalent on N basis) to maize and 50 percent N and 100 percent P_2O_5 and K_2O to groundnut.

Maize + cowpea - groundnut system recorded significantly higher maize equivalent yield (99.76 q ha^{-1}), soil available nitrogen, phosphorous and potassium after harvest of groundnut crop (297.25, 22.75 and 247.45 kg ha^{-1}, respectively) as compared to maize +f renchbean - groundnut system. Among nutrient management practices, application of 100 percent recommended N, P_2O_5 and K_2O + poultry manure (recommended FYM equivalent on N basis) recorded higher maize equivalent yield (113.01 q ha^{-1}), soil organic carbon (0.75 percent) and soil available nitrogen, phosphorous and potassium after harvest of groundnut (298.15, 23.00 and 250.15 kg ha^{-1}, respectively). Highest gross returns (Rs. 73,946 ha^{-1}), net returns (Rs. 42,772 ha^{-1}) and benefit cost ratio (2.37) were obtained with maize + cowpea - groundnut system due to application of 100 percent recommended N, P_2O_5 and K_2O + poultry manure (recommended FYM equivalent on N basis) to maize.

Key words: maize based cropping system, nutrient management, yield sustainability, soil fertility

Study of *Brachionus calyciforus* and *Brachionus falcatus* with Respect to Physico-Chemical Parameters of Upper Dudhana Dam From Jalna District (M.S.) India

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The occurrence and abundance of zooplanktons are depends on its productivity, which in turn is influenced by physico-chemical parameters and the level of nutrients in the water. The zooplankton community constitutes an important component of aquatic ecosystem and many species are suitable as live feed and also play an important role in the trophodynamics cycling and aquaculture productivity. The zooplanktons in general belong to four main taxonomic groups such as Rotifera, Cladocera, Copepoda and Ostracoda. Rotifera is the dominant group among the zooplanktons in which *Brachionus* is mostly dominant genera in the monogonant rotifers.

The present study deals with the abundance of two fresh water *Brachionid* species *i.e. Brachionus calyciflorus* and *Brachionus falcatus* with respect to physico-chemical parameters of Upper Dudhana dam. The dam is located in Jalna district (M.S.) India and lies between 19°55' 11.8" N longitude to 75° 41' 39.9" E latitude. The zooplankton samples were collected by using plankton net (40µ) and preserved into 4% formalin. The density of stated two *Brachionid* species was determined by *Lackeys* Drop count method. The water samples were collected for one year and analyzed for determination of (Temperature, pH, Transparency, Alkalinity, Chloride, TDS, Hardness, Ca, Mg, DO and BOD) during the period of sampling from Feb.2014 to Jan.2015. Result showed that the density count of *Brachionus calyciflorus* was maximum i.e. 54.5 no. of org/L in the month of June and minimum or absence of this species in the month of Oct. at the same time the values of TDS were 700 mg/L and 140 mg/L respectively. Similarly *Brachionus falcatus* showed maximum density count 15.75 no. of org/L in Apr. and minimum or absence of that species in the month of Jan.,whereas the values of TDS were 1500 mg/L and 151 mg/L respectively. Analysis showed the positive correlation.

Key words: Fresh water, Brachionid species, Density count, Physico-chemical parameters.

Assessment of Particulate Matter Emissions from the Heterogeneous Traffic around Road Network

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This paper presents to assess average particulate matter (PM) concentrations measured near the roadside at Jharia coalfield area District Dhanbad, Jharkhand, India in post–monsoon season (October 2014). In this study, the concentration of ambient PM levels for PM10, PM2.5 and PM1 were investigated for eight selected sampling locations. The PM data analysis showed at road side is higher than standards. The frequency distribution of PM concentrations in post-monsoon season indicated that the PM values at the study site fall under good to moderate categories.

Key words: Particulate matter, Optical particle counter, Particle number concentration, Heterogeneous traffic, Emission

Influence of Canopy Direction and Spatial Distribution of Fruits of Guava on the Cosmetic Appearance of Fruits

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The present investigation was undertaken to determine the effects of fruit canopy positions and directions in the trees at harvest on the chlorophyll content of the fruit thereby determining the cosmetic appearance of the fruit of guava cvs. Allahabad Safeda and Khaja. No significant differences were observed among the canopy position or direction as well as their interactions with the varieties on the 'chlorophyll a' content of the fruit. Cv. Allahabad Safeda showed higher 'chlorophyll a' content of fruit than cv. Khaja. With respect to 'chlorophyll b' content, upper canopy gave the highest 'chlorophyll b' content which was *at par* with middle canopy. Cv. Allahabad Safeda yields the highest 'chlorophyll b' content and the interaction effect reveals that cv. Allahabad Safeda in the upper and middle canopy gave the highest 'chlorophyll b' content. No significant differences were observed among the varieties, canopy direction as well as their interactions on the 'chlorophyll b' content of the fruit. No significant differences were observed among the canopy position and their interactions with varieties on the total chlorophyll content of the fruit. The canopy directions as well as their interactions with the varieties showed no significant differences on the total chlorophyll content of the fruit. Among the variety, cv. Allahabad Safeda yield the highest total chlorophyll content. Thus, in general, fruits of lower canopy were more attractive due to lesser chlorophyll content of fruit skin in both the varieties of Khaja and Allahabad Safeda.

Key words: Chlorophyll, cosmetic appearance, guava

Exclusive and Mutual Effects of Methyl Jasmonate with Sulfur in Modulation of Photosynthesis and Growth of *Brassica Juncea* under Cadmium Stress

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Down-regulation of various metabolic pathways in plants by cadmium (Cd) and the alleviation of Cd toxicity by sulfur (S) have now been recognized. Methyl jasmonate (MeJA) elicits protective effects in response to heavy metal stress. However, there are insufficient studies on response of plants with reference to MeJA under heavy metal stress. The present work was aimed at examining the individual and combined effects of MeJA and S on photosynthesis and growth of mustard (*Brassica juncea L. cv.* Ro Agro 4001). The study has revealed that 50 µM Cd significantly impaired photosynthesis and growth by increasing leaf H_2O_2 and TBARS content. These adverse effects of Cd toxicity were significantly mitigated by exogenously supplied single S (1mM) and MeJA (10 µM L^{-1}) and more prominently in their combined treatments. The chlorophyll content, gas exchange parameters chlorophyll fluorescence, Rubisco activity were increased together with the increased leaf superoxide dismutase (SOD) and ascorbate peroxidase (APX) activities by individual and combined treatments of S and MeJA. Sulfur assimilation measured in terms of ATP-sulfurylase activity and glutathione (GSH) content also increased with these treatments. These results suggest that exogenous application of individual and combined doses of S and MeJA exhibit protective effect photosynthesis and growth of mustard under Cd stress through increase in antioxidant system and S-assimilation.

Key words: Cadmium, Methyl jasmonate, Ascorbate peroxidase, Superoxide dismutase, ATP-sulfurylase, Glutathione

Studies on Occurrence of Rice BPH *Nilaparvata lugens* (Stal.) in Two Districts of Chhattisgarh Plains

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Rice is one of the domesticated cereals, a tropical C_3 grass that evolved in a semi-aquatic, low-radiation habitat. Over half of the world's population depends on rice as a staple crop. Rice production is affected by many biotic as well as abiotic factors. Insect pests are major constraints for rice production. Among the insect pests brown planthopper (BPH) *Nilaparvata lugens* (Stal.) causes the most serious damage to the rice crop globally. The brown planthopper causes direct damage to rice plant by sucking the plant sap. In addition to the feeding damage, it also transmits grassy stunt, ragged stunt and wilted stunt viral disease of rice. Heavy damage caused by brown planthopper produces circular patches in the field termed as hopper burn. Different agronomic factors *viz.* closed spacing of plants, excess use of fertilizers etc. that contribute to high yield levels in modern rice varieties also favors a high population BPH in rice ecosystem. The BPH is migratory insect pest. It is monophagous and damage only cultivated and few wild rice. Changing climate is more favorable for BPH menace. Recently in India severe outbreaks of this pest were noticed in Haveri, Shimoga, Mandya, Mysore and Chamarajanagar districts of Karnataka. Similarly outbreaks have been noticed in several parts of world and the year 2009 was the worst year for BPH outbreaks. In Chhattisgarh, rice is staple food of majority of the population. It is grown in 36 lakh hectares area in all the three agro climatic zones of Chhattisgarh *viz*. Chhattisgarh plains, Northern hills and Bastar plateau zone. Brown planthopper is one of the major pest occur in all the three zones. Keeping this in view the study was conducted in two BPH prone districts of Chhattisgarh plains region during 2013-14. In each districts two blocks were selected for survey and in each block three fields were observed for BPH occurrence. It was found that the BPH population was varied at each location. In general Dhamatari region showed maximum number of BPH insects Followed by Kurud region. Maximum BPH was observed in second fortnight of October. The BPH population ranged from 0.0613 to 5.107 insects/plant in Arang, 0.013 to 5.813 in Abhanpur of Raipur district while, it ranged from 1.026 to 7.973 in Kurud and 0.227 to 11.73 in Dhamatari region of Dhamatari district. In future, survey at multiple locations can be conducted to know the district vise occurrence status of BPH in Chhattisgarh state. The data can be amalgamated to draw a firm conclusion on pest management and helps in decision making for the policy makers.

Key words: Rice, *Nilaparvata lugens*, BPH occurrence, Survey

Reaction of International Rice BPH Nursery to Raipur *Nilaparvata lugens* (Stal.) Population

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Rice (*Oryza sativa* L.) is a plant belonging to the family of grasses Poaceae. It is one of the three major food crops of the world and forms the staple diet of about half of the world's population. Asia is the leader in rice production accounting for about 90 per cent of the world's production. The Chhattisgarh state is popularly known as 'rice bowl' of the country as rice is the principal crop of this state. The productivity of rice in Chhattisgarh is comparatively lower than the national average. This is due to several constraints responsible for such low productivity of rice in the region. Among these, insect pest is one of the most important factors limiting the rice production. There are more than hundred species of insect pests of rice but only about twenty of them are of major economic significance. Among these insect pests of rice, brown planthopper *Nilaparvata lugens* (Stal.) is the most common and turned up as a major pest in the last three decades. Exploitation of host plant resistance is a major component to manage this pest. The development of rice varieties that are resistant to the brown planthopper BPH is an important objective to control this pest. Resistant plant development is the continuous processes. So far twenty one genes for BPH resistance have been identified in *Indica* varieties (12 genes) and wild species (9 genes). The break down of resistance in several varieties carrying major resistance genes have been reported from many Asian countries due to emergence of virulent biotypes. Intensive research on all possible aspects of BPH is in progress so that suitable pest management strategy could be evolved to combat this menace. Keeping this in view an experiment was conducted to study the performance of international BPH nursery-13 against local BPH population under glasshouse conditions at department of Entomology, IGKV, Raipur (CG) during 2013-14. Forty three genotypes were screened against rice brown plant hopper along with standard checks. Two genotypes were categorized as highly resistant, ten as a resistant whereas eleven genotypes were categorized as moderately resistant to BPH. Among the tested genotypes Sinna Sivappu has shown lowest plant damage score (0.5) followed by IR05N412 (1.0). It was found that genotype Rathu Heenati which has shown resistant reaction at Vietnam, Thailand and DRR population was also found to be resistant against Raipur BPH population, whereas ASD7 which was resistant at Vietnam was found to be susceptible. Maximum numbers of genotypes were susceptible to Raipur BPH infestation which indicates the stronger virulence of the local BPH population.

Key words: Rice, *Nilaparvata lugens*, BPH, IRBPHN, Screening

Resource Management, ToT and Water Monitoring on Aqua-Terrestrial Ecosystem for Enhancing Productivity and Sustainable for Rural Livelihoods

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Survival of human civilization is inextricably linked with wetlands which sustained economic stability of hundreds million of people. And this swampy environment of the carboniferous period produced and preserved many of the fossil fuels on which we greatly depend now, for this James (1995) has rightly termed as *'Nature's kidney'* of the world. In north-eastern part of Indian sub-continent have chains of rivers, tributaries, canals, oxbow lakes, which have a pivotal role in the regions for rural agricultural-fisheries productive system. These zones including coastal biosphere under aqua-terrestrial ecosystem comprises flat alluvial plains intersecting with the main river system - *The Ganges, Padma, Mahanada, Mahanadi* mostly under Indo-Gangetic basin, almost covering 25-30% of low-lying areas subject to frequent waterlogging and flood making them swampy, which are almost turns to out of normal cultivation during peak rainy months. However, these are immense valuable, can offer and being utilized for the enormous production system, agro-based value-added enterprising and generating income, making livelihoods that socially sustainable and food security for teeming rural populates. Keeping in view, need-based water monitoring and IFS modeling were developed in different agro-zones (New Alluvial, Old Alluvial and Coastal & Saline zones) based on wetland ecosystems in the regions, utilizing all possible skill personnel of water engineering for reorientation of existing system and making fruitfully for making its production potentiality.

This paper based on technological intervention, field monitoring, research and over all, extensive ToT (transfer of technology) programmes, wherein, kind of community ownership (SHGs, NGOs, FS etc.) has been created for comprehensive utilization of wetlands by introducing innovative aquatic enterprises (water engineering, aquaculture modeling, hydroponics vis-à-vis enhancing productivity and value-addition) emphasized mostly suited in the giving ecosystems. This field research programmes have been possible with the involvement of group of expertise and government sponsored research projects (NWDPRA, ICAR, DoLR, Ministry of Rural Development, Government of India, New Delhi) covering a wide sector of rural farming communities

during last more than decades through the active involvement of Bidhan Chandra Krishi Viswavidyalaya (The State Agricultural University), Mohanpur, Nadia (W.B.), India. The complex as well as composite farming systems by relegating commercially viable aquatic food crops [deep-water rice (*Oryza saliva* L.), water chestnut (*Trapa bispinosa* Roxb.), makhana (*Euryale ferox* Salisb.), *lati* or *jal* or *pani kachhu* (*Cyrtosperma chamissomis*, *Colocasia* sp.) etc.], food-cum-ornamental crops [lotus (*Nelumbium speciosum* Willd.), water-lily (*Nymphaea* spp. Linn.) etc.], non-food commercial crops (mat-sedges, *Calamus*, shola-pith etc.) and more valuable aquatic medicinal plants] integrated with fish variables under wetlands, and seasonal vegetables (leafy and other vegetables) including other plantations under terrestrial ecosystem were practiced systematically, and their valuable produce including quality products were emphasized greatly for increasing productivity and making them sustainable in nature. Thus, the research endeavourer has modeled wetland based IFS (Integrated farming systems) utilizing aqua-terrestrial ecosystem foe its subsequent replications in other ecosystem, within India and abroad. These were implemented through the unique approach of watershed plans implemented through need-based excavation & renovation of existing basins; methodological approaches (selection & planting variables, INM, bio-degradable plant protection, field monitoring) and extension activities (awareness campaigning, need-based training utilizing all extension media etc. and over all impact on livelihood pattern). Major and other essential plant nutrients and feed materials (fishes) were combined and balanced through organic (FYM, neem & mustard oilcake, vermicompost, rice-bran, fish-meal etc.) and inorganic sources (NPK, zinc-based micronutrient) including spray materials, respectively nourished year-round throughout the cropping programmes and these were formulated integrately for upright production system, exhibited economic outturn due to wide use of natural resources in the different agro-zones of this sub-tropics. For easy understood and comparability, all yield variables converted to makhana equivalent yield (MEY), based on average market price.

Results shows that the individual crop yield and MEY of all crop variables were remarkably influenced by the IPNM imposed on these cropping programmes including its quality of produces (carbohydrates, starch, sugar, protein, minerals etc.), which was able to fetch more market price for making the farmers sustainable in nature. Individual grain yield of deep-water rice, fresh nuts of water chestnut, seeds of makhana, stolons or *lati* of *Cyrtosperma*, *Colocasia* and flower-stalks of water-lily were highest productivity, in which plants received optimum and balance form of plant nutrients and this was significantly differed with other input levels including farmer's practice. Among various organic sources, neem oilcake performed better which produced maximum level of yield as well as nutritive quality.

Production of seasonal vegetables, viz. leafy vegetables, peas & beans type; cole crops; Cucurbitaceous and Solanaceous crops; root and bhindi or okra crops etc. produced highest level of production system, which was nourished with IPNM system (organic, inorganic and recurring spray of trace elements including growth substances) with proper dose and timely application. It is obvious that for judging the agricultural production system of any crop variables, ultimate benefit to a farmer to achieve the gain what they have obtained in their farming systems utilizing all possible resources *i.e.* benefits, subtracting production cost. Results reveal that B-C ratio (benefit-cost) had

gone in favour of highest productivity, using maximum and balanced level of all plant nutrients (IPNM), and this was economically viable to the rural farming community in the regions. Nutritive quality (carbohydrates, starch, sugar, protein, minerals etc.) of the produces was remarkably influenced with the IPNM system practiced on these cropping systems. Comparative monetary advantages of diversified mixed farming system (GMR, gross monetary return; NP, net profit & B-C ratio) than monoculture, which is being economically viable to the resource poor to marginal farming communities, even exhibited >2.5 folds, gained to its sustainable level of the regions as a whole. This has gained over the system applicability through their value-added, decorative as well as remunerative products produced by the women and aged communality of the rural areas.

From the studies it may be concluded that it is thus imperative to utilize this vast unused wetland including the terrestrial ecosystem of the country with impetuously for food, livelihood, engagement of household labours and ultimately, economic stability that are inextricably linked with rural economy and sustainability as well.

Key words: Wetland resource management, water engineering, rural farming community, IFS of aquatic crops-fish & other variables, IPNM, value-addition, income generation and livelihoods

A Comparative Study of the Developmental and Seasonal Variation of the Protein Profile of the Pollen of Three Species of *Datura*

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Datura is a genus consisting of 9 species of poisonous vespertine flowering plants of which three species viz. *Datura metel, Datura stramonium* and *Datura inoxia* are abundantly found in West Bengal, India and are easily confused with each other. The pollen of the much studied plant *Datura metel* has been reported to be allergenic but there are still no reports on the allergenicity of the pollen of the other two species i.e. *Datura stramonium* and *Datura inoxia*. The present paper reports the comparative protein profile of the three species at different stages of maturity. The pollen was collected separately from the three species both before and after anthesis and the change in protein profile and concentration studied for both immature (before anthesis) and mature (after anthesis) pollen, as well as in different seasons. A slight decrease in protein concentration was observed in the mature pollen in case of *Datura metel* and *Datura inoxia* but in *Datura stramonium* the protein concentration for mature and immature pollen did not show any noticeable change. The SDS-PAGE protein profile showed a total of 16, 14 and 10 protein bands designated as d1-d16, D1-D16 and D'1-D'10 respectively for *Datura metel*, *Datura inoxia* and *Datura stramonium* with in the molecular weight range of 16 kDa to 205 kDa. There was also a variation in the protein profile between immature and mature pollen with the number of protein bands being more in case of immature pollen in *Datura metel* and *Datura inoxia* but same in case of *Datura stramonium*. Noticeably 4 similar bands were observed among the three species in case of immature and mature pollen proteins.

Key words: Datura metel, Datura inoxia, Datura stramonium, Protein, Pollen, SDS-PAGE

Bioaccumulation of Trace Metals in Target Tissues of *Labeo rohita* Reared in Fresh Water Lakes of Bangalore, Karnataka

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Presently, there is a steady increase in the concentration of trace metals in all habitats *viz*, air, water and terrestrial owing to rapidly growing technology and heavy metal application in several industries. Heavy metals are an important group of pollutants in aquatic ecosystems due to their bio-accumulative and non-biodegradable properties. These are released into the aquatic system as a result of direct input, atmospheric deposition and erosion due to rain water. Therefore, aquatic animals are often exposed to high levels of heavy metals which have become a global challenge since they concentrate in their tissues and are known to produce cumulative deleterious effects along the food chain. The present study was aimed to assess the content of trace metals present significantly in the water samples of industrially polluted Yellamallappa Chetty Lake B when compared to sewage polluted Vengaiah lake A and its accumulation in vital tissues, liver and kidney of *L. Rohita* reared in these lakes of Bangalore. The results showed relatively high concentration of cadmium, lead and aluminium in the fish tissues sampled from Lake B and minimal of copper, zinc and iron content in those of lake A when compared to Hebbal fish farm (a reference site)

The present study suggests that the fish reared in lake B were susceptible to genotoxic and cytotoxic effects due to the heavy metal content in the industrial effluents.

Key words: L. rohita, water sample, liver, kidney, trace metals

Micronuclei and Nuclear Abnormalities in *Labeo rohita* Reared in Lakes of Bangalore

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The present study was aimed to evaluate genotoxicity in erythrocytes of *Labeo rohita* reared in two lakes viz., Vengaiah lake - sewage polluted (Lake A) and Yellamallappa Chetty lake - industrially polluted (Lake B) of Bangalore. To assess the micronuclei and nuclear abnormalities in erythrocytes, blood samples were collected from heart of the MS222 anesthetized fish. The results were compared with the fish reared in the Hebbal fish farm (Control). The data revealed high frequencies of erythrocytic abnormalities including nuclear as well as cytoplasmic ones in the fish blood sampled from lake B when compared to lake A. Such abnormalities in erythrocytes of fish varied seasonally also with summer exhibiting maximum variations which can be attributed to the presence of genotoxic pollutants in the selected water bodies. The values were statistically significant at $P<0.0001$.

Key words: *Labeo rohita, lakes, erythrocytes nuclear abnormalities*

Environmental Factors on Semen Characteristics of Bulls Used for Artificial Insemination (AI) Programme in Bangladesh

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The present study was to evaluate the effects of environmental factors (season, ambient temperature and relative humidity) on the semen traits of bulls used for Artificial Insemination (AI) programme, in Bangladesh. A total of 3720 semen samples were collected from 71 bulls of three AI stations during 1999 to 2004. The average values of volume of ejaculate(eja.), colour, density, mass activity, sperm concentration, sperm motility, total no. of sperm cells/eja., total no. motile spermatozoa /eja., no. of semen doses /eja. and post-freezing motility of sperm, % of head, tail, total sperm abnormalities and non return (NR) rate at 60 days of first AI cows were 7.14±2.1 ml, 3.23±0.9 (scale:1-4), 3.56 (scale:1-5), 2.91±0.81 (scale:1-4), 1314.5±12.6 million(m)/ml, 63.95±4.61%, 9375.7±3431.5 m, 6023±2299 m, 312.0±115.3, 55.09%, 5.35±1.9%, 11.16±2.1%, 16.38±3.2% and 78.72% respectively. Spring, summer, autumn and winter season had significant effect ($P<0.05$) on most of semen traits except volume of semen. A good number of semen traits values were highest in summer season. Ambient temperature groups of <21°C, 21 to ≤25°C, 25 to ≤29°C and >29°C had significant effect ($P<0.05$) on all the semen characteristics except on volume of semen. Relative humidity groups of <65%, 65 to ≤75 %, 75 to ≤85 % and >85% had significant effect ($P<0.05$) on nearly all semen traits. The highest NR rates was recorded in spring (80.27%) followed by winter (78.95%), summer (78.76%) and autumn (76.16%) and no significant difference was found in spring and winter.

Key words: Artificial insemination (AI), bull, season, temperature, humidity and semen characteristics.

Role of NGOs to Protect Environment

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Everything that surrounds and affects living organisms is environment. Environment includes all the physical and biological surroundings of an organism along with their interactions. Environment belongs to all, influences all and is important to all. For improving global economy and for better standard of living, several environmental problems like global warming, ozonedepletion, dwindling forests and energy resources, loss of global biodiversity, pollutions etc. ultimately degrading environment and human health. A major cause of this is unsustainable resource use and unsustainable growth practices. We have to know the global as well as local importance of environment.

In order to make people aware about these aspects of environment with which we are so intimately associated, it is very important to make everyone environmentally educated.Here arisetheroles of NGOs. NGOs are simply agencies or groups, which are different from government bodieswithin and across different countries of the world. They help to create environmental awareness and community education in society. However, NGOs are distinctive in containing a voluntary component and also because they do not operate for profit.

There has been an increasing awareness in recent years that protection of environment is necessary for sustaining the economic and social progress of a country. Involvements of NGOs play an important role to propagate environmental awareness. They can help by advising the government about some local environmental issues and at the same time interacting at the grass root level. They can act as an effective and viable link between the two. They can act both as an “action group” or a “pressure group”. They can be very effective in organizing public movements for the protection of environment through creation of awareness.

Key words: Global warming, ozone depletion, NGOs, sustainable development, eco-restoration

Limnological Study of Bansagar Multipurpose Project of Madhya Pradesh, India with Special Reference to Ichthyo - Faunal Diversity

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Bansagar Dam is a multipurpose river Valley Project on Sone River situated in the Ganges Basin in Madhya Pradesh, India envisaging both irrigation and hydroelectric power generation. The Bansagar Dam across Sone River has been constructed at village Deolond in Shahdol district on Rewa – Shahdol road, at a distance of 51.4 km from Rewa (24°11′30″N 81°17′15″E / 24º 19′ 67″ N 81º 28' 50" E) having catchment area of 18648 sq. kms., dam height-67 metre, dam length-1020 metre, dam type- masonry/ earthen, spillway capacity- 47742 m^3/s and live storage of 5.41 km^3. Dams and barrages cut off the connectivity of the river with its associated ecosystems as they alter the flow, temperature and sediment regime of lotic systems. Hydrological modifications and absence of water in rivers affect species richness, so the links between dam, hydrological changes and fisheries require urgent attention and more work. The objective of this investigation was to find out hydrobiological parameters of Bansagar Project including lotic and lentic habitat with ichthyofaunal biodiversity for period of 2012-2014. Water quality parameters such as temperature, pH, conductivity, hardness, total alkalinity, total dissolved solids (TDS), dissolved oxygen, free carbon dioxide, nitrate, nitrite, sulphate and phosphate were analysed following APHA (2005) and Trivedi and Goel (1984) to evaluate the distribution and diversity of bio resources between sampling sites. Community indices such as abundance, relative abundance, Shannon-Wiener Index, Simpson's Diversity Index and evenness index were used (Magurran, 1988). Ichthyofaunal identification was done according to Shrivastav (1984) and Jayram (1999).

Fishes of 61 taxa 34 genera of 14 families, 7orders of sub class Actinoptrygii, Class Teleostomii were identified. A total of 47 taxa of zooplankton were recorded with 20 rotifers, 5 copepods, 6 cladocerans, 2 ostracoda and 11protozoans. More number of zooplankton species was recorded in upstream and lower percentage 38 in canals of barrage Silpara. Phytoplankton has shown great fluctuation in species diversity and evenness in upstream, downstream and in canals probably due to changes in hydrological flow from dam which is reflected in abundance, diversity and richness of fish species. Periphyton diversity was used as a bio monitoring tool to detect and evaluate the status of the water quality and calculated by applying the Shannon Weaver diversity index, H' (1963). The grading of water was as follows: Diversity index 4 was in upper stretches; between 3-4 in middle water, between 2-3 at Beeher and less than 2 was Beeher -Bichhia. Periphyton population varied between 3,105-36,980 u cm^{-2}. Lowest periphyton density was observed during monsoon while highest density was seen

during pre monsoon. Bacillariophyceae was (57.4-76.4%) in all the seasons. Chlorophyceae showed its maximum value during pre monsoon (37.1%) whereas Bacillariophyceae during monsoon (46.4%). Average H' and J value were 3.6 and 0.77 respectively. At lower stretch, periphyton populations were 8,475 u cm^{-2}, 7,820 u cm^{-2} and 8390 for winter, pre and post monsoon respectively. Bacillariophyceae was the dominant group (53.2-57.7%). The contribution of Chlorophyceae increased and fluctuated from 39.4-42.9% whereas Cyanophyceae remained low (1.8-2.4%). Upper stretches were more suitable habitat for fishes compared to lower. Exploitation rate was maximum (0.77) and minimum (0.56) at river stretches near barrage. Major carps were over exploited in Bansagar dam and optimum exploitation was in the Beehar barrage. The growth coefficient of major carps was maximum (0.78 yr-1) at upper stretch compared to the middle stretch (0.61 yr-1) and at lower stretch in the Beeher at Silpara barrage (0.50 yr-1). Exploitation rate was maximum in the Bansagar (0.82) and the Tons river (0.80) compared to Beeher River (0.71). Major carps were highly over exploited in all sampling stations. Over exploitation results in reduction of average size of fish in a stock.

Key words: Hydrobiological parameters, Ichthyofaunal diversity, Species diversity index, Bansagar Multipurpose Project, Beeher River, Madhya Pradesh

Eco-Restoration of Fly-Ash Dykes with Metal Tolerant Ornamental Ferns for Sustainable Environment

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In India, majority of power stations are coal based where fly ash (FA) becomes a major source of residue and pollution for surrounding environment due to presence of several noxious metals and metalloids. The present study deals with the development of a vegetation cover on fly ash dykes, with metal tolerant ornamental ferns in view of sustainable environment. Three fern species viz.; *Adiantum capillus-veneris, Diplazium esculentum* and *Thelypteris dentata* were grown on different amendments of fly ash (FA) and garden soil (GS) as well as garden soil (GS) alone as control. Physico-chemical properties of FA and GS used during experiment were done before plantation of fern species as well after harvesting the three months old ferns. All the target species were grown for three months and harvested tissues were evaluated in terms of plant growth, metal accumulation and antioxidant responses when grown on different amendments of fly ash (FA) with garden soil (GS). All the species accumulated significant amount of metals in fronds and rhizome including roots; however the extent of metal accumulation varied. The significant increase in biomass and photosynthetic pigments were found in the test species grown on 50 % FA amendment in comparison to 100 % GS as control but further decreased at 100 % FA. It indicates that 50 % FA amendment did not generate oxidative stress in ferns and seems to be suitable substratum for healthy fern growth. The activity of antioxidant enzymes, like melanoaldehydes (MDA), superoxide dismutase (SOD), ascorbate peroxidase (APX) and guaiacol peroxidase (GPX) were induced in 50:50 ratio of FA and GS, and found maximum at 100 % FA, but even though no any phytotoxic symptoms was shown morphologically in target species. Results of physico-chemical studies done after harvesting of fern species also indicate the significant decrease in toxic metals in FA in comparison to raw FA before fern plantation. Results also showed usefulness of these species in phytoremediation of toxic metals from FA and their further implication in development of a vegetation cover on FA dykes for dust free healthy environment. Besides, the ornamental ferns grown on FA dykes may be source of income generation also because fern twigs are integral part of floral decoration in these days.

Key words: Heavy metals, Pteridophytes, NTPC, Photosynthetic pigments and Oxidative stress

Environmental Risks of Anthropogenic Metals and Their Spectrophotometric Determination using 4-Hydroxybenzaldehydethiosemicarbazone

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Since the second part of 20th century, there has been growing concern over the diverse effects of heavy metals on humans and aquatic ecosystems. A significant part of the anthropogenic emissions of heavy metals ends up in wastewater. Major industrial sources include surface treatment processes with elements such as Cadmium, Lead, Manganese, Copper, Zinc, Chromium Mercury, Arsenic, Iron and Nickel are discharged in wastes. Heavy metals can be hazardous even at very low concentrations, when they get in to water supplies and aqueous environments the health of plants, animals as well as humans will be impaired. As such they are stable elements and they cannot be metabolized by the body and bioaccumilative by nature. Toxic metals are commonly found in waste water and removing them efficiently poses a unique challenge. The author has developed an organic reagent "4-HydroxyBenzaldehydethiosemicarbazone" and studied the complexation reaction between various metal ions and 4-HBTS spectrophotometrically. The data pertaining to these studies reveals that heavy metals like Nickel Ni (II), copper Cu (II), and Bismuth Bi (III) shows favorable conditions for complex formation under weak acidic condition (P^H- 5-6).The author calculated the range of determination of metal in each system. The results showed that these metal ions can be determined quantitatively in µg quantities using the standard procedures. The suitability of this method for the determination of nickel is in the range 0.2348-2.348 µg/mL, for copper the range is 0.127-1.27 µg/mL and Bismuth can be estimated in the range of 0.835-8.35µg/ml in metallic sample solutions. Thus the above mentioned method has been extended for the determination of heavy metals present in wastewater sample.

Key words: anthropogenic, wastewater, heavy metals, aqueous environment, 4-HBTS, Complexation, Spectrophotometry, pH

Diversity of Gasteroid Fungi in Hollongapar Gibbon Wildlife Sanctuary, Jorhat, Assam, India

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Hollongapar Gibbon wildlife Sanctuary (HGWLS), Jorhat, Assam is mainly famous for Hollock Gibbon and other six primate species found in the sanctuary. The **gasteroid fungi** are informal or non-taxonomic group of fungi in the Phylum *Basidiomycota*. They are placed in this informal group because they produce their spores inside their basidiocarps (fruit bodies) rather than on an outer surface. The gasteroid fungi includes stinkhorns, earthballs, puffballs, pseudo truffles, earth stars and bird nest's—are not closely related to each other. Like other fungi, gasteroid are some of the most important organisms in the world, because of their vital role in ecosystem function and influence on humans and human-related activities. Macro fungi not only produce the well attracted variously colored fruiting bodies, but also play a significant role in day to day life of human beings through utilization in industry, agriculture, medicine, food industry etc. Moreover, fungi help in bioremediation, in recycling nutrients, and in decomposing the dead organic matter in soil and litter, as bio-fertilizers and in many other ways. Many species of stinkhorns, earth balls, puffballs and pseudo truffles are edible where as earth star and bird's nest macro fungi help in decomposition of organic matter in soil and litter. It is necessary to estimate the diversity of these fungi that will enable them to be included in considerations of biodiversity conservation. An attempt is made through this study for the first time to provide an updated list of gasteriod fungi in the study site. There are five numbers of compartments in the Sanctuary and stratified random sampling technique was used for fruit body survey during April 2012 to September 2014. The fungal samples were photographed, collected, allotted accession numbers and preserved for further microscopic study in the laboratory. A total of 17 gasteroid fungal species belongs to 10 genera, 5 families, 4 orders, 2 sub-classes and 1 class, have been found in the study site. The family *Phallaceae* (7 spp.) is highly dominant in the study site followed by *Agaricaceae* (5 spp.), *Geastraceae* (2 spp.), *Sclerodermataceae* (2 spp.) and *Rhizopogonacea*e (1 sp.). The name of the gasteroid species along with their occurrence percentage are *Phallus indusiatus* (1.6), *Phallus duplicatus* (0.64), *Phallus cinnabarinus* (0.48), *Phallus merulinus(*1.28), *Phallus atrovolvatus* (2.48), *Mutinus bambusinus* (12.02), *Clathrus delicatus* (0.32) are belong to stinkhorn; *Scleroderma citrinum* (3.69), *Scleroderma* sp. (5.61) are belong to earthball; *Rhizopogon* sp.(4.81) is belongs to pseudo truffle; *Bovista longispora* (24.84), *Morganella pyriformis* (4.01), *Bovista dermoxzantha* (4.97), *Calvatia* sp. (0.8) are belong to puffball; *Geastrum saccatum* (20.19), *Geastrum* sp. (5.61) are earthstar and *Cyathus striatus* (6.72) is belongs to bird's nest fungi. The diversity index and similarity index between the compartments have been calculated to study ecological dynamics of the gasteroid fungal species. The conservation and biological screening on these fungi are still under investigation.

Key Words: Conservation, Diversity index, Dominant, Ecosystem, Occurrence, Sampling

A Study on Food Security in Terms of Calorie, Protein and Fat Intake of All Food Items in Nagaland State of India

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Food security essentially means that all people at all times have access to safe and nutritious food to maintain health and active life. Adequate food in terms of quantity and quality for all the people is a prerequisite condition for a sustainable growth of a nation. The present study is an endeavour to examine the extent of food insecurity among the people of Nagaland, a North-Eastern state of India. The present study has been conducted in Kohima District of Nagaland State. The study has been carried out with the objectives of finding the present intakes of calorie, protein and fat per day per consumer unit of the sample households and estimating extent of food security across various groups on the basis of size of operational holdings. The study is based on primary data obtained from 100 sample households following simple random sampling without replacement method during the agricultural year 2011-12. Simple tabular analysis along with multiple regression model and core food security model is employed to fulfil the stated objectives. Data have been collected on the basis of the present intakes of calorie, protein and fat per day per consumer unit for the sample households in Kohima District. The present calorie intake (kcal/day/CU) by each of the sample size groups is compared with the Recommended Dietary Allowance (RDA) of 2425 kcal/day/CU made by the Indian Council of Medical Research, ICMR (Adhikari et al., 2003) and analysed as to where the position of calorie intake of the sample households stands. The overall calorie intake per day per consumer unit derived from the consumption of all food items is higher for urban sample households as compared to rural sample households. The overall protein and fat intake per day per CU of this District is found to be more than the RDA for tribal sample households but lower for non-tribal sample households. By applying the Core Food Security Model (i.e. on the basis of its eighteen questions) we have estimated the extent of food security of our sample households. If we compare between rural and urban sample households of Kohima District in terms of food insecurity, that the incidence of food insecurity is much higher in the rural area than that in the urban area. 96 per cent of rural and 58 per cent of the urban sample households of this district are found to be food insecure. Among the food insecure rural households 36 per cent are in the 'food insecure with hunger' category and the corresponding figure for the urban counterpart is 22 per cent. In both the areas the incidence of food insecurity is higher among the non-tribal households compared to that of tribal households.

Key words: Food security, insecurity, Core Food Security Model, Recommended Dietary Allowance, Calorie-protein-fat intake

Bio-Efficacy of Pyrazosulfuron Ethyl 10% WP against Weeds in Transplanted Rice

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Paddy (*Oryza sativa* L.) is an important crop which is extensively grown in tropical and subtropical regions of the world. It is cultivated in area of 44.0 million hectares with an annual production of 104.3 million tons in India. Weeds are the major cause of yield reduction in rice. Hand weeding is the traditional weed control measure and still being the most popular in rice. However, due to high labour cost, non-availability of labour and huge time requirement for manual weeding, farmers are inevitable to go for other alternative measures like chemical weed control. An experiment was conducted during *Kharif* 2012 and 2013, at Agricultural Research Station, Dhadesugur, University of Agricultural Sciences (UAS), Raichur, Karnataka, India, to evaluate the phytotoxicity and bio-efficacy of pyrazosulfuron ethyl 10 % WP (5, 10, 15 and 20 g a.i./ha as spray) against the weeds in transplanted rice. Sprays of Saathi (Market Sample) @ 15 g a. i. /ha, Pretilachlor 50% EC @ 500 ml a. i/ha, hand weeding at 15 and 40 days after planting (weed free check) and a weedy check (untreated check) were also maintained. The dominant weeds were *Echinochloa colona, Panicum repens, Cynodon doctylon, Ludwigia parviflora, Leptochloa chinensis and Cyperus sp.* Weed control efficiency (100 %) was higher in hand weeding treatment (Table 2). Pyrazosulfuron ethyl 10 % WP at 20 g a.i./ha given higher weed control efficiency (76.88, 87.39 and 91.33 % at 15, 30 and 60 DAA, respectively) when applied at 3 days after sowing. It was closely followed by the application of Pyrazosulfuron ethyl 10 % WP at 15 g a.i./ha (72.31, 79.44 and 86.02 % at 15, 30 and 60 DAA, respectively) and Saathi at 15 g a.i./ha (72.13, 79.06 and 86.29 % at 15, 30 and 60 DAA, respectively). Further, total dry weight of weeds (14.42, 9.46 and 7.48 g/m^2 at 15, 30 and 60 DAA, respectively) was lower with application of Pyrazosulfuron ethyl 10 % WP at 20 g a.i./ha. It was closely followed by the application of Pyrazosulfuron ethyl 10 % WP at 15 g a.i./ha (17.79, 14.48 and 12.68 g/m^2 at 15, 30 and 60 DAA, respectively) and Saathi at 15 g a.i./ha (17.56, 14.56 and 10.93 g/m^2 at 15, 30 and 60 DAA, respectively). Overall result showed that the tested herbicide pyrazosulfuron ethyl 10 % WP at 20 g a. i./ha was comparatively more effective against broad-leaved, grassy and sedge weeds. It is therefore, recommended that pyrazosulfuron ethyl 10 % WP at 20 g a.i./ha can safely be used for controlling all three categories of weeds in transplanted rice as well as to get higher grain yield of rice.

Key words: Bio-efficacy, Dry weight, Grain yield, Phytotoxicity, weeds

Newer Adsorbents and Cavitation Intensified Process for Dye Wastewater Treatment

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Industries such as textile, pulp & paper, tannery, oil & paint release wastewaters in large volumes containing variety of dyes. Direct discharge of dye effluents can cause serious problems to the environment due to high COD, toxicity and color. The effluent treatment here is difficult due to dyes having complex molecular structure, thus difficult to chemically degrade and also many dyes are not easily biodegradable. The conventional treatments e.g coagulation, membrane separation process, chemical oxidation, reverse osmosis etc. have limitations in dye removal, especially at lower concentration. Adsorption appears to be the most promising method for removal of different dyes in such situation especially at low concentrations and with surface modified adsorbents for high efficiency.

The present work is an attempt to evaluate adsorptive dye removal on various modified carbon adsorbents and analyse the differences due to dye structure and nature of adsorbent. Apart from adsorptive dye removal, process intensification for enhancing the dye removal efficiency has also been studied using cavitation coupled with adsorption.

Key words: Adsorption, Dye removal, Process intensification, Effluent, Industry

Organic Sources of Nutrients on, Physical, Chemical and Biological Properties of Soil after Harvest of Groundnut

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A field experiment was conducted during kharif 2011 at Alur, Hiriyur Taluk Chitradurga District, Karnataka to know the "Effect of different organic sources of nutrients on physical, chemical and biological properties of soil after the harvest of groundnut" (*Arachis hypogaea* L.) under rainfed condition. Results revealed that, application of vermicompost (3 t/ha) + Panchagvaya spray (3 % @ 30, 60 and 75 DAS) + Liquid manure (2000 L ha) + Jeevamruta (2000 L/ha) recorded significantly higher available nitrogen (269.9 kg/ha), phosphorus (45.9 kg/ha), potassium (389.1 kg/ha), iron (6.22 ppm), zinc (1.77 ppm), copper (0.68 ppm), manganese (9.87 ppm), maximum water holding capacity (55.3 %) and water stable aggregates (78.2 %) as compared to other treatments. Whereas, significantly lower available nitrogen, phosphorus and potassium (256, 37.1 and 374.6 kg/ha, respectively) recorded in the treatment with the zero application of NPK as compared to other treatments. Application of vermicompost + Panchagvaya spray + Liquid manure + Jeevamruta (2000 L/ ha) in combination was improved the physical, chemical and biological properties of soil as compared to only application of NPK and zero application of NPK treatments.

Key words: Organic manures, Panchagavya, Jeevamruta, available iron, Nitrogen.

Organic Sources of Nutrients on Growth, Yield, Quality and Economics of Groundnut

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A field experiment was conducted during kharif 2011 at Alur, Hiriyur Taluk Chitradurga District, Karnataka to know the "Effect of different organic sources of nutrients on growth, yield, quality and economics of groundnut" (*Arachis hypogaea* L.) under rainfed condition. Results revealed that, application of vermicompost (3 t/ha) + Panchagvaya spray (3 % @ 30, 60 and 75 DAS) + Liquid manure (2000 L ha) + Jeevamruta (2000 L ha) recorded significantly higher plant height (26.8 cm), number of pods per plant (42.4), oil yield (690.4 kg/ha), protien yield (386.6 kg/ha), pod yield (2312 kg/ha) and gross returns (Rs 71,829/ha) and which is onpar with the application of FYM (7.5 T/ha)+ Panchagvaya spray (3% @ 30,60 and 75 DAS) + Liquid manure (2000 L ha)+ Jeevamruta(2000 L ha) and only application of recommended NPK. Whereas, significantly lower plant height (16.3 cm), number of pods per plant (19.0), oil yield (204.6 kg/ha), protien yield (107.9 kg/ha), pod yield (802 kg/ha) and gross returns (Rs 25,612/ha) compared to other treatments.

Key words: Organic manures, Panchagavya, Jeevamruta, pod yield and quality.

Biodiversity among the Different Breeds of Sheep

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India has varied agroclimatic regions. West Bengal too has different agroclimatic region ranging from hilly, terai, alluvial, dry arid and coastal & saline region. Like other species, sheep has exhibited a wide range of variation, reflected by different breeds of sheep. The present study aimed for biodiversity analysis of sheep population in West Bengal and its comparison with other Indian sheep breeds. In the present work, we have phenotypically characterized the sheep population based on morphological traits, at different agroclimatic zones of West Bengal, then confirmed the findings at molecular level. The morphological traits include body weight, biomorphometric characteristics, body colour, pattern, reproductive characteristics, wool characteristics, disease resistance traits and blood Biochemical parameters. Phylogenetic tree constructed from different sheep populations of West Bengal have revealed four different breeds of sheep. The sheep breed as Garole, Bonpala and Chotanagpuri were already reported. The sheep from Birbhum region of West Bengal formed a separate distinct cluster, which depicts the existence of a different sheep breed. Phylogenetic tree was also formed with sheep breeds from all over India, where also Birbhum sheep were clustered separately. The sheep breeds were characterized at molecular level based on the functional genes as Growth hormone and CD14 gene. Molecular characterization of sheep breeds with mitochondrial DNA marker is in progress in our lab. One of the most distinct and economical characteristics of the sheep breed of West Bengal, which is famous world wide is its higher fecundity conferred by Booroola Fecundity gene (Fec B)/ BMP-IB receptor. It increases the ovulation rate and hence increases litter size. Since in WB, sheep are reared mostly for mutton production, more litter size leads to greater meat production in turn. This homozygous variant of Booroola fecundity gene is also available in Black Bengal goat of this region. Hence it may be inferred that this particular variant of Booroola fecundity gene is fixed in these region of West Bengal. The recent concern is that sheep breeds at border areas of West Bengal is being diluted with other breeds from neighbouring states, hence extensive conservation programme need to be adopted immediately. Hence it may be concluded that extensive biodiversity is existing among the sheeps which need to be conserved.

Key words: biodiversity analysis, sheep population, West Bengal

Management of Tea Mosquito Bug, *Helopeltis theivora* by using Allelopathic Plant Extracts as Foliar Spray, under the Agro Climatic Condition of Barak Valley (Southern Assam)

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Tea mosquito bug has gained importance as one of the major pests of tea in the recent years and its management has also become one of the central problems for the tea planters in north-east India. The pest causes extensive feeding punctures in the tender pluckable shoots due to which shoots dry up become deformed and even curl up and yield of the infested bushes is significantly reduced. The effectiveness of different approaches as cultural operations like Black Plucking (BP), Normal Plucking (NP) and Level off Skiff (LOS) along with the spraying of allelopathic plant extract (i.e., *Clerodendrum viscosum, Parthenium hysterophorus, Chromolaena odorata* and *Ipomoea carnea*) treatments (foliar spray) significantly reduced the infestation level and increased the crop yield (2-3 times) in comparison to control, where only water was used as foliar spray.

In comparison to all the plucking systems, the productivity is found to be higher in the Level of Skiff (LOS) plots, followed by Normal plucking (NP) and Black Plucking (BP) treated plots. In the Normal Plucking the productivity is found to be higher in the *C. viscosum* leaf extract treated plot area (i.e., 756 kg/ hectare) whereas in Blacking Plucking, spray with the leaf extract of *C. viscosum,* productivity leaf yield was observed to have increased considerably and in Level of Skiff, the higher productivity was observed in the *C. odorata* leaf extract treated plot (i.e., 840 Kg/hectare respectively). Keeping the above in view the potential of some allelopathic plant extracts (phytochemical) in the emergence of tea pest of N.E India has been discussed.

Key words: Allelopathy, Foliar spray, *Helopeltis theivora*, Leaf extract and Productivity.

Inter-Relationship between Surface Water Temperature and Salinity in Estuaries of Indian Sundarbans

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The Indian Sundarbans at the apex of Bay of Bengal is a mangrove dominated deltaic complex anastomosed with several estuaries, inlets and creeks. The geographical set up of the deltaic complex exhibits the presence of two important sectors namely the western sector and the central sector. Sampling stations selected in these two sectors exhibit a rise in surface water temperature and alteration of salinity since last 30 years. These changes have serious implications on the biotic community of this deltaic complex. The present paper is an attempt to analyze the change in surface water salinity in response to fluctuation in temperature. A snapshot of possible changes in the biodiversity spectrum is also highlighted in this paper.

Key words: Indian Sundarbans, western sector, central sector, surface water temperature, surface water salinity

Water Pollution and Its Impact on Human Life in India

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The major environment issue in India is water pollution. Water is essential for survival. It has been stated that our existence is intimately connected with the quality of water available to us. Human body made up of 75% water. Therefore, if our bodies are not continuously supply with pure water, our bodies become dehydrated and the vital organs will deteriorate until they are no longer viable for human life. Fresh water resources all over the world are threatened not only by over exploitation and poor management but also by ecological degradation. Industrial growth, urbanization and the increasing use of synthetic organic substances have serious and adverse impacts on freshwater bodies. It is generally accepted fact that the developed countries suffer from problems of chemical discharge into the water sources mainly ground water, while developing countries face problems of agricultural run-off in water sources. Some chemical substances that are found in water are due to natural processes or human activities causing water pollution. This polluted water contains Arsenic, Fluoride, chloride, Iodine and Nitrates .These chemical substances causing different diseases in human. Unfortunately our drinking water is not safe as we think. Drinking water is contaminated with toxic pathogens and chemicals, as last count over 4000 chemical have been found. The most common type of water contamination is through human and animal faces. Some countries, Such as United States have the means to safely dispose of these types of pathogens; however other countries, such as China and India are not able to properly dispose of the faces in a safe manner. In 1947, Congress passed the safe drinking water act in order to protect the public health.

Key words: Pollution, Ecological degradation, Human life, Contamination.

Evaluation of Breed, Age and Sex Responsible for Seroprevalence of Brucellosis in Small Ruminant at Northern Barind Tract

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Brucellosis persists as a problem for animals all over the world and results in considerable economic losses.

It was designed for serological evaluation of brucellosis in Northern Barind tract in relation with breed, age and sex.

The study was carried out in Northern Barind tract including Rajshahi, Noagoan, Chapainowabjong and Natore district from January 2012 to December 2014. A total 475 serum samples were subjected to test for iELISA and SPSS program used for analysis.

The breed had no significant effect and the prevalence was 6.9% & 5.1% in local and cross breed of small ruminant. Similarly the age had no significant effect and the value of positive cases were1.9%, 4.0% & 6.1% in young, youth and old aged small ruminant. But the sex had significant effect and the seroprevalence were 2.5% &9.5% in male and female sex of small ruminant.

The local breed older age and female small ruminant observed highest prevalence in Northern Barind tract, Rajshahi in Bangladesh.

Key word: Seroprevalence, Small ruminant, age, sex and breed

Studies on Growth, Secondary Metabolites and Photosynthetic Response in *Tephrosia purpurea* (L.) under Salinity

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Salinity is one of the major abiotic stresses that adversely affect on crop productivity and its quality. The present investigation was carried out to study the alterations in the growth characteristics, photosynthetic pigments and flavonoid content of *Tephrosia purpurea* under the influence of salinity. The genus *Tephrosia* L. or Sarpunkha ,belongs to family Fabaceae (Sub family -Papilionaceae) is a plant of high economic value due to the presence of phytochemicals like flavonoids, alkaloids, carbohydrates, tannins and phenols, gums and mucilage, fixed oils,fats,saponins. Flavonoids have antioxidants and strong antimicrobial activity. The plant also relieves dental pain, asthma, leprosy, arrests bleeding Plants were treated with different NaCl concentration (50,100,200,300mM).Normally irrigated plants were treated as control. Observations were recorded from day 25 upto day 65 at ten days interval. The result shows that the biomass, leaf area and chlorophyll content of *Tephrosia purpurea* increased upto 100 mM NaCl concentration .An increase in the photosynthetic pigments at lower salt level indicates osmotic adjustment mechanism developed by the plant to incumbent with salt stress. Increased level of secondary metabolites at elevated level of salinity might be help in increasing tolerance at higher level of salinity. Increase in growth and photosynthetic parameters observed at especially up to 100 mM of salinity. Hence it may be suggested that the *Tephrosia purpurea* could be cultivated on moderately saline habitats and help in the utilization of the unproductive saline habitats

Key words: Abiotic stress, biomass, productivity, *Tephrosia purpurea,* salinity, secondary metabolites

Observation of Benthic Macroinvertebrate Richness of Shahpura Lake of Bhopal, Central India

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Macro-benthic invertebrates are the animals that live on bottom sediment of Lentic and Lotic water bodies' such as lakes, reservoirs, ponds and river stream. Macro benthos play as an great consequence role to perform aquatic community consist of involved in mineralization, promoted and to associate of sediments and flow of oxygen into sediments, cycling of organic matter. Zoobenthic invertebrate communities mostly related the effects of variant pollution stressors over time and provide an ecological measure of fluctuating environmental condition. These attributes have led to use of benthic indices for monitoring non-point source pollution and for watershed assessments. The benthic marco-invertebrates appear to be intimately related with the changing environment. The Capital city of Madhya Pradesh, "Bhopal" is also known as City of Lakes founded by Raja Bhoj in the eleventh century endowed with a number of water bodies that provide livelihood & scenic beauty to the city. Shahpura Lake which was known as the third lake of Bhopal formed in 1974–75 under the Betwa river irrigation project scheme which envisaged the creation of lake near Chunabhatti village in south portion of Bhopal city. The lake water is being used by fisheries department for fisheries activities. The over flow from lake meets the river Kaliasote, a tributary of river Betwa which ultimately meets in river Yamuna. A preliminary study was made to assess of the diversity and density of macroinvertebrate community as well as to observe the spatial and variation of macroinvertebrate community in Shahpura Lake from January to June 2012. Macroinvertebrate samples were collected by collecting sediments with Ekman dredge from a circle of 100 meters sediment at each selected 12 sites at 7am to 10 am of Shahpura Lake. The organisms were sieved with bolting silt No – 30 and preserved in 4% formaldehyde solution Identification of macroinvertebrates was done with the help of standard keys. Species richness was calculated by Adoni (1985). A total number of 43 species were recorded from Shahpura lake consist of Arthropoda the dominant phylum with 25species, Mollusca with 13 species and Annelida with 5 species. During the period of study the macroinvertebrate richness was 59740.7 ind. / m^2 in Shahpura Lake. The density of Oligochaeta was found highest with 28622.2 ind. / m^2 which contributed 48% to total macroinvertebrate density. After Oligochaeta, the second largest group was Insecta with 19071.6 ind. / m^2 that was 32% of the total macroinvertebrate density. Gastropoda was the third largest group with a total of 10985 ind. / m^2 gave 18% participation to the overall macroinvertebrate density. Hirudinea group with the least contribution to macroinvertebrate community with a total of 1046.9 ind. / m^2 and overall contribution of 2% to macroinvertebrate density. And finally group Crustacea was found the least with 14.8 ind. / m^2. The diversity and density of the organisms found indicated that Shahpura is a highly polluted lake.

Key words: Macro benthos, diversity, density, Shahpura lake, sediment

Study of Chromosomal Aberrations and Mitochondrial Cytochrome C Oxidase Gene Profiling of *Channa punctatus* (Bloch, 1794) from Polluted Water Bodies of Two Sites in Rural and Urban Areas of West Bengal, India (In Reference To Basirhat, North 24 Parganas and Keshtopur Canal, Kolkata)

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Anthropogenic activities involve various chemicals as well as different heavy metals which ultimately reach into water bodies through run off and ultimately affects aquatic ecosystem. The growth in numbers and volumes of chemicals released into the environments has been increased immensely over the past 50 years due to industrialization and urbanization and most of these compounds are genotoxic and non bio degradable. Aquatic genotoxicity is reflected perfectly in fish as biomagnification of those pollutants and it can be easily assessed in their system. In recent years, cytogenetic studies have established its importance in understanding genotoxic effects of pollutants on aquatic organisms. The alarming increase in industrialization and urbanization trigger the toxicological problems on the fish as well as aquatic environment. Various fish species serve as important source of protein in the diet, so it is important to assess whether fish can serve as an early warning for potential threat both for aquatic organism as well as consumer of fish.

The present study deals with the cytological effects of effluents discharged into respective sites of rural and urban importance using *Channa punctatus* from the water as in situ sentinels by karyotyping as well as cytochrome c oxidase gene analysis. The study also aims to gain more insight into the relationship between the chromosomal differentiation and pollution. Karyotype analysis was done according to Khuda-Bukhsh and Barat in 1987 with some modifications. Chromosome morphology was determined on the basis of arm ratio as proposed by Levan *et al*., 1964. Cytochrome c oxidase gene was analysed by doing PCR of isolated DNA from fish scales using the protocol of Wasko *et al*., 2003. Quantitative estimation of copper, lead and cadmium in water samples and other parameters of water samples were done following the standard methods (Apha, 1995) by atomic absorption spectrophotometer.

The normal number of chromosome in control group of *Channa punctatus* is 2n=32, consisting of 16 metacentric, 14 submetacentric and 2 acrocentric chromosomes. Different chromosomal aberrations like End to End joining, Break and Gap, Fragmented chromosome, Attenuated chromosomes are found in *Channa* species collected from two polluted sites. The difference in banding pattern was found in study of cytochrome c oxidase Gene PCR products which may be due to difference in nucleotide sequences resulting from point mutation or deletion or inversion or translocation.

Key words: Water Pollution, *Channa punctatus*, Karyological sudy, cytochrome c oxidase gene profiling

E-Waste: Control of this Modern Hazard

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Advances in the field of science and technology brought about industrial revolution in the 18th century which marked a new era in human civilization. In the 20th century, the information and communication has brought enormous changes in the way to organize our lives. But at the same time the technologies have led us to a great problem, namely disposal of the waste produced by this technology. Especially the hazardous waste which poses a great threat to human & environmental health.The research paper is going to make an indepth study of the characteristics of E-Waste, its impacts and the measures that should be taken to control this hazardous waste.

Key words: E-waste, hazardous materials, bioremediation, recycling, management

Environmental Pollution and Sustainable Development

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The geographical condition that exists around us comprises our environment. Environment is a general term that refers to the external conditions in which an organism lives. It is defined as sum of all social, biological, physical and chemical factors, which comprise the surroundings of man. On the other hand, Economic development is a result of gradual process of interaction of various economic, political, cultural, environmental and social elements. Environment is one of the important elements, which is directly connected with economic development. Environmental economics is now playing an important role in the current climate change debate. As the human surrounding is highly polluted in recent times, environmental pollution is a huge problem faced by human being all over the world. Sustainable development refers to that process of economic development which meets the needs of present generations without compromising the ability of future generations to meet their own needs.

We study the environment for two main reasons. Our first objective is to understand some basic facts about the environment and how natural ecological systems function. Our second objective is to suggest some long-lasting, successful solutions of environmental problems. Environmentalists believe that the world would be destroyed if people do not understand environmental problems and try to solve them. A final word about environmental education, i.e. educational programmes designed to increase public awareness of environmental issues.

The discussion between Environment and Economic Development: Environment economics is partly a study of economics which deals with the interrelationship between "environment" and "economic development'. Environment is helpful for development, but development is harmful for environment. Because most of the environmental problems, pollution problems, environmental imbalances, overuse of environmental resources, acid rain and global warming etc. are result of development process. As economic development process goes on, these problems also on simultaneously.

With the industrial/economic activities, waste and pollution problems are also increases. With the starting of developmental transfer process, agriculture-rural based economy converted into industrial and urban-based economy. This would result very fast industrialization and urbanization. Industrialization and urbanization resulted in air, water and land pollution and very badly damaged the environmental system. Industries and automobiles are main contributors of air pollution. Domestic and

industrial wastes create water pollution problem. Higher dose of pesticides, insecticides and fertilizers and moreover salinity and alkalinity resulted in degradation of land and fertile land converted into desert. We cannot stop water logging which is a main cause of land degradation. Urbanization would take place simultaneously with the process of development, which is main cause for environmental degradation. Thus development process damages the environment system through over use of environmental resources and pollution problems. It badly damaged on sustainable development. It has also created problems for existences of human beings because of seasonal unnatural changes, various acid rains and global warming. Pollution has created very serious problem of global warming.

Seasonal cycles would be badly changed. Droughts and floods would be increased. Sea level would rise. Drought prone areas would be victimized. Poverty is also one important reason for over use of natural resources. Thus in underdeveloped country like India, over using of environmental resources is due to poverty, population and underdevelopment. This would create problems of pollution, environmental balance and sustainable development.

There are various Causes of Environmental Degradation: 1. Increasing pressure of population on land has caused a substantial conversion of forest land for other purposes. 2. Rapidly growing urbanization has caused pressure on housing and other civic amenities. 3. Increasing use of chemical fertilizers, pesticides, etc. has also caused environmental problem. 4. Rapid industrialisation in the country has led to air, water and noise pollution.

Environmental problems in developing countries have become increasingly critical in the last few decades. If all the nations of the world were home, owners living around a small lake, each one dependent on the lake for water supply, but each one also using the lake for waste disposal. Depletion of the earth's protective ozone has becoming life threatening because of excessive uses. The increased ultraviolent radiation is the cause of skin cancer, eye cataracts and has a great impact on agricultural production. Burning of fossil fuel has increased CO2. Cause global temperature, which also effect agricultural production. A rise in sea level which effect coastal group. So we should cut back on fossil fuel. Virtually all countries depend more or less on fossil fuel in increases economics. We must emphasize cost-effective policies, to improve energy efficiency and to switch to fuels that emit less CO2.The Kyoto Protocol is the first step towards effective International efforts to reduce global CO2 emission.

Since, the biggest users of fossil in the world today are the developed countries. Therefore, they have a greater responsibility in controlling the damage to environment caused by the use of pollution causing materials. Some of the important measures being considered for this purpose are increased use of renewable and clean sources of energy, less use of fossil fuels, organic farming, and measures to reduce warming and global limits on carbon emission.

Many international agreements have been signed among countries such as the Agreement on Environment, Agreement on climate change, and Global Warming.

Internally, the developing countries should adopt intensive-based policies/cost effective policies. Population control has frequently been recommended as a means of lessening environmental impacts.

Externally, Environmental issues becoming more international. One country's pollution causes damage in another country. Each country's emission affects all countries, including itself. Money subsidies, technology transfer are the part of agreement. In recent years there is a serious issue arises the relationship between environment and international trade. International trade is environment destructive. So restriction on trade for Value of Environment is needed.

Finally, the developed world can play a vital role in helping third world countries to develop through transfer of skilled and technology without hampering environment.

The Government of India has undertaken several measures to protect the environment and several Strategies for Sustainable Development.

In view of serious repercussions of economic development, the global concern is the adoption of environment friendly strategy of economic growth. This means that the development should be sustainable i.e. the development should take place without damaging the environment and the development in the present should not compromise on the needs of the future generations.

Key words: Environment, Environmental Pollution, Sustainable Development

Role of NGOs in the Protection of Environment

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The protection of environment is a pressing issue. Every person, organisation and institution has an obligation and duty to consider ways to protect and reserve it. Due to its damage over the past decades has been a growing interest in the environment or more specifically in the damage being done to the environment, in many parts of the world. Today, the necessity of environmental awareness and enforcement is more demanding and urgent than ever before. Despite provisions in Indian Constitution providing for Environmental protection and many statutory provisions, the environment degradation continues. The main cause for environment degradation is lack of effective enforcement of various laws.

There is a role for individual government and for intergovernmental agencies to put in place policies which will help to rectify the situation. A Non-Governmental organization is a social service organisation working towards a better society and nation.True to its name, 'It preserves to bring in a positive change by uniting people who share the common vission of a developed nation,& pay back to the society' Their main mission is generally societal or environmental in nature. NGO's is any non-profit, voluntary citizen's grouped which is organised on a local, national or international level, Task oriented and driven by people with a common interest.

The rise of NGO's as a result of the failure of the state development.They believe that the state is inefficient agent,they try to formulate a parallel system determined to resolve the problem. The importance of public awareness and NGOs involvement in environmental protection is acknowledged worldwide. NGO's have been taking a number of steps to promote discussion and debate about environmental issues, outside the broad spheres of popular media and the educational system. Advocacy and awareness is especially crucial in promoting concepts such as sustainable development, natural resource conservation and the restoration of ecosystems. NGOs can sensitize policy makers about the local needs and priorities. They can often intimate the policy makers about the interests of both the poor and the ecosystem as a whole. In providing training facilities, both at community and government levels, NGOs can play a significant role. They can also contribute significantly by undertaking research and publication on environment and development related issues. It is necessary to support and encourage genuine, small, local level NGOs in different parts of the country which can provide much needed institutional support specific to the local needs.

Key words: Environment, NGOs, Conservation, sustainable development, Evaluation

Effect of A Herbicide on the Activity of A-Amylase, Cellulose Content and Total Tissue Carbohydrate Content of Epigeic Earthworm *Perionyx excavatus* under Laboratory Conditions

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Insecticides are major inputs in addition to seed, fertilizer and water in the modern agro-ecosystems. Continuous and indiscriminate use of insecticides in agricultural fields causes serious damages to soil sub-system. Reduction in soil health including decline in invertebrate biodiversity, chemical and microbial activity apart from contamination of water and food chain are of great concern in recent years. Earthworms being the dominant constituent of the non-target invertebrate biomass in the soil are the worst victims of this environmental pollution. Earthworms constitute up to 92 % of soil invertebrate biomass. Earthworms are considered as ecosystem engineers having pronounced effect on soil structure and play an important role in leaf litter fragmentation, enhanced decomposition and accelerating nutrient recycling rates. Nitrogen-fixing bacteria are found in the gut and casts of earthworms which produce greater rates of nitrogen fixation in casts when compared with soil. Earthworms can also act as "biological concentrator" and are the potential transmitting agents and there is a possible risk of insecticides reaching higher trophic levels. Earthworms are thus wide used as key organisms in ecotoxicological research dealing with soil sub-system throughout the world. Open choice experiment was done on indigenous epigeic earthworm *Perionyx excavatus* with *Shorea robusta* (shal), *Tectona grandis* (teak) and *Anacardium occidentale* (cashew) leaves to determine their food preference. The activity of the digestive enzyme α-amylase, cellulose content and the total tissue carbohydrate content was determined under laboratory conditions in natural garden soil (pH-7.17, organic carbon-0.86% moisture content-61.2%) by exposing the earthworms to sub-lethal dose of a herbicide, Pendimethalin, i.e., 25% and 50% of LC_{50} value, determined earlier. The specimen earthworms were kept inside inert polyethylene boxes of 192 cm^2 area each containing 200g of sieved garden soil along with 10 worms. 65-75 ml of distilled water was added to maintain 60-70% moisture. The earthworms were provided with semi-decomposed cashew leaves as food during the entire experimental period on small a petri-dish inside each box and the level of soil and petri-dish were kept same. The food was contaminated with pesticides in the treatment boxes. The whole set up was kept inside an Environmental chamber and the temperature (28±0.5°C) and humidity (67%) was maintained. The determination of α-amylase activity and cellulose and total tissue carbohydrate content were performed on 3^{rd}, 7^{th}, 15^{th} and 30^{th} day from the setting of the experiment. The earthworms showed maximum preference for cashew leaves. The total tissue carbohydrate percentage (%),

cellulose content (µg) and α-amylase activity (mg of maltose/5 min) of the worms in the pesticide treated boxes showed a drastic rise in level on the 3rd day and 7th day compared to the control i.e., control- 28%, 25% of LC_{50}-40.2%, 50% of LC_{50}-38.1% and control- 27.5%, 25% of LC_{50}-37.1%, 50% of LC_{50}-35%, control-3.8±1.0µg, 25% of LC_{50}-6.0±0.75µg, 50% of LC_{50}-7.1±1.0µg and control- 5.0±1.0µg, 25% of LC_{50}- 11.8±1.0µg, 50% of LC_{50}-10.1±1.5µg, control-0.041±0.85 mg of maltose/5min 25% of LC_{50}-0.062±1.0 mg of maltose/5min, 50% of LC_{50}-0.076±1.0mg of maltose/5min and control-0.040±1.0mg of maltose/5min 25% of LC_{50}-0.074±0.80mg of maltose/5min, 50% of LC_{50}-0.081±1.0mg of maltose/5min respectively. But the total tissue carbohydrate percentage (%), cellulose content (µg) and α-amylase activity (mg of maltose/5 min) of the worms in the pesticide treated boxes showed a sharp fall in their levels on the 15th day and 30th day compared to control, i.e. control-26%, 25% of LC_{50}-16.8%, 50% of LC_{50}-16.5% and control-26.5%, 25% of LC_{50}-17.5%, 50% of LC_{50}-15.4%, control-5.64±1.0µg, 25% of LC_{50}-3.0±1.0µg, 50% of LC_{50}-2.7±1.25µg and control-5.64±1.0µg, 25% of LC_{50}- 3.1±1.0µg, 50% of LC_{50}-2.8±1.5µg, control-0.040±1.0mg of maltose/5min, 25% of LC_{50}-0.020±1.0mg of maltose/5min, 50% of LC_{50}-0.031±1.0mg of maltose/5min and control-0.045±0.90mg of maltose/5min 25% of LC_{50}-0.030±1.0 mg of maltose/5min, 50% of LC_{50}-0.033±1.0mg of maltose/5min respectively. It can be assumed from the above result that the earthworms, after being provided with herbicide contaminated food, could not sense the contamination and consumed it. So the levels of the above said three parameters rose drastically. But during the period between 7th and 15th day they might have been able to sense the contamination and so they went on to avoid the food afterwards as a result of which the levels of the three above said parameters declined sharply till the 30th day from the setting of the experiment. From the above study it can be concluded that Pendimethalin is toxic to the earthworms at tissue and enzyme level and can cause changes in α–amylase activity and cellulose and tissue carbohydrate levels and finally these three parameters can be studied and used as bio-markers to detect insecticide pollution in agro-ecosystems.

Key words: Pendimethalin, Pretilachlor, digestive enzyme, biological concentrator, *Anacardium occidentale*

Trend and Impact of Shoreline Change in Hoogly Estuary using Remote Sensing and GIS Technique

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The tropical river basins of India are significant for providing livelihood of densely populated cities with ecologically enriched coastal zones. This study focuses on one such huge river basin, Ganges. Here we choose land-water dynamic in Hooghly estuary, comprising of Nayachar, Ghoramara and Lohachara islands, located in the mouth of river Saptamukhi and Muriganga. This area got historical documentation of shoreline change since early 19th century; when Ghoramara, was attached with Sagar Island. In the year of 1903 the island was separated by Muriganga River. Recently, the island is economically important due to large number of fish drying industries. Other adjacent island Nayachar got significant growth since 1987, when state government handover it to fisheries department. With nearby association of Haldia port, this area requires scientific investigation of trend of shoreline change (accretion/erosion rate) and its related impact using multi-temporal Satellite images. Here we used ETM+ SLC-Off data of 2015 and other SLC-on data since 1975. SLC-Off data were processed using ENVI LANDSAT Gap fill tool (local histogram matching algorithm). Spatial filtering, Histogram Equalization and band rationing techniques were used to demarcate shoreline positions. Rate of erosion/deposition and their location are mapped with the help of visual image interpretation techniques in GIS platform over the time span of 1975 – 2015. The result shows that Lohachara Island is completely submerged whereas Ghoramara is now in endangered situation with disappearance of 52% of its total area. On the other hand, Nayachar is continuously increasing. Comparing to past(1975) and recent (2015) satellite data, total area of Ghoramara shrinks from earlier 7.40 Km^2 to recent 3.8 Km^2 whereas Nayachar enriched from its initial 32.03km^2 to present 46.72km^2. Lohachara Island was submerged due to various effects like sea level rise, coastal erosion and devastation flood on 1980. On the other hand, Ghoramara worked as natural protector for Nayachar from direct ebb tidal effect. Temporal analysis shows that southern part of Nayachar is vanishing; whereas northern part is extending towards Haldia port. This expansion of island will may be a great threat of Haldia port. Finally, here we speculated series of dykes with suitable engineering decisions and plantation along the shoreline as sustainable solution for mitigation.

Key words: Coastal Erosion, Shoreline Change, Sedimentation, Island shrinking, Haldia Port

Influence of Blossom and Backing Showers on Yield of Coffee in Kerala

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A study on variability in yield of arabica and robusta coffee as influenced by blossom and backing showers was undertaken with data recorded at Regional Coffee Research Station, Chundale, Wayanad, Kerala State. The yield data for 30 years (1980 to 2009) revealed that during the years when the annual rainfall was high, arabica and robusta coffee yield was poor and vice versa. Annual rainfall do not have significant role in deciding arabica and robusta coffee yield, though it responds negatively and blossom and backing showers are critical to coffee yield. Good distribution of rainfall throughout the year increased the coffee yield. It was evident that better yield could be obtained even if the rainfall during February was scanty but make up with rainfall in March. Rainfall is the most important factors among various weather elements influencing flowering and yield of coffee.

Key words: Blosssom and backing showers, rainfall, coffee yield

Coral Reef Bleaching and its Possible Monitoring using RS and GIS at Andaman Sea

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Coral reefs one of the unique and sensitive eco-system in the marine biota which can easily be exterminated by natural or anthropogenic changes. Such uniqueness of the coral reefs with huge diversity in Andaman Sea experienced mass coral bleaching events during 1998, 2002, 2005 and 2010 respectively where 80% corals have been bleached in April, 2010 due to high sea surface temperature. But after getting a huge rain in September, 2010 corals started to recover again. For this purpose regular monitoring to assess the impact of climatic change and implement some action plans for its conservation is needed. The present status of coral reef in South Andaman Island shows a growing consciousness on need to deal with the increasing threats leading to the degradation of the coastal and marine resources of the region. The efforts required in support of this cause for an exhaustive study to build a database for sustainable management of reefs is also discussed. A comparison of the different monitoring mechanisms and reef management measures indicate the need to augment the conservation measures in Andaman Sea to protect the already declining reefs in the region.

The present study was carried out to delineate and characterize the coral reef changes using SOI Toposheet, IRS-1D LISS III 1998 and IRS-P6 LISS IV 2009 and coral monitoring through satellite images (OCM 1, 2, MODIS) and field observations. A careful assessment of changes that occurred in the coral ecosystems of South Andaman have been identified and adequate measures for its risk reduction, conservation and management were suggested which forms a major milestone for effective coral ecosystem management and leads to sustainable utilization of coastal resources.

Key words: climate change, Coral bleaching, sustainable conservation and management.

Study on the Diversity of Hepatoprotective Medicinal Plants of Manipur

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The present study is an attempt to survey the hepatoprotective enthno-medicinal uses found in Manipur. The ethnic knowledge can provides an insight for further research in pharmacologists and therefore develop new novel drugs.

The present investigation has been undertaken to collect base line information on hepatoprotective ethnomedicinal importance which are found in Manipur is one of the major threats to public health.

A systematic field survey has been conducted to generate some of the hepatoprotective plant through discussion with ethnic communities; Meitei-valley community of Manipur and a total about 163 respondents were interviewed personally which includes 14 traditional healers /informants.

In the systematic survey and investigation revealed total of 50 plant species belonging to 39 families and used as hepatoprotective by the people of Manipur. The Study also revealed the diversity among plant parts used for medicine against hepatoprotective.

These ethnomedicinal data may provide a base to start the search for new compounds for the phytochemist, pharmacologist and pharmacognosysts and therefore develop new novel drugs. Moreover, attention is called for the conservation of such plants with medicinal properties from over-exploiting.

Key words: Ethnomedicinal, Hepatoprotective, Liver, Manipur, Natural products.

Bioremediation- A Tool for Cleaning Waste Material: A Review

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Anthropogenic activities such as intensification of agriculture, industrialization, urbanization has resulted in excess loading of hazardous waste into the environment thus rendering it polluted. It has become a great concern for the mankind to tackle the contaminants and maintain the quality of the environment. The most promising and less expensive solution to this problem is the bioremediation. Bioremediation is the term used to describe biological strategies applicable to repair of damaged environment using biological factors. This technique has been categorized into *ex-situ* and *in-situ*.

The present paper reviews and explores the concepts in bioremediation, highlights the various sources of bioremediation agents, limitations and challenges associated with processes in treating pollutants present in the environments.

It is of no doubt that bioremediation has paved a way to cleaner and greener environments and may be used as a management tool. With the understanding of microbial communities, focus on interdisciplinary research we can overcome the obstacles faced by the current technologies. This technique will go a long way in cleaning the environment in future. Besides this there is an urgent need to educate and make aware of the various contaminants that can harm the environment.

Key words: Anthropogenic, industrialization, contaminants, bioremediation, microbial.

Wild Medicinal Plants used by Maring Tribe of Manipur and Their Conservation Stategies

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The use of wild medicinal plants in the treatment of diseases was conceived by tribal people thousands of years ago. Maring tribe settled in the remotest corner of north-east India, Manipur has been using several plants and their various parts by collecting from near and around their settlement for medical preparation and has a vast hidden knowledge of more than 1500 species of plants found in the wild. In the process they have developed the concept of living in harmony and conservation of the available biodiversity. Therefore, they not only utilize them but also conserve them. Sacred groves, herbal gardens, restricted areas are some the practices adopted by the tribal. To document the medicinal plants found in wild and used by the Maring tribe for medicinal preparation with focus on their conservation mode.

Local traditional healers and village elders were consulted as well as interviewed with model questionnaire. Traditional beliefs, customs, taboos etc. were kept into account.

A total of 40 medicinal plants found in wild and belonging to as much as 30 families and which may prove to be base for the discovery of noble drugs have been discussed. These plants have been used in various diseases ranging from cold, painful urination to tumour.

However, in the recent years due to the incoming of roads and the area as an important tourist destination, the plants have been designated as vulnerable and their degradation in the wild has been a great concerned. *Ex-situ* and *in-situ* conservation, prevention of over-exploitation of medicinal plants from their natural habitat, creating awareness programme and more importantly alluring the younger generation has been the need of the hour.

Key words: Conservation, biodiversity, sacred groves, *ex-situ*, *in-situ*

Molecular Characterization of Orchidaceae Family: A Short Review

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Orchidaceae family constitute the second largest family in flowering plants under the order Asparagles and the plant belonging to this family are herbaceous found mostly as epiphytic, terrestrial and saprophytic. They are cosmopolitan throughout the world except the hot desert and Antarctica with about 10,000 genera, and 25,000-35,000 species. Due to their extraordinary flowers which exhibit an incredible range of diversity in shape, size and the colour of their flowers they are in high demand. In India, Orchids are represented by 1129 species and 184 genera and show maximum diversity in the eastern Himalaya, including the North Eastern region, Western Ghats, Eastern Himalaya & Eastern part of Western Himalaya. Until now, biological specimens were identified using morphological features not only that if a specimen is damage or is in an immature stage of development, even specialists are unable to make identification. DNA barcoding is a taxonomic method that uses a short genetic marker in an organism's DNA to identify its belonging to a particular species. It differs from molecular phylogeny in that the main goal is not to determine classification but to identify an unknown sample in terms of a known classification. DNA barcoding is becoming an important tool in biodiversity conservation. The present study deals with the DNA barcoding of Orchidaceae family.

The study reveals that molecular characterization can be used for the identification of Orchidaceae family.

Key words: Orchidaceae, Asparagales, Cosmopolitan, DNA barcoding, Biodiversity.

Urban Green Space: The Challenges of Making Indian Cities Green and Sustainable

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Urban environment is important for all of us, not least because so many of us live in cities but it directly influence the lives of millions of citizens and in turn, have a substantial impact on the wider environment. Thus, cities need more than ever to be sustainable and should offer the kind of quality of life and opportunity that make people want to live in them and make businesses want to invest. Urban areas drive economic development and deliver many public services, such as education, health care and transportation, but they are also associated with environmental degradation, congestion, economic and social exclusion. To improve the quality of the urban environment has therefore become a major objective for policy makers and making sure that urban policies are coherent is a challenge. It has ambitions to create a more competitive, sustainable and inclusive continent in an increasingly globalizing world. To realize this ambition, we need attractive areas to live, work and relax in and creating livable urban areas is a key way of establishing Indian cities in a strong economic position in a highly competitive world.

Urban green space, such as parks, forests, green roofs, streams, and community gardens provides critical ecosystem services. Green space also promotes physical activity, psychological well-being and the general public health of urban residents. This paper reviews the literature on urban green space, especially parks, and compares efforts to green Indian cities. Most studies reveal that the distribution of such space often disproportionately benefits more affluent communities.

This manuscript explains the benefits and challenges of urban green spaces based on the critical discussion of study results from different studies in Indian cities. The important roles played by green spaces are social, economic, cultural and environmental aspects of sustainable development. Urban green spaces can be a comprehensive tool for long term protection of environmental sustainability through improving the quality of life and air quality, increasing property value due to their amenity and aesthetic characteristics, and reducing the energy costs of cooling buildings. Therefore, need to focus on urban green space strategies that are 'just green enough' and that explicitly protect social as well as ecological sustainability. To do this, an integrated approach regarding the planning, monitoring, designing and maintaining of urban green spaces is required for improving the environmental sustainability in cities.

Key words: Integrative approach; Socio-Economic Value; Sustainable Environment; Urban Green Spaces

Floral Alpha Diversity of Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan District, Himachal Pradesh, India

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The current study was undertaken to document the floral diversity of Dr Y S Parmar University of Horticulture and Forestry campus, which is situated in Solan district of Himachal Pradesh, India lying between 30°51'55"N 77°10'11"E. Total 110 different species belonging to 102 genera and 59 families were identified. Of the 59 families highest number of species i.e. 5.45 % were recorded from Euphorbiaceae followed by Lamiaceae and Rosaceae with 4.54 % where as Apocynaceae, Asteraceae and Mimosoideae were representing 3.63 % of total species followed by other families.

Key words: Floral diversity, Himachal Pradesh, Euphorbiaceae and Lamiaceae

Bioaccumulation of Cu and Zn in Earthworms from a Mineralization Zone

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The use of earthworms to assess metal toxicity in terrestrial ecosystems is widely recognized. Metal concentration was studied in earthworm *Perionyx excavatus* inhabiting soils with known uranium ore deposits in Meghalaya and two sites for this study was chosen. A variation in the concentration of the metals was seen in the body of the animal while lesser variation was observed in the concentration of metals in soil. The range of copper concentration in the tissue from site 1 ranges from 17.56 ± 0.77 to 23.94 ± 1.84 while those from site 2 ranges from 19.71 ± 1.09 to 23.65 ± 2.23. The concentration of Zn in tissues of samples from site 1 ranges from 53.90 ± 6.02 to 68.28 ± 2.67 while from site 2 the concentration of Zinc ranges from 44.25 ± 2.67 to 60.33 ± 3.61. This study shows that bioaccumulation takes place in the earthworm studied and that it is an indication of the potential of the use of these organisms as bioindicators.

Key words: Uranium, Meghalaya, Earthworm, Trace Metals, Bioaccumulation,

Restoration of Contaminated Land Fill Sites - A Case Study from Kerala, India

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This paper describes the dramatic success in the eco-restoration of a heavy-metal contaminated open garbage dump at the Amrita Institute of Medical Sciences (AIMS), a super-specialty hospital located in Kochi, Kerala, India. Today, the hospital manages its municipal solid waste on an industrial scale, composting some eight metric tonnes of organic waste daily. This case study outlines the path followed to achieve zero-waste. Alongside, the rehabilitation of a former dump site is described in detail; at this very site are carried out all composting operations of AIMS. A number of heavy metals (As, Cd, Cu, Co, Pb, Hg, Cr) were detected in the soil and river sediment at the site. The main restoration activities included mulching, surface-addition of compost and fresh soil and phytoremediation using vetiver and other plants. Within three years of the restoration activities, heavy metal concentrations in the contaminated soil reduced drastically. There was relatively low uptake of the heavy metals by the plants; however, they might have been crucially responsible for providing a favorable environment for soil restoring microorganisms in their rhizosphere. Observable habitat-restoration continues at the site, including the return of birds and insects and other wildlife, making this an ideal site for further research and demonstration for community awareness and education.

Key words: Zero waste, habitat restoration, bioremdiation, heavy metals, vermin-compost, phytoremeditation, vetiver grass.

Organ-Specific Variability of Myco-Endophytic Colonization in *Droseraburmanni* Vahl. and its Relationship with Secondary Metabolite Production

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Droseraburmannii Vahl., locally known as *Rupsokola* (Assamese), is an acaulescent, pubescent, insectivorous herb belonging to the family Droseraceae. Although, threatened with respect to conservation status, itshabitation being restricted to wastelands, riverine banks and marshes. The present study envisaged isolation of fungal endophytes along with screening ofplumbagin and phenolic metabolites in three parts of the plant, *viz*. – inflorescence, leaf whorl (/frond/ tentacle) and rhizome. Sampled individuals of *D. burmannii* were collected from naturally occurring populations located in Jorhat district of Assam, India.A total of nine fungal species belonging to three genera i.e. *Aspergillus*Mich., *Penicillium*Link and *Pythium*Pring.apart from *sterilia mycelia* were isolated; of which *Penicilliumcitreonigrum*Dierckxexhibited the highest density (0.67±0.03), frequency (2±0.11) and colony forming units ml^{-1} (6×10±0.41). With regard to ecological indices, rhizomes exhibited highest Index of Similarity (1±0.02) and Index of Dissimilarity (0±0), while fronds exhibited opposite trend (0±0 and 1±0.02, respectively). Maximum accumulation of total phenolic metabolites was observed in the aqueous (1562.5±48.21 Gallic Acid Equivalent/ plant dry weight, 312.5±9.64 Gallic Acid Equivalent/ plant part extract) and methanolic(1350.0±14.28 Gallic Acid Equivalent/ plant dry weight, 270.0±2.85 Gallic Acid Equivalent/ plant part extract) extracts of inflorescence of the plant. With regard to the production of plumbagin, maximum accumulation was observed in the diethyl ether extract of inflorescence (21.74 % of plant dry weight) and hexane extract of rhizomal portion(13.79 % of plant dry weight).The production of plumbagin, a napthoquinone, effective in treatment of hyperglyceamia,hypolipidaemia, leprosy,leishmaniasis and arteriosclerosis apart from acting as immunomodulator, aphrodisiac, chitin synthetase inhibitor and abortifacient, is observed to be much more in comparison to other species of *Drosera*L., viz. – *Droserarotundifolia*L., *D. capensis* L. and *D. anglica*Huds., which is comparable to members of Plumbaginaceae family (the genus *Plumbago*L. and *Vogeliaindica*Gibson). Thus, the test species can be taken into consideration for*in-vitro*, *in-vivo*, *in-situ* and *ex-situ* culturing/ cultivation for a projected, effective secondary metabolite production scheme.

Key words: Ecological indices, Fungal endophytes, Insectivorous angiosperm, Plumbagin, Total phenolic metabolites.

Fish Diversity, Ecological Perspectives and Identifying Priority Areas for Sustainable Utilization and Management in the Tributaries of Ganges Basin

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The riverine ecosystem of India have suffered from intense human intervention resulting in habitat loss and degraded ecosystems and as a consequence many fresh water fish species have become threatened, particular in Ganges basin where heavy demand is placed on fresh water. The Ganges basin contain drainage area of about 1,060,000 km^2 which is fifth largest in the world and the tributaries of the river basin serves as a key source of water for various services and, as a consequence, have almost certainly suffered changes in water quality and habitat. The major environmental factors having negative impacts on fisheries are mainly human impacts on riverine morphology, disruption of ecology, intensive agriculture, and modern developments. Despite the urgent need for efficient conservation planning in the face of continuing changing freshwater environments, inadequate effort has been spent on applying systematic conservation planning. In this connection, important tributaries of river basin were assessed and the spatial distributional patterns of fish assemblages in these tributaries were determined and important areas prioritized by using multiple biological indicators. The different conservation indices i.e. Rarity and Origin index were assessed for various assemblage types to identify the most potential areas to focus the conservation efforts. The assessment also indicated that the tributaries are particularly relevant because it comprises several attributes associated with ecosystems susceptible of conservation: (a) high species richness with most diverse fish fauna which represents rich diversity of 116 native freshwater species. Variations in the trophic metrics were also recorded among the studied rivers The information in this study highlights the fact that fish species living in these tributaries are significantly varied and sensitive to anthropogenic disturbance, since instances of local diversity depletion and shift in distribution pattern of fishes were observed. The different indices used in this work showed contrast patterns in the various assemblage types. Thus, our results suggest that the use of a single criterion to assess value of fish assemblages may be hazardous. While each index may be subject to a specific discussion, the combination of various indices is better more accurate in identifying sites of high conservation value vis a vis spatial ecosystem health management. We developed a model to identify priority areas in the studied tributaries with less perturbed fish communities of special significance which could be adapted in other contexts or with other taxa to plan appropriate ecosystem health and management practices.

Key words: Fish diversity, assessment, ecology, tributary, indices, priority sites, Ganga basin

Persistence of Pyrene in a Hydrocarbon Mixture: Response of an Efficient and Inefficientpyrene Degrader and Impact of Triton X-100

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Polynuclear aromatic hydrocarbons (PAHs) are a diverse group of organic compounds that have gathered significant environmental concern due to their toxic, mutagenic and carcinogenic properties. Bioremediation has been proposed as an effective and environment-friendly means of clean-up of PAHs contaminated sites. High molecular weight (HMW) PAHs are relatively more recalcitrant due to their structural complexity and poor bioavailability. Association with co-pollutants may further cause hindrance in degradation of HMW PAHs.The objective of this study was to determine the impact of other petroleum hydrocarbons ondegradation of the HMW PAH, pyrene, from a multicomponent synthetic non-aqueous liquid (NAPL)by two pyrene degrading bacterial strains *Sphingomonas* sp. MSY and *Pseudomonas aeruginosa* RS1. The effect of addition of surfactant Triton X-100 on pyrene degradation from the NAPL was also studied.

Key words: Polynuclear aromatic hydrocarbons, bioremediation, degradation

A Survey on Various Drag Models in Fluidized Bed

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Today's world is progressing in science and technology at a much quicker rate than earlier times keeping pace with ever increasing demands of energy. Of them, coal comes under maximum utilization, especially by the power and the energy sector, which depend heavily on coal for producing electricity. But, unfortunately, Indian coals have less carbon content and considerably greater amountof ash. Majority of the industries are inept in handling and chemically treatingvarious pollutants and ash, ultimately releasing them into the atmosphere, thereby causing pollution. New and advanced technology has given birth to a better solution in the form of fluidized bedtechnology. A fluidized bed is a state where static solid particles are transformed in dynamic fluid-like state with the help of fluidizing medium. This technology has several advantages which include use of biomass and low grade coal, good thermal control, high rate of heat and mass transferdue to the high surface area-to-volume ratio of fine particles, compactness, eco-friendliness and better grip over toxic emissions. In order to understand hydrodynamics of fluidized bed, computational fluid dynamics (CFD) simulations are done with the help of drag models. These drag models describe the momentum transfer between differentphases. On the basis of literature survey,a review on optimization of different drag models, based on imitation of actual experimental results, was done undervarying operatingconditions.From the literature survey, following drag models are considered in the present work; Syamlal O'Brien, Representative Unit Cell (RUC),Hill Koch Ladd (HKL), space-averaged, Wen-Yu,energy minimization multi-scale model (EMMS), McKeen and Gidaspow models. The Syamlal O'Brien model proposes a suitable value of Kgs (interaction force between gas and solid phases) based on terminal velocities of particles. The void fraction profile in Syamlal O'Brien model was found uniform as smaller bubbles were formed which collapsed at the centre of the reactor, promoting lower bed expansion value. The Gidaspow drag model combines the Ergun equation with the Wen-Yu equation. The McKeen model considers a suitable drag equation scale factor because drag decreases when inter-particle cohesive forces come into action.The RUC and the HKL models predicted the highest drag in a typical bubbling fluidised bed. It was found from the experimental data that the RUC model, the HKL model and the Gidaspow model gave the best agreement. The Wen-Yu equation model is used for higher gas-volume fractions and Ergun equation

model is used for lower gas volume fractions. The EMMS model considers the particle-gas-compromising regime in the bed, which is characterized by a minimum energy per unit mass of the particles, and then, the mechanisms of gas-particle interactions are analysed for different scales (particle level, intermediate level and furnace level). In space-averaged drag model, the fine mesh results of the vertical component of the drag force are averaged, and a correction coefficient is then written as a function of the gas phase volume fraction. The simulation results showed that the space-averaged model and the EMMS model produced similar solids distribution compared to the Wen-Yu model. The pressure prediction using the Ergun/Wen-Yu model was found to be excessively high throughout the riser height and reduced in case of space-averaged and EMMS models.Thepredicted bed heights using McKeen and EMMS drag models are lower than that of using the Syamlal O'Brien and the Gidaspow drag models.

Key words: Wen-Yu, Syamlal O'Brien, Gidaspow, EMMS, simulation

Study on Finishing Effect of Fish Oil on Growth Performance, Fatty Acid Profiles and Proximate Composition of *Cyprinus carpio* (Linn.)

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Aquaculture involves the farming of aquatic organisms such as fish, crustaceans and aquatic plants. Today, it is the fastest growing sector of animal production worldwide. The increased demand of fish can be met from aquaculture as the capture fisheries is towards decline. Aquaculture largely depends upon capture fisheries for fish meal and fish oil used in aquafeeds. Fish oil has a high level of n-3 highly unsaturated fatty acids (n-3 HUFA), particularly, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which have high health value for fish and human beings. Since aquaculture is expanding and capture fisheries is contracting, the supply of fish meal and fish oil is becoming limited and hence more expensive. EPA and DHA are highly valued with regard to human nutrition. In addition, the content of fat-soluble vitamins, primarily A and D and also antioxidants (e.g. vitamin E, carotenoids) in fish oil is of importance. The use of fish oil for aquafeed production is viewed as the most stringent obstacle to overcome the sustainable development of the aquaculture sector. Annual worldwide FO production has remained relatively static over the last decade, leading to inflated prices. The current trend is towards the replacement of FO by alternative lipid sources in aquaculture feeds for sustainable aquaculture production. Fish oil replacement with alternative dietary lipid sources seems to be possible if the essential fatty acid requirements are satisfied. The substitution of fish oil with any alternative lipid source results in a reflection of the dietary fatty acid composition in fish flesh— a potentially undesirable trait from an omega-3 long chain polyunsaturated fatty acid (n−3 LCPUFA) consumption viewpoint. One way to boost the LC-PUFA concentration of farmed fish may be to use 'finishing' feeds containing 100% fish oil. Fish is increasingly being preferred as a part of our everyday diet and *Cyprinus carpio* is one of the favoured freshwater food fish among carps. Therefore the objective of this study was to examine the applicability of the finishing feeding strategy in common carp production with defined and tailored flesh quality for specific needs in human nutrition. This study investigated effects of fish oil finishing diets on growth performance, fatty acid profiles and proximate composition of common carp. Three isonitrogenous, isolipidic and isoenergetic diets were formulated. Diet 1 contained 50% fish oil and 50% canola oil and Diet 2 contained 50% fish oil and 50% poultry fat. The finishing feeding diet (Diet 3) contained 100% fish oil. Fish were given different dietary treatments *viz.* T1= 40 day (1-40) feeding with Diet 1 and 20 (41-60) day feeding with Diet3, T2 = 40 day (1-40)

feeding with Diet 2 and 20 (41-60) day feeding with Diet3, T3= 60 day feeding with Diet 3. There was non-significant difference in the growth performance and proximate composition of fish in all the treatments. Inducing a dietary shift from canola oil based and poultry fat based feeds to fish oil based feeds supplied as finishing diet (i.e. T2 & T4) strongly increases long-chain PUFA concentrations in common carp as compared to those fed only canola oil (T1) and poultry fat (T3) based feeds. Amongst T2 and T4, highest n-3 PUFAs and n-3/n-6 ratio was observed in T2, suggesting that T2 appears to be better. In conclusion, inducing a dietary shift from vegetable oil-based and animal fat-based feeds to fish oil based feeds supplied as finishing diet increases long-chain PUFA concentrations in common carp as compared to those fed only canola oil and poultry fat based feeds. Beneficial from fish fitness and human nutrition perspectives, C20–22 PUFA are increased in carp fed finishing feed for 20 days of the experimentation period compared with those exposed only to canola oil and poultry fat based feeds for the whole experimentation period. In contrast, using canola oil based and poultry fat based feeds, often considered as suitable alternatives to reduce use of marine resources in aquaculture nutrition, as a finishing diet mostly results in increased PUFA concentrations in common carp. Further research is required to keep a high and steady dietary supply of long-chain PUFA for human nutrition by farmed fish fed via sustainable supplements and/or feeding strategies.

Key words: *Cyprinus carpio*, fish oil finishing effect, canola oil, poultry fat, fatty acids

Study of Avifaunal Diversity of an Aquatic Habitat in Surat, Gujarat

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Of all the animals, birds have been the most well-known groups because human beings have used them for feeding, communication, pollinating plants, and decorate the home etc. Also birds are important to some animals for biological controls. Birds are important to continue ecological circle, especially in food chain. From the last two centuries, industrial developments and anthropological effects have degraded habitats and caused the natural balance to deteriorate. Birds play an important role in maintaining balance of ecosystem.Knowing the status and role of avian community in maintaining the balance of an ecosystem, the current study was carried out to evaluate their diversity at habitat.The present study deals with theassessment of bird diversity in and around a freshwater ecosystem. The avifaunal diversity of Regama Forest Pond located in Surat District of Gujarat State, India was studied. Avifaunal diversity calculation of the site was carried out in winter months in 2013-2014 and 2014-2015. Statistical representation of Avifaunal diversity was Biodiversity indices. Bird census was carried out using Point Count Method to assess the Bird diversity of site. Total 47 numbers of species were observed during study. The dominant species were Lesserwhistlingducks, Red-wetteled lapwing, Green-bee-eater, Intermediate-egret,Cattle-egret, Greater egret, Rose-ringed parakeet, Little cormorant, Comparing the data of both the years, higher number of bird species were there in 2015 which shows increase in Species at site.The study will be enable to know anthropogenic pressure on the natural ecosystem.

Key words: Bird Diversity, Biodiversity Indices, Freshwater ecosystem, Regama forest pond

Water Pollution at Jojari River: An Analysis

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Water is a priceless element of nature and is meant for all living creatures including the flora and fauna. Human civilization has always been revolving around "water". We cannot assume our existence without water. Any unwanted thing in the environment is known as pollution. On the basis of the availability only one percent fresh water is available for various human activities as well as industrial use. Due to the industrial revolution whole environment has reached to a deteriorating stage. With the help of research and development various type of dye and printing techniques are adopted by textile industries. These techniques are based on various chemicals and reagents. This serves us with different colours, designes, and shades. But because of excessive use of chemicals water lost its purity. Particularly the textile industry has become a monster for the environment. Jodhpur, Pali and Balotra have distinct position in dying and printing industries. Jodhpur district has 215 textile industries which are governed through Rajasthan Industrial Infrastructure Corporation. Jodhpur textile industries mostly deal with screen-printing processes. The overall finished products in 60% of industries are printed fabric and 40% have dyed and bleached fabrics. Industrial wastes are discharged into Jojari River. This paper tries to find of the government policies regarding environment protection and water pollution. How they are formulated; whether they are implementation or not; if not than what are the corrective actions were taken by Government; How to make every stockholder more responsible towards the society? We believe that every problem has solution. For this we have to become more realistic and honest towards the society.

Key words: Water pollution, textile industries, water policy, water treatment, health issues

Heavy Metal Concentration in Drinking Water Sources Near to Chemical Industry of Ratnagiri District, Maharashtra

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Metals are commonly found in the environment all around the world, their presence being due to natural occurrence or as a result of anthropogenic activities. Heavy metals enter and contaminate water bodiesthrough industrial effluent, agriculture runoff, domestic sewage. Ratnagiri is an important district of Maharashtra. Recently several chemicals, pharmaceuticals companies and some power plants are grown up in this region. Developmental activities are attracting more tourism industries in this region which directly or indirectly causes Environmental Pollution.

The present investigation was carried out to assess drinking water quality of the area near to chemical industry of Mirjole industrial zone of Ratnagiri city. Water samples were collected from six selected sampling stations (open well) for the pre monsoon and post monsoon period during August 2013 to January, 2014. The Heavy Metals like Copper, Mercury, Chromium, Zinc, and Cadmium were analyzed using Atomic Absorption Spectrophotometer. Heavy metal concentration was compared with the Bureau of Indian Standards (BIS) and hence it was found that water quality in Avashi village of 6 different locations was very severely polluted with Heavy Metal contamination.

Key words*:* BOD, COD, Nitrate, Physicochemical, Phosphate, Water quality

Environmental Impact Assessment of Tourism on Bhatye Beach of Ratnagiri Coast, Maharashtra

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An Environmental Impact Assessment (EIA) is an essential tool for identifying the environmental, social and economic impact of a project in advance, so that damage can be prevented or mitigating action taken**.** Tourism is one of the world's largest industries and coastal tourism is one of the most common types of tourism. It is based on a unique resource combination at the interface of land and sea offering amenities such as water, beaches, scenic beauty, rich terrestrial and marine biodiversity, diversified cultural and historic heritage, healthy food and, usually good infrastructure. The development of tourism in coastal areas is related to socio-economic features of the receiving environment such as local community interests, health and security conditions, political factors including unpredictable crises and traditional models of tourism. The growth of tourism in coastal areas has reached its peak in recent decades.

Paper reviews the problems, potential and prospects of ecotourism and its impact on Ratnagiri coast. Konkan region has high potential to develop as a tourism center hence Ratnagiri and Sindhudurg district are declared as a tourism district by the Maharashtra government. It presents the overall analysis of ecotourism enterprise with the implicit assumption that the local communities should be benefited. However, due to several social and legal hurdles the goals have not been achieved so far as in case of neighboring Goa state. In order to minimize tourism-induced problems and secure both the sustainability of the tourism industry and coastal resources used by other sectors, increased attention must be paid to the integration of coastal tourism into strategic development planning.

Key words: EIA, socioeconomic, sustainable, ecotourism, biodiversity

Pollen and Molds Induced Bronchial Asthma among Kolkata Population, India

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The increasing trend in allergic diseases has become obvious in the present day, especially in developing countries like India, because of many factors such as change in ambient air quality, increased air pollution, metamorphic change in living habits, lifestyle and climate. The allergens like pollens, fungi, etc. present in the air plays a pivotal role in pathogenesis of several allergic complaints such as allergic rhinitis, bronchial asthma etc. They are causing various nasobronchial allergic disorders, affecting 12-20% of the population around the globe. In India, 15-20% of the people suffer from various nasobronchial allergic manifestations and the number is rising in day by day. To provide the patients with best possible diagnosis and treatment, identification of offending allergens are of major importance. However early identification of individuals who are genetically at risk of developing pollen and fungal allergyis also an essential element of early avoidance strategies to prevent sensitization to aeroallergens and will aid the design of appropriate therapies. As accustomed, the information in this respect is mostly available from developed and western countries while preliminary information from developing countries like India, particularly Kolkata Metropolitan areas is still fragmentary and insufficient. The present study was designed to identify the offending pollens and molds and also investigating their role in causing asthma among kolkata population, India.

Key words: Aeroallergen, Nasobronchial Allergy, SPT, IgE, CD14

Pattern of Abundance, Habitat, Threats and Conservation Priority of Narmada Mahseer (*Tor tor*): A State Fish of Madhya Pradesh

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Freshwater environments are experiencing serious threats to both biodiversity and ecosystem stability and many strategies are being developed to solve the crisis. In Central India very little work has been done on the status of Mahseer, an important resource of Narmada and there remain significant gaps in the existing knowledge on pattern of abundance, distribution, stock, habitats and prioritization of important spawning grounds. River Narmada one of the biggest west flowing Indian River originating from Amarkantak and stretching about 1312 km in length and is the only largest west flowing river of the country fed by 41 major tributaries. Several studies indicated declining trend of mahseer in Narmada owing to the indiscriminate fishing of broodstock and juveniles, fast degradation of habitats, construction of dams, and other anthropogenic interventions. Significant decline of Mahseer (25-30 % to 4%) catch has been recorded by different authors has been recorded. The present study was carried out based on primary data collected from the landing centres following standard methods. The review and analysis of data indicate that increase in pollution status as evident by water quality index which shows poor quality and diversity index for phytoplankton, zooplankton and benthos. Considerable alteration of substrate, sediment load and flow are considered to be the main reason for the decline of mahseer. This emphasizes an urgent need for initiating research and actions for alternative management techniques to conserve this precious fish. Since mahseer (*T.tor)* is declared as state fish of Madhya Pradesh it is recommended to ensure that the habitat, spawning and migratory requirements of mahseer are fulfilled. The present study depicts the pattern of abundance, distribution, habitat, ecology, biology, threats, and conservation priority of *Tor tor* in river Narmada, identifies research gaps and advocates innovative strategies for their sustainable utilization and management.

Key words: Tor tor, water quality index, spawning habitat, decline, proritazation, decline, dams, anthropogenic interventions

Application of Ethephon Reversed Nickel and Zinc-Induced Oxidative Stress in Mustard Plants

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The unrestricted industrialization and urbanization carried out during the past few decades have increased level of heavy metals in the soils and posed a pervasive threat to the agricultural system. Heavy metals are known to cause toxicities around the world with different toxicity issues in the different manner in plants. Ethylene regulates a wide range of physiological and molecular processes which includes sulfur assimilation, antioxidant system, osmolytes production and others metabolism. The influence of exogenously sourced ethylene in the protection of photosynthesis against nickel (Ni) and zinc (Zn)-induced oxidative stress in mustard (*Brassica juncea* L.) was investigated. Plants grown with Ni (200 mg kg^{-1} soil) or Zn (200 mg kg^{-1} soil) without ethephon exhibited increased activity of 1-aminocyclopropane carboxylic acid synthase and ethylene with increased oxidative stress (H_2O_2 content and lipid peroxidation) compared with control plants. Exogenously sourced ethylene (200 µL L^{-1} ethephon) protected photosynthetic potential and growth by up-regulation of sulfur assimilatory enzymes (ATP-sulfurylase and serine acetyltransferase activity) and increased content of cysteine, methionine and reduced glutathione under Ni and Zn stress. These ethylene-induced changes in oxidative stress and protection of photosynthesis were associated with increased sulfur metabolism. Ethephon application lowered stress ethylene by increasing sulfur metabolism and alleviated Ni and Zn-induced oxidative stress. The use of ethylene action inhibitor, norbornadiene (NBD) in the study also confirmed the involvement of ethylene in reversal of Ni and Zn-induced oxidative stress by up-regulation of sulfur metabolism.

Key words: Ethylene, Nickel, Oxidative stress, Sulfur assimilation, Zinc,

Study of *Eimeriaahsata (Honess, 1942)*, in Goat and Sheep from Osmanabad District, Maharashtra State, India

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The coccidiosis is mainly a subclinical infection; it is associated with poor growth rates, diarrhoea, dysentery and anaemia (Soulsby, 1982). However, coccidiosis is considered to be one of the economically most important diseases in intensive sheep and goat industries in the world (Varghese and Yayabu, 1985; Chhabra and Pandey, 1991).

Coccidiosis is influenced by two factors: intensification of goat production and coccidiosis carrier-state in adult dams that are the main source of infection in kids. Coccidiosis in small stock is caused by Eimeria species, which tend to be host-specific (Levine, 1985). Fourteen species have been described from goats in Maharashtra (Nikam 1983 & More 2011).

The objective of this study was to investigate the prevalence of coccidiosis in goat & sheep and to study species composition. The study included survey, percentage prevalence & identification of coccidia.

The species was determined based on morphology of oocysts (shape, color, form index, presence or absence of micropyle and its cap, presence or absence of residual, polar and Stieda bodies) and time of sporulation Coudert's key (Coudert, 1992). A portion of the *Eimeria*spp. positive fecal samples was sporulated in sodium dichromate 2.5% in a wet chamber at 24–26 ◦C (Pellerdy, 1974).

During the present study ***Eimerian*** species are collected from goats and sheep. Present author is describing here only species i.e. ***E. ahsata***.The oocysts collected from the goats are ellipsoid or elongate ovoid and large in size. The wall of the oocyst is typically thick, double layered.

Key Words: *Eimeria,* oocyst, Sporocyst, Sporozoite.

Probable Factors for Some Curd Disorders of Cauliflower

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Cauliflower (*Brassicaoleracea* L. var. *Botrytis*, family- Brassicaceae) is one of the most important winter vegetables of India, comprising of 4.694 M mt yield per year. It belongs to a large group of plants known as Cole crops. It is quite cold resistant and like other Cole crops require a cold temperature regime for flowering. The tightly packed, creamy white flower buds (shortened single inflorescence) attached on a fleshy stalk known as head or curd is the edible and consequentlymarketable part. Different non parasitic curd disorders like buttoned curd, leafy curd, discoloured curd, riciness, blind heads etc. are the disappointing problems to the farmers. Probable factors which may cause these disorders were assessed considering both green house and field records for two consecutive years (2013 and 2014) in a particular area of West Bengal plain. Observations suggested that continuous extreme cold temperature or high temperature or fluctuating temperature along with older or larger or crowded transplants, nitrogen deficiency are the probable main factors of different curd disorders. Effects of irrigation were not considered in this study. Results obtained were critically discussed. However, further research, extensive field trials, proper discussions with experienced, skilled local farmers are needed to ensure maximally profitable cultivation of cauliflower.

Key words: Buttoning, riciness, temperature, transplants nature.

Invasion of *Prosopis juliflora* and Ecological Economics of Maldharies in Banni Grasslands of Kachchh

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Banni is the largest and finest stretch of grassland in India (2617 km^2 second largest grassland in Asia, is located on the southern border of Great Rann of Kachchh in Kachchh district of Gujarat State (GUIDE 2011). Banni grassland once referred to as Asia's finest grassland, accounts for approximately 45% of the permanent pastures and 10% of the grazing ground available in the state of Gujarat (Parikh and Reddy, 1997). A large tract of Banni being a low lying area converts into seasonal wetland during good monsoon years which attracts large number of migratory avi-fauna from different parts of the world. Thus, Banni plays a pivoted role and is one among the important areas of migratory birds in the world. Banni is an important grazing land for the livestock of Maldhari communities of Kachchh and Gujarat from the time immemorial. The livestock rearing is the only and major profession of the Maldhari community in Banni for their livelihood and survival. In 1950s, *Prosopis juliflora*, an invasive alien plant has invaded most of the grassland and converted it into woodland. At present, *P. Juliflora* has become an important natural resource in Banni grassland which provides many additional livelihood options to the local communities for their sustenance. It is the source of charcoal making, honey and gum, fuel wood, handicraft items, etc. The current study aimed at investigating the changing socio-economic dynamics of Banni over a 70 year period with special reference to introduction and gradual invasion of Prosopis in Banni. It is really striking to find how the indigenous communities of the region are harmoniously living with invasive species. This is an internationally unique example of human co-existence with invasive species. Further, in the second part, the project aims to carry out a comprehensive estimation of ecosystem services of Banni in its triple perspectives as grassland, as woodland as well as a wetland ecosystem.

Key words: Grassland ecosystem, Maldharies, Prosopis, Invasive species, wetland ecosystem, biodiversity services.

Habitat Preference and Population Status of Rare and Endangered Plants of Grassland Vegetation of North-Eastern U. P.

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The grassland vegetation of north-eastern U.P. is quite rich in angiospermic flora. About 287 species have been encountered within 620 random quadrats, sampled at various sites across the vegetation. More than 60% species showed common occurrence; 28% were less commonly and about 12% species were mostly localized and rare. The rare species are *Astercantha longifolia, Evolvulus alsinoides, Baccopa monnieri, Chrysanthellum indicum, Crotolaria calycina, Desmostachya bipinnata, Heliotropium ovalifolium, Ionidium suffruticosum, Leucas cephalotus, Perotis indica, Sphenoclea zeylanica, Spermacoce pusilla and Tribulus terrestris.* As regards to preference for light environment, most of these species occurred at fully exposed sites. About 35% species flourished only under partial shade but very few could survive under shade. Majority of species preferred mesic (Low land) habitat barring a few which could occur towards more hydric (flood plain) habitat of lowland sites. The number of species thriving at upland sites and showing preference to relatively xeric habitat was also considerable. They showed remarkable differences with respect to their sociability. About 30% of these species exhibited some degree of aggregation ranging from small patches to compact mats while the rest of species were far less frequent as regards to their occurrence across the grassy and old-field vegetation of the region. The species of *Evolvulus*, *Chrysanthellum, Perotis, Spermacoce, Tribulus* mostly occupied the sites having potassium- rich sandy-loam soils of river beds while *Astercantha longifolia, Baccopa monnieri Heliotropium ovalifolium and Sphenoclea zeylanica* preferred normal clayey soil.

The distribution status of these species suggests that the long-term severe disturbance might have caused acute fragmentation of the natural habitat which resulted into chance distribution of once very common and widely spread species as evident from the species content of different local floras. Fast shrinkage and ill treatment of grasslands via unmanaged and recurrent grazing and trampling have pushed these highly important plant species towards threatened category and several of them have already faced local extinctions. The population size and conservation status of these rare but locally available and medicinally important herbs species warrants the adoption of effective conservation device to save them from being fully extinct form whole of the region.

Key words: Grassland, Population, Habitat fragmentation, rare species, Conservation

Air, Water, Soil and Noise Pollution and Control Strategies

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The world today is confronted with the great problem of environmental degradation and pollution. Different types of pollution, fast depleting forest resources, rapid population explosion, expanding industrialization, unplanned urbanization, mining, soil erosion etc. have created ecological imbalances in recent years. Man's quest for economic development has been mainly responsible for the ruthless exploitation of natural resources. With growing population, requirement of food grains and other consumer items increase greatly, leading to yast environmental degradation. The unchecked population growth and increasing demands consequently taxed the finite or limited resources of the earth more and more. This also leads to environmental pollution.

Both natural and anthropogenic activities are responsible for environmental pollution, but the impact of the latter is severe and sometimes irreversible. Sometimes the natural causes may also be more dangerous. To keep drinking water sources clean and safe the following measures should be adopted:
A cement concrete platform around tube wells and ring wells extending to 1m in all directions, having a gentle slope towards a drain should be built These platforms should be free from cracks and damages. Water sources should have sound drainage systems to check stagnancy. Waste water should not be allowed to accumulate in these areas. The mouth of a ring well should be covered at all times to prevent foreign bodies from entering into it. The lining of a ring well should be built of stones set in cement up to a depth of at least 6 m so that water enters from the bottom and not from the sides.

The term environment means surroundings. It is a composite term for the conditions in which organisms live and thus consists of air, water, soil and sunlight which are the basic needs of all living beings and plant life, to carry on their life functions. The environment also includes other like temperature, wind, energy etc. thus it consists of biotic and biotic substances. Environment creates favorable conditions for the existence and development of living organism.

There was a time when everything around us was pure and safe. The air water and soil were in balanced condition. Natural it was enjoyable. In primitive days the limited needs of man did not disturb the harmony with nature, because population was less. But in subsequent years population has increased many folds. Advancement in science and technology accelerated and thus environment degradation started. In attempt to make

life more comfortable, man destroys forests thoughtlessly, pollutes air and water recklessly, spoils nature ruthlessly. Today the air we breathe and the water we drink are not pure and safe at all.

Environmental problems have attracted the attention of a wide section of people all over the world during the last few decades. People are becoming increasingly conscious of the variety of environmental problems today. Nature's precious resources are getting depleted because of indiscriminate and unplanned activities of man. Environmental problems of two types – Natural and Man made

World educators and environmental specialists have repeatedly pointed out that any solution to the environmental crisis will require environmental awareness and clear understanding of the problem and hence the answer all these is Environmental Education. Education always of knowledge. That is why the Stockholm conference on Human Environment in 1972 emphasized the need for environmentally oriented education. It is not a new discipline and should not be treated as a new discipline, but rather a new dimension in education system.

In short, it can be said that environmental education is education through environment, about environment and for the environment. Environmental Education Environmental education is the educational process dealing with man's relationship with his natural and manmade surroundings and includes the relation of population, pollution, resource allocation and depletion, conservation, transportation technology and urban and rural planning to the total human environment. Environmental education is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among man, his culture and his biophysical surroundings.

The report of the first intergovernmental conference of environmental education held at Tbilisi (USSR, 1977) is the single most important document which provides broad guidelines for environmental education. Awareness and sensitivity to the environment and environmental challenges

Environmental education is a multidisciplinary subject. In order to know the environment and its different complex phenomena, one requires knowledge from various disciplines. Subjects like botany, zoology, biotechnology, bioengineering, microbiology; genetics, biochemistry etc. help in understanding biotic components and their interactions. The basic knowledge of physics, chemistry, mathematics and statistics help in understanding the different phenomena in the environment. Computer and information technology is part and parcel of environmental education. Similarly, for control of pollution, environmental engineering is essential. Other branches of engineering e.g. chemical, civil, mechanical, including new innovative technologies, have been involved in protecting the environment. Green chemistry finds its distinct and well specified role in protecting the degraded environment. Subjects like sociology, economics, education and philosophy are involved in a number of ways. Environmental laws are always enacted for the protection of the environment. So

environmental education is of a multidisciplinary nature where different aspects are dealt with through a holistic approach. Need for environmental awareness:
The world today is confronted with the great problem of environmental degradation and pollution. Different types of pollution, fast depleting forest resources, rapid population explosion, expanding industrialization, unplanned urbanization mining, soil erosion etc have created ecological imbalances in recent years. Man's quest for economic development has been mainly responsible for the ruthless exploitation of natural resources Moreover, the highly materialistic, greedy and luxurious life style and attitude of the human race has led in indiscriminate exploitation and destruction of the natural resources. All these activities have become a threat to the very existence of a number of living organisms. So creation of public awareness is a must to protect the environment from further deterioration. Environmental problems can be best addressed if the people become environmentally aware. No government can solve these problems by simply implementing certain environmental protection rules if people do not co-operate. People are to be environmentally educated. They should learn that if we degrade our environment today, we will have to suffer tomorrow and our future generation will be in great danger. We are a part of the environment and it is our duty to protect it.

Key words: environment, pollution, natural, development, degradation, industrialization

Optimization of Phenolics and Utilising the Pretreated Water Hyacinth Biomass for Xylitol Production

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Lignocellulosic biomass from forests, agriculture and agro-industry residues are considered as abundant and inexpensive source of polysaccharides. The useful exploitation of this resource depends on the degradation of these polymers to sugars of which hemicellulose is important in overall conversion process. Water hyacinth (*Eichhornia crassipies*) represents hemicellulosic rich (38%) weed biomass that could be utilized for a variety of value added products such as xylitol. It is an exceptionally fast growing plant. The biomass productivity of this plant is very high and there is abundant availability of this biomass in certain parts of the world making it a suitable feedstock for distributed xylitol production.

Production of xylitol from biomass involves hydrolysis, detoxification and fermentation. Optimization of the factors affecting pretreatment is necessary for achieving desired yields. This process aims to remove lignin and various uronic acid substitutions in hemicellulose which lowers the yield of reducing sugars. NaOH pretreatment is the most commonly studied alkaline pretreatment process as it causes swelling of lignocellulosic materials which allow the separation of structural linkages between lignin and carbohydrate polymers, decreases cellulose crystallinity and cause lignin disruption which might lead to an increase in internal surface area.

Dilute acid hydrolysis using is a simple and rapid method and is commonly used for hydrolysis of biomass. Unfortunately the sugar liquors obtained contains several microbial inhibitors such as furans, aliphatic acids and lignin-derived phenolics. Due to low molecular mass phenolics is most toxic. A sequential two step process (pretreatment followed by hydrolysis) usually generates hydrolysates with low content of inhibitors.

Xylitol ($C_5H_{12}O_5$), due to its unique properties finds applications in pharmaceutical, healthcare, and food industries. Fruits and vegetables, which naturally contain xylitol, are not used for xylitol extraction because their low content (less than 9 mg /g) makes manufacturing expensive. Xylitol is currently produced using catalytic hydrogenation from commercial xylose but the process is expensive with low yields (60 %) due to the separation of xylitol from the chemical compounds formed during manufacturing. Biotechnology provides an alternative through microorganisms such as bacteria, molds

and yeasts that can convert xylose into xylitol, a highly specific and economic process since 80% of the sugar is transformed into sugar alcohol. The biotechnological alternative is even more appealing when using low cost raw matter such as cellulose from agricultural residues. The fermentation organism must be able to ferment all monosaccharide present and in addition, withstand potential inhibitors in the hydrolysate. Yeasts are considered as the best xylitol producers among the microorganisms investigated.

In the present work, NaOH pretreatment was performed and the oligosaccharides containing liquors were subjected to acid hydrolysis.

Solubilization of lignin can lead to the production of phenol degradation products, like vanillin and guaiacol, as well as organic acids, like acetic and formic. After optimization using Response Surface Methodology, the highest concentration of phenolics was **3524.16mg/l** obtained after soaking temperature of 3 h, 3% concentration, agitation speed of 130 rpm, and soaking temperature of 98 ^{o}C.

In recent time, Response surface methodology (RSM) is the most efficient method for empirical modelling and optimization. It is a statistical based protocol preferentially used for non-linear optimization of quadratic functions. RSM fits the responses derived from design of experiments (DOEs) to a polynomial function RSM can be collectively explained as collection of statistical techniques for designing experiments, building models, evaluate the combined effect of factors, and finding for the optimum condition. RSM was implemented successfully to optimize the percentage of phenolics by performing various experiments. For the estimation of responses of the dependent variable the second-order polynomial coefficients were calculated using the software package Design Expert Version 9.0.3. Response surface plots and Contour Plots were also obtained using Design Expert Version 9.0.3.The surface plots was beneficial to determine the interaction between process parameters on the total Phenolics content whereas the Contour Plots not only determines the interaction of the components but also the optimum level of each component for maximum response.

Here 3% H_2SO_4 is used as acid catalyst for obtaining optimum xylose yield. Water hyacinth hydrolysate after post-hydrolysis contained 27.23 g/l of fermentable monosaccharides, xylose. Xylitol bioproduction is favored at high xylose concentrations therefore, WHB hydrolysates is concentrated for an efficient xylitol production.
After post-hydrolysis the total phenolics were reduced from 3524.16 mg/l to1541.28 mg/l (% removal) and xylose concentration was increased to 314.93 mg/g from the initial 272 mg/g of xylose.

Batch fermentation was performed from the concentrated water hyacinth hemicellulosic hydrolysate, using 10% (v/v) *Pichia stipitis* (NCIM 3500) and *Candida shehatae* (NCIM 3497).34.22 g/l of xylitol was produced from *Pichia stipitis* at 48 h and 44.82 g/l of xylitol was produced from *Candida shehatae* at 48h. The results are in accordance with 26 g/l xylitol produced from corn husk by *Pichia stipitis* CBS 5773 as reported earlier. 32.5 g/l of xylitol was obtained by *Candida tropicalis*Y-27405 from WHB.

With the hike in worldwide interest for Xylitol production, lignocellulosic material can prove to be a better alternative. Water hyacinth biomass can act as an efficient source for the analysis of phenolics by NaOH Pretreatment. The process parameters were optimized using software package Design Expert Version 9.0.3. which released a maximum phenolics of 3524.16 mg/l at soaking time 3h, concentration of NaOH 3%, agitation speed 130rpm, treatment time 11min, treatment temperature 98 ^{o} C. Then acid hydrolysis was carried out with the dried pretreated biomass by autoclaving at 121^{o} C for 15 min which yielded 272.26 mg of xylose/g of dry biomass. The filtered hydrolysate after fermentation yielded 24.22 g/l of xylitol using *Pichia stipitis* and 22.82 g/l of xylitol with *Candida shehatae* both treated for 48h at 30^{0} C.

Therefore, it can be concluded that water hyacinth is a novel alternative source for the bioconversion of lignocelluloses to highly value added product xylitol, which requires further studies on kinetics of the process and optimization thereon.

Key words: Xylitol, pretreatment, fermentation, optimization, phenols.

Studies on Prevalence of Different Pathogenic Diseases in Indian Major Carps in Raniganj Block of Burdwan District in West Bengal

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Fish culture is long been associated with human civilization. In a country like India, millions of peoples are engaged in fish culture to earn their bread and butter. Although the vast and varied inland fishery resources of India have a rich production potential, this potential has not yet been achieved. Fishes, like other animals, are also susceptible to various kinds of diseases. This poses a great problem to the fish farmers and they incurred a huge economic loss. In this connection a two years wise extensive study on the prevalence of various diseases in IMC has been conducted at Raniganj colliery zone (Burdwan district) of West Bengal. Raniganj block is basically a colliery zone comprising of six gram panchayets. Inspite of being colliery zone the fish farming is also a common practice and provides occupation to thousands of families.

It has been found that the present average productivity from aquaculture ponds and tanks is 12 quintal/ha/yr in this region against a much larger potential 30 quintal ha/ yr. This excessive low production is mostly due to the prevalence of various fish diseases and pathogenic conditions. Estimates of the prevalence of various fish diseases seen in Raniganj area are: EUS ranged from 32.4 to 72.5%; gill rot, from 8.6 to 34.2%; tail and fin rot, from 2.6 to 10.8%; argulosis, from 0.6 to 9.5%; and fungal diseases, from 1.4 to 2.6%. The Gillrot disease is observed maximum in Catla fishes i.e., 55%. Whereas the Finrot disease is equally prevalent (i.e., 35%) in both Catla and Mrigel. *Myxobolus* infection is maximum found in Rohu fishes (50%). Argulosis affects Catla the most i.e., about 40% of Catla stock. EUS affects the bottom feeder Mrigel fish the most(i.e., 55%). These diseases occur throughout the year but become prevalent in winter season. However, fish mortality is mostly due to EUS (50%) and gill rot disease (25%). Fish mortality due to EUS observed in Mrigale, Rohu, and Catla at 50%, 30% and 20% respectively. In case of Gill rot, percentages are 30%, 30% and 40% respectively.

During the study, it has also been observed that most of the reservoirs and small water bodies of this region have either sub-optimal water quality or detrimental ecological conditions that limit their production. The ponds, due to water extraction, siltation and, in many cases, sewage or factory effluents discharge, have become degraded as fish habitat, and quite obviously, there is mortality and decline in fish production. Again some ponds are mostly in various stages of eutrophication, the majority of them choked with submerged or floating vegetation and having sub-optimal water quality. This has

affected the general fish health condition, and most fishes are stressed and have retarded growth.

In India, since, culture-based fishery activities are predominantly rural based, the adverse effects of disease outbreaks are felt mainly by the poor fishermen. It is thus essential that adequate attention be given to the management of fish habitat and fish health in India. This would involve firstly, developing trained manpower and infrastructure for fish health research, diagnosis and extension; and secondly, establishing a proper network for dissemination of information on fish disease and fish health management to interested parties during disease outbreaks.

Key words: Fish culture, fish didease, Indian Major Carps, fish pathogens, treatment

Neurotoxicity of Lead

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Chronic lead (Pb) exposure causes a variety of adverse health effects in developing humans and animals. The primary target for low levels of Pb-exposure is the developing central nervous system. Cognitive and behavioral effects such as low tolerance, aggressiveness, impaired attention and executive functions are some consequences associated with Pb-exposure. Chronic exposure to Pb results in biochemical changes related to energy metabolism in the adult brain. Pb-exposure in growing children has a severe impact on their development and behavior. Children show behavioral concerns such as inattentiveness, hyperactivity and irritability, when exposed to even low levels of Pb-exposure. Children exposed to higher Pb-levels have learning and reading disabilities, delayed growth and occasional hearing loss. At still higher levels, Pb can cause permanent brain damage and sometimes death. Our studies reported that Pb-exposure 1) alters Ca^{2+}-mediated cellular events including phosphoinositide and nitric oxide (NO) mediated signal transduction pathways and 2)can influence brain cell proliferation and a number of pathological biomarkers of oxidative stress, apoptosis, inflammation and cell viability and some of these effects can be partially reversed by selected neuroprotective compounds.

Key words: Neurotoxicity; Lead exposure; cell proliferation, oxidative stress, apoptosis

Population Structure, Biomass Partitioninig and Productivity Pattern in Four Congeneric Species of *Moghania* under Different Disturbance Regime in Sal Forests of Gorakhpur, India

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The woody perennials of four species of genus *Moghania* (*M. chappar* (Benth.) Kuntze, *M. bracteata* (Roxb.) L., *M. lineata* (L.) Ktze. and *M. prostrata* Roxb. contribute significantly to the understorey vegetation cover of sal dominated forests of Gorakhpur division. The main objectives were to determine the effects of disturbance on different *Moghania* spp. with reference to its *genet* and *ramet* population and its productivity pattern. Sal forest of 50 ±5 yr were marked and 1-ha plots within stands facing low, moderate or high disturbance were identified within each of three zones of the Sanctuary and a total of 40 quadrats per plot were considered for observation on the population structure. *Genet* density of *Moghania* spp. decreases with increasing the level of disturbances, while *ramets* were maximum at moderate disturbance. *M. Chappar* was the most dominant in all the sal forests. *M. lineata* showed better growth at high disturbance while *M. chappar* and *M. bracteata* commonly occurred at low to moderate disturbance. *M. prostrata* was very sensitive to disturbance and occurred at stands facing low disturbance. In general, the individuals of different *Moghania* species from young to old age classes steadily decreased at low disturbance. This trend was, however, reversed in stands facing high disturbance where the age pyramid showed retrogressive population with very rare young plants. At moderate disturbance, the population structure showed the dominance of young plants but the age pyramid showed normal or stable population structure. In most of the cases, there was significant difference between low and high disturbance in terms of number of sprouts along the age series of genets.

The total as well as above ground biomass showed significant difference ($P < 0.01$) among the species and disturbance level as evident from F- test. Aboveground productivity was greater at moderate level of disturbance for species other than *prostrata* which showed its maximum only at low disturbance. In general aboveground productivity increased up to 4 year, while belowground productivity showed no clear-cut pattern with respect to degree of disturbances. At high disturbance, the mean biomass allocation towards different compartments of *Moghania* spp. was significantly different and the total biomass was positively correlated to canopy cover at low as well as moderate disturbance. The ratio of shoot and root biomass ranged from 1.67 to 2.80 for *chappar*, *bracteata* and *lineate* at moderate disturbance. Irrespective of disturbance level, this ratio for *prostrata* remained close to 1. There was significant positive correlation (< 0.01) between number of shoots with shoot biomass and with root biomass for *M. chappar* at three disturbance level. The species of *Moghania* have considerable high potential of the production of non- timber wood in stochastic environment and can cope-up well with moderate disturbance. They can provide good understorey cover even in presence of considerable disturbance and thus can add to the maintenance of ecosystem attributes of the disturbed forests.

Key words: *ramet* and *genet* population, age structure, sal forest, disturbance, biomass allocation

Environmental Policy Law and Legislation

Nilanchala Sethy

In this living world human beings are the main creature, builder and moulder of this environment. Environment is nothing else, it is surroundings of ours, where have we birth and live .The environment saves us and fulfils our basic needs like food, cloth and shelter etc. At the same time protection and preservation of environment depends upon the human being. Environment is like as our mother, so it is our prior duty save our mother. In ancient period people believed and worshiped the nature. The main motto of social life was 'to live in harmony with Nature'. Day to day human beings changed their attitude towards nature. He thought himself; he is the master of nature. Due to advanced science and technology human being has tried to control the environment, which is an impossible thing for the human being.

In the beginning the nature has vary pure. In the 21st century the environment lost its purity and highly polluted of air, water, land, noise etc. It leads to green gas effect, acid rain, floods, cyclone etc due to population exploitation, industrialization, urbanization, poverty, deforestation, over exploitation of natural resources, taken steps towards research for new resources of energy and raw materials, examine the nuclear weapons and war in the Arabic countries. These are some of the facts which are contributed to environmental deterioration of the world over. These causes are organised by human being for his development but in fact directly and indirectly the human being create more problems in the present and future generation. In these surroundings where we live, if it has polluted, we suffered our self many problems due to polluted air, water, noise etc.

There are many Laws, rules and Regulations in International and National level in the aimed of protection and preservation of environment and conservation of natural resources for future generation. The purpose of the law is prohibition of doing certain things, the Law related to environment where we live, enjoy and use for own interest all basic elements of environment like Air, Water, Land, products and other creature of this environment, in this way whole Laws which has made for protection of environment, control the human activity, because whole human beings are main culprit of the environment pollution. These rules and regulations control human wills and curtail our freedoms which have gone against the environment and human civilization. So it is now right time that the human beings should try to change their feeling and attitude toward their environment and take necessary steps by their daily work towards environment for the protection and preservation of the environment. It can be possible only when human beings are guided by the rules and regulation of the environment protection. The research paper is going to analyse and examine the laws and policies implemented for the protection of the environment.

Key words: Fundamental Rights, Sustainable Development, Disasters, Self Help, Duty

RS-GIS Based Assessment and Management of Sip and Jamner River Basin: A Tributary of River Narmada

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The present study describes the status of Environment Management in the major tributaries of River Narmada. The quantitative analysis of drainage system is an important aspect of characterization of watersheds. Geomorphometry is measurement and mathematical analysis of landforms. A morphometric analysis was carried out to describe the topography and drainage characteristics of Sip and Jamner Sub-watersheds. The Sip and Jamner River was analyzed using remote sensing and Geographical Information System (GIS) techniques. Geomorphometric characterization was carried out using Arc GIS (Version 9.0) and ERDAS Imagine (Version 8.7) software. The Geomorphometric parameters of the sub-watersheds are classified in stream numbers, orders, lengths and other Geomorphometric parameters like bifurcation ratio, drainage density and Drainage Texture Ratio etc. Both Rivers classified as 7th order drainage basin.

The Sip sub-basin covers an area 781.30 sq. Km and Jamner sub-basin covers an area 606.05 sq. Km which was determined with the help of topographic maps of 1:50,000 scale. Total length of Sip and Jamner tributaries is 3,035.24 km. The values of bifurcation ratio and drainage density suggest that the area has been affected by structural disturbances. The values of drainage Texture Ratio (Rt) for the Sip sub-watershed 13.14 and Jamner sub-watershed 12.90 which indicates very coarse to coarse drainage texture.

Remote sensing and GIS techniques both are the best efficient tools in drainage delineation and updating of data in the study. The Linear quantitative analysis of morphometric parameters is found to be of best use in river basin evaluation, watershed management & prioritization for soil and water conservation as well as for natural resource management.

Key word: Geomorphometry; Sub-Watershed; Remote Sensing; GIS; Narmada River

Biodiversity of Koderma Wildlife Sanctuary, Jharkhand – Its Threats and Conservation

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The oral presentation describes the biodiversity of Koderma Wildlife Sanctuary, Jharkhand. Koderma is known as "Mica City of India", as it has the richest deposit of Mica in our country. It was notified as a Wildlife Sanctuary in the year 1981. It lies between 24°25'–24°38' N and 85°25'–85°40' E and covers an area of 150.62 km^2. It falls in the bio-geographical region of Deccan Peninsula in Chotanagpur Plateau Province.
The sanctuary has been thoroughly explored covering all seasons for documenting its rich phytodiversity and that resulted in the collection and documentation of 429 taxa of Angiosperms belonging to 98 families (APG III System of classification of plants). A total of 8 species of Pteridophytes and 2 species of Bryophytes have also been recorded from the sanctuary. The most dominant family is Leguminosae, comprising 59 species followed by Poaceae comprising 33 species. An analysis on the life-form composition of the flora reveals that the herbaceous species account the largest floral composition followed by arboreal species. The present study also reports a new record of taxon (*Malva parviflora* var. *microcarpa*) for the state of Jharkhand from the sanctuary. The faunal diversity includes sloth bears, neel-gai, sambhars, foxes, jackals, spotted deer, barking deer, langurs, wild boars, bats, peacock, cuckoo, koel, parakeet, parrot, white breasted kingfisher, myna, woodpeckers, wagtail**,** paradise flycatcher, cobra, rat snake, skink and crab. The Koderma Wildlife Sanctuary is concerned for protecting the flora and fauna. But at the present scenario the biodiversity of the sanctuary is under tremendous stress. Illegal mica mining, felling of trees for fuel wood, man-made fire, grazing in the core and buffer areas and invasion of exotic weeds are posing major threats to the existing biodiversity of the sanctuary.

The Birhor tribal community living adjoining to Koderma Wildlife Sanctuary is conserving the traditional knowledge on the uses of various plants, which they have acquired generation after generation.

A periodic monitoring by the personnel of State Forest Department and proper and effective conservation measures and strategies are necessary to protect and conserve the existing biodiversity of the Koderma Wildlife Sanctuary.

Key words: Koderma Wildlife Sanctuary, phytodiversity, protection, threats, Birhor, traditional knowledge, conservation

Delineation of the groundwater potential zones in the municipal areas of Dhanbad district, Jharkhand, India

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Remote sensing data and Geographic Information System are used to locate the different potential zones for groundwater in an area. Integration of remote sensing data and GIS has proved to be a major breakthrough in the field of groundwater research which helps in monitoring, assessing and conserving groundwater. The objective of this study is to explore the groundwater availability and most importantly demarcating the various groundwater potential zones in the municipal areas of Dhanbad district, Jharkhand. Various maps (i.e., percent slope, lineament, drainage density, land use/land cover, geology, geomorphology, soil etc.) were prepared using the remote sensing maps as well as digitization of the secondary maps. Then using the weighted overlay analysis method, the hydrogeological parameters classified into different categories and weightages are assigned depending on their suitability to hold groundwater. Using weighted overlay analysis tool in ArcGIS software, all the thematic maps were integrated into one map depicting the groundwater potential zone map which was classified into different classes (i.e., very good, good, moderate, poor, very poor) based on its hydrogeomorphological conditions. The result depicts that the groundwater potential zones of the study area found to be helpful in better planning and management of groundwater resources.

Key words: Remote sensing, GIS, lineament and hydrogeomorphology.

A Review on the Adverse Impact of Waste Dumps on Environment and Their Management Strategy in Mining Industry

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Coalmine waste dumps require large amounts of land and can lead to pollution of both the atmosphere and the water. Abandoned mine waste – dumps are focus of environmental impact, especially when there are reactive minerals. The objective of this paper is to review the major impact of waste dumps generated from mining industry which when exposed to atmosphere can be active to severely contaminate the soil, surface and groundwater, and endanger both local & downstream ecosystem as well as strategy to minimize their impact. There are various different methods available to study these impacts, out of which some of the methods reviewed with the help of case study of which one is that, impacts can be analyzed with the help of time series study of physio – chemical properties of dump soil of different dumps of different ages and other is to study the impact of waste dump on water quality due to leaching and runoff through mineralogical and geochemical study of element mobility of dumps as well as geochemical analysis of surrounding surface and groundwater samples. Nowadays, developed countries with mining tradition are dealing with the need to minimize the impacts from waste dumps. A waste rock management strategy ensure that disposal of such material should be inert or at least stable and contained. Reclamation of waste dumps either by natural stabilization or by artificial reclamation with the help of local species or other vegetative growth is worldwide accepted practice which has been discussed in detail in this paper.

Key words: Waste dump, groundwater, ecosystem and reclamation

Effect of Weed Control Methods on Microorganism in Babycorn (*Zea mays* L.) Cultivation

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Weed management is an ever-present challenge to crop production. Weeds have the potential to usurp resources that would otherwise provide nourishment to growing crops or interfere with planting or harvesting operations. Because of these potential negative impacts, much research has been devoted to developing management strategies aimed at reducing weed populations, usually through mechanical disturbance or chemical applications (Zimdahl, 2004). In recent years, the intensive use of herbicides has increasingly become a matter of environmental concern, partially because of the adverse effects of these chemicals on soil microorganisms. Hence field experiments were carried out during 2010-11 and 2011-12 at Instructional Farm (New Alluvial Zone) of Bidhan Chandra Krishi Viswavidyalaya, Jaguli, West Bengal to evaluate the efficacy of different weed control methods in babycorn and their impact on soil micro-flora. The soil of experimental field was sandy-clay loam with medium to low fertility. The experiment was laid out in a randomized block design with seven treatments and three replications. The treatment consists of atrazine @ 2 kg a.i. ha^{-1} (pre-emergence at 3 DAS), metribuzin @ 2 kg a.i. ha^{-1} (pre-emergence at 3 DAS), paddy straw mulch @ 10 t ha^{-1}, hand weeding (HW) twice at 20 DAS and 40 DAS, atrazine @ 1 kg a.i. ha^{-1} (pre-emergence at 3 DAS) + HW at 30 DAS , metribuzin @ 1 kg a.i. ha^{-1} (pre-emergence at 3 DAS) + HW at 30 DAS and weedy check. The crop management was followed as per standard protocols. The results revealed that the toxic effect of herbicides reduced the bacterial population (aerobic non symbiotic N-Fixing bacteria and P- solubilising bacteria) initially (up to 25 DAS), but thereafter, there was a steady growth of the population in the rhizosphere soil. The intial suppression of microbial population was more pronounced in metribuzine with higher dose compared to that of atrazine. Moreover, the optimum moisture, temperature and greater availability of nutrients under the straw mulch treatment favoured the maximum growth and multiplication of soil microbes continuously, followed by hand-weeding twice. Straw mulch enhanced population of aerobic non symbiotic N- fixing bacteria and P-solubilising bacteria by 157.96% and 178.11 % respectively over weedy check, which showed an declining trend due to harmful effect of root exudates secreted by complex weed flora. However, the herbicide atrazine and metribuzine applied at higher or lower concentration did not exhibit any phytotoxicity symptoms at any stage of crop growth. The studies concludes that straw mulch treatment maximum favours the soil microbial growth. The toxic effects of herbicides on the bacterial population being recovered at later stages.

Key words: soil micro flora, straw mulch, N- fixing bacteria, P solubilising bacteria, phytotoxicity

Indian Perspective of Implementation of Environmental Laws

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In our country, it has been a tradition since thousands of years to worship Mother Nature. In fact, in our ancient cultural matrix as much importance is given to the five basic elements of nature as the Almighty Himself. These elements are known as "*Panch Maha Bhootas*". Needless to mention sky, water, air, fire and earth are said five basic elements of which the whole world is supposed to be comprised of. If we leave 'fire' out of the picture for the time being, all the remaining four are facing the modern age hazard called "Pollution" in one form or the other. Let's try to have a closer look at the problem from the grass-root level. Neither of these elements are creation of human. Still then, it is the mankind that is exploiting them the most. For sure, it is the human being that has been and is still polluting the natural resources for its own motives more than any other living being. Coming to a narrower level, from universal to global, for past couple of decades or so, the sinister effects of the human encroachment on the nature have been attracting attention of many all over the world. As a part of a world-wide endeavour, many nations of the world have given a serious thought to this problem and have been trying to curb the menace as much and as early as they could. This is being done in many ways, such as plantation of trees on a large scale, bringing awareness amongst people using all possible means and methods of communication and also by bringing suitable legislations on to the statute books. For the purposes of our present paper, we will harp on this point only in its Indian perspective. In our country, legislation has been taking care of environment protection even in the pre-independence period. There were hardly any laws dealing exclusively with the subject. Laws falling within the ambit of criminal jurisprudence such as The Indian Penal Code, 1860 contained some such provisions.

In the Constitution of India it is clearly stated that it is the duty of the state to 'protect and improve the environment and to safeguard the forests and wildlife of the country'. It imposes a duty on every citizen 'to protect and improve the natural environment including forests, lakes, rivers, and wildlife'. Some of the important laws for the protection of environment include Indian Forest Act 1927, Wildlife Protection Act of 1972, Water (Prevention and Control of Pollution) 1974, Forest Conservation Act 1980, Air (Prevention and Control of Pollution) Act 1981, Environment (Protection) Act 1986, Protection of Plant Varieties and Farmers' Rights Act of 2001, Biological Diversity Act 2002, Wild Life (Protection) Amendment Act 2002, National Green Tribunal Act, 2010. The constitutional provisions are backed by a number of laws – acts, rules, and notifications. The EPA (Environment Protection Act), 1986 came into force soon after

the Bhopal Gas Tragedy and is considered an umbrella legislation as it fills many gaps in the existing laws. However, the meager quantum of punishment then prescribed is inadequate in today's context. It was only after India gaining freedom that, statutes having any 'teeth' as such saw the light of the day in this respect. Post-independence, the legislature has shown its concern for this burning issue of world-wide importance. However, like in case of most of prevailing procedural laws, the major obstacle between these legislations and the achievement of the purpose for which they have been brought on the statute-book is nothing but lack of proper implementation on the part of concerned agencies. The purpose of the present paper is both, to focus and to attract attention on the need for just and proper implementation of laws related to environment in terms of their letter and spirit.

Key words: biodiversity, constitution, environment protection, legislation, wildlife

Agriculture Chemicals and Their Non Target Hazards on Human Health

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The use of pesticides and fertilizers in agriculture has grown dramatically over the past 30 years. Currently, approximately 600 active pesticide ingredients are used, but adequate toxicologic data are available for only approximately 100 of these.The use of a wide range of agriculture chemicals to destroy pests and weeds is an important aspect of agricultural practice in both developed and developing countries. Undoubtedly, this has increased crop yield and reduced postharvest losses. However, the expanded use of such pesticides expectedly results in residues in foods, which has led to widespread concern over the potential adverse effects of these agriculture chemicals on human health. It is clear that the possibility for exposure to pesticides is greatest among farm workers. Also, it is exceedingly plausible that less controlled and regulated uses of pesticides may offer the greatest opportunity for exposure to toxicologically significant quantities. Very limited epidemiological data are available for evaluation of the health effects of pesticides on humans. Only a small proportion of a population is likely to receive a pesticide dose high enough to cause acute severe effects; however, many more may be at risk of developing chronic effects (such as cancer, adverse reproductive outcome, and immunological effects) depending on the type of pesticide they are exposed to. The pesticides currently in use include a wide variety of chemicals with great differences in their mode of action, uptake by the body, metabolism, elimination from the body, and toxicity to humans. A variety of cancers have been linked to exposure to various pesticides, particularly hematopoietic cancers. Immunologic abnormalities and adverse reproductive and developmental effects due to pesticides also have been reported. The health effects associated with pesticides do not appear to be restricted to only a few chemical classes. With pesticides that have a highly acute toxicity but are readily metabolized and eliminated, the main hazard lies in acute, short-term exposures.Other pesticides that are rapidly eliminated but induce persistent biological effects also present a hazard connected with long-term, low-dose exposures. Adverse effects may be caused not only by the active ingredients and the associated impurities, but also by solvents, carriers, emulsifiers, and other constituents of the formulated product. This review attempts to describe several aspects of the problem.

Key words: Pesticides, Fertilizers, Agriculture Chemicals, Human health.

Effect of Organic Fertilizers on Ecological Imbalance

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The importance and, in some cases, the major problems associated with organic fertilizers. Manure produced by cattle, pigs and poultry are used as organic fertilizer the world over. To this is added human excreta, especially in India where animal and human excreta are traditionally used in fish culture as well as on soils. However, intensive livestock production has produced major problems of environmental degradation.In addition to problems associated with excessive application of manure on the land, is the problem of direct runoff from intensive cattle, pig and poultry farms. Although this is controlled in many western countries, it constitutes a serious problem for water quality in much of the rest of the world. To the typical pathways of degradation, that of surface runoff and infiltration into the groundwater is added the volatilization of ammonia which adds to acidification of land and water.Fertilization of surface waters, both as a result of direct discharges of manure and as a consequence of nitrate, phosphate and potassium being leached from the soil. Contamination of the groundwater as a result of leaching, especially by nitrate. Phosphates are less readily leached out, but in areas where the soil is saturated with phosphate this substance is found in the groundwater more and more often.Surface water and the groundwater are being contaminated by heavy metals. High concentrations of these substances pose a threat to the health of man and animals. To a certain extent these heavy metals accumulate in the soil, from which they are taken up by crops. Acidification as a result of ammonia emission (volatilization) from livestock accommodation, manure storage facilities, and manure being spread on the land. Ammonia constitutes a major contribution to the acidification of the environment, especially in areas with considerable intensive livestock farming.

Key words: Organic fertilizers, Manure, Runoff, Environment, Groundwater, Surface water.

Modern Agriculture Practices is Responsible for Enviromental Pollution; Water Quality as a Global Issue

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Sustainable agriculture is one of the greatest challenges. Sustainability implies that agriculture not only secure a sustained food supply, but that its environmental, socio-economic and human health impacts are recognized and accounted for within national development plans. Sustainable development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for the present and future generations. Such Sustainable development (in the agriculture, forestry and fisheries sectors) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable. It is well known that agriculture is the single largest user of freshwater resources, using a global average of 70% of all surface water supplies. Except for water lost through evapotranspiration, agricultural water is recycled back to surface water and/or groundwater. However, agriculture is both cause and victim of water pollution. It is a cause through its discharge of pollutants and sediment to surface and/or groundwater, through net loss of soil by poor agricultural practices, and through salinization and waterlogging of irrigated land. It is a victim through use of wastewater and polluted surface and groundwater which contaminate crops and transmit disease to consumers and farm workers. Agriculture, as the single largest user of freshwater on a global basis and as a major cause of degradation of surface and groundwater resources through erosion and chemical runoff, has cause to be concerned about the global implications of water quality. The associated agrofood-processing industry is also a significant source of organic pollution in most countries. Aquaculture is now recognised as a major problem in freshwater, estuarine and coastal environments, leading to eutrophication and ecosystem damage. The principal environmental and public health dimensions of the global freshwater quality problem.

Key words: Global, Ecosystem, Agriculture, Water pollution.

Drying of Biomass for Co-Firing with Coal: A Case Study

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The world is developing rapidly and which is significantly facilitated by industrial attributes. Energy is the key factor in the growth of industries. Fossil fuels are largely being utilized conveniently for the generation of energy. Fossil fuels are non-renewable fuels formed by anaerobic decomposition of dead organisms. One of the major components of fossil fuel is carbon. Fossil fuels pose serious environmental problems during their conversion process.India is the third largest emitter of CO_2at present with a coal consumption of 565.64 million tonnes, which is a matter of serious concern. For 1MW power generation, approximately 0.7MT/hr bituminous coal is required, which is having fixed carbon percentage in the range of 45-85% and the approximate CO_2 production is 1.81MT/hr after combustion.CO_2 is one of the greenhouse gases that causes the average surface temperature to rise which vast majority of scientists think will cause adverse climatic effects.Thus the scientists are looking for renewable sources of energy so that greenhouse gas emissions can be reduced.One such method is using a blend of fossil fuel and biomass during co-firing in a power plant.Biomass is a biological material that is derived from living or recently living organisms. It is mostly derived from plants. As a fuel, it can be directly used or converted to some form of biofuel. Wood remains the largest biomass energy source to date. There are many examples like forest residues like dead trees, branches and wood stumps which can be used as biomass for co-firing. Yard clippings, wood chips and municipal waste. Industrial biomass can be grown from number of plants. Plant energy is produced by plants grown specifically for the use as fuel that produce high biomass output per hectare as compared to the low energy input like the straw that can be burnt to produce heat or electricity. But a major setback in using biomass is the moisture content. Due to moisture present in the biomass, the energy production of biomass is very less and hence inefficient. Moreover, due to the moisture content and high pressure in the boiler, corrosion of the boiler surface takes place, thus decreasing the life of boiler in the power plant.Instead if dry biomass is used, then a lot of benefits like improved efficiency, improved power production, reduced fuel usage, lower emissions and improved boiler operation can be obtained. So drying of biomass can have short term as well as long term benefits. There are many types of drying processes used for drying of biomass.
The present article presents the various drying methods, biomassco-firing with coal and its advantageous effects on environment.

Key words: Biomass, Drying, Dryers, Biomass co-firing, Environment

Spatail and Temporal Trend in the Dissolved Trace Metals in the Coastal Region of Sundarban Mangrove Wetland

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Rapid urbanization and industrial development during last decade have provoked some serious concerns for the environment. Metals contamination in river is one of the major quality issues in many fast growing cities, because maintenance of water quality and sanitation infrastructure did not increased along with population and urbanization growth especially for the developing countries. Water pollution by trace metals is an important factor in both geochemical cycling of metals and in environmental health and they are also getting importance for their non-degradable nature and often accumulate through tropic level causing a deleterious biological effect. Metals enter the aquatic environment from a variety of sources. Although most metals are naturally occurring through the biogeochemical cycle, they may also be added to environment through anthropogenic sources, including industrial and domestic effluents containing toxic metals as well as metal chelates, urban storm, water runoff, landfill leachate, atmospheric sources and boating activities. These point and non-point sources of pollution are responsible for deterioration of water quality posing threat on human beings and sustaining aquatic biodiversity.

Key words: Trace metals, Spatial and temporal pattern of distribution, heterogenicity Carcinogenic risk, Canonical correspondence analysis, Sundarban mangrove wetland.

Eucalyptus: A Novel Tree for Phytoremediation

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Eucalyptus belongs to the family Myrtaceae, mostly found in tropical region is a native to Australia. It is fast growing, easy to care, drought tolerate, and can be grown in poor or less fertile soil. It is a main material for paper pulp production, and a major source of bio-energy. *E. tereticornis* worked as bio-pumps (biodrainage) and lowered the water table and helps to remove toxic heavy metal Arsenic, Cesium, Chromium, Lead, Manganese, Zinc etc. They are capable to sequestering heavy metals and other environmental contaminants in their shoot tissues at high concentration. Generally, heavy metals such as cadmium and lead are not readily absorbed or captured by organisms. The assimilation of metals such as mercury into the food chain may worsen matters. Phytoremediation is useful in these situations, because natural plants or transgenic plants are able to bio-accumulate these toxins in their above-ground parts, which are then harvested for removal. Therefore, Phytoremediation is an emerging technology that uses plants to clean up organic and inorganic contaminants in-situ from soil, ground-water, surface water and even the atmosphere. These techniques include phytoextraction, rhizofiltration, Phytostabilization, Phytovolatilization, Phyto-degradation, Phytotransformation and removal for aerial contaminants.

Key word: Bio-pump, sequestration, food chain, phytoremediation, environment.

Toxic Effects of Neem Extract on Biodiversity

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Azadirachta indica is a tree in the family Meliaceae as is native to India, Pakistan and Bangladesh growing tropical and subtropical regions. Neem is natural source of insecticides, pesticides and agrochemicals and also used as bio-control agent to control many plant disease. With beneficial effect sometimes it has also bad effect on living organism and produces toxin on flora and fauna to affect their propagation, reproduction and overall lifecycle. Their toxic effects are studied on sheep, goat, guinea pigs, rabbits and various insect by affecting lifecycle. Additionally, Azadirachtin is the most prominent constituent of a series of limonoides (tetranortriterpenoids) present in the seed kernels of neem. The azadirachtin affect growth, development, behavior, reproduction and metamorphosis in diverse insect taxa. Their toxic effects are also reported on avian species, aquatic species, human and soil microorganism. Neem seed oil causes occasional diarrhea, nausea and general discomfort with physiological and metabolic process on human being. Children are badly affected by neem oil after their ingestion that causes vomiting, drowsiness, respiratory difficulty. The toxicological nature of neem is also harmful for the pregnant women. A higher dose can cause mortality. However, the seed oil is toxic and hence its use in large amounts may prove hazardous.

Key word: Azadirachtin, agrochemicals, limonoides, toxicology, metamorphosis, hazardous.

Allelopathic Alien Invasive Species as a Threat to Biodiversity

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Alien invasive plants are considered as a biggest threat to biodiversity next to habitat loss. These species multiply in alien environments vest fast and run very aggressive in a brief period imparting their harmful effects on native flora. Among the many reasons behind invasiveness, inhibitory allelopathic impact of them has been implicated as an important factor in many cases. During the last few decades, there has been a substantial work on invasive weeds in India, but very little study has been directed towards them in terms of allelopathic interaction with co-existing biodiversity. With this background, this study attempts to find out allelopathic impact of invasive weed *Eupatorium odoratum* L. on its associated weed *Mimosa pudica* L. The combination *E. odoratum* as donor plant and *M. pudica* as a target species has been selected because the later grows along with the former in forest edges, road-sides, crop-field margins of West Bengal. The experimental study reveals that various concentrations of leaf extracts and leaf leachates of *E. odoratum* reduced the germination, speed of germination, seed viability, field emergence capacity, plant growth and metabolism of *M. pudica.* This study thus concludes that inhibitory effect of *E. odoratum* has the potential to interrupt regeneration and growth processes of *M. pudica*. The study thus indicates that, *E. odoratum* should be treated as a potential threat to biodiversity.

Key words: Invasive species, allelopathy, biodiversity

Phytoremediational Potential of Mangrove Plants in Indian Sundarban Wetland

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Heavy metals are an important category of pollutants and as such have major detrimental impacts on the health of terrestrial and aquatic communities and ecosystems (S´anchez 2008). They released into aquatic systems and eventually settle down to be incorporated into sediments. Phytoremediation is a particular type of bioremediation that uses plants for the removal or degradation of harmful organic pollutants and toxic elements from soils, sediments, and waters (Paz-Alberto et al. 2011). It is a cost-effective "green" technology based on the use of specially selected elements-accumulating plants to remove toxic elements from soils and water (Ahmed et al., 2014). Mangrove plants special capability of surviving in high-salt and anoxic conditions and high tolerance to heavy metal stress (Alongi et al. 2004) contribute to their potential use in preventing dispersion of anthropogenic pollutants into aquatic ecosystems (Yang et al. 2008). In spite of their importance, mangrove ecosystems have suffered significant anthropogenic contaminant inputs due to their location close to urban development (MacFarlane et al. 2007), among which the majority are heavy metal pollutants (MacFarlane 2002).

The present research paper is going i) to assess the phytoremedial potential of flora growing on metal enriched soils ii) to reveal the potential of mangrove plants to accumulate and tolerate the above mentioned metals, and iii) to find out a potential bioindicator species for phytoremediation.

Key words: phytoremediation, bioindicator, index of geoaccumulation, enrichment factor, Sediment quality guideline, *Sonneratia apetala*

Solid Waste Management

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Solid waste is the unwanted or useless solid materials generated from combined residential, industrial and commercial activities in a given area. Systematic control of generation, collection, storage, transport, source separation, processing, treatment, recovery, and disposal of solid waste is collectively known as solid waste management. Increasing population levels, booming economy, rapid urbanization, and the rise in community level standards have greatly accelerated the municipal solid waste generation rate in developing countries. Today, the urban areas of Asia produce about 760,000 tonnes of municipal solid waste per day, or approximately 2.7 million m^3 per day. In 2025, this figure will increase to 1.8 million tonnes of waste per day, or 5.2 million m^3 per day. Therefore, managing wastes in a systematic method assumes importance in these countries.

Solid waste may be categorised according to its origin (domestic, industrial, commercial, construction or institutional); according to its contents (organic material, glass, metal, plastic paper etc); or according to hazard potential (toxic, non-toxin, flammable, radioactive, infectious etc). It causes environmental pollution, various health hazards to humans etc., therefore it is necessary that these wastes should be disposed off safely.

This paper explains various steps involved in solid waste management like collection, transportation and proper disposal, treatments like thermal treatment (which refers to processes that involve the use of heat to treat waste), biological waste treatment (where certain specific microbes act on the waste and degrade), dumps and landfills techniques where wastes are dumped or buried in the ground itself and the ill effects of solid wastes. This paper also explains the advantages of that particular technique used.

The objective of this paper is to create a safe environment by disposing these hazardous wastes properly using techniques which are efficient and economical.

Key words: wastes, pollution, microbes, disposal, techniques.

Genetically Modified Crops for Better Nutritive Value and Yield

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Food is one of the basic requirements of all organisms. On confining ourselves to *homo sapiens* and speaking in that perspective, the demand for food is being increased rapidly as human population is being amplified every second and it is estimated to reach 9 billion by 2050 but on the contrast to this the land available for agricultural purpose is getting reduced, this shows that food production and security is a major issue of concern.

We also find that major part of the food produced is lost during the pre-harvest period due to plant disease and due to the pests, rodents and mainly due to improper storage facilities during the post harvest period. To add on to this, climate is another factor which has a significant impact on food production. These environmental changes, new trading patterns and urbanization are all expected to increase pressures on food security in coming years. Thus there is a great need to find out the alternatives through which food production can be increased.

This paper is to convey some scientific methodologies that can be put into action in order to enhance the nutritive quality and yield of the crops. In this view transgenic crop plants is one of the major scientific approach. A transgenic crop plant contains a gene or genes which have been artificially inserted in a plant instead of the plant acquiring them through pollination. These transgenic crops are often called genetically modified or GM crops, although in reality all crops have been genetically modified from their original wild state by domestication, selection and controlled breeding over long periods of time. The transgene that is the inserted gene sequence may come from another unrelated plants, or from a completely different species for example: transgenic Bt corn, which produces its own insecticide, contains a gene from a bacterium.

Bacillus thuringiensis is a bacterium that is pathogenic for a number of insect pests. Its lethal effect is mediated by a protein toxin it produces. Through recombinant DNA methods, the toxin gene can be introduced directly into the genome of the plant where it is expressed and provides protection against insect pests of the plant. This gene from bacillus thuringiensis is incorporated in plants like cotton, maize, etc which are susceptible to insect infestation. The development of such kind of GM crops could lead to the reduction in the usage of insecticides, herbicides and tolerance for soil alkalinity free aluminum and iron toxicities.

The other aim of this work is to understand the production of golden rice at its root level and to discuss about its applications. Golden rice is a genetically modified variety of rice which is mainly introduced to address vitamin A deficiency which is wide spreading globally and majorly in south east countries. The theory behind golden rice is the biosynthesis of β-carotene (which is a precursor to vitamin A) in the endosperm of rice, thus increasing its nutritive value. As rice is the staple food for a large fraction of the world's population, thus golden rice can reach people easily and help to solve vitamin A deficiency crisis.

This paper also explains the enzyme catalyzed steps, recombinant DNA technology, splicing etc. and how the three transgenes (phytoene synthase, lycopebe β-cyclase, phytoene desaturase) are inserted into the DNA of rice that enables the plant to synthesis β-carotene its endosperm and how golden rice can be economically marketed.

Key words: transgenic crops, vitamin a deficiency, golden rice, β-carotene

Diversity Study on Ruteline Beetles (Scarabaeidae: Coleoptera) of Buxa Tiger Reserve (BTR), Dooars, West Bengal, India

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Scarab beetles composing the family Scarabaeidae is one of the largest family in the order Coleoptera. The total number of Scarabs from the world is reported to be around 27,800 species under 600 genera distributed over 11 subfamilies. Of this the subfamily Rutelinae is known by about 4,100 species under 200 genera worldwide.

Scarab beetles under the subfamily Rutelinaealso known as Shining leaf chafers play anindispensible role in agriculture and forestry. Both adults and larvae of some of these beetles are economically important and may cause considerable damage to agriculture and forestry due to defoliation or root-feeding, while many are beneficial because they pollinate plants, recycle plant material, and are valuable dung recyclers.Despite its importance in both agriculture and forestry, the subfamily is poorly known, particularly from this part of the globe and demandsserious revisionary studies. The study area Buxa Tiger Reserve (BTR), Dooars, is located in the biogeographic province 7B, lower gangetic plain of Eastern Himalayas and represents one of the tropical rain forests of Eastern India.It occupies an area of about 759.26 sq. kms and is located between latitudes 26°30" to 26°55" North and Longitudes 89°20" to 89°35" East of India.

Above prompted to study the taxonomic diversity of scarab beetles of the forest, as tropical rain forests support habitat for a huge range of insect species.

Both extensive and intensive surveys were conducted during 1993 – 2005 in different beats under different ranges of Buxa Tiger Reserve. Field visits were made in every month of each calendar year during the period of survey (except 15th June to 15th September when the forest remains closed for rejuvenation). For collection sweep nets, bush beating and collection in inverted umbrella, hand picking techniques were used. Several pit fall traps were laid in the collection localities of the Reserve to trap ground dwelling scarabs. Dung of various animals was also examined to make collections. In the evening hours UV light trap was used to collect nocturnal beetles. The collected samples were studied under Stereozoom Binocular Microscopes Zeiss SV6, SV11 and Olympus SZ 30.

The faunistic investigation on the diversity spectrum of the forest revealed in the recognition of 36 species under5 genera. Of these 5 species are recorded new from the Country, 9 from the state and 13from BTR. 11 species are recorded as endemic to India. The forest is dominated by the members of the Genus *Anomala* (n=20), of which the species *Anomalarufiventris* Redtenbacher is represented by highest number of individuals.

Their seasonal distribution is most during Premonsoon followed by Monsoon and Post monsoon. Zoogeographically all the recorded species are of oriental distribution followed by Ethiopian.

Key words: Diversity, Scarabaeidae, Rutelinae, New Records, Buxa Tiger Reserve

Organic Fertilizer from Halophytes: A Pathway to Alternative Livelihood in Indian Sundarbans

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Use of chemical fertilizers in large scale in recent times has caused deterioration of food quality and environment. People throughout the world have therefore inclined towards food growth through organic farming. Organic farming is based on the use of fertilizers prepared from floral ingredients including seaweeds and several other marine flora. The present paper describes the manufacture of organic fertilizer from rock clay, saltmarsh grass extract and mangrove litter extract. Nursery back up of the raw materials has been initiated in few islands of Indian Sundarbans to sustain the preparation of organic fertilizers from mangroves and mangrove associates. The efficacy of organic fertilizer has been established through high growth rate and chlorophyll content of *Heritiera fomes* (commonly known as Sundari), an endangered species of Indian Sundarbans. The present paper may open an alternative livelihood for the poverty stricken people of Indian Sundarbans.

Key words: Indian Sundarbans, organic fertilizers, mangrove litter, saltmarsh grass, alternative livelihood

Effect of Chlorpyrefos on The Enzyme Activities of an Epigeic Earthworm *Perionyx excavatus*, in Near Natural Conditions

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Insecticides are major inputs in addition to seed, fertilizer and water in the modern agro-ecosystems. Continuous and indiscriminate use of insecticides in agricultural fields causes serious damages to soil sub-system. Reduction in soil health including decline in invertebrate biodiversity, chemical and microbial activity apart from contamination of water and food chain are of great concern in recent years. Earthworms being the dominant constituent of the non-target invertebrate biomass in the soil are the worst victims of this environmental pollution. Earthworms constitute up to 92 % of soil invertebrate biomass. Earthworms are considered as ecosystem engineers having pronounced effect on soil structure and play an important role in leaf litter fragmentation, enhanced decomposition and accelerating nutrient recycling rates. Nitrogen-fixing bacteria are found in the gut and casts of earthworms which produce greater rates of nitrogen fixation in casts when compared with soil. Earthworms can also act as "biological concentrator" and are the potential transmitting agents and there is a possible risk of insecticides reaching higher trophic levels. Earthworms are thus wide used as key organisms in ecotoxicological research dealing with soil sub-system throughout the world. The acute toxicity for 96 hrs over the earthworms were recorded and then the activity of the enzymes acid phosphatase, alkaline phosphatase and the acetylcholinesterase (AchE) was determined under near natural conditions in natural garden soil (pH-7.17, organic carbon-0.86% moisture content-61.2%) by exposing the earthworms to Recommended Agricultural Dose (RAD) of an organophosphate pesticide, Chlorpyrifos. Three replicates of the treated pots were maintained. The specimen earthworms were kept in earthen flower pots of 1592 cm^2 area each containing 2000g of un-sieved garden soil along with 15 worms. 1.5-2.0 litres of water were added to maintain 60-70% moisture. The whole set up was kept at a suitable place where it would get equal amount of sunlight and shade. The soil temperature (12-15°C) and the ambient temperature (20-25±0.5°C) were measured and humidity (67%) was maintained. Small amount of water was sprinkled every day to avoid total dryness of the soil. The determination of acid phosphatase, alkaline phosphatase and AchE were performed on 5^{th}, 7^{th}, and 15^{th} and day from the setting of the experiment. In case of the treated pots the levels of activity of acid phosphatase and acetylcholinesterase were suppressed while the level of alkaline phosphatase activity was elevated with respect to the control pots. The percentage inhibition of actylcholinesterase activity in the treated pots was also measured. The results are: Acid phosphatase-3^{rd} day: control-7.4±1.0 µg PNP/mg of protein/30 mins, RAD- 6.8±1.0 µg PNP/mg of protein/30 mins, 7^{th} day:

Control-6.7±1.5 µg PNP/mg of protein/30 mins, RAD- 4.9±1.0 µg PNP/mg of protein/30 mins, 15th day: Control-7.0±1.0 µg PNP/mg of protein/30 mins, RAD- 6.8±1.5 µg PNP/mg of protein/30 mins, Alkaline phosphatase-3rd day: Control-10.0±1.0 µg PNP/mg of protein/30 mins, RAD- 20.7±2.0 µg PNP/mg of protein/30 mins, 7th day: Control- 13.5±1.0 µg PNP/mg of protein/30 mins, RAD- 23.6±2.0 µg PNP/mg of protein/30 mins, 15th day: Control: 13.5±1.0 µg PNP/mg of protein/30 mins, RAD-16.8±1.5 µg PNP/mg of protein/30 mins, Acetylcholinesterase: 3rd day: Control-140±3.0 nmoles/min/mg of protein, RAD- 80±2.5 nmoles/min/mg of protein(42.9% inhibition), 7th day: Control- 140±3.0 nmoles/min/mg of protein, RAD- 94.7±2.0 nmoles/min/mg of protein(32.3% inhibition), 15th day: Control- 142.8±3.5 nmoles/min/mg of protein, RAD- 96.3±2.5 nmoles/min/mg of protein(32.6% inhibition). The percentage mortality value of 96 hrs acute toxicity test of chloropyrifos was 20%. It is very clear from the results that the acid phosphatase and the acetylcholinesterase activity is suppressed up to 7 days but after that the suppressions decreased in the period between 7 and 15 days, i.e. the pesticide toxicity n the soil is the process of recovery and the normal condition of the soil is in its way of achievement slowly. Same is result in case of alkaline phosphatase. At first the level of alkaline phosphatase activity was highly elevated up to 7th day. But after that on the 15th day the level was suppressed considerably almost near to the control value. From the above study it can be concluded that Chlorpyrifos is apparently less toxic to the earthworms but it acts at tissue and enzyme level and can cause changes in acid phosphatase, alkaline phosphatase and the acetylcholinesterase activities and finally these three parameters can be studied and used as bio-markers to detect insecticide pollution in agro-ecosystems and this can also help in the study of pesticide contamination restoration in the soil.

Key words: Chlorpyrifos, acid phosphatase, acetylcholinesterase, biological concentrator, acute toxicity

Raiganj Wildlife Sanctuary, A Heaven to Asian Open-Bill Storks (*Anastomus oscitans*)

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The present study was undertaken to check the biodiversity profile of Raiganj Wildlife (Bird) Sanctuary, North Dinajpur, West Bengal, India specially focusing on Asian Open-Bill Storks population. Apart from Asian Open-Bill Storks other birds, odonates and butterfly diversity were also studied during October 2014. Attempts were made to identify the major threats to biodiversity chiefly caused by anthropogenic intervention and possible remedial measures to be taken for conservation of this unique ecoregion. Special emphasis was given to study the status of distribution, nesting behaviour and conservation threats of Asian open bill storks.

The 1.30 Km^2 sanctuary is located in-between and around north (25º37′48.82″-25º38′21.06″) to east (88º07′09.3″-88º07′00.49″) surrounded by the Kulik river. Birds were counted following the point count method (in some cases binocular frame count method). Bird density was calculated using following formula: $\check{D} = (n_1 + n_2 / \pi r^2 m) \log_e (n_1 + n_2/n_2)$ [where, r = radius of concentric zone from the point of observation (30 m and 50 m); n_1 = number of birds counted within r; n_2 = number of birds counted beyond r; m = number of replicate counts]. This sanctuary supports 32-40% of Asian open bills of south Asia during their breeding period (May to December) and known for one of the biggest heronry formation in Asia. Number of birds per year is nearly 70000 -80000 (according to population census). Nests were about 35-40 m high from the ground level and most of them were in the canopy of the nesting trees. On average in the present study we found 2-3 chicks per nest (total 4-5 individuals), and 4-6 nests per tree. Beside Asian open bills 4 main species of birds are most common- Black-crowned night heron(12016), Cattle egret(10124), Little egret(6678), Little cormorant(8445).In nesting behaviour study of Asian open bills over a specific time(6am-10 am, 11am-2pm, 3pm-4.30 pm) bi-parental care was observed. One parent was always protecting the nests from predators; another parent was going to search food or twigs. Change over time of parents' was 15-20 minutes on average. Spreading of wings to protect the chicks from sun, collecting twigs for making nest bed, watering of nests by wet leaves and twigs, regurgitation of food by parents were few interesting parental behaviours observed during the study. 30 species of butterflies (palm fly, blue Mormon, common Mormon, and common evening brown etc.) and 18 species of Odonates (fulvous forest skimmer, Asiatic blood tail, ground skimmer, ruddy marsh skimmer, coromandel marsh dart etc) are abundant in the sanctuary. Besides faunal diversity floral diversity of that

forest is also high, indicating towards a healthy ecosystem. This sanctuary (IUCN category II protected area) is presently facing serious threats mainly due to two sources-(i) natural [cyclonic storm, rain] (ii) anthropogenic intervention. Biotic interferences are of following types- habitat fragmentation (82%), poaching (52%), sound and air pollution (62%), pesticide use (73%), erosion of riverbank and fishing (49%) as opined by local residents (n= 120). Bird conservation implications are necessary to protect this high bio-diverse zone. Protection of sanctuary area by fencing, lowering of pesticide use, liming of surrounding wetlands, artificial supply of food (snail, fish etc), public awareness etc. can be implemented to maintain the aesthetic value of this eco-tourist spot and save a precise bio-indicator of this ecosystem.

Key words: Anthropogenic intervention, bird conservation, habitat fragmentation, threats, nesting site, population census, biodiversity, aesthetic value, eco-tourism,bio-indicator

Diversity, Distribution and Seasonal Variations of the Microzooplankton Tintinnids (Ciliophora: Tintinnida) along the Hooghly (Ganges) River Estuary

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Loricate ciliate tintinnids (TIN) (body size 20-200 µm) are ubiquitous components of plankton community and play important roles in aquatic ecosystems in regards of their abundance, biomass, diversity and energy turnover. TIN are important consumers of the pico and nano- sized fractions of the plankton and the linkage in transferring energy from the microbial loop to higher trophic levels in the marine and estuarine waters (Jiang et al., 2011). They differ from each other by the possession of vase-shaped shell (lorica), which sometimes consists of particles collected from the surrounding water & cemented together. Despite various investigations on coastal zone resources, ciliate protozoa as an important component were usually ignored for their small size, fast migration rate, fragile external membranes and the difficulty in laboratory culture (Wang et al., 2014). The present investigation was carried out to determine the diversity, distribution and seasonal distribution pattern of TIN communities in relation to selected environmental factors, which seems to be most crucial to ciliate communities in the meso-macrotidal Hooghly (Ganges) River Estuary (HRE).

Key words: Tintinnids, species assemblage, lorica oral diameter, seasonal pattern, Hooghly River Estuary

Bioavailability Assessment of Trace Metals in The Surface Sediments of Hugli (Ganges) River Estuary, India

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Contamination of aquatic environment by trace metals have been intensively studied in recent years, due to the fact that metals are persistent, toxic, tend to bioaccumulate, and that they induce a risk for humans and ecosystems (Lenoble et al.,2013). Metals released into coastal environments rapidly bind to particulate and sink to the sediments. However, sediments in coastal environment are a sink as well as possible delayed source for heavy metals into the aquatic phase due to desorption and remobilization with changing physiochemical conditions (Ra *et al.*, 2011a). Because of adsorption, hydrolysis and co-precipitation only a small portion of free metal ions stay dissolved in water and a large quantity of them get deposited in the sediment (Gaur et al. 2005). The study of sediment plays an important role as they have a long residence time. With respect to contaminated sediment, study of bioavailability is very important in predicting the potential environmental and ecotoxicological impacts (Tumer and Olsen, 2000). It may be defined as the maximum amount of a contaminant which is available, or solubilised, in the gastro intestinal environment of an organism (Tumer and Olsen, 2000).

Key words: sediment, trace metals, bioavailability, ecological risk assessment, Hugli River Estuary.

Promoting the Growth and Quality of Sugar free plant Stevia by Application of Sodium Benzoate

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Stevia rebaudiana is a medicinal plant belonging to the family Asteraceae. The leaves of *Stevia* contain sweet steviol glycoside which is a calorie free natural sweetener. This plant is very sensitive to water stress. Attempts are made to increase the tolerance capacity of this plant under adverse conditions. In this regard, an experiment was conducted in the Botany Research Building of DDU Gorakhpur University. *Stevia* plants were grown in earthenware pots containing sand supplied regularly with Hoagland's nutrient solution. The plants were divided into 8 sets with three replicates each. The treatments included S1-100 ml water, S2- 200 ml water, S3-300 ml water, S4 – control (400 ml water)., S5 – 100 ml water + Sodium benzoate (0.05%), S6 – 200 ml water + SB (0.05%), S7 – 300 ml water + SB (0.05%), S8 – control + SB (0.05%). The results of our experiment reveal that the morphological parameters viz. biomass, number of leaves, and plant height were greatly reduced on exposure to water stress and the biochemical contents viz. total nitrogen content, total protein content and total amino acid content were also significantly affected under water limited conditions. However, foliar application of Sodium Benzoate resulted in marked enhancement of the studied parameters hence promoting the growth and quality of *Stevia rebaudiana.* This study reveals the beneficial effects of sodium benzoate which is helpful in increasing the tolerance capacity of *Stevia* under water stress thus enhancing its growth and biochemical contents.

Key words: *Stevia rebaudiana*, Sodium Benzoate, growth, quality

Mapping of a Fern Species (*Diplazium esculentum* (Retz.)Sw.)in Western Himalayan Region using Geo-Informatics for Environmental Management

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Diplazium esculentum(Retz.) Sw. is a widely distributed fern species of India. In addition, various economic, environmental and medicinal values have also been reported from this species. Looking at its importance a mapping was carried out to know their probable spatial distribution in Kangra district of Himachal Pradesh, India using geo-informatics techniques. Various thematic layers such as elevation, soil pH, mean annual temperature, mean annual rainfall, actual evapo-transpiration, potential evapo-transpiration and moisture index were prepared and overlaid in Geographic Information System environment. The result showed that 59.34 % geographical area of the district was found as probable area suitable for its occurrence. It was observed that this species was mostly growing near household/industrial waste disposal sites, sewages and stagnant water channels. The same pattern of its distribution has been reported in literatures from other parts of country. The results suggest that this species may be a potential candidate for phytoremediation of polluted and degraded sites. Simultaneously a large area found as suitable for its occurrence in Himachal Pradesh may be an indicator of rising level of environmental degradation in this low disturbed region.

Key words: Diplazium; Environment; Fern; GIS; Himachal Pradesh; Mapping;

Evaluation of Pollutants in Rice Agro-Ecosystem of Hooghly District, West Bengal Employing Deformities of Chironomid Larvae

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The study examined the morphological deformities in Chironomid larvae resulting from environmental pollution such as heavy metals, pesticides as well as organic contaminants. Chironomid larvae were collected from rice fields from Rishra, Serampore and Khanakul District Hooghly, West Bengal, India. The samples were collected random and at monthly intervals during July 2009 to September 2012. At each sampling site, measurement of water pH, dissolve oxygen and water temperature were made. Total water analysis and XRF analysis were also made in the laboratory using soil samples. The head capsule was removed from the larval body and treated with a warm 10% KOH solution. Thereafter, the head capsules were washed in distilled water and transferred to 70% alcohol, and put in alcoholic phenol. The phenol–balsam technique was applied for preparation of microslides. The reference guides were used for identify larval sampled. The morphological deformities were recorded using a light microscope at low magnification (40x to 100x). Result showed significant differences in morphological deformities of larval head capsule between three rice field sampling sites. Samples obtained from Rishra exhibited high incidence of deformity (55.10%) compared with Serampore (26.53%) and Khanakul (18.37%). Out of the total deformity, response in mentum (49.80%) is much higher compare to antennal (30.62%) and mandible (19.59%). Collection site of Rishra was most polluted area with various types of industrial effluents discharge into the rice field periodically. Beside industrial effluents the farmer uses large amount of pesticide in the rice field. The occurrence of higher frequencies of deformities in Rishra indicated that the frequency of deformities was apparent with increase of environmental pollutants. Since chironomid larvae are non-target organism in rice field. Thus incidence of several types of mouthpart deformity in non target organism may be an early warning bio indicator system of the rice agroecosystem.

Key words: Chironomid larvae, Morphological deformity, Bioindicator, Pollution, Heavy metals, Pesticides, Rice fields

Phytoremidiation- A Review

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Global development raises new challenges, especially in the field of environmental protection. The demand for a country's economic agricultural and industrial development outweighs the demand for a safe, pure & natural environment; therefore, it is the industrial, economic & agricultural developments that are often linked to polluting environment. It has been found that human activities leads to substantial accumulation of heavy metals and other pollutants in soils Technology that use plants to clean up contaminated sites. Green technology that uses plants systems for remediation and restoration. Phytoremediation is that type of process uses plants to remove, transfer, stabilize, and destroy contaminants in soil and sediments. Contaminants may be either organic or inorganic. Unlike organic compounds, metals cannot be degraded, and clean up usually requires their removal. The major hazardous metals of concern in India in terms of their environmental load and health effects are lead, mercury, chromium, cadmium, copper and aluminium. Their source is mostly anthropogenic-industrial activity, vehicles, etc. Most of the conventional remedial technologies are expensive and inhibit the soil fertility; this subsequently causes negative impacts on the ecosystem. Hence, in order to deal with these contaminants in an eco-friendly manner considerable numbers of plants have been identified worldwide which are hyper accumulators of various heavy metals. Phytoremediation is gaining worldwide importance due to its low cost involvement and eco-friendliness. So, in this paper discussing the phyto remediation concept and its processes to overcome industrial soil pollution.

Key words: Heavymetas, Phytostabilization, Rhizofilteration, Rhizodegration, Soil sediments

Seasonal Avian Diversity from Heterogeneous Habitat Patches in and around an Urban City of West Bengal, India

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Urbanization and industrialization have incessantly contaminated the natural environment and as a consequence major cities around the globe are under immense threat of pollution. The present study site 'Steel City', Durgapur (23° 30' N; 87° 20' E), situated at the north bank of Damodar River is no exception of this. Situated at the juxtaposition of Lower Gangetic Plain and Deccan Peninsula this urban industrial belt of West Bengal houses many large and small scale industries, which includes Durgapur Steel Plant, Alloy Steel Plant, Battery factories, Durgapur Chemicals Limited and a number of sponge iron factories. However, Durgapur, since industrial inceptions, had definite plans to conserve its greenery. Consequently even today when the city is severely overloaded with real estates and other developmental projects, numerous vegetation patches and unoccupied lands are interspersed in between industrial areas and human habitats. The city surrounds are dotted with agricultural lands along with human settlements and receives water from a number of freshwater ponds and wetlands, however, the major contribution is played by river Damodar. However, this river receives various levels of pollution loads throughout its journey before merging into Hooghly River and has been counted in the list of most polluted rivers in India. Ever accelerating urbanization coupled with heavy pollution loads from burgeoning industries are ought to interfere with the natural functioning of ecosystem, consequently, it is felt important to monitor the biodiversity dynamics of the present study location with special reference to anthropogenic interventions. Birds are among one of the most studied taxonomic groups and well known as bio-indicator of ecosystem health and functioning. Alteration of microenvironment has been found to bring change in avifaunal community of a particular geographic area. In a developing country like ours, rapid urbanization is a major challenge to conserve biodiversity. India is presently ranked at seventh position in the list of countries having most number of threatened bird species. Study of the avifaunal communities in different urban habitats gives us the proper knowledge of city planning and urban bird conservation. The objective of this study is the quantification of avifaunal diversity from diverse habitat patches of Durgapur and its surrounding areas throughout the year. The changes in the population trends of bird species due to habitat alteration were also taken into account. Habitats were divided into 4 broad categories for the purpose of the present study, *i.e.* river, wetland and other water associated habitat types (RWW); grassland, bush and cultivation (GBC); woodlands (WL), and areas neighboring human settlements (HS). Data were recorded twice a month for two

whole years, during January 2013 – December 2014. Regular surveys were systematically done by modified point count method. In this method fixed radius (30 m, 50 m and 100 m) circular–plot was applied to record and calculate the density of the avian species. Birds were observed during the most active periods of the day, *i.e.* from 6:00 to 10:00 hrs and 15:00 to 18:00 hrs. However, observations were also made during other timings according to convenience. Nocturnal birds were identified and quantified by analyzing specific call patterns. The data of seasonal variation was evaluated by dividing the whole year into four major seasons *i.e.* summer (April-June), monsoon (July-September), autumn (October-November) and winter (December-March). Shannon-Wiener index of general diversity, Pielou's evenness index, Margalef's richness index and Simpson's dominance index were calculated to analyze the avian community structure. A two way ANOVA was performed to comment if there were any significant difference in bird diversity covering different seasons from different habitats. A total of 174 species belonging to 55 families were recorded in present study of which 4 species were under threatened categories (*viz.Ciconia episcopus*, *Leptoptilos javanicus*, *Threskiornis melanocephalus* and *Anhinga melanogaster*). The present study also revealed 7 species that were not reported previously from this ecoregion to the best of our knowledge. Highest number of species were found in habitat RWW (125 species) while the lowest number of species were recorded from HS habitat (80 species). This most clearly points out the negative impact of anthropogenic interventions on birds from the present study location. Out of the 4 threatened species found in the present study 3 were associated with GBC. 31 species recorded in the present study were found to belong in habitat generalist category, while, 71 species were found to be habitat specialist most of which were associated with RWW (33 species). Overall diversity analysis showed highest diversity at GBC (Shannon-Wiener Diversity index score 3.86), while lowest diversity score was recorded from RWW (Shannon-Wiener Diversity index score 3.27). Again, seasonal fluctuation of Shannon-Wiener diversity was found to be most prominent in RWW because of high abundance of winter migrant species in autumn and winter seasons, which also resulted in highest overall dominance and lowest evenness scores from this study area. No significant variation in bird diversity covering different seasons was found in the ANOVA study. However, significant difference in bird diversity was observed when comparisons were made between different habitat types ($p < 0.05$, ANOVA with Tukey's comparisons). Though the avian diversity and abundance were found to be on the higher side from the present study location its worth mentioning that areas with human habitats and industrial settlements were less diverse for avian diversity. The present findings strongly indicate the negative influence of anthropogenic activities on avian diversity. Urbanization has been reported to affect nesting, predation, brood parasitism and food availability and during the present investigation we also found instances of all of these. Moreover, Urbanization has often been found to replace specialist by generalists and the present study also attests the statement. As in most part of the world, diversity in and around the present study location is also facing immense threat from burgeoning human activities. Once densely forested, this region is presently represented by patches of forest lands. Moreover, the increased inclination towards profitable monoculture of plants is destructing the forest heterogeneity along with diminishing diversity. Concerns from all corner of the society are a prime need of the hour to conserve this diverse ecoregion.

Key words: Habitat Association, Durgapur, West Bengal, Avifaunal Diversity

ANOVA, Point Count, Urban City
Association of Climatic Variables with Lactation Peformance of Deoni Cows in Subtropical Region of India

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Livestock sector plays a critical role in the welfare of India's rural population. India is endowed with significant share of world livestock population as well as milk production. The total milk production of India during 2011-12 is 121.7 million tonnes. The India ranks first in the world for milk production and the per capita milk consumption of world is 281 gm per day (FAO, 2011). Cattle are the foundation of Indian farming and their importance as milk and draught animal has been recognized since ages together. Milk is an ideal food, for all and everywhere. So far as the productivity is concerned, the indigenous cattle are by far below the level of economic viability. Improvement in production and performance traits of indigenous breeds becomes essential to make them economically viable. Among the various factors affecting animal productivity climate is one. Change in climate is stressful for livestock. Climate change will have direct effects on livestock performance and welfare, mainly through increases in temperature and the frequency of extreme weather events, and will also affect animals indirectly through changes in the availability of fodder and pasture and the distribution of pests and parasites. High temperatures are associated with a greater incidence of heat stress in livestock, which can have negative effects on milk yield, a better understanding of how livestock respond to weather is essential to enable farming to adapt to a changing climate. Climate change is mainly expected to impact dairy cattle through heat stress and an increase in the frequency of extreme weather events.

The research is designed to investigate the effects of climatic variables on milk yield and lactation length in Deoni cattle maintained at Cattle Cross Breeding Project herd, Vasantrao Naik Marathwada Agriculture University, Parbhani of Marathwada region of Maharashtra. Milk data of 438 lactation records of Deoni cows and the meteorological data over a period of 15 years (1995-2008) were obtained from Cattle Cross Breeding Project, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani and University Meteorological Observatory, respectively.

The data on milk yield were plotted against the monthly maximum and minimum temperature, monthly relative humidity at morning hours and evening hours, monthly

temperature humidity index similarly the data on milk yield were plotted against sunshine hours, monthly wind velocity, monthly THI for analysis. In order to find out the precise effect of seasonal climate on milk yield in indigenous and crossbred, the data were plotted against the monthly attributes for this purpose, the complete year was divided into 3 seasons as rainy (June to September), winter (October to January) and summer (February to May). To investigate the effect of environmental variables on lactation length and lactation milk yield, the data were analysed by using correlation and multiple regression model. The main environmental variables were also compiled as monthly minimum and maximum temperature, monthly minimum and maximum relative humidity, monthly wind speed (km/hr) and monthly sunshine (hr) as well as THI. This multiple regression equation describes an average relationship between dependent and independent variable, which is used to predict the dependent variables. The variability of model was tested with the help of coefficient of multiple regressions (R^2). The significance of R^2 was tested with 'F' test and significance of individual partial regression coefficient was tested with student't' test. To determine the role various environmental factors in the variation of lactation length, lactation and milk yield, stepwise regression was undertaken based on the contribution of different environmental variables. Basically, regression helps to estimate the functional relationship between the independent and dependent variables.

It was observed that lactation milk yield and lactation length was highest (542.97 $\pm$ 16.40 and 195.07 $\pm$ 9.85) among the cows calved during winter season as compared to rainy (515.91 $\pm$ 26.99 and 177.04 $\pm$ 5.3) and summer season (480.24 $\pm$ 18.52, 174.53 $\pm$ 7.29). All the climatic variables considered in the study accounted for 43 %, 82 % and 86 % direct variation on lactation milk yield and 37 %, 42 % and 47 % direct variation on lactation length in rainy, winter and summer season, respectively, as verified by the value of coefficient of determination (R^2). This research indicates that Deoni cows were not sensitive to seasonal changes on their lactation length, but causes direct variation in the range of 82 to 87 per cent in lactation milk yield in winter and summer seasons. This indicates that Deoni cows are exposed to negative effects of heat stress in relation to lactation milk yield in this region and demanding additional productive strategies like improving environment, management and comfort level of cows for increasing their lactation performance. As climatic variables causes Deoni cows are originated in this region they did not suffer much from heat stress but if favorable conditions are provided to these animals their productivity will be increased in future.

Key words: Climatic factors, lactation milk yield, lactation length, regression

Observations on Nectar Plant Preference Repertoire of Butterflies and Their Possible Role in Propagation of Flowering Plants in Kolkata Metropolis

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Butterflies (order Lepidoptera; suborder Rhopalocera), the flying jewels play an important role in nature. Apart from being one of the most prominent biodiversity indicators they also act as our native gardener for their dependence on indigenous plants for completion of the life cycle. We had a butterfly garden within Lady Brabourne college campus which was found to be frequented regularly by about 29 species of butterflies.

This study was undertakento understand the relevance of butterflies in the propagation of flowering plants in Kolkata and its surrounding areas.

The butterflies and other pollinators were surveyed in the study area over a period of two years. The nectar plant preference for those butterflies was studied in different time slots in different seasons for the last two years.Behaviour of butterflies was studied using focal-animal sampling method.

Here we present observations on feeding and plant preference behaviour of the different species of butterflies found in our study area. Time based and seasonal study of their behaviour over fixed time intervals revealed thatthe butterflies have definite nectering preferences towards the so called weeds. These neglected plants are the more preferred ones than any other garden plants. The Exotics like *Lantana* which were earlier reported to be highly preferred are now being preferred over by *Mikania*, *Leonurus, Stachyterpheta* etc.

The differential preference potential as well as pollination capabilities of the butterflies studied here may shed a light on the propagation pattern of so called 'weeds' of the Kolkata metropolis. This study will surely add to our future attempts in understanding the complex nature of interaction between an environmentally important group like butterflies with its immediate surroundings. This study will also contribute to the plan of biodiversity restoration and development of management strategies for such habitats in the urban area.

Key words: Butterfly, Butterfly garden, Nectar, Weed, Food preference,Insect - plant interaction,Biodiversity indicators.

Effectiveness of C/N Ratio during Rotary Drum Composting of Sewage Sludge

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Sewage sludge is an unavoidable by-product during wastewater treatment processes; as it contains harmful substances, such as heavy metals, unstabilized organic compounds, pathogens, viruses, etc. which make its disposal management difficult. Therefore, recycling has become an alternative approach for sewage sludge management, and yields a product potentially useful for agriculture. Rotary drum composting is a proven technology to produce uniform end product without any odour or leachate related problems by providing proper agitation and aeration between the waste materials. As a result, the composting time is drastically reduced to 2-3 weeks. In addition, the quantity and nutrients balance as well as the degree of availability of nutrients to various microorganisms are essential. For achieving good quality compost, environmental factors such as temperature, moisture content, nutrients should be appropriately controlled.

The effects on composting at different initial C/N ratios on the decomposition, hygienization and stability process are not well understood. With this issue in mind, the aim of the study was to investigate the changes in physicochemical, biological and stability properties of composting of sewage sludge mixed with cattle manure and sawdust at an initial C/N ratio of 15, 20, 25 and 30 including control in a rotary drum type composter.

Key words: Sewage sludge; Composting; Rotary drum; C/N ratio; Stability

Role of Geographical Indications in Biodiversity Conservation and Sustainable Development

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Geographical Indications are a category of Intellectual Property Rights and are defined as 'a sign used on goods that have specific geographic origin and possess qualities or reputation that are due to that place of origin'. A number of International Conventions such as Paris Convention, Madrid Agreement, Lisbon Agreement and Trade Related Aspects of Intellectual Property (TRIPS) Agreement have paved way for formulation of Geographical Indications. They have been broadly categorized as Quality Trademark, Apellates of Origin (AO), Protected Geographical Indications (PGO) and Protected Designation of Origin (PDO). Present article envisages the protection granted by Geographical Indications by citing interesting cases. Geographical Indication system in India is elaborated by case studies in respect of several Indian products. The study also encompasses how biodiversity conservation is closely linked to implementation of Geographical Indications. Certain agricultural products or endangered genetic resources when linked to Geographical Indications undergo popularization and widespread marketing resulting in recovery of endangered genetic resources and conservation of germplasm by producers in collaboration with regional or national research centres. Geographical Indications also provide an effective tool to indigenous communities to strengthen their traditional knowledge by popularization of underutilized genetic resources that were neglected by industrialization. But the implementation of Geographical Indications as a vehicle for genetic resource management and biodiversity conservation is more pronounced in developed rather than developing countries. Therefore there is an urgent need of formulation of proper legal framework in developing countries which should be precise, flexible and low cost for effective conservation of biodiversity and sustainable development.

Key words: Quality Trademark, Protected Geographical Indications, Apellates of Origin, Darjeeling Tea, genetic resources, traditional knowledge, developing countries, sustainable use

Ethnomedicinal Plants used by the Paite Tribe of Manipur, India

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The present study deals with an investigation on the conservation of ethnomedicinal plants which are variedly used in various ailments. Ethnobotanical survey based on the utilization of plants by the tribals has gained has gained much importance in the recent past all over the world. A lot of etnobotanical work is accumulated from the study. Total 34 plants species were documented during the ethnobotanical studies in the Paite inhabited villages Singhat sub-division of Churachandpur district which is about 175 kms from Imphal. The villagers used the different parts of the plants like leaves, roots, stem, bark, in curing different ailments. The plants mostly are wild and unattended need to be conserved as soon as possible for more further investigation.

Key words: Conservation, Churachandpur, Ethnobotany, Paite, Manipur.

Some Ethnobotanical Plants Found in Villages Nearby Nambor-Doigrung Wild Life Sanctuary of Golaghat, Assam, India, used by Mising Tribe along with Their Conservation Needs

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The term Ethnobotany was first coined by Harshberger in 1895. Ethnobotany is usually defined as anthropological approach to botany. Ethnobotany deals with the direct relationship of plants with man. Mising is a tribal community belonged to Mongoloid group – a multitude of people that followed Austro-Asiatic races to India. Livelihood system of Mising people is traditionally dependent on the forest resources. They are agriculturist, hard working and very much peace loving. The present paper highlights plants used in different ethnobotanical fields(edible, curing diseases including ethnoveterinary, furniture/wood, religious beliefs etc.). A small group of people has been selected and interviewed qualitatively about a wide range of topics in a semi-structured way, allowing a comprehensive view of how community acts as a whole. The herbarium label include the name of the institution, and of the collector, the project title, local name, family, genus and species of the specimen, specialist and date of collection, locality, vegetation and habitat, latitude and longitude, altitude, plant description and collection date. Picture of plant in its natural habitat has also been taken as it is very useful for its identification. The list of plant names has been compiled and presented in tabular form. Different plants (40) used in various ethnobotanical uses by the tribe have been specified. A review of scientific literature of Ethnobotanical information in the present study shows that not many plants have been scientifically studied. So, it is high time to document and properly identify and conserve the Traditional knowledge of the tribals regarding the uses of the plants. A considerable number of Ethnobotanical plants need to be studied to discover their potential in obtaining newer drugs from those plants. Conservation efforts need to be taken up as soon as possible for preservation of these plant species. Otherwise, these plant resources will be lost that may never be replaced.

Key words: Ethnobotany, Anthropology, Mising, Ethnoveterinary, Traditional knowledge.

Evaluation of Some Microbial Preparations Against*Scirpophaga Incertulas* (Walker) on Rice in Cachar District of Assam

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Rice is the staple food for more than 65% of the Indian population and cultivation of rice is the main occupation of those engaged in agriculture. In Assam, rice occupies about two-third of the total cropped area in the state and being the major source of agricultural GDP. As a result rice plays a significant role in the state economy. In Assam, due to geo-climatic variations and agriculture's dependence on rainfall, wet land cultivation is practice and is traditionally-grown throughout the year *viz*., Boro or summer rice (November/December to May/June); Aus or autumn rice (March/April to June/July); and Sali or winter rice (June/July to November/December) with winter (Kharif) rice as the main crop. The climate in this region with high rainfall and humidity is conducive for pest incidence and multiplication. Among the paddy pests, yellow stem borer (YSB), *Scirpophaga incertulas* Walker is distributed throughout India and is regarded as the most dominating and destructive pest species. This is a pest across all ecosystems and as monophagous pest damages the rice crop from nursery to harvest**.** The damage symptoms due to stem borer larvae on affected plants differ with the development period at whichplant infestation is initiated. If the plant is young, the center leaves of the damaged tillers turn brown and die. This condition is called 'dead heart'. If the damage occurs after the spikelets form, then the panicles turn white - a condition known as 'whitehead'. It causes more than 3 to 95% yield loss in India and accounts for 50% of all insecticides used in rice field.. The microbial pesticides offer an alternative to chemical insecticides with increased target specificity and ecological safety so that they are used either uniqly or in combination with other pest management programmes. They have efficiency and safety for humans and other non target organisms. These are ecologically safe, so that other natural enemies are free of their threatening, leading to preservation of other natural enemies, and increased biodiversity in managed ecosystem. So, microbial agents are highly specific against target pests so they facilitate the survival of beneficial insects in treated crops. Keeping the above facts in mind, the present study was undertaken to evaluate the efficacy of some micro organisms against the pest infestation. For the efficacy test, five treatments were assayed against the pest species, *viz*., *Beauveria bassiana* (Jas Bessi), *Metarhizium anisopliae* (Jas Mata), *Trichoderma viride* (Neemoderm), *Pseudomonas fluorescence* (Pseudocare) *a*nd *Verticellium lecanii* (Jas Verti). Two concentrations, one recommended dose and the other higher the recommended dose for each treatment was tested. The experiment was laid out in RBD (Randomized Block Design) method. Each treatment was replicated thrice. Treatments were applied as foliar spray and spraying was done twice in a season, one at vegetative and second one at reproductive

phase of the crop i.e., 40 and 80 days after of transplantation. The knapsack sprayer and spray volume @ 100 ml/m^2 was used with hollow cone nozzle to impose the spray treatments. Observations on stem borer infestation were recorded at 1st, 7th, 15th and 21st days after application of each treatment. Control (water spray) was run against the treatments. Data were statistically analyzed after transformed into Arc sin value. ANOVA was employed to test the efficacy of treatments by using MS-Excel software. Though initially microbial agents did not show better performance against control, but after a week observations almost all the treatments showed better performance compared to the initial observation over control. The overall treatment revealed that among the micro organisms, the highest efficacy was showed by *Trichoderma viridae* (recommended dose) (1.74% DH) giving percent reduction of 84.46 % over control (11.21% DH) followed by *Pseudomonas fluorescence* (recommended dose) (2.19% DH) and *Verticellium lecanii* (higher dose) (2.22% DH) during vegetative phase of the crop plant. While, the least efficacy was showed by *Metarhizium anisopliae* (recommended dose) giving the infestation percent of 5.30% DH and 52.72% reduction over control (11.21% DH), followed by *Metarhizium anisopliae* (double the recommended dose) (4.27% DH) and *Pseudomonas fluorescence* (double the recommended dose) (3.16% DH). During reproductive phase of the crop plant also, the highest efficacy was showed by *Trichoderma viridae* (recommended dose) (1.37% WH) giving percent infestation reduction of 83.81% over control (8.48% WH) followed by *Beauveria bassiana* (recommended dose) (1.41% WH) and *Trichoderma viridae* (double the recommended dose) (1.61% WH). And the least efficacy was showed by *Metarhizium anisopliae* (recommended dose) giving 2.93% WH infestation percent and 65.50% WH reduction over control (8.48% WH), followed by *Pseudomonas fluorescence* (double the recommended dose) (2.50% WH) and *Metarhizium anisopliae* (double the recommended dose) (2.40% WH).From the experiment conducted, it can be concluded that during both the vegetative and reproductive phase of the crop plant the least infestation of the paddy was observed from treatment *Trichoderma viridae* (recommended dose) proved to be the most effective treatment among all the other treatments which may be recommended in controlling the *S. incertulas*.

Key words: Deadheart, Infestation, Vegetative, Whiteheads, Microbial insecticide

Bio-Efficacy of Bio-Pesticides against Tetranychyus Cinnabarinus (Boisduval) Infesting Solanum Melongena in Cachar District, Asssam

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Brinjal (*Solanum melongena* L.) is an important Solanaceous crop of sub- tropics and tropics. It is the perennial grown commercially as an annual crop. Brinjal has been cultivated in India for the last 4,000 years, although it is often thought of as a Mediterranean or mid-eastern vegetable. Besides, it is use as a fresh vegetable, and known to have medicinal properties in curing diabetes and remedy for liver complaints. The fruit is an excellent cholesterol regulator. Apart from these, brinjal is a good source of ascorbic acid and phenolics, both of which are powerful antioxidants. Brinjal is considered as a very good source of dietery fiber, which lowers the risk of coronary heart disease (Wagner, 2006). However, it is widely cultivated in both temperate and tropical regions (grown mainly during warm season) of the globe (Rai *et al*., 1995).Brinjal (also known as eggplant) is an economically important vegetable grown over 1.7 million hectares worldwide with a production of 29.46 million tonnes with an average productivity of 17.43 tonnes per hectare during 2004-05 (Anon., 2006a). Many reports indicated that mites suck the sap usually from the lower surface of leaves producing small white specks, which gradually dry and drop off. The decreased vitality and leaf drop adversely affect plant growth, flowering and fruiting. In severe infestation, *Tetranychid* mites web profusely and form a thick sheath of webbing that covers the entire plant (Grandjean, 1948 and Jeppson *et al*, 1995) these webs become filled with soil particle in windy weather and inhibit the photosynthetic activity of the plant. Thus the mite has been proved as an indirect pest causing loss in quality and quantity of the yield. (Butani and Mittal, 1992). In brinjal spider mites appeared much earlier on summer crop as compared to Kharif and Rabi. Botanical pesticides are important alternatives to synthetic pesticides since they possess an array of beneficial properties including repellent, antifeeding, growth regulatory activity and toxicity to insect and mite pests (Prakash *et al*., 2008).Increasing health awareness of the society on pesticide residue in agricultural products requires environmentally safe pest control methods free from pesticides. Neem extract is known as a potential insect repellent, antifeedant, growth regulator and ovipositional deterrent affecting more than 200 species of arthropod pests (Ascher, 1993). Considering the above facts an attempt has been made to study the bio-efficay of biopesticides against *T. cinnabarinus*. For the management practice study was carried out in Irongmara field, which is 2 kms away from the University campus. Four bio-pesticides i.e Neemexcel (Azadiractin 0.15%EC), Achook (Azadiractin 0.03% EC), Rishabh (Cashew nut shell product) and Neemozyme (Ascophylum nodosum) were tested against the pest. Bio efficacy was evaluated in Randomised Block Design (RBD) method with bio pesticides. Control (water spray) was also run against the treatment. During spraying, emphasis was given on the ventral

surface of the leaves because *T.cinnabarinus* inhabits mostly on the ventral surface of the leaves. Five leaves were selected at random from each treated plant. The mite population count per 5 quadrats of 1cm2 on each leaf was observed. The number of living mites per 5 quadrats of $1cm^2$ in each leaf were recorded Observations were made at 1^{st}, 3^{rd}, 5^{th} and 7^{th} day after treatment. On 1^{st} DAT cent percent mortality was observed by Risabh 2.0% and Neemozyme 2.0% against immature stage. In case of adult, cent percent mortality was observed on both the concentrations of Risabh (2.0% & 1.0%) followed by Neemozyme 2.0% with 94.50% mortality and less effective were recorded by Neemexcel 1.0% and Neemozyme 1.0% with 72.2% pest mortality. On 3^{rd} DAT, cent percent mortality of immature stage was observed by Neemexcel 1.0%, Risabh (1.0% & 2.0%) and Neemozyme 2.0%. In case of adult pest, both the concentration of Risabh (1.0% & 2.0%) was afforded 100.0 % mortality followed by Neemozyme 2.0%. On 5^{th} DAT, cent percent mortality was recorded on both the concentrations of Neemexcel and Risabh (2.0% & 1.0%) followed by Neemozyme 2.0% with 78.20%. In case of adult, cent percent mortality was recorded on both the concentrations of Neemexcel and Risabh (2.0% & 1.0%) and Neemozyme 2.0%, least effectiveness was observed on Achook 0.3% which afforded 73.0% mortality. On 7^{th} DAT, 100 % mortality was recorded in immature stage by Rishabh 1.0 % and least effectiveness showed by Neemozyme 1.0% with 42.10% mortality. In case of adult cent percent mortality was observed on Risabh 1% and least effective on Neemozyme 1.0% with 61.10% mortality. After $3^{rd}$and 7^{th} day of treatment in case of immature stage, the study revealed significant effect at $p<0.05$ but in case of adult it showed significant effect only after 1^{st} day of treatment.From the above result it was found that Risabh both the concentrations (2.0% &1.0%) proved to be more effective than other bio pesticides. Therefore, Risabh may be recommended against the *T.cinnabarinus* pestpolulation in agro-climatic conditions of Cachar District of Assam.

Key words: Pest, brinjal leaf, mortality, effective, significant

Description of Free Living Marine Ciliate *Hemigastrostyla Enigmatica*from Velas Beach, Ratnagiri (M.S.)

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Free living ciliates are usually abundant in various eutrophic marine biotopes playing significant roles in marine ecosystems.Compared with those inhabiting freshwater or soil biotopes,relatively fewer studies have been conducted on the marine forms in recent decades.Marine ciliate *H.enigmatica*(Dragesco & Dragesco Kerenis, 1986), new to Ratnagiri,were collected from the velas beach,Ratnagiri.They were identified based on live observation and taxonomical characters of *H.enigmatica*.

The objective of this study to observethe taxonomical character of *H.enigmatica*.From Velas Beach, Ratnagiri (M.S.)

Samples were collected from velas beach Ratnagiri (M.S).*Hemigastrostyla enigmatica* was found in sample collected on September 2014 from velas beach Ratnagiri when the water temperature was 27oc and the salinity 33%. Ciliate were isolated and cultures were establishedat room temperature in beaker containing filtered sea water with squeezed rice grain to enrich the bacterial food (Song et al. 2011).

For permanent slide preparation various method was used on the basis of protozoan class. Silver line system (KLEIN, 1926-58)is applied to demonstrate the sliver line system in different protozoans.Hematoxylin stain was used as nuclear stain.The present species was compaire with H.paraenigmatica and H.elongata and after comparison the present species was *Hemigastrostyla enigmatica.*

Key words: Taxonomy, Shape, AZM, *H.enigmatica.*

Allylpyrocatechol Reduces DNA Damage by Reducing Reactive Oxygen Species

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Oxidative stress is defined as an imbalance between pro-oxidants and anti-oxidants, leading to disruption of redox signalling culminating in cellular damage. Reactive oxygen species (ROS) are important pro-oxidant molecules generated through an incomplete reduction of oxygen molecules especially during respiration. Rapid urbanization leads to pollution of environment. This in turn is responsible for increased generation of ROS in the body with depletion of the anti-oxidant enzymes causing increased oxidative stress. This generation of ROS gets amplified in several pathophysiological conditions such as inflammation, immunological disorders, exposure to UV or radiation etc. They manifest detrimental consequences by virtue of their reaction with cellular components like the cell wall, lipid membranes, mitochondria and DNA. ROS can produce gross chromosomal alterations in addition to point mutations and are known to cause DNA lesions and breaks. Nitric oxide (NO) and the reactive products derived from it such as peroxiynitrite are mutagenic agents which are responsible for nitration, nitrosation and deamination reactions on DNA bases.
Allylpyrocatechol (APC) is responsible for the anti-inflammatory activity exhibited by the methanolic extract of leaves of *Piper betle* but knowledge of its role in ROS production is limited. This study intends to explore the efficacy of APC in reducing ROS production and ROS induced DNA damage.

Key words: Allylpyrocatechol, DNA cleavage, nitric oxide, ROS, superoxide radicals

Avian Diversity of Powarkheda Fish Farm, Hoshangabad, Central India

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India is one such destination, which provide wintering grounds for migratory water birds and has a rich variety of wetland habitats. Powarkheda fish farm is a very important fish seed production and rearing unit of Madhya Pradesh Fisheries Federation and Central Institute of Fisheries Education (CIFE). The total area of the farm is about 42 ha among which 34 ha is used for fisheries. There are 8 brooder ponds 20 rearing pond and 66 nursery ponds. 8 ha land of the farm is lying as forest. There is a small canal passing through the farm. The water birds gather in this farm and use the forest as their resting and nesting ground. It was also observed that when the water depth of the nursery and rearing ponds reduced, formed a marshy land which is the most favored habitat for wetland birds as the marshy lands are full of benthic animals and macrophytes which serves as their food. An observation was made on the diversity of water birds in Powarkheda fish farm from January 2014 to December 2014. The primary objective of this study is to provide a base line assessment of the present state of the avifaunal population of Powarkheda farm to document the avian profile of the area, document the habitats available to the water birds and to study habitat utilization by different species of water birds. Identification of water birds by morphological characters using by Ali, S. (2002) with the help of Nikon binoculars of 12x50 magnification and their distribution in the farm area. A total of 41 species of water birds belonging to 7 order and 10 families were recorded from the farm during the study. Migratory birds also visit the farm during winter season. Ardeidae was the most dominant family recorded throughout the year, in terms of species richness and population. According to IUCN threatened bird list (2014) there were four near threatened wetland bird species (Painted Stork, Black-necked Stork, Oriental White Ibis and Darter) and one vulnerable species (White-Necked Stork). The mosaic of habitats makes it a unique avifaunal refuge.

Key words: Powarkheda fish farm, water birds, diversity, conservation status, bird habitats

Plankton Diversity and Distribution in High Altitude Rice Fields of Apatani Plateau, Arunachal Pradesh

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The flooded hill agro ecosystems in high altitude (5000 ft above mean sea level) are being utilized by 'Apatani' tribes in Ziro valley ($26^0$50/ - $98^0$21/ N latitude and $92^0$40/ - $94^0$21/ E longitude), Arunachal Pradesh, since time immemorial.They also adopted the practice of raising fish as companion crop of wetland rice making the whole farming a low input, organic and eco-friendly system. The sources of water in these high altitude rice fields are the diverted mountain streams and trickle down rain water of the monsoon season. Therefore the rice field forms a unique habitat naturally for diversified groups of fish food organisms during the season. However, there exist hardly any information regarding the abundance, diversity and distribution of such aquatic resources. Plankton are one of the important aquatic resources comprised of unicellular or multicellular organisms which are floating and drifting with limited power of locomotion. They play a vital role in high altitude ricefish farming for the growth and development of stocked fish. Being an important ecological indicator, Zooplankters occupy a central position between planktonic autotrophs (phytoplankton and periphyton) and heterotrophs (macro invertebrates and fishes).

Key words: Phytoplankton diversity, Zooplankton diversity, high altitude wet rice field, Ziro Valley

Diversity of Cladoceran (Crustacea: Branchiopods) in Flood Plain Wetlands of Subansiri River Basin, Assam

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Flood plains wetlands in subansiri river basin are existing as heterogeneous water bodies along the river subansiri forming potential habitat for wetland fauna and flora including planktonic life forms. The cladocreans are zoolplantonic life form belongs to Arthropoda, crustacea, class Branchiopoda, divided into 4 suborder, 11 families, 80 genera and 400 speceis. These are small crustacean generally ranging in size from 0.2 to 5.0 mm with one compound eyes and thoracic appendages phyllopod. The body and limbs are covered by a bivalve carapace which is composed of single pieces with no hinge dorsally. These are important component as live fish food for many species of fish especially for juvenile stages. In addition to that these groups play an important role in the nutrient cycling occupying the second trophic level in aquatic ecosystem. These wetlands posses good potentiality of fish production. However there is no information on cladoceran abundance, diversity and distribution from the study area particularly in the context of secondary productivity of fishes till date.

On the above background a study was carried out to obtain a base line data on population dynamic and species diversity of cladocera for a period of one year from June, 2013 to May, 2014. Monthly samplings of planktons are done in three categories of flood plain wetlands (Oxbow lake, Beel and Deep water rice field) in 12 selected sample sites. Cladoceran samples are randomly collected by filtering 100 litres of the subsurface water with a plankton net made of nylon cloth (mesh size 60 µm). The content collected in the plankton tube were transferred to polyethylene tube and preserved with 4% formalin. The quantitative studies are done by following Lackeys drop count method under Nikon eclipse E2000. The population dynamics was accomplished for four seasons viz, Premonsoon, Monsoon, Postmonsoon and winter. The permanent mount of different species made in glycerine were examined under Olympus CX4 and Leica DM 3000. For determining species diversity various diversity indices (Bargar Parker, Simpson and Shannon weiner) and for richness (Margalefs and menhenick) were used. The cladocerans were identified following standard monographs and books. About 25 speceis of cladocera belongs to six family (Daphnidae, Bosmindae, Moinidae, Macrothricidae and Sididae) were identified. The chydoridae were most dominant followed by Daphnidae and Bosminidae. The daphnidae, chydoridade, macrothricidae and bosminidae, are showing dominancy in premonsoon, monsoon, post monsoon and in winter respectively. The Cladoceran was most abundant in the month of July (211×10^3) and low in January (20×10^3). The study affirmed that the Subansiri river flood plain wetlands are rich in cladoceran species and qualitative and quantitative variability related to seasons. The cladoceran rich flood plain wetlands can be very effectively used for fish and fishery development.

Key words: Cladoceran diversity, wetland, fish feed, fishery and aquaculture.

Diversity of Blood Worms (Diptera: Chironomidae) of Ganga Lake, Itanagar, Arunachal Pradesh and Their Relation to Environmental Variables

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Density and species composition of chironomidae larvae fauna from twelve sampling sites of Ganga Lake located in the vicinity of Itanagar, the state capital of Arunachal Pradesh were investigated. Monthly sampling was done from November 2008 to October 2009. In addition, simultaneously, physical and chemical parameters of water were measured. 3624 chironomid larvae were examined and a total of twelve taxa were identified. Chironomid larvae were the third dominant group of the total zoobenthos density. *Chironomus striatipennis* was the most abundant chironomid species contributing with about 66.2% of the total chironomid fauna. Dominant species were the following: *Kiefferulus barbatitarsis* (12 sites, 12%), *Polypedilum nubifer* (11 sites, 10.2%), *Chironomus javanus* (10 sites, 4%), *Glyptotendipes barbipes* (Kieffer, 1916) (8 sites, 1.6%) and *Microchironomus tener* (7 sites, 1.8%). The relationships between the dynamics of the Chironomidae larvae and the environmental variables were supported by the Pearson correlation index. According to Pearson correlation between the average number of *Chironimusstriatipennis, Chironomus javanus* and temperature, BOD were directly proportional ($P<0.05$) while *Paratendipes hirsutus, Paratendipes unimaculipennis, Polypedilum insignum* were inversely proportional ($P<0.05$).

Key words: Non-biting midges, physic-chemical parameters, species richness.

Effect of Saprolegnia Species Infection on Freshwater Fish Health

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Mycological studies were carried out on fish with fungal infection. Fungi are group of organism called heterotrops that require living or dead matter for growth and reproduction. Fungi are present everywhere in freshwater or in salt water, in cool or warm temperatures. In most cases, fungi serve a valuable ecological function by processing dead organic debris. However fungi can become a problem if fish are stressed by disease, by poor environmental conditions, receive poor nutrition, or are injured. If these factors weaken, fungus can infest the fish. All fungi produce spores which spread disease. The disease caused by saprolegnia species is called saprolegniasis, which is often first noticed by observing fluffy tufts of cotton like material coloured white to shades of grey and brown on skin, fins, gills or eyes of fish. Microscopically the fungal hyphae on skin and underlying muscles with marked degenerative and inflammatory reactions were observed. The effect of saprolegnia species infection, on biochemical, haematological & pathological alterations of H. fossilis was observed after seven days of post infection. A significant increase in Na^+, K^+, glucose & cholesterol were noticed while total plasma protein decreased were noticed. Saprolegnia infection induced haematological changes, results suggested the parasitism induced anaemia and increase in percentage of WBC & ESR. The present study was planned to investigate the effect of saprolegnia species infection in freshwater fish H. fossilis.

Key words: Fungi, H. fossilis, Haematology, Biochemical Change, Pathology, Parasite

Bioremediation of Used Motor Oil Found in Automobile Industry Effluent by Microbial & Enzymatic Pathway: A Review

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Motor oils are derived from petroleum-based and non-petroleum-synthesized chemical compounds. Motor oils today are mainly blended by using base oils composed of petroleum hydrocarbons, polyalphaolefins (PAO), and polyinternal olefins (PIO), thus organic compounds consisting entirely of carbon and hydrogen. This type of oil is used for lubrication of various internal combustion engines in automobile industries as well as in other various industries having heavy machineries. The main function is to reduce wear on moving parts; it also cleans, inhibits corrosion, improves sealing, and cools the engine by carrying heat away from moving parts.Oils generally enter waters through spills, leaks, and improper disposal, and can be toxic to plants and animals even in small amounts. The concentration of dispersed oil and grease (OG) is an important parameter for water quality and safety. OG in water can cause surface films and shoreline deposits leading to toxicity, environmental degradation, carcinogenicity, mutagenicity, kill wildlife, cause ecosystem damage that can last for generations by forcing changes in reproduction and compromising complex food webs and can induce human health risks when discharged in surface or ground waters. Additionally, OG may interfere with aerobic and anaerobic biological processes and lead to decreased wastewater treatment efficiency. Cleanup and recovery from an oil spill is difficult and depends upon many factors, including the type of oil spilled, the temperature of the water (affecting evaporation and biodegradation), and the types of shorelines and beaches involved. Spills may take weeks, months or even years to clean up. Bioremediation is the act of adding materials to contaminated environments, such as oil spill sites, to cause an acceleration of the natural biodegradation process (U.S. Congress 1991). It is a promising means by which oil released into salt marshes, as well as other wetland types, can be removed with little impact to the habitat. Natural process employing microorganisms or enzymes is considered to be very effective, cost effective and environmentally friendly method of degradation of hazardous oily effluent than conventional methods. Mechanical and chemical methods generally used to remove hydrocarbons from contaminated sites have limited effectiveness and can be expensive. Bioremediation is the promising technology for the treatment of these contaminated sites since it is cost-effective and will lead to complete mineralization of oil. Oil is biodegraded slowly by species from the genera *Chromobacterium*, *Micrococcus*, *Bacillus, Pseudomonas, Candida, Saccharomyces* etc. They are called hydrocarbonoclastic

microbe. Many enzymes like lipase, papine are able to degrade oil from wastewater. Bioremediation functions basically on biodegradation, which may refer to complete mineralization of organic contaminants into carbon dioxide, water, inorganic compounds, and cell protein or transformation of complex organic contaminants to other simpler organic compounds by biological agents like microorganisms and enzymes. This study reveals the presence of bacteria capable of metabolizing engine oil in the environment & proves enzymes as potential bio-degradative agent. This paper presents an updated overview of degradation of used motor oil which is a type of petroleum hydrocarbon by biological agents like microorganisms or enzyme.

Key words: biodegradation, hydrocarbonoclastic microbe, petroleum hydrocarbon, toxicity, enzymes, natural process, cost effective, environmentally friendly

Conservation and Management of Riverine Ecosystems in Relation to Central Narmada Riverscape

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Narmada, the lifeline of Madhya Pradesh, is a major west flowing river of central India originates from the Satpura ranges of Madhya Pradesh and joins the Bay of Cambay flowing through three states namely MP, Maharashtra and Gujarat. Out of 1350 km stretch about 1210 km of its stretch falls in MP. In last few decades the river has witnessed many ecological changes due to increasing human interference. The present paper discuss in details about the changes took place in last few decades in the catchment area of the river and fragmentation of habitats due to formation of small, medium and large reservoirs. For the present study we selected the central stretch of the river starting from the confluence of Dudhi to Indira Sagar reservoir. We selected five sub-basins of major tributaries in this riverscape and prepared their thematic maps with the help of GIS. Remote Sensing data was also used to prepare land use maps and change in land use has also been detected. Physical habitat mapping was also done using the Rapid Bioassessment Protocol. Mesohabitats present in these tributaries were also mapped and documented during the study. The sub-basins of the tributaries namely Dudhi, Barna, Ganjal, Sip and Jamner were selected for the present study. During the study it was found that since most of the tributaries are in hilly slopes, they have a series of runs and riffles but very few pool habitats are available in these streams. Physical habitat assessment indicates that four sub-basins namely Ganjal, Barna,Sip and Jamner are in Optimal category whereas Dudhi sub-basin falls in marginal category indicating its deteriorating condition. Substrate categories indicate that sand is the dominant substrate type in Dudhi whereas Barna and Jamner are dominated by cobble substrate type. Ganjal has gravel and Sip has boulder substrate type in domination. Landuse and landcover change has also been detected in these sub-basins for the last few decades and it was found that in some sub-basins a major change in landuse has been recorded.

Fragmentation of habitat and disruption in flow is another important factor in this riverscape as a medium reservoir has been constructed by damming the stream Barna which has created a discontinuation of the stream from the main river. This reservoir has also altered the ecological conditions of the streams of Barna sub-basin as most of the stream stretch is now inundated by the back waters of the reservoir and converted the shallow water habitats into deep water habitats. The reservoir also supports a rich biodiversity of fishes which are exploited for commercial fishery also. Dam across the Barna stream is also a barrier for fish migration which in long term will adversely affect the fish diversity. Similar conditions have been in Jamner stream which joins the Indira Sagar reservoir from its tial end and the backwaters of the reservoir alter the ecology of the stream. The present paper deals with ecological problems associated with these sub-basins and suggest possible solutions to conserve and manage the ecosystem of these streams and the river Narmada.

Key words: Stream ecosystem, landuse-landcover, catchment, fragmentation of habitats

Cytotoxic Effect of Two Pesticides Namely Carina50 and Dursban on Root Tip Cells of *Lathyrus sativus* L.

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The synthetic chemicals (pesticides) used in agriculture for controlling pests are hazardous to the health of domestic animals and humans, and many of these chemicals have already been proved as chromosome damaging as well as mutagenic and carcinogenic in nature. These synthetic chemicals are introduced into the environment through plants and moulds resulting into environmental hazards and thus ever increasing use of these chemicals in agriculture calls for a careful study of their genetic side effect .With a view to it, the present investigation has been undertaken to ascertain the cytotoxic side effect of two pesticides(widely used in West Bengal plains) namely Carina 50 (profenofos) and Dursban (chloropyrifos) on root tip cells of *Lathyrus sativus* L.(Fabaceae) aiming to provide necessary informations to the future breeders and researchers for proper monitoring of doses of these chemicals in field. In this investigation, dry and filled seeds of *Lathyrus sativus* L. have been exposed to different concentrations of the pesticides to ascertain their effects. A total of ten different mitotic aberration types have been detected at different divisional stages. The anomalies encountered in this study were nuclear margination, clumped and sticky metaphase, giant cells, Chromosome Bridge, Chromosome Bridge with laggards, laggards at metaphase, micronucleus, early and late separation, and multipolarity indicating that both the chemicals caused irreparable damages to the cells. It was also observed that cytotoxicity increased with increase in concentration for both the chemicals. Aberration spectrum and total aberration frequency were found to be higher in Carina 50 than those in Dursban. Mitotic Index was noted to be increased in all the treatments in comparison to control. In the present investigation, it was revealed that both the chemicals were clastogenic, turbagenic and mutagenic in nature.

Key words: Biocide, chromosome aberration, aberration spectrum, aberration frequency, mutagenicity, chromosome damaging chemical, environmental hazards.

Ethnomedicinal Plant used in Treatement of Chest Disease in Senapati District of Manipur

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Senapati district of Manipur in the North East India occupies the Northern part of Manipur which is bounded on east of Nagaland, south by Imphal East and West. It lies between 23˚80'N-25˚68'N and 93˚03'E-94˚78' E longitude and total geographical area of the district is 3317sq.km. The district is inhabited by several ethnic communities such as Naga, Kuki, and Nepalese and other. The vegetation of the district is deciduous type. The district is rich of fauna and flora. Ethnobotanical study was conducted in district Senapati District of Manipur aiming at identifying plants used to treat chest diseases mainly related to respiratory system. A semi-structured questionnaire was used to interview members of the local inhabitant including traditional healers, herb sellers, and other villagers. Ethnobotanical data was analyzed using relative frequency of citation (RFC) to determine the well-known and most useful species in the area. The plant parts used as well as the modes of preparation and administration were recorded. Thirty one plant species belonging to sixteen families were collected and identified by their vernacular name. The plants were collected from the different parts of this district with the help of local practitioners. The Lamiaceae were the most represented family with five species, followed by Solanaceae (4), Acanthaceae and Apocyanaceae (3) Asteraceae, Poaceae, Rutaceae and Zingeberaceae with two species each. All the remaining7 families were represented by one species each. The majority of the documented plants were herb, shrub and trees. The plant part most frequently used to treat respiratory disease in the study was reported as leaf, flower, whole plant, fruit and root. For each plant species listed, local vernacular name, family, habit, mode of uses and frequency of citation were given.

Key words: ethnomedicine Senapati, Chest disease

Ichthyofaunal Diversity of Veraval: A Photographic Documentation and Identification

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Nature is equipped with a high range of floral and faunal diversity. Ichthyofaunal diversity is the fish diversity that essentially represents the fish faunal diversity and their abundance. The sea site conserves a rich variety of fish species which supports a large amount of commercial and non-commercial fisheries. The sampling site includes the city of Veraval (20.9°N 70.37°E), Gujarat, India. It is one of the largest fishing ports in India as it contributes to a total of 40% of fishing industry. It is also renowned for construction of wooden fishing boats without the use of any high-tech machineries. The present study is carried out at Bhidiya Port using Grab Sampling Method in which preservation of fishes of marine ecosystem is done for determining the ichthyofaunal diversity of Veraval coast along with the photographic documentation. The total number of species studied till yet are 35.Thestudy is further being continued. The study is bifurcated into assessment of commercial and non-commercial fish species. Thus, the study provides an insight of the fish diversity that is economically important and also environmentally important that facilitates sustainable development.

Key words: Ichthyofaunal diversity, Photographic documentation, Marine ecosystem, Commercial and Non-Commercial fisheries, Sustainable development, Gujarat

Evaluation of Breed, Age and Sex Responsible for Seroprevalence of Brucellosis in Small Ruminant at Northern Barind Tract

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Brucellosis persists as a problem for animals all over the world and results in considerable economic losses. It was designed for serological evaluation of brucellosis in Northern Barind tract in relation with breed, age and sex. The study was carried out in Northern Barind tract including Rajshahi, Noagoan, Chapainowabjong and Natore district from January 2012 to December 2014. A total 475 serum samples were subjected to test for iELISA and SPSS program used for analysis. The breed had no significant effect and the prevalence was 6.9% & 5.1% in local and cross breed of small ruminant. Similarly the age had no significant effect and the value of positive cases were1.9%, 4.0% & 6.1% in young, youth and old aged small ruminant. But the sex had significant effect and the seroprevalence were 2.5% &9.5% in male and female sex of small ruminant.The local breed older age and female small ruminant observed highest prevalence in Northern Barind tract, Rajshahi in Bangladesh.

Key word: Seroprevalence, Small ruminant, age, sex and breed

Homestead Farming: Explores the Chain of Agri-Aqua-Ecosystem Services

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Ecosystem services are the benefits of people obtain from ecosystems. It acts as a bridge between the environment and human well-being. Towards this venture, homestead farming (HF) is an integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. The livelihood of majority of 78% of Indian farm families supports homestead farming (HF) as a necessary one rather than a primitive strategy. An innovative approach by HF or a small scale ecological family farming is the key strategies to realize multiple objectives including development of rural livelihoods and ecosystem by balancing the fair and equitable sharing of the benefits arising out of the utilization of resources. The high level of interaction among biotic and abiotic components such as varied types of plants, animals, birds, fish and other aquatic flora and fauna resulting ecological and economic benefits. It includes sustainable farm production and meeting diverse need of a farm family through their various growing period and crop duration. In this context, a baseline survey has been conducted in 18 villages in the coastal areas of South 24 Parganas district of West Bengal assessing the linkage of this agri-aqua ecosystem with a farm family and the community. The proper addition of various components made a remarkable improvement in the soil quality which is evident from the improved crop production and ensuring sustainability to the agri-aqua-ecosystem. A better resource management has been initiated in 2 villages by integrating various techniques like soil water conservation by providing adequate nutrients, cropping sequence management or multi-cropping and multitier arrangement of different components. Evidence from the field recorded that scientific intervention increase the species diversity by 13-33% and the average production of the entire system by 104% compare to the base line. It also enhances the gross income of the homestead farm by 79% which extremely minimize the partial dependency on the market food products and provides economic stability to the farm family. The system significantly scaling up the scope of employment by 58% from an average 190 working days to 300 working days. Therefore this multipurpose enterprise preserves the local cultural heritage which can serves as a buffer during disasters and play a significant role in feeding the world. In spite of these, the future of HF over the long run is not certain as it is not recognized farming system/practice which obstructs the government support and the mindset of the farm families. Thus the study demands formulation and implementation of required effective policy which can turn over these limitations and enable the system as a more conducive to biodiversity preservation, balances in ecosystem services and leading towards a more sustainable development.

Key words: Ecosystem services, multipurpose enterprise, diversity, economic stability, employment

Assessment of Accuracy of the Land use Classification in Coal Mining Area using Remote Sensing and GIS

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Remote Sensing and emerging GIS technology is the best tool in the hands of researchers of various disciplines of recent generations. Remote-sensing research focusing on image classification has long attracted the attention of the remote-sensing community because classification results are the basis for many environmental and socioeconomic applications. The production of thematic maps, such as those depicting land use and land cover, using an image classification is one of the most common applications of remote sensing. Land cover is a fundamental variable that has an impact and it links many parts of the human and physical environments. The objective of this paper is to evaluate the accuracy of landuse classification methods and different types of satellite images. Remote sensing technologies were utilized to extract some of the important spatially variable parameters, from satellite images of coal mining area, Jharia, Jharkhand .Five different classification techniques(Unsupervised, Mahalanobis, Maximum Likelihood, Minimum Distance, Spectral Angle Mapper) were carried out on three different types of satellite images (LANDSAT-5,LISS-3,LISS-4)of same date to provide accurate result. It was found that though the resolution of LISS-3 image is higher than Landsat-5 image the accuracy of the previous was the least among all the three images as it has overestimated the vegetation area.

Key words: Classification techniques, vegetation, satellite image, thematic map

Study of Spatial and Temporal Distribution of Fin Fish Juveniles in Some Selected Areas of Indian Sundarban Mangrove Biosphere

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Sundarban is a mangrove based deltaic complex formed by depositional activities of three great rivers namely the Ganges, the Bramhaputra and the Meghna. Mangrove ecosystems fringe tropical and subtropical coastlines throughout the world functioning as nurseries for a wide variety of vertebrate and invertebrate marine species. Thus, understanding the degree of utilization of mangrove habitats by juvenile fin fish communities is important in aiding the development and implementation of effective resource management programme.Early and/or late stage juveniles of various fin fish species were recorded in and around the four selected rivers of Indian Sundarbans. Seasonal and river wise abundance patterns of these species were also estimated. Usually the assemblages were much better in Saptamukhi and Thakuran rivers rather than Muriganga and Hetania-Duania rivers. Juvenile species that used this vast nursery as classic nursery utilization (CNU), interrupted persistence (IP), delayed recruitment (DR) and facultative estuarine residents (FER) were also identified and again the Saptamukhi river showed better result over Muriganga in case of CNU and in general availability of smallest size classes. Early stages of fin fishes that use small/large creeks, mud flats or sand flats, mouth of estuary, river bed depression and mangrove root areas for their nursery ground were recorded in low saline Muriganga-Hughli and moderate to high saline Saptamukhi–Thakuran estuary. Small and large creeks (H1 type of habitat) were emerged as the most preferable nursery ground for the assemblages of various fin fish species, equally followed by mud flats (H2 type of habitat) and sand flat areas (H3 type of habitat). From these above mentioned analysis it was found that juveniles of different species utilize this entire biosphere differently in respect to their seasonal or river wise distribution or abundance, utilization patterns of nursery, pattern of assemblages in different kind of habitats.

Key words: nurseries, habitats, communities, creeks, mud flats, sand flats, assemblages

Biopesticides: An Ecofriendly Approach

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Risks which are associated with chemical pesticides are of great concern to public and environment hence biopesticides can be used as an alternative. They are living organisms, cultivated in laboratory in large scale and used to control harmful organisms; they kill organisms by biological effects. They are obtained from natural material, less toxic, biodegradable, host specific, effective in less quantity, economic, safe for workers, farmers, public, animals and environment. Mainly they are of three types-Microbial pesticides, biochemical pesticides and Plant -pesticides. Although large number of biopesticides are available, but their use is not so popular, due to lack of awareness. More biopesticides need to be searched, as well as awareness about them among farmers is also required. In the present paper different types of biopesticides, their significance and suggestions have been discussed.

Key words: Biopesticides, Microbial, Chemical pesticides, Ecofriendly, Awareness.

Diversity, Population Density and IUCN Status of Freshwater Edible Mussels (Bivalvia: Unionidea) and their Role as Sentinel Organism of Water Quality in Perennial Ponds of Howrah District, West Bengal,India

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Freshwater mussels are the most important flagship benthic bivalves in the pond of West Bengal. Freshwater mussels are harvested heavily for food at different districts of West Bengal, Orissa and other North Eastern States of India and factors have been implicated in the decline of freshwater mussels with special reference to habitat degradation. However literature review reveals that so far no comprehensive research work hasbeen initiated on the freshwater Bivalves in West Bengal and a thorough knowledge regarding their diversity, population and their role as sentinel organism in West Bengal ecological conditions is the thrust area in modern day science. Moreover excessive use of water by humans can change the water quality of the freshwater ponds and lakes. As a part of this research work we are presenting in this paper the data obtained from Howrah district of West Bengal.

So far the IUCN status (version 3.1.2001) of the recorded species were not assessed due to lack of information. The goal of this paper is to determine the diversity, distribution ofthe recorded freshwater mussels with special reference to their population, which are the prime factors of assessing the IUCN status species -wise. Along with this how the viable populations try to protect in natural conditions of the pond also will be emphasized.

Following methods have been followed –
Identification of the collected species was done from the Malacological Department, Zoological Survey of India, Kolkata.

For analysis of population diversity of freshwater Bivalves :
The study was based on sample study. Ten (10) freshwater ponds were selected at random during every survey time / season. The position of the ponds selected for survey were recorded through GPS system. The area of the selected ponds was in between 2-3 ha. (Basic position of the ponds was selected from the supplied data map of Fisheries Department, Govt. of West Bengal). Number of Sample/ponds was from four to five times. Sampling size was 1 sq meter / time. Each year was surveyed for three seasons i.e. summer, rainy and winter seasons. After collection of Bivalves, we could separate different stages like juvenile stages and adult stages. From the collected

species the growth rate (length and breadth) was also recorded season wise. Along with survey data the water sample was collected from respective ponds and physico-chemical analyses forWater temperature, pH, Dissolved Oxygen,Turbidity,Biochemical oxygen,Total phosphates,Nitrates and Total suspended solids was carried out. The benthic soil was also collected/pond/season for the analysis of Organic matter.The data of sample, soil and water parameters were statistically correlated.From the above mentioned collected data the role of bivalves as bioindicator was also studied.

Diversity and spatial distribution of natural population of the freshwater edible mussels has been studied in the different ponds of Howrah district, West Bengal, India from 2012 to 2014. Benthic bivalve community of these ponds are represented by four species like *Lamellidensmarginalis*, *Lamellidenscorrianus*,*Parreysiafavidence* and *Parreysiacaerulea*with different population density and shell length and breadth up to 3 m depth area of the pond. In this paper we are reporting for the first time the occurrence of two species like *Parreysiafavidence* and *Parreysiacaerulea* in Howrah District. The range of average density of both juvenile and adult are recorded (no/m^2) more in *L.marginalis* (4.2 - 3.2) followed by *L.corrianus* (3.12 - 2.2), *P.favidence* (1.9 - 1.1) and *P. caerulea* (1.3 - 0.7). The aged individuals though very less in number are dispersed to areas beyond 1m depth but within 2.4 m water depth. There is a positive relationship between juvenile mussel density, adult mussel density, shell length and breadth in case of *Lamellidensmarginalis*and *Lamellidenscorrianus*. Maximum two bivalve species was observed in 78% of ponds followed by 13% with three species and 9% of pond with four recorded species. Considering all necessary documents of the IUCN status (version 3.1,2001) all the four studied species were analyzed and designated as “Least Concern” (LC) category in this region. Average season wise population pattern, Shannon-Wiener diversity Index, Simpson’s Dominance Index, Pielou’s Evenness Index and Margalef’s Richness Index were studied with the four reported species in relation to nine physico-chemical parameters of the pond-water samples from where those four species were collected/reported. The mussels population shows positive correlation withDissolved Oxygen of the water, alkalinity, hardness, conductivity, phosphorous and soil organic carbon. The study revealed that of the nine physico-chemical characters of pond water, all eight other than nitrate are within desirable limits for the presence and survival of these bivalve species. The nitrate level is above the permissible level in 63%of the ponds surveyed in this district may be due to organic waste run off. Mussels can be considered as sentinel organisms having the characters of biological indicators within “LC” category and are indicative of the pond-water quality, which in turn can be analyzed through the physico-chemical parameters.

Key words: Edible Bivalves, Abundance, New occurrence, Shannon diversity,Spatial distribution, IUCN status,Water analysis, Bioindicator, “LC category”

Studies on Growth and Yield Performance of Different Table Varieties of Banana (*Musa Paradisiaca*) under High Rainfall Situation of Hill Zone of Karnataka

D.Thippesha, D.Jemla Naik, Geetha shetty and B. Hemla Naik

The study was conducted to know the performance of different table varieties of Banana under high rainfall situation of Karnataka during 2009-11 with 8 treatments replicated four times with a Randomized Block Design. The treatments/includes planting of 8 varieties viz., Ney poovan, Robusta, Dwarf Cavendish, Grand Naine, Rasthali, Poovan, Karibontha and Karpooravalli. These varieties were grown as per the recommended practices (UAS, Bengaluru) of Banana. The result on growth performance of different table varieties at shooting reveals that, the variety Ney poovan registered highest plant height (274 cm) followed by Karibontha (242 cm), Grand Naine (240 cm) Rasthali (193 cm) and lowest was in Dwarf Cavendish (151cm). The Robusta recorded thicker pseudostem (64.40cm). The Rasthali produced more number of leaves (13.33) with highest leaf area (7.88m^2). Whereas, the Karpooravally produced less number of leaves (11.33) with lowest leaf area (5.64m^2) at the time shooting in main crop. The variety Karpuravalli utilized more number of days (417) to harvest the bunches and less number of days (388) were taken by Dwarf Cavendish to harvest the bunches. There was significant difference in the yield and yield parameters among the table varieties of banana. The variety Grand Naine, recorded maximum number of hands, weight of hand, fingers/hand, weight of fingers and overall yield (65.22 t/ha.) followed by Robusta (54 t/ha.) and Dwarf Cavendish (50.72 t/ha.). While, minimum yield was observed in Rasthali (22.15t/ha). Among the pests, incidence of hairy caterpillar was observed during early crop growth and ranges from 3.00 to 16.00 per cent, the incidence was more in the local cultivars compared to Cavendish group. The incidence of pseudostem weevils was below (4.00 %) the economic threshold level. The incidence of cigatoka leaf spot was more in Rasthali (13.0 - 23.0%) and less in Karibontha and Karpooravalli. The bunchy top incidence was also observed in the range of 5.00 to 10 per cent and was found to be occurred in Cavendish group. The study reveals that, among different table varieties, the Grand Naine performed better with respect to the growth, yield characters and yield followed by Robusta and Dwarf Cavendish under high rainfall situation of hill Zone of Karnataka.

Key words: Banana, varieties, Grand Naine, Hill zone, growth, yield

Studies on Varietal Performance of Tissue Culture and Suckers on Growth and Yield of Banana (*Musa Paradisiaca*) under Hill Zone of Karnataka

D.Thippesha, D. Jemla Naik, Geetha shetty and P. K. Suresha

The study was conducted to know the performance of different tissue culture verities of Banana under hill zone of Karnataka and compared with the conventional (suckers) plants during 2011-13 with 6 treatments replicated four times with Randomized Block Design. The treatments includes planting of 6 tissue culture varieties viz., Dwarf Cavendish, Grand Naine, Robusta, Rasthali, Ney poovan, and Red banana. These varieties were grown as per the recommended practices (UAS, Bengaluru) of Banana. The result on growth performance of different tissue culture varieties at shooting reveals that, the maximum plant height (289.93 cm) pseudostem diameter (72.05 cm) and leaf area (11.19 m^2) was recorded in Red banana. Whereas, the minimum plant height (155.13 cm), leaves (12.00) and leaf area (7.10 m^2) was recorded in Dwarf Cavendish and pseudostem diameter was less (56.73 cm) in Rasthali variety of Tissue cultured plants. Among the type of planting materials used Tissue cultured plants were grown better with respect to vegetative characters and required less number of days to harvest compared to sucker produced plants. The tissue culture banana recorded more values for yield and yield attributes compared to the suckers plant in all the varieties except red banana and the yield was increased to the tune of 16 to 23 per cent over suckers. The extent of pests and disease incidences was negligible in all tissue cultured materials. Finally it is concluded that, the tissue cultured materials of all the varieties except red banana resulted more yield (15 – 23%) compared to the suckers/conventional plants and among the varieties Grand Naine recorded highest yield compared to all other varieties under hill zone of Karnataka.

Key words: Banana, Tissue culture, varieties, Red banana, Grand Naine, growth, yield, Hill zone

Butterfly Diversity of Nokrek Biosphere Reserve, Meghalaya, Northeast India

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Nokrek Biosphere Reserve is in the West Garo Hills district of Meghalaya, Northeast India. The present study was carried out in the year 2011 and 2012. The survey reveals the presence of 63 butterfly species belonging to 6 families: Hesperiidae, Lycaenidae, Nymphalidae, Papilionidae, Pieridae and Riodinidae. The family Nymphalidae, represented by 29 speciesis the most dominant followed by Pieridae (13 species),Papilionidae (11 species), Hesperiidae (4 species), Lycaenidae (4 species) and Riodinidae (2 species). The present study also provides an account of their seasonality pattern.

Key words: Butterfly, diversity, seasonality, Nokrek Biosphere Reserve, Meghalaya

Impact of Natural Organic Fertilizer (Seaweed Saps) on Increase Yield and Nutrient Status of Black Gram (*Phaseolus Mungo* L.)

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A field experiment was conducted during the *Kharif* season of 2013 at Research Farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh). Seaweed sap is a new generation of natural organic fertilizers containing highly effective nutritious and promotes faster germination of seeds and increase yield and resistant ability of many crops. Unlike, chemical fertilizers, extracts derived from seaweeds are biodegradable, non-toxic, non-polluting and non-hazardous to humans, animals and birds. The objective has been taken towards the balancing nutrients requirement for the optimum productivity of black gram crop by foliar application of sea weeds sap to enhance growth, yield, nutrient uptake and economic of Black gram in *Vertisol* of Chhattisgarh. The foliar spray was applied twice at different concentrations (0, 2.5, 5.0, 7.5, 10 and 15%v/v) of sea weed extracts (namely *Kappaphycus* and *Gracilaria*). Foliar applications of sea weed extract significantly enhanced the growth, yield, nutrient uptake and B:C ratio parameters. The highest grain yield was recorded with applications of15%*Kappaphycus*sap+recommended dose of fertilizer (RDF), followed by 15%*Gracilaria* sap + RDF extract resulting in an increase by 49.2% and 37.8% grain yield, respectively compared to the control (Water spray + RDF). The highest nutrient uptake [nitrogen (N), phosphorus (P) and potassium (K)] by crop were observed under 15% K Sap + RDF. The highest net return (Rs. 25,244 ha^{-1}) and B:C ratio (1.27) were observed with the application of 15% *Kappaphycus* sap+ RDF.

Key words: *Kappaphycus* sap, *Gracilaria* sap, Nutrient uptake, Grain yield and Fertilizer

Influence of Varying Degree of Salinity-solidity Stress on Phytoplankton and Cultivable Microbes in the Estuarine Water of the Sundarban Mangrove Forest, India

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Salinity-sodicity stress on phytoplankton along with cultivable microbial population rate was investigated from the estuarine water isolated from the Sundarban Mangrove Forest, India. Our study revealed that optimum salinity for the growth of bacteria and phytoplankton were totally differed and phytoplankton showed more resistant to fluctuation in salinity than that of bacteria.

The Indian Sundarban mangrove forest in the estuarine portion of the River Ganges covers an area of 9630 km^2 out of which 4264 km^2 is law protected forest. It is the largest delta on the globe (world's heritage site, www.unesco.org/en/list/452) and covers about 2.84% of the global mangrove area (15 $\times 10^4$ km^2). This is a virgin island and is quiet safe from human intrusion.The biodiversity of Sundarban includes numerous species of phytoplankton, zooplankton, micro-organisms, benthic invertebrates, mollusks, amphibians and mammals. Sundarban Mangrove forest is highly productive marine ecosystem where halophilic microbes actively participate in bio-mineralization and biotransformation of minerals. Mangroves are the only woody halophytes dominated ecosystem situated at the confluence of land and sea, they occupy a harsh environment, being daily subject to tidal changes in temperature, water and salt-exposure and varying degree of anoxia. Eutrophication as well as presence of toxic *Dinoflagellates* and *Cyanophyceae* in the tidal creek of Sundarban estuary definitely revealed the deteriorated status of the water quality. Salinity-sodicity properties of coastal estuarine water determine the degrees of inhibition of microbial activity and biochemical processes that are fundamental in maintaining ecological quality and productivity in estuarine waters of coastal regions. The impact of salinity-sodicity was found to act as a major function to stress on estuarine water microorganisms from previous research works.

The main aim of the present study was to investigate the response of the bacteria and phytoplankton to varying degree of salinity isolated from the Sundarban Mangrove forest.

Physicochemical parameters of the estuarine water were measured following standard methods. Bacteria and phytoplankton were allowed to grow in respective medium with different salinity. The growth rate and their optimum salinity for maximum growth rate were recorded. Bacterial growth rate was found to be maximum in between 25 to 27 psu of salinity whereas growth rate of phytoplankton was maximum in between 30 to 32 psu of salinity. The result suggested that phytoplankton dwelling in the estuarine water of Sundarban mangrove ecosystem were more resistant to fluctuation in salinity than that of bacteria. Nutrients and physicochemical parameters of the estuarine water should significant control over the growth rate of both phytoplankton and bacteria.

Key words: Sundarban Mangrove Forest, phytoplankton, bacteria, Salinity-sodicity, estuarine water, growth rate.

Local Socio-Economic Impacts Due to Mining & Life Satisfaction Study of Sample Households of Tasra Block, Dhanbad

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In the region of Jharia Coalfield of Dhanbad District coal mining activities have a long standing practice. These mining practices created a clearly instrumental fiscal growth in the region. But Mining in itself is a rather forceful intervention in the environment, but capitalist social relations have resulted in forms of mining, which exasperate the attack on nature and, as part of it, on the human bodies. The industry destroys nature and harms humans – and it creates a different social environment. The study area commonly called as Tasra Block lies in the eastern extremity of Jharia Coalfield (JCF) in the Dhanbad district of Jharkhand state will involve the displacement of more than 23007 people of the seven villages included. The study investigates the socio-economic impact of coal mining and tries to find out the life satisfaction of sample households in the region. A structured questionnaire for gathering demographic information, i.e. age, education, income, occupation, religion, food intake, water availability etc was prepared. Impact prediction was carried out by assigning significant points (based on direction, magnitude, scale and probability of impact) to potential socio-economic parameters during construction, operational and decommissioning phase. For determining life satisfaction the Reasonable Quality of Life for a unit of family is defined, and Correlation between socioeconomic factors and life satisfaction has been established as it reflects the status of development of society and their aspiration.

Key words: Mining, Socio-economic, Life Satisfaction, Tasra

Sustainable Agricultural Technologies as a Strategy for Climate Change in the Island of Mauritius

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As is the case in many other countries, agriculture in Mauritius is facing the problems caused by drastic climate variability and climate change. Soaring temperatures, erratic rainfall patterns, drought periods followed by sudden heavy downpours are leading to problems of soil erosion, nutrient leaching, increased incidence of insect and other pests, disruption in crop phenology, etc. Production of vegetables is being adversely affected, with the need to import vegetables in which Mauritius was previously self-sufficient, e.g. carrots, beans, cabbage, etc. There is considerable research ongoing at the level of the Ministry of Agro-Industry and Food Security, as well as at research institutions and Universities on understating the impacts of climate change on local agriculture, estimating vulnerabilities, and investigating adaptation and mitigation strategies.

This paper reports the results of part of one such study conducted by the Faculty of Agriculture, University of Mauritius on developing sustainable agricultural technologies as a climate change adaptation and mitigation strategy for some of the major horticultural crops in Mauritius.

Haricot beans represent an important food crop in the Republic of Mauritius, eaten green as a fresh vegetable and also for the fully developed red beans. Local production has been steadily declining with the result that haricot beans are grown mainly for their tender green pods, while the red beans are imported. Red beans are a staple diet in the island dependency of Rodrigues, and bean cultivation (along with maize, chillies, lime) is an important agricultural activity in that island. Hence, haricot beans are on the Government list of vegetables whose production needs to be stepped up for food security in the Republic.

Key words: Intercropping, yellow sticky traps, banana mulch, repellent plants, soil physical and chemical properties, soil biodiversity, weeds, pests, dry matter yield, total biomass

Mulching as a Climate Change Adaptation Strategy for Soil Health and Fertility Improvement, Pest Control, and Crop Yield Increase in the Island of Rodrigues, Mauritius

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Rodrigues (lat. 19/43, long. 63/25) is an island dependency of the Republic of Mauritius. As a result of its hilly topography, volcanic soils and fertile valleys, crop and animal agriculture developed as the main economic activity, and source of livelihood and employment for the majority of its people. However, in recent years, land degradation due to soil erosion and unsustainable agricultural practices are serious problems limiting agricultural production. Climate change is further exacerbating the situation, with higher temperatures that overheat the soil causing rapid breakdown of organic matter and significant loss of soil moisture, and long periods of drought followed by sudden strong rains, which wash away the top soil into the lagoon, causing eutrophication and heavy silting.

Mulching was studied as an adaptation strategy to climate change for increasing crop yields through the reduction of pest and weed infestation, improvement in soil health and fertility, reduction in soil temperature, increase in soil moisture and organic matter, and decrease in soil erosion and nutrient runoff. A participatory approach was used, by involving farmers right from the time of project inception, and conducting the studies in the farmers' fields.

Key words: Banana leaves, coconut leaves, vetiver, maize, soil biodiversity, soil moisture, soil temperature, soil organic matter, weeds, pests, dry matter yield, total biomass

Effect of Chlor-Alkali Solid Waste Effluent on the Primary Productivity of a Little Millet Crop

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The primary productivity of a little millet (*Panicum sumatrense* Rath ex.Roem and Schult) crop Variety SS.81-1, exposed to chior-alkali solid waste effluent @ 100 g m^{-2} (treatment - 1), 200 g m^{-2} (treatment - 2), 300 g m^{-2} (treatment - 3) and 400 g m^{-2} (treatment - 4) was studied in *vivo* at the Agriculture Research Station, Ankuspur in the District of Ganjam, Odisha at an interval of 15 days starting from 30 days after sowing till harvest of the crop following the ICAR Technology as proposed by Seetharam (1994) with little modification depending upon the soil condition and climate of the locality. The compartmental production i.e. live green, standing dead, above ground net, below ground and total net production followed a trend control < treatment - 1 < treatment - 2 < treatment - 3 > treatment - 4 in most of the sampling period. Similar trend of results were also observed in case of fodder yield, grain yield and gross primary production at harvest whereas a trend of control > treatment – 1 > treatment - 2 > treatment - 3 < treatment - 4 was noticed for harvest index. ANOVA test pertaining to live green production, aboveground net production and total net production showed high significant F value ($p \leq 0.001$) during 60^{th}, 75^{th} and 87^{th} day after sowing. Fodder yield, grain yield, gross primary production and harvest index value also showed high significant variation at 0.001p level. The bivariate correlation studied among the various compartments in control and 4 treatments revealed almost significant correlation among themselves.

Compared to control, the treatment showed variation in the compartmental production value probably due to the influence of chlor-alkali solid waste effluent. Moreover, the management practices of the crop by modern improved technology i.e selection of seed variety, soil amendment practices, application of fertiliser and biofertiliser, plant protection measure showed increase in production. Besides,the precipitation, atmospheric temperature, relative humidity, solar insulation, soil characteristics, soil microbes, etc. do play a vital role in variation of primary productivity of the crop plant. This study showed that, the chlor-alkali solid waste effluent could be efficient to produce increasing amount of above ground production (including grain yield). However, further study is necessary under various soil conditions to have a concrete solution relating to the application of chlor-alkali solid waste effluent in agriculture.

Key words: Compartment, fodder yield, grain yield, harvest index, below ground

Diversity and Distribution of Genus Puntius with Reference to Habitat Analysis in Six River Systems of Southern Western Ghats, India

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Freshwater systems are arguably among the most endangered ecosystems on the Earth. Freshwater ecosystems are interlinked with part of our social life and development irrespective of urban and rural areas as a daily source of protein rich food. The river system contains lots of biotic life undiscovered. Increasing use and misuse of natural resources exert great pressure on earth's sustainability. Human activities on water lands/streams/rivers changed the hydrologic and ecological processes. Aquatic communities are evolved for conditions in unmodified habitats and when the habitats are altered, the capability to support native aquatic community is altered. Sound management of aquatic resources needs an understanding the condition of habitats, the extent of changes in habitats and the factors influencing the changes. In order to arrive at a better understanding of the biological processes within the wetland ecosystem, a synchronous study of ecological aspects is highly imperative. India harbours a rich and diverse fish fauna with nearly 11% of the total fish species of the world. This paper provide information on the diversity and distribution and influence of the spatial dimensions for the diversity of Genus *Puntius* with respect to six river systems of Southern Western Ghats.Fishes were collected using cast net, dip net, gill net and drag net from various streams and rivers of Southern Western Ghats. At most care was taken not to damage the species while collecting. Species diversity (H) – Shannon and Weaver, 1949), Evenness index (E) (Pielou, 1975) and Dominance index (D) (Simpson, 1949) has been analyzed to exhibit the present diversity, abundance and dominant status of the *Puntius* species.Habitat Inventory has been done based on the Methods of Gorman and Karr (1978), Armantrout (1990), Manimekalan (2000) and Arunachalam (1995). The contribution of the spatial (habitat) dimensions and its influence for the species diversity has been analyzed using Principal component analysis (Willis, 2005) using XLSTAT.In the present study 168 individuals of the 17 species of genus *Puntius* have been collected from 31 sites of six river systems of Southern Western Ghats. Species like *Puntius melanampyx, Puntius carnaticus, Puntius amphibious, Puntius fasciatus, Puntius mahecola,* were commonly found in all the six river systems. Among the 31 sites high species diversity of genus *Puntius* was recorded at Sinnaru of Cauvery River system (H'- 0.659) and low diversity was recorded at Naduthotam, Periyar River System recorded (H'- 0.137). The maximum species richness was recorded at Gulithuraipatti and Kallampalayam (S – 6). The maximum species abundance 66 was recorded at Urilikal and lowest abundance 3 was recorded at Oorpannikaham and Valukuparai. The maximum dominance (D - 5.182) was recorded at Sinnaru and lowest dominance (D-

1.221) was recorded at Naduthotam. In species richness and abundance there is wide variations between the present collection sites.Principal component analysis was used to illustrate the influence of the variables and its importance for the Ecological structure of the river system and the fish species. The various habitat characteristics like water quality, Channel morphology, and the substratum type influencing the *Puntius* species distribution analysis results explains that species abundance and richness are mainly influencedby the factors like Altitude (6.940), Area (21.449) and Volume (58.428). All other character plays a supportive role to express the variations between the study sites. Based on the contributions of the spatial dimensionsthe study sites like Belikoondu, Kallampalayam, Sorrakottaodai, Anjurily, Thenkasithodu, Belemeenthurai, Kovaikutralam, Naduthotam, Nadathittu, Kadapilliyarthittu and Sinnaru exhibits variations than comparing to the other study sites. The present finding supports the above theory the results express that species diversity, richness and abundance is low at high altitudes and low in high. In Sinnaru of Cauvery River species diversityis high (H-0.659) because of the altitude, area of the channel and the volume of flow. The maximum richness was recorded at Gulithuraipatti and Kallampalayam (S – 6), due to the channel flow, altitude and the submerged substratum types with muddy water flow. The maximum *Puntius* species abundance 66 was recorded at Urilikal due to the low area of the channel and the maximum percentage of the rocky boulder substratum. The maximum dominance of *Puntius* species (D - 5.182) was recorded at Sinnaru influenced by the vast channel area and the flow of the water. Rest of the sites were low due to the less percentage of influence made by the habitat structures.The results obtained concludes that altitude also plays a major role in species diversity and species abundance which supports the proposed the theory that diversity changes with altitude on mountainsides, being lowest at higher elevations Colinvaux (1930).

Key words: Diversity, Spatial Dimensions, PCA, *Puntius,*Southern Western Ghats

Production Potential and Economics of Rainfed Maize (*Zea Mays L.*) as Influenced by Farmyard Manure and Bio-digester Liquid Manure

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Maize (Zea mays L.) is an exhaustive crop, showing inconsistency in yields. Since prices of chemical fertilizers and cost of cultivation is increasing hence, there is a need for developing low cost technology on nutrient management which increases the efficient and judicious use of all the major sources of plant nutrients in an integrated manner so as to get maximum economic yield without any deleterious effect on physico-chemical and biological properties of the soil. A field experiment was conducted under rainfed condition on red sandy loam soil to study the effect of farmyard manure and biodigester liquid manure on production potential and economics of rainfed maize (*Zea mays L.)"* at Agricultural Research Station, University of Agricultural Sciences (Bengalure), Bhavikere, Karnataka. There were totally 13 treatment combinations comprasing of different levels of farmyard manure (FYM) (7.5, 10 and 12.5 t ha^{-1}) and biodigester liquid manure equivalent (75, 100, 125 and 150 kg N ha^{-1}) compared with control (FYM 7.5 t ha^{-1} + RDF: 100:50:25 kg NPK ha^{-1}). Application of FYM at 12.5 t ha^{-1} + Biodegester liquid manure equivalent at 150 kg N ha^{-1} recorded significantly higher grain weight (105.2 g cob^{-1}), No. of seeds cob^{-1} (421.0), No of rows cob^{-1} (15.1), cob girth (15.6 cm) cob length (17.0 cm), grain yield (56.2 q ha^{-1}), straw yield (108.9 q ha^{-1}), harvest index (0.38), gross returns (Rs. 46,391 ha^{-1}), net returns (Rs. 34,989 ha^{-1}) and B:C (3.1) and it is on par with application of FYM at 10 t ha^{-1} + Biodegester liquid manure equivalent at 150 kg N ha^{-1} recorded higher grain weight (104.3 g cob^{-1}), No. of seeds cob^{-1} (420.4), No of rows cob^{-1} (14.5), cob girth (14.3 cm), cob length (15.5 cm), grain yield (55.1q ha^{-1}), straw yield (107.0 q ha^{-1}), harvest index (0.37), gross returns (Rs 45,105 ha^{-1}), net returns (Rs.33,930 ha^{-1}) and B:C (3.0) and Control (FYM 7.5 t ha^{-1} + RDF: 100:50:25 kg NPK ha^{-1}) recorded grain weight (103.3 g cob^{-1}), No. of seeds cob^{-1} (418.3), No. of rows cob^{-1} (13.9), cob girth (14.0 cm), cob length (14.7 cm), grain yield (56.2 q ha^{-1}), straw yield (108.9 q ha^{-1}), harvest index (0.38),gross returns (Rs.44,766 ha^{-1}), net returns (Rs.32,566 ha^{-1}) and B:C (2.7) as compared to the remaining treatments.

Key words: Biodigester Liquid Manure, Farmyard Manure, Organic farming, Rainfed maize.

Performance of Intensive Aquaculture Integrated with Irrigation System

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Aquaculture integrated with irrigation system is found to be an effective pathway to address (i) the conflict between the intensive aquaculture and the environmental sustainability, (ii) the world wide scarcity of freshwater, (iii) the increasing demand of nutritional food and (iv) employment generation particularly in rural areas. Three Indian major carps (IMC) *Catla catla, Labeo rohita,* and *Cirrhinus mrigala,* were cultured at three different stocking densities *viz*., 20000 (St.D-2.0), 35000 and 50000 (St.D-5.0) fingerlings ha^{-1} for a period of 300 days in polythene lined ponds with suitable management practices. The wastewater from the ponds was judiciously reused to irrigate crops. The highest value of gross and net fish production was recorded in St.D-5.0 (14814 and 14039 kg ha^{-1} $crop^{-1}$) followed by St.D-3.5 (10870 and 10322 kg ha^{-1} $crop^{-1}$) and St.D-2.0 (6784 and 6468 kg ha^{-1} $crop^{-1}$). Significantly higher values of profit, net present value (NPV), profitability index (PI) and internal rate of return (IRR) were recorded in higher stocking densities compared to lower ones ($p<0.05$). Recorded NPV value of Rs 5612161 in St.D-5.0 is equivalent to monthly income of about Rs 46500 which is considered very high monthly income in Indian context. A comparative evaluation of economic feasibility (St.D-3.5) was made between (i) the actual study conducted within the irrigation system (WIS) and (ii) a hypothetical case of aquaculture performed alone (OIS). Significantly higher net present value (NPV) and internal rate of return (IRR) and lower value of payback period were estimated in WIS compared to OIS for all three stocking densities ($p<0.05$).

Key words: Indian major carps, intensive aquaculture, internal rate of return, irrigation system, net present value

Environmental Investigation with Reference to Biological Enviroment of Fluorspar Mining in Vadodara District Gujarat

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One of the most important impacts of mining is biological degradation. As a result of rapid industrialization and exploration of minerals, there has been introduced a variety of changes in the environment. The mining activities induce such changes in the environment in the form of pollution and perturbation that cause wide spread damage to the living organism in the biosphere.

Our study area is fluorspar mine and its surrounding area located at Ambadungar Hill, village Kadipani, district Vadodara Gujarat. The industrial impact of mining has been responsible for exposing metal reserves that would not normally come in contact with the surface environment. Deposition of tailing in the environment has been shown to be hazardous to normal aquatic life because tailing from mineral beneficiation operation represent a major source of the release of heavy metals.

Impacts on biological environment are predicted based on survey of laws of trees and impact of incremental SPM on flora and fauna and available scientific knowledge and techniques. The impact of flora and fauna are predicted by deforestation required and impact due to dispersion of suspended particulate matter.

Chhotaudepur reserve forest fall in 10 Km of studied area. Total number of 138 species of flora (include trees, shrubs, grasses, and climbers) have been reported and 11 species of birds were identified during the survey. However the impact of dispersion of predicted SPM concentrations is well within the mine lease area. Thus the impact on the flora and fauna surrounding the mine site will be negligible.

Key words: Biological Degradation, SPM, Flora, Fauna, Fluorspar

Bio-ethanol Production by Fermentation of Whey Lactose Permeate Using Various Microorganisms: A Review

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The current world demand for bioethanol is increasing daily, as a consequence of reduced availability of fossil fuels, and increased efforts towards developing eco-friendly and more environmentally green sources of energy. Therefore, an alternative energy source such as ethanol, as fuel, has been considered for future, given it produces lesser pollutants than fossil fuels, thereby reducing air pollution and climatic changes caused by increased levels of carbon dioxide and other GHG emissions. Ethanol production from fermentation of industrial wastes is lucrative because of their easy availability, abundance and lower cost. Whey is one such source. Whey is the liquid remnant, following the precipitation and removal of milk casein during cheese making; and is a major by-product of dairy and cheese industries. The major constituent of whey is lactose (4.5-5 % w/v), which contributes to its high BOD (30,000-50,000ppm) and COD (60,000-80,000 ppm) content. Thus it poses a major environmental concern as a waste product, with an estimated production of 145 × 10^6 tons of whey per year, corresponding to 6 × 10^6 tons of lactose. Moreover costs incurred in effluent treatment processes also increase, with added complexity of process. Thus conversion of whey lactose to bioethanol is a viable option for bioremediation. Lactose permeate obtained from whey is fermented upon by different microorganisms, to produce ethanol. While *Saccharomyces cerevisiae* is the common organism used in ethanol fermentation, it cannot readily utilise lactose, which must be hydrolysed to glucose and galactose before it can ferment them into ethanol. This is because *Saccharomyces cerevisiae* lacks the *lac* operon gene, responsible for hydrolysis and uptake of lactose. Thus for *S.cerevisiae* to utilise lactose permeate as a substrate, it must first be hydrolyzed. This is done by the enzyme β-galactosidase coded by the LAC4 gene, which breaks down lactose to monomeric sugars- glucose and galactose, which are then utilised by *S. cerevisiae* to produce ethanol. Other species of yeast, namely *Candida* and *Kluyveromyces* readily utilise lactose to produce ethanol, due to the presence of the necessary genes responsible for lactose hydrolysis and its subsequent uptake and fermentation to ethanol; thus being effective organisms for whey fermentation. The genes responsible for lactose utilisation have also been extracted from strains of yeasts *Candida* and *Kluyveromyces*, to genetically modify *S. cerevisiae*, thus eliminating the need for prior hydrolysis of lactose. Strategies such as protoplast fusion (with *Kluyveromyces fragilis*), expression of β- galactosidase, which is then secreted to an extracellular medium, or simultaneous expression of *K. lactis* genes encoding for permease and β- galactosidase (LAC12 and LAC4 respectively), has been employed to engineer strains of *S. cerevisiae*, that are capable of using lactose directly, as their substrate. Amongst the various strains of *Kluyveromyces, K.lactis* has been studied widely and serves as the model organism in

many studies, though due to its metabolic diversity, *K. marxianus* has gained significant attention and has been studied for its immense potential for biotechnological applications, and is widely used in recent studies. *Candida pseudotropicalis* has also been found by various studies, to be an organism of choice for fermentation of whey into ethanol.However, all the yeasts studied, have individual characteristics which pose certain advantages as well as some inherent limitations. Though, for all the organisms capable of fermenting whey to ethanol, there is scope for further enhancement of yield, despite of existing limitations, by devising new techniques or engineering of more potent strains. The aim of this review is to discuss about whey permeate as a substrate and document the corresponding microorganisms proven to produce high yields of ethanol, and the associated techniques employed in each case.

Key words: Whey, bioethanol, *Saccharomyces cerevisiae, Kluyveromyces sp.,Candida sp.,* lactose fermentation

Hazardous Effects of Pesticides on Biodiversity

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The term "pesticide" is a composite term that includes all chemicals that are used to kill or control pests. In agriculture, this includes herbicides (weeds), insecticides (insects), fungicides (fungi), nematocides (nematodes), and rodenticides (vertebrate poisons). Besides its beneficial role, sometimes it performs bad effects on biodiversity. These pesticides go in water and polluted it. The impact on water quality by pesticides is associated with the following factors comprises, active ingredient in the pesticide formulation, contaminants that exist as impurities in the active ingredient, additives that are mixed with the active ingredient (wetting agents, diluents or solvents, extenders, adhesives, buffers, preservatives and emulsifiers) and degraded that is formed during chemical, microbial or photochemical degradation of the active ingredient. Heavy treatment of soil with pesticides can cause populations of beneficial soil microorganisms to decline. Additionally, Overuse of chemical fertilizers and pesticides have effects on the physicochemical properties of soil resulting to decline soil health. This indiscriminate use of pesticides causes to disturbed food chain, effects on food nutrition, soil health that cause human being and ecosystem gets jeopardized. People should aware both beneficial and harmful role of pesticides. There should be a prompt policy and strategy for effective doses of pesticides which should have implemented by governs body for sustainable production and agricultural security to make good and healthy nation.

Key words: Pesticides, biodiversity, hazardous, ecosystem, photochemical.

Air Pollution are Controlled by Escape Velocity of the Earth

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Due to accurate Escape Velocity on the earth, air doesn't go out from earth surface and hence life exists. The Escape Velocity of earth is 11.5km/sec where as moon has 2.5km/sec only. If Escape Velocity of earth either increase or decreases slightly it leads to make air dense or rare respectively.The average velocity of molecule of light gas existing on atmosphere of earth at the highest temperature is very less than the escape velocity of our earth. As a matter of fact, molecule of H_2 gas has escape velocity 2.6 km/sec at $500K^0$ where as earth has 11.5 km/sec. So, it is clear that such light gas H_2 can't go out from earth surface than rest of heavy gas hasn't out from earth surface. Hence, due to this fact there is atmosphere around of earth and life here. Life completely depends on existing atmosphere, atmosphere depend on escape velocity only in any planet or satellite.

It is true that as much amount of pollution is created by human on earth, contaminated air particles are diffusing from earth surface proportionally and existing flora, fauna and living creature are getting rid of pollution. After slight increment of escape velocity of earth we won't eliminate contaminated particle in surrounding by mutual adjustment from above facts it is clear beyond doubt that life existing on earth is depending only the escape velocity of our earth.

Rooting out pollution from the earth Barmuda triangle or Devils triangle had be establish of which works on magnetism and it swallows the good and bad particle from earth ,between Miyami and Bahamas in the south America Barmuda trigle swallows any state of matter existing on earth surface and as a result earth is getting rid of pollution.

Key words: atmosphere, air pollution, escape velocity, Barmuda triangle.

Studies on Prevelence of Helminth Parasites in Goats from Aurangabad

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A six month study was undertaken to determine the prevalence of helminth parasites in Goats from Aurangabad region. The prevalence of nematodes is higher compared to cestodes and trematodes. Infection intensity of nematodes is higher compared to cestodes and trematodes. Trematodes infection was nil.

Key words: Helminth, parasitic, prevalence.

Study and Analysis of Macro-Invertebrate Species Diversity in the Wetlands of Upper Brahmaputra Valley, Assam

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Macro-invertebrates play important role in the overall structure and function of the aquatic ecosystem. They convert the reduced carbon compounds derived primarily from the surrounding land (allochthonous material) into temporary storage compounds in their own tissues (Cummins 1973). Macro-zoo benthic fauna serves as the primary source of food for fish and other aquatic organisms. They usually live on plants surface and stones, plants also protect them during a particular phase of the life-cycle. Some invertebrates feed on the plants. The benthic communities react to environmental changes and can be used to provide information about the water quality. Their mass development is seen in places of strong organic contamination. Aquatic insects can thrive under varied ecological condition in freshwater and serve as indicators of several ecological characters. There are more than fifty numbers of wetlands in Dibrugarh Districts of Assam. The study was carried out at random method. Sediment samples were collected from 5 stations at monthly interval from July 2011 to June 2012. The submerged plants were collected in plastic bags immerged in 4% formalin and identified by Needham *et.al* 1972 and Patil and Gouder 1989). Molluscan shells collected washed preserved and identified by Fernando 1963 and Patil and Gouder 1989.

Diptera, Oligocheata, insect species, chironomidae, gastropods, Pelecypoda etc. were found in the study areas of Dibrugarh district, Assam. Statistical analysis was done by SPSS software programme.

Key words: Macro-invertebrates, Wetlands, Assam

Geoinformatics Environmental Planning Assessment and Future Prospects in Agriculture

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Geoinformatics particularly in the field of satellite remote sensing, GIS and GPS technologies have special advantage in terms of generating state of the art informatics capturing the spatial variability, vulnerability and dynamism of agricultural system. This information would enable us to provide valuable scientific insights into the factors contributing to the low productivity which in turn would from the essential ingredients to evolve site specific suitable and effective strategies to enhance it. Geoinformatics to promote collaboration between computer science and the geosciences to solve complex scientific questions. GIS has become significance for environmental planning and assessment mainly because of the need to compare a great number of spatially related data with their attributes and overlay them. These tools are receiving attention within the agriculture scientist community. It not only provides a visual inventory of the physical, biological and economical characteristics of the environment. It allows rational management without complex and time-consuming manipulation. Ecological integrity of farming system is an imperative need to extend the access of information and market to the small and marginalized farmers. The precision agriculture model using geoinformatics technology for India while addressing these issues would provide and innovative route for sustainable agriculture in globalised and liberalize economy.

Key words: Agriculture, Environment, GPS, Geoinformatics, GIS.

Environmental Protection and NGOs: Some Concerns Regarding Role for Better Contribution

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Non- Governmental Organizations is a broad term, which includes charity organizations, advisory committees and various other professional organizations. NGOs are involved in the whole spectrum of development activities from creating environmental awareness. NGOs are now playing an important role in framing the environmental policy, mobilizing public support for environmental conservation, and protecting the endangered species of forest and animals. The issues like future of environmental protection, sustainable development and zero population growth are some of the major concerns of the environmental NGOs.

Environmental policies will achieve positive results only when they are addressed to local issues and solve the problems of the local people. The policymakers should keep in mind of the people while framing the policies and implementing the environmental friendly projects.

Key words: Environmental Protection, Non-governmental Organizations, India

Trend in Changes of Crop Sequences due to Water Problems Ensuring Food Security in Gangetic Flood Plain of West Bengal, India

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Food grain based cropping systems *viz.* rice-wheat (10.5 M ha), rice-rice (5.9 M ha) and coarse grain based systems (10.8 M ha) are considered to be the major contributors to national food basket. Out of these, rice and wheat are the highest contributor and together shares 65% of national food grain production. Unfortunately these high productive systems are having high resource demand and continuously practiced over decades in irrigated area of the country. A suitable crop sequences can improve the total food production without hampering the available resources and environment. Gangetic flood plain of West Bengal comprises of about 38% of total area of the state and out of 3.29 M ha area only 0.45 % under forest, 23.83 % under non agricultural use and 71.95 % under net sown area (Anonymous, 2012). India is getting 4000 km^3 of water annually from all sources like precipitation, glacier etc. Out of this 2131 km^3 water is lost through evaporation, 1179 km^3 lost through run off and leaching out of the soil. Only 690 km^3 is stored as ground water and acts as a source of drinking water and irrigation water (Gupta, 2014). The length of water availability periods is very much important for selecting a crop sequence for the area concerned with a great aim to achieve maximum production.

Since 1970 there was the beginning of over-exploitation of the ground water often beyond the naturally replenishable limit. This was directly related to the introduction of high-yielding but water-intensive seeds that replaced the traditional ones. Now more than 0.60 millions of shallow and more than 5000 deep tube wells are operating in the agricultural fields of the State. Regarding irrigation command area both culturable command area (CCA) and gross irrigation potential created (GCA) were significantly increased in 2nd (1994-95) and 3rd (2000-01) minor irrigation census in case of shallow tube well (STW) and deep tube well (DTW) and trends ware reverse for dug-well (DW), surface flow (SF) and surface lifting (SL).

During rainy season with the ample rainfall farmers generally *kharif* rice, followed by pulses, oilseeds, potato and other vegetables. In contrast to the increase in *boro* rice area, oilseeds, vegetables, potato as well as pulse crops either showed their static or declining trend. They opined that the increase in irrigated area is one of the most important reasons behind this shift in the choice of crop. Due to availability of assured irrigation farmers showed their reluctance to cultivate pulse crops, rather they opted to

grow *boro* rice. Due to exploitation of this resource, in early 80's decade our state witnessed first sign of depletion of ground water level in some areas when the pre monsoon water level dropped below suction limit of centrifugal pumps and discharge in the shallow tube wells decreased and hand tube wells went dry in the peak summer.

To have the idea about the status of different crop sequences, the available data (2010-11) on major crops in some districts under Gangetic flood plain of West Bengal were analysed. The analysis result showed that rice-rice is the predominant system followed by rice-rapeseed& mustard-jute, rice-rapeseed mustard-sesame and rice – potato - jute. Crops like *boro* paddy, potato etc require huge amount of irrigation water whereas wheat, oilseed, pulses require comparatively less water. If we can minimize coverage area of high water requiring crops then huge amount of irrgation water would be saved. From the experiment it was found that by sacrificing one ha of *boro* paddy we can save 1400-1600 mm irrigation and with that amount of water we can grow more than 3 ha of wheat or 7 ha of *rabi* pulses. But Cultivation of *boro* rice not only raised economic condition of farmers but also enhanced the food security of the state. Food grain loss due to sacrifice of *boro* paddy can easily be compensated rather made surplus by growing wheat or pulses using the water of *boro* paddy. Therefore, it is better to grow less water requiring crops instead of high water requiring crops in the view to save irrigation water and protect our precious ground water.

Yield gap of major crops grown in the zone during last five years were calculated on the basis of optimum yield subtracting the actual farmers' plot yield. Optimum yield of the said crops were determined by making average of research plot yields of five years under optimum input and management condition. A huge yield gaps were recorded and those were 1308.29, 1499.71, 1240.85, 445.12 and 460.25 kg ha^{-1} for aman paddy, boropaddy, wheat, rapeseed & mustard and lentil respectively. However, this yield gap can be minimized by adopting various technological intervention like SRR (seed replacement ratio), good agronomic management and increased irrigation facilities.

Reduction of *boro* rice area in Gangetic flood plain of West Bengal is inevitable to sustain the degradable agro eco-system. A rational substitution of *boro* rice area with other food crops like wheat and pulses is necessary for food security as well as economic growth of the farmers. In spite decrease in area of *boro* rice, adoption of modern agricultural technologies for other crops will ensure food security. A mass awareness programme to educate the farmers about modern technologies for water saving as well as yield maximization comprising of use of modern seeds, integrated nutrient management, integrated pest management, modern storage facilities is urgently necessary.

Key words: Crop sequence, yield gap, ground water, command area, irrigation

Naphthalene Induced Haematological and Biochemical Changes in *Anabas testudineus*

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Naphthalene is a non-polar PAH which occurs naturally as a component of coal tar and crude oil and is manufactured for use principally as a chemical intermediate (e.g. phthalic anhydride). It is found in wide range of products, including petroleum products, mothballs, wood preservatives, solvents, dyes and can be released to the aquatic environment by a variety of means (e.g. discharges or spillages from the chemical and petroleum industries, coal gasification plants, atmospheric fallout). The present study was carried out to observe the damage done by Naphthalene as it is widely used by Human population in everyday life. *Anabas testudineus* was selected to carry out the toxicology test.

Objective-Assessment of the impact of Naphthalene on aquatic animal as extrapolation of the results to humans is based on these observation and results. Basic toxicity components like LC_{50}, Hematological indices, biochemical parameters and histological studies were carried out to record any change induced by varying concentrations of Naphthalene on *Anabas testudineus*.

Methodology- Water quality parameters were tested using Standard methods by APHA. Fishes weighing 2-5 gm were brought from CIFA [Central Institute of Freshwater Aquaculture, Bhubaneswar] hatchery and acclimatized in Laboratory conditions for two weeks. Morphometric characterization of *Anabas testudineus* was done before designing the dose. Naphthalene dose concentration was tested from 0.1 mg/l to 5.4 mg/l to obtain lethal concentration value. 20 fishes were taken for each concentration tested and the tests were carried out in triplicate to avoid any error. The concentration range taken was 0.1 ,0.2, 0.3, 0.4, 0.5, 0.6, 0.7,0.8, 0.9,1.0.1.1,1.2, 1.3, 1.4, 1.5,1.6,1.7,1.8,1.9, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 3, 3.1, 3.2 , 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 4.0, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 5.0, 5.1, 5.2, 5.3, 5.4 mg/l respectively. Estimation of Acetylcholine esterase, Protein, Glycogen was carried out by Spectrophotometric method by *Ellman* et al, 1961, *Lowry et al, (1951)*. Blood Smear preparation was done by differential staining method using Field Stain A and B along with Giemsa. Giemsa staining gave better results in comparison to Field staining.

Result and Conclusion- LC_{50} - 5.4 mg/l of Naphthalene killed 50% of Experimental animals. After deriving LC_{50} sublethal dose concentration was designed and the sets were labelled as Experimental Set1, Set2, Set3 and Set4 with one comparative Control

set. Protein, Glycogen, Adenosine Triphosphate, Acetylcholine esterase activity decreased in all experimental animals compared to control fish. Blood cells showed aggregation and chain formation under the influence of Naphthalene toxicity. Aggregation of blood cells will hamper oxygen carrying capacity and also affect the defense mechanism of aquatic animal.Naphthalene was found to be toxic to most of the cells and tissues and can even leach into the ground water in greater quantities than the other PAHs. Due to its release into to environment, higher levels of Naphthalene will be found in the ground water than other PAHs. Hence alternative treatment method has to be devised to make Naphthalene less toxic to aquatic animals and in the long run to Humans.

Key words: Acetylcholine esterase, aggregation of blood cells, protein, ATP, experimental and Control set

Review Essay on Mycoremediation of Oil Spills using *Penicillium chrysogenum*

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This study paper is designed to review on mycoremediation of crude oil by strain of *Penicillium chrysogenum*. Despite of the abundance of fungi in wastes, *Penicillium* species, especially *Penicillium chrysogenum* have receives little attention in bioremediation and biodegradation studies of Xenobiotics such as hydrocarbons and heavy metals, even at low concentrations, can be toxic to humans and other forms of life. And global pollution is increasing due to the variations in natural and anthropogenic activities leading to contamination of various terrestrial and aquatic ecosystems with heavy metals, inorganic and organic compounds. Controlled and Uncontrolled discharge of solid and liquid wastes, use of agricultural fertilizers, herbicides, insecticides and pesticides sewage disposal and accidental spillage are some of the main contributors of alarmingly increased content of various contaminants in the biosphere. The *Penicillium chrysogenum* is used to remove metal ions with high efficiency and degrades hydrocarbon's chain.

Key words: Bioremediation, Biodegradation, Mycoremediation, *Penicillium chrysogenum*, Heavy metals and Hydrocarbons.

Bioremediation: A Useful Tool to Control Pollution

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Sites contaminated by heavy metals and other pollutants are common throughout the world. Bioremediation is a waste management technique that involves the use of organisms to remove or neutralize pollutants from a contaminated site. Bioremediation stimulates the growth of certain microbes that use contaminants as a source of food and energy. Contaminants treated using bioremediation include oil and other petroleum products, solvents, and pesticides. Microbes eat and digest contaminants, usually changing them into small amounts of water and harmless gases like carbon dioxide and ethene. The use of genetic engineering to create organisms specifically designed for bioremediation has great potential. The bacterium *Deinococcus radiodurans* has been modified to consume and digest toluene and ionic mercury from highly radioactive nuclear waste. For bioremediation to be effective, the right temperature, nutrients, and food also must be present. Proper conditions allow the right microbes to grow and multiply and eat more contaminants. Bioremediation relies on microbes that live naturally in soil and groundwater. These microbes pose no threat to people at the site or in the community. Bioremediation has the advantage of using natural processes to clean up sites. Because it may not require as much equipment, labor, or energy as some cleanup methods, it can be cheaper. Contaminated soil and groundwater are treated onsite without having to dig, pump, and transport them elsewhere for treatment. However, in recent years there has been a flurry of interest developed in the implementation of biological approaches for bioremediation of at least some forms of inorganic contamination and paved the way for some other promising technologies to emerge.

Key words: Bioremediation, Contaminants, Microbes, Pollutants, nutrients

Induced Genetic Variability using SA and EMS for Genetic Improvement of *Vicia faba* L.

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Sustainable agricultural intensification is the need of the hour to cope with the present mutable climatic conditions that imposes threat to the crop production and food availability for the rapid increasing population. To circumvent the situation and achieve food security, development of high-yielding crop varieties with wide adaptability is the most viable option. Genetic variation is imperative to crop improvement; therefore, conservation and management of plant genetic resources while exploiting them for accelerated and targeted evolution definitely amplify the possibilities in plant breeding. The present investigation was carried out with an objective of inducing genetic variability using chemical mutagens in yield contributing traits of Broad bean (*Vicia faba L.*) var. Mayur 12, an autogamous crops having narrow genetic base, procured from IARI, New Delhi. The healthy and viable seeds of Broad bean cultivar (Mayur 12) were subjected to different treatment levels viz, EMS (0.1%, 0.2%, 0.3%, 0.4%) and SA (0.01%, 0.02 %, 0.03%, 0.04%) at room temperature of 25±2 ^{o}C. The assessments were made on bio-physiological damages, morphological variants and quantitative traits. Mostly, there were significant variation observed between SA and EMS treated population and the levels of variations were more conspicuous as the dose increases. Different economically important mutant were observed namely dwarf mutant, bushy mutant, high yielding and early maturing mutant at various doses of mutagens. The higher doses of SA (0.03%, 0.04%) and moderate doses of EMS (0.2%, 0.3%) were found to be useful while EMS (0.4%) proved lethal. The results provided broad genetic variability that would be highly practical to the pulse breeders in planning their selection and hybridization programmes.

Key words: *Vicia faba* L., ethylmethane sulphonate (EMS), sodium azide (SA), plant breeding, quantitative traits, sustainable agricultural intensification.

Impact of DMSO on MMS Mutagenecity in Polygenic Traits of *Lens culinaris* Medik

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In the present scenario of variable natural environment and sky-high natality, sustainable boost in the agricultural productivity is the utmost priority. Induce mutagenesis generates noble genetic combination without affecting the overall genomic makeup of the crop, thus, it provides the basic requirement of genetic variation for any crop improvement programme. The present study has been carried out to investigate the mutagenic effect of MMS alone and in combination with DMSO on lentil (*Lens culinaris* Medik.) var. L4076, procured from IARI, New Delhi. Comparative impacts were studied on bio-morphological variations and agronomic traits of the crop to establish the effect of DMSO on MMS mutagenecity. The healthy and viable seeds were treated with different dose levels viz, MMS (0.01%, 0.02%, 0.03%, 0.04%) and 2% DMSO with MMS (0.01%, 0.02%, 0.03%, 0.04%) at room temperature of 25±2 ^{o}C. The assessment on seed germination, pollen quality and chlorophyll content showed considerable biological damages at higher MMS treatments while comparatively lower in combination doses. Morphological variants were also screened and isolated on the basis of economic importance from the treated populations. Economically important mutants like dwarf mutant, bushy mutant, high yielding and early maturing mutant were identified and the frequency of the mutants were more in combination treatments. Statistics on quantitative traits viz. days to maturity, plant height, fertile branch, pods/plant, 100 seed weight and seed yield showed significant deviations from the control population. DMSO effectively decreased the MMS induced biological damages while increase the frequency of induced economical mutants and ultimately an increase in most of the agronomic traits studied. Since, most of the desirable traits are polygenic in nature; the success of breeding depends on careful selection of the mutants. The investigation revealed that the DMSO, known for it's tissue penetrant and germination enhancer qualities, can be utilize in combination with MMS treatments to attain minimum biological damage and maximum genetic variation in mutation breeding of lentil genotypes.

Key words: *Lens culinaris* Medik. (Lentil), methylmethane sulphonate (MMS), dimethyl sulfoxide (DMSO), Induce mutagenesis, Agronomic traits.

Assessment of Relative Diversity of Wild Ornamental Fishes of Two River Basins of Arunachal Pradesh, India

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Being bordered with Bhutan, China, Bangladesh and Myanmar, the state of Arunachal Pradesh uniquely shares their flora and fauna and hencepossesses great potential to support both food fish (FF) and ornamental fish (OF) industries of India. This mountainous state is engorged with ten river basins and numerous streams that harbour enormously rich and diversified piscatorial forms. At present nearly 95% of the total OF supplied from this region is wild fishesthat are caught directly from their natural habitat in order to be sold into the aquatics trade. This practice is extremely harmful as it causes over-exploitation and ultimately results dwindling of this immense fish resource. In addition, introduction of exotic species, pollution, global climate change, indiscriminate fishing for food etc. is making the situation even more critical. Considering this situation, there is an urgent need to document the fishes of this area and assess the current status of their diversity so that necessary steps could be taken for their conservation. But such types of studies are lacking except some scattered information in the literature.

Key words: Dikrong, Ranganadi, Ornamental fish (OF), potential ornamental fish (POF), biodiversity

Floristic Diversity and Sediment Correlation in Different Regions of Mangrove Dotted Atharbanki Creek, Mahanadi Estuary, East Coast of India

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Results of an ongoing study in the coastal state of Odisha (Latitude $17^0$49'N-$22^0$34'N and Longitude $81^0$24'-$87^0$29'E) at Atharbanki creek (Latitude $20^0$17'25.81"N and Longitude $86^0$42'08.08"E), Mahanadi estuary, reveals a large diversity of denuding mangrove flora and typical clayey soil texture with high percentage of organic matter at mangrove dominated zones. The whole creek is dominated with few tree species like *Avicennia alba*, *Avicennia marina*, *Avicennia officinalis, Rhizophora mucronata* and *Sonneratia apetala*. The shrubby elements namely *Acanthus ilicifolius, Excoecaria agallocha, Caesalpinia crista, Dalbergia spinosa, Tamarix troupii, Aegiceras corniculatum* etc. are also commonly seen. *Sarcolobus carinatus, Derris trifoliata, Derris scandens, Solanum trilobatum* and *Ipomoea cymosa* are the notable climbers/twiners of Atharabanki area, where the salinity is comparatively low. The percentage of organic matter is high in the core mangrove regions which ranges between 0.677 to 9.342 along the creek. In all, three sediment textural classes were identified namely clay, sandy clay, and sandy clay loam. The salinity of the creek varied from 0.13 PSU to 19 PSU with an average of 5.16 PSU. Moreover, the pH and dissolved oxygen content fluctuated between 5.68 to 9.50 and 4.24 to 9.12 respectively throughout the creek.

Key words: Creek, Mangroves, Denuding, Organic matter, Texture, pH, D.O, Salinity etc.

Algal Flora from Brinjal Field of Bhagpur, Cachar District, Assam

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While algae are primarily known from aquatic habitats they are also important contributors to the soil microflora. Almost all terrestrial ecosystems has some kind of algae throughout the year that may become visible during favourable habitat conditions. Soil algae excrete growth-promoting substances such as hormones, vitamins, amino acids, and organic acids that affect other organisms in many ways. The present work was carried out to make an assessment of the algal flora of brinjal (*Solanum melongena L.*) fields of Bhagpur located in Cachar district of the state of Assam (India). The algal samples were collected randomly from soil surface at regular interval from December 2012 to June 2013 from five brinjal fields of Bhagpur area. A total 20 species were recorded under Chlorophyceae, Bacillariophyceae and Cyanophyceae from the different sampling sites. Of these, 9 species under 8 genera belonged to Cyanophyceae, 6 species under 6 genera belonged to Bacillariophyceae and 5 species under 5 genera belonged to Chlorophyceae. The soil pH (~5.7) was found to be mildly acidic. It has been observed that Cyanophyceae constitute major part of soil algal population. The most dominant species were *Anabaena, Chroococcus, Chlorococcum, Lygnbya, Cylindrospermum, Calothrix, Stichococcus,* and Nostoc. Out of 8 genera of Cyanophyceae four genera *Anabaena sp., Cylindrospermum sp., Calothrix sp.* and *Nostoc sp.* are heterocystous and remaining four are non-heterocytous. The algal occurrence has been correlated with soil quality parameters.

Key words: Algal flora, Brinjal field, Soil quality, Assam

Public Interest Litigation and Role of the NGOs for the Prevention of Illegal Mining Activities in India
[Environmental Degradation, Non Renewable Energy, Judicial Remedies, Mining and Constitution of India]

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Environmental Non-Governmental Organizations are the children of the growing dissatisfaction among people with the performance of the government and private sector in the matter of environmental protection, coupled with the collective conviction to take pioneering steps to change the present state of affairs for the better. Responding to the situations of gas disasters, water quality degradation, air pollution, deforestation, unscrupulous mining, health hazardous insecticides, and chemicals which challenge living beings' right to wholesome environment, the ENGOs work at various levels of economic processes and organization of the public opinion. They play a pivotal role in taking environmental issues before the administration and judiciary for redressing the grievances. ENGOs take up the cause of the environmental protection and do everything within their means to further this cause.

The cause of environmental protection needs a special attention in the era of development. Unfortunately the governments are adopting the developmental path in a frenzied manner, neglecting the interests of the nature. By virtue of Art. 32 and Art. 226 of Constitution of India which enables the ENGOs took up the cause of environmental protection to the judiciary. There is a vast body of decisional law built through Public Interest Environmental Litigation which has shaped the modern environmental principles, national policy and the development of environmental jurisprudence in India The impetus of this paper revolves around and focuses on one such activity, specifically solving the crisis of illegal mining. India's enormous multi-state illegal mining has several pernicious evil effects on the national economy, population, environment etc. There is a need to stop this immediately and effectively. There are several regulatory agencies that help in curbing illegal mining. However, this paper is concerned with one such agency that plays an equally vital role, explicitly non- governmental organizations.

The main aim of this paper is to understand the diverse roles played by NGOs in preventing illegal mining, which the author intends on achieving by relying on certain landmark judgments' of the supreme court that elucidate the same. Specifically, the celebrated Samaj Parivartana Samudaya and others v State of Karnataka and others which deals with the illegal mining scam in the district of Bellary in Karnataka, the landmark M.C. Mehta v UOI which dealt with the infamous mining scam in the Aravalli Hill Range, the Goa Foundation vs. Union Of India & Ors are some to name a few. Most of

the case Supreme Court of India has appointed various committee to look into the illegal mining activities in India. All these cases were brought before the court by various NGO's in order to prevent illegal mining and for the purpose of protecting the environment. The Supreme Court has also reiterated by according value to the environment in a manner that it deserves. The role played by the NGOs in India is commendable in terms of preservation of valuable mineral resources. The Court approach is evident from all such land mark case which has been brought by the NGOs. In this paper author will bring out the the constitutional rights of the NGOs in terms of the filling public interest litigation petition against the various environmental problems including illegal mining activities. The author shall conclude by suggesting certain remedies and emphasizing on the importance of continuous active participation of NGOs in preventing problems like illegal mining.

Metallic Ion Concentration in Water and in Two Exposed Fish Species in Damodar River System

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As considerable quantity of industrial effluents are continuously discharged in Damodar river water, depositing various chemical pollutants, causing cytotoxicological effect of river biota including fishes. Keeping this in view, seasonal heavy metal concentration were determined in surface water and tissues of two important fish spp.viz. *Macrognathus puncalus* and *Cirrhinus reba*. These fishes are commonly found throughout the entire stretch of the studied river system and also largely consumed by local people. More over the *Macrognathus pancalus* is bottom dweller and omnivore, which indicates that this fish could be readily contaminated by the toxic substances through food intake directly. Whereas the bottom feeder *Cirrhinus reba* may get contaminated by toxic metals of surface water as well as bottom and column water toxicants due to its food habit. Analysis was done using an atomic absorption spectrophotometer, during the years 2007, 2008, 2009. Seven stations covering the tributary reservoir also were studied, considering heavy population in the surrounding areas and possibility of pollution from point and non point sources. The physiochemical parameters were analyzed using APHA standards.

Values of metal concentration in water were high, at the sites of Rajarappa, Chandrapura, Durgapur among these Rajarappa seems to be highly polluted and affected by heavy metals. The reason behind might be that, the colliery and coal washeries is continuously discharging metals in the vicinity of this station and are adsorbed onto water , sediment , due to interaction with some other compounds. Metal pollution levels in the other stations like Panchet, Tarakeshwar showed a lower concentration but were also not within limit of mean International standard. The concentration of all metals in water were higher the WHO recommended limits and it is suggested that the water of Damodar River was not suitable for drinking.

The results of the present study showed that increasing concentrations of zinc > lead >copper > nickel > cadmium, in river water leads to the disastrous effect of this aquatic biota. Amongst all the metals analyzed, Zn and Pb were observed to have the highest concentrations in water, and fish samples. Moreover, Zn concentration found to be highest, higher than the recommended level by WHO (1985) at nearly all stations when compared to data obtained from uncontaminated waters of Tori. The levels of heavy metals accumulated by the two freshwater fish species do exceed the maximum permissible limit values of heavy metals for fish tissues as prescribed by various national and international agencies in all sites other than Tori Thus the bio-concentration factor of heavy metals in the fish tissue are high. Study indicates, among

all the sites Tori seem to be the less contaminated site. Also the fishes from Tori displayed lower metal concentrations in tissue compared to the other stations.

These contamination might be due to the intense coal mining, washeries industrial effluents discharge, increase in agricultural influx waters, domestic wastes and some anthropogenic activities. The findings reveals that, higher concentration of metals in the river water indicates the fact that pollutants discharged into the aquatic environment do remain in aqueous phase and accumulated by fish tissue through food or water intake. The adversity is deep into the fact that, heavy metals in excess of the limits have an adverse effect on the surrounding environment and the aquatic life in the river which is destroying all the aquatic biota as well as those lives also who consume them. There is thus an increasing need for continuous monitoring of the pollution levels of Damodar River waters and a check on the disposal of sewage, waste water and effluents from coal mines, coal washeries, residential and industrial units on areas adjoining the river banks.

Key words: Heavy Metals, Water Pollution, Mines, Industrial effluents, Sewage, Toxicity levels, *Macrognathus pancalus, Cirrhinus reba*, Damodar river

A Review on Biodegradation of Polythene: The Microbial Approach

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The use of polythene is increasing day by day and its degradation is becoming a great challenge. Annually about 500 billion to 1 trillion polythene carry bags are being consumed around the globe. Polythene is durable and needs up to 1000 years for natural degradation in the environment. This present review focuses on the level of polythene pollution, cost effective methods, the source of polythene degrading microbes, brief mechanism of polythene degradation, the methods used for the biodegradation of the polythene, the assessment of polythene degradation by efficient microbes,the products of polythene under degradation process and the future aspects of polythene degradation.A brief survey is presented on various individual group of enzymes such as laccase, cutinase, hydrolase, esterase,protease and urease etc. These enzymes are secreted by various predominant microbes like *Streptococcus, Bacillus, Pseudomonas, Staphylococcus, Aspergillus, Penicillium, Phanerochaete, Pestalotiopsis*etc

Review on Methods for Biological Assays of Pharmaceutical Product

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The present study paper on the biological assays of pharmaceutical product is intended to review on the available literature that are widely applicable in the bioassay of pharmaceutical substances.There is an urgent need for more strategies and procedures for bioassay techniques, including methods that employ multicellular and unicellular organism. The presence of small amounts of pyrogen or endotoxin in recombinant protein preparations and other pharmaceutical product can cause side effects in host organism such as endotoxin shock, tissue injury, and even death. Due to these reactions, it is essential to remove endotoxins from drugs, injectables, and other biotechnological products, an overview of this subject is provided by this paper. An extensive review of literature with regard to methods for pyrogen, endotoxin and toxicity bioassay test of pharmaceutical and biotechnological preparation was carried out. Rabbit pyrogen test is an older, more routine,standard and official in vivo multicellular test methods in most pharmaceutical compendia.Limulus amebocyte lysate(LAL) is an in-vitro test currently employ in the detection and quantification of endotoxins that are of bacteria and non bacterial origin in a variety of solution, and can be use for screening of starting materials. The possible advantages of LAL test compared to Rabbit method include rapidity reliability ease and adaptability. Biological assays are very essential in clinical medicine and other field of science for the role it plays in evaluation and assessment of pharmaceutical and biotechnological preparation.

Key words: Assay, Bacteria, Rabbit, Multi-cellular, Unicellular.

Trees as a Bio-Indicator of Heavy Metal Pollution in Different Land use Pattern of Varanasi City

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Environmental pollution is one of the major apprehensions of urban environment. Large quantities of air pollutants with potential carcinogensare emitted each day.Air pollution is one of the major global health risk factor and population of all age group is equally exposed to it. Many metals, particularly heavy metals are toxic and released from many different anthropogenic sources such as industry, fossil fuels combustion of vehicular traffic, fertilizers, paints and batteries in urban environment. Transportation sector contributes most significantly to heavy metal pollution in urban areas. Higher plants can be efficiently used as bio-monitors to ascertain environmental pollution because it endures high spatial and temporal tenacity due to higher availability and lower sampling expenses. Long living nature and lower detection limits of tree species enable them as effective bio-monitors for long term heavy metal monitoring program in urban units.

The objectives of this present study were to estimate the heavy metal bioaccumulation potential of different tree species and to examine the influence of various land use pattern on the spatial-temporal pattern of air transported heavy metals and the air quality as far as the presence of toxic elements are concerned.

Concentrations of six heavy metals (Zn, Cu, Ni, Mn, Co and Cd) were determined in leaves of 12 tree species (*Delonixregia* (Boj.) Rafin.,*Holopteleaintegrifolia*(Roxb.) Planch., *Callistemon lanceolatus*DC., *Thevetiaperuviana* (Pers.) Schum., *Cassia siamea* Lam., *Polyalthialongifolia* Sonn., *Dalbergiasissoo* Roxb., *Albizialebbeck* Linn., *Azadirachtaindica* Juss., *Mangifera*indica Linn., *Ficusreligiosa* Linn.and *Psidiumguajava* Linn.belonging to 10 angiosperm families widespread throughout the city were tested for their suitability for air quality bio-monitoring.Leaves were collected from fully developed leaves of about the same age sampled at 2 m height above the ground from external portion of canopy,in different seasons of 2013 from four different land use types (heavy commercial, light commercial, industrial and residentialwhich served as reference site owing to lower anthropogenic activity) of Varanasi city, situated in Indo Gangetic plains of India. Leaf samples in triplicates were digested in di-acid solution until a transparent solution was found. The extracted solution was filtered and elemental composition was determined using atomic absorption spectrophotometer (AAS).

The results of the investigation indicated that the bioaccumulation of heavy metals was significantly affected by different land use type, seasons and within plant species. Site-dependent variations were found with the highest concentrations at industrial area followed by commercial and least atresidentialsite. Traffic activity was found most significant factor in all the land forms except industrial. Overall sequence of heavy metals in tree leaves was Zn>Mn>Cu>Ni>Co>Cd.Concentrations of Zn ranged from 18.1-289.5 μg g^{-1} among all land use type with highest concentrations of Zn were detected in *C. siamea*, *D.sissoo* and in *F.religiosa* with maximum increase of 9.3 folds in *C.siamea* in industrial site compared to reference site. *H.integrifolia*(18-35μg g^{-1}) and *F.religiosa*(31-37μg g^{-1})showed higher Ni accumulation whereas increase was maximum in case of *D.sissoo* (4 folds) in industrial area compared to reference area. Mn concentrations ranged from 14.9-115.87μg g^{-1} among all plants. *A.lebbeck*, *D.sissoo* and *T.peruviana* showed higher Mn accumulation among all land use type. *C.siamea* and *A.indica*showed higher Mn accumulation at commercial site compared to industrial site. There was no significant difference between Co concentrations for majority of plants between industrial and commercial areas with higher accumulation in case of*A.indica*and *P.longifolia*. Cu concentration ranged from 11.4-32.2 μg $g^{-1}$with *P.longifolia* and *C.siamia* showed higher accumulation. Cd showed least accumulation among all metals with concentration ranged between 0.25-15.5 μg g^{-1}.

Compared to reference site higher accumulations were observed in *C.lanceolatus* for Zn, *H. integrifolia* and *F.religiosa* for Ni, *T. peruviana*and *C.lanceolatus* for Mn, *A.lebbeck* and*M. indica* for Cu, *D.sissoo*for Co and *A.lebbeck* for Cd. When cumulative concentrations of all the six heavy metals were compared in all land use type *F. religiosa*, *C. siamea*, *A. lebbeck* and *P. longifolia* were found to be major accumulators whereas *M. indica* and *P guajava*were identified as least accumulator species.

In conclusion no single species showed higher accumulation ability for all heavy metals but different species showed different accumulation ability for specific heavy metals. Cumulative heavy metal content of all six metals in leaves showed distinct difference with maximum accumulation in *F. religiosa* followed by *C. siamea* and *A. lebbeck*.As these species showed higher accumulation ability as well as increase at higher polluted environment they can be used as bio-monitor of the heavy metals in the urban environment as well as for phytoremediation whereas different metal accumulator's species can be useful in individual metal indicator in urban atmosphere.

Key words: Heavy metal, urban, accumulation, leaves, *F.religiosa*, *A.lebbeck*

Some Medicinal Plants used by the Rabha Tribe of South Kamrup (Assam) with Special Reference to Their Conservational Need

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A large number of herbs are being used for treatment of different ailments all over the world (Chowdhury, *et al*., 2005). Ethnobotany, as a traditional health practices where herbal medicines are utilized by the tribal people in different parts of the world. These people collect the herbs from their surroundings such as home gardens, nearby forest, roadside etc. and this traditional knowledge they received from their ancestors which is passes from generation to generation in their communities. But now a day's these medicinal plants show less in quantity. This is due to some human activities like urbanization, pollution**,** Habitat loss and deforestation, Over-exploitation of natural resources etc. These activities cause the species extinction which is the prime factor of biodiversity crisis. For the people of rural areas this traditional medicine is safe and low cost and it is faithful for them. The Rabha tribe is a large tribal group of Assam inhabiting in Brahmaputra valley of Assam. There are seven sub-tribes of Rabha community such as Rangdaniya, Maitoriya, Pati, Koch, Bitliya, Dahuriya and Sangha. Among them Rangdaniya, Maitoriya and Pati are dominant (Endle, 1911).The aim of the present study is to discuss and evaluate some medicinal uses of the plants as well as their conservation so that people can utilize these plants for traditional practices to treat their various health problems.

Key words: Medicinal plants, Ethnobotany, Rabha tribes, biodiversity crisis, Kamrup District.

Efficacy of Botanical, Bio-Control, Nutrients and Fungicides against *Exserohilum turcicum of Maize under in-vivo Condition*

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The investigation was carried out at Division of Crop improvement, Plant Pathology section, ICAR Research Complex for NEH Region, Umiam, Meghalaya during 2011. One botanical (T_2-*Lantana camara* @ 50 ml l^{-1}), three bio-control agents (T_3- *Trichoderma harzianum;* T_4-*Trichoderma viride;* T_5- *Trichoderma asperellum* @ 50 ml l^{-1} each*)*, three nutrients supply (T_6-K+Zn; T_7-P+Zn; T_8- N+Zn at different doses), one fungicide (T_1-Mancozeb 75% WP @ 2.5 g l^{-1}) served as check (control) and one untreated plot (T_9) served as absolute control having three replications with Randomized Complete Block Design (RCBD) were being considered for the study. Observations on various parameters, *viz*. Percent Disease Index (PDI) through disease rating of 1-5 was recorded and yield attributes such as number of plant/plots, number of cobs/plant, seeds weight and cob length were recorded. Area under disease progress curve and apparent infection rate was estimates from set of six observations. Results showed least PDI (18.44) under T_1 followed by T_4 and T_3 respectively. So far nutrient supply is concerned T_6 was encountered with the least PDI (26.56). However, maximum PDI (62.33) was recorded from control plots followed by plots sprayed with T_2 (37.22). AUDPC estimation with respect to different treatments indicate summary of disease intensity over time. The least AUDPC (33.33) was recorded under T_1. Among bio control agentsT_4 was estimated with least AUDPC (45.67) followed by T_3 (48.33). T_6 recorded with least AUDPC (47.67) followed T_7 (49.67) so far nutrient supply is considered. Maximum AUDPC was recorded from absolute control plot, T_9 (124.00). Apparent infection rate (r), the rate of disease progress based on different treatments of the extent of infection at different time was also estimated. The least (0.05) r value were recorded from plots sprayed with T_1 and T_4 followed by plots sprayed with T_3, T_5, T_6, T_7 and T_8 being at par with r value of 0.06. However, maximum r value was estimated from T_9 (0.11).There was no significant difference between yield attributes such as number of plants per plots and number of cobs per plant. But there was a significant difference between 100 seeds weight and cob length among the treatments. Maximum 100 seeds weight was recorded from plots sprayed with T_1 (0.021) followed by T_4 and T_6 being at par with seeds weight of 0.019. T_7 and T_8 sprayed plots recorded seeds weight of 0.017. Maximum cob length was recorded from plots sprayed with T_6 (13.37) followed by T_1 (12.96 cm), T_3 (12.26 cm) and T_4 (12.08 cm).

Key words: Botanical, bio-control, nutrients, fungicides, *Exserohilum turcicum,* AUDPC

Catalytic Oxidation of Waste Water using Hydrogen Peroxide and Flyash as Catalyst

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As due to population increase and industrial development there is huge generation of waste water. Biological treatment method is very slow. There is need to treat waste faster and more efficiently. Advanced oxidation process is a process which involves the generation hydroxyl radicals in sufficient quantity to effect water purification.The hydroxyl radical is a powerful, non-selective chemical oxidant which treat organic matter.Hydrogen peroxide is widely used chemical oxidant now a day because of its ecofriendly nature. Its decomposition gives water and oxygen. Effluent treated with H2O2 is susceptible to biodegradation.Usually Fenton process which involves reaction with H2O2 with iron (II) as catalyst. But this method is costly. There is a need for low cost catalyst for reaction with H2O2.The present study focus on use of industrial waste like fly ash in catalytic oxidation. As the fly ash contain compound like Fe2O3, Al2O3 SiO2 it act as a good catalyst.

The main objective is to prepare fly ash based catalyst suitable for effective oxidation of waste water with H2O2 and to develop suitable method for waste water treatment using catalytic oxidation by H2O2.The focus is to study COD removal efficiency by using fly ash in catalytic oxidation of waste water with H2O2 and to find optimum dose of H2O2 and optimum time required for treatment.

Key words: Fly ash, AOT, COD removal, Fenton process

Studies on Morphological, Behavioral and Biohemical Alterations in a Freshwater Fish, *Labeo rohita* Expose to Tannery Effluents Collected from Ramsar Wetland of West Bengal, India

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A tannery effluent was collected from the discharged point to East Kolkata Wetland, A ramsar site of Wesbengal, India. Acute toxicity of the tannery effluent was determined for 96 hours period against *Labeo rohita*. The LC_{50} value of effluent was calculated by Finney method (1971). Three sub lethal concentrations 3.53%, 1.76% and 0.88% were selected on basis of (1/2, 1/4, 1/8) of LC_{50} value. Various morphological and behavioral alterations were observed in the three sub lethal concentrations for 96 hours. Morphological changes like loosening of scales, sinking of eyeball, redness of eye, profuse mucous secretion, bleeding from gills and hemorrhages were recorded. Behavioral changes consist of gulping of air, opercula movement, erratic swimming, and loss of equilibrium, restlessness and sluggishness. Concentration 3.53% confirmed to be highly toxic whereas 1.76% and 0.88% concentrations cannot be overlooked as they also induced alterations in morphology and behavior of fishes. Control fishes were also continuously observed and contrasted with the alterations caused by effluent in each concentration. For the examination of biochemical changes the LC_0 and LC_{50} concentrations were 15% and 20% for tannery effluents, after acute toxicity experiments for tannery industrial effluents, various tissues viz. gill, liver, muscle and kidney were obtained separately from control, LC_0 and LC_{50} groups. These tissues were used for biochemical estimations. The glycogen content in all the tissues decreased considerably upon acute toxicity of tannery effluents except muscle in LC_{50} group of tannery effluent, when compared to control group. The total protein content decreased in all tissues except gills in LC_{50} group of tannery effluent, In general total lipid content decreased in all tissues after acute exposure when compared to control group. The results obtained in the present study showed that, the industrial effluents from tannery caused marked depletion in biochemical composition in various tissues of the fish *Labeo rohita* after acute exposure.

Key words: Acute toxicity, tannery, $LC_{50,}$ Behavior, Morphology, Biochemical changes, Ramsar wetland.

Comparative Antibacterial Activity of Chewingsticks and Tootpaste commonly used in Kano (Nigeria) on Clinical Isolates of Staphylococcus and Streptococcus Species

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A number of plants and their part are used as chewing sticks in kano, Nigeria. Different researches have been carrying on the antimicrobial effect of chewing sticks on oral micro organisms. This research was aimed to determine the antibacterial activity of aqueous extract of plants and five different types of conventional toothpaste, commonly used in kano on clinical isolate of staphylococcus and streptococcus species obtaining from dental problem with a view to finding the most efficacious one among them, sensitivity disc method was used to test the antimicrobial activity of chewing sticks, Al. lebbeck, Az. Indica, J. curcus, N. natifolia and V. amydalina and Toothpaste are Dabur, Florish, Close up, Machine, and My my. It was found that non of the plant had activity in aqueous extract on the two species of the bacterial isolate at various concentration. But in ethanolic extract were active against all the test bacterial isolate obtaining from dentel problem with greater zone of inhibition in N. natifolia, following by Az. Indica and smaller zone of inhibition in J. curcus. In comparism with conventional toothpaste, chewing stick produced similar or greater zone of inhibition then my (toothpaste).

The some of the secondary metabolite were all presents with more intend in ethanolic extract. The extracts of these plant and toothpaste may served as sources for chemotherapeutic agents for the management of orofacial infection.

Key words: Staphylococcus, streptococcus, chewing stick, toothpaste, infection

Aquatic Insect as Bioindicator

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Around the world, freshwater habitats are being subjected to increased levels of human disturbance. A recent assessment of the status of inland water ecosystems shows that globally most threatened river catchments are to be found in the Indian subcontinent. A study based on 195 animal species of inland water ecosystems indicates that on average monitored populations have declined by 54% during 1970-2000. This compares with a decline over the same period of some 35% in 217 marine and coastal species, 15% in 282 terrestrial species. It is imperative to identify, monitor and conserve important areas biodiversity especially of the riverine ecosystems as inland water ecosystems are suffering the greatest negative impact from human activities at present. A spectrum of biological communities including plankton, periphyton, microphytobenthos, macrozoobenthos, aquatic macrophytes and fish has been used in the assessment of the water quality. However, experiences from USA and European programmes have demonstrated that benthic macroinvertebrates are most useful in monitoring freshwater ecosystems. Factors governing aquatic insect distribution are Oxygen availability, Temperature and Sediment and substrate type. Typical responses to aquatic insect communities following disturbance are, as particulate material including sediment increases, certain species of mayflies (Caenidae) and caddisflies like the filter-feeding Hydropsychidae increase in relative abundance, when dissolved oxygen is reduced, haemoglobin-possessing bloodworms (Chironomidae) increase in number, stonefly nymphs decline as temperature increases, pesticide runoff leads to substantial reduction in species diversity, if nutrient levels increase due to fertilizer run off or livestock yard wastes entering the water, a few species will increase dramatically with concomitant general decline in species diversity. Biological monitoring using insects has many advantages as many taxa differ with regard to their sensitivity to environmental change and habitat requirements so we can choose the taxon according to the needed resolution, we can focus on functional groups such as primary consumers or top predators to monitor ecosystem function, there is a general lack of ethical constraints in sampling insects where no one really cares if they are killed in the monitoring process and insect populations tend to be very large, so that killing a few hundred individuals will not negatively impact the population. Insects can be the "canaries" for environmental damage that can harm humans, such as water quality or the build up of toxic chemicals. The primary goal for environmental monitoring is to ascertain the effects of the disturbance on life. So, using living creatures satisfies this goal in a direct manner. A biotic index is a “scoring system” and assigns scores to taxonomic groups based on assumed\ tolerance of the taxa to pollution and habitat disturbance.

Key words: Bioindicator, ecosystems, macroinvertebrates, taxon, scoring system

Sustainable Biodiversity Conservation: Community-Based Management Approaches

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The IUCN World Conservation Congress report revealed a profound shift in the way protected areas are being managed around the world. In 1990, just 14% of protected areas allowed sustainable uses of natural resources, but currently that number has risen to above 30%. At the same time, the amount of area managed exclusively by governments has declined from 96% to 77%, a trend reflecting the rise of **community-based conservation** and co-management schemes with indigenous people. From the 1970s onwards, it became clear that the top-down preservationist management approach had to be supplanted by a more **bottom-up, inclusive** and **participatory sustainable-use** narrative. The community-based conservation policy asserts that it is possible and preferable to strike a balance between the needs of local people and the conservation of nature. This study attempts to discuss the various community-based conservation strategies with a view to understand their precise role and functioning in the Indian scenario.

Community based natural resource management approach combines conservation objectives with the generation of economic benefits for rural communities. A key point underpinning the Community Based models is that local communities have **inherent resource management capabilities**, and therefore, only the right incentive structure needs to be established. These models represent a significant shift from the State-driven, centralized, technocratic and blueprint approaches that were dominant previously. The catalysts for this change came 'from above' (*e.g.* international donors and the State) as well as 'from below' (e.g. communities and social movements). Some believe that the growth of community-based models is ***`one of the most dramatic transformations in natural resource management in modern history'***. The adoption of the Millennium Development Goals – that identified **poverty eradication and environmental sustainability** as global imperatives – **gave further impetus to community-based models**. It was felt that it would not be possible to achieve these goals without focusing on the link between environment and poverty and acknowledging the **central role of local governance institutions**. Community-based models employ **three main strategies**. They are 1) providing **compensation** (or substitution); 2) promoting **alternative livelihood** opportunities; and 3) creating a direct stake in **conservation** for local people. **While the first two approaches support preservation, the third reflects a conceptual shift from preservation to sustainable use**.

Autonomous community efforts (ACE) are initiated by communities for conservation and management of biological resources. ACEs in India are extremely diverse in terms of the governance institutions, management objectives and ecological impact. Such efforts can be broadly classified into **two categories** – 1) **community conserved areas** (CCAs) **and 2) sacred groves** (SGs). **The main difference between the two lies in resource use. While**

resources in CCAs are generally appropriated for use, those in SGs are used only in exceptional circumstances, or for religious/spiritual reasons.

Co-management of forests: In recent decades, India has experimented with the concept of co-management of State-owned natural resources such as forests. Although community involvement in the management of State forests has a long history, it was a few successful experiments in community involvement on State forest lands in the 1980s that sowed the seeds of **Joint Forest Management** (JFM). Under JFM, the state Forest Department enters into an agreement with the local community, which is allowed greater access to the forest resources as well as a share in revenue, in return for protection of the forests against unauthorized extraction, encroachment and damage.

Decentralized governance of biodiversity: India has devolved considerable powers to local self government institutions in rural areas, which are known as Panchayati Raj Institutions (PRIs). The Constitution (Seventy-third Amendment) Act, 1992 added a new Schedule to the Constitution of India (Eleventh Schedule) that lists 29 subjects devolved to PRIs. The list includes minor **forest produce, social forestry, farm forestry and fisheries**. The PRIs play an important role in the implementation of the **Biological Diversity Act, 2002**. Under the Act, every local body has to constitute a **Biodiversity Management Committee** (BMC) for the purpose of promoting conservation, sustainable use and documentation of biological diversity. An important function of the BMC is the preparation of a **People's Biodiversity Register** that contains comprehensive information on availability and use of local biological resources, or any other traditional knowledge associated with them.

Many observers believe that **participatory democracy**, not dominated by vested interests, is a pre-requisite for achieving sustainable development. An environmental perspective must guide the evaluation of all development projects, recognizing the role of natural resources in local livelihoods. This recognition must be informed by a comprehensive understanding of the perceptions and opinions of local people about their stakes in the resource base. To ensure the sustainability of the natural resource base, the recognition of all stakeholders in it and their roles in its protection and management is essential. There is need to establish well-defined and enforceable rights (including customary rights) and security of tenure, and to ensure equal access to land, water and other natural and biological resources. It should be ensured that this applies, in particular, to indigenous communities, women and other disadvantaged groups living in poverty. **Integrated Natural Resource Management** (INRM) is a process of managing natural resources in a systematic way, which includes multiple aspects of natural resource use (biophysical, socio-political and economic) striving to meet production goals of producers and other direct users (e.g. food security, profitability, risk aversion) as well as goals of the wider community (e.g. poverty alleviation, welfare of future generations, environmental conservation). The conceptual basis of INRM continues to evolve over the years through the convergence of research in diverse areas such as sustainable land use, participatory planning, integrated watershed management and adaptive management. INRM is definitely a major stride towards Sustainable Resource Management seeking to combine economy with ecology.

Key words: Resource management, Autonomous community efforts, Decentralized governance of biodiversity, Integrated Natural Resource Management

Changes in Activities of Scavenging Enzymes and Ros Indices in Response to Arsenic-Induced Oxidative Stress in *Pteris vittata* and *Eichhornia crassipes* to Determine Stress Tolerance

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Arsenic Pollution is a contemporary **environmental** problem and arsenic contamination in soils often leads to groundwater contamination and arsenic toxicity in plants, animals and humans. Remediation of arsenic-contaminated soils has become a major environmental issue. Elevation of arsenic levels in soils causes considerable concern with respect to plant uptake and subsequent entry into flora, fauna and human food chains. Arsenic speciation in the environment is complex, existing in both inorganic and organic forms, with interconversion between species regulated by biotic and abiotic processes.

Phytoremediation is the use of plants to remove or render contaminants harmless in the ecosystem. Phytoremediation actually includes several methods, such as phytovolatilization, phytostabilization and phytoextraction. **Phytoextraction** is the use of plants, preferably hyperaccumulators, to take up contaminants. Phytoextraction has become increasingly popular because of its low cost compared to more traditional remediation technologies. The costs involved in phytoremediation may include planting, maintenance, harvesting and disposal of plant biomass. The volume and mass of the plant disposal are significantly less than the disposal of soil when excavation is required. However, because phytoextraction is dependent on the plant, conditions at the site must be able to maintain plant production, and the contaminant must be accessible to the roots for uptake. In addition, soils with very high contaminant concentrations may inhibit plant growth and/or significantly prolong the amount of time required for remediation.

This study aims to examine the comparative arsenic uptake and metabolic adaptations of *Pteris vittata* (Brake Fern) and *Eichhornia crassipes* (Water Hyacinth) under arsenic stress. The comparative study will reveal the metabolic alterations and responses of the two plants to arsenic stress thereby indicating the more efficient plant in combating and tolerating the stress. Arsenic-induced oxidative stress will be analyzed by ROS indices Total Peroxide and Malondialdehyde (MDA) content and the activities of scavenging enzymes Catalase, Peroxidase and Superoxide Dismutase (SOD). The biochemical and enzymatic profile *i.e.* studies on these parameters of *Pteris* and *Eichhornia* will reveal the impact of arsenic stress on the physiology and metabolism of these two plants and their possible use in phytoremediation (phytoextraction) of arsenic-contaminated soils. *Pteris vittata and Eichhornia crassipes* used for the experimental work are of identical age. *Pteris* plants were germinated from spores and 4 month old plants were

acclimatized in a hydroponic system to promote root growth. After acclimatization in 0.2 strength Hoagland nutrient solution for 2 weeks, the plants were transferred into 0.2-strength Hoagland nutrient solution containing different concentrations of arsenic as As (V), as sodium arsenate ($Na_2HAsO_4.7H_2O$). The plants were harvested at three intervals *i.e.*1, 5 and 10 days after arsenic treatment. *Eichhornia* was collected from nearby ponds and allowed to grow, acclimatize and reproduce in the laboratory. Hence the daughter plants obtained were of the same age and were taken as test materials. Like *Pteris* they were subjected to the same treatment with arsenic as sodium arsenate. The plants were harvested at three intervals, i.e. 1, 5 and 10 days after arsenic treatment. Control sets were maintained for all experiments for comparison. Total peroxide was estimated according to Thurman *et al.* (1972), MDA according to the method of Heath and Packer (1968), catalase enzyme was assayed according to Gasper and Lacoppe (1968), peroxidase according to Chance and Maehly (1955) and SOD according to Marshall and Worsfold (1978). All the experiments were carried out in triplicates and then subjected to statistical analyses.

Most of the arsenic concentration was found in the fronds (*Pteris*) or leaves (*Eichhornia*), so the work was carried out with frond and leaf samples. The selected concentrations of arsenic are 0, 130 and 270 µM for 1, 5 and 10 days. From the results obtained *Pteris vittata* seems to be more effective in arsenic uptake than *Eichhornia*. Arsenic concentration was high in 10 day old samples of *P. vittata* as compared to *Eichhornia* which showed relatively lower uptake. Total peroxide and MDA, indices of Reactive Oxygen Species were elevated in *Eichhornia* showing the prevailing arsenic toxicity while the scavenging enzymes *viz.* catalase, peroxidase, SOD showed significantly diminished activities in *Eichhornia* as compared to *Pteris*, which is the reason for the severe arsenic toxicity in *Eichhornia*.

Generally, at high contaminant concentrations in soil or water, plants often suffer (like *Eichhornia*, in the present study) and/or die because of their inability to metabolize these harmful elements. However, some plants can, (like *Pteris*, in the present study) survive and/or thrive when they accumulate high concentrations of toxic elements.
From the results obtained, *Pteris vittata* appears to be more suitable than *Eichhornia crassipes* for its possible use in phytoextraction of arsenic-contaminated soils. The comparative study reveals that *Pteris vittata* is the more efficient plant in combating and tolerating arsenic stress, as revealed by the biochemical and enzymatic profile. The physiological status of *Eichhornia* reveals the inefficiency of the plant to deal with arsenic stress. Arsenic-induced oxidative stress is significantly high in *Eichhornia*, the activities of the scavenging enzymes is significantly diminished and are thus responsible for the prevailing stressful conditions. Since *Pteris* is a better accumulator of arsenic and is physiologically more adapted to cope with arsenic stress, it is more suitable for phytoremediation (phytoextraction) in cases of arsenic pollution or contamination as compared to *Eichhornia*.

Key words: Phytoremediation, phytoextraction, arsenic pollution, total peroxide, malondialdehyde (MDA), catalase, peroxidase, superoxide dismutase (SOD)

Fluoride Removal in Water using Locally Available Low Cost Industrial Waste like Fly Ash and Bottom Ash

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High levels of fluoride in water is a serious problem in this world.Most of the rural population in Indiarely on the ground water sources for drinking purposes which generally contain under-ground deposits such as salts and minerals. One such is the fluoride which causes an adverse impact on human as well as animal health. Adsorption seems to be the most attractive method because of its high efficiency and easy handling nature.Even though activated carbon, a common adsorbent used in water and wastewater treatment, showed advantages, the main drawback of the activated carbon is the cost and difficulty in regeneration. Therefore, utilization of industrial and agricultural wastes as adsorbent for the Defluoridation process has received great attention. As this method uses locally available industrial waste, it reduces the impact on landfills and other disposal methods. Due to a greater availability of such wastes, this method will be low cost and hence mainly benefitted to rural area people. And due to high availability of waste, it can even be industralised. Batch studies for optimization at various pH, temperature, concentration and contact time were conducted in laboratory. Various adsorption isotherms were modeled using the data like Fruendlich, Langmuir, Temkin isotherms. Langmuir isotherm showed the best fit and suggested a monolayer adsorption for both fly ash and bottom ash separately. The optimum dosage was found to be 1g in 50ml at pH of 6.5 and 30^{o}C with 80 minutes contact time and92% removal efficiency for fly ash and 85% for bottom ash. Column operations will be carried out to develop an industrial application of this research. Column studies varying the proportions of fly ash and bottom ash are yet to be conducted.

Key words: *Adsorption; fly ash; Bottom ash; Batch study; isotherms; Fixed-bed column study; proportioning*

Study on the Effects of Density, Larval Competition, Environmental Stress on Life History Traits and Protein Expression Pattern in *Drosophila melanogaster*

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Density-dependent competition among larvae is an importantfactor regulating the growth of Drosophila populations. The current study investigated the role of density dependent competition among the larvae of *Drosophila melanogaster* under controlled as well as exposed to pollutants collected from the nature. The study design allowed competitiveinteractions within and between males and females tobe compared.Further investigation has also carried out to explore altered protein expression pattern under competition alone and competition and pollutants induced stress exposure.

Key words: Drosophila, larval development, competition, pollution

Socio-Economic Analysis of Household Livelihood Security of Small Market Intermediaries of Traditional Agricultural Market in West Bengal-A Case Study

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Food security is a condition related to the ongoing availability of food. According to the Food and Agriculture Organization (FAO), food security "exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life". Household food security exists when all members, at all times, have access to enough food for an active, healthy life. Individuals who are food secure do not live in hunger or fear of starvation. Food insecurity, on the other hand, is a situation of "limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways", according to the United States Department of Agriculture (USDA). India is home to 25 percent of the world's hungry population. An estimated 43 per cent of children under the age of five years are malnourished (WFP 2012). West Bengal stands among top three rice producing states in India. Rice is the staple food for the state and cultivated annually in 6.2 million hectare. However the state registered an average of 32% households live below poverty line (BPL) and who cannot meet the minimum daily requirement of calorie. The percentage is much higher in rural areas. The state remains in moderately alarming category considering the hunger index. This paper presents the Food and livelihood security situation among rural households at Nagar-ukhra village in Nadia district. Primary data were used in this study and these were obtained with a structured questionnaire. The households were randomly selected from one location with the number selected randomized to the selected location. The analytical tools used include tables, percentages, food security incidence income, habitat and education. The food security in the study area has been measured using The Core Food Security Model developed by Gary Bickel *et al*., 2000. Fifty sample respondent households have been classified into three categories. Sample respondent households having total household annual income up to rupees 1 lakh only belong to Group-I, sample respondent households having annual income more than rupees 1 lakh, but upto rupees 1.5 lakh belong to Group-II and sample respondent households having annual income more than rupees 1.5 lakh but less than rupees 2.00 lakh belong to Group-III. From the table, it is noted that group-I consists of 29 sample households, group-II consists of 12 sample households and group-III consists of 9 sample households. The data supports the dominance of Group I intermediaries in the selected market which accounts 58 per cent.

Age is an important social factor that influences individual working ability. Research findings linking age to productivity abound. Productive age is normally considered to be between age 15 and 49 (Johnson and Neumark, 1997). It is in line with this, that the research examines age of respondents as a relevant socio-economic characteristic by categorizing it as: (1) age less than 6 years, (2) age between 6 to 14 years (3) age between 14 to 60 years and (5) age above 60 years. Food insecurity incidence decreases with increase in level of education. Food insecurity incidence is relatively low for those engaged in professional occupation and highest for traders. , it is visualized that cereals have contributed the major share of household expenditure on food items. There are no correspondences between income group on one hand and amount of expenditure of cereals, vegetables, pulses, meat & chicken, edible oil, milk consumed. But, there are positive correspondences between income group on one hand and amount of expenditure of fishes, sugar, eggs consumed. Total average expenditure on food items has also increased with the increase in total income level of the household.

Key words: *nutrition, income, food insecurity, household, calorie*

Effects of Air Pollutants on Some Selected Plants Growing Near Darjeeling Railway Station, West Bengal, India

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Addition of some extraneous materials to water, air and land affect the natural quality of environment and induce the ecological imbalance which ultimately results in pollution. Thus pollution is definitely an undesirable change in the physical, chemical or biological characters of air, water, and soils. Pollutants may be anything including physical, chemical and biotic component which adversely affects environments. The present study area is located in the vicinity of loco-shed at Darjeeling railway station. Being a hill station Darjeeling is generally considered as a pollution free zone. But the present study area is regularly exposed to the pollutants emitted by the steam engine of the toy trains. Furthermore this area is situated directly on National highway 55. As a result of this, plants located on this area are regularly come in contact by automobile exhaust. Thus this particular site can be cited as an example for the introduction of pollution in the queen of hills, what prompts me to select that very site. Our present study indicates the significance ecological imbalance, affects different morpho-anatomical characters and also some biochemical features of the aforesaid species. Such morpho-anatomical and biochemical study in future may create a role for the identification of phyto-indicators of such pollutants. Different parameters are taken into consideration for present study in order to evaluate the effect of air pollutants on specific selected plants(*Eupatorium adenophorum, Fagopyrum cymosum, Galinsoga parviflora, Polygonum runcinatum, Stellaria sikkimens*) such as-morphological variation of vegetative plant parts i.e. leaf and steam,variation in leaf surface architecture like vein islets and vein endings, determination of stomatal length and breadth, stomatal frequency and stomatal index ,stem anatomical variation in control and polluted plants, estimation of chlorophyll content in control and affected plants and peroxidase enzyme activity in two different environmental condition. Our present study indicates that some plant species are very sensitive to certain gaseous air pollutants and the resulting effects show sometimes more or less specific, well-visible and measurable symptoms. On this basis, species of our plants under consideration can be selected to serve as biological indicators for the possible presence of certain air polluting substances. But these indicator plants may also be used for the quantitative determination of the effect intensities of the air pollutants involved. Besides, some plant species or varieties may accumulate certain components of air pollution, without changing these substances, in such a way that after accumulation in the plants these substances may be analyzed physicochemical (qualitatively and quantitatively).

Key words: air pollutants, morphology, anatomy, peroxidase, Darjeeling

Effect of Andrographolide on *Papilio demoleus* L. (Lepidoptera: Papilionidae) Larvae

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The anxiety to control pests has resulted in indiscriminate use of pesticides in the field causing environmental pollution and posing threat to human safety and public health. Amongst the alternatives, uses of bio pesticides have been found effective, eco friendly and could possibly provide a viable option. In the present study Andrographolide was used to assess feeding intensity and insect growth regulatory activity of *Papilio demoleus* larvae. *Papilio demoleus* is commonly known as citrus swallowtail. The caterpillars feed on leaves of citrus, prefer blossoms and young ones. Attack by larvae on young trees result in a great loss of foliage causing general weakness and sometimes death also. Andrographolide is a plant extract, which was isolated from the *Andrographis paniculata*. The antifeedant activity of Andrographolide our observations were noted at 24 hrs and 48 hrs duration. A significant antifeedant activity was observed against fourth instar larvae of *Papilio demoleus,* the present study clearly indicates that Andrographolide acts as an insect growth regulator and it influences the metamorphosis in the treated resultant larvae and pupae metamorphosed into larval-pupal intermediates, pupal-adult intermediates and mal-formed adults. Ovaries also exhibited the deformities like large oocytes, chorionated oocytes which blocked the ovarioles and reduced the fecundity. Andrographolide inhibited the growth and development of the pest *Papilio demoleus* it is a safe and eco-friendly pesticide results and conclusions will be discussed.

Key words: Antifeedant activity, Insect growth regulators *Papilo demoleus*, Andrographolid, Plant Products

Diversity and Ecology of Zooplankton from Bordowa Beel of Nalbari District, Assam

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Bordowa beel is a marshy wetland of Nalbari district of Assam. A study was under taken to investigate the diversity and ecology of zooplankton from this beel. During the period of study 12 genera of zooplankton belonging to 3 groups were reported i.e. Cladocera (3 genera), Copepoda (3 genera) and Rotifera (6 genera). Rotifers were found to be dominating among all the groups of zooplankton. Zooplankton population show correlation with various physico-chemical parameters of water.

Key words: Zooplankton diversity, ecology, Nalbari, Assam

Impact of Genetically Modified Plants on Crop Genetic Diversity and Food Security

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Genetically modified crops are aimed at introducing or conferring new traits such as insect-pest resistance, disease resistance and resistance to abiotic and biotic conditions or the production of certain nutrients or pharmaceuticals agents in crop plants. It has also supported documentation and conservation of biological and genetic diversity through fingerprinting and molecular characterization. Biotechnology innovation has been incorporated into a large number of locally adopted plant varieties and this has brought the improvement in quality parameters e.g. FLAVR SAVR tomato, environmental stresses, herbicide tolerance, insect-pest tolerance e.g. Bt cotton. A classical example is the Potato enrich with protein content with insertion of AmA1 gene from *Amygdalus* spp. which was developed to help increase the intake of dietary protein and also Cry 1 Ab gene insertion produce New Leaf and New Leaf Plus variety for resistance against Potato viruses. FLAVR SAVR tomato is the first transgenic tomato variety to increase the shelf life of fruit for sustainable development and Severianin is the parthenocarpic variety of tomato produce transgenically through Rol B gene. GM crop technology has the potential to make food in greater quantity and of better quality available to the population that need it most by improving yield and reducing the requirement of pesticides. In recent years, many transgenic crops have been developed that supply specific dietary molecules, including certain vitamins and fats for food security and sustainable development. India is presently working on 111 transgenic crop varieties of various vegetables, fruits, spices, cereals, bamboo etc. The total cultivated area under GM crops has increased many folds since then with India with 5th position in the world. Biotechnological methods permit a greater understanding of both species and genetic diversity in plants, the mechanism by which that variation generated in nature and the significance of that variation in the adaptation of plants to their environment is understood. India plant diversity has to be conserved and restored for sustainable development which aims at framework to integrate developmental strategies and environmental policies at local, national and global levels. GM soybean has also been reported with high level of oleic acid which reduces the risk of heart diseases and also produces anti-cancer proteins.

Key words: Transgenic, Biotechnology, GM crops, Genetic diversity, FLAVR SAVR, Sustainable.

Environmental NGOs across the Globe: Their Objectives, Role and Achievements

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Environmental protection is a very crucial issue. It is the duty of every individual to save mother earth and protect it. The environmental degradation has becomeas a very serious issue and consequently, environmental issues have come out as a major concern for the wellbeing of people. A countless number of NGO are emerging which actively work for the protection and preservation of environment. Environmental NGOs have become key players in tackling the adverse effects of the deteriorating environment on man and animals. Environmental organizations have always been helping to protect the environment, habitats, flora, and fauna by promoting the concepts like sustainable development, conservation of natural resources and ecosystem restoration.

These ENGOs are distinguished in international, continental or semi-continental, national and regional. Approximately 70 international ENGOs across the globe, 22 continental organizations, across the 4 continents Africa, Europe, North America and South America and almost 79 organizations in 45 nations of the world are involved in conservation and environmental management. A huge number of regional and local ENGOs are existing from the city to the small town level.

The objectives of these environmental NGOs are to create awareness among people on crucial environmental issue, promoting sustainable development, campaigning on global issues such as climate change, deforestation, genetic engineering and global warming etc, to analyze the environment quality, to conduct research and publications on environment related issues, to transmit the environment related information to general public through articles, research publications and audiovisual aids.

To fulfill all these objectives, NGOs are playing central role in raising environmental concerns since the recent decades. Also, people participation in environmental management has also been encouraged by the ENGOs.The area of activities carried out by environmental NGOs has widened. Apart from just raising environmental concerns, they undertake activities like promoting environmental education, training and capacity building and campaigning. These NGOs are working at grassroots level to protect the environment with or without the participation of governmental agencies. About 1000 NGOs across the world have participated in Stockholm conference (1972) on environment.

The Environmental NGOs have significantly contributed in protection and preservation of environment by working at individual level, community level or international level. For e.g., WWF has greatly contributed to the environment protection from conservation of giant panda to the efforts to prevent green house gas emissions. The Agenda 21 and Rio declaration were the major achievements of The United Nations Conference on Environment and Development (UNCED) in which the environmental NGOs have participated actively. Similarly, ENGOs have greatly succeeded in campaigning against the illegal trade of products of endangered species. Centre for Environment Education (CEE), through its education programme helped the Bangalore city in India to reduce wastage of water, fuel and natural resources which helped the city curb the challenge of tones of waste disposal. The programme is a great success in creating awareness in people in waste reduction. It is expected that in future many more such sensitive environmental issues will be taken care of by the ENGOs.

Key words: Environment, Ecosystem, climate change, sustainable development, global warming, deforestation.

Immuno Biochemical Characterization of Leptin Protein from Different Animals Representing Biodiversity

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The role of leptin, a cytokine-like adipose tissue-derived protein hormone, as a lipostatic signal makes it one of the best physiological markers for body weight, food intake, energy expenditure and reproduction. Information regarding molecular characteristics of leptin protein in different animal species is scarce. With the aim of characterizing the native leptin protein of diversified animal species, leptin was isolated from three different types of terrestrial and aquatic animals viz. i. Bengal goat (*Capra hircus*, most-priced meat purpose breed of Bengal), ii. Mithun (*Bros frontalis*, a semi wild bovine species found in the north-eastern hilly region of India) and iii. Rohu (*Labeo rohita*, the most popular sweet water fish of Indian subcontinent). Subsequently, immunobiochemical characterization of the leptin protein was done at molecular level. In the present study, chemical treatment and ultra-sonication technique were used for isolating leptin. Purification of the protein was performed by affinity column chromatography. The molecular, biophysical and serological characterization of leptin was carried out by 2D-gel electrophoreis, SDS-PAGE, Circular dichorism, MALDI-TOF Mass spectroscopy and Western blot. The SDS-PAGE and 2D gel analysis showed that native leptin from all the species possesses molecular mass of 16 kDa. Western blot analysis confirmed its sero-reactive property. MALDI-TOF mass spectroscopy and peptide analysis revealed the exact molecular mass of goat leptin as 15948.72 Da, mithun leptin as 17214.26 Da and rohu leptin as 16283.38 Da. Existence of serodiagnostic potential of native leptin was observed in all of these diversified animal species by ELISA using anti-leptin antibodies. This sero-reactive property of leptin might be exploited while preparing of sero-diagnostic tool(s) to measure leptin concentration in blood that might be needed to select specific animals(s) for selective breeding purpose to augment biodiversity conservation.

Key words: leptin, Black Bengal Goat, fish, Mithun, Purification, Molecular Characterization, Sero-diagnostic kit

Declining Food Security in India under the Impacts of Climate Change and Possible Mitigation Measures

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In India, about 60% of the net cropped area is under rain-fed agriculture which makes it highly vulnerable to climate-induced changes in precipitation patterns, rainfall, water availability and temperature profile. It is estimated that by the 2050, with a temperature increase of 2°C-2.5°C compared to pre-industrial levels, water for agricultural production in the river basins of the Indus, Ganges and Brahmaputra will reduce further and may impact food availability for over 60 million people. The Gangotri glacier is also shrinking at the rate of 32 meters per year and the threat over river Ganga getting converted into a seasonal river from a perennial one is looming large over it which is evaluated to affect livelihood of 50 million people in the Northern Gangetic plain alone. There is clear evidence that due to observed increase in global temperature, the food grain production is declining eventually threatening food security in the country.

Climate may have indirect but significant influence on cropped areas as shortfall in rainfall can lead to reduced water supply for irrigation ultimately reducing agriculture yield. The increased hydro-meteorological disasters under changing climate can cause flood, drought, cyclone, flash flood etc which affect the agriculture negatively. Climate models have indicated that a 2 degree rise in temperature would affect both rice and wheat production by 17-18% in tropical region. Even changes in cropping patterns are indicated across the country due to changing temperature profile and rising CO_2 concentration in the atmosphere.

Climate change affects food systems in several ways ranging from direct effects on crop production from changes in rainfall leading to drought or flooding, or warmer or cooler temperatures leading to changes in the length of growing season, to changes in markets, food prices and supply chain infrastructure. The low ability to cope with shocks and to mitigate long-term stresses due to global warming means that coping strategies that might be available are inappropriate and we have to seek sustainable solutions.

Analyzing the future prospects shaped by already present warming trends, the scientists believe that by the 2040s, India will see a significant reduction in crop yields because of extreme heat. Reduced water availability due to changes in precipitation levels and falling groundwater tables are likely to aggravate the situation further in India. The capacity to adapt food systems to reduce their vulnerability to climate change is not uniform because of the multiple socio-economic and bio-physical factors affecting food systems and hence food security. Improved systems of food production, food distribution and economic access may all contribute to food systems adapted to cope with climate change, but in adopting such changes it will be important to ensure that they contribute to sustainability.

The paper seeks out to evaluate the impacts on agriculture production affecting food security under global warming and explore options of mitigating the negative impacts of climate change.

Key words: Climate change, global warming, food security, drought, flood, disasters, mitigation, sustainability

Review of the Legal Frame Work of Menstrual Waste Management – are we Doing Enough?

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However surprising it may sound, there is, in fact, an enormous amount of menstrual waste which we need to deal with. A lack of initiative and stringent, or let us say, ignored legal framework has not lent a helping hand thus far. Suffice it to say that sanitary waste almost entirely consists of bio non-degradable materials (more or less plastic in some form or another) coupled with other medical hazards which it creates could lead to an enormous heap of non-biodegradable waste to deal with in the years to come. To top it all is the recurring nature of menstrual waste which, logically put, being a function of the population is and will continue to grow exponentially. We, therefore, have before ourselves a situation where it is pertinent to stand up and take note of this waste and to create a mechanism to deal with it before it is too late. Locally speaking, India, being a traditionally highly conservative society, would not only have to be educated about the concerns surrounding menstrual waste but also cement the implementation of such waste by way of robust legal tools. While we are at it, we could also learn from the methods adopted by various other nations and improvise such that we develop a mechanism best suited for our country. Are there any innovative or alternative that may be devised to use or re-use such waste?

To review the present legal framework of India (if any) in dealing with the issue of menstrual waste management accessing its effectiveness and to learn from our counter parts as to how we can build a robust mechanism to deal with the problem.

Key words: Menstrual waste, menstrual hygiene, waste management

Impact of thermal stress on white nistari race of *Bombys mori* L.

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The present investigation was aimed to study the impact of thermal stress on multivoltine silk worm *Bombyx mori* L of white nistari race ($M_{12}W$).Tolerance of temperature of the silk worm eggs, larvae, pupae & adults at 18^0C, 34^0C and 44^0C was studied. In general late age worm registered maximum tolerance compared to the adult moths and the eggs. Exposure to 18^0C and 34^0C was tolerated equally whereas temperature beyond 40^0C has been proved to be lethal. Heat shock resulted in appearance of additional protein species in larval haemolymph. Silk worm economic traitslike effective rearing rate by number & weight, cocoon weight and shell weightsignificantly increased after heat stress over control which probably due to occurrence of heat shock proteins (HSPS) at larval stage.

Key words: White Nistari race, heat shock protein, pupae, haemolymph

Plastic Roads

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Next time you do shopping, carry home the things in a plastic carry bag & when you throw the waste plastic, think & realize that you are contributing your share to a deadly plastic pollution whose ill effects are irreversible & capable of reaching out to many generations to come.

Plastic is one of the major toxic pollutants of our time. Being composed of toxic chemicals and most importantly a non biodegradable substance, plastic pollutes earth and leads to air pollution and water pollution.

We have embodied ourselves so much with plastic; we can't imagine our lives without plastics. The reduction process might take some time. Some things are inevitable, like plastic packets used for milk, blood & medicines. The next option is to reuse, but after repeated reuse one or the other day it has to be disposed..The only way to overcome the deadly and lasting danger of plastic pollution is to cut down its use & recycle the present generated waste in such a manner that to minimize pollution during the process & enhance efficiency & conserve energy and our precious fossil fuels.

In the present paper the polluting effects of plastic are noted and an optimum plastic management is identified. Waste plastic is used as additive with varying percentage of bitumen to form plastic roads. Comparing conventional bitumen concrete mix and plastic added bitumen, we have 8% as optimum percentage of waste plastic to be added to bitumen to form durable roads.

The use of this technology not only strengthened the road construction but also increases the road life as well as will help to improve the environment and also creating a source of income.

India is a under developing country still a large part is to be explored and connected through roads, implementation of this kind of project may prove beneficial.

Key words: Plastic, bitumen, non-biodegradable, reuse & recycle, plastic waste management.

Development of a Quantification Method of Hexythiazox Residue Using GC-MS/MS and Food Safety Evaluation of this Acaricides in Grape

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Grape (*Vitis vinifera*) is an important commercial sub-tropical fruit crop in World. Approximately 71% of world grape production is used for wine, 27 % as fresh fruit, and 2 % as dried fruit. It contains antioxidant rich phytochemicals including anthocyanins, resveratrol, flavanols, flavan-3-ol, minerals and vitamins. India is one of the major table grapes growing country with a production of 1240000 MT in the year 2012 and about 20% of the total production is exported to different countries, mainly in European Union countries. Cultivation of grapes can suffer high yield losses due to various diseases and pests, especially mites (mainly two spotted red spider mite *Tetranychus urticae*). However, to ensure high-quality and higher quantity of grape production, pesticides are widely used in the period of cultivation to combat disease and pests. To combat mites, different acaricides are being used. Hexythiazox ((4RS,5RS)-5-(4-chlorophenyl)-N-cyclohexyl-4-methyl-2-oxo-1,3-thiazolidine-3-carboxamide) has novel acaricidal chemistry with marvelous ovicidal and nymphicidal properties. As grape fruit makes an important contribution to the human dietary intake, it is essential to investigate the persistence behaviour of the applied acaricide for food safety. As hexythiazox is newly introduced, no experimental study on the persistence of the chemical in fruit like grape is available under Indian agroclimatic condition as well as there is no standard quantification method for residue analysis. Thus we developed an easy and effective analytical method for the quantification of hexythiazox (MAIDEN 5.45 EC) in grape fruit and soil using triple quad GC-MS/MS in multiple reaction monitoring mode. The method includes extraction with ethyl acetate and 0.1(N) sodium hydroxide followed by clean up using dispersive solid phase extraction (d-SPE) with primary-secondary amine. The recovery percentage was ranged between 86-110% for 20, 50 and 100 ng/g for all matrices having RSDa< 20% (n=6) and correlation coefficient (R^2) of matrix matched calibration curves were ≥ 0.99. The method was also sensitive enough to set at the LOQ 20 ng/g for grape and soil respectively. Validation criteria of linearity, specificity, trueness, precision, LOD and LOQ were estimated. In order to evaluate its safety use in India a multilocation field dissipation study in grape was conducted at three different agroclimatic zones of India by following the proposed analytical method where hexythiazox 5.45 EC was applied @ 25g and 50g a.i./ha. The initial deposit of Hexythiazox in grape fruit ranged from 0.13-0.27 mg/kg at Birbhum, West Bengal, and 0.19-0.29 mg/kg at Rahuri, Maharashtra, and 0.20-0.37 mg/kg at Hyderabad, Andhra Pradesh and 0.17- 0.33 mg/kg at Pune, Maharashtra

respectively. One remarkable observation is that the initial deposit of hexythiazox residue was below CODEX MRL value of 1.0 mg/kg respectively. Hence, pre-harvest intervals (PHI) do not apply in this case. Around 60-70% of initial residue was dissipated by 3rd day. The results showed that hexythiazox residue was quantified below quantification limit after the 5th day of application with range of half-life 1.18-2.03 days on grape fruits. No residue of hexythiazox was quantified in soil at harvest. To evaluate safety risk assessment of hexythiazox on grape, the theoretical maximum residue contribution is comparing with the maximum permissible intake. According to FAO/WHO JMPR report, the prescribed ADI of hexythiazox is 0.03 mg/kg/bw. In the present supervised field trials, the mean residue of hexythiazox after 3 days of application was 0.039 mg/kg. The MPI of hexythiazox is 0.48 mg/average child/ day. The calculated TMRC of hexythiazox are much lower than the MPI of hexythiazox at recommended dose. Thus, the application of hexythiazox in grape at the recommended dose is safe for human consumption.

Key words: Grape, Hexythiazox, GC-MS/MS, Residue, Half-life, and Safety Evaluation.

Ecosystem Resilience: A Concern

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Ecosystem is fundamentals for survival and well-being of human society. Various environmental functions like purification of air and water, control of soil erosion, pollination regulation of climate are some of the functions performed by healthy ecosystem.

Unfortunately composition and functions of ecosystems are now-a-days greatly influenced by number of drivers including climate change, human activities. All this has caused extreme fragmentation and habitat loss and fragmentation resulting in loss of nature, plants and animals.

We need to understand the levels of ecosystem functioning and to identify mechanism by which ecosystem recovers after damage. The capacity of an ecosystem to mitigate or adopt the change is explained as **resilience**. It in inherent feature of healthy ecosystem. The adapting capability, the resilience is intimately connected to social economic factors. Drivers of ecosystem in isolation or in combination reduce thee resilience. This is alarming and will be very evident during the course of this century.

In present time social economical development and ecosystem resilience are not being tuned with each other resulting in tipping points. Predicting future catastrophic changes in social and economic system is impossible. However efforts are to be made to identify “earlywarning signals” before tipping points are reached.

Paper reviews the concept of resilience and other related aspects including mechanism of resilience, core factors, management and related policies.

Key Words: Ecosystem, Development, Resilience of ecological and social changes, Drivers of ecological system.

Cultivation of Algae in a Photobioreactor Combined with Ceramic Membrane Technology for Simultaneous Remediation of Organic Rich Wastewater and CO_2 Sequestration

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Microalgae have received growing interest in recent years due to their unique potential of wastewater remediation and CO_2 sequestration for production of waste to renewable resources. The current study addressed on algal cultivation in a labscalephotobioreactor using organic rich domestic wastewater. Phytoremediation aspects along with growth rate of four different types of algae, namely, *Anabaena* sp., *Chroococcus*sp., *Enteromorpha* sp. and *Phormidium* sp. was analyzed. The algae treated wastewater was further treated in a ceramic membrane based microfiltration unit for complete reduction of suspended and turbid contaminants along with separation of algal biomass. Clay-alumina based ceramic tubular membrane developed by CSIR-Central Glass and Ceramic Research Institute was used for this purpose. The overall study indicated that a combined system of algal photobioreactor with *Anabaena* sp. and ceramic membrane filtration could be used for an effective reduction of organic loadings and other contaminants in addition with generation of microalgal biomass as a value added resource.

Key words: Algae, waste waster, photobioreactor, ceramic membrane technology

An Integrated Process Involving Ceramic Membrane Based Microfiltration and Activated Sludge Process for Treatment and Recycling of High Organic Containing Domestic Wastewater

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Domestic wastewater is one of the largest sectors of waste water generation. Treatment of these effluents needs special methods since the effluent consists of water from washing utensils, clothes, bathing, oils and fats from cooking, food materials, surfactants etc. Apart from containing pathogenic organisms and organic material, domestic wastewater is rich in nutrients like phosphorus, potassium, magnesium, nitrogen etc. which are required by plants for their growth. Therefore, the wastewater can be treated to such an extent that the water is not fully devoid of nutrients and can be recycled and used in agricultural purposes. Untreated wastewater contains harmful organisms which can create hazard to environment and humans consuming food crops irrigated with untreated wastewater. Different methods has been employed for treatment of wastewater like electrocoagulation (Kurt et al., 2008), activated carbon, sand filters (Al-Jlil, 2009) etc. But membrane based treatment options are now being explored because of it being a cleaner technology. Complete removal of pathogens is possible with ultrafiltration and nanofiltration membranes. Polymeric membranes are generally used for these types of applications. Anaerobic membrane bioreactors have been employed for treatment of wastewater and convert the BOD to reusable gas (Chang, 2014). Ceramic membranes have performance characteristics similar to that of polymeric membrane and additionally have certain advantages like high thermal and chemical stability and longer operation life. These membranes have been indigenously developed by CSIR-Central Glass and Ceramic Research Institute from cost effective composition of clay and alumina (Bandyopadhyay et al., 2006). Attempts were undertaken to treat domestic wastewater of high strength in terms of organic loading by side-stream membrane bioreactor. Wastewater was collected from CSIR-CGCRI canteen during lunch time and characterized. Pre-treatment was carried out by activated sludge process containing microbial consortia. The sludge was collected from sewage pumping station. Batch mode and continuous mode of study was conducted. Cross-flow microfiltration study was carried out for 120 minutes at 1kg/cm^2 transmembrane pressure and permeate was collected at regular intervals and characterized. Performance of the separation process was evaluated in terms of the permeate quality and permeate flux. The combined process resulted in about 90% reduction in COD from an initial value of 1650mg/L and 98% reduction in turbidity from an initial value of 140 NTU. About 99% reduction in oil and grease was obtained from an initial value of 4g/L. The results at par with discharge limits prescribed by regulatory authorities. The wastewater can thus be reuse for agricultural purpose.

Key words: Domestic Waste water, microfiltration, activated sludge, organic

Phylogenetics and Sequence Analysis of Toads-Some Problems for the Unwary

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mtDNA sequence comparison can provide us deep insight into phylogenetic relationships but can also present problems for the unwary. Alignment comparisons are not always as straight forward as they might seem and comparative models applied to deduce relationships need to be carefully chosen with full regard to the assumptions on which they are based. Most importantly perhaps genes are not organism so some sequence analysis can be poorly informative about relationships especially if evolution of those organisms has involved significant epigenetic factors for example in controlling gene expression. This paper highlights some of the most prevalent problem while working with 12SrRNA and 16SrRNA genes of *Duttaphrynus melanostictus* (Common Toad) of Dooars region of west Bengal. Sequence similarity of non coding region of common Toad found in Dooars region of West Bengal along with different varieties of common Toad (Family-Bufonidae) found in China based on maximum likelihood and parsimony model followed by evolution distance measured by UPGMA and ClustalW software analysis reveals that *Duttaphrynus melanostictus (*WB*)* share 95% similarity with *Bufo melanostictus* and 94% similarity with *Bufo himalayanus* of China.

Key words: mtDNA, Epigenesis, GenBank, Primer, Toad.

Socio-Economic Analysis of Household Food Security in Rural Areas in West Bengal State of India

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Food security is a condition related to the ongoing availability of food. According to the Food and Agriculture Organization (FAO), food security 'exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life'. Individuals who are food secure do not live in hunger or fear of starvation. Food insecurity, on the other hand, is a situation of 'limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways', according to the United States Department of Agriculture (USDA). India is home to 25 percent of the world's hungry population. An estimated 43 per cent of children under the age of five years are malnourished (WFP 2012). West Bengal stands among top three rice producing states in India. Rice is the staple food for the state and cultivated annually in 6.2 million hectare. However, the state registered an average of 32 per cent households live below poverty line (BPL) and who cannot meet the minimum daily requirement of calorie. The percentage is much higher in rural areas. The state remains in moderately alarming category considering the hunger index. This paper presents the food and livelihood security situation among rural households at Nagar-ukhra village in Nadia District.Primary data were used in this study and these were obtained with a structured questionnaire. The households were randomly selected from one location with the number selected randomized to the selected location. The analytical tools used include tables, percentages, food security incidence income, habitat and education. The food security in the study area has been measured using The Core Food Security Model developed by Gary Bickel *et al*., 2000. Fifty sample respondent households have been classified into three categories. Sample respondent households having total household annual income up to rupees 1 lakh only belong to Group-I, sample respondent households having annual income more than rupees 1 lakh, but upto rupees 1.5 lakh belong to Group-II and sample respondent households having annual income more than rupees 1.5 lakh but less than rupees 2.00 lakh belong to Group-III. The major research findings of the study are as follows. Lion's share of the household income comes from the source of market intermediaries followed by agriculture, service and business respectively. Major share of annual mandays comes from the business of agricultural market intermediaries when all the sample households pooled together. Per household consumption of each food item has broadly increased with the increase in income level with few exceptions. Cereals and vegetables contribute the major share of food items. Cereals have contributed the major share of household expenditure on food

items. There are no correspondences between income group on one hand and amount of expenditure of cereals, vegetables, pulses, meat & chicken, edible oil, milk consumed. Cereals have contributed the major share of per consumer unit per day calorie requirement of the family members of sample households in study area. There are positive correspondences between income group on one hand and the amount of calorie per day per consumer unit obtained from the pulses, sugar and eggs on the other. Cereals have contributed the major share of per consumer unit per day protein requirement of the family members of sample households in study area. There are positive correspondences between income group on one hand and the amount of protein per day per consumer unit obtained from the pulses and eggs on the other. Edible oils have contributed the major share of per consumer unit per day fat requirement of the family members of sample households in study area. Extent of food security has increased with the increase in the level of income. Both the extent of 'food secure' and 'food insecure without hunger' has increased with the increase in the level of household income. There is no case of 'food insecure with hunger' in the highest income group.

Key words: Food Security, Household, Cereals, Vegetables, Calorie, Protein, Fat, Core Food Security Model

A Temporal Study on Aquatic Insect Diversity of Keibul Lamjao National Park, Manipur, North East India

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Keibul Lamjao National Park (KLNP), Manipur is the unique floating park of the world made up of a mass of heterogeneous mixture of vegetation and decomposing organic matter, *phumdis. Phumdis* float on lake water with about one-fifth of thickness above and four-fifths under the water surface appearing in three distinct vertical zones, lying one above the other. The ecosystem of Keibul Lamjao National Park is a combination of aquatic wetland and terrestrial ecosystem. The terrestrial ecosystem comprises of three small hillocks and aquatic ecosystem mainly comprises the deep water area in the northern part of KLNP which is an extension of Loktak Lake, Manipur (Ramsar site). Besides its uniqueness as the only floating park, this park is the only home to the famous Sangai (*Rucervus eldii eldii*). This park bore the brunt of construction of Ithai Barrage across Manipur leading to a decrease in the thickness of the *phumdis* of KLNP thereby threatening the survival of Sangai deer. "Sangai" is in the 'Endangered' category of the IUCN Red List of Threatened Taxa because of its small isolated population (less than 250 individuals) in an isolated deteriorating habitat. Although studies have been made on the chemistry and nutrient availability of water around the floating mass and also on vegetation of national park very few studies have been conducted on the biodiversity of this national park. Hence there is a dire need of scientific data for the ecological management of this national park as key species should be identified and monitored. Aquatic insects are the most widely used organisms in freshwater biomonitoring of human impact and no studies have been conducted on the aquatic insect community of water of the National park, which is a protected area. In this paper an attempt has been made to study monthly variation in the density and diversity of aquatic insects of the national park during 2009-2010 and to ascertain their role as bioindicators. So continuous surveillance of biological responses of the aquatic insects could be used to assess changes in the environment particularly changes due to anthropogenic stress. Monthly collection of insects and water samples were made from five different sites of KLNP in replicates and analysed by standard methods and identified by standard keys. The study recorded 3 orders (Hemiptera, Odonata and Coleoptera), 12 families (Belostomatidae, Gerridae, Corixidae, Notonectidae, Nepidae; Libellulidae, Lestidae, Calopterygidae, Aeshnidae, Coenagrionidae; Dytiscidae, Hydrophilidae) and 23 species of aquatic insects. Highest density of insects was recorded in the month of March in site 1 and 2, February in site 3 and 4 and November in site 5. Order Hemiptera was recorded in all the months in all the sites except site 2 in September, and site 4 in November and December. In site 1, insects of the family Nepidae were recorded in all the months and in site 3 families Belostomatidae was

recorded in all the months. In site 4 insects of the family Libellulidae were recorded in all the months except March. In S5 Belostomatidae was recorded in all the months except September, August and February. Diversity indices like Shannon diversity index (H/), Evenness index (J) and Berger Parker Index of Dominance in all the sites and in all the months were computed. Very low Shannon H/ values (<1) of aquatic insects of national park throughout the year indicated stressed condition of water of the park. The study revealed very low dissolved oxygen (DO) in all the months and in all the sites. Among all the months and all the sites both lowest and highest values were recorded in site 3 ranging from 1.1 mgl^{-1} in September to 6.63 mgl^{-1} in July. Biological oxygen demand (BOD) ranged from 1.04 mgl^{-1} in site 3 in September to 9.07 mgl^{-1} in site 5 in August. Both highest (7.15 mgl^{-1}) and lowest (1.65 mgl^{-1}) concentration of free CO_2 was recorded in site 1 in the month of September and June, respectively. Heavy metals such as Mercury, Lead and Iron in most of the sites were found beyond the permissible level of BIS (IS 10500: 1991).Significant correlations of insect density and diversity with different environmental variables in different sites were computed and discussed in the paper. The Biological Monitoring Working Party (BMWP) scores of the different sites based on the tolerances of aquatic insect families showed that water quality was moderate. Again Average Score Per Taxon (ASPT) scores indicated clean condition of the system. Stream Invertebrate Grade Number-Average Level (SIGNAL) scores also indicated polluted nature of water. Absence of the sensitive groups of aquatic insects such as Ephemeroptera and Trichoptera indicated perturbation of the system. This study showed fluctuation of tolerant and semi-tolerant aquatic insect families in different months and their relationship with different physico-chemical parameters of water. The study also revealed the fact that national park area though protected is under stress. The causes and consequences of deteriorating condition of water of national park have been discussed in the paper.

Key words: Density, diversity index, BMWP, ASPT, SIGNAL

Application of Factorial Design for Optimization of Bismarck Brown Dye Adsorption using Green House Gas Emitting Agro Waste Material

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The factorial experimental design technique has been used to investigate the adsorption of Bismarck Brown (BB) from wastewater onto agricultural waste Areca Husk Fibre Carbon (AHFC). There is a growing interest in using low-cost and commercially available materials for the adsorption of dyes. The structural and morphological features of activated carbon are characterized by FTIR, XRD, SEM and EDAX studies. Batch experiments are carried out for the adsorption of dye molecules onto AHFC. Various adsorption parameters such as pH, temperature and particle size of the adsorption capacity are studied. The Factorial Design (2^3) is adopted for the various parametric studies and from these studies the interactions between three process parameters for the adsorption of dye is evaluated. The factors pH 4-9, particle size 100-250 BSS mesh number and temperature 300-320 K are the optimum levels for this adsorption phenomenon. These results of adsorption are subjected to statistical analysis by using the *t*-test, ANOVA, *F*-test. All these statistical tools have been applied to test the fitness of adsorption. To optimize and to know the maximum efficiency, all these values revealed from this study are used to obtain the normal probability plots, main & interaction plots, Pareto charts and contour plots from which the regression values are evolved by using Design of Experiment software with a revelation of the best fitness on these experimental data. Physico-chemical characteristics and adsorption efficiency of AHFC of the wastewater are also being determined. The results revealed that AHFC is potentially low cost adsorbent for the adsorption of dye molecules onto AHFC.

Key words: Areca Husk Fiber Carbon; Bismarck Brown, Factorial Design, ANOVA Study

Effect of *Rhizobium* Inoculants on Nodulation and Yield of Lentil (*Lens culinaris*), Chickpea (*Cicer arietinum* L.) and Bean (*Lablab purpureus* L.) at Rajshahi Area

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Rhizobium spp. was isolated from root nodules of lentil (*Lens culinaris*), chickpea (*Cicer arietinum* L.), bean (*Lablab purpureus* L.) on Yeast Extract Manitol Agar (YEMA), and it's morphological, cultural, physiological and biochemical characteristics were studied. It was observed that the colonies were circular, light pink, convex, entire and opaque. The bacterium was gram negative, rod shaped, aerobic, non-spore forming and motile. The optimum cultural condition of *Rhizobium* spp. for their growth was at pH 7.0 and temperature 28°C. It showed negative chemical reaction for indole, Hofer`s alkaline medium, hydrogen sulfide production and Voges-Proskauer and positive reaction for citrate utilization, MacConkey agar, ammonia production from peptone, urease, nitrification test, congo red test and utilization of carbohydrate. Purity and concentration of extracted DNA were performed at 260/280 and 260/230 nm and obtained as 2.27 and 2.33 for lentil, 2.22 and 2.26 for chickpea and 2.23 and 2.36 for bean and concentration as 222.2, 279.9 and 239.8 ng/µl for lentil, chickpea and bean respectively. Finally the selected three bacterial isolates were identified up to species as *Rhizobium* sp. through 16S rRNA gene sequencing. This study also shows that enhancement of soil fertility along with the yield of lentil, chickpea and bean occurred due to nodulation. Data on plant height (cm) at maturity, days to flower, pod/plant (gm), seed/pod weight (gm), weight of nodules/plant, were considered to assess the effect of nodulation in lentil, chickpea, and bean. Soil treated with *Rhizobium* spp. showed higher values than control regarding total nitrogen and organic matter (%).

Key words: Rhizobium, Lentil, chickpea, bean, Rajshahi

Dissolved Oxygen Dynamics in Relation to Water Quality of Bakreswar Reservoir

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Unlike the natural lakes, reservoirs and dams are created artificially by impounding the flowing waters of rivers and these are engineered systems designed to serve some specific purposes and to meet some ofthe practical demands of the society. Establishment of a dam is automatically followed by the creation of new ecosystems that have hybrid characteristics belonging to both of the lake and the riversystem; for example, residence time (which is similar to the lakes), current velocity (lower than that of rivers but more than that of natural lakes), width and channel depth (like the rivers).A thorough analysis of the water quality and water quantity is necessary to assess the impacts of pollution as this can reduce quantity of usable water and may lead to water wars, in order to acquire safe and unpolluted water.The present study is carried out at Bakreswar reservoir which issituated in the Birbhum district. This reservoir was created by the damconstructed on Bakreswar River.This dam was built with the major purpose of supplyingfresh drinking water not only to the surroundingvillages but also the Bakreswar Thermal Power Station situated nearby. According to previous studies carried out with respect to zooplankton abundance of this reservoir, it can be said that this reservoir has a good assemblage of different kinds of zooplankton species.Thedistinct temporal variations of the environmental factors play a major role in the system and its association with zooplanktonis useful in predicting the water quality of this reservoir.Dissolved oxygen (DO) content of a water body is of paramount importancewhen talking about anyaquaticecosystem; since the amount of dissolved oxygenthat is present, controls the biological productivity of the system and in turn effects the composition of the various component species. Thus an effort to measure and study the dynamics of dissolved oxygenof the Bakreswar reservoirwas attempted in the present study in order to understand the water quality.Water samples were collected from the reservoir, in fortnightly intervals, from three separate locations of the reservoir and both the physical and chemical factors including dissolved oxygen, atmospheric temperature, pH,conductivity, salinity, solar radiation, water temperature, alkalinity, hardness, chloride, productivity etc. wereanalyzed using standard procedure. The model has been properly calibrated and validated with the observed data. Two independentsetsofdata were used for this purpose collected over a period of two years (March 2012 – February 2013 and March 2013 – February 2014). The parameter values which were not possible to collect from directly from the field observations, were obtained from literatures were calibrated. To make the model realistic it was properlyvalidated with the observed data and to know the statistical significance, chi square goodness fit test were performed.

Key words: Dynamic Modelling, STELLA, Oxygen, Reservoir, India

Quality of Traditional Aquaculture Farm Effluents at Different Production Levels and Its Impact on the Receiving Environment in North 24 Parganas District of West Bengal, India

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Brackishwater aquaculture is practiced in three maritime districts of West Bengal namely. North 24 parganas, South 24 parganas and East Midnapore and plays significant role in the state's economy.Total potential brackishwater area available in the state is 210000 ha of which 47588 ha is under use at present. Area coverage under use in North 24 Parganas district is 34500 ha andtraditional brackishwater aqua farming is practiced exclusively in this district.Most of these areas distributed mainly in Haaroa, Minakhan and Sandeshkhali blocks receive sewage water from Kolkata metropolitan city through Bidyadhari River and its tributaries diluted by mixing with sea water.Traditional farms locally known as 'bheries', receives sewage mixed brackishwater.Fishes and shrimps are grown in this water and harvested every lunar cycle after 3-4 months growing period.This culture operation generally lasts for 10 months (February-December) and nutrients are brought into the impoundments through water exchanges (20-30%) during lunar cycles. Production from these areas is higher (0.7-0.9tons/ha/year) due to higher nutrient profile of water compared to traditional brackishwater aquaculture production (0.4-0.6 tons/ha/year) in other areas where sewage is unavailable. Feeding is not generally done in this farming practice. These areas play significant ecological role by improving quality of water through conversion of nutrient load into fish biomass.Less polluted effluent is dischargedin the receiving water body than the source water.Increment in production is needed to meet the increasing demand and to enhance profitability. Some progressive farmers are trying to increase production by increasing stocking density and application of commercially available feed. Scarcity of information about consequences of intensification on the ecological role of these areas necessitated this study. Quality of source water, effluents from improved traditional aquaculture impoundmentsat different production levels and receiving water body was comprehensively investigated. The study was carried out at three locations of Haroa block and 4 impoundments (0.16-0.21 ha)were used in each location for trial in different targeted production level.20-30% water was exchanged every lunar cycle following the common practice. Quality of source water (SW), effluents from impoundments with existing production level of 0.7-0.9(EC),targeted increased production level of 1.5-1.7 (EL),2.3-2.5(EM) and 3.1-3.3 (EH) tons/ha/year was evaluatedfortnightly for a period of 10 months during every full moon and new moon. An interview based survey revealed that in addition to auto stocked fishes and shrimps farmers generally stock pre-nursed fingerlings of grey mullet (*Mugilcephalus*), tade mullet (*Liza tade*), parsia (*Liza parsia*) and tilapia (*Oriochromisnilotica* and *O. mossumbica*) @ 250, 500, 1000 and 500 numbers/ ha during

the month of February. Multiple stocking of tiger shrimp is done @ 5000/ ha monthly during full moon or new moon starting from February till September. Partial harvest of shrimp starts during April and continued every lunar cycle.Fishes are generally harvested at the time of dewatering during December. Increment in production was achieved byincreasing stocking density2, 3 and 4 timesof generally practiced stocking protocol and application offarm made dough feed @ 10-1% of estimated biomass in all impoundments except those with targeted existing production level. Physico-chemical parameters of water, plankton density and microbiological parameters were analysed following standard methods. Water samples from source were collected before exchanges and effluents were collected during discharge from the impoundments.

Salinity and temperature were insignificantly different in water samples and ranged between 16.3-0.2 ppt and 33.0-18.0 °C, respectively over time. Similar pH was recorded in samples from EC, EL and EM whereas significantly lower values were recorded in SW and EH. Concentration of dissolved oxygen (ppm)showed similar trend with similar values inEC (5.94±1.45), EL (5.79±1.22) and EM (5.73±1.98). Significant ($p<0.05$) lower dissolved oxygen were observed in SW (4.89±1.95) and EH (5.19±1.87). Chemical oxygen demand (COD) in EC and EL were similar and ranged between 10.97-12.02 ppm throughout the study periodand significantly ($p<0.01$)higher COD (ppm) was recorded in EH (17.07±3.27)and SW (19.55±4.83) and it was moderately high in EM (13.96± 2.55). Similar trend has been observed in case of NO_3-N, NO_2-N, NH_4-N and PO_4-P. However, phytoplankton density ($\times 10^3$/ L) were similar in effluents from EC (14.64± 3.55), EL (14.98±2.98) andEM (15.16±4.75) but those were significantly ($p<0.05$) less thanSW (16.85±4.65) and EH (19.83±3.21). A drastic depletion of total heterotrophic bacteria(47.34-55.73 × 10^5 CFU/ml) and total coliform (29.58-40.31 × 10^2 MPN/100 ml)in effluents from all the production levels were observed compared toSW (THB: 143.56±6.41 × 10^5 CFU/ml, TC: 119.69±7.46 × 10^2 MPN/100 ml). Total production achieved at final harvest was 0.87±0.06, 1.62±0.12, 2.34±0.09 and 2.93±0.21tons/ha/year in targeted existing, low, medium and high production levels respectively.Feed conversion ratio (FCR) achieved was 0.96: 1, 1.14: 1 and 1.51: 1 in low, medium and high production levels. About 26% of total harvested weight was comprised of tiger shrimp.

Nutrient and bacterial load in the source water was very high as it received sewage from Kolkata metropolitan city. Quality of this water is improved through presently practiced culture method converting nutrient load into fish biomass through autotrophs. Increment in production up to medium level(2.3-2.5 tons/ha year), which is approximately 3 times than the present production level will not affect significantly the water purification capacity of the system. Production level of 3.1-3.3 tons/ha/year produced effluent of similar quality with source water except less bacterial load. Lower bacterial load in the effluents of all production levels may be attributed to better pond management and periodical lime application. Production from traditional brackishwater aquaculture system can be increased up to 2.4 tons/ha/year keeping intact the ecological role of the system.

Key words: Farm effluents, aquaculture, pollution, North 24 parganas

Trends in the Genomic Epidemiology of *Vibrio cholerae* O1 Isolated Worldwide Since 1961

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To explore the worldwide changing dynamics of *V.cholerae* O1El Tor strains in a comparative way since its birth in 1961 to the current century from the aspects of virulence, resistance and rapidly evolving clonality.

The bacterium *Vibrio cholerae* is a reemerging global problem that causes cholera, an acute infectious diarrheal disease. The O1 serogroup is alienated into three serotypes, Ogawa, Inaba, and Hikojima, and two biotypes, classical and El Tor. Therefore the outbreak and pandemic strains need to be constantly monitored for their changing genotype and phenotype. NICED is a national reference laboratory and obtains per year 700 - 1000 strains of *V. cholerae* from different parts of India and abroad for biotyping, serotyping and phage typing. Among several typing methods, phage typing is one of the most significant and convenient methods for the identification and differentiation of *V. cholerae* strains. The current research aims to include the targeting cholera toxin. Cholera toxin, the chief virulence factor of cholera, is composed of two subunits, an enzymic A subunit of 27 kDa and an intestinal receptor-binding B subunit consisting of five identical 11.6 kDa peptides. MAMA-PCR technique is utilised in our study to distinguish between two kinds of *ctxB* genes and to locate the spread of variable traits of *V. cholerae* O1 strains since the year of 1961. Subsequently, El Tor strains with the classical type of ctxB were distinguished in samples from the early nineties onwards. This study is a bondage the understanding and mapping the world scenario of *V. cholerae* and its genotypic changes that takes place in last five decades. We have selected clinical *V. cholerae* O1 strains isolated in different states of India and abroad between 1961 and 2010 from patients with severe diarrhea associated with cholera on the basis of clinical symptoms.

Key words: *Vibrio cholerae*, variable traits, *ctxB* gene, MAMA-PCR, WHO

Emergency Response Planning for Urban Area using GIS Based Network Analysis

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The urban transportation systems are very complex in nature, due to the fact that they combine different modes of transportation over a limited space in high-density areas with increasing transport demand. With variety of information needed in the field of Transportation, Geographic Information Systems have long been recognized as a valuable tool for the representation and analysis of transportation networks and related activities. This paper mainly focused on emergency response planning for fast and comfortable transportation and urban development. Geographic Information Systems (GIS) and Remote Sensing are considered to be powerful tools for monitoring urban facilities. Transportation data is normally considered a key element of base maps and serves as essential reference data in this context. Besides its role as reference data, transportation data is at the core of applications, such as emergency response, routing, urban and regional planning, public transport, municipal service provision and general purpose mapping.GIS based service area analysis and shortest route analysis are used for better development in urban domain. Multispectral data has been used to demarcate the urban area explanation. Band rationing, sharpening and spatial filtering techniques was used to better understanding of unban clusters. Networks were generated using Google earth on screen vectorization process and validate in satellite images. Service area analysis was prepared based on hospital location. This present study mainly focused on the emergency response planning in developing area. The study shows that increased of general hospitals will very essential for better development.

Key word: Service area analysis, network analysis, emergency planning.

Changing Geomorphology of the Sundarbans Matla-Bidyadhari Interfluves in Recent Years

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The Matla-Bidyadhari interfluves in the Indian part of the Sundarbans delta is generally a gently-sloping floodplain. The major composition of the soils in the study-area laying between 21°55' & 22°45' latitudes and 88°35' & 88°55' longitudes contains mostly Gangetic alluvium, salinized in different extents from the tidal ingress. Major part of the interfluves constitute flatland with average height of about 2m above the MSL, while some parts lay in lower or higher elevations and the soils show special distribution pattern across regions. The interfluves located in the mature, as well as, active deltaic regions that influence the organic carbon settlement, trapping of clay particles or the micro-organisms that take part in decomposition processes. During diurnal inflow of tidal waters from the bay, the suspended salts get settled on the topsoil where the flow overtops the embankments, as also in all the other regions of the Sundarbans delta and thus result in gradual increase in salinity. This apart, climate-change induced storm surge and sea-level rise has been affecting the traditional agriculture and aquaculture practices. There is a general trend of increasing pH, conductivity and decreasing organic carbon content in soil in the region in the last four decades. In fact, the increasing salinity and the pedological changes in the floodplains of Matla-Bidyadhari interfluves have become major discouraging factors in traditional agricultural and aquacultural practices. On the contrary, production of tiger shrimp aquaculture (*penaeus monodon*) and culturing more lucrative *PM-post larvae* by converting traditional agricultural and aquacultural lands into shrimp-aquaculture pond is becoming rampant. For this, unscrupulous cutting of embankments is resorted to capture saline water in the agricultural fields. The practice of converting the areas into shrimp and shrimp-seed ponds is continuing unrestricted notwithstanding that this practice is permanently degrading and changing the geomorphology of the areas, which are being taken into shrimp-aquaculture. That apart, the practice is also affecting the adjacent agricultural fields, which are still under traditional cultivation. The mangrove environment of the region is already badly affected by human encroachment, agriculture, climate-related impacts and sea-level rise. The fringe-stretches of mangroves still left are being cut-down for expanding the highly profitable aquaculture-areas. Majority of the other species of shell and fin-fishes are already almost extinct from the regions, as also the agricultural produce native to the regions by now, inflicting major biodiversity-loss.

Key words: Matla-Bidyadhari interfluves, Penaeus monodon, PM-post larvae, Mangroves, Biodiversity-loss

Biodiversity of Traditional Genotypes of Rice (*Oryza sativa* L.): Collection, Conservation and Characterization for Further Improvement

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India is the richest source of rice biodiversity. Assam and adjoining states is the *primary centre* (The Hindustan Centre of Origin, which includes Myanmar, Assam, Malaya Archipelago, Java, Borneo, Sumatra and Philippinese) of origin of rice. Traditional land races are important reservoirs of valuable traits and need special attention for future conservation. A number of scented and non-scented traditional genotypes of rice are available in India in general and Northeastern India in particular. Some varieties are being extensively grown in specific problem oriented areas of West Bengal and Assam, such as deep water rice, submergence and drought tolerant used by tribal etc. *Aus Dhan* of West Bengal posses biotic and abiotic stresses tolerance ability. Non-scented local cultivar has also equal importance in rice breeding. Landraces and wild species posses immense potential of most valuable gene which can be efficiently utilize in the breeding programmes to develop high yielding rice varieties with quality and resistance to biotic and abiotic stresses. In spite of the fact that these landraces are being grown for centuries, no systematic effort has been made to improvements of local non-Basmati-scented races of rice. A new important source for the introduction of new trait or development of new plant type is the existence of genetically diverse gene pool of scented and non-scented rice in our country. Until a collection has been properly evaluated it has little practical use. There was little effort has been taken to use the local landraces of rice for their improvement. Considering the importance of local land races of rice, the present investigation was planned to characterize the collected rice germplasm at our collection and to identify the important traits which can be used in improvement of rice by the rice breeders.

Extensive survey was done in three northern districts of West Bengal to collect FVs. Information was gathered from the local peoples of the above mentioned places on the salient features of the local cultivars. Local cultivars were also collected from different parts of West Bengal and Assam through representative survey. The experimental materials consist of 170 local genotypes of rice and their derivatives. The field experiment was carried out at the Instructional Farm of Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal. The farm is situated at 26°19′86″

N latitude and 89°23′53′′ E longitude, at an elevation of 43 meter above mean sea level. The climatic condition of *Terai Zone* is sub-tropical in nature with eminent characteristics of high rainfall, high humidity and prolong winter season. Thirty days old seedlings were transplanted (singles seedling per hill) in plots measuring 3 × 1.5 m area in randomized block design with two replications. Row to row and plant to plant spacing were 30 and 20 cm, respectively. Standard agronomic practices compatible to the humid tropic of Terai Zone were followed to obtain good crop stand. Data were recorded according to the *Table of Characteristics* in the "Guidelines for Conduct of Test for Distinctiveness, Uniformity and Stability for Rice". In this communication the important characteristics of local genotypes of rice were documented for their probable use in rice breeding.

High phenotypic and genotypic variability recorded for large number of traits such number of tillers, number of panicle, grain per panicle, 100-grain weight, days to maturity, panicle shape (compact, loose, erect), awning (awnless, short to long awned), husk colour, (straw, golden, golden brown, purple black), grain shape (long slender, short slender, medium slender, long bold and short bold), lodging (susceptible and tolerant). Large numbers of rice landraces such as Kalobhog, Mohanbhog, Tulaipanji, Badshahbhog, Kalojeera, Radhunipagul, Gobindobhog, Chinakamani, Jhapaka, Fudugey, Kagey, Tulsimukul, Dudheswar, Sadanunia, Kalomunia etc. are occupying sizeable acreage for their special attributes like aroma, fineness, tolerant to insect pests, tolerant to diseases, submergence tolerance, drought tolerance etc. Grain yield showed high significant positive association with number of panicles per plant, 100-grains weight and grain thickness. Positive direct effect on grain yield per plant was observed in number of panicles per plant, 100-grains weight, and grain length and grain breadth.

Some genotypes posses special characters in our study materials. In general, a pedicel bears one spikelet in a panicle. In the repository of local cultivars, *Narkeldari* and *Thuri* showed more than one spikelet borne in a pedicel. This feature resulted high grain density in a panicle. Rice is single seeded fruit and generally it bears one kernel per spikelet. The cultivar *Jugal* had more (2-3) kernels per spikelet. The rudimentary lemma and pelea of local cultivar Sarmili is comparatively longer and white in colour and the normal lemma and pelea are dark purple in colour. The colour of fully opened leaves of *Kharadhan* is deep purple. Another local cultivar (Sadabhatkalo) whose lemma and pelea are straw coloured, but its dehusked rice colour is black and cooked rice also black in colour.

Key words: Farmers' Varieties, collection, conservation, genetic variability, characters association

Leaf Litter Traits, Decomposition and Carbon Stock of Dry Tropical Soils under Different Tree Plantations on the Campus of Banaras Hindu University

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Soil is the largest carbon pool of terrestrial ecosystems and plays a key role in the global carbon cycle. It stores 3.5% of the earth's carbon as compared to 1.7% in the atmosphere, and only one percent in vegetation. Litter production and their decomposition are essential components of soil carbon stock because substantial amount of carbon enters into the soil through aboveground and belowground plant parts then they are broken down by microorganism during the process of decomposition. Studies have shown that within a biome, plant functional traits (particularly leaf nitrogen content, lignin, tannin, SLA of leaf) explain substantial variation in rates of litter decomposition. Moreover, understanding the importance of plant functional traits to predict the future global change through C cycle is an essential step to study. In this reference; relationships among different tree litters, litter traits, CO_2 efflux (as a measure of litter decomposition), soil organic carbon stock (SOC stock) under different tree plantations (*Tectona grandis, Dalbergia sissoo, Cassia siamea and Ziziphus jujuba*) on the campus of Banaras Hindu University were studied.

Study was conducted in July of year 2013. Soils were randomly sampled in each plantation at three soil depths (0-15, 15-30 cm and 30-60 cm) with three replicates. Data on leaf litter decomposition were determined on monthly basis (starting from July 2013 to June 2014) by litter bag technique. CO_2 emission was determined by soda lime absorption method. SOC stocks (Mg ha^{-1}) were calculated by multiplying soil organic carbon to bulk density of respective depth. Data were analyzed following standard methods and subjected to appropriate statistical analyses. Results showed significant variations in SOC stock due to tree plantation and soil depths. Tree litter production and CO_2 emission differed notably due to tree plantations. SOC stock was highest in *Tectona grandis* which had highest litter fall and lowest in *Ziziphus jujuba* plantation. Depth wise; it was maximum at highest depth and minimum at upper soil surface. Total litter fall was lowest in *Dalbergia sissoo* plantation. Specific leaf area (SLA), leaf dry matter content (LDMC), leaf thickness (LT), leaf carbon content (LCC), Leaf Nitrogen content (LNC) and C:N ratio of leaf litters varied substantially due to variation in tree plantation. Leaf litter C:N ratio was maximum in the *Tectona grandis* and minimum in the *Dalbergia sissoo*. LCC and LNC were highest in *Cassia siamea* and lowest in *Ziziphus jujuba*. Leaf thickness was maximum in *Tectona grandis* and lowest in *Cassia siamea*, opposite to this; LDMC was highest in *Cassia siamea* and lowest in *Tectona grandis*. Litter decay constant (K) was negatively and significantly related with leaf thickness

and C:N ratio. On the other hand, it was positively related with LNC. Therefore; leaf thickness, C:N ratio and leaf nitrogen contents could be determinant of litter decomposition. Due to linear and positive relationship between litter input and SOC stock, study may infer higher SOC stock at the sites experiencing higher litter input. The quadratic relationship between CO_2 emission and litter input, suggested higher release of CO_2 at moderate level of litter than the lowest or highest levels of litters. Study showed that the leaf litter of *Ziziphus jujuba*, *Dalbergia sissoo* and *Cassia siamea* were easily decomposable due to their high decay constant and CO_2 emissions, hence, accelerated the process of carbon mineralization. On the other hand; high C:N ratio and leaf thickness as well as the less decay constant of *Tectona grandis* may hinder the decomposition process than the leaf litters of other studied plantations. Overall, study suggested that tree plantations and leaf litter traits determined the litter decomposition and as a result governed the SOC stock in the soils of dry tropical environment.

Key words: SOC stock, tree plantation, CO_2 emission, litter decay constant, litter production, leaf functional trait

Vermicomposting and Composting as Environmental Biotechnology for Waste Management and Sustainable Agriculture

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Biotechnology is broader term and not only restricted to genetic engineering and recombinant DNA technology. The application of biological research techniques to the development of products that improve human health, animal health and agriculture is called as Biotechnology in expansive sense. At present, one of the most important intimidations for human is the disposal of different organic wastes. These wastes include tree leaves, garden wastes, agricultural wastes etc. Leaves are potential sources of valuable nutrients providing a high quality of organic matter, which should be returned to the soil. Vermicomposting and composting are promising agricultural biotechnology measures for converting organic waste to organic manure. *A field* experiment was carried out in the research farm located at Shibala, Maharashtra to utilize the huge amount of leaf litter as valuable resource for composting and vermicomposting, In this investigatation the influence of these manures on *Trigonella* yield and nutrient uptake was also studied. The freshly fallen dead leaves were collected and used as raw material to prepare compost and vermicompost Composting was done by two methods as NADEP tank (aerobic) and Bangalore pit (anaerobic) methods. Vermicomposting is done in a pit. Chemical analysis by adopting standard method was carried out for dry matter, N, P, K, Ca, ash content and C:N ratio. The Experimental design was a randomized block design (RBD) with five treatments and four replications. The five treatments were (i) NADEP compost (AC); (ii) Bangalore pit compost (BC); (iii) Vermicompost (VC) (iv) Chemical Fertilizer (NPK) and (iv) Control (CON). To evaluate the performance of manures, *Trigonella–foenum graecum* L. seeds were sown at the rate 30Kg/ha in 1.8 x 2.4m plot. *Trigonella* was harvested after 39 days of sowing and fresh sample was analyzed for chlorophyll (a, b and total), β carotene, vitamin C content. Chemical analysis was carried out in *Trigonella* as crude protein, reducing sugar, dry matter, N, P, K, Ca percentage. Total yield, percent increase over CON was also calculated. The results show that vermicomposting and composting biotechnology can be successively applied for conversion of rural bio waste and biomass into nutrient rich nutrinet resources. When *Trigonella* was grown on these organic manures, yield and nutrient quality of *Trigonella* was enhanced as compared to chemical fertilizer and control treatments. The percent increase over control for fresh weight was maximum in VC followed by AC, BC, NPK and lowest in CON. The vermicompost prepared from leaf liteer was found more effective as compared to both the composts. The ver-micomposting biotechnological treatment of leaf litter appears to be most cost effective and ecofriendly technique which is useful for sustainable agriculture.

Key words: bio waste, ecofriendly, manure, *Trigonella*, resources, yield

Estimation of Carbon Sequestration in Sacred Grove in Ratnagiri Dist., Maharashtra with Help of GIS

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Carbon sequestration is the process of capture and long-term storage of atmospheric carbon dioxide (CO2) in the tree. Carbon sequestration is useful to either mitigate or defer global warming and avoid dangerous climate change. The amount of carbon sequestered and stored in forest varies greatly based on a large number of factors, including the type of forest, its Net primary production, the age of the forest, and its overall composition. As more photosynthesis occurs, more CO2 is converted into biomass, reducing carbon in the atmosphere and sequestering it in plant tissue above and below ground resulting in growth of different parts. Biomass production in different forms plays important role in carbon sequestration in trees. Sacred groves, locally called Devachi rai, are the virgin forest patches preserved on religious ground. These forest patches are example of traditional bio-diversity conservation methods since ancient time. Estimates of carbon stocks and stock changes in tree biomass (above and belowground) are necessary for reporting to the United Nations Framework Convention on Climate Change (UNFCCC) and will be required for Kyoto Protocol reporting. Present study was carried out to estimate sequestrated carbon of trees in Samb Devrai, a scared grove having thick vegetation possess high carbon sequestration potential, contributing in reducing concentration of CO_2 in the atmosphere. It is located at Patgav, in Sangameshwar Tahsil, Dist-Ratnagiri in Maharashtra. In all plots of 20x20 m size were laid randomly, measuring the indicator parameters (e.g. tree DBH, or height). Species of trees were identified with the help of flora. Total 16 tree species were found. Out of which *Terminalia bellerica* was most common tree species in this sacred grove. The maximum carbon sequestration was found by *Terminalia bellerica* and minimum by *Moullava spicata*. The total carbon sequestration in this sacred grove is 1462 ton. Samb sacred grove is rich with biodiversity. In this sacred grove carbon is sequestered in large quantity from the atmosphere. Same efforts used for other sacred groves will be benefited for income generation and livelihood of local people through ecosystem conservation. Social awareness campaign about role of sacred grove in conservation of biodiversity and carbon sequestration is recommended.

Key words: biomass, biodiversity, carbon dioxide, conservation, global warming

Fungal Diversity Associated with Leaf Decomposition of Mangrove Plant *Kandelia candel* (L.) Druce

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Mangroves are open systems with respect to both energy and matter and thus couple upland terrestrial and coastal estuarine ecosystems. Mangrove vegetation contributes to the primary production in the aquatic environment in the form of leaf and litter fall. Mangroves provide energy to marine habitats through production and decomposition of plant detritus. Decomposition of this organic material by bacteria and fungi results in protein enriched fragments of detritus. India with a long coastline of about 7516.6 km, including the island territories, has a mangrove cover of about 6,749 km^2, the fourth largest mangrove area in the world. Studies revealed that mangrove fungi are the second largest group among the marine fungi. The microbial decomposition of mangrove leaves has been studied by different scientists mainly of *Rhizophora apiculata. Kandelia candel* (L.) Druce is a mangrove plant belongs to family Rhizophoraceae. Though it is one of common mangrove species of Ratnagiri coast, studies are not carried out to record fungi associated with leaf decomposition of this plant in this area. The present study aims to study diversity of fungi on randomly collected leaves of mangrove plant at Ratnagiri, West coast of India. The decomposing leaves of *Kandelia candel* were collected from six different sites of Bhatye estuary (Kajli river) Ratnagiri, Maharashtra. The decomposing leaves were collected in clean and sterile polythene bags and aseptically cut in to small pieces. These were then washed with sterilized seawater to remove debris on the leaves. Then they were dipped in 0.01 % $HgCl_2$ solution for 3 min for surface-sterilization of the pieces. The pieces were then washed with sterilized seawater to remove all the traces of $HgCl_2$ solution. For estimating fungi, the pieces were then placed on plates with Martin rose Bengal agar medium incorporated with an antibiotic mixture (chlorotetracycline-HCl10 %, chloramphenicol 2 % and streptomycin sulphate 2 %) for suppressing bacterial growth in the media. Petri plates were incubated at room temperature (27±2 °C) for 2-6 days and the colonies were counted. Fungi were identified with standard literature. In *total 19 species of fungi were identified out of which 5 fungi species belong to Aspergillus.* Least frequent fungi species was *Hypocrea sp.* found at only two sites. While comparing fungal diversity among six different sites, site 2 showed high diversity where as site 4 showed least diversity. Diversity of fungi may change from site to site in little extent. These fungi not only help in decomposition of leaves but also support nutrient cycle. Mangrove forests generate considerable amount of detritus such as leaf litter and constitute an ideal environment for many detritus dependent fungi.

Key Words: Biodiversity, detritus, ecosystem, esturine, organic, terrestrial.

'Empty' World versus 'Full' World Paradigm: A Study of Deforestation in Assam

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Welfare to the society has two broad sources: services from the man-made capital (i.e. from the economy) and services from the natural capital (ecosystem services). In an 'empty'world, welfare from the ecosystem services is more, whereas in a 'full' world economy, it is less. Deforestation is a major global environmental issue which degrades the ecosystem services of forests. It can affect sustainable socio-economic developmental processes in the developing countries as forests have been a source of subsistence to the poor in the agricultural economies. Assam, a state in the North-East India, is facing massive deforestation since 1990s. This paper identifies the various socio-economic causes of deforestation in Assam. The period of study is 1991-2013. Also regression analysis is used to see the trends of forest cover changes. The study analyses determinants of both positive and negative changes in the forest cover of Assam in the study period and reveals that there is a transition from 'empty' to 'full' world situation in Assam's forest.

Key words: deforestation, regression method, full world, empty world, sustainable development

An Approach towards the Valuation of Contaminated Land and Property: Arsenic Contaminated Land and Property

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Overburden population, industrialization, urbanization, ever-growing demand for development, havoc and unscientific use of natural resources yield a lot of wastes. All these waste contaminate environment and land. Contamination is recognized as physical or nonphysical environmental influences which bring negative effect to the land and property.[1] Contaminants, such as asbestos, acid rains, nitrates, arsenic are the ingredients that cause contamination.[1] It has locational influence on value. Arsenic (As) is one of the contaminants that affects land and property. It has direct and indirect effect on society.

Though, several approaches are employed to fight back its detrimental effects, such as health hazards. But very few or limited works have been done to evaluate the effect of arsenic contamination on contaminated land valuation. Thus a proper methodology to assess the value or assess the effect of contamination over the value of land and property of the West Bengal is a work of great importance.
The conventional approach of evaluation is accompanied with the few limitations, such as unknown contaminants and its effects, natural calamity, unforeseen environmental risks, weather pattern variation, variation of professional skill, political influences, scarcity of guiding rule to evaluate magnitude of effect of contamination on land and property in terms of money.

Therefore, a better methodology of assessing the contaminated land has been proposed which compares the value of any property/ subject/ land before and after the contamination along with the stigma value. This method includes field survey, selection of best practice approach and constant assessment. To ascertain market value of a property, it practices sampling, assesses previous results and valuation report and then only concludes the present value of any property.

The proposed methodology has encompassed the direct effect of contamination on human, domestic animal and vegetation life [2] as well as indirect effect such as market value of contaminated land (as indirect effect of Arsenic plays a direct role of contamination in market value)[3]. Hence, this methodology is capable to quantify the actual effect of contamination (such as, Arsenic) in terms of money which is much more apprehensible by today's corporate mind set up. It has been found in this study that a normal property has faced a value depreciation of 31% by medium Arsenic contamination in West Bengal.

Key words: contaminated land, arsenic, methodology, West Bengal

Diversity of Gasteroid Fungi in Hollongapar Gibbon Wildlife Sanctuary, Jorhat, Assam, India

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Hollongapar Gibbon wildlife Sanctuary (HGWLS), Jorhat, Assam is mainly famous for Hollock Gibbon and other six primate species found in the sanctuary. The **gasteroid fungi** are informal or non-taxonomic group of fungi in the Phylum *Basidiomycota*. They are placed in this informal group because they produce their spores inside their basidiocarps (fruit bodies) rather than on an outer surface. The gasteroid fungi includes stinkhorns, earthballs, puffballs, pseudo truffles, earth stars and bird nest's—are not closely related to each other. Like other fungi, gasteroid are some of the most important organisms in the world, because of their vital role in ecosystem function and influence on humans and human-related activities. Macro fungi not only produce the well attracted variously colored fruiting bodies, but also play a significant role in day to day life of human beings through utilization in industry, agriculture, medicine, food industry etc. Moreover, fungi help in bioremediation, in recycling nutrients, and in decomposing the dead organic matter in soil and litter, as bio-fertilizers and in many other ways. Many species of stinkhorns, earth balls, puffballs and pseudo truffles are edible where as earth star and bird's nest macro fungi help in decomposition of organic matter in soil and litter. It is necessary to estimate the diversity of these fungi that will enable them to be included in considerations of biodiversity conservation. An attempt is made through this study for the first time to provide an updated list of gasteriod fungi in the study site. There are five numbers of compartments in the Sanctuary and stratified random sampling technique was used for fruit body survey during April 2012 to September 2014. The fungal samples were photographed, collected, allotted accession numbers and preserved for further microscopic study in the laboratory. A total of 17 gasteroid fungal species belongs to 10 genera, 5 families, 4 orders, 2 sub-classes and 1 class, have been found in the study site. The family *Phallaceae* (7 spp.) is highly dominant in the study site followed by *Agaricaceae* (5 spp.), *Geastraceae* (2 spp.), *Sclerodermataceae* (2 spp.) and *Rhizopogonacea*e (1 sp.). The name of the gasteroid species along with their occurrence percentage are *Phallus indusiatus* (1.6), *Phallus duplicatus* (0.64), *Phallus cinnabarinus* (0.48), *Phallus merulinus(*1.28), *Phallus atrovolvatus* (2.48), *Mutinus bambusinus* (12.02), *Clathrus delicatus* (0.32) are belong to stinkhorn; *Scleroderma citrinum* (3.69), *Scleroderma* sp. (5.61) are belong to earthball; *Rhizopogon* sp.(4.81) is belongs to pseudo truffle; *Bovista longispora* (24.84), *Morganella pyriformis* (4.01), *Bovista dermoxzantha* (4.97), *Calvatia* sp. (0.8) are belong to puffball; *Geastrum saccatum* (20.19), *Geastrum* sp. (5.61) are earthstar and *Cyathus striatus* (6.72) is belongs to bird's nest fungi. The diversity index and similarity index between the compartments have been calculated to study ecological dynamics of the gasteroid fungal species. The conservation and biological screening on these fungi are still under investigation.

Key words: Conservation, Diversity index, Dominant, Ecosystem, Occurrence, Sampling

Proximate Analysis of *Sonneratia apetala* Fruit Jelly

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We evaluated the biochemical composition of the jelly prepared from the fruits of mangrove flora *Sonneratia apetala* collected from Indian Sundarbans. The fruit of this species is available only during monsoon season and is consumed by island dwellers. The main purpose of this study is to provide nutritional information through the analysis of protein, carbohydrate, lipid and vitamin C of the jelly prepared from the fruits of this true mangrove species. The present study confirms the use of this jelly for human consumption as it is highly rich in vitamin C. The result of the study can be used to develop mangrove based alternative livelihood for the local island dwellers of Indian Sundarbans.

Key words: *Sonneratia apetala*, Indian Sundarbans, biochemical composition, alternative livelihood, island dwellers

Textile Sulphate Rich Dyebath Wastewater Treatment by Using Pressure-Driven Membrane Processes

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Textile processing industries are water, energy and chemical intensive industries which generates vast amount of wastewater loaded with pollutants comprising dissolved solids, auxiliary chemicals, many inorganic and organic dye residues (in cotton dyebath dump) and even suspended solids (mostly generated from the textile being processed). Colored wastewater creates an aesthetic problem and discourages the downstream use, it has to be removed before discharging into water sources.

Traditional methods for dealing with textile wastewater consist of various combinations of biological, physical and chemical methods. Because of the large variability of the composition of textile wastewaters, most of these traditional methods are becoming inadequate. Dyes are formulated to produce colors that are resistant to washing, light exposure, oxidizing and reducing agents. This makes them highly recalcitrant in conventional wastewater treatment processes. Dye Bath contains higher solids in the range 4-5% whereas wash water contains only 0.5-1% solids.

Membrane technology has wide range of applications in the textile industry, various types of dyes and chemicals can be recovered from the textile effluent and large amount of wastewater can be reused. It is a new separation technology, with high separation efficiency, low energy consumption and easy operation.

The textile dyebath dump wastewater rich in sulphate was segregated and treated with pressure-driven membrane system. The pilot system was articulated and includes three membranes (Microfiltration, Ultrafiltration, and Nanofiltration) using various pumps, valves for conveying water through various units. The pilot system for proposed study uses microfiltration as pre-treatment followed by ultrafiltration and nanofiltration to remove colour and dissolved solids/ionic species mainly. Permeate and retentate of each membrane process was analysed to quantify the parameters and to check the water quality of effluent.

The Application of membrane filtration processes (microfiltration, ultrafiltration and nanofiltration) selectively with high strength difficult waste streams not only enables high removal efficiencies, but also allows reuse of water and recovery of some of the valuable dyeing constituents. Membrane treatment despite being costly is a promising advanced treatment option.

Key words: Microfiltration; Ultrafiltration; Nanofiltration; Water Reuse; Dyeing; Textile industry

Effect of Micro Climatic Condition on Community Structure of Similipal Biosphere Reserve, Odisha, India

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Data on microclimatic condition of moist deciduous forest covers of Similipal Biosphere Reserve (SBR), Odisha in core, buffer and transition areas was collected from March.2011 to February, 2013. The microclimatic data was compared with various analytical (frequency, density, abundance, etc.) and synthetic (species diversity, concentration of dominance, species richness and evenness) parameters of vegetation layers (herb, shrub and tree) to know how microclimate affects vegetation structure. Variations in microclimatic variables (light intensity on the forest floor, air temperature, soil surface temperature, humidity, etc.) were measured in three different zones viz. core, buffer and transition of SBR. The microclimatic parameters showed wide variations among different zones and also among the seasons. Light intensity on the forest floor in three different zones of the reserve ranged from 54.16 ± 9.84 to 762.91 ± 43.74 (µmol $m^{-2}s^{-1}$). In mid-summer, post-monsoon and mid-winter light intensity on the forest floor ranged from 96.43 ± 17.51 to 1012.47± 67.71, 34.19 ± 6.41 to 589.9 ± 34.36 and 22.34 ± 3.11 to 677.3 ± 37.53 (µmol $m^{-2}s^{-1}$) , respectively. Among the three zones of the reserve maximum light intensity on the forest floor was observed in transition zone in comparison to core and buffer zone of the reserve. All the three zones of the reserve received maximum light intensity on the forest floor between 1000 and 1200 h. The ambient air temperature ranged from 22.45 ± 3.41 to 35.21 ± 3.45°C in mid-summer, 19.15 ± 2.23 to 27.69 ± 3.73 °C in post-monsoon and 11.31 ± 2.11 to 21.03 ± 2.51°C in mid-winter season. Soil temperature ranged from 17.23 ± 3.31 to 31.54 ± 3.27°C in mid-summer, 14.41 ± 2.44 to 26.88 ± 2.67 °C in post-monsoon and 7.39 ± 1.51 to 20.17± 2.46°C in mid-winter season. Correlation between microclimatic variables and structural parameters of different vegetational layers of the reserve indicated that light intensity on the forest floor is one of the most important microclimatic variables in establishment of forest community.

Key words: Moist deciduous forest, Light intensity, Similipal, Analytical characters, Synthetic characters, Correlation

Bioremediation of Cement Kiln Dust Alkalinity and Metal Leachate Using Alkali-Tolerant *Bacillus* sp.

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A new strain of alkali-tolerant bacterium performing alkalinity reduction of highly alkaline cement industry waste, cement kiln dust (CKD), was isolated from mixed dye waste water sample. CKD is generated in large quantities during production of cement clinker and major part of it is landfilled. High alkalinity restricts its re-utilization in cement kilns as raw feed material and application in construction material as cement replacement due to reduction in the strength and durability of the concrete. Alkaline leachate and heavy metals generated from landfilled CKD causes soil and water pollution, thus CKD needs to be treated before landfill. Alkalinity of CKD and related solid wastes can be reduced by chemical as well as biological means. However, the biological treatment process offers better package over chemical process by being safe and economical.

The biological treatment can be applied by using microorganism able to thrive in highly alkaline environment. Isolated bacterium has the ability to withstand highly alkaline conditions (pH ~12). The isolate belongs to genus *Bacillus* as determined by morphological, biochemical characterization and 16s rRNA gene sequencing. The strain was identified as Gram positive, rod shaped and grew well in the temperature range of 28-50°C, pH 5-12 and tolerate up to 8% salinity. The strain was able to hydrolyze starch, pectin and gelatin, catalase positive and produced acid. The 16S rRNA sequence (1408 bp) of the strain revealed 94.7% sequence similarity with *B. halodurans* strain DSM 497 (AJ302709) and formed phylogenetic clade with bootstrap value of 99% using neighbour joining method. The isolate was then designated as *Bacillus halodurans* strain KG1 (NCBI-GenBank accession number JQ307184) and deposited to NCIM Pune (India) under deposition number NCIM 5439.

In CKD leachate, up to 73% alkalinity, 87% chloride and 3.58 pH units were reduced after treated with 0.8 O.D. concentration of *B. halodurans* strain KG1 strain at 20 days of incubation. The treated powdered CKD, after bacterial treatment, analysed with X-ray fluorometry (XRF) showed 45.7% reduction in K_2O (reason for alkalinity in CKD) content compared to control. XRD analysis supported the reduction in alkalinity in terms of absence of crystalline alkaline sulfate phases (arcanites). Metal analysis of untreated and bacterial treated CKD leachate samples were done by inductive coupled plasma mass spectrometer (ICP - MS). In control CKD, the content of Ag, Cr, Pb, Ni, Mo

and Cu in control CKD was 0.338, 2.066, 0.130, 0.122, 0.127 and 0.285 mg/L, respectively, which then reduced to 0.029, 0.519, 0.040, 0.036, 0.039 and 0.081 mg/L in KG1 treated CKD.

The results revealed that isolate KG1 was able to reduce the metal content in CKD under alkaline conditions which suggests its potential application in bioremediation of other solid alkaline industrial wastes. This study shows that this biological technology can be efficiently utilized due to cost-effective and environmental friendly.

Key words: Alkalinity, *Bacillus* sp., Biological treatment, Cement kiln dust, Heavy metals, XRF.

Health Risk Assessment of E-Waste Workers from Informal E-Waste Recycling Units of Chennai City Due to Contamination of Polychlorinated Biphenyls in Dust Samples

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Release of Polychlorinated Biphenyls (PCBs) from the informal electronic waste (e-waste) recycling is proved to cause serious health issues. India being the second largest importer and third largest producer of e-waste, the proliferation of informal recycling operations in urban areas is growing rapidly. PCBs which were widely used in capacitors and transformers are carcinogenic and neurotoxic, exposing workers to unsafe occupational conditions. Dust samples have therefore been collected from four major e-waste recycling centre in Chennai, the IT hub of south India. PCB analysis was carried out using Gas Chromatography-Mass Spectrometry (GC-MS) and potential cancer risk of the workers exposed to contaminated sites were assessed as per USEPA recommendations. Levels of PCBs were found to be nearly 30 folds higher in Pudupet compared to other sites due to the high volume of computer waste that are recycled in this site. Ingestion and dermal contact of dust in the occupational conditions are proven to be important non-dietary exposure pathway for PCBs. Pudupet has the maximum risk among all the sites with ingestion risk of $4.28X10^{-7}$ and dermal contact risk of $1.69X10^{-7}$. Though all the values are below acceptable limit of $1X10^{-6}$, the rate at which the volume of e-waste is informally recycled in these sites is increasing by atleast one and a half times every year putting workers and occupants at serious risk.

Key words: Cancer risk, occupational exposure, non dietary exposure

Ecological Risk Assessment of Organochlorine Pesticides from the Surface Waters of Brahmaputra River

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Organochlorine Pesticides (OCPs) has been an integral part of Indian agriculture until it was banned due to environmental concerns but is still in restricted use for vector control programs due to its low cost and effectiveness. Although banned, the residues are still found in various matrices of the environment causing threat to the environment. OCPs are expected to cause potential toxicity to aquatic organism. To study the ecological risk, 13 organolchlorine pesticide residues was quantified using Gas Chromotography-Mass Spectrometry (GC-MS) in surface water samples taken from 16 locations along the Brahmaputra River from Assam, a northeastern state of India. Five species in five groups were identified and ecotoxicological risk was calculated. Ecological risk assessment was performed based on the USEPA (1998) guidelines, the toxicity was calculated in terms of Hazard Quotient (HQ). Ecological risk was highest for insects (Σ HQ = 53666.5) followed by Molluscs (Σ HQ = 5654.2), Phytoplankton (Σ HQ = 802.08), Fishes (Σ HQ = 364.99) and Zooplankton (Σ HQ = 131.13). DDT has been extensively used for the control of vector borne diseases especially malaria in these belt and it was found that the organism most affected with the risk was Mosquitoes with HQ value 53666.5. It was observed that the surface water of Brahmaputra River from the northeastern belt is contaminated with OCPs and is indicating a possible threat to the River water ecosystem.

Key words: Organochlorine pesticides, Ecological Risk assessment, ecosystem

Eco-Friendly Control of Foot and Root Rot Disease of Lentil Using Biological and Botanical Agents

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The efficacy of twelve botanical extracts and four biological control agents were tested for controlling foot and root rot disease of lentil at the experimental field of RARS, Ishurdi, Pabna. Accordingly, water extracts of dried leaves of *Allamanda cathertica, Rosery ocimum, Andragraphis paniculata, Ficus glumerata, Lawsonia inermis, Azadiracta indica, Nicotiana tabacum,Justicia adhatoda* seeds of *Nigella sativa, Allium sativum, Corchorus capsularis, Zinger officinalis* and biologicalcontrol agents like *Trichoderma harzianum* and *Trichoderma viridi* (both liquid and compost) were prepared and treated seeds before sowing. Out of these twelve botanicals and two biological control agents *Lawsonia inermis* leaves extract showed best performance against the selected pathogens compare to other extracts and biological control agents.*Nigella sativa* seed extract also showed good activity for controlling foot and root rot disease of lentil which was similar to*Allium sativum* and *Trichoderma viride* (liquid). However, *Justicia adhatoda* leaves extract showed lowest efficacy which was statistically similar to *Andragraphis paniculata* and control.

Key words: Botanicals, extract, *Trichoderma*, disease, Lentil

Carbon Nanotubes in the Remediation of Water Contaminated with Polycyclic Aromatic Hydrocarbons

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Surface Water quality is declining due to over exploitation and contamination by humanbeings Direct dumping of untreated effluents bypharmaceutical industries, petrochemical industries, release significant amount of Polycyclic Aromatic Hydrocarbons (PAH's) into water.In India treatment capacity exists only for one third of the quantity of sewage generated which are not capable of treating PAHs thereby causing severe effects on mankind... Water purification using nanotechnology exploits nanoscopic materials such as Carbon Nanotubes (CNT's) giving an edge over conventional water treatment systems. In addition, CNT's have potential applications in water treatment due to their adsorption characteristics over PAH's.The major factor which defines the capability of Nanotubes as an extremely versatile remediation tool includes their very small particle size (1-100nm). CNT's prove to show enhanced filtration of water and better than the present conventional system. So a water filter made of CNT's could help because of faster flow rate of water through them.CNT's has been therefore used for removal of PAH's from drinking water. Carbon Nanotubes (CNTs) weresynthesized by simple arc discharge between two graphite electrodes immersed in NaCl distilled water solution. The cooling ability of NaCl solution is better than deionised water and cheaper than liquid nitrogen. Synthesis of CNTs was investigated in NaCl solution with different experimental parameters, such as voltage, current, catalyst concentration and NaCl solution molarities, using Fe and Ni catalysts. Produced raw materials contained considerable amount of impurities such as amorphouscarbon and metal catalyst particles. These filters can be effectively used to remove PAH's efficiently from any water surface prone to PAH's. Filter membrane made of Carbon Nanotube has the capacity to adsorb the targeted PAH which in this case was phenanthrene. Nanofilter pores are significantly smaller. Such filters can be anchored on to a solid matrix such as zeolite for improved water treatment. Carbon Nanotube filters may hold the potential to cost-effectively address some of the challenges of site remediation, oil spill areas, or used in water treatment plants. So the conventional sorptive media could be replaced by Carbon Nanotubes.

Key words: CNT, PAH, Phenanthrene, Arc Discharge, Remediation

Arresting Polycyclic Aromatic Hydrocarbons Associated Vehicular Pollution by Using Carbon Nanotubes as Air Filters

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Presence of Polycyclic Aromatic Hydrocarbons (PAH's) in the vehicular exhaust smoke is one of the major pollution crisis in India whose automobile sales figures are soaring high every year.On an average, amount of PAH's released by vehicles accounts for almost 1.7 - 15.059 mg/km.Their persistence and carcinogenicity pose severe threat to the urban community where personal automobile usage is dominant. PAH's are one of the first atmospheric pollutants identified as carcinogens that are released due to vehicular emission. For potential environmental applications as superior sorbents, Carbon Nanotubes have been studied for removal of PAH's. Carbon Nanotubes (CNT's) adsorb these PAH's and help in resolving the situation.Because of their hydrophobic surfaces strong interaction between CNT's and PAH's are expected. The presence of high-energy adsorption sites, such as CNT defects, functional groups, and interstitial and groove regions between CNT bundles provide reasons for adsorption. Therefore, adsorption of PAH's by CNT's were studied to investigate the relationship of adsorption with sorbates. CNT's produced by using electric arc discharge paves the way in making a nano air filter which adsorb these PAH's from vehicular exhausts. This simplified method does not require expensive noble gases,high temperature furnace and vacuum equipments. Carbon Nanotubes (CNTs) were thereforesynthesized by simple arc discharge between two graphite electrodes immersed in NaCl distilled water solution. Arc discharge was not stable in deionised water due to its electrical insulatingcharacteristic. Therefore, salt solution was used as the liquid environment in order to improveelectrical conductivity of solution.Synthesis of CNTs was investigated in NaCl solution with differentexperimental parameters, such as voltage, current, catalyst concentration and NaCl solutionmolarities, using Fe and Ni catalysts.Carbon nanotubes were synthesized by using amixture of Fe and Ni (1.8:0.9 mols %) as a catalyst. The experiments were optimized withusing 0.3 molar of NaCl solution and 3 mol% catalyst concentrations. Raw as-producedmaterials were partially purified by acid treatment and thermal oxidation methods.Adsorption capacity of PAH's on CNT's imply that CNT's are like pollutant collectors or sinks. This would result in decreased organic chemical mobility, bioavailability and environmental risk. An air filter could remove the PAH's through adsorption by CNT's and can be installed to vehicles with their exhausts. So installing air filters to the vehicular exhausts is a novel method which could help us reduce the pollution through vehicles to a great extent and subsequently reducing PAH's in the environment.

Key words: Carbon Nanotubes, PAH's, Adsorption, Synthesis, Air Filters, NaCl, Vehicular Exhaust

GC-MS Determination of Phthalates in Atmospheric Air of Southern India and its Human Health Risk Assessment

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Present study was intended to address the seasonal distribution and possible sources of major phthalates in atmospheric air of Tamilnadu, India. Passive air sampling was conducted at 31 locations in urban and coastal areas during April 2009 to January 2010 and phthalates in the samples were quantified by using gas chromatography-mass spectrometry. The extraction method showed good recovery (107 -115 %) for dimethyl phthalate (DMP), diethyl phthalate (DEP), butyl benzyl phthalate (BBP) and di-n-octyl phthalate (DnOP). The average concentrations of phthalates in urban and coastal areas ranged from 0.21 to 7.86 ng/m^3 and 0.19 to 3.92 ng/m^3 with mean concentration of 1.92 ng/m^3 and 1.52 ng/m^3, respectively. The detection frequency was 100 % for all phthalates, however, DEP and BBP were high during pre-monsoon season and the highest concentration was observed in urban air. Principle component analysis revealed the signature of possible sources of phthalates as plasticizers in vinyl flooring, synthetic leather, building materials and plastics. Based on USEPA's risk assessment, the observed phthalate levels are safed did not exceed the tolerable daily intake (TDI). Nevertheless, the calculated phthalate exposure for children seems to be high for all the seasons. Furthermore, this is the first report on phthalates in atmospheric air over a wide geographical area in Tamilnadu, India using passive air sampler.

Key words: Air pollution, Phthalates, Passive air sampler, GC-MS, Human health risk assessment, India

Effect of Grassland Species and Decomposition of Litter by Microbial Activities

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Decomposition of litter is greatly influenced not only by its chemical composition but also by activities of soil decomposers. The litter decomposition of a grassland community located at Rangamatia of Mayurbhanj district, Odisha (210 56' N; 860 41' E). The floristic composition of the grassland community comprised of 36 species (15 were grasses and 21 were non - grasses). I examined the litter in each species was incubated in soil of a standard composition for one to two months under controlled conditions. After incubation, the structure of bacterial and fungal communities in the soil was examined using phospholipids fatty-acid analysis and denaturing gradient gel electrophoresis. Species from improved grasslands had significantly higher rates of nitrogen mineralization and decomposition than those from semi-natural grasslands because the former were richer in nitrogen. Litter from improved grasslands was also richer in gram-positive bacteria, whereas that from semi-natural grasslands were richer in actinomycetes and fungi. The composition of both bacterial and fungal communities was closely related to the rate of litter decomposition. These results suggest that plant species greatly influence litter decomposition not only through influencing the quality of substrate but also through changing the composition of soil microbial activities.

Key words: grassland, abundance, incubation, litter, microbes

Aniline Recovery from Aqueous Solution using Natural Solid Wax

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The disposal of wastewater from industrial process has received considerable attention and legislation for protection of the environment. The largest users of aniline are companies that make methyl diphenyldiisocyanate, pesticides, dyes, and rubber, further in drugs, photographic chemicals, varnishes, and explosives. Exposure to aniline can occur in the workplace or in the environment following releases to air, water, land or groundwater. Since Aniline is toxic and carcinogenic and therefore has to be removed from the disposed water. The present study aimed to study the permeability of supported liquid membrane on aniline using solid triglycerides and the effects of pH in feed, initial aniline feed concentration and strip concentration in the transport of aqueous solution. Supported solid membrane (SSM) transport of aniline was good with Beeswax as membrane material. Hydrophobic polytetrafluroethylene (PTFE) membrane of 0.45 µm pore size as the support material gave maximum transport. Permeability of aniline was studied at different pH, initial feed concentration of Aniline and strip concentrations. The result obtained from the SSM maximum permeability of Aniline was achieved for 1 ppm initial aniline concentration at pH 11 and at the 4th hour of reaction time. The optimum concentration of stripping and maximum percentage recovery of aniline was achieved at 0.2 N H_2SO_4 were 1.27×10^{-11} and 79% respectively.

Key words: Aniline, Recovery, PTFE membrane, Beeswax and Permeability

Determination of Heavy Metals and Acute Toxicity Studies of Vat Dyes on Earthworm (*Lumbricus terrestris*)

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A study was carried out to determine the heavy metal contents and the toxicity of three vat dyes (blue, green, and red dyes and their additives NAOH (caustic soda) and $NAHSO_4$) on earthworms (*lumbricus terrestris)* using 24 hour filter paper contact test. Five concentrations was formed using warm distilled water (0.1, 0.2, 0.3, 0.4, 0.5mg/l). Heavy metals were also detected using atomic absorption spectrophotometer. The results indicate that the red vat dye is the most toxic to the earthworms with LC_{50} of 0.12 mg/L and 0.12 mg/l with additives at 24-h of exposure, the LC_{50} of the blue vat dye is 0.129mg/l and 0.21 mg/l with additives and green dye is the least toxic when compared to the red with LC_{50} of 0.3 mg/l and 0.137mg/l. NAOH and $NaHSO_4$ shows LC_{50} of 0.13 and 0.5 respectively which shows that the NaOH is most toxic between the two additives used. Seven heavy metals detected were found to be present at 0.1g of each of the vat dye with their absorption and concentrations. The study concludes that all the vat dyes commonly used by the local dyers in Kano metropolis are highly toxic and can cause potential damage to the organisms in the soil ecosystem.

Key words: Heavy Metals, Vat dyes, Lethal concentration Lc, toxicity,earthworms, contact test, absorption spectrophotometer.

Effect of Pesticide (Malathion) and a Factory Effluent on Plant Dry Weight and Number of Pods per Plant on Soybean (*Glycine max L.*)

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Agricultural chemicals are being extensively used by the farmers for obtaining high crop yields by controlling pests and diseases and eliminating weeds. But the Indian farmers do not realize that their indiscriminate use may have adverse effect on crop plants as well as other non target organisms. This investigation deals with the effect of one pesticide (Malathion) and Effluent of a Sugar Industry on plant dry weight and number of pods per plant on two varieties of Soybean (*Glycine max L.*) namely Bragg and Birsa-1. The normal concentration used during crop cultivation under field conditions was used as medium dose for Malathion. Effluent was diluted to 10%, 25% and 50% with distilled water and filtered after proper shaking. Seeds of two varieties of Soybean (*Glycine max L.*) namely Bragg and Birsa-1 were presoaked in distilled water. 100 seeds were then treated with three concentrations namely 0.10%, 0.20% and 0.40% for Malathion and 10%, 25% and 50% for Effluent for two hours and then sown in experimental field in two replications along with the control after thorough washing.

The plant dry weight showed marked reduction in all the treatment doses of both the varieties as compared to the control; being lowest in their high concentration. Dose dependent inverse relationship was observed in both the varieties in Malathion. However, no definite correlation was observed for Effluent. For observation on number of pods per plant in variety Bragg a decreasing trend with increase in concentration was observed for both Malathion and Effluent showing significant reduction in their medium and high concentration as compared to that of control. In variety Birsa-1, inverse relationship between treatment doses and number of pods per plant was observed in Malathion treatment whereas in Effluent all the treatment doses showed a very narrow range of variation.

Differential response to various treatments was observed in the two varieties of Soybean. Variety Birsa-1 seems to be more prone to adverse effect of these treatments than variety Bragg, which could be due to their different genetic makeup. It is therefore important to use pesticides very judiciously. The only available remedy, thus is to go in for bio-pesticides and organic farming.

Key words: Birsa1, Bio-pesticides, Bragg, Effluent, Malathion Treatment, Number of pods per plant, Plant Dry Weight, Soybean

Role and Challenges of Environmental NGOs in Protecting Environment

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The level of knowledge among the Indians is at a lower level than what used to be in the Harappan times. The codes like civic sense, environmental consciousness and righteous behavior nose dived long back and at present, our societies are sitting over kegs of garbages. Whatever plans that the governments formulate, and try to implement, are subverted by the people. It calls for a serious looking in.

Non-governmental organizations (NGOs) play an important role in growing awareness and execution of pre formulated plans in the society mainly by campaigns and education programs. Environmental NGOs are involved in environmental management, lobbying, advocacy, and/or conservation efforts. They are generally characterized by creativity, flexibility and innovativeness. The issues like future of environmental protection, sustainable development and zero population growth are some of the major concerns of the environmental NGOs. Many countries including India are facing the profound environmental, social, and economic impacts of rapid population growth, development, and natural resource constraints. Having a strong NGO network with a mandate to engage civil society, businesses, and the public sector can help these countries to tackle most of the issues in a smooth way. However, NGOs face many barriers in pursuing their missions, such as a lack of understanding about their role in civil society and public perception that the government alone is responsible for the well being of its citizens and residents. Environmental NGOs can play a crucial role in helping to fill gaps by conducting research to facilitate policy development, building institutional capacity, and facilitating independent dialogue with civil society to help people live more sustainable lifestyles. In the present script it is sought highlight the ways and means to sensitize the people about the global presence of NGOs and their role in protecting environment. Also intended is the discourse about the challenges faced by an NGO.

Key words: environment protection, crucial role, conservation efforts, NGO network, zero population

The Fear of Losing the Traditional Botanical Knowledge of Baiga Tribe of Nemna, Dist. - Sonbhadra, U. P.

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The village Nemna is situated in the southern part of district Sonbhadra of the UP, bordering MP state of India. Since an unknown past, it has been famous for its luxurious environment and forest products. Several tribal communities like Kol, Gond and Baigas dwell in the forest area and utilize a wide variety of plants for food, fodder, fuel, medicine, dye, gum, tannin and household and farm implements. Nowadays, NTPC Rihand and its associates have opened the doors for employment, all for good but as the young generation is seeing a shift in their income pattern, it is feared that the vast expanse of ecological knowledge the Baigas had mastered would be lost for ever. An ethnobotanical study was carried out with a view to properly document the human plant interaction which was till now propagated orally only from generation to generation.The first hand information on medicinal uses of plants by Baiga tribes senior medicine men viz. mode of preparation, administration, duration of the treatment etc. was collected using a questionnaire.The study revealed that the Baigas of Nemna are rich in ethnobotanical diversity. For treating Bilani, a disease of the eyes, they use *Mangifera indica*. Sihula, a skin disease istreated using the bark of Kurli. Sarphonk is effective against snakebite while Gainthi increases immunity. The bark of Koraya is used thrice a day to cure malaria.As a custodian of these and many more practices the traditional knowledge of the Baigas need to be conserved. Let us save them both- the Baigas and these plants.

In another similar work carried out by the author Bichna village of Khunti district of Jharkhand, only a month later of presenting the work in a Tirupati Conference, the prime ethnobotanist Mr James Kiro passed away this January. Had it not been done, the unique wisdom would have been lost for ever.

Key words: Bichna village, diseases, Nemna, traditional knowledge, tribals

Health Hazards of E-Wastes and Their Management

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E-wastes refer to discarded electronic or electrical devices. Certain components of these devices contain toxic substance like lead, mercury, cadmium, PCB etc which pose a threat to human health and environment. Discarded computers, televisions, fax machines, photocopiers, cell phones electrical lamps and batteries if improperly disposed can cause environmental hazards. Leads is found in monitor cathode ray tubes (CRTs), solder in printed circuit boards, lead-acid batteries..Lead damage nervous system, kidney and brain of young children. Cadmium is found in semi conductors, chip resistors and rechargeable batteries. It damage kidney and liver. Cadmium and its compounds are known human carcinogens. Mercury is found in LCD lights, thermostats, sensors, switches, relays, mobile phones and circuit boards. It cause damage to various organs including brains and kidney. Polychlorinated biphenyls (PCBs) on burning produce dioxin which cause reproductive and developmental problems. It also damage immune system and interfere with regulatory hormone. Beryllium is found in the motherboard of electronic goods which cause lung cancer. Thus proper management is necessary while disposing or recycling e-wastes. Dumping of e-wastes should be banned in landfill sites. There is need of a scientific e-wastes recycling to reduce pollution and landfill wastes in an eco- friendly manner.

Key words: E-wastes, Human health, Environmental hazard, Management

Termites Damage and Crop Loss Studies in Telangana, India

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India is basically an agricultural country with most variable climate conditions and different geographic features. A variety of cereals, oil seeds, pulses, vegetables and horticultural crops are being cultivated in the country. Maize, groundnut and cotton are three important crops cultivated in kharif/rabi and kharif respectively in Telangana region of Andhrapradesh, India.These are damaged by various species of termites in different zoogeographical regions (Harris 1969, wood et al1980). In Telangana, the termites belonging to the genus *Odontotermes* have been reported damaging the groundnut crop in the farm of ICRISAT (Patancheruvu) Andhrapradesh. Vikramreddy and Sammaiah (1988) have been reported *Odontotermes brunneus* damage to maize and groundnut.

The losses due to termites damage in some parts ofthe world have been estimated millions of rupees per year Fletcher (1912).The loss due to termites in India runs into several million of rupees per year (Roonwal1972), but very little attention has been paid to the study of crop loss studies and control of termites in India. In general damage is greater in rain fed than irrigated crops(Kushwan1972).In general the most important pest termites in Telangana region are fungus growing species *Odontotermes* (M.V.Reddy&Sammaiah 1988). In view of the extensive and serious damage caused to crops by termites, there is a need to assess the losses caused by termites to agricultural crops like maize, groundnut and cotton especially in Telangana region.

Key words: Termites, Environment, Odontotermes, climate condition

Microbial Fuel Cell (MFC): Sustainable Use of Leachate as Energy Source

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Landfill leachate is the collection of water drained from rain, precipitation and decomposing of organic matter. It contains wide range of organic and inorganic compounds, salts, chemical contaminants and heavy metals and is characterized by age, precipitation, seasonal weather variation, waste type and composition. In nature, leachate is degraded by different species of bacteria particularly obligate anaerobes to facultative aerobes and the degradation and energy production are directly proportional to the total organic carbon (TOC), pH, biological oxygen demand, chemical oxygen demand and heavy metals.The degradation of leachate by physico-chemicalmethods is expensive. Alternatively, MFC is a new approach in developing technology as a potential source not only to degrade and also generate electricity from organic matter available in leachate by using bacteria.

Kodungaiyur landfill is the second official municipal waste disposal site for Chennai and the daily waste disposal ranges between 2100 to 2300 metric tones. Leachate samplings from Kodungaiyur landfill were doneduring monsoon and post-monsoon seasons from 2014-2015 to investigate the potential of leachate in microbial energy production. Preliminary testslike pH, BOD, COD and heavy metal content of leachate were performed that resulted in pH of 8 - 11, COD of 1,760 mg/l, BOD of 380 mg/llevel. Heavy metal test was resulted in Manganese0.2 mg/land Copper 0.23 mg/l. However, Cadmium and Lead were found negligible. Electricity generation from landfill leachate was examined by using the dual chambermicrobial fuel cell (MFC) and maximumcurrent obtained was 0.5 Vatset voltage in the meter 20 V. This technology provides an economical route for electricity energy recovery in leachate treatment.

Key words: Landfill leachate, microbial fuel cell, energy

Diversity of Dominant Trees in Relation to Soil Nutrients in the Model Plantation Site at Kalinganagar, Odisha

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The Shannon-Weiner species Diversity was computed on the basis of quadrate study in the Khurunti Model Plantation Site of TATA Steel Kalinganagar Project at Duburi (Jajpur district), Odisha. The pH of the soil is extremely low in this region which has posed an adverse impact on the diversity index value of the Model Plantation Site. The ambient soil quality was also analyzed in the selected site and the major macro- and micro-nutrients were observed to be extremely low. Long term use of chemical fertilizers will further make the soil acidic, which is already acidic in nature. As a part of management action plan, use of diluted lime water and organic fertilizer is recommended.

Key words: Model Plantation Site, Kalinganagar, Shannon-Weiner species diversity index, soil quality, macro- and micro- nutrients, management plan

Green Zinc Sulphate Nanoparticles of Anacardium Occidentale Leaf Modulates Ehrlich's Ascites Carcinoma Cell Proliferation

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Cancer is the one of the deadly diseases and it is the single most common cause of deaths in both developed and developing countries. Nano oncology, an emerging interdisciplinary research field, is expected to fulfill its entire aim in detecting, targeting and treating cancer cells. *Anacardium occidentale of* Anacardiaceae family, a common medicinal plant possesses antiseptic, antidysenteric, antibacterial, antiulcerative, antidiabetic, cough suppressant, decongestant, diuretic, and astringent properties. With *Anacardium occidentale* as the plant of interest and zinc sulphate nanoparticles as the drug carrier, green zinc sulphate nanoparticles of Anacardium occidentale leaf were synthesized.

The present study aimed to investigate the efficacy of green zinc nanoparticles (ZnNPAOs) from water extract of Anacardium occidentale leaf (WEAOL) as an antineoplastic agent against Ehrlich Ascites Carcinoma in comparison to WEAOL.

The ZnNPAOs were characterized and study of cytotoxicity, cell viability, cell morphology, chromatin condensation, DNA fragmentation, nitric oxide (NO) generation and release level were done. ZnNPAOs and WEAOL were administered intraperitoneally at the dose level of 75- and 150 mg/kg body weight/day respectively for consecutive 15 days after 24 hour of EAC cell inoculation (1×10^6 cell) to mice using 5-fluorouracil as standard drug.

The study revealed that ZnNPAOs possess antiproliferative and apoptotic effects on EAC cell line at IC_{50} of 10 $\mu g\,mL^{-1}$ compared to WEAOL (25 $\mu g\,mL^{-1}$). Decrease in tumor volume, and body weight of the EAC-bearing mice, decrease in the levels of hepatic lipid peroxidation (MDA), oxidized glutathione (GSSG) and increase in the levels of reduced glutathione (GSH), and catalase (CAT) activity were observed in ZnNPAOs and WEAOL-treated mice compared to EAC-control mice.

From the present study, it is concluded that both of ZnNPAOs and WEAOL possess *in vitro* cytotoxic, apoptotic, in vivo antineoplastic, antioxidant activities against EAC cells but the efficacy of ZnNPAOs is more than WEAOL.

Key words: ZnNPAOs; WEAOL; Ehrlich Ascites Carcinoma; Antineoplastic; apoptotic effects

Rice Seed Bed is the Primary Source of Green House Gas Emission – A Study

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Rice paddy of Indian agricultural system is considered to be the major contributor of green house gases in the atmosphere. Emission of GHGs from rice fields is highly sensitive to rice management practices, and thereby rice cropping system has become an important concern in this context. In our present study we aimed to quantify methane and nitrous oxide flux rates from rice seedbed under different moisture condition. The field experiment was consisted of two types of seedbed i.e., raised bed (non-flooded condition) and low bed (flooded condition). Rice variety Satabdi were sown on four dates at 7 days intervals during two successive kharif seasons of 2013 and 2014. The research work was conducted at agricultural farm, Bidhan Chandra Krishi Viswavidyalaya under new alluvial agroclimatic zone of West Bengal. The gaseous emissions were determined during germination to 3rd leaf stage of rice seedlings in the seedbeds by static chamber based Gas Chromaograph technique. The measurement of green house gas emission rates were done at 9 Am and 11 AM. Simultaneously soil temperature was recorded daily at 5, 15 and 25 cm of soil depth. The result implies that each individual factor namely year, date of seeding, time of gaseous sampling for GHG quantification and moisture condition affect significantly methane emission rates. In contrast with that nitrous oxide emission was also significantly influenced by these factors except date of seeding. Maximum methane emission (6.61 g m^{-2} day) occurred for the rice seedlings at 1st leaf stage grown under 4th seeding date at raised bed during morning (at 11 AM). Maximum nitrous oxide flux (0.365 g m^{-2} day) obtained during morning (at 9 AM) at 3rd leaf stage from raised bed where rice seeds were sown on 3rd seeding date. Low beds were responsible for comparatively lower green house gas emission rates than raised beds. Both the greenhouse gases fluxes from rice seedbeds were also influenced by soil temperature at different soil depths. Thus we can conclude that green house gases mainly methane and nitrous oxide not only emitted from puddle rice field but also emitted in different flux density from rice seedbeds under different moisture condition.

Key words: Green house gas, moisture condition, rice, seedbed, soil temperature

Biodiversity Conservation through Biotechnological Approaches

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Biodiversity is essential for the continued existence of humanity Biodiversity provides man with the raw materials for food, shelter, energy and medicine, as well as many aesthetic pleasures, besides numerous ecological services, they protect watersheds, combat soil erosion, control soil quality and mitigate the effects of man pollutions, Biodiversity has emerged as a scientific discipline in the recent past basically response to fast basically response to fast extinction of wild species due to human activity as well as the recognition that without biodiversity there is no survival of humans. India is one of the twelve mega-biodiversity countries of the world.

People have added carbon dioxide, nitrous oxides, methane and other greenhouse gases to the atmosphere by extracting and burning fossil fuels such as coal, oil and natural gas. The effect of these gases has been to trap heat and accelerate the rate of global warming and climate change. Climate change is a major threat to the world's biodiversity. The earth is warming up and there is now overwhelming scientist consensus that it really happening and is human- induced with global warming on the increase and species and their habitats on the decrease chances may be one of the greatest threats facing the planet. Recent years show increasing temperature in various regions and or increasing extremities in weather patterns the impacts of the global climate changes are already visible as increasingly frequent crop failures increased human suffering through severe storm damage and increase throughout the coming century unless action is taken now to slow the rate of global climate change. The main causes climate changes, Habitat loss, pollution, population growth, over haunting, commercial haunting and solid waste.

Conservation of Biodiversity: There is an urgent need for the conservation of biodiversity Ecotourism can help in biodiversity conversation by developing local institutions and empowerment of people increased livelihood options, reducing man and animal conflict, providing funds for forest conversation. Creating awareness among rural people, urban cites and policy maker to work for the biodiversity conservation. Biotechnology places vital role in conversation of biodiversity. Approaches have been made by biotechnologists towards conversations of plants *insitu and exsitu* methods, micro propagation embryogenesis and transformation. Breed of Endangered species in a coordinated venture by biotechnologists Worldwide by implementing techniques like cryopreservation of semen artificial insemination, in vitro fertilization and embryo transplantation.

Key words: Biodiversity, climate change, global warming, Conservation *in situ, ex situ.*

Performance Analysis of a Ceramic MF Membrane for Removal Efficiencies

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The pre-requisite for operation of a Reverse Osmosis (RO) plant requires feed pre-treatment for removal of suspended solids, bacteria, colloidal particles; etcwhich would otherwise lead to fouling of RO membrane. In recent years, the performance of polymeric membranes for pre-treatment has improved significantly. Also, increasing demand for better performance has led to the use of alternatives like ceramic membranes. Ceramic membranes are highly stable both physically and chemically and also enable cleaning with harsh chemicals (if necessary) thus, the membrane performance stability can be assured, which is critical in dealing with waste streams that often vary constantly.

This study focuses on the removal of parameters like Turbidity, C.O.D, and TSS from wastewater using a Ceramic Micro Filtration membrane. The pore size of the membrane is .2-.3 micron. Ceramic MF here is directly used for removing various parameters. The setup consists of an inlet which allows the water to be passed through a membrane with the help of a pump, there are pressure gauges to measure the pressure across the membrane (i.e at both inlet and outlet) the throttle valve allows the pressure to be regulated bypassing some amount of feed. The permeate from the membrane can be collected and used, the reject is allowed to pass and again used as concentrate.

The feed for turbidity removal was synthetic water using bentonite clay for imparting turbidity and then later checked for domestic wastewater. Highly turbid wastewaterwas removed using PAC as coagulant where dosage was determined using jar test and then later passed through the membranes where in both cases Removal efficiency of more than 99% were achieved.

COD and TSS removal were directly checked using wastewater, which was an outlet from the tube settler of an existing STP. The removal efficiency for COD was about 95% whereas about 90% of TSS removal was noted. A notable amount of work is being done for analyzing reactive silica removal using ceramic MF membrane.

Key words: Reverse Osmosis, Polymeric membrane, Ceramic microfiltration membrane, Permeate

Temporal Variation of Dissolved Heavy Metals in and Around the Fish Landing Stations in Lower Gangetic Delta

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Diamond Harbour and Namkhana are the two major fish landing stations in lower Gangetic delta region where marine and estuarine fishes are landed on regular basis. These landing centers house huge number of fishing vessels and trawlers, which use anti-fouling paints for their conditioning. In the absence of any treatment of these effluents, the anti-fouling paints are directly discharged into the estuarine water, whose main ingredients are zinc, copper and lead. The present paper is an attempt to scan the level of these heavy metals in these two major fish landing stations over a period of more than two decades. The increasing trend of dissolved zinc, copper and lead in the aquatic phase of these landing stations offers a warning signal to the overall health of the ecosystem. Some selective agents of bio-remediation (preferably endemic macrophytes) can be used to minimize the level of dissolved heavy metals and restore the alarming condition of the estuarine health.

Impact of Climate Change on the Industrial Development of Jharkhand

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Climate change is one of the most serious and growing cause of concern among the academicians, the environmentalists and the respective ministries around the world at large. Economic development, globalization and industrialization have made climate change a threatening reality, endangering the very existence of the planet and the humanity. Climate change is basically the result of accumulation of Green House Gases (GHG) in the atmosphere which in turn is due to fossil fuel use, incessant fumes from industries, deforestation and urbanization etc. It is primarily due to global warming which refers to increase in CO_2 concentration in the atmosphere which is responsible for the observed increase in the average temperature of the air near earth's surface and oceans especially in the past two decades. The activities committed by human beings are changing the composition as well as behavior of environment in an undesired way. These activities release pollutants in the atmosphere as by products. Due to excessive deforestation, combustion of coal and fuel, the amount of CO_2 is increasing day by day. In addition to CO_2, the other green house effect producing gases are CH_4, N_2O, CFCsetc. All these gases act like a blanket which retains heat in itself. This heating up of environment due to trapping of infrared radiations from the sun by an increase in carbon dioxide in atmosphere is called green house effect. The effect of climate change is more pronounced when it comes to Jharkhand as its capacity and resources are limited. Jharkhand being rich in mineral deposits like iron and coal, mining and industries form the backbone of its economy. Someof the giant industries of India like Tata Steel, Tata Motors, Heavy Engineering Corporation, Steel Authority of India Limited, etc are located herein. Jharkhand is in precarious situation due to its high climate sensitivity and vulnerability, combined with low adaptive capacity due to these industrial activities being on an incessant rise.The state is already suffering due to its high dependence on mineral resources. Further the forest and water resources in the State are facing threat due to industrial and urban growth.Water resources, forests, agricultural produce, industrial output and human health will be severely impacted due to a shift in precipitation i.e. erratic rainfall patterns and change in average minimum and maximum temperatures.

Climate change is bound to negatively affect the performance of industrial processes and power generation in the state. The hydro power plants will suffer as availability of water will decrease as their output will reduce, while the thermal power plants will require larger amount of coolants to maintain production output

levels as temperature rise reduces performance of machines operating on the principles of heat exchange. Similarly, industrial demand for water and power will rise to maintain their productivity levels. Since the demand for these critical services (water and power) will go up across the various sectors, the direct procurement cost of such services will rise, reducing the financial self sufficiency of the industries.

The objective of this research paper is to identify the climate change risks to industrial sector in the state and to promote the sustainable growth in Jharkhandby suggesting measures and mitigation strategies and facilitating optimal utilization of state's minerals and natural resources.The climate change adaptation measures for industries cannot be independent of the mitigation measures as 'energy' is one of the most critical inputs to the industrial processes and the biggest direct impact of climate change on industries will be on the availability and economics of energy.In order to survive and remain competitive in changed weather scenario,the industries need to focus primarily on energy and natural resource management by promotion of energy efficiency by gradually replacing the old technologies and processes by more efficient ones. Industries should also invest in renewable and green energy sources and should integrate climate change adaptation strategies into its policies and procedures for better industrial growth and sustainable development of the state of Jharkhand.

Key words: Green House Effect, Sustainable Development, Energy Efficiency, Natural Resource Management, Climate Change Mitigation Strategies

Acephate induced Acetylcholine Esterase Inhibition and Subsequent Morphological Alterations in Adult Compound Eye of *Drosophila melanogaster*

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Acephate, an organophosphate pesticide is widely applied in agricultural fields against chewing and sucking type of insects like thrips, lepidopteran larvae, saw flies etc. But non-target organisms also suffer exposure to such pesticide through consumption of contaminated fruits and vegetables. This might cause undesired effects on development and physiology of non-target organisms including human. With this point of view, the present study was undertaken to comprehend the impact of Acephate if any, on Acetylcholine esterase (AChE) activity as well as on ommatidial arrangement of compound eye of a non-target insect *Drosophila melanogaster.*

The present study monitored Acephate induced variation in Acetyl cholinesterase (AChE) activity of *D. melanogaster*. Further, any dose responsiveness in the AChE enzyme activity was evaluated following Ellman *et.* al., 1961. 1st instar larvae were fed with different concentrations (0.5, 1, 1.5, 2, and 2.5 µg/ml) of Acephate up to 3rd larval instar. Around 50 3rd instar larvae per treatment were collected and homogenized in HEPES (Hydroxy Ethyl Piperazine Ethane Sulfonic acid) buffer. Homogenates thus prepared were centrifuged at 10,000 g for 15 mins at 4˚C. The obtained post-mitochondrial supernatant from each category was collected and used for the enzyme assay and analyzed for AChE activity.

Some of the similarly treated larvae (Exposed to variable concentrations of Acephate) were grown into adults to investigate variations in the morphology of their compound eyes under Scanning Electron Microscopy (SEM).Control sets were maintained simultaneously for comparison. All experiments were done in triplicate sets.

Control groups showed mean AChE activity of 13.6±0.20 nmol/min/mg which was found to decrease as 11.53±0.17 and 6.67±0.33 nmol/min/mg of enzyme activity for 0.5 and 1.0 µg/ml treatment concentrations. With further increase in treatment concentrations, AChE activity was found to increase in a dose dependent manner and reached near normal level (12.66±0.44 nmol/min/mg) at 2.5 µg/ml concentration.

Key words: Acephate, Acetylcholine esterase, Compound eye, *Drosophila melanogaster*, Ommatidium, Pesticide

Environmental Pollution and Micro algal Technology

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With the beginning of industrial revolution, the compositions of atmosphere have been changing as well as the climate also gradually changing. There is rapid economic development all over the world in last 50 years .The rapid industrialization increases energy consumption. The air quality also declined significantly during the process of industrialization. The global energy requirement is increasing day by day and it also creates high prices of increased usage fuel. Actually the demand of energy in a country depends upon its populations.

Key words: Environmental pollution, algae, micro algal technology, sequestration

Unravelling the Cryptic Soil Fungal Communities from Endosulfan Contaminated Sites of Kollam District of Kerala, India

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In agricultural field, the microorganisms present in soil are exposed to different kinds of pesticides including persistent organic pollutants (POPs) viz., aldrin, chlordane, DDT, dieldrin, endosulfan, endrin, heptachlor, hexachlorobenzene (HCB), mirex and toxaphene in different concentrations. Since many pesticides are not target specific, they not only affect the target pests but also unintentionally have significant influence on the metabolism of beneficial and or unbeneficial microbial communities. Most of the organisms are eliminated from the ecological niche under toxic effect at higher concentrations of pesticides. However, few of them evolve at lower concentrations in different ways and utilize pesticide compounds either as supplementary carbon source or sole carbon source. The microbes that able to withstand and thrive in pesticide contaminated soil have the potential to degrade pesticides and are reliable sources of phytoremediation. However, several physico-chemical and biological parameters strongly influence the degradation of pesticides. Different species of bacterial and fungal communities may exhibit different degrees of degradation by various metabolic pathways. Besides bacteria, fungi are the second largest component in tropical ecosystem and play a vital role in biogeochemical cycle including carbon cycle. Exploitation of fungi to mineralize the pollutants has several advantages like the mycelial growth habit permeates large volumes of soil and allows the fungus to colonize the substrates rapidly in ways that other organisms cannot do. In addition, the rapid proliferation of the fungus can maximize physical, mechanical and enzymatic contact with the surrounding environment. Although the production and application of pesticides were banned in India in 1985 excluding DDT is being used to eradicate malaria and visceral leishmaniasis and, HCH for vectors that developed resistance to DDT and for restricted crops. All the POPs have been continually reported as their existence in the environment. Endosulfan is one of the most acutely toxic compounds that are stable in the environment and have been continually detected either as parent compound or transformed products in air, water, soil, agricultural crops, vegetables and fruits, honey, milk and milk products, and food commodities due to their persistent nature. The white rot fungi particularly *Phanerochaete chrysosporium*, *Trametes versicolor* and *Pleurotus* spp. and mitosporic ascomycetes have been extensively studied for their role in degradation of wide variety of xenobiotic compounds including endosulfan by transferring electrons to the compounds to be degraded. However, the soil basidiomycetes those do not produce ephemeral basidiomes are cryptic species that to be uncovered and investigated for their degradation of organic pollutants in the contaminated sites. Therefore, it is aimed to investigate the distribution of fungi particularly endosulfan degrading fungi including soil basidiomycetes inhabited in endosulfan contaminated soil. A total of 30 soil samples from endosulfan contaminated sites were collected from different regions of Kollam district of Kerala during the post monsoon in 2014. The diversity and distribution of soil fungi will be statistically analyzed and discussed in detail. The diversity of fungi occurring in endosulfan contaminated soil will provide new insight into the role of fungi in their ecological niche.

Key words: pesticides, soil fungi, endosulfan, Kollam

Diversity of Entomobryomorpha (Class: Collembola) of Kathara Coalfield Area of Jharkhand

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Collembolans are small wingless apterygote hexapods, found in the soil, aparta few exceptions. Their role in soil fertility has been ascertained and has been identified as an important link in the food chain of the soil ecosystem that buffers between above ground and below ground microorganisms. Collembolans have been of interest to Zoologist in general but soil entomologist in particular andhave generated moreinformation on its bionomics. Most of the scientific studies in India have been from down South whereas the Zoological Survey of India has focused itself to West Bengal, Tripura and Meghalaya rest of the country's collembolan diversity hasbeen not properly reported and recorded as they are yet to explore. Jharkhand rich in biodiversity, but there has been no serious study on the diversity of the collombolabearing a fewreports. Present author while working on soil meso- arthropods of coalfield area got the collembola as by product of Berlese-Tullgren funnel, which is being reported here. The study was carried out in the over burden dumps (OBD) of different chronosequence of the Kathara coal field area of Jharkhand through year 2007-2010.

The objective of the study was to measure the diversity of the Collembolaand consolidate therecords of the collembola of Jharkhand. For sampling four OBDs were selected, which were of different agesviz; 5, 15, 30 and 50 years respectively. Collembolans were collected by standardized 10m X 10m quadrate divided into unit cells of 1m X 1m quadrate. The soil samples were collected from randomized unit cells so as to get the representation of micro habitat of the OBD and theses samples were subjected to Berlese-Tullgren funnel for behavioral movement of the micro and mesoarthropods including Collembolaof the soil. The collected trash was segregated and slides were prepared for taxonomic grouping of the soil arthropods. Segregated collembolans were identified while following the keys of Bellinger*et al.* (2014).

All together 878 collembola were collected from the four OBDs during the study period and were taxonomically placed to the order Entomobryomropha. These collembolans were further divided to three families viz., Entomobryidae (55%), Isotomidae (44%) and Tomoceridae (1%). In the family Entomobryidaehad seven species while Isotomidae was represented by six species and Tomoceridaeby only one species. The alpha diversity was calculated and the Shannon diversity index of site I was found to be 0.753, site II is 1.3819, site III is 1.5930 and site IV is 1.7542. Out of the results we were able to reach to the conclusion that the OBDs of the coal mine area gradually establishing and there is role of collembolan diversity. Further it was also observed that the site I has lowest and site IV has higher diversity index as site IV is more established OBD.

Key words: Diversity, Collembola, Entomobryomorpha, coalfield, over burden dumps (OBD)

Oscillation of Phytopigment in the Major Estuaries of Indian Sundarbans

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Two major estuaries with contrasting geographical set up and salinity profile in Indian Sundarbans are Hoogly and Matla. Chl*a,* an indicator of estuarine aquatic productivity was monitored in this two estuaries since more than two decade (1984 to 2014). The results exihibit an alarming condition in the Matla estuarine water, where as in the Hoogly estuary the condition is not significantly drastic.

The hyper saline condition of Matla estuary may be the possible reason for the elimination of Phytoplankton species that prefer low saline water.

Eco restoration of the Matla estuary is extremely important as primary productivity is the foundation of fish diversity in the estuarine water through which local economy of the people is maintained.

Key words: Chl *a*, Salinity, Phytoplankton, Productivity

Efficacy of Some Bangladeshi Botanical Extracts for Controlling of Pests in Brinjal Field

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Bangladesh is rich in floral biodiversity. It supports approximately 5000 species of angiosperms. The efficacy of nine Bangladeshi botanical extracts was tested for controlling of pests in experimental brinjal field of Rajshahi University. Accordingly, water extracts of dried leaves of *Nicotiana tabacum*, *Aegle marmelos*, *Allium sativum*, *Ficus hispida*, *Lawsonia inermis*, *Vitex negundo* and seeds of *Carum roxburghiana*, *Corchorus capsularis* and *Swietenia macrophylla* were prepared and sprayed on experimental brinjal plot. Out of these nine botanicals, *Nicotiana tabacum* leaves extract showed best performance against the selected pest attack compare to other extracts. Extract from the leaves of *Ficus hispida* also showed good activity in the protection of brinjal plant from pest. The efficacy of *Aegle marmelos* and *Ficus hispidia* leaf extracts was found same in brinjal plot against the pest attack. However, *Carum roxburghiana* extract showed lowest efficacy, hampered the normal plant growth of brinjal and reduced the yield of brinjal fruits compare to other botanicals.

Key words: Botanicals, biodiversity, extract, activity, pest

Status of Physico-Chemical Parameters of Brackish Water Hilsa Culture Ponds in West Bengal

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Water quality is one of the most important factors which determine the successful culture of any fishes in culture pond.. This paper aims to investigate the physico-chemical parameters in culture ponds of Hilsaat Kakdwip research centre of CIBA in Kakdwip, West Bengal. Three brackishwaterponds (0.1 to 0.15 ha) were selected for rearing of hilsaand,a riverine seed collection site of hilsa, Muriganga River was also selected as natural site for the study.Water samples were collected for a period of six months from July, 2014 to December, 2014. HACH standard meter was used to measure temperature, dissolved oxygen (DO), salinity and pH of water sample at the collection site. The standard method of APHA (1995) was followed for the analysis of physico-chemical parameters. All the physico chemical parameters such as pH, alkalinity, Salinity, dissolved oxygen, nitrate, nitrite, phosphate, total hardness and ammonia were investigated every ten days interval. During the study period, temperature of aquaculture pond ranged from 26.35°C to 32.05°C whereas temperatureof river water ranged from 26.60°C to 30.85°C. The pH of aquaculture ponds was not much variable and it was recorded in between 7.51 to 9.30. The salinity of Muriganga River ranges from 4.48ppt to 12.48ppt. Salinity of aquaculture pond was ranged between 3.83mg/L to 7.27mg/L. The level (mg/L) of Nitrite-N (0.011±0.005), nitrate-N (0.123±0.049), total ammonia-N (0.107±0.042), phosphate-P (0.187±0.059)of culture ponds and river showed monthly variation during the study periodbut within acceptable limit for aquaculture. The DO value of river water ranged between 7.00mg/L to 10.93mg/L whereas DO of aquaculture pond ranged from 6.49mg/l to 9.95mg/l. The present investigation revealed that physico-chemical parameters of aquaculture ponds were comparable with those of natural habitat.

Key words: Physico-chemical parameter, Hilsa, Water quality, Salinity, Temperature.

Comparative Study on Nutrient Composition of Hilsa Collected from Hooghly and Padma River

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The Indian shad, *Tenualosa ilisha,* popularly known as hilsa is one of the most important and tropical fish in Indo-Pacific region. In West Bengal hilsa occupy top position among edible fishes due to its unique taste and flavor. Among the hilsa fishes available in West Bengal, people prefer Padma hilsa over Hooghly hilsa. Preliminary study conducted by us using nine Point Hedonic scale (Jones *et al.*, 1955) also revealed aroma, taste and muscle texture of Padma hilsa were significantly ($P<0.05$) superior to Hooghly hilsa. The aim of the present study was to investigate the reason behind the differential taste and flavor of hilsa available in different ecosystem namely Hooghly and Padma river in West Bengal. The study compared the proximate principles, mineral composition, amino acid profile, fatty acid profile of hilsa (>800g) collected from Hooghly and Padma river. The study revealed that moisture, crude protein, ether extract were significantly higher ($P<0.01$) in Hooghly hilsa but carbohydrate content were significantly higher ($P<0.01$) in padma hilsa. No significant difference was found in total mineral content. Among minerals Ca, P and Mg content were significantly ($P<0.05$) higher in Hooghly hilsa compared with Padma hilsa. Trace element *viz,.* Mn, Zn and Cr content were significantly ($P<0.01$) higher in Hooghly hilsa compared to Padma hilsa where as Fe content was significantly ($P<0.01$) higher in Padma hilsa. The fatty acid analysis profile revealed that total saturated fatty acid content was significantly higher ($P<0.01$) in Hooghly hilsa compared to Padma hilsa. Total Mono-unsaturated fatty acid was significantly higher ($P<0.01$) in Padma hilsa as compared to Hooghly hilsa. Among mono-unsaturated fatty acid palmitoleic acid and oleic acid were significantly higher ($P<0.01$) in padma hilsa. But no significant difference in poly unsaturated fatty acid content was observed between Hooghly and Padma hilsa. In amino acid analysis study total essential amino acid was significantly higher ($P<0.05$) in Hooghly hilsa as compared to that of Padma hilsa. Total non essential amino acid content was significantly ($P<0.01$) higher in Padma hilsa. Among essential amino acids, leucine and Isoleucine content were higher ($P<0.01$) in Hooghly hilsa as compared to those of Padma hilsa. Among nonessential amino acids, aspartic acid, glutamic acid and alanine were significantly ($P<0.01$) higher in Padma hilsa. The study reveals that significantly higher level of taste enhancing fatty acids like oleic acid and amino acids like alanine, glutamic acid in padma hilsa compared to Hooghly hilsa might be attributed to better taste and flavour of the padma hilsa.

Key words: *Tenualosa ilisha,* Hooghly River, Padma River, proximate, mineral composition, amino-acid, fatty -acid.

Analysis of Antibiotics in Wastewater Treatment Plant in Perungudi, Chennai

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Pharmaceuticals particularly antibiotics are prominent in preventing and curing diseases thus playing incredible role in the medical field. On the other side, there emerged an alarming global consideration for the disposable of these antibiotics which if not done meticulously will pose a serious threat to the living beings in the form of antibacterial resistance. There are several possible sources and routes for antibiotics to reach the environment, but wastewater treatment plants have been identified as the main point of their collection and subsequent release into the environment, via both effluent wastewater and sludge. When these antibiotics reach the environment through various modes, through bioaccumulation and bio magnification finally affects the human beings. The study shows the occurrence analysis and quantification of antibiotics from the Sewage Treatment Plant in Perungudi, Chennai. Sampling is undergone in both inlet and outlet and the Solid Phase Extraction (SPE) is employed to concentrate the sample. The antibiotics present in the sample are analyzed and quantified using suitable Liquid Chromatography- Mass Spectrometry (LC-MS) method. The antibiotics which are quantified using LC-MS are above detectable limits showing conventional treatment processes lack the capacity to remove the antibiotic concentrations.

Key words: Pharmaceuticals, antibiotics, waste water treatment plants, environment, Perungudi

Molecular Methods for Monitoring Environmental Contaminants and Bioremediation: A Review

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Biodegradation is the most important parameter influencing the toxicity, persistence and ultimate fate of pollutants in soils as a principle abatement process in the environment. Among various biological, physical and chemical methods developed for decontamination of polluted sites, bioremediation methods utilizing microorganisms provide a cost-effective and contaminant/substrate specific treatment technology. A successful bioremediation approachrequires sufficient proof for the degradation of the contaminants and detoxification of the contaminated soil or water. Current environmental regulations require appropriate monitoring practices determining of the disappearance of the contaminants and their degradation products to a regulatory levels. Studies during the last decade have indicated that the microbial community response may be a better indicator of residual toxicity and can be used to complement the disappearance or sequestration of contaminants.Differential morphological, physiological and metabolic characters are the basis of traditional culture-dependent methods. This includes isolation and cultivation on solid media, most probably number (MPN) assays and BIOLOG substrate utilization patterns. Culture- independent methods for community analysis are based on direct examination of metabolically active microorganisms using differential strains, denaturing gradient gel electrophoresis (DGGE), fluorescence in situ hybridization (FISH) and phospholipids fatty acid analysis (PFLA). Advances in molecular biology have extended our knowledge of the complex metabolic process involving microbial transformation of contaminants. Recent advances in molecular methods and genetic finger printing such as polymerase chain reaction (PCR) _DDGE, thermal GGE, terminal restriction fragment length polymorphism (T-RFLP), amplified ribosomal DNA restriction analysis (ARDRA) and BIOLOG have enhanced our ability to investigate the dynamics of microbial communities in a contaminated ecosystem. Bacterial biosensors with potential to continuous online monitoring of pollutant concentrations in environmental applications offer the possibility to identify and quantify and characterize the biodegradability of target pollutant. Recent advanced molecular techniques applied in monitoring environmental contaminant and bioremediation were reviewed in this paper.

Key words: biodegradation, bioremediation, contaminants, detoxification, microbes' pollutants, soil and water

Assessment of Particulate Matter Emissions from the Heterogeneous Traffic around Road Network

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This paper presents to assess average particulate matter (PM) concentrations measured near the roadside at Jharia coalfield area District Dhanbad, Jharkhand, India in post–monsoon season (October 2014). In this study, the concentration of ambient PM levels for PM10, PM2.5 and PM1 were investigated for eight selected sampling locations. The PM data analysis showed at road side is higher than standards. The frequency distribution of PM concentrations in post-monsoon season indicated that the PM values at the study site fall under good to moderate or poor categories.

Key words: Particulate matter, Optical particle counter, Particle number concentration, Heterogeneous traffic, Emission

Occurrence of Allergic Dermatitis in Relation with *Parthenium hysterophorus* L in Rajshahi City, Bangladesh

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Parthenium hysterophorus L is a type of weed, having so many adverse effectson the environment. It causes allergic dermatitis along with other allergic manifestations to human health. It invaded Rajshahi city several years back and now it was grown abundantly in many areas of the city. This study was designed to find out the relation of the occurrence of allergic dermatitis in human population who are exposed to*Parthenium hysterophorus* in the community.

Key words: *Parthenium hysterophorus L,* allergic dermatitis, human health, Rajshahi

Wetlands in North Bihar Could Provide a Basis to Food and Energy Security in the Region

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North Bihar is replete with a vast number of lentic and lotic water bodies that provide a characteristic to the region as a land of Pokhari (ponds/tanks), Maachh (fish) and Makhan (gorgon nut). The region is known for a diverse group of fishes, aquatic rice varieties and water lilies. Fish eating is linked with a high level of intelligence in the associated human populace.

Government today is laying much stress on poverty alleviation through ensuring food security. It is true that hunger has been conquered but much more remains to be done on the front of the "hidden hunger" and that could be achieved through proper utilization of aquatic biota including the water plants and animals that are a good source of micronutrients. The state of Bihar is all set to make blue revolution a success within a period of next five years. The state has also emerged as an epicenter of second green revolution under which organic farming is being promoted in a significant manner. Impetus is being given to grow *Sesbania* spp. as a natural bio-fertilizer as the same could help minimize the use of inorganic agrochemicals and as such thwart the menace of diseases like cancer that is afflicting the farmers in Punjab & Haryana today.
SRI system of paddy cultivation is paying its dividend in the state by setting records of production. A number of aquatic plant species are used for meeting the rural energy requirements as well as for stabilization of soil in flood prone areas. These plants also hold the potential of containing the life style disease like diabetes and cardiovascular ailments. Mass cultivation of these plants could help their incorporation as nutritive items in the primary health care system of the country.

The paper takes into account some facets of food and energy security for which wetlands in north Bihar provide a sound basis.

Key words: Wetlands, North Bihar, food security, aquatic plants

Bioethanol Production by Fermentation of Whey Lactose Permeate Using Various Microorganisms: A Review

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The current world demand for bioethanol is increasing daily, as a consequence of reduced availability of fossil fuels, and increased efforts towards developing eco-friendly and more environmentally green sources of energy. Therefore, an alternative energy source such as ethanol, as fuel, has been considered for future, given it produces lesser pollutants than fossil fuels, thereby reducing air pollution and climatic changes caused by increased levels of carbon dioxide and other GHG emissions. Ethanol production from fermentation of industrial wastes is lucrative because of their easy availability, abundance and lower cost. Whey is one such source. Whey is the liquid remnant, following the precipitation and removal of milk casein during cheese making; and is a major by-product of dairy and cheese industries. The major constituent of whey is lactose (4.5-5 % w/v), which contributes to its high BOD (30,000-50,000ppm) and COD (60,000-80,000 ppm) content. Thus it poses a major environmental concern as a waste product, with an estimated production of 145 × 10^6 tons of whey per year, corresponding to 6 × 10^6 tons of lactose. Moreover costs incurred in effluent treatment processes also increase, with added complexity of process. Thus conversion of whey lactose to bioethanol is a viable option for bioremediation. Lactose permeate obtained from whey is fermented upon by different microorganisms, to produce ethanol. While *Saccharomyces cerevisiae* is the common organism used in ethanol fermentation, it cannot readily utilise lactose, which must be hydrolysed to glucose and galactose before it can ferment them into ethanol. This is because *Saccharomyces cerevisiae* lacks the *lac* operon gene, responsible for hydrolysis and uptake of lactose. Thus for *S.cerevisiae* to utilise lactose permeate as a substrate, it must first be hydrolyzed. This is done by the enzyme β-galactosidase coded by the LAC4 gene, which breaks down lactose to monomeric sugars- glucose and galactose, which are then utilised by *S. cerevisiae* to produce ethanol. Other species of yeast, namely *Candida* and *Kluyveromyces* readily utilise lactose to produce ethanol, due to the presence of the necessary genes responsible for lactose hydrolysis and its subsequent uptake and fermentation to ethanol; thus being effective organisms for whey fermentation. The genes responsible for lactose utilisation have also been extracted from strains of yeasts *Candida* and *Kluyveromyces*, to genetically modify *S. cerevisiae*, thus eliminating the need for prior hydrolysis of lactose. Strategies such as protoplast fusion (with *Kluyveromyces fragilis*), expression of β- galactosidase, which is then secreted to an extracellular medium, or simultaneous expression of *K. lactis* genes encoding for permease and β- galactosidase (LAC12 and LAC4 respectively), has been employed to engineer strains of *S. cerevisiae*, that are capable of using lactose directly, as their substrate. Amongst the various strains of *Kluyveromyces, K.lactis* has been studied widely and serves as the model organism in

many studies, though due to its metabolic diversity, *K. marxianus* has gained significant attention and has been studied for its immense potential for biotechnological applications, and is widely used in recent studies. *Candida pseudotropicalis* has also been found by various studies, to be an organism of choice for fermentation of whey into ethanol.However, all the yeasts studied, have individual characteristics which pose certain advantages as well as some inherent limitations. Though, for all the organisms capable of fermenting whey to ethanol, there is scope for further enhancement of yield, despite of existing limitations, by devising new techniques or engineering of more potent strains. The aim of this review is to discuss about whey permeate as a substrate and document the corresponding microorganisms proven to produce high yields of ethanol, and the associated techniques employed in each case.

Key words: Whey, bioethanol, *Saccharomyces cerevisiae, Kluyveromyces sp.,Candida sp.,* lactose fermentation

Management of Pharmaceutical and Personal Care Products in the Aquatic Environment Using Constructed Wetlands

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Pharmaceutical and personal care products (PPCPs) constitute a diverse group of unregulated contaminants widely found in the aquatic environment that deserve special interest due to their potency to bioaccumulate, endocrine disrupting efficiency and other health effects. One of the major sources of PPCPs in the aquatic environment is the effluent discharge from wastewater treatment plants (WWTPs). PPCPs of different types in varied concentration are released into surface, ground and coastal waters since treatment plants are not equipped with facilities to remove such compounds. Harmful effects include fall in reproduction rates of aquatic organisms due to enormous amount of synthetic hormones in the waste stream. Modern technologies such as advanced oxidation processes (ozonation, photolysis and heterogeneous photolysis, Fenton and photo-Fenton, sonolysis, electrochemical oxidation, etc.), activated carbon adsorption, membrane separation, and membrane bioreactor have been found to effectively remove pharmaceuticals from wastewater but these techniques are extremely expensive for large scale application and thus have narrow application. Constructed wetlands are proved to treat waste water that is laden with pharmaceutical contaminants. Removal efficiency of various types of PPCPs by surface flow constructed wetland, horizontal subsurface flow constructed wetland, vertical flow constructed wetland and hybrid system constructed wetland varied from 50-100%, 5-100%, 60-97% and 5-98%, respectively. However, further research is required in order to understand the removal efficiencies, toxicity to the plants, removal mechanisms and effect of other external factors such as pH, temperature etc. in order to understand the large scale application. Also, the research works were mostly done in pilot scale, so the efficiency of such treatment method in the large scale remains a question.

Key words: aquatic, pharmaceutical, waste water treatment plants

Ichthyofaunal Dynamics and Freshwater Dolphin in the River Beas (India)

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The river Beas rises in the Himalayas in central Himachal Pradesh and flows to river Satluj in western Punjab state. River Beas water samples were collected at Harike/Beas confluence sampling point and 50 km upstream Harike Beas bridge. Fisheries status was surveyed near the landing sites as well as in the market at Harike and local market at Karmuwale Pind. During the survey, the diversity of 62 fish species were recorded under 43 genera which include *Notopterus, Gudusia, Catla, Labeo, Cirrhinus, Ctenopharyngodon, Hypophthalamichthys, Cyprinus, Schizothorax, Tor, Barilius, Chela, Crossocheilus, Aspidoparia, Salmostoma, Danio, Esomus, Garra, Amblypharyngodon, Puntius, Pseudambassis, Chanda, Botia, Osteobrama, Aoriichthys, Wallago, Ompok, Rita, Bagarius, Clupisoma, Eutropiichthys, Mystus, Gagata, Glossogobius, Anabas, Colisa, Hemiramphus, Xenentodon, Channa, Clarias, Heteropneustes, Macrognathus, Mastacembelus.* The percentage catch composition of fish species were recorded as IMC - 32%, Common carp - 25%,Long whiskered catfish - 7%,Giant river catfish- 7%, Grass carp - 2%, Minor carp (4) - 5%, Featherback- 2%, Mahseer - 2%, Snowtrout– 2%,Magur - 0.5%, Singhi - 0.5%, miscellaneous species (9 Sps) - 15%. Percentage catch compositions were found to be varied during different season. Despite this, awareness campaign with charts, posters, banners, pamphlets and biomonitoring survey were conducted during different months in the lower stretch of river Beas at Harike Pattan and Karmuwale village (30 km upstream Harike Barrage). Six freshwater dolphins were encountered through visual observation during Plank boat built survey in 30 km stretch of the river Beas. The minimum population was estimated to be four in the river Beas near ferry route of Karmuwale village, high depth as well as in meander portion of the river. During postmonsoon the frequent dolphin sighting was recorded to be more compare to monsoon followed by winter and summer. Fishermen released freshwater dolphin in same environment when accidental entangling of dolphin was encountered during the operation of fishing nets. The species is identified as *Platanista gangetica minor* (Indus River dolphin) and known as bhulan. The recent awareness campaign on the conservation of freshwater dolphin made the local people accountable towards the safety and protection of this species as it is considered the mirror of the riverine health. The species is used as a tool to assess the biodiversity of the lotic water system. The frequent population survey is needed to find out the exact status and disturbance factors for the survival of Indus river dolphin and action for its conservation in river Beas. As per IUCN Red list data, the species is recognized as threatened river dolphin. There is a need of suitable conservation and management strategies to save the population of the freshwater charishmatic megafauna as well as fish fauna for maintaining the ecological health of the river Beas.

Key words: Ichthyofauna, freshwater dolphin, conservation, Beas, Punjab

Diagnosis of Paramphistomosis in Ruminants by Immunological Techniques

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Transmission of diseases, its diagnosis and preventive measures have now become a major concern for the scientists in respect of human health issues. Paramphistomosis is a group of disease caused by the various species of parasites of paramphistomatidae family in domestic ruminants. Paramphistome was identified through faecal examination and serodiagnostic tests in the ruminants. Immunodiagnostic assays were used to test ruminant sera in the laboratory for the detection of paramphistome antibodies. The highest prevalence rate was noticed in buffaloes followed by sheep, cattle and goats. The somatic antigen and E/S antigen of *Paramphistomum epiclitum; Gastrothylax crumenifer; Gigantocotyle explanatum* andsomatic antigen of adult *Cotylophoron cotylophorum* were prepared following homogenization, sonication in freeze-drying protocol and protein estimation after cleaning, washing and identification of parasite or flukes under DST sponsored project for immunodiagnostic tests. Somatic adult *P. epiclitum* antigen was also fractionated by gel filtration chromatography. These antigens were characterized by sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE) techniques as per the method of Laemmelli, using 12% resolving, 5% stacking gel and standard MW markers. The purified fractions of somatic antigen of *P. epiclitum* were characterized by SDS-PAGE which revealed large number of polypeptides of different molecular weight. Western blot analysis of adult somatic *P. epiclitum* and *G. crumenifer* antigen using high titre anti-rabbit *P. epiclitum* antigen sera revealed many immunogenic polypeptides. *P. epiclitum* showed five immunodominant polypeptides where as two in *G. crumenifer* using experimentally infected sheep sera. The specific immunodominant polypeptides of *P. epiclitum* were identified for diagnostic purposes using experimentally infected sheep sera after immunoblotting. These observations are very important for the diagnosis of paramphistomosis and immunological control of the disease in domestic ruminants especially in livestock industry. The disease can be minimized through immunological tests, identification of immunogenic polypeptides which have significant role in the early detection, diagnosis and appropriate treatment of the disease and to curtail losses in livestock industry.

Key words: Paramphistomosis, Diagnosis, Ruminants, Punjab

Interrelationship between Nutrient Load and Phytoplankton Standing Stock in the Hooghly Estuarine System

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The Hooghly estuary in the maritime state of West Bengal is the western most estuarine system in the subcontinent of Indian Sundfarbans. The estuary receives a huge quantum of sewage and municipal wastes from the thickly populated city of Kolkata, Howrah and the industrial complex of Haldia. Apart from this agricultural run-off from the adjacent landmasses a huge quantum of sewage from the north and south 24 parganas districts contribute appreciable amount of nutrients in the estuarine water. The nutrients being the main ingredients in the phytoplankton cell exhibit significant seasonal variation owing to the oscillation of precipitation pattern and the subsequent run-off from the adjacent landmasses. This has profound influence on the phytoplankton standing stock in the estuarine water. The present paper is a comparison account of the oscillation of the major six *Coscinodiscus* species in response to alteration in level of nitrate, phosphate and silicate load. The comparative study was undertaken during 2000 and 2012 with the aim to analyze critically the temporal variation of the selective biotic and abiotic components.

Key words: *Coscinodiscus* spp., Hooghly estuary, phytoplankton standing stock, nutrient level, temporal variation

Estimated values of Soil Nutrients in Samples Collected from Different Areas of Sundarban for the Growth of Sundari Plants

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The Sundarban Delta has been formed from the deposition of silt brought down by such rivers like the Brahmaputra and the Ganga (from the Himalayas) along their network of tributaries. Only River Hooghly receives huge freshwater and nutrients from the Ganga, while the others do not receive such freshwater. Therefore, the soils of the Sundarban are derivatives of fine Gangetic deltaic alluvium but the entire coastal strip of India including the Sundarban delta contains mostly saline soil.

The Sundarban has extremely rich halophytic vegetation which is known as Mangrove forest and that encompasses along with a variety of other plants including trees, shrubs, grasses, epiphytes, and lianas. Among the above varieties, prominent species 'Sundari' (*Heritiera fomes*) is dominant. Over the years, the stock of Sundari trees in the region has got depleted. Sundari, being valuable timber, has been over-exploited in the past. The greater part of the inner estuarine zone has become more saline due to lack of fresh water and the Sundari, which prefer less saline soil, do not proliferate these days. This situation has geometrically been deteriorating the soil potentiality with high incidence of salinity and spread of uncultivated land. For investigation, soil samples were collected from different places like, Buridhabri (junction point of Jhila River and Buridhabri Khal), Jhingakhali (junction point of Rai Mangal River and Bhangarkhali River), Mollakhali (junction point of Amtoli and Gomar River), Sajnekhali (Hogul River), Sudhanyakhali (Sudhanyakhali Khal), and Dobanki (Dobanki Khal) on November 2013. An attempt has been made to estimate nutrients of the collected soil samples to gear up the intention of the cultivators, so that they may cultivate Sundari trees for golden future of Sundarban.

Key words: Sundarban Delta, Mangrove swamps, Mangroves, Saline soil, Nutrient

On Some Aspect of Physico-Chemical Characteristics and Microbiological Assessment in Water Quality of Different Regions of Indian Sundarban

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The Indian Sundarban is one of the most dynamic ecosystems of the world with extremely rich diversity of aquatic flora and fauna. But this largest aquatic mangrove ecosystem has been threatened with serious environmental pollution and man-made hazards. The main aim of this study is to know the physico-chemical characteristics and microbiological assessment of the water quality of Sundarban. In this connection water samples were collected from different places like, Buridhabri (junction point of Jhila River and Buridhabri Khal), Jhingakhali (junction point of Rai Mangal River and Bhangarkhali River), Mollakhali (junction point of Amtoli and Gomar River), Sajnekhali (Hogul River), Sudhanyakhali (Sudhanyakhali Khal), and Dobanki (Dobanki Khal).

Physico-chemical characteristic of the water quality were analysied and found the colour, odour, pH, total dissolve solids, total alkalinity, total hardness and also to know the presence of the dissolved elements like Aluminium (Al), Barium (Ba), Boron (B), Calcium (Ca), Chloride (Cl), Copper (Cu), Fluoride (F), Iron (Fe), Magnesium (Mg), Manganese (Mn), Nitrate (NO_3), Selenium (Se), Silver (Ag), Sulphate (SO_4), Zinc (Zn), Cadmium (Cd), Cyanide (CN), Lead (Pb), Mercury (Hg), Nickel (Ni), total Arsenic (As) and Chromium (Cr). In addition to this, microbiological assessment of water sample was also done using APHA method. Microbiological parameters of the water sample such as total Coliform Bacteria, E. Coli were also estimated.

Key words: Indian Sundarban, TDS, Alkalinity, APHA method

System Boundaries for Life Cycle Assessment of Solid Waste Management Options: A Review

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Integrated waste management is one of the holistic approaches to environmental and resource management emerged from the concept of sustainable development.Most of the European countries follow the followinghierarchy for waste management: (a) prevention (in waste generation), (b) preparing for reuse, (c) recycling, (d) other types of recovery (including energy), and(e) disposal of waste. Solid waste is a major contributor of many different negative environmental impacts.Life cycle assessment (LCA) is a decision-support tool thatcan quantify the environmental impacts of solid waste management options consideringoptimum system boundary(cradle to grave).LCA methodology has been usedextensively to determine the optimum municipal solid waste management strategy. LCA process is a systematic approach and consists of the following four major components: (a) goal definition and scoping todefine and describe the product, process or activity, (b) inventory analysis (data collection), (c) impact assessment (including classification, characterization, normalization, grouping, weighting, and valuation), and (d) interpretation of the results. The LCA computer models can calculate thenet energy use (NEU), global warming potential (GWP), and acidification potential (AP) for various types of municipal solid waste management options.This review described the applications of LCA insolid waste management options andthe methodological issues.Specific attention waspaid to address system boundaries for various options of solid waste management to facilitateoptimum life cycle inventory. This review will help structuring information for decision processes using LCA in solid waste management.

Key words: Life cycle assessment; Solid waste management; and System boundary

A Preliminary Study on the Diversity of Family Crambidae (Lepidoptera: Insecta) from North East India

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North East India is one of the bio diverse hot spot of the world with a very rich diversity of faunal components. A lot of studies have been done and rather going on to explore the biodiversity of North East India but still this region is a home to many of the unexplored faunal groups. So, the authors initiated the studies for the exploration of Crambid diversity from North East India in 2012. The members of family Crambidae (Pyralidae: Lepidoptera) are small to medium size and with more or less cryptic coloration. The identifying characters of this family are: proboscis basally scaled and the paired tympanal organs (Hearing Organs) situated ventrally on the 2nd abdominal segment. The wing span of these moths varies from less than 10mm to more than 80mm, fore wing with vein R_5 free. Crambids hold the antennae in a specific way when are at rest, it is situated on top of the thorax or at the edge of it in varying ways. Male genitalia is without uncus arms. Many of the Crambid species are of high economic importance. Their larvae are typically stem borers in plants of the grass family. Some important pest species of family Crambidae are *Chilo partellus* Swinhoe (spotted stalk borer), *Chilo suppressalis* Walker (Asiatic rice borer) *Duponchelia fovealis* Zeller, (Pest of mostly herbaceous ornamental plants and field crops) *Diatraea saccharalis* Fabricius (sugarcane borer) *Diatraea grandiosella* Dyar south western corn borer *Desmia funeralis* Hubner (grapes leaf folder). For the knowhow of diversity of Crambidae, five collection cum survey tour were conducted to the states of Arunachal Pradesh, Sikkim, Mizoram and Meghalaya. The surveys resulted to a total number of 600 examples under 25 species of family Crambidae. All the collected specimens were processed as per techniques in lepidopterology. Identification was done with the help of relevant literature (Hampson 1896). The inferences will be discussed.

Key words: Crambid, diversity, North East India

Mangrove Litter Based Fish Feed for Carp Culture: An Innovative Approach to Manage Aquatic Health and Resources

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The foundation of rural Indian economy stands on agriculture and pisciculture. The Indian sub-continent is blessed to have a large area of aquatic ecosystem. Management of this aquatic ecosystem through scientific methods can yield maximum benefit in terms of fishery. Fish production pace in the present century is facing retardation because of disease problem, environmental pollution, lack of protein rich floral based fish feed in the market and quality of the final harvested product. Fish feed being an important component of modern pisciculture practice needs development to boost up fish growth without hampering the ambient environment. The present paper is an attempt to develop and manufacture floating fish feed (for carps) from mangrove litter extract. The extract is rich in protein and several micro-nutrients essential for the growth of fishes. In this study we compared our fish feed with an available commercially fish feed (purchased from the market) and noted our product to be rich in astaxanthin, although the protein percentage is relatively lower than the commercially available fish feed in the market. It is expected that such floral based fish feed may upgrade the environment of culture pond in terms of DO (dissolved oxygen) level and organic load and may serve as the road map of sustainable pisciculture.

Key words: Pisciculture, fish feed, mangrove litter, astaxanthin, protein percentage

Temporal Variations of Dissolved Heavy Metals in and Around the Fish Landing Stations of Lower Gangetic Delta

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Diamond Harbour and Namkhana are the two major fish landing stations of lower Gangetic delta region where marine fishes are landed on regular basis. These landing centers house huge number of fishing vessels and trawlers which use anti-fouling paints for their conditioning. In the absence of any treatment facilities of these effluents, the anti-fouling paints are directly released into the estuarine water, whose main ingredients are zinc, copper and lead. The present paper is an attempt to scan the level of these heavy metals in these two major fish landing stations over a period of more than two decades. The increasing trend of dissolved zinc, copper and lead in the aquatic phase of these landing stations offers a warning signal to the overall health of the ecosystem. Some selective agents of bio-remediation (endemic macrophytes) can be used to minimize the level of dissolved heavy metals and restore the alarming condition of the estuarine health.

Key words: Fish landing station, anti-fouling paints, zinc, copper, lead

Proximate Analysis of *Sonneratia apetala* Fruit Jelly

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We evaluated the biochemical composition of the jelly prepared from the fruits of mangrove flora *Sonneratia apetala* collected from Indian Sundarbans. The fruit of this species is available only during monsoon season and is consumed by island dwellers. The main purpose of this study is to provide nutritional information through the analysis of protein, carbohydrate, lipid and vitamin C of the jelly prepared from the fruits of this true mangrove species. The present study confirms the use of this jelly for human consumption as it is highly rich in vitamin C. The result of the study can be used to develop mangrove based alternative livelihood for the local island dwellers of Indian Sundarbans.

Key words: *Sonneratia apetala*, Indian Sundarbans, biochemical composition, alternative livelihood, island dwellers

Community Structure of Indian Sundarban Mangrove Flora

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The Indian Sundarbans sustains some 34 true mangrove species. A study conducted on the Shannon Weiner index of true mangrove species in the Sagar Island and Lothian Island during 2014 reveal significant spatial variation, which may be due to difference in the degree and type of anthropogenic stress operating in and around the selected islands. Sagar Island is highly stressful zone owing to multifarious anthropogenic activities (like pilgrimage, tourism, navigational activities, fish landing etc.), which has imparted relatively low value to Shannon Weiner species diversity index. The picture is reverse in case of Lothian Island which is a protected Reserve forest in the Sundarban Biosphere Reserve.

Key words: Indian Sundarbans, mangrove species, Shannon Weiner Index

Salinity Based Livelihood in Indian Sundarbans

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Indian Sundarbans is highly vulnerable to sea level rise. A figure of 3.14 mm/yr rise in sea level rise has been recorded in Diamond Harbour region which is adjacent to Indian Sundarbans. Because of sea level rise, saline water intrudes into the islands through creeks and inlets causing a major damage to agricultural crops particularly paddy. The degree of damage becomes more serious during cyclonic depressions followed by high eave actions and tidal amplitude (as happened during AILA in 2009). On this background, some livelihood options befitted to hypersaline condition like seaweed culture, oyster culture, mangrove - based fish feed preparation etc. have been discussed in this paper. These options can upgrade the economic profile of the island dwellers of Indian Sundarbans if they are carried out scientifically. The present paper is a road map to these livelihood options.

Key words: Indian Sundarbans, sea level rise, livelihood options, economic profile

Impact of Salinity on Fish Spectrum in Indian Sundarban Estuaries

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Climate change induced sea level rise and subsequent hike in salinity is a major feature in the estuaries of Indian Sundarbans. Significant rise in salinity has been observed in the Matla River of central Indian Sundarbans since last few decades. A study conducted on the fish diversity of this river since 1984 reveals the dominancy of trash fishes over dominant commercial fishes in the estuaries of central Indian Sundarbans. This may have significant impact on the local economy.

Key words: Indian Sundarbans, climate change, salinity, central, Matla River, trash fish, livelihood

Seasonal Variation of Heavy Metals in *Tenualosa ilisha* From Lower Gangetic Delta

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Heavy metals are stable and persistent environmental contaminants of aquatic environments. They occur in the environment both as a result of natural processes and as pollutants from human activities. The aquatic phase of lower Gangetic delta is under severe stress due to release of untreated effluents from the industries situated in the lower stretch of the Hooghly estuary. Zn, Cu and Pb are predominant in the estuarine waters of Indian Sundarbans. These metals have been detected in substantial amount in the muscle of *Tenualosa ilisha* (a commercially important fish species of Gangetic delta) collected from four different stations in the lower Gangetic delta region with an order Zn > Cu > Pb.

Key words: Heavy metals, Indian Sundarbans, Hooghly estuary

Traditional Management and Commercial Utility of *Barringtonia acutangula*: A Floodplain Tree Species from North East India

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Barrringtonia acutangula, locally known as '*hijol*'isanaturally growing tree species, uniquely adapted to the aquatic conditions. Floodplain ecosystems throughout the world are known for their multiple benefits. Flood frequency, duration, timing and intensity have profound influence on the floodplain tree species. Present study was undertaken to explore traditional management of *Barringtonia acutangula* in the floodplains of Cachar district of Barak Valley, Assam and to know the commercial utility of the species in floodplain ecosystem. A single survey covering 30 *Barringtonia* plantation managers were interviewed backed by field observation to document traditional management and commercial utility of the species. A unique management system of *Barringtonia* forest for fish farming was observed during the study. The speciesis managed for sprout production (sprout diameter >10cm and length>150cm, tree diameter > 20 cm) used in fishery management by the fishermen community called '*Kaivartas'*.Fish farming through the fishery management is an important source of livelihood to fishermen community in both rainy and winter season. Sprouts are pollarded in the month of June-July that coincides with the rainy season of the year. Adequate moisture in the rainy season promotes sprout regeneration in the same of harvesting year.Besides, this species provides different types of subsistence and commercial goods including fuel wood, building materials, fodder etc. Dried leaves are collected by women and used as fuel for cooking purposes.In floodplains of Barak Valley, plantation managers sell sprouts of *Barringtonia* once in every three years. Sprouts are sold to the farmers who do not own their personal *Barringtonia* plantation in the same floodplain or in a distant floodplain. Plantation managers prefer to harvest the older sprouts (> 3 yrs). Younger sprouts (<3 yrs) are retained in the tree for subsequent new sprout production and to maintain a sustainable harvest cycle. On an average, an individual farmer sells ~ 300 sprouts per year and generating INR 14000 annually. Therefore, management of the species in floodplain can provide benefits on a local and national level through livelihood, economy and environmental security for the inhabitants of the floodplain area.

Key word: Barrringtonia acutangula, traditional management, floodplain, commercial utility

Photocatalytic Degradation of Polycyclic Aromatic Hydrocarbons on Soil Surfaces Using TiO_2 under UV Light

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Naphthalene is one of the polycyclic aromatic hydrocarbons (PAHs) which considered as hazardous priority persistent organic pollutants due to its toxicity and carcinogenicity. Napthalene is ubiquitous in the environment through incomplete combustion, automobile emissions and subsequent atmospheric deposition. It is a well known phenomenon that photogenerated radicals of hydroxyl and superoxide upon illumination using semiconductors such as TiO_2, ZnO and SnO_2 by ultraviolet or visible light source breaks down organic substances. Since titanium dioxide (TiO_2) is cost effective, less toxicity and chemically very stable, it has been adopted for the photodegradation of Naphthalene. Though several methods have been proposed to synthesize the TiO_2, the ultrafine TiO_2 nanocrystal at room temperature has been chosen specifically for lowering the cost, simplifying the process and shortening the period. Photocatalytic processes involving TiO_2 semiconductor particles under ultraviolet (UV) light irradiation have potential advantages. Solid TiO_2 (in the crystalline form of anatase) is a semiconductor that under UV irradiation can promote an electron (e^-) from the valence band (VB) to the conduction band (CB), leaving a positive hole (h^+) at the site where the electron was originally captured. By increasing the intensity of the UV more electron hole can be generated which in turn decrease the recombination of the electron hole and thus facilitates the efficient degradation of the Naphthalene. In this study, Naphthalene standards can be degraded photocatalytically by using TiO_2 nanocrystal to be an anatase phase.

Key words: Photocatalysis, Napthalene, TiO_2, anatase phase

National Parks in Madhya Pradesh - A Special Reference Bandhavgarh and Kanha

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The State of Madhya Pradesh is centrally located and is often called as the "Heart of India". The State is home to a rich cultural heritage and has practically everything; innumerable monuments, large plateau, spectacular mountain ranges, meandering rivers and miles and miles of dense forests. Madhya Pradesh have 11 National Parks, including Bandhavgarh National Park, Kanha National Park. Out of 11 National Parks we are discussing about two main National Parks and these are Bandhavgarh National Park, Kanha National Park.

Forest and wild-life are very essential to maintain ecological balance of an area. Forest is the important component of environment and economy of any country. Conservation of forests and wild-life is very important. Government deals with the field level activities like preparation of the development plans, creation and maintenance of tourism infrastructure. By making our Sincere and Hard efforts we can make Kanha and Bandhavgarh as the best national parks of India.

Key words: Wild-Life, Forests, Conservation, Flora and Fauna

Water Quality Status of Laknavaram Lake, Warangal Dt. Telangana India

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Laknavaram Lake is around 80 km from Warangal city, 15 km away from the National Highway -202 Hyderabad-Warangal to Mulgu-Eturnagaram road. It is under Mulugu Tribal Constituency. It is a natural lake popular known as Laknavaram Cheruvu surrounded by trees and green hills lined up to hold the rain water. The King *Ganapathi Deva* year 2011 ruler of Kakatiya Kingdom, Capital City Orugallu now renamed as Warangal. It is located between latitude 17^{o} 42 $_{1/2}{}^{1}$ and 18^{0} &10 ^{1} North between longitude 79 ^{0} 55 ^{1}East. It was used for irrigation purpose. It's rich Bio diversity with more than 200 species. The forests include mixed dry deciduous type with Tectona grandis, Pongamia pinnata, Terminalia arjuna, Millingtonia hortensis, Ferronia limonia, Madhuka longifolia, Syzygium cumini, Ficus religiosa, Butea monosperma. Dendrocalamus strictus, Holoptelea integrifolia, Hardwickia binata, Aegle marmelos, Gmelina arborea, Acatio milotica, Ailanthus excels, Azadirichta indica, Diospyros melanoxylon etc., while the fauna includes several endangered animals like Tiger ,Sloth Bear. Foue Horned Antipole Chinkaraq, Wolf, Panther, Hyena etc. Birds like snipe blue green Pigeon Patridges, Qmail are observed in the forest. The climate is usually hot around the year the temperature often reaches 40^{0} C during summer. It comes under Godavari river basin and the lake catchment area is 1280 sq.klm and average rain fall is over 1500 mm. Improvement of Protection fodder and water resources of have been the prime focus of the management for the Biodiversity conservation of the protected area. Which is flooded with forest run off stored in the lake.Lake water are life here of the tribal people for their drinking purpose, irrigation, aquaculture and recreation and it is a revenue income to Government. During tribal festivals like Sammakka and Saralamma Jatara , the pilgrims use the lake water for bathing, cooking, drinking recreation purpose and religious purposes. Water quality is determined in the lake has been carried out by physico-chemical, biological parameters quantification was the measurement for water quality Management of the lake and its conservation. The water samples were collected in day time 9.00 to 4.00 pm at five sites during one year 2013-2014. Appearance is neat and clear. Light orange color in rainy season. Odour is agreeable. Physical parameters like temperature (air, water) 23^{0} C to 39^{0} C, electrical conductivity were conducted at five different sites. The chemical characteristics such as pH range was 7.0 to 7.5, dissolved oxygen, biological oxygen demand, chemical oxygen demand, total alkalinity, total hardness range 40-60 mg/L, chloride, calcium, magnesium etc, and eutrophic factors like sulphates phosphates, nitrates, and percentage of organic matter, E.coli were analyzed. The values indicated that the water in good quality as per the WHO standards.

Key words: Physical, Chemical, Biological

A Review on Traffic Generated Particulates in Urban Areas, Their Health Impacts and Available Control Technologies

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Vehicular emission is the dominant source of toxic air pollutants in urban areas. The pollution levels in urban centersare of particular concern worldwide not only because of the magnitude of emissions, but also due to the high probability of exposure risk to large population as well as the presence of complex ventilation and meteorological conditions. Fine particles emanating from transportation activities are the major pollutants to be concerned, because of the association of a large number of toxic organic compounds and trace elements with these airborne particulates. Fine particles could be potentially more significant in terms of their impact on health and the environment than larger particles. This paper presents a comprehensive review of physico-chemical characteristics of particles emanating from transportation activities. The study also depicts a brief overview of the adverse health and environmental issues associated with the particles along with a discussion of the current methods to regulate the emission of the particles along including technological advancements, fuel quality improvements, regulatory enforcements and traffic management. Based on the investigation, the study portrays the need for future research, especially for the appropriate identification of the cause and source of trace metals and organic fractions in order to develop effective control measures.

Key words: Ambient air, fine particles, health Impacts, trace elements, toxic air pollutants, toxic organic compounds, vehicular emissions

Physico-Chemical Profile of Sukhana River, in Aurangabad, (M.S.) India

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The present study deals with comparative study of past and present senario water quality of Sukhana River, Aurangabad [M.S] India. The physico-chemical characteristics were studied and analyzed during January - December 1987 and presently January - December 2010. Seasonal variations in the past and present study of Sukhana River in Aurangabad [M.S] India were observed. The results revealed that the condition of this River has been increased in pollution year by year because year values are highly significant conform by f test (ANOVA). Parameter of Sukhana River are pH, Total solids, Total dissolve solids, Total suspended solids, DO, BOD, COD, Alkalinity, Total Hardness, Chloride, Nitrate and Phosphate are 6.94, 567.58, 470.41, 97.16, 1.45, 44.58, 92.41, 437.66, 487.83, 106.33, 0.24 and 138.75 respectively beyond the permissible limits according to WHO and ISI standards for drinking purpose.

Key words: physico-chemical parameters, seasonal variations, ANOVA, Pollution.

Seasonal Variations and Biodiversity of Zooplankton in Harsool-Savangi Dam, Aurangabad, India

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The present study concerns seasonal variations, correlation coefficient and biodiversity indices of zooplanktons during January – December 2008 in the Harsool-Savangi dam, Aurangabad India. A total of 25 genera were recorded of which 10 were Rotifers, 8 Cladocerons, 5 Copepods and 2 Ostracods. Present study revealed maximum percentage wise compositions of Rotifers at north site 58.28 %, Cladocerons at south site 29.78 %, Copepods at east site 16.59 % and Ostracods at south site 4.20 %. Minimum percentage wise compositions Rotifers at south site 51.54 %, Cladocerons at west site 26.71 %, Copepods at north site 11.03 % and Ostracods at north site 1.36 %. Margalef's index (R_1) and Menhinick index (R_2) values (3.58 and 0.87) were found to be the highest at south site and lowest values (3.16 and 0.56) were found at north site. Simpson's index (λ) values (0.43) were found to be the highest at north site and lowest values (0.37) were found at south site. Shannon – Weiner index (H') values (1.06) were found to be the highest at south site and lowest values (0.94) were found at north site. Maximum species evenness was recorded at south site; minimum species evenness was recorded at north site. Maximum population density of Rotifers, Cladocerons, Copepods and Ostracods (799, 350, 163 and 18) were recorded at north site in summer and minimum (58, 35, 22 and 13) were recorded at south site in monsoon respectively.

Key words: Zooplankton, biodiversity indices and percentage wise compositions

Comparative Study of Synthetic Hormones Ovaprim and Carp Pituitary Extract Used in Induced Breeding of Indian Major Carps

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In present study during 2008- 2009 observed the spawning response of ovaprim compared with pituitary extract in Indian major carps, at fish breeding center at Jaikwadi, Paithan Dist. Aurangabad (M.S) India. Total ten trial doses of ovaprim were used in induced breeding and ten trial doses of Carp Pituitary Extract (CPE) used for induced breeding in Indian major carps i.e *Catla catla, Labeo rohita and Cirrhinus mrigala.* The percentage of fertilization ranged (88.11 - 97.94%) was found with ovaprim treatment. and (53.19 - 85.48%) with pituitary extract treatment. The percentage hatchling ranged (74.70 - 95.92%) with ovaprim treatment and (60 - 58.82%) with pituitary extract treatment.

Cyclic Changes in Ovarian Maturation and Histological Observation in Indian Major Carp Catla Catla [HAM]

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Annual reproductive cycle of female *Catla catla* was studied during the (January 2009 December 2009) through gross and histological studies. GSI was observed (13.00±9.30 %). On the basis of gross and histological studies, seven ovarian stages namely, i) immature/resting ii) regenerating iii) developing iv) maturing v) mature/gravid vi) regressing and vii) regressed were distinguished. Based on GSI studies, spawning seem to for a period (late June-early September). Histological studies revealed six stages of oocyte development namely i) chromatin nucleolar ii) perinucleolar iii) cortical alveolar iv) early vitellogenic v) late vitellogenic and vi) early germinal vesicle movement. The present studies describe the morphological and histological changes in the ovaries of *Catla catla*. The annual breeding cycle of the fish has been divided in to four stages in the following month of year i.e i) the preparatory phase (January – March) ii) pre spawning phase (April – June) iii) spawning phase (July – September) iv) post spawning phase.

Key words: *Catla catla*, Morphological, histological changes, GSI, annual breeding cycle.

Rogor Induced Histopathological Changes in the Gills of Freshwater Fish *Puntius stigma* From Sukhana River, Aurangabad (M.S) India

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Histological biomarkers of toxicity in fish organs are a useful indicator of environmental pollution. The histological effects of rogor, an organophosphate insecticide, on the gill tissues in *Puntius stigma* were determined. The fishes *Puntius stigma* were exposed to lethal concentrations at 96 hrs LC_{50} and sub lethal concentrations at (1/5, 1/10 and 1/15 ppm) of rogor for 30 days. The fishes shows severe histological changes in the gill lamellae such as bulging, epithelial hypertrophy, fusion of secondary lamellae, hemorrhage, curling of lamellae, swelling of pillar cells, swelling of chloride cells.

Key words: Rogor, Histopathological changes, gills, *Puntius stigma*

Effect of Organophosphate Insecticide (Rogor) on Protein Content of *Channa striatus* from Sukhana River, Aurangabad (M.S.)

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The Pesticidal effects on biochemical parameters of fresh water fishes are well illustrated from the recent research in the field of toxicology. Among the major biochemical components proteins are of prime importance as they are determine nutritive value of fresh water fishes.

Activity of a few biomarkers have been investigated on fresh water fish *Channa striatus* exposed to three sub – lethal concentrations of rogor (1/5, 1/10 and 1/15 of 96hrs LC_{50} value). The alteration in protein contents of muscle, liver and kidney were investigated. The protein levels were found to be depleted in all the tissues after exposure to rogor over the control. Therefore the detailed result and observations are summarized in the present investigations.

Key words: Organophosphate insecticide, Sukhana river, rogor, *Channa striatus,* proteins.

Some Aspects of Water Quality Parameters of Pardeswadi Lake, Waluj MIDC Aurangabad (M.S.) India

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Water quality focuses on the various aspects off the physico-chemical parameters of water by which state of the water body can early be observed. Measurements of various water quality parameters play the key role in detecting the status of pollution and suitability of particular water body for various aquatic organisms and agricultural products. The present survey / study was conducted to measure the various physico-chemical parameters of the water at Pardeshwadi Lake, at Ramrai Jogeshwari and Kamlapur in MIDC area, waluj Aurangabad, Maharashtra, India.

In waluj MIDC area, sterlite colgate & Palmolive, Cosmo films, arpika engineering, Solidar Remedies, NRB baring, Graware Polyester and Foster industries lays chemical mixed water and sewage in drainage and in open ground channels, in waluj, Jogeshwari, Ranjangaon, Shenpunji. Optic fiber plant of Sterlite industries lays down its sewage water in stream which flows by the side of crop field contains water from colgate and Palmolive and cosmo films and then joins to Pardeshwadi Lake and Pollutes the water of lake which make harzard for the health of people in the area.

Key words: Physico-chemical Parameters, Pollution and Pardeswadi lake

Appraisal of Physico-Chemical Parameters Pro Authentication of Pollution Status of Ravivarpeth Lake Ambajogai Dist. Beed Marathwada Region (M.S.) India

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The present study deals with asssessment of important Physico-chemical parameters of Ravivar Peth Lake at Ambajogai Dist. Beed in the midst of the geographical-co-ordination at 18-45' North Latitude and 76-10' East Longitude in Marathwada region [M.S] India [Asian continent]. The study was undertaken to confirm the status of water body. The imperative parameters were studied and analysed every month during January –December 2005. For this investigation three different sampling stations were selected as station A, B and C. The results construed that the conditions of Ravivar Peth Lake in different months showed fluctuations in physicochemical parameters reflected accordingly to the seasons, climate and the pollution load over the investigated waterbody.

Water Quality Assessment of Lower Dudhana Dam, At Selu, Dist. Parbhani (M.S.) India

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The present paper deals with the assessment of the water quality of Lower Dudhana Dam, At Selu, Dist. Parbhani (M.S) India. The good water quality always produces a good health of human beings than poor water quality. An analysis on the physic-chemical parameters of Lower Dudhana Dam was carried out during January 2013 to Dec. 2013. The use of water is mostly for irrigation, drinking and fishing purpose only. The monthly changes in physical and chemical parameters such as water temp., air temp., TDS, pH, Colour, Odor, TS, TSS, Electric Conductivity, Total hardness, Chlorides, Alkalinity, Phosphate, Sulphate, Nitrate, Magnesium, DO, BOD, COD and Fluorides were analyzed for a period of one year. All parameters were within the permissible limits. The present results indicated that the dam is non-polluted and can be used for domestic, irrigation and fishing purpose.

Key words: Physico-chemical parameters, Lower Dudhana dam, Monthly variations

The Limnological Study and the Potential Resources for Fisheries Development in the Wetlands of Brahmaputra Valley, Assam

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The wetland fisheries are dominated by miscellaneous species of fish including major carps, catfishes, live fishes etc. The diverse fish fauna constitute a repository of biological wealth. The Brahmaputra basin along with its tributaries, wetlands, ponds, streams etc. constitute more than 167 species. The present study deals with the Ichthyo-faunal diversity in Relation to Physico-chemical and biological parameters of two wetlands of Dibrugarh District, Assam i.e. Garudharia and Maijan wetland. Various diversity indices have been used to assess the fish diversity. The result of the present investigation reveals the occurrence of 80 species of fishes belonging to 23 families and 10 orders were recorded in Maijan and 64 species of fishes belonging to 18 families and 8 orders were recorded in Garudharia. Prediction of potential fish yield was done by Ryder's Concept of Morpho-edaphic index. Water parameters like DO_2, PH, Free CO_2, Total Alkalinity, Hardness, Chloride, Mg, Ca, Fe, Nitrate etc. and the biological parameters like GPP, NPP, Respiration, Biomass etc. were analyzed. The study was undertaken for a period of two years from 2011 to 2013. The present paper deals with the assessment of fisheries potential and the co-efficient of co-relation with other biotic variables which were done using SPSS software package.

Key words: Ichthyo-fauna, Diversity, Potential Resources, wetlands.

Standardization of Nutrient Management Practices for Organic Cultivation of Rice (*Oryza sativa.* L) Under Southern Transitional Zone of Karnataka

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A field experiment was conducted during *kharif* season of 2014 at Organic Farming Research Centre (OFRC), University of Agricultural and Horticultural Sciences, Shimoga to Standardization of nutrient management practices for organic cultivation of Rice (*Oryza sativa.* L). The experiment was laid out in a randomized complete block design with different treatments like FYM + 100 % N equivalent FYM, 75 % N equivalent FYM, 100 % N equivalent FYM, 125 % N equivalent FYM, FYM + 100 % N equivalent vermicompost, 75 % N equivalent vermicompost, 100 % N equivalent vermicompost, 125 % N equivalent vermicompost and 50 % N equivalent FYM + 50 % N equivalent vermicompost replicated thrice. Among the different treatments, application of FYM + 100 % N equivalent vermicompost recorded significantly higher grain yield (36.42 q ha^{-1}), straw yield (47.26 q ha^{-1}) and harvest Index (0.44) due to higher yield attributing characters like Panicle length (25.52 cm), Test Weight (20.45 g), Panicle weight (3.65 g), No. of filled grains (171.57) compared to other treatments but application of 75 % N equivalent FYM recorded significantly lower grain yield (30.25 q ha^{-1}), straw yield (40.94 q ha^{-1}) and harvest index (0.42) due to yield attributing characters like Panicle length (19.65 cm), Test Weight (17.02 g), Panicle weight (1.92 g), No. of filled grains (107.60) .

Key words: Organic rice, Nutrient Management, Vermicompost and Farmyard manure.

Development of Organic Production Techniques on the Growth, Yield and Quality of Chilli (*Capsicum annuum*) in Dry Zones of Karnataka

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The field experiment was conducted during the rainy (*kharif*) season of 2011 and 2012 in sandy clay loam soils at Zonal Agriculture Research Station, GKVK, Bangalore, to study the effect of different sources of organic manures on growth, yield and quality of chilli (*Capsicum annuum*). There were thirteen treatments {T_1-BDLM @ 100 kg N equi/ha, T_2-BDLM @ 100 kg N equi/ha + Vermiwash (3%), T_3-BDLM @ 100 kg N equi/ha + Panchagavya (3%), T_4-BDLM @ 125 kg N equi/ha, T_5-BDLM @ 125 kg N equi/ha + Vermiwash (3%), T_6-BDLM @ 125 kg N equi/ha+ Panchagavya (3%), T_7-EBDLM @ 100 kg N equi/ha, T_8- EBDLM @ 100 kg N equi/ha + Vermiwash (3%), T_9-EBDLM @ 100 kg N equi/ha+ Panchagavya (3%), T_{10}-EBDLM @ 125 kg N equi/ha, T_{11}-EBDLM @ 125 kg N equi/ha+ Vermiwash (3%), T_{12}- EBDLM @ 125 kg N equi/ha+ Panchagavya (3%) and T_{13}- Control (Package of practice)} comprising basal application of farmyard manure and vermicompost, biodigested and enriched biodigested liquid manures (BDLM and EBDLM applied after transplanting in 3 splits), 3 sprays of 3% Panchagavya (PG) and Vermiwash (VW). The treatments were replicated thrice. Among the treatments application of enriched biodigested liquid manure (EBDLM) at 125 kg N equivalent/ha + 3 sprays of Panchagavya (3%) recorded significantly higher plant height (87.0 cm), number of branches per plant (32.9), leaf area index (2.0 cm) leaf area duration (51.9), total dry matter production per plant (105.7 g), dry fruit yield (9.0 q/ha), 100-fruit weight (135.1 gm), fruit length (14.4 cm), Number of fruits/plant (39.0), ascorbic acid (137.3 mg/100 g), Capsaicin (0.64 %), Total extractable colour (280.8 ASTA unit), Oleoresin (15.4 %) and benefit cost ratio (1:2.74) as compared to the control (recommended practices).

Key words: Capsaicin, Liquid manures**,** Oleoresin, Organic chilli, Panchagavya

Floral Bology of *Clerodendrum viscosum* Vent., an Important Medicinal Plant of Asiatic Tropics

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Clerodendrum viscosum Vent (Verbenaceae) is a native of tropical countries including India. The plant is a perennial, large shrub and flowers during February to April. Inflorescence is of dicashial cymes arranged on a large panicle. Number of flowers per panicle varies from 148 – 411. The flowers are bisexual, zygomorphic and the flower type is of tube-flower. Limbs spreading, upper limbs represent two petals and the lower limbs by three petals. Stamens 4 in number, epipetalous, didynamous. Carpels two, syncarpous, tetraloculed with a long, filiform style and bifid stigma. In *C. viscosum* the flowers start opening very early in the morning and completed by 7.00 am. It produces 4 day flowers and the flowering phenology is of cornucopia type. The flowers offer both nectar and pollen grains to the visitors for successful pollination. The flower visitors include bees, butterflies, hoverfly, hawkmoths and sun birds. Among them, some bees (Halictus sp.) and butterflies perform as pollinators and rest of visitors act as nectar robber. As the plant shows dichogamy, so, the mode of pollination will be either geitonogamous and / or xenogamous which will again obligately dependent on pollinator activity.

Key words: *Clerodendrum viscosum*, Flowering phenology, Pollination, Pollinator

Aniline Recovery from Aqueous Solution using Natural Solid Wax

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The disposal of wastewater from industrial process has received considerable attention and legislation for protection of the environment. The largest users of aniline are companies that make methyl diphenyldiisocyanate, pesticides, dyes, and rubber, further in drugs, photographic chemicals, varnishes, and explosives. Exposure to aniline can occur in the workplace or in the environment following releases to air, water, land or groundwater. Since Aniline is toxic and carcinogenic and therefore has to be removed from the disposed water. The present study aimed to study the permeability of supported liquid membrane on aniline using solid triglycerides and the effects of pH in feed, initial aniline feed concentration and strip concentration in the transport of aqueous solution. Supported solid membrane (SSM) transport of aniline was good with Beeswax as membrane material. Hydrophobic polytetrafluroethylene (PTFE) membrane of 0.45 µm pore size as the support material gave maximum transport. Permeability of aniline was studied at different pH, initial feed concentration of Aniline and strip concentrations. The result obtained from the SSM maximum permeability of Aniline was achieved for 1 ppm initial aniline concentration at pH 11 and at the 4th hour of reaction time. The optimum concentration of stripping and maximum percentage recovery of aniline was achieved at 0.2 N H_2SO_4 were 1.27×10^{-11} and 79% respectively.

Key words: Aniline, Recovery, PTFE membrane, Beeswax and Permeability

Air-Soil Exchange of Polychlorinated Biphenyls (PCBs) in the Informal Electronic Waste Recycling Units and Dumping Sites of Chennai

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Polychlorinated biphenyls (PCBs) are a family of semivolatile compounds recognized as priority pollutant in Stockholm Convention due to its toxicity and persistence in the environment. Surface soil samples were collected from e-waste sites (n=7) and dumpsites (n=4) across Chennai. Soil samples were extracted using Microwave accelerated reaction system (MARS 6) and analyzed for PCBs in GC-ECD. Concentrations of Σ_{28}PCBs were found with very high level in the e-waste sites (6-488 ng/g) of Chennai compared to dumpsites (0.3-6 ng/g). Homologous profiles of both e-waste and dumpsite were dominated by penta-PCB followed by tetra-PCB in all the sites. PeCB-118 congener was found significantly higher level in all the sites contributing (>50%) on the overall concentration. Air-soil exchange of sampling site was determined by using previously observed atmospheric PCBs level of Chennai. In fugacity fraction, majority of e-waste sites show net volatilization from soil for all the PCB congeners. Contrastingly majority of dumping sites were found with deposition except Kodungaiyur showing net volatilization.

Key words: PCBs, e-waste site, dumping site Fugacity fraction and Chennai

Students' Attitude towards Compulsory Tertiary-Level "Environmental Studies" Course at Campus Based Institutes of West Bengal

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In many areas of social science environment has become the central point of growing global concern. Continuing problems of pollution, loss of forest, solid waste disposal, degradation of environment, global warming, depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues. Education for Sustainability is the best programme to deal with the environmental problems. Awareness and understanding of environmental issues provide the basis and rationale for commitment and meaningful action towards sustainable development. Environmental education allows every human being to acquire the knowledge, skills, attitudes and values necessary to shape a sustainable future. According to the directives of the Honorable Supreme Court, UGC introduced a basic six months compulsory course on environment for all the students of undergraduate courses of all branches of Higher Education. It is true that despite of various initiatives taken by different authorities like Ministry of Environment and Forest, University Grants Commission, State government etc. for implementing "Environmental Studies" as a common subject the ultimate result is not much encouraging in India including West Bengal. To find out the students' attitude towards compulsory course of 'Environmental Studies', six campus based universities namely Visva Bharati, Jadavpur university, Rabindra Bharati University, IIT, Kharagpur, Bidhan Chandra Krishi Viswavidyalaya and Uttarbanga Krishi Viswavidyalaya were chosen as the sample universities for the study. Three hundred and sixty students from six universities those who have already completed the compulsory course of 'Environmental Studies' were selected as the respondents and the data were obtained using a valid and reliable attitude measurement scale developed by the authors. Studies revealed a high level of positive attitude towards 'environmental studies programme'. There was no significant difference found in attitude among the with respect to their gender and university type. The present findings will be valuable for the regulatory authorities for further decision or policy making.

Key words: Environmental education, Environmental studies, Tertiary education, Sustainable development, Attitude

Revisiting Sudeip Shrivastava V. UoI and AWBI V. Nagaraja (Jallikatu Case) W.S.R. to Ecocentrism and the Development of Environmental Law in India

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For the purpose of this paper I would like to critically analyze two decisions that were taken by the National Green Tribunal (NGT) as well as the Supreme Court of India. The first judgment is that of SudeipShrivastava v. Union of India that was heard by the NGT on 24th March 2014. This case was concerning the granting of licenses to a mining company in the light of the Forest Conservation Act. The second judgment is that of the Animal Welfare Board of India v. A. Nagaraja & Ors. (*Jallikattu Case*) that was given by the Supreme Court of India sometime after the first judgment.

Both judgments took an ecocentric view of the situation than a deontological approach. However, there was a considerable difference between the approaches that was taken by the National Green Tribunal from that of the judgment given by the Supreme Court of India.

In this paper I would compare the two judgments while tracing the trajectory of Environmental Law in India and it constant progress. The Environmental law has been historically very exploitative, however, while progressing towards the new millennium, our laws have become rather ecocentric and mindful of the present condition of the various threats to the Environment. I will trace the development of Environmental law in India.

Key words: Environmental Law, India, ecocentric, judgement

Geospatial Modeling using Integrated SAR and Optical Remote Sensing Data for REDD Related Forest Biomass Retrieval

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Forest stand biomass acts as a valuable indicator for monitoring and evaluating REDD (Reducing Emissions from Deforestation and forest Degradation). The combination of Synthetic Aperture Radar (SAR) and optical forest remote sensing targets the retrieval of the aboveground biomass (AGB), which is a primary variable related to carbon cycle in land ecosystems, and hence identified as an essential climate variable (ECV). Optical remote sensing data have been widely used to derive forest biophysical parameters in-spite of their poor sensitivity towards the forest properties. Microwave (or SAR) remote sensing provides a better option owing to its inherent ability to penetrate the forest vegetation. This study aims at developing best possible regression models for retrieving forest above-ground bole biomass (AGBB) utilizing optical data from Landsat TM and microwave data from L-band of ALOS PALSAR Fine Beam Dual (FBD) HH/HV polarized data and the combination of the two over Indian sub-continental tropical deciduous mixed forests of Munger (Bihar, India). Spatial biomass models were developed using integrated remote sensing and field data. Considering the variability and inaccessibility of the study area, a total of 34 square sample plots representing homogeneous vegetation units, with an area of 0.1 hectare each were selected from every forest type and density classes present in the study area; hence covering 0.005% of the total forest area. The Landsat TM imagery was geometrically rectified and co-registered in reference to already registered Landsat ETM+ and IRS P6 LISS-III images of the same region, which were in-turn co-registered with the Survey of India (SOI) toposheet considering analogous distinct identifiable objects on the toposheets, ground and image. Principle components, texture measures and vegetation index like Normalized Difference Vegetation Index (NDVI) were calculated from the Landsat TM image at the stand level. The raw Single Look Complex (SLC) ALOS PALSAR imagery was converted to backscatter intensity data. The data was properly calibrated and preprocessed prior to its use for biomass retrieval. The preprocessing of the ALOS PALSAR data was performed in a sequence of steps in SARScape software. These data were used singly and in combination to develop Multiple Linear Regression (MLR) model to predict AGB, with inputs of the primary data as generated from the field. The results using Landsat TM showed poor correlation (R^2=0.295 and RMSE=35 t/ha) when compared to HH polarized L-band SAR (R^2=0.868 and RMSE=16.06 t/ha). However, the prediction model performed even better with synergic use of the optical and SAR (R^2=0.892 and RMSE=14.08 t/ha). The addition of TM metrics positively contributed in improving PALSAR estimates of forest biomass. Hence, the study recommends the combined use of both optical and SAR sensors for better assessment of stand biomass with significant contribution towards operational forestry.

Key words: *ALOS PALSAR, Landsat TM, NDVI, Texture, PCA, Polarization, Backscatter, Tropical deciduous forest, Above-ground biomass, Regression*

Invasion of *Prosopis juliflora* and Ecological Economics of Maldharies in Banni Grasslands of Kachchh

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Banni is the largest and finest stretch of grassland in India (2617 km^2 second largest grassland in Asia, is located on the southern border of Great Rann of Kachchh in Kachchh district of Gujarat State (GUIDE 2011). Banni grassland once referred to as Asia's finest grassland, accounts for approximately 45% of the permanent pastures and 10% of the grazing ground available in the state of Gujarat (Parikh and Reddy, 1997). A large tract of Banni being a low lying area converts into seasonal wetland during good monsoon years which attracts large number of migratory avi-fauna from different parts of the world. Thus, Banni plays a pivoted role and is one among the important areas of migratory birds in the world. Banni is an important grazing land for the livestock of Maldhari communities of Kachchh and Gujarat from the time immemorial. The livestock rearing is the only and major profession of the Maldhari community in Banni for their livelihood and survival. In 1950s, *Prosopis juliflora*, an invasive alien plant has invaded most of the grassland and converted it into woodland. At present, *P. Juliflora* has become an important natural resource in Banni grassland which provides many additional livelihood options to the local communities for their sustenance. It is the source of charcoal making, honey and gum, fuel wood, handicraft items, etc. The current study aimed at investigating the changing socio-economic dynamics of Banni over a 70 year period with special reference to introduction and gradual invasion of Prosopis in Banni. It is really striking to find how the indigenous communities of the region are harmoniously living with invasive species. This is an internationally unique example of human co-existence with invasive species. Further, in the second part, the project aims to carry out a comprehensive estimation of ecosystem services of Banni in its triple perspectives as grassland, as woodland as well as a wetland ecosystem.

Key words: Grassland ecosystem, Maldharies, Prosopis, Invasive species, wetland ecosystem, biodiversity services.

Flowering, Yield and Fruit Quality of Litchi (*Litchi chinensis* Sonn.) cv. Bombai in Response to Sulphur and Magnesium Nutrition

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The experiment was conducted in the Horticultural Research Station Mondouri, Bidhan Chandra Krishi Viswavidyalaya during the years 2012-14 with the objective to study the effect of sulphur and magnesium nutrition on flowering, yield and quality of litchi cv. Bombai. The experiment comprised of 17 (Seventeen) treatments [Treatment details: T_1 - Sulphur @ 50 g/plant/year; T_2 - Sulphur @ 100 g/plant/year; T_3 - Sulphur @ 150 g/plant/year; T_4 - Magnesium @ 50 g/plant/year; T_5 - Magnesium @ 100 g/plant/year; T_6 - Magnesium @ 150 g/plant/year; T_7 - Sulphur @ 50 g/plant/year + Magnesium @ 50 g/plant/year; T_8 -Sulphur @ 50 g/plant/year + Magnesium @ 100 g/plant/year; T_9 - Sulphur @ 50 g/plant/year + Magnesium @ 150 g/plant/year; T_{10} - Sulphur @ 100 g/plant/year + Magnesium @ 50 g/plant/year; T_{11} - Sulphur @ 100 g/plant/year + Magnesium @ 100 g/plant/year; T_{12} - Sulphur @ 100 g/plant/year + Magnesium @ 150 g/plant/year; T_{13} -Sulphur @ 150 g/plant/year + Magnesium @ 50 g/plant/year; T_{14} - Sulphur @ 150 g/plant/year + Magnesium @ 100 g/plant/year; T_{15} - Sulphur @ 150 g/plant/year + Magnesium @ 150 g/plant/year; T_{16} - N: P_2O_5: K_2O @ 800: 400: 800 g/ plant/ year (Control); T_{17} - Unfertilized Control] with four replication and laid out in randomised block design. The results revealed that application of Sulphur @ 100 g/plant/year + Magnesium @ 150 g/plant/year (T_{12}) caused earlier panicle emergence in both the years (i.e. 19th Jan in 2013 and 22nd Jan in 2014) compared with other treatments. The maximum length of panicle (32.97 cm) was recorded from the tree received Sulphur @ 100 g/plant/year + Magnesium @ 100 g/plant/year (T_{11}) followed by 32.19 cm of length of panicle and 22.49 cm breadth of panicle from Sulphur @ 100 g/plant/year + Magnesium @ 150 g/plant/year (T_{12}). Treatment with sulphur @ 100 g/plant/year + magnesium @ 150 g/plant/year (T_{12}) advanced the flower opening by 2-3days compared to other treatments. The treatment Sulphur @ 150 g/plant/year + Magnesium @ 50 g/plant/year (T_{13}) caused the earlier completion of flowering (i.e. 17th March in both the years). The treatment Sulphur @ 100 g/plant/year + Magnesium @ 150 g/plant/year (T_{12}) also caused earlier fruit set (15th March in 2013 and 16th March in 2014) and maximum number of fruit set (60.18 per panicle). The highest number of fruits produced/plant (2492.75 fruits/ plant) and maximum yield of (58.32 kg/ plant) was recorded from treatment Sulphur @ 150 g/plant/year + Magnesium @ 100 g/plant/year (T_{14}) followed by the yield (57.27kg/tree) recorded in the treatment with sulphur @ 100 g/plant/year + magnesium @ 150 g/plant/year (T_{12}). Fruit with maximum aril content (17.53 g) was recorded by treatment with sulphur @ 100 g/plant/year + magnesium @ 150 g/plant/year (T_{12}). The treatment sulphur @ 150 g/plant/year + magnesium @ 100 g/plant /year (T_{14}) caused highest TSS content (17.57°Brix) followed by the treatment sulphur @ 100 g/plant/year + magnesium @ 150 g/plant/year (T_{12}) with TSS content 17.44°Brix. The lowest acidity of (0.36%), maximum total sugar (15.50%), reducing sugar (12.22%), highest anthocyanin content of peel (41.23 mg/100g) was recorded from plant receiving Sulphur @ 100 g/plant/year + Magnesium @ 150 g/plant/year (T_{12}). From perusal observation of the results it can be concluded that application of Sulphur @ 100 g/plant/year + Magnesium @ 150g /plant/year in litchi would improve the fruit set, fruit retention, yield and quality.

Limnological Study of Bansagar Multipurpose Project of Madhya Pradesh, India with Special Reference to Ichthyo - Faunal Diversity

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Bansagar Dam is a multipurpose river Valley Project on Sone River situated in the Ganges Basin in Madhya Pradesh, India envisaging both irrigation and hydroelectric power generation. The Bansagar Dam across Sone River has been constructed at village Deolond in Shahdol district on Rewa – Shahdol road, at a distance of 51.4 km from Rewa (24°11′30″N 81°17′15″E / 24° 19′ 67″ N 81° 28' 50" E) having catchment area of 18648 sq. kms., dam height-67 metre, dam length-1020 metre, dam type- masonry/ earthen, spillway capacity- 47742 m^3/s and live storage of 5.41 km^3. Dams and barrages cut off the connectivity of the river with its associated ecosystems as they alter the flow, temperature and sediment regime of lotic systems. Hydrological modifications and absence of water in rivers affect species richness, so the links between dam, hydrological changes and fisheries require urgent attention and more work. The objective of this investigation was to find out hydrobiological parameters of Bansagar Project including lotic and lentic habitat with ichthyofaunal biodiversity for period of 2012-2014. Water quality parameters such as temperature, pH, conductivity, hardness, total alkalinity, total dissolved solids (TDS), dissolved oxygen, free carbon dioxide, nitrate, nitrite, sulphate and phosphate were analysed following APHA (2005) and Trivedi and Goel (1984) to evaluate the distribution and diversity of bio resources between sampling sites. Community indices such as abundance, relative abundance, Shannon-Wiener Index, Simpson's Diversity Index and evenness index were used (Magurran, 1988). Ichthyofaunal identification was done according to Shrivastav (1984) and Jayram (1999).

Fishes of 61 taxa 34 genera of 14 families, 7orders of sub class Actinoptrygii, Class Teleostomii were identified. A total of 47 taxa of zooplankton were recorded with 20 rotifers, 5 copepods, 6 cladocerans, 2 ostracoda and 11protozoans. More number of zooplankton species was recorded in upstream and lower percentage 38 in canals of barrage Silpara. Phytoplankton has shown great fluctuation in species diversity and evenness in upstream, downstream and in canals probably due to changes in hydrological flow from dam which is reflected in abundance, diversity and richness of fish species. Periphyton diversity was used as a bio monitoring tool to detect and evaluate the status of the water quality and calculated by applying the Shannon Weaver diversity index, H' (1963). The grading of water was as follows: Diversity index 4 was in upper stretches; between 3-4 in middle water, between 2-3 at Beeher and less than 2 was Beeher -Bichhia. Periphyton population varied between 3,105-36,980 u cm^{-2}. Lowest periphyton density was observed during monsoon while highest density was seen during pre monsoon. Bacillariophyceae was (57.4-76.4%) in all the seasons.

Chlorophyceae showed its maximum value during pre monsoon (37.1%) whereas Bacillariophyceae during monsoon (46.4%). Average H'and J value was 3.6 and 0.77 respectively. At lower stretch, periphyton populations were 8,475 u cm^{-2}, 7,820 u cm^{-2} and 8390 for winter, pre and post monsoon respectively. Bacillariophyceae was the dominant group (53.2-57.7%). The contribution of Chlorophyceae increased and fluctuated from 39.4-42.9% whereas Cyanophyceae remained low (1.8-2.4%). Upper stretches were more suitable habitat for fishes compared to lower. Exploitation rate was maximum (0.77) and minimum (0.56) at river stretches near barrage. Major carps were over exploited in Bansagar dam and optimum exploitation was in the Beehar barrage. The growth coefficient of major carps was maximum (0.78 yr-1) at upper stretch compared to the middle stretch (0.61 yr-1) and at lower stretch in the Beeher at Silpara barrage (0.50 yr-1). Exploitation rate was maximum in the Bansagar (0.82) and the Tons river (0.80) compared to Beeher River (0.71). Major carps were highly over exploited in all sampling stations. Over exploitation results in reduction of average size of fish in a stock.

Key words: Hydrobiological parameters, Ichthyofaunal diversity, Species diversity index, Bansagar Multipurpose Project, Beeher River, Madhya Pradesh

Environment Degradation and Human Health

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Although the estimates vary considerably, global warming stemming from man-made emissions, primarily from fossil fuel combustion, could increase surface temperature by 2-11^0 C in this century. Global warming will in future, and in all likelihood already triggering an expansion in the range and incidence of different kinds of infections and diseases in plants, animals and mankind. Hot climate make insect pests in general and vectors & pathogens in particular to spread over a wider range and enhances their survival rate. An increase of 1^0 C in surface temperature is estimated to correspond 10 % increase in incidence of insects as pests and insurgence of vector borne diseases. In absolute terms, a rise of 3-5^0 C temperature translates to about an extra 50-80 million cases of malaria per year in India, and 290 million more cases of malaria worldwide. As insect metabolism is temperature dependent and small changes can have significant effects on lengthening of breeding seasons and changes in insect distribution geographically. As many as, 30 new diseases associated with established insect species have flared up during last two decades throughout the Globe. The effect is enormous on new invasive insect species and also responsible for resurgence of old pest species. The effect of climate change and global warming is drastic on insects in our megabiodiverse country India.

Key words: global warming, diseases, insects, India

Identification of Rice Landrace with Cold Tolerance at Various Growth Stages through Phenotypic and Genotypic Analysis

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In this study, a rice landrace was screened for cold tolerance at different growth stage (seed germination, vegetative and reproductive stage) through phenotypic and genotypic level. In seed germination, it accounted for more than 80 per cent of survival rate under flooding. In cold screening, it was categorized as highly tolerant at 4°C after 8 days stress at phenotypic level and its association with cold tolerance at vegetative state confirmed at molecular level also with SSR markers. With SSLP markers linked with Ctb1 locus for booting stage cold tolerance, this landrace possessed gene sequence similar to that of reference genotype. Therefore, we state that this landrace after thorough screening at phenotypic level could be used in breeding programme for improving cold tolerance in locally adapted indica rice cultivars since this rice genotype has responded at significant level in cold tolerance at seed germination, vegetative and reproductive stage in the screening of phenotypic as well as molecular level.

Key words: cold tolerance, rice landrace, microsatelite (SSR) marker, seed germination, SSLP marker

Effect on Total MUFA's of *Cyprinus carpio* (Linn.) Reared in Different Salinities during Different Seasons

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The past decade has witnessed a substantial increase in knowledge of the role of particular fatty acids in determining health and nutritional well-being. The fat from fish is considered the most accessible and concentrated source of polyunsaturated (PUFA's), monounsaturated (MUFA's) and saturated fatty acids (SFA's). Monounsaturated fat is considered to be one of the healthiest types of dietary fat, which remains stable at higher temperature and is, therefore, better for cooking because they're less likely to hydrogenate or become saturated. Consumption of higher levels of MUFA's lowers the levels of undesirable low density lipoprotein (LDL) blood cholesterol without decreasing high density lipoprotein (HDL) cholesterol levels and reduces cardiovascular disease, which is beneficial for the human body. Numerous clinical studies point to an epidemiological evidence that dietary intake of MUFA's have a beneficial effect on the risk of coronary heart disease, lowering of systolic blood pressure, (SBP) and significantly reduced diastolic blood pressure (DBP). Clinical research has further shown a protective association between Oleic acid (the most abundant fatty acid within MUFA's) and breast cancer. Clinical studies have related that the consumption of a high-MUFA diet can be used instead of a high carbohydrate diet in patients with non-insulin-dependent diabetes mellitus.

Cyprinus carpio, the common carp or golden fish, in the Indian sub-continent is a highly delicious, valuable table fish. It is a well-known stenohaline freshwater fish used as a generalist species because they tolerate a wide range of conditions and habitats. Salinity is one of the most significant environmental parameters influencing fatty acid composition of fish. In the present study, common carp was reared in laboratory conditions at different salinities during different seasons (summer, autumn and winter) to observe the total monounsaturated fatty acids (MUFA's) content of carp fingerlings. A total of one hundred and fifty fingerlings were subjected to different salinity regimes (0, 1.5, 3, 6, and 12 ppt). The experiment was conducted in triplicate for 60 days in aquaria of 38 litres capacity fitted with complete aeration and filteration system, with 10 fishes in each. The different rearing groups were fed with the same standard diet during all the different seasons. The period from May-July had a high water temperature range between 28.0^{0}C- 37.0^{0}C during experiments with laboratory air temperature ranging from 31.0^{0}C- 37.5^{0}C. Similarly, the months September-November were taken as the mild water temperature of 22.5^{0}C- 30.5^{0}C with air temperature ranging from 23.0^{0}C- 31.0^{0}C. December-February months were considered as low water temperature (14.5^{0}C-

19.0^{0}C) with air temperature ranging from 13.5^{0}C -19.0^{0}C. Muscle total MUFA's were determined by Gas Chromatography and the samples in triplicate from different treatments were analyzed twice - on day zero of every experimental beginning and again after 60 days of rearing by using standard procedures (AOAC, 2000). Salinity, season and their interaction significantly affected total MUFA's. During the different seasons, the content of total MUFA's significantly decreased with increase in salinity ($p \leq 0.05$). The oleic acid (18: 1n-9) was the only major MUFA identified in different salinities during all seasons while palmitoleic acid (16:1n-7) was identified only in 6 ppt (0.20±0.10) during autumn. Total MUFA's were identified maximum in 0 ppt (9.28±0.72) during summer and minimum in 6 ppt (4.38±0.17) followed by 12 ppt (4.25±0.07) during winter. The present findings demonstrate that environmental salinity affects the muscle total MUFA's of carp fingerlings which indicates that the change may be related to a specific adaptation in fish physiology when exposed to saline environment. The results direct attention to the fact that rearing of common carp in areas of high water salinity could contribute to an increased fish production and economic benefit in the water logged areas which had earlier been classified as wasteland.

Key words: *Cyprinus carpio*, unsaturated fatty acids, salinity, temperature.

Effect of Heavy Metal on the Survival, Growth and Development of the Earthworm *Eisenia fetida*

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Earthworms form one of the major macrofauna among soil biota to maintain dynamic equilibrium and regulate soil fertility. Their existence depends on adequate moisture, soil texture, pH, electrolyte concentration, and food source in the given ecosystem. This clearly indicates the interdependency of the environmental factors to the survival of earthworms; when such conditions are created, they further contribute to soil fertility through their activity. The present study was to determine the effect of the polluted soil on the survival, growth and development of *Eisenia fetida.* Metal contaminated soil samples were collected from five different sites of Ludhiana City which is an industrial hub of Punjab. The sites were selected on their proximity to industrial units, as the discharge was to affect the soil and water bodies. The soil samples were analyzed to determine the heavy metals in the soil and the prominent metals identified were Lead, Chromium and Nickel. The artificial soil was prepared following OECD guideline No.207. To allow accumulation rates in the artificial soil to be compared with the contaminated soils, metals were added to the soil in similar ratios to those found at the sites. Salts of lead nitrate, chromium nitrate and nickel nitrate were mixed with soil to give dry weight concentrations of 42.6 mg/kg, 70.0 mg/kg, 112 mg/kg of lead; 64.0 mg/kg, 173.5 mg/kg, 347 mg/kg of chromium; 50.0 mg/kg, 94.5 mg/kg, 189mg/kg of nickel. These three concentrations were classified as low, high and very high. The dry soil was moistened with distilled water to obtain approximately half of the final required water content. Three replicates were used for each test and control. Juvenile forms of *E. fetida* were obtained from the stock culture maintained at the laboratory. Ten worms were selected, acclimatized for seven days, washed, weighed, placed into each of three replicate trays and were checked to ensure that all the worms had burrowed into the soil. Optimum growth conditions of temperature, pH and moisture were maintained and worms were sorted from all the soil samples and monitored for parameters like survival, weight, cocoons laid and hatchlings on days 7, 14, 21, 28 of the experiment. The results indicate that there was 100% survival of *Eisenia fetida* in all soil samples amended with lead, chromium and nickel as a mixture. Extrusion of coelomic fluid and loss of weight of earthworm was recorded in the treatment groups as compared to control, indicating that the presence of heavy metals in the substrate adversely affect the growth of earthworms. Worms started producing cocoons one week earlier in control sample and soil samples which had low heavy metal concentration *vis-a-vis* the treated groups. The total number of cocoons produced was significantly less ($p>0.05$) in soil sample with low dose as compared to control sample of soil. Earthworms in samples with high and very high doses produced cocoons in the 2nd

week of the experiment. The total number of cocoons laid in treatment samples of all concentrations were significantly lower as compared to control leading to the inference that the concentration of heavy metals is directly proportionally to the reduced production of cocoons. The emergence of hatchlings started one week earlier than soil of medium and high concentration of metals. The, production rate of 0.75±0.09 hatchling per cocoon per week in control was the maximum, as compared to the treatment samples, which followed a gradient – soil sample 1 (low concentration), hatchling production rate of 0.43±0.12 hatchling per cocoon per week> sample 2 (0.33±0.06)> sample 3 (0.13±0.08), indicating that the presence of heavy metals adversely affected the reproduction in earthworm. The study indicates that the presence of heavy metals in agricultural soils is detrimental to the survival of the earthworms. The population and presence of earthworms could be an indicator of soil health as their presence could be very beneficial for increasing the productivity of our crops.

Key words: Composting, *Eisenia fetida*, heavy metals, reproduction, soil.

A Study on Induction of Oxidative Stress by Arsenic Trioxide on Some Vital Organs of Chick Embryos

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Regular exposure to arsenic through contaminated drinking water (>10ppb) in arsenic-endemic areas lead to chronic toxicity not only in adults and children but also has the ability to potentially affect the growing foetus in the mother's womb. The objective of the present study is to determine the risk arsenic poses to the developing embryo. Chick embryos were used as model organism in this study. Fertilized eggs of White Leg-horn chicken were injected with a single sub – lethal dose of Arsenic trioxide (As_2O_3) @ 3 µg / egg in the blasto-disc area at zero- hour incubation. The treated and control embryos were then incubated and sacrificed at different fixation intervals. Vital organs like liver and kidney tissues were harvested for toxicity studies. Size and weight of the arsenic challenged whole embryos were found to be significantly reduced with concomitant loss in weight of the vital organs. Protein synthesis was reduced from 41mg/gm to 12 mg/gm in liver and 23 mg/gm to 12 mg/gm in kidney of the arsenic intoxicated embryos. There were significant elevation of acid phosphatase, alkaline phosphatase and lipid peroxidase enzymes by almost 50% with a corresponding reduction of GSH content in both liver and kidney showing an induction of oxidative stress in the affected tissues of the treated embryos. Atomic absorption spectrometry studies have shown arsenic accumulation in the vital organs of the treated chick embryos. Therefore, arsenic trioxide may be held responsible for the induction of oxidative stress and subsequent disruption of proper growth and development of the growing chick embryo.

Key words: arsenic, embryos, liver, kidney, oxidative stress.

Long-Term Climate Change Impacts Monitoring on Alpine Vegetation of Arunachal Himalaya using Multi Summit Approach

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Anthropogenic activities coupled with other pressures led to climate change which threatens the biodiversity including alpine ecosystems. Keeping above in account ISRO-SAC has initiated a long-term monitoring network HIMADRI project to perceive the impact of climate change induced impact on Himalayan mountains with an aim to gather the globally comparative data as it follows the standardised sampling design like GLORIA's Multi-Summit approach. This approach mainly focuses on quantitative data of species richness, composition, vegetation cover, soil temperature and temporal changes in composition and vegetation patterns based on the results of summits of selected target regions. An advantage of such approach further includes comparability, simplicity and economy including less instruments/time involvement. Arunachal Pradesh is the largest state of North eastern region of the country sharing international boundaries with China, Bhutan, Myanmar and Tibet with 83743 km^2 geographical areas which constitute 2.54% of total area of the country and lies in the belt of Indian Himalaya considering rich biological diversity and high (80.39%) forest cover (FSI 2013). The present study emphasises the ground survey data on surface cover type and vegetation pattern in Alpine region. The study is carried out using multi summit approach at Mangelum Gumpa (3657m asl), PTSO Lake (3953m asl) and Nagula (4179m asl), Tawang district. All the plants present in the summit area were quantified based on the standard methodology and specimens were collected and identified. Ground coverage was mainly categorized in to species and litter cover. Quantitative study on surface covers of the selected summit reveals that (83.50-83.12%) of vascular plant, (0.0-0.4.37%) solid rock, (9.68-19.13%) of bryophytes and (1-1.44%) of lichen and (4.81-5.68%) of litter. *Polygonum* sps, *Rhododendron* sps, *Juniperus* sps, were among the dominant plant species of Nagula, PTSO and Mangelum, respectively as compare to the other recorded species. *Abies densa* is most common species of Mangelum and PTSO Lake while completely absent at Nagula. The findings are based on the initial data collected from long-term established monitoring summit and will help to understand the effect of climate change in Indian Himalaya in long run way.

Key words: Cover type, Vegetation pattern, Arunachal Pradesh, Climate change

GIS Based Study on Some Environmental Aspectsof Ganga Ghats in Varanasi, Uttar Pradesh, India

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These has been an increase in nationwide interest in restoring urban rivers, whether for open space or recreational purposes or as a catalyst for economic development. All across the country, cities that once turned their backs on their rivers are now welcoming them with open arms.

Riverfront sites are often among the most ignored sections of our cities. These sites are dirty, abused, derelict, and plagued by environmental issues: unstable landfills, contaminated soils and water, lost habitats, disturbed artifacts, trapped sedimentary pollutants, etc. City residents were completely cut off from their rivers. Despite these issues riverfronts are still valued. Nothing quite compares to the experience of being close to the water's edge. The objectives of the present study are: (i) demarcation of silt deposition, civic amenities, stench, filth and sanitation sites over the Ghats of the Ganga in Varanasi and (ii) demarcation of the socio-economic profiles of the dependent population and their activities along the river front in Varanasi. Varanasi is located in the middle Ganges valley of North India, in the Eastern part of the state of Uttar Pradesh, along the left crescent-shaped bank of the Ganges, averaging between 15 and 21 meter above the river. In the present study, it is proposed to prepare a large scale map of the Ghats at 1:100 showing the status of various environmental aspects. Such a map showing the entire length of Ghats is non-existent. Mapping is carried out using Differential Global Positioning System (DGPS) and Total Stations (TS) both of Leica make. Ground Control Points (GCPs) with DGPS are taken and Total Station survey proceeded using these GCPs. Total Station points are transferred onto GIS platform and lines are drawn bringing out the steps/Ghats along the river front in ArC-GIS. Various environmental attributes are added onto this map and they are analysed vis-à-vis the socio-economic profile of the population along the river front.

Key words: Ganga River, Varanasi Ghats, DGPS, Total Station, Environmental Impacts

Antibacterial Activity of Probiotic Lactobacilli from Curd Samples against Clinical Bacterial Isolates

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The probiotic lactic acid bacteria grow in many food products, mainly in the fermented foods, and thus can be isolated from various fermented products of milk like yoghurt and curd. The curd isolates of lactobacilli have been reported earlier as probiotics based upon their sodium chloride tolerance, antibiotic susceptibility patterns and tolerance to low pH.

The current study was undertaken to isolate and identify the lactobacilli strains from curd samples for probiotic characterization, antibiotic resistance determination and to explore the antibacterial activity of the isolated *Lactobacillus* strains (alone or combination with one another, and with antibiotic) against human pathogenic bacteria: *Escherichia coli*, *Salmonella enterica* serovar Typhi, *Klebsiella pneumonae*, *Acinetobacter baumannii* and *Staphylococcus aureus*.

Key words: *Lactobacillus* strains, commercial and homemade curds, bile salt tolerance, zone diameter of inhibition, human pathogenic bacteria.

A Clean and Green Synthetic Route and Applied Aspects of Organomacrocyclic Complexes of Tin (II)

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Macro cycles are molecules that have opened new vistas of research in biomedical sciences. The chemistry of metal-nitrogen and metal- sulfur bonded compounds has come to occupy a prominent position in the research due to their economical importance in the field of agriculture, medicinal and industrial chemistry. Although N_4 – tetraamide derivatives of transition metal ions have been synthesized and some of their structures characterized, their interaction with main group metal ions and the formation of their coordination complexes are subject of current interest. The Principle theme of the our investigation in this field is to synthesize such macrocyclic tin(II) complexes which can be used to fight against infectious disease caused by microorganism without affecting the host so as to contribute in the field of agriculture and medicine. Therefore the, emphasis has been given to develop eco-friendly new inorganic pesticides and contraceptive agents. This paper deals with the designing of medically useful macrocyclic tin (II) derivatives of diamines and dicarboxilic acids. Finally, attempts have been made to assess the comparative growth inhibiting potential for a variety of fungal and bacterial stains. The main emphasis has been given on in vivo studies on male rats by performing biochemistry and fertility test. The aim is also to prevent the toxic effect or abnormal observations of the pesticides and antifertility agents. Good antimicrobial complexes have been selected for antitumour activity. The positive findings will be discussed in detail.

Key words: Macro cycles, macrocyclic tin (II), diamines, dicarboxilic acids, ecofriendly

Conservation of Biological Diversity under Changing Climate Scenario

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Global biodiversity is known for setting biophysical and ecological balance and support livelihoods for human well-being. With diverse species arriving at a number of about 1750000, it is more important to understand their distribution, endemism and challenges in different ecologies, keeping in view the tangible and non-tangible benefitsrendered by this mighty biological diversity in a wide range of climate and topographical domains.

Meanwhile, agricultural biodiversity which has a direct linkage to human survival is also beingcontemplatedfor developing a sustainable and resilient ecosystem. In the scenario of climate change, ecological sensitivity and environment linkages of biological diversity, fosters reduction in the pressures on biodiversity loss, thus envisaging ecosystem-based adaptation through science and technology interventions, however, within the policy framework to steer biodiversity conservation linking ecology, economic and ethics.

Key words: biodiversity, climate change, conservation

Microemulsification Technique in Food Processing Technology and Pharmaceutical Sciences

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Microemulsions are transparent and thermodynamically stable mixtures of oil and water stabilized by surfactants. Microemulsions contain extremely high oil/water interfacial areas offering ultra-low interfacial tension (less than 0.1 mN/m). Practical applications of microemulsion systems include enhanced oil recovery (EOR), drug delivery, nanoparticle synthesis food and cosmetics. A microemulsion is a transparent or nearly transparent, quasi-homogeneous, thermodynamically stable mixture of two immiscible liquid stabilized by surfactant (or mixture of surfactant). As pharmaceuticals drug delivery systems, microemulsion have unique properties, including clarity, high stability and ease of preparation (Kumar and Mittal, 1999). The transparency of microemulsions makes them especially attractive for cosmetic formulations as they give the perception of a clean system. The ultralow interfacial tension between oil and water facilitates the penetration of the production to nanoscale pores of human skin, making microemulsions a candidate for deep-cleansing products (Komesvarakul et al., 2006). Due to their physicochemical properties, microemulsion often advantages over traditional topical and transdermal drug delivery systems. Moreover, microemulsion dispersion are promising candidates as means for controlled drug delivery, and as drug carriers for oral, topical, and parenteral administration furthermore, microemulsion have been shown to process promising potential in the fields of cosmetic and various consumer products (Agrawal and Agrawal, 2012). Microemulsification technique retards the oxidation of fish oil. The peroxide and anisidine values are both drastically decreased when compared to pure fish oil, which has been demonstrated by keeping samples at 40°C for 18 days. Furthermore an improved effect was seen when ascorbic acid was solved in glycerol instead of in water. The oral delivery of hydrophobic drugs represents a major challenge because of the low aqueous solubility. Self microemulsifying drug delivery systems (SMEDDSs) have gained exposure for their ability to increase bioavailability and solubility of poorly soluble drugs. The efficiency of oral absorption of the drug compound from the SMEDDS depends on much formulation related parameters, like surfactant concentration, oil/surfactant ratio, polarity of the emulsion, droplet size and charge, all of which in together grouped to determine the self-emulsification ability.

Key words: Chemical interactions, Fish oil, Microemulsion

Impact of Rural Household Environs on Infant Mortality in the Urban Fringe Villages of Chhattiisgarh

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The aim of this paper is to analyze the impact of rural household environs on the infant mortality in the urban fringe villages of Chhattisgarh. The study is based on primary data. Information regarding ten cities namely Raipur, Bhilai, Durg, Rarnandgaon, Bilaspur, Korba, Ambikapur, Raigarh, Jagdalpur and Dhamtari are covered in this study. Primary data have been collected from 40 fringe villages in the region. Four villages from each of these ten cities have been purposive and randomly selected. Information from all the 1835 mothers, from all the 40 selected villages, who have delivered a baby or whose child died or child birth and death both occurred during the year 2011, have been obtained by schedules.

All the 1835 mothers gave birth to 1871 live and 16 still babies, and in all 137 infants died in the year 2011. The infant mortality rate in the fringe areas was 75.65 per thousand. A highest IMR of 109.09 per thousand in Ambikapur fringe areas is reported because of low economic status and low level of education particularly among the tribal community. The perinatal, neonatal, and post-neonatal mortality rates in the fringe areas have been 31.00, 58.26, and 14.97 per thousand respectively. The mortality rate of male children (74.92 per thousand) has slightly more than female children (71.58 per thousand). The IMR for female infants exceeded, particularly in Ambikapur, Bhilainagar, Raipur, Raigarh and Jagdalpur cities than the male infants.

The determinants of household environs namely number of rooms, sewerage system, cattle sheds , type of house, toilet facilities, type of family, source of drinking water, electricity facilities, cleanliness of house, place of delivery, delivery assistant, period of breast feeding, water and solid food intake, have considerably affected the infant mortality in the urban fringe villages of Chhattisgarh.

Key words: household environs, infant mortality, Chattisgarh

Prevalence of Macrofungi in different Seasons in Allahabad Region

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The present investigation was carried out in different parts of Allahabad region in order to measure the frequency of growth and type of macrofungi in different seasons of a year. Frequent field visits and collections were made between July 2009 and June 2010 and fruiting bodies were collected. Specimens were preserved either by drying in oven at 60˚C ± 3˚C or by keeping them in preservatives like FAA (Formalin Acetic Acid Alcohol) solution. Hard and woody species were air dried and kept with naphthalene balls. As a result of an extensive field survey and microscopic examination after staining in laboratory, 24 taxa belonging to 11 families were identified. 2 families and 3 taxa belonged to class Ascomycetes viz. Family Xylariaceae and Morchellaceae, and 9 families and 21 taxa to class Basidiomycetes viz. Family- Auriculariaceae, Phallaceae, Lycoperdaceae, Astraeaceae, Agaricaceae, Bolbitiaceae, Coprinaceae and Tricholomataceae. Out of total 21 species 9 species were found on wood and 12 were collected from soil. Some of these macrofungi are edible viz. *Auricularia auricula-judae, Auricularia polytricha, Calvatia cyathiformis, Agaricus augustus, Agaricus campestris, Coprinus comatus, Coprinus micaceous, Clitocybe flaccid* and *Marasmius oreades*. *Amanita vaginata* is poisonous and remaining species are inedible. The period from late June to September (South-West Monsoon) coinciding with the season under maximum rainfall was found to be most favourable for growth of macrofungi.

Key words: macrofungi, growth, seasons, Allahabad

Flowering Calendar of the Macrophytes of Keibul Lamjao National Park, Loktak Lake, Manipur, India

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In Manipur State there are generally four seasons namely, winter (November, December and January), spring or monsoon (January, March and April), rainy season (May, June and July) and Summer (August, September and October). However, to know the floristic composition of the angiospermic plants, we need to collect information throughout the year. In the present study the flowering calendar of Keibul Lamjao National Park (KLNP), Loktak Lake having six study sites viz., Keibul, Nongmaikhong, Kumbi, Khordak, Sargam and Toyaching were studied and monthly flowering calendars were taken for two year period (2010 to 2011).Comparison of flowering calendars of the stages of flowering period of six study sites during the calendar year 2010 to 2011 were incorporated. Flowering calendars were regular periodically surveyed and recorded. Sargam showed maximum number of flowering plants (44), during the period September to November. In Nongmaikhong the number of flowering plants were (29) in the month of September to November. In case of Kumbi number of flowering plants reached 30 during the month of September to November. In Khordak the numbers of plants were recorded up to 32 during the period of September to November. However, Toyaching reached the number of plants (35) during the period June to August. Lowest plant numbers (14) were noticed in Keibul during the month of June to August. From the findings, we need to conserve the natural habitat of KLNP thereby maintaining the luxuriant growth of the seasonal and perennial, macrophytes which are mentioned above during the study of flowering calendar, so as to maintain and conserve the natural flora and fauna of the park.

Key Words: Keibul Lamjao National Park, Flowering Calendar

Seasonal Fluctuation of Sugarcane Woolly Aphid (*Ceratovacuna lanigera* Zehntner Homoptera: Aphididae) and Its Predators in Southern Trasitional Zone of Karnataka

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Survey conducted to know the seasonal incidence of sugar cane woolly aphid from 2009-2012 at Shimoga revealed that, the incidence began in the first fortnight of June and there after increased gradually and reached its peak during the month of October - November later on the incidence declined gradually and reached its lowest peak in February – March. In conclusion, the population dynamics of *C. lanigera* indicated enormous reproduction potential due to parthenogenetic type of reproduction and its high proliferation during favourable climatic conditions. Both *D. aphidivora* and *M igorotus* were identified as key mortality factors and active natural predators which could be successfully relied for the management of *C. lanigera* and their augmentation, multiplication and release be encouraged in sugarcane fields. Correlation between weather parameters and wooly aphid population revealed that, the pest population had highly significant positive correlation with all the predators. The pest intensity was significant and negatively correlated with maximum temperature. Seasonal incidence of *Micromus igorotus* and *Dipha aphidivora* revealed that the peak activity of the predator was noticed during October - November thorough out the studies period this may be due to peak woolly aphid activity during October - November and also due to temperature which could be congenial for the multiplication of woolly aphid and also its predator, as the summer approaches the activity of SWA as well as *M. igorotus* and *Dipha aphidivora* starts declining this could be due to high summer temperature. The correlation between *M igorotus*, and weather parameters indicate that they were significant and negatively correlated with maximum temperature and so also in case of *D.aphidivora*.

Key words: Sugarcane Wooly aphid, Predator, *Dipha aphidivora, Micromus igorotus*

Bioecology of Sugarcane Woolly Aphid (*Ceratovacuna lanigera* Zehntner Homoptera: Aphididae) in Southern Trasitional Zone of Karnataka

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The biology of sugarcane woolly aphid revealed that, the total nymphal duration of the aphid under field condition ranged from 24.00 to 29.00 days with an average of 26.53 ± 1.2 1 days during July - August 2010 and 18.00 to 23.50 days with an average of 20.80 ± 1.55 days during July - August 2011 . Under laboratory conditions the duration ranged from 18.00 to 23.50 days with an average of 20.80 ± 1 .55 days during July - August 2010 and 24.00 to 29.00 days with an average of 26.9l ± 1.17 days during July - August 2011 . The longevity of apterous adult ranged from 17.00 to 19.50 days with an average of 18.65 ± 0.67 days during July - August 2010 and 13.00 to 14.00 days with an average of 13.33 ± 0.34 days during July - August 2011 under field condition. Under laboratory condition longevity of adult ranged from 13 .00 to 14.00 days with an average of 13.33 ± 0.34 days during July - August 2010 and 20.00 to 22.50 days with an average of 21 .78 ± 0.75 days during July - August 2011. The mode of reproduction in SWA was mainly through parthenogenetic viviparity. The number of young ones laid by the apterous adult varied from 32.00 to 53.00 nymphs with a mean of 47.00 ± 5.39 nymphs in its life span of 18.65 days during July - August 2010 and it ranged from 38.00 to 60.00 with a mean of 48.90 ± 7.30 nymphs in its life span of 13.33 days during July-August 2011 in field conditions and in laboratory conditions it ranged from 23.00 to 49.00 nymphs with a mean of 36.70 ± 6.83 nymphs in its life span of 13.33 days during July - August 2010 and it ranged from 23.00 to 49.00 nymphs with a mean of 36.45 ± 5.88 nymphs per aphid during its life span of 21.78 days during July -August 2011. Dispersal takes place in both nymphal (apterous form) and in adult stage (alate form). In apterous forms, migration takes place during first and second nymphal stages before the woolly growth. During early hours of the day the first and second nymphal stages of apterous form move actively from basal portion of leaf to the tip forming a balloon like structure. When there is a slight jerk due to wind, the entire balloon will be carried along the wind, it falls on the neighboring plant or field. This type of dispersal recorded when the aphid infestation was severe.

Key words: Sugarcane Wooly aphid, Predator, *Dipha aphidivora*, *Micromus igorotus*

Bioecology of Micromus Igorotus (Banks) {Hemerobidae: Neuropteran} a Predator of Sugarcane Woolly Aphid (*Ceratovacuna lanigera* Zehntner Homoptera: Aphididae) in Southern Trasitional Zone of Karnataka

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The biology of *Micromus igorotus* Banks reveled that, the eggs were laid in single or multiple rows on the silken thread. The eggs were oval shaped and light brown in colour initially and later turned to dark brownish in colour. The incubation period ranged from three to five days with an average of 3.40 ± 0.58 days during July- September 2010 and the total larval period lasted for 6.64 ± 0.99 with a range of 5 to 9 days during July - September 2010. Larva spin white, flimsy cocoon in protected place generally on dried sugarcane leaf exiles in field, in laboratory on corrugated paper strip in between ridge and furrow. Pupa present inside the cocoon, the cocoon has two layers. Outer layer (Foundation layer) and inner layer which is thick, chitinious brown in colour and oval shape. The pupal duration was 7.08 + 1.32 days during July- September 2010. The adult moths were medium sized, brown in colour with long filiform antennae and dark brown eyes. Adults are weak fliers, more active at dusk and attracted towards light both pair of wings are transparent with clear venation. They have mandibulated type of mouthpart and feed on aphids. Female moth is quite bigger than male moth. Male adult longevity ranged from 14 to 28 days with a mean of 22.00 + 3.84 days the female adult longevity ranged from 28 to 38 days with a mean of 32.35 ± 2.81 days during July- September 2010. The fecundity ranged from 432 to 876 eggs per female with an average of 690.90 + 136.68 eggs during July – September. The feeding potential of the predator of SWA under laboratory conditions during 2010 July to September reveled that mean number of SWA aphids preyed by the first, second and third instar larvae amounted to 40.10 + 9. 17 (range = 22 to 56) 135.45 ± 12.20 (range 112 to 160) and 162.95 ± 16.59 (range = 124 to 191), respectively.

Key words: Sugarcane Wooly aphid, Predator, *Micromus igorotus*

Standardization of Mass Production Techniques of Micromus Igorotus (Banks) {Hemerobidae: Neuropteran} a Predator of Sugarcane Woolly Aphid (*Ceratovacuna lanigera* Zehntner Homoptera: Aphididae) in Southern Trasitional Zone of Karnataka

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Expermiments conducted to standardization of mass production of *M. igorotus* an important predator of sugarcane woolly aphid in southern Transitional Zone of Karnataka revealed that out of five materials that were evaluated for their suitability as ovipositional substrate for *M. igorotus* under laboratory condition maximum number of eggs were laid when silk of multivoltine thread was offered in net mesh as ovipositional substrate the oviposition ranged from 432 to 876 eggs with mean of 690.90 + 136.68, similarly regards to the larval densities to be released into insect rearing box maximum pupation was recorded when 70 larvae were released in group per rearing box the number of larvae that went to pupation is 54.90 (78.75 ± 4.13 percent), range =71 to 86 percent and the pupal densities to be released into insect rearing box maximum adult emergence was recorded when 70 pupa were released in group per rearing box (22 cm diameter) the number of pupa from where adult emerged was 52. 1 5 (74.45 ± 431 percent, range 64 to 80 percent) and maximum pupation was obtained when corrugated brown color paper was offered as pupation substrate.

Key words: Sugarcane Wooly aphid, Predator, *Micromus igorotus,* Mass Production

Standardization of Mass Production Techniques of Dipha Aphidivora Meyric {Pyralidae: Lepidoptera} a Predator of Sugarcane Woolly Aphid (*Ceratovacuna lanigera* Zehntner Homoptera: Aphididae) in Southern Trasitional Zone of Karnataka

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A Field experiment was conducted to standardize the mass production techniques of *Dipha aphidivora* an important predator of sugarcane wooly aphid reveled that When 80 *D. aphidivora* larvae were released on, non-replicated sugar cane crop of 4, 5, 6, 7, 8 and 9 months old crop under shade net cages, where the average temperature was 28^{0}C and average relative humidity was 76 per cent. Under the shade net cages the pest intensity rating was 4 when the predators were released for multiplication and to all the crop uniformly 25 percent more nitrogen was given. The number of *D.aphidivora* harvested after three months per shade net was 972, 1368, 2687, 4582, 2491 and 1286 from fourth, fifth, sixth, seventh, eighth and ninth month old crop, respectively. When the known number of *D.aphidivora* pupae to be released per shade net cage , 20, 40, 60, 80, 100, 120, 140, 160, 180 and 200 pupae were released per shade net cage of 100 cubic feet , the number of *D.aphidivora* harvested after two months was 800, 1320, 3700, 4780, 2890 1860, 1240 1100, 890 and 600 respectively.

Different irrigation intervals were followed i.e., irrigating first shade net caged crop daily, irrigating the second shade netted crop once in two days, irrigating the third shade netted crop once in three days, irrigating the third shade netted crop once in three days, irrigating the fourth shaded netted crop once in four days, irrigating the fifth shade netted crop once in five days, irrigating the sixth shade netted crop once in six days and irrigating the seventh shade netted crop once in seven days and in all the seven treatments uniformly seven month old crop was maintained at the time of release of *D. aphidivora* pupa and to all the treatment 25 percent more nitrogen was given and for all the treatment uniformly 80 *D. aphidivora* pupa was released at the time of release of pupa the pest intensity ratting was maintained at 4. The number of *D.aphidivora* harvested after three months from these shade net cages was 2630, 4890, 3940, 2790, 1920, 1680 and 940 from daily irrigating crop, once in two days irrigating crop, once in three days irrigating crop, once in four days irrigating crop, once in five days irrigating crop, once in six days irrigating crop and once in a week irrigating crop respectively.

Key words: Sugarcane Wooly aphid, Predator, *Dipha aphidivora,* Mass Production

Assesment of Impact of Micromus Igorotus (Banks) {Hemerobidae: Neuropteran} a Predator of Sugarcane Woolly Aphid (*Ceratovacuna lanigera* Zehntner Homoptera: Aphididae) in Southern Trasitional Zone of Karnataka

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The observations over eight fortnights revealed that all the treatments differed significantly. In treatment with initial infestation of SWA with *M. igorotus* (T_1), population of SWA was 11.36 aphids per 2.5cm^2 leaf area during I fortnight and it was reduced to 5.64 and 1.60 aphids per 2.5cm^2 leaf area during II and III fortnights, respectively. The population was nil during IV fortnight. Again the population increased during V, VI and VII fortnight with 1.7 5.42,and 8.96 aphids per 2.5cm^2 leaf area , respectively again begin to decrease during VII and VIII fortnight with 0.82 aphids per 2.5cm^2 leaf area . The mean number of predators present was 1.10 In treatment with heavy infestation of SWA with *M.igorotus* (T_2) population of SWA was 50.36 aphids per 2.5cm^2 leaf area during I fortnight and it was reduced to 35.20, 20.40, 8.20, 4.60, 1.62, 0.76 and 0.00 aphids per 2.5cm^2 leaf area during II, III, IV, V, VI, VII and VIII fortnight, respectively. The mean number of predators present was 2.00 per plant. The pooled analysis of population counts over eight fortnights revealed significant difference between the treatments and the population of SWA ranged from 3.90 to 106.85 aphids per 2.5cm^2 leaf area. Significantly the highest population of 106.85 aphids per 2.5cm^2 leaf areas was recorded in the treatment with heavy infestation of SWA without *M.igorotus* and heavy infestation of SWA without *M.igorotus* and where inoculative release of *M.igorotus* was done with mean number of 20.25 and 12.12 aphids per 2.5cm^2 leaf area, respectively. The lowest population of 3.42 aphids per 2.5 2.5cm^2 leaf area was recorded in treatment with initial infestation of SWA without *M.igorotus* and where inoculataive release of *M.igorotus* was done followed by treatment with initial infestation of SWA with *M.igorotus* with number of 3.90 aphids per 2.5cm^2 leaf area.

Key words: Sugarcane Wooly aphid, Predator, *Micromus igorotus*

Feeding Potential of Micromus Igorotus (Banks) {Hemerobidae: Neuropteran} and Dipha Aphidivora Meyric {Pyralidae: Lepidoptera} Potential Predators of Sugarcane Woolly Aphid (*Ceratovacuna lanigera* Zehntner Homoptera: Aphididae) in Southern Trasitional Zone of Karnataka

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The feeding potential of the predator *Micromus igorotus* on SWA under laboratory conditions during 2010 July to September reveled that mean number of SWA aphids preyed by the first, second and third instar larvae amounted to 40.10 + 9. 17 (range = 22 to 56) 135.45 ± 12.20 (range 112 to 160) and 162.95 ± 16.59 (range = 124 to 191), respectively. Feeding potential increased with increase in instar stage. Average rate of intake, on daily basis by these instars, was 22.27, 52.91 and 57.37, respectively. The total larval consumption ranged from 298 to 393 with a mean of 339.85 ± 25.99 aphids. Adult lacewing, being predaceous on SWA, males consumed on an average 200.20 ± 25.19 range = 156 to 250 adult females consumed 312.32 ± I 3.78 (range = 223 to 300). Thus, the predator during its life time consumed 630.60 ± 37.34 aphids with a range of 569 – 701 aphids this accounted to mean reduction of 18.33 aphids per day. The feeding potential of pyralid predator, *D.aphidivora* studied on the sugar cane woolly aphid reveled that, the total feeding potential from I instar to V instar larval duration ranged from 1074 to 2266 mixed instar aphids with an average of 1870.60 ± 303.47 mixed instar aphids under laboratory conditions during July August 2010. The feeding potential was maximum in IV instar larvae with 493.70 ± 15.40 mixed instar aphids fed followed by V, III, II and I instar larvae. The per day feeding potential was maximum in V instar larvae followed by IV, III, II and I instar larvae. The percentage of feeding was maximum in case of IV instar followed by V, III, II and I instar. The total feeding potential from I instar to V instar larval period was 986 to 2490 mixed instar aphids with an average of 1372.65 + 54.85 mixed instar aphids under field conditions during September October 2009.

Key words: Sugarcane Wooly aphid, Predator, *Micromus igorotus*, *Dipha aphidivora*

Nutrient Removal Potential of Two Hydrophytes (Pistia and Salvinia) from a Eutrophicated Water Body in Sambalpur Town, Odisha

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Eutrophication is the process of nutrient enrichment and the associated excessive plant growth in water bodies. Most of the aquatic macrophytes are naturally occurring and well adapted for their surroundings and have capability to remove excessive nutrient load from the water. However, the removal efficiency of excessive nutrients like, Nitrate, Phosphate varies from plant to plant. The common Salvinia (*Salvinia minima*) and Water Lettuce (*Pistia stratiotes* L.) are two floating perennial plants and have been well studied for their tremendous potential for removing toxic heavy metals. However, literatures regarding their potential to remove nutrients from eutrophicated water bodies in Odisha are few. Keeping this in view the present study was carried out to assess removal efficiency of excessive nutrients like, Nitrate, Phosphate by *Salvinia minima* and *Pistia stratiotes* L. from a eutrophicated water body. Healthy *Pistia stratiotes* & *Salvinia natans* were placed in clean water for about three days, and then placed in the tubs containing waste water collected from a eutrophicated water body of Sambalpur town (experimental set up). The chemical parameters like pH, conductivity, COD, NO_3-N content, PO_4-P content of control (only waste water) and experimental tubs containing *Salvinia* and *Pistia* (five replicates) were determined in seven days interval up to 28^{th} days. Then the percentage removal of NO_3, PO_4 contents, and percentage reduction in COD and conductivity in both control and experimental waste water were calculated. The results indicated that *Pistia* and *Salvinia* have strong adaptability and grow rapidly, and can remove NO_3, PO_4 effectively and reduce COD and conductivity efficiently. The percentage reduction of COD, Conductivity, NO3, and PO_4 from waste water by Salvinia and Pistia were 71% and 60%, 78% and 75%, 78% and 60%, 89% and 86% respectively within 28 days. Thus, the study clearly emphasises that *Salvinia* and *Pistia* have strong nutrient removing capacity from waste water and can be used for phytoremediation purposes.

Key words: Eutrophication, *Salvinia minima, Pistia stratiotes* L, Odisha

Preliminary Study on Diversity and Occurance of Water Birds in Santragachi Bird Sanctuary, West Bengal, India

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The wetlands are defined as "area of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary with water that is static or flowing, fresh, brackish or saline include areas of marine water, the depth of which at low tide does not exceed six meters" (Ramsar Convention, 1971 and WWF, 1992). It is now universally accepted that wetlands, far from being the wastelands of past perception, can have a wide range of valuable functions which provide goods and services to mankind. According to Maltby (1986) the manifold values of wetlands as gene conservation, water treatment, nutrient and heavy metal removal, fresh water fishes, flood mitigation, tourism, wildlife habitat and energy and carbon-dioxide storage and release of oxygen.

The relation between wetlands and birds is shaped by many factors. These include the availability, depth, and quality of water; the availability of food and shelter; and the presence or absence of predators. Birds that use wetlands for breeding depend on the physical and biological attributes of the wetland. Birds have daily and seasonal dependencies on wetlands for food and other life-support systems. Thus these wetlands are considered to be an abode to migratory birds which serves as their refueling or stop over sites in their long journey and some even serve as their breeding grounds as well (Stewart, 2003).

The present study deals with the relationship between the physic-chemical parameter on diversity and occurrence of water birds in and around Santragachi Birds Sanctuary.

Key words: Diversity, Occurrence, Water Birds, Santragachi Bird Sanctuary

Deterioration and Degradation of Aquatic Systems due to Brick Kilns – A Study in Cachar District, Assam

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In Cachar brick industries are unorganised, rural, small scale industries which play an important role in economic development of the entire region. It has been observed during the study that these brick industries are responsible for large scale environmental pollution like land degradation, air pollution, water quality degradation etc . The present study deals with the quality of water in the selected brick kilns in Cachar district and its degradation during Jan-Dec 2014. 27 sites have been selected for the study. 18 sites (A1,A2,A3,B1,B2,B3,C1,C2,C3,D1,D2,D3,E1,E2,E3,F1,F2,F3) were selected near the brick kilns, 6 sites (A4,B4,C4,D4,E4,F4) were selected as control sites (10-15 kms away from the brick kilns) and 3 sites (G1,G2,G3) were selected from Chatla wetland in Cachar district for comparison. Water samples have been collected and Physico–Chemical properties of water like temperature, pH, conductivity, Total alkalinity, Dissolved oxygen, Carbondioxide, Nitrate, Phosphate, Transparency was estimated by using Standard Methods (APHA,1995,2005; Trivedi and Goel,1984). The study reports low water temperature i,e.19.8ºC ±1.2 in the Site D4 and high water temperature i,e. 26.5ºC±3.3 in site F2 located in brick kiln area. The higher level of water temperature might be due to heat generated by the brick kilns during its operational period while water temperature is low in the control site. Transparency is 7.7±0.2 cm in control site A4 and less in site F2 i,e. 2.4±0.3 cm, which might be due to erosion of soil that goes to the nearby aquatic system through the catchment channels. High level of pH has been observed in control site B4 i,e.7.1±0.1 while low in site C3 i,e.4.5±0.3 within the brick kiln area which might be due to leaching of compounds from the raw materials used in the brick kilns. Dissolve Oxygen level is more in control site C4 i,e. 12.3±0.6 mgl^{-1} and low i,e. 2.8±0.5 mgl^{-1} in site B1. Free CO_2 level was higher in site C2 i,e.18.1±1.3 mgl^{-1} and lower in site E4 i,e. 3.35±0.1 mgl^{-1} which shows more respiration of aquatic biota and decomposition of organic matter in water lowering the pH of water. Total alkalinity was high in site F4 i,e. 54.3±0.4 mgl^{-1} and low in site F3 i,e. 16.3±0.4 mgl^{-1}. Nitrate level was higher in B3 i,e.1.14±0.07 mgl^{-1} and lower in G2 i,e. 0.06±0.02 mgl^{-1} which might be due to the presence of aquatic plants and algae that use nitrate as a source of food. Phosphate level was low in site G2 i,e.0.11±0.02 mgl^{-1} and higher in site D3 i,e.1.63±0.02 mgl^{-1}. Presence of organic matter may increase the level of Posphate. Thus, from the results it can be concluded that the brick kilns highly affect the physico-chemical and biological properties of aquatic systems degrading its nature and quality. So, it is very essential to adopt some mitigation measures and also to implement appropriate regulatory measures regarding the maintenance of environment. It is also important to follow several conservation strategies to protect the degradation of aquatic bodies in the vicinity of brick kilns.

Key words: Degradation, Water quality deterioration, Physico-chemical properties, Soil erosion, Leaching

Brewing Trials using Sorghum Malt and Cassava as Adjuncts

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Brewing trials were carried out with sorghum malt and cassava (Manihot esculanta) as adjuncts. Five samples of wort were produced using different concentrations of cassava adjuncts at the following concentrations: 10%, 20%, 30%, 40% and 50% respectively. 100% sorghum malt was used as a control. The boiled, hopped and filtered worts were fermented within the temperature range of 12 – 14^0C using the bottom fermenting yeast, Saccharomyces uvarum. Primary fermentation lasted for 7 days while the beers were lagered for 14 days at 0 – 2^0C. The sorghum malt had a Germinative energy of 98% and a Germinative capacity of 96% respectively. While the cassava sample had HCN content of 9.7g/100g and HCN of malt as 3.16/100g. The beers obtained had SG ranges from 1.004 – 1.008 for all adjunct concentrations including the control (100% malt). The p^H obtained were 4.15 – 4.30 while alcohol content by weight are 3.8 – 3.9% and alcohol content by volume 4.85 – 4.95%. The HCN contents of beers were 1.62/100mg – 9.72 mg/100mg; with colors in EBC as 4.00 – 15.00 100% malt has the highest colour followed by 40% adjunct. In all the beer from 100% malt 10% adjunct have HCN below the acopteble level of 5mg/100mg and accepted at $p \leq 0.05$.

Key words: HCN, SG, EBC, Germinative energy, Germinative capacity, Saccharomyces uvarum, Mashing

Food Security and the Environment: Implications for North-East India

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Food security is always a matter of concern to the humanity from the time immemorial. Amongst the challenges of 21st century- climate change, food security and soil degradation is the most threatening aspect to the world today. Climate change and its impact on food security in North East Region (NER) are very poorly studied despite the fact that the region is climate- sensitive as far as the agricultural activity is concerned. Food security is affected by low levels of agricultural productivity and inadequate purchasing power. Extreme weather conditions and climatic change have major impact on the productivity of crop and food security in North East India. The three pillars of food security is largely affected by the climate change in NER. The region contributes only 1.5 percent to the total food grain production of the country, despite of receiving about 13 percent of the total rainfall of the country. Both the population growth and the growth in the demand for food in this region is increasing at much faster rate than in other regions of the country. The temperature of atmosphere in this region is increasing at an unbelievable pace with an overall decline in rainfall affecting the food security to a challenging manner. The tentative situation handling mechanism is at all there or not, is a question mark to the physical and social scientists. If any mechanism is available then also, how far it will help the population to cope-up and improve their food security is a matter of concern to the policy planner.

Key words: Food security, Climate change, Agricultural productivity

Effects of Seasonal Variations on Oxidative Stress Response in the Brain of *Bufo melanostictus*

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Brain is the most active organ for oxidative metabolism. Information on seasonal variation in reactive oxygen species (ROS) generation and their metabolism by redox regulating molecules in brain of amphibians in general and toads in particular in relation to season and sex could clarify the physiological basis of seasonal variation in terrestrial poikiolotherms.

The present study was undertaken to investigate the effects of seasonal variation on oxidative stress physiology in brain of the toad *Bufo melanostictus.*

Key words: Antioxidant, brain, poikilotherm, season, habitat warming

Development of Mathematical Model of Moving Bed Biological Reactor to Evaluate the Biofilm Thickness

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Moving bed biofilm reactor is an emerging and widely utilized form of treatment containing both attached and suspended form of biological process. The principle of biofilm treatment is formation of layer like aggregation of microorganisms over the carriers, which is an attached process, and carriers are held in suspension. The carriers are held in suspension by continuous aeration. The study of Monod kinetics relating to operating parameters is figured out using Excel in the preparation of mathematical model. Thickness of biofilm over the carriers is related to the influent substrate concentration so as to control the surface loading in the process. The operational parameters in this model are solids retention time, hydraulic retention time, percentage fills of carriers, surface loading rate and some other temperature affecting parameters.
The mathematical approach of finding the thickness of biofilm relates the flux concentration gradient and the surface loading rate. The wastewater flowing through the aeration tank supplied with oxygenated air containing dissolved and colloidal solids are consumed by the microorganisms (substrate utilization) forming a thin biofilm layer on the surface of carriers, which is both attached and suspended process. The biofilm generated plays a major role in the secondary treatment of wastewater. Thus biofilm modeling becomes important in quantifying various parameters, like effluent COD or removal efficiency. This model optimizes the value of solids retention time to be maintained in the system based on the surface loading rate and calculates the biofilm thickness formed over the carriers. The paper deals with the effect of substrate concentration and surface loading rate on the biofilm generated.

Key words: Moving bed biological reactor, biofilm thickness, percentage fill of carriers, modeling.

Domestic Wastewater Treatment using Constructed Wetland: An Efficient Alternative for the Treatment of Domestic Wastewater

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Constructed wetland are engineered systems that are designed and constructed to utilize the natural process involving wetland vegetation, soil and their associated microbial assemblage to assist in treating different types of wastewater. Many different processes occur simultaneously inside the system in order to reduce the contaminant level in wastewater. The contaminants present in wastewater are manly removed by filtration, sedimentation, biochemical interaction such as microbial degradation. They are designed to take advantages of different processes that occur in the natural wetland but do so within a more controlled environment.Constructed wetlands have been used widely for the treatment of municipal, industrial and agricultural wastewater, as well as for urban storm water. In this study *Typha* sp. was used as vegetation for the reduction in the contaminant level present in the domestic wastewater by using integrated set-up. An integrated set-up was constructed taking into account the EPA 1986 manual with dimension of 0.7×0.4×0.3m. The flow rate adapted is 6l/day with *Typha latifolia* as vegetation. For convincing flow of the wastewater a bottom slope of 1% is also adapted. After the plants attained its full growth the feed of domestic wastewater was given and the nutrient uptake by different parts of the plants will be analysed. A removal percentage of 70% of BOD and around 75% removal percentage of COD is expected from this study.

Key words: Domestic Waste Water, constructed wetland, treatment, Typha sp

Study of Ethnomedicinal Plants used by Certain North Eastern Tribes Settled in Assam

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Assam , a constituent state of India, strategically very important parts of North eastern region. The state is bounded by Bhutan and Arunachal Pradesh on North, Nagaland and Manipur in the East, Meghalaya and Mizoram on the South and Bangladesh. A survey was conducted to study the Biodiversity of ethnomedicinal plants along with their usages by some selected tribal communities settled in Assam. These comprises of Jaintia, Barman, H'mar, Chiru, Hrangkhol, Bodo, Rabha, Rongmei, Vaiphei, and Riang, tribes settled in Assam. In the present investigation it is revealed that out of 250 plant species, belonging to 110 families and 180 genera, comprising maximum species which are used for the treatment of diarrhea, dysentery, stomach disorders, spleen trouble, skin disease, cold and fever, cuts and wounds, a few of the species for curing diabetes, jaundice, arthritis and bone-fracture, kidney-stone, snake-bite, insect bite some to cure tooth-ache and mouth-ulcer, a few to cure gynecological problem, abortion, Childbirth, gonorrhea, sex hormonal diseases, mental disease, cancer, piles, and some plants against ethnoveterinary diseases, etc were reported. However, due to urbanization and modernization the present generation of the tribal communities under study are losing interest in indigenous knowledge on the uses of medicinal plants, causing immense loss to the tribal society in particular. Few species were losing their habitats i.e. *Angiopteris evecta* (Forst.) Hoffm.(endangered), *Bulbophyllum careyanum* (Hook.) Spreng., *Homalomena aromatica* Schott. *Dischidia rafflesiana* Wallich etc. It is therefore, ardently required to document this traditional knowledge and to carry out the phyto-chemical analysis and bio- activity of the plants recorded so that some potential plants for medicinal use can be detected for commercialization. Appropriate measures should be taken to maintain the habitat of medicinal plants by controlling deforestation, soil erosion, etc.

Key words: Ethnomedicinal plants, selected tribes, Assam

Molecular Characterization of Genus *Puntius* using Mitochondrial Gene Markers CO1 and 16SrRNA from Southern Western Ghats, India

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Comparative examination of morphological characters was one of the traditional methods of distinguishing fish taxonomy. A revolutionary impact on fish genetics has been evolved based on the development of DNA-based genetic markers. It is theoretically possible to observe and exploit genetic variation in the entire genome with DNA markers. In recent years, mitochondrial DNA, because of its fast evolution 5 to 10 times faster than single copy of nuclear gene, has been widely applied in systematics, population genetics and conservation biology. Traditional morphology based taxonomic procedures are not always sufficient for identification to the species level and can sometimes lead to misidentification. In this condition, a multidisciplinary approach to taxonomy especially by using the molecular data is become essential for species identification. Under the basic concept of evolution, every species is believed to be undergoing micro and macro evolutionary process resulting in the expression of significant genetic variations at levels of species specific chromosome morphology/structure, gene controlled protein structure and polygene controlled morphometrics and meristic. The classical Morphometrics/meristic and the modern molecular genetics tools have been employed in a number of teleost fishes to study intra-specific variations as well as inter - generic / inter-specific differences in them.The ability to quickly put a name to an unknown specimen benefits not only conservationists, but is also a tremendous tool for ecologists as well. In addition to enabling species identification, DNA barcoding will support phylogenetic analysis and help to reveal the evolutionary history of life on earth. It could also be applied where traditional methods are unrevealing. Studies of vertebrate species generally have shown that sequence divergence accumulates more rapidly in mitochondrial than in nuclear DNA. However, DNA bar-coding has evolved as a modern tool of taxonomy; conflict still remains in the selection of a standard marker for this even within vertebrates. Both CO1 and 16S (unaligned) rRNA genes could be used as DNA barcodes for effective and more accurate identification of species can be suggested as a solution. This paper providesinformation on the molecular characterization of genus *Puntius* collected Southern Western Ghats.Fishes were collected using cast net, dip net, gill net and drag net from various streams and rivers of Southern Western Ghats. At most care was taken not to damage the species while collecting. A small portion of tissue from the right side (fin clips of approximately 5 x 5 mm size) pectoral and pelvic fins was excised in a small tube and preserved in 99% Ethanol and labelled. The genomic DNA was isolated and PCR amplification was carried out using universal primers for partial mitochondrial

CO1 and 16sRNA sequences of approximately 650 bp length. Based on the obtained sequence of phylogenetic tree was constructed using the Neighbour-Joining method using by Molecular Evolutionary Genetics Analysis (MEGA). The present study provides a clear indication of the patterns of CO1sequence divergence within and among the species.Mitochondrial CO1 and 16SrRNA genes resolve the taxonomic ambiguities of genus *Puntius*. The less intra-specific variation was observed than the intraspecific variation in both CO1 and 16S rRNA genes and the phylogenetic tree expresses all the species of *Puntius* from Southern Western Ghats to originate from a common ancestral group (i.e. all the species of the genus *Puntius* has similar molecular status by which they fall under a single phylogenetic clad) further more supporting to the field of Taxonomy of fresh water fishes of India.

Key words: *Puntius,* Southern Western Ghats, CO1, 16sRNA, Phylogeny

Management of Competitor Moulds of Oyster Mushroom (*Pleurotus ostreatus*) and Role of Abiotic Factors

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The main obstacle for increased production in West Bengal is frequent contamination of the mushroom growing beds with micro flora. Competitor moulds of oyster mushroom bed is one of the major hindrance in increased yield of *Pleurotus*. Survey in four different mushroom farms in and around Bolpur and also laboratory trials revealed the occurrence of seven contaminants viz. *Aspergillus niger*, *Trichoderma viride*, *Penicillium notatum* , *Rhizopus* sp. *Sclerotium rolfsii, Coprinus* sp. and *Chaetomium* sp. on the mushroom beds. Out of these *Trichoderma viride ,Penicillium notatum, Aspergillus niger, Sclerotium rolfsii* and *Coprinus* sp. were the most dominant fungal contaminant and their incidence were minimum during January (2.87%) and maximum during the month of June (32.8 %*)*. A good harvest of mushroom (105%) B.E. was obtained during the month of October. A range of average maximum temperature (24.63 –33.18 ^{0}C), minimum temperature (9.40 -25.51 ^{0}C) and average relative humidity (68.90 - 85.27%) was found most appropriate for the cultivation of oyster mushroom in this region. Among the botanicals tested for management of competitors moulds, *A. indica* (neem) showed its supremacy and gave maximum inhibitory effect (54.1 to 71.6 %) against *Aspergillus* niger , *Trichoderma viride*, *Coprinus* sp., and *Penicillium notatum* and found less effective against *Sclerotium rolfsii in vitro* followed by extracts of *Pongamia pinnata* (42.4 to 61.3%). A range of 35.3 to 62.4% reduction in inky caps (*Coprinus sp.*) and 26.3 to 68.4% in green moulds (*Trichoderma* spp) were recorded with different phyto-extracts. The botanicals except *Acacia nilotica* reduced the incidence of competitor moulds (18.18 to 70.91%) in mushroom beds which increase the yield up to 21.3 %. The information will provide the idea about the appropriate cultivation time as well as provide an alternative method of surface sterilization of substrates which may reduce the use of fungicides in oyster mushroom cultivation.

Key words: oyster mushroom, competitor moulds, Bolpur

Design and Performance Characterization of a Novel Shear Enhanced Membrane Module in the Treatment of Desizing Waste Water

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Indian textile industry contributes about 4% to gross domestic product (GDP), and 17% to the country's export earnings, according to the Annual Report 2010–11 of the Ministry of Textiles. Prior to the weaving stage, sizing agents, such as polyvinyl alcohol (PVA) is added for smoothening the fibers and to enhance the thread tenacity. In the desizing operation, chemicals are removed by washing the clothes with hot water, which produces an effluent stream, commonly known as desizing waste water. Among several treatment processes, membrane separation is one of the standard techniques used to recover PVA from the waste stream.

Over the last two decades membrane based separation processes have emerged enormously. However, membrane based processes suffer from a severe drawback of massive flux decline with time. Because of this membrane technology is not yet being thought as a potential alternative of different energy intensive conventional separation processes. In any pressure driven membrane separation process, the solutes get accumulated on the membrane surface, resulting an inevitable reduction in solvent flux. The phenomenon is known as 'concentration polarization. The well known phenomena of these reversible concentration polarization and irreversible membrane fouling are primarily responsible for transient flux decline in general. Use of high membrane shear has been recognized long back as a remedial technique of polarization and fouling. Dynamic or shear enhanced (DSE) modules, first commercialized in late eighties, constitute a separate class of filtration units, which can generate a very high membrane shear without increasing the feed flow rate. A standard DSE module must consists of either rotating or a vibrating part.

The present work has been undertaken in an attempt to indigenously develop and characterize a novel DSE module, named as Intermeshed Spinning Basket Module (ISBM), considering its inherent similarity with the well know spinning basket reactor. In the present study, the module has been characterized under different basket rotational speed (Ω) and transmembrane pressure (TMP) in ultrafiltration of simulated desizing wastewater using polyvinylidene fluoride (PVDF) membranes of 100 kDa molecular weight cut-off (MWCO). The statistical analysis has been also being performed.

Key words: Intermeshed Spinning Basket Module, permeate flux; regression analysis; shear enhanced module; time-weighted flux

Sinteraction between Two Commonly Co-Occurring Invasive Species in Kolkata

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According to the Convention on Biological Diversity, invasive alien species may threaten the economy and development (owing to their impact on agriculture and forestry), harm the environment (e.g. threatening biodiversity) and adversely affect human health.Studies on invasive alien plant specieshave highlighted their aggressiveness on resident species and ecosystems in their non-native range.In recent years, the presence of multiple invaders co-occurring together has been reported. Although interactions betweennative and invasive plant species have been widely reported in ecology, those between co-occurring invasives have been less studied.

This study was therefore formulated to check for presence of invasive plants in Kolkata and try to understand the interaction between the two most commonly growing invasives within this region.

Key words: Invasive plants, co-occurrence, interaction, lateral branches, regenerative abilities

Landslides Hazard Zonation using Geospatial **Techniques and LSV Method in Nilgiris District (A Comparative Analysis)**

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Landslides in Western Ghats of India, particularly within Nilgiris district has impacted negatively on the social and economic lives of the people. As a result, appropriate management measures needs to be adequately taken to reduce the risk from potential landslides. This study aimed at delineating and ranking landslide potential zones in order to minimize its future threat within Nilgiris district. Several methods including geospatial, empirical and statistical methods have been used exclusively or simultaneously for delineating and ranking landslides vulnerability. This study examines landslide vulnerable areas in Nilgiris district using a comparative approach. Both Geospatial and LSV techniques were implemented and the outputs were comparatively analyzed. Multi Influencing Factor (MIF) method has been used for the computation of the weightages and weighted-overlay analysis was performed using GIS. In the case of the LSV method, susceptibility factor for each parameter has been computed including landslides intensity per unit area. Slope, Aspect, Rainfall, Lineament density, Drainage density, Geological Formation, Soil types and Land use/Land cover are the input parameters used for this study which were obtained from LANDSAT 8, CARTOSAT and other agencies like SOI, GSI etc. The outputs are hazard zonation maps which were ranked into four different zones (Low, Moderate, High and Very high prone zones) depending on the potential threat. The results were comparatively analyzed and validated by ground-truthing and superimposing landslides inventory data. The most accurate output map is determined and recommended for strategic and developmental planning so as to minimize landslides future threats in Nilgiris district.

Key words: Landslides Hazard Zonation, Multi-influencing Factor, Weighted-overlay, Landslides susceptibility factor.

Depth Wise Variation of Arsenic and Organic Carbon in Sundarban Mangroveestuarine System

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Increasing concentration of arsenic in the sediment and pore water in the Sundarban Mangrove estuary claim an environmental risk. The mobility and fate of arsenic either in the sediment or aquatic environment are controlled by a) redox condition b) dissolution-precipitation of mineral with arsenic as a constituent ion and c) sorption-desorption. The aim of this study to investigate arsenic mobilization and its feedback in the Sundarban mangrove sediment.Water and sediment cores were obtained from four different stations of sundarban mangrove estuary. Freeze dried sediment samples were used for the measurement of organic carbon by Walkey-Black wet combustion method. Redox potential profiles were measured by gently lowering the electrodes into the sediment and pH was measured using a combined electrode. Air dried sediment sample was used for grain size analysis following the sedimentation method. Particulate matter was filtered from the tidal water and sediment were freeze dried and the extracts obtained after treating them with acid mixture (HF/HNO_3) were used for the measurement of arsenic.Arsenic concentration varied from 0.336 to 2.741 ngL^{-1} in the Sundarbanmangrove water, 0.31 to 19.9 mgL^{-1} in the pore water, in Polycheate 4.32ugg^{-1} and in mangrove leaves 0.17ugg^{-1}. The sediment is of sand to silty clay loam type and the clay content varied from 2.5to 22.6%. Organic matter exhibited concentration (3.15-5.14mgg^{-1}) in the sediment. This could be due to the marine sedimentation and mixing processes at the sediment water interface where the rate of delivery, as well as rates of degradation by microbial- mediated processes are expected to be high. Decrease of organic carbon (0.78 to 0.45) and Eh (-32.5 to -250.4 mV) with increasing depth are common features for all the stations indicatingmicrobial-mediated oxidation of organic matter.Concentration of arsenic in deeper layer relatively higher than to the surface (2.15-3.5$mgKg^{-1}$) in different stations indicates that arsenic supply seems to have declined; this could be due to the commissioning of Farakka barrage in 1975 to regulate the fresh water flow through the Hooghly-Bhagirathi channel for navigation.

Key words: pore water, Redox potential, particulate matter, marine sedimentation, navigation

SHEFROL® Bioreactor to Treat the Wastewater Generated by the Small Communities

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Prime Ministers goal of a "Swatch Bharat" can be achieved with focus on the need for low cost, low maintenance, easy to use treatment technologies. Clean and green wastewater treatment technologies that can be employed at rural and semi urban community levels which usually lie out of the reach of centralized treatment facilities.
SHEFROL® (SHEet Flow ROot level) bioreactor was developed by Abbasi and co-workers (*Official Journal of the Patent Office,* 20 7611, 2012) at the Center for Pollution Control and Environmental Engineering, Pondicherry University. The distinguishing attributes of this system are its low installation, operation and maintenance costs; high efficiency; and negligible ecological footprint. SHEFROL® is capable of using a wide variety of vascular plants – terrestrial, amphibious, and aquatic – depending on the type of wastewater to be treated and ease of availability of the plants. In most cases the plants used in SHEFROL® are weeds that are freely available.
In this paper we describe studies on the assessment of the performance of *Pistia stratiotes* as a bioagent in a pilot-scale SHEFROL® bioreactor treating inflows of wastewater ranging from 15,000 to 20,000 liters of domestic effluents generated per day by a cluster of buildings inside the Pondicherry university campus which has no conventional treatment facility at present.
At an HRT (hydraulic retention time) of 8 hrs the system was found to reduce the concentration of the pollutants to the acceptable limits prescribed by India's central pollution control board for discharge on land for irrigation.

Key words: SHEFROL®, Pistia stratiotes, domestic effluents

The Effect of Protection on Phanerogamic Biodiversity of Some Selected Sacred Groves of Odisha

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Biodiversity around the world is now under severe threat mainly due to anthropological disturbances and population pressure. It has been estimated that, at the present rate of extinction of 10 to 20 thousand species per year, human activities will eliminate 10 million species of plants and animals by the year 2050. It is also feared that a high proportion of these extinction will be in rich biodiversity areas like tropical forests, wetlands and coral reefs. Therefore conservation of biodiversity has become the top most priority all over the World. In this context, sacred groves can play a vital role. Sacred groves are patches of native vegetation protected and preserved by indigenous local communities mostly tribal for their cultural and religious beliefs. These forest patches are sometimes found within a forest or isolated from it due to establishment of human settlements. These protected patches usually harbor rich biodiversity and are traditionally protected area as in-situ conservation sites of several species and act as repositories of several rare and endangered species. Apart from biodiversity conservation such sites also render a varieties of ecosystem services to the local people and act as the source of subsistence for them. Such Sacred groves are found frequently in the tribal dominated states of India. Although many of these sacred groves are now found in disturbed conditions, still they can be considered as in-situ biodiversity conservation sites which can render a number of ecosystem services for the welfare of human being. But up till now the existence of these sacred groves have neither properly been documented nor the ecosystem services they render have been evaluated, particularly in the state of Odisha.

The present paper aims to make an eco taxonomical exploration of some selected groves to have a phyto-sociological analysis of the vegetation which includes the species composition, species diversity, population structure of tree species and their carbon sequestration potential and other ecosystem services rendered them.

Five different sacred groves, namely Mendha, Andhari, Papanga, Dedungri and Gujarpat situated in four different districts of Western Odisha namely Sundergarh, Jharsuguda, Bargarh and Sambalpur have been selected for the study. Out of the five sacred groves, Mendha belong to Sundergarh, Andhari to Jharsuguda, Papanga to Bargarh and Dedungri and Gujarpat to Sambalpur district. All the four districts are tribal dominated districts of western Odisha. The sacred groves selected for the study differ in their area ranging from 0.8 ha (Gujarpat) to more than 1000 ha (Andhari) in size. The management of the sacred groves also differ in the respect that they are either

managed by the temple trust, local community, or jointly by local community and government. Andhari, Gujarpat and Papanga are comparatively undisturbed patches whereas Dedungri is moderately disturbed and Mendha is disturbed one. The identification of plant species recorded from the sacred groves have been made following standard flora book (Saxena and Brahmam, 1996) The phyto sociological analysis for determination of frequency, density, abundance/basal area and Importance value index of plant species present in these five sacred groves have been made following the method of Mishra (1968). Diversity, dominance, evenness and similarity indices of tree species have been calculated following the method of Shannon and Weiner (1963), Simpson(1949) and Pielou (1975) respectively. Girth class analysis of tree species have been made following the method of Singh et.al (1986). Above ground biomass (AGB) and belowground biomass (BGB) of tree species have been calculated following the equation of Chambers et al. (2001) and Cairns et al. (1997). All these parameters studied for the sacred groves have been compared with respective natural forest control sites adjacent to the sacred groves.

The results indicated that all the sacred groves (except Gujarpart) are more species rich and diverse than the natural forest sites as indicated by their species richness and diversity indices. The density (nos./ha) of tree species, AGB (Mg/ha) and BGB (Mg/ha) were also found to be higher in the sacred groves than their respective natural control sites. Association pattern and population structure of tree species were found to be changed in disturbed sacred groves as compared to the adjacent natural forest sites. Out of the 41 species of plants declared as either rare, endangered and threatened (RET), the presence of as many as 9 species could be recorded from these sacred groves.

Therefore it can be concluded that Sacred groves can definitely serve as in-situ conservation sites for biodiversity. Protection of these sacred groves has a positive effect on the conservation of biodiversity in these sacred groves. Besides this these sites can contribute significantly in providing ecosystem services. Further documentation and ecosystem services accounting of sacred groves will create awareness amongst both the indigenous and non-indigenous people towards conservation of these sacred forest patches.

Key words: phytosociology, ecosystem services

Interaction of Lichen Community with Metal Pollutants Present in Air

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Air pollution being an alarming problem of urban and heavily industrialised areas of West Bengal has got several impacts on environment and human health. On account of the increasing levels of pollution, monitoring the rising environmental changes has become a major concern. Monitoring of air pollution using bioindicators is emerging as a potentially effective and economical alternative process to direct ambient air measurements. In India, it is quite difficult to use air samplers in remote areas due to lack of electricity. Hence biomonitoring is the one and only solution which therefore emphasizes the role of epiphytic lichens of West Bengal in being selected as the biomonitor organism.

Lichens are excellent indicators of environmental condition of an area as they are extremely sensitive to environmental changes. Lichens lack significant cuticle or epidermis and are devoid of a well-developed root system; therefore they absorb nutrients directly from the atmosphere. Along with nutrients, pollutants are also absorbed and/or adsorbed on the lichen thalli without having any visible signs of injury to the thallus. Lichens show differential sensitivity towards wide range of pollutants. Certain species are inherently more sensitive, while some species shows tolerance to high levels of pollutants. These characteristics make certain lichen species suitable for being utilised as an indicator species (based on their sensitivity and tolerance). These features of lichens, combined with their extraordinary capability to grow in a large geographical area, rank them among an ideal and reliable bioindicators of air pollution.

Our main objective was to study the biodiversity of lichens in few areas of West Bengal, the impact of pollution on the availability of lichens and the extent of trace elemental accumulation based on the degree of pollution in those areas, the variation in the species based on the pollution trend and also finding out sensitive or tolerant species.

Key words: air pollution, biomonitoring, indicator, lichen

Arsenic Contamination in the Groundwater of Hasnabad Block in North 24-Pargana District

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The groundwater of Hasnabad block of North 24 Parganas district has been found to contain arsenic in concentration above the permissible level and hence not suitable for drinking. Water samples are collected through the handpumps from different localities of the block and analysed for arsenic. The statistical analysis of the results obtained from the estimation of arsenic from the samples showed that …….. Another objective of the study was to ascertain the safe depth of the block as the data would help technologists to a great extent for the installation of new tubewells in the locality to get arsenic free water.

Key words: Arsenic, groundwater, Hasnabad block

Enhancing Household Food Security through Home Gardening: A Case Study

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A home garden is a micro-environment composed of a multi-species (annual to perennial, root crops to climbers etc), multi-storied and multi-purpose garden situated close to the homestead. It refers to the traditional land use system around a homestead, where several varieties of plants are grown and maintained by the household members and their products are primarily intended for the family consumption. Home gardens serve a wide range of purposes such as Food security, nutrition and a cash income, fodder, firewood and timber, spices, herbs and medicinal plants, green manures and pesticide crops and cultural and religious uses. Thus, also contributes to sustainable livelihood as home gardens are maintained only with organic manures. This paper attempted to estimate the contribution of home gardens in enhancing household food security to a poor household. The average land area under home garden ranges from a small tract of land to 2 acres of land. A case of one household in Manipur hill district who have been maintaining home garden for some years is presented in this paper. There were five members in the family. Wide ranges of seasonal fruits grown in the gardens were jackfruits, guava, mangoes, papaya, banana, litchi, orange and other wild types of fruits. Seasonal vegetables like long beans, field beans, brinjal (egg plant), Colocasia, Alocasia, mesta, mustards, cabbage, king chillies, were identified. spices identified were cinnamon, tespata, occimum species, false coriander and ginger. Other perennial vegetable crops were tree beans, bamboo shoot, bitter leaves etc. This garden has benefited the family nutrition, increase household income, provide a buffer to food insecurity during lean season (agriculture off-season), provide habitat protection and soil conservation.

Key words: Home garden, income, family nutrition, household food security

Mapping of Altered Mineral Zones by Multi-Sensor Data Analysis, A Case Study of Bauchi, Nigeria

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Alteration zones constitute one of the most important guides for mineral exploration. It occurs along certain structural features like faults, shear zones, plugs, dykes and deformities. Present study aims to evaluate and map the altered mineral deposits by analysis of multispectral {Enhanced Thematic Mapper (ETM+)} and hyperspectral (Hyperion) datasets. Various thematic maps were prepared from the ETM+ and ASTER Digital Elevation Model (ASTERDEM), which were used as the input for the finding the final alteration zone mapping. Principal Component Anlysis (PCA) and band ratio were also applied to the ETM+ for the detection of altered mineral deposits. Hyperion images were first compensated for atmospheric effects after the removal of the bad bands from the dataset. Minimum Noise Fraction (MNF) transformation was applied to reduce the data noise and spectral dimensionality. Pixel Purity Index (PPI) and n-Dmensional visualization were used for extracting the pure pixels. These pure pixels are then compared using a mineral spectral library distributed from United States Geological Survey (USGS) as a reference and are used in Spectral Angle Mapping (SAM) to classify the image for identifying the occurrences of same minerals. The results revealed the potential use of Hyperion data over multispectral data in precise altered mineral identification and mapping.

Key words: Alteration zones, Principal Component Anlysis, Band ratio, Minimum Noise Fraction, Pixel Purity Index, Spectral Angle Mapping.

Detection of Urban Heat Island in Kano Metropolitan Nigeria: Spatio-Temporal Analysis

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Major cities of the world are faced with the problem of overwhelming increase in temperature as compared with their surrounding countryside. Recent researches concluded that, the reason behind this phenomenon is the conversion of natural surfaces such as vegetation with low thermal inertia to man-made structure structures like tarred roads and concrete structure with high thermal inertia; this concept is known as "Urban Heat Island". Remote sensing and GIS is found to be a significant technique to study this phenomenon.

In this study the spatial and temporal pattern of urban heat island (UHI) phenomena in Kano metropolis, Kano state Nigeria was detected and analyzed using remote sensing and GIS. Land surface radiance temperature (SRT) values were extracted from a Landsat TM image (1986), ETM+ (2000) and ALI (2014). Built-up area and road system were derived from 1:50,000 scale topographic maps. A Normalized Difference Vegetation Index(NDVI) map was extracted from the same image in Arc Map.Multiple correlation and regression analyses were used to examine the relationship between UHI pattern and land use/land cover parameters (i.e. NDVI, built-up density and road density). Markov chain analysis was used to predict and forecast the spatial extent of land surface temperature and urban sprawl in 30 years to come.

The result shows that, multiple heat islands emerged over several satellite cities within the metropolis. The statistical analysis indicates that the UHI intensities had a negative relationship with NDVI, but positively correlated with built-up. Interestingly, the temporal analysis indicate areas observe with lower land surface temperature in 1986 have been recorded with higher temperature in 2000 and 2014.

Key words: Land Surface Temperature, Environmental Criticality Index, Impervious Surface Absorption, Normalized Difference Vegetation Index,Land use Land cover, Markov chain algorithm

Toxicological Effect of Aqueous Seed Extract of *Datura Stramonium* on Liver of Experimental Rats

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Datura stramonium which is commonly called Jimsonweed in English originated in the Middle East but has since become a cosmopolitan plant that grows in temperate and tropical countries alike. It is often found growing as a weed between rubble in uncultivated spots and on road-sides. The toxicity of *Datura stramonium* has been locally and internationally reported. This is due to the alkaloids produced in the leaves, seeds, roots, and other parts of the plant which are very poisonous. Their ingestion can result in convulsion, coma, and even death. This research paper aimed at finding the potential liver toxicity of the plant's seed as its abuse among youths of this contemporary society is increasing at an alarming rate. The effect of daily administration of aqueous seed extract of *Datura stramonium* for two weeks on the serum activities of aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) as well as serum concentration of albumin was studied using laboratory albino rats. The treatment involved oral administration of the extract at concentrations of 150mg/Kg, 300mg/Kg and 600mg/Kg. The control rats were found to have AST, ALT and ALP activities of 26.00 ± 2.52 19.13 ± 1.63 and 49.17 ± 11.02 IU/L respectively and 3.68 ± 0.45 g/dL albumin serum concentration. The serum levels of AST, ALT, ALP and albumin did not significantly increased for 150mg/Kg, 300mg/Kg and 600mg/Kg at P = 0.05. The result revealed that the aqueous seed extract of *Datura stramonium* did not have significant effect on the serum liver enzymes and albumin. This implies that the plant seed extract does not cause liver damage and therefore is not toxic to the laboratory animal's liver at the doses administered.

Key words: *Datura stramonium*, Toxicity, Liver, AST, ALT, ALP.

Influence of Different Sources of Nutrients on Productivity, Economics and Nutrient Uptake of Rice (*Oryza sativa* L.)

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A field experiment was conducted during *kharif* season at Zonal Agricultural Research Station, Mandya to influence of different sources of nutrients on productivity, economics and nutrient uptake of rice (*Oryza sativa* l.) under krishnaraja command area of Karnataka. The experiment was laid out in a split plot design with three different methods of rice cultivation as main plot *i.e.,*Conventional method, System of rice intensification (SRI) and Aerobic method and sub plot treatment as five sources of nutrients including both organic sources and inorganic sources and replicated thrice. Among the different methods of rice cultivation, SRI method of rice cultivation recorded significantly higher yield (8545 kg ha^{-1}) as compared to conventional method (6475 kg ha^{-1}) and aerobic method (7050 kg ha^{-1}). This was attributed due to higher nitrogen uptake (164.33 kg ha^{-1}), phosphorus uptake (48.06 kg ha^{-1}), potassium uptake (227.82 kg ha^{-1}) and resulted higher net return (Rs. 94, 330 ha^{-1}) and B:C ratio (2.79). Among different sources of nutrients, RDF (100 % N through neem coated urea) recorded significantly higher grain yield (8487 kg ha^{-1}), nitrogen uptake (157.48 kg ha^{-1}), phosphorus uptake (47.76 kg ha^{-1}) and potassium uptake (215.93 kg ha^{-1}) and intern resulted higher net return (Rs. 94, 534ha^{-1}) and B:C ratio (2.88) over other treatment combinations.

Key words: Productivity, Economics, Nutrient uptake, Methods of rice cultivation, Neem coated urea

Microphytobenthic Biomass and Species Composition in a Tropical Coastal Lagoon on the East Coast of India

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The term Microphytobenthos refers to the microscopic, photosynthetic eukaryotic algae and cynobacteria that live on sediments surfaces. Microphytobenthos (MPB) play an important role as primary producers in the carbon cycle of the benthic food chain. Sediment sample were collected at 35 predetermined stations during the year Jan2009-Dec2012 in the lagoon with the help of a grab (van Veen) from where sub-samples were drawn using a hand corer (2.1cm internal diameter and 5 to 6 cm long). Sediment samples were analysed for their composition in 19 stations for the period of two years i.e. January 2010 to December 2011), semi quantitative analysis was carried out for only one year sediment (2010) in the same stations. altogether 104 species of MPB were recorded of which 19 were centric, 63 pennate, 19 cyanophyceans and 3 Dinophyceans. There were only 4 structure-forming or abundant species found in the lagoon presenting more than 30 % of the samples collected. They are *Grammataphora* sp., *Cocconeis*sp., *Microcystis* sp., *Cymbellaminuta*, 5, are namely *Synedra* sp., *O.agardhii, Navicula* sp., *Gloeocapsa* sp., *Bacillariapaxillifera* were common represented in 20-30% of the sample. Sector wise the number of species in the south zone sediments was higher (88). Pennate diatoms remained the most dominant group throughout the lagoon. However, their number decreased markedly from south to north. Seasonally, during January 2011 – December 2011 The number of species were more. Coinciding with the post monsoon species number had increased relatively (61) (centrales 8, pennales 39, cynophyceans 12 and dinophyceans 2). Before for the lagoon depending on the river inflow the months were divided into two periods i.e. lean and active. For the present study the same was followed. Seasonally there were 3 species dominant in lean period and 6 were in active period. The common species in lean period were *Cocconeis*sp., *Bacillariapaxillifera, Gloeocapsa*sp., *Thalassiothrixlongissima, Actinocyclus*sp., *Synedra*sp. and only 2 in active period i.e*Cymbellaminuta, Gloeocapsa*sp.the composition of MPB along this lagoon varied considerably in space and time. Diatoms were the dominant group. There was a general preponderance of pennate diatoms such as *Cymbellaminuta, Pleurosigma*sp., *Ple. elongatum, Naviculas*p., *Nav. Pelliculosa, Cocconeis*sp., *Synedra*sp., *Amphora* sp., *Grammataphora*sp. throughout the study period. Overally abundance wise pennales were the dominant group contributing to 67% of the total population. Next to that cynophyceans contributing 27% followed by centrales 6%. Abundance was high in channel area (43.3%) followed by south sector (38.2%) and low in north sector . The important species were

*Grammataphora*sp.(24%), *Microcystis*sp.(10%), *Cocconeis*sp.(9%), *Oscillatoria*sp.(9%), *Microcoleus*sp.(5%), *Cymbellaminuta*.(4%),*Synedra* sp.(4%), *Ple. elongatum*.(4%), *Navicula* sp. (4%), *Nitzschiacocconeiformis* (2%), *Nit.sigmoidea*. (2%), *Actinocyclus*sp. (1%), *O.limnetica*. (24%) contributing 80% of the population overall the lagoon. Only two species*Grammataphora* sp. (44%), *Cocconeis* sp. (10%) contribute more than 50 percentage of the population in south sector, *Microcystis* sp. (27%), *Oscillatoria*sp. (10%), *Microcoleus* sp. (8%) and *Grammataphora* sp. (8%) were the dominant species in north sector whereas, *Cocconeis*sp. (12%), *Ple. Elongatum* (10%), *Synedra*sp. (10%), *Coscinodiscus*sp. (6%), *Oscillatoria*sp. (6%), *Navicula*sp. (6%) and *Asterionellopsisglacialis* (5%) were dominant in channel area. Sediment chlorophyll was recorded high in south sector during 2010 mean (21.7µg.g^{-1}) and low in channel area mean (8.0.g^{-1}). Sediment chlorophyll was high during January to March coinciding with pre monsoon and again in July there was increase. Sediment chlorophyll and water chlorophyll follow opposite to each other and it was tested with linear regression between sediment chlorophyll and water chlorophyll (R=-0.54, P=0.03). The observations showed that benthic chlorophyll correlates with SD (r=0.41;P=0.01), Depth (r=-0.51; P=0.003), pH (r=0.76; P=0.0001)and Temperature (r=0.60;P=0.01). The observations showed salinity positively correlates with species richness (SRp, d'), species diversity (H') and negatively with sediment chlorophyll which is a index of biomass. Alpha diversity was high in channel stations then compared to south and north stations. SRp and richness was low in north sector. Average species richness (SRp) varied between 10-21 (15) species in the south; 8-20 (13) in the north region and, 25-29 (27) in the channel locations. Overall, Margalef index (d') varied from a minimum of 1.5 (st.31) to a maximum 6.1 (st.35), average being 3.3. The dendrogram provided a sequence of fairly convincing groups of stations confirmed by MDS plot for the same locations of which Group-I consisted of stations representing the south locations (sts. 1,3,5,7,11,13, 15 & 17), Group-II the north locations (sts. 21,23,25,27,29, 31& 33) and Group-III the channel locations (sts. 34, 35 & 36). Station 19 is remaining out layer. The findings have shown significant difference (ANOSIM Global R: 0.71 at 0.01%) in the composition of MPB between the three sectors examined.

In conclusion MPB composition(61%) and abundance(67%) in chilika lagoon is dominated by diatoms mainly pennales where as in water column it was cynophyceans. More number of species was found in south sector. Sediment chlorophyll also more in south sector. Depending on the cluster drawn on the basis of +/- date the lagoon can be classified into two sectors. Diversity was more in channel stations. Diversity depends on salinity and biomass depends on depth, SD, water temperature and pH.

Key words: Diversity, chlorophyll, abundance, chilka, alpha diversity.

Survey on Availability of Bee Flora in Malnad Region of Karnataka

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The survey was conducted to know the availability of bee flora in Malnad region of Karnataka during 2014 at Organic Farming Research center, UAHS, Navile, Shimoga. Sagar and Hosanagar taluks were surveyed from Shimoga district; Koppa and Narasimharajapura taluks from Chickmagalore district. As per the survey, we found that total of 94 species were identified as bee flora. Among them 28 species were Agricultural and Horticultural crops, 21 species were medicinal and aromatic crops and 45 species were wild plants. Among the study area, Sagar taluk was recorded greater diversity of bee flora, followed by Hosanagara, Koppa and Narasimharajapura. The study has shown that Malnad region of Karnataka is rich in bee flora and availability of floral source may also depend on variation in cultivated crops and weather condition of the area.

Key words: Bee flora**,** cultivated crops, survey, and Malnad region

Studies on Honey and Pollen Flow Season of Malnad Region of Karnataka

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The investigation was conducted to study the honey and pollen flow season in Malnad region of Karnataka during 2014 at Organic Farming Research center, UAHS, Navile, Shimoga. Plant species in an area of Malnad region were surveyed to identify honey and pollen season of honeybees. The flowering period of plant species were recorded. Observation was made on the bees activity on flowers of different plant species. Plants were categorized as major, moderate and minor sources of pollen and/or nectar. A total of 94 species were identified as bee flora in study area. Among 94 species, 36 species were recognized as major, 30 as moderate and 28 as minor source for both pollen and nectar. March to May and August to October months were the honey flow periods. Species of *Mangifera indica, Eucalyptus sp., Cocus nucifera, Carica papaya, coffee arabica* were some of the identified plants which were bloomed during those months. November to January and June to July were identified as dearth period for bees to collect honey. Some of the plants bloomed during dearth period were *Althaea rosea, Cucumis sativus, Cucurbita pepo, Solanum melongena, zea mays, Ipomea batatus, Matricaria chamomilla* and many cucurbits. This study shown that Malnad region of Karnataka is rich n bee flora and has great potential for bee keeping as many plants bloomed even in dearth period.

Key words: Honey flow, dearth period, flowering period and bloom

Species Diversity and Tree Regeneration Patterns in Tropical Dry Deciduous Forests of the Jharia Coalfield in Jharkhand, India

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The study was carried out to assess the species diversity and tree regeneration patterns of tree species in three sites of tropical deciduous forest around Jharia Coalfield in Jharkhand, India. Regeneration status of species was determined based on population size of seedlings and saplings. The species richness was calculated by using Margalef index. The Sorenson's index of similarity was calculated for each pair wise plot comparison. A total of 32 species belonging to 27 genera and 18 families were recorded from the three sites each of 1-ha. The Margalef index of species richness of tree species are increasing from highly disturbed site (1.12) to least disturbed site (2.57). The total basal area of disturbed site was low (4.64 m^2 ha^{-1}) as compared to undisturbed site (10.47 m^2 ha^{-1}). The basal area distribution is typically reverse J-shaped in the study sites along with some fluctuations in the basal area of higher girth classes. Results revealed that the species richness of undisturbed sites was more heterogeneous in comparison to highly disturbed site. It also revealed that the seedling individuals were disproportionally higher compared to the adult individuals, which could lead to higher recruitment of saplings if anthropogenic pressure is controlled.

Key words: Basal area, population size, species richness, Margalef index, Sorenson's index.

Incidence of *Vibrio parahaemolyticus* in Shrimp and Environmental Samples of Brackishwater Aquaculture Systems of West Bengal and Odisha

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Vibrio parahaemolyticus is a very important organism both in terms of being the seafood-borne human pathogen and also as causative agent of Acute Hepatopancreatic Necrotic Disease (AHPND) or Early Mortality Syndrome (EMS) in shrimp. But this organism is stated to be widely distributed in water bodies including fishery environment.The present work was undertaken with the aim to study the occurrence of *V. parahaemolyticus* in shrimp and environmental samples of South 24 Parganas, North 24 Parganas& Purba Medinipur districts of West Bengal and Baleswardistrict of Odisha and also to find out whether AHPND causing *V. parahaemolyticus* is present or not.

A total of 32 samples comprising of 15 shrimp, 5 soil and 12 water samples collected during February to October, 2015 were screened for the presence of *V. parahaemolyticus*. Out of that the presence of this organism was detected in 9 shrimps, 4 soil and all the 12 water samples. The isolates of *V. parahaemolyticus* were confirmed by standard biochemical tests. A total of 71 isolates of *V. parahaemolyticus* were recovered from those positive samples. All the isolates were screened for the presence of *toxR* gene by PCR and this gene was detected in all the isolates except one isolate from one soil sample of Purba Medinipur district. The isolates while checked for AHPND strain did not show any positive amplicon size of 336 bp by PCR using AP3 primer pair indicating absence of this strain.

Thepresent study indicates that *V. parahaemolyticus*containing *toxR* gene is widely distributed in the shrimps and brackishwater fishery environment of South 24 Parganas, North 24 Parganas, Purba Medinipur and Baleswar districts. But AHPND causing strain of this organismwas not present in any of the samples.

Key words: AHPND, *Vibrio parahaemolyticus*, EMS, *toxR*, PCR

Sustainable Agriculture and Adoption of Organic Farming – A Few Case Studies

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The inhabitants of the hilly state of Sikkim would practice sedentary farming by traditional techniques. After 1980s, to increase yield of crops, HYV seeds, chemical fertilizers and pesticides have been used in farmland. But in 2002-2003, the state govt. of Sikkim emphasized organic farming and passed resolution to transform Sikkim totally organic state. And organic farming procedures are being implemented to transform the whole subsistence agriculture in to high value organic enterprise.

The objective of the present research work is to make a study about the level of adoption of organic farming practices in the agricultural plots. For this purpose, study has been carried on four villages viz. Luing, Sichegaon, Rasithang and Ranka of Gangtok subdivision of East District of Sikkim.

Key words: crop combination, organic fertilizer, agroclimate, greenhouse, traditional seed, terrace farming

Cultivation of *Kharif* Onion (*Allium cepa* L.) in West Bengal

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Onion is considered to be the second most important vegetable crop grown in the world after tomatoes. India is the second largest producer of onion after China. In India, Onions are grown in three season *viz*., *rabi* (Nov-Dec), *Kharif* (May- June) and late *kharif* (Aug-Sep). The bulk of *rabi* onion is harvested during April – May, just before the onset of the monsoon, the prices of onion decline during this period while the same shoots up during the rainy season. *Kharif* onion is important to stabilize the market price. In West Bengal, *rabi* onion is mainly adopted by farmers. The State has to depend on the other states which produce *kharif* and late *kharif* onion for supply of bulb during lean period (October to March). Such dependences are sometimes resulted in abnormal increase in the prices. Growing onion during *kharif* season in West Bengal is somewhat a new strategy to be adopted, which is a very usual in the Southern and Western parts of our country. The problem of non- availability and sky touching price of onion during October to January, encourages exploring the possibilities of growing onion during *kharif* season. Field experiments were conducted in sub-tropical red and laterite zone of West Bengal during 2013-14 on bulb and seed production of *kharif* onion. Average onion bulb production was recorded 171.1q/ha. Experimental result also indicated the possibilities of *kharif* onion seed production under red and laterite belt of West Bengal.

Key words: *Kharif* onion, yield, seed, Scope, Future thrust.

Climate Change vis-à-vis Phenological Change – Its Bearing on Ecosystems and the Survival of Plant Species

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Phenology of plants includes different vegetative and reproductive life stages, such as seed dispersal, dormancy, germination, shoot extension, leaf production, leaf loss, cambial activity flowering, fruitingwhereas animal's phenology includes mating, reproduction, fledging, dispersal, migration, diapause etc. Timing of a seasonal event can be seen as a type of heritable trait and can be governed by different environmental cues, similar to other life-history traits making it important from evolutionary perspective. Investigating phenology of flora and fauna is therefore a key factor to understanding different functional aspects of interactions within communities and the inner workings of ecosystems.The main objective of phenological observations are to link the recurring and periodic life cycle events of plants and animals and how the pheno-events are influenced by seasonal and inter-annual variations in climate through time. The climate system is a complex, interactive system consisting of the atmosphere, land surface, snow and ice, oceans and other bodies of water, and living organisms. Climate is usually described in terms of the mean and variability of temperature, precipitation and wind over a period of time, ranging from months to millions of years (the classical period is 30 years). Climate undergoes changes with time which can be due to natural variation or due to human intervention. The earth's climate system has demonstrably changed on both global and regional scales since the pre-industrial era, with many of these changes attributable to human activities. Phenological observations provide sensitive data and baseline research material in identifying how plant species respond to regional climate conditions and its changes. Climate change has altered the phenology and dynamics of interactions in all major ecosystems and as a result there is a considerable variation in the rate of phenological events in intra- and inter-specific level and differential pheno-phases.The advancement of pheno-events like bud burst, flowering, fruiting has been well documented for many species.Phenology can also influence species interactions quantitatively with either increasing or decreasing temporal overlap of two interacting species which can have a negative bearing on the survival of species. This can be exemplified by changes in plant pollinator interactions which have been linked tolocal or regional climate change through field and laboratory experiments.Global climate change could significantly alter plant phenology because temperature influences the timing ofdevelopment, both alone and through interactions withother cues, such as photoperiod. Past evidences indicate a lengthening of vegetative growing season in the Northern Hemisphere, particularly at higher latitudes where temperature risehas been greatest. There is variation among plant and animal species

with respect to theirlife-history strategies, physiological tolerances,colonizations, probabilities of population extinctions and dispersal abilities. Therefore, even if species are subjected to similar climatic trends, there is variability in their responses. Like, in the case of flowering plants, insect-pollinated species aremore affected by climate than wind-pollinated species. Similarly, diversity in temporal responses of plant phenologyis due to different sensitivity to climate among events andspecies. Spring events changing more than autumn events can be explained by the above as spring events are more sensitive toclimate they are also undergoing the greatest alterations as compared to other seasons.The primary impact of climate change may be manifestedin the form of asynchrony in the species' food and habitat resources. There may be a potential disruption of coordination in timing between the life cycles of predators and their prey, herbivorous insects and their host plants, parasitoids and their host insects, and insect pollinators and flowering plants. There may occourcomplex asynchrony like mistimed peak phytoplankton bloom andpeak zooplankton abundances in aquatic ecosystem. This underlines that that both land and aquatic organisms are under constant threat because of climate change.

To investigate the phenological changes over time scientists collect various baseline data over decades based on simple observations of different pheno-events. Based on these available datasets different meta-analysis and mathematical models have been proposed by which the changes in the species' functional events can be predicted. The study of synchrony between plant and animal mutualism is an areaof much needed research where one predicts the outcomes of the mismatch of different pheno-phases will bring to both the species as well as to the ecosystem. Therefore, the government and the scientific community should pursue more extensive research to generate baseline data ofpheno-phases and use them for future monitoring. Research on the impact of climate change on phenology should be shared among educational institutes to create a common interest to observe the changing nature of not only flora but fauna as well. This will help in mitigating the asynchrony between species interaction and chances of species extinction. In the present paper we aim at analyzing the impact of climate change on the phenology and reproductive biology of plant species and comment on the possible findings.

Key words: Climate change, Phenology, Plant species, Reproductive biology, Species extinction, Species interaction.