BOOK OF ABSTRACTS

4th International Conference on Environment and Ecology (ICEE 2018)

Hosted by:
Department of Zoology
Gauhati University
Guwahati, Assam

In Association with:
International Foundation for Environment and Ecology
Kolkata

In Collaboration with:
Confederation of Indian Universities
New Delhi

12th to 14th February 2018

VENUE
Gauhati University
Guwahati • Assam • India

Edited by:
Tanmoy Rudra
Arnesha Guha

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Theme:
Make India Clean as well as
Cleaning up Technologies

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Dept. of Zoology, Gauhati University

The Department of Zoology was established in 1963 with a limited number of Faculty and Facilities. During the last 50 years, the Department has made all round progress and acquired a position among the leading departments of GU and other Universities of India. The dept. offer specialization in several major disciplines of Zoology (e.g. Animal Physiology and Biochemistry, Cell and Molecular Biology, Entomology, Fish and Fishery Biology, Animal Ecology and Wildlife Biology) and also offer MSc. in Animal Ecology and Wildlife Biology. This Dept.t is recognized by the NAAC peer team as one of the best science dept. of the University. This Department has been selected as FIST sponsored Department under DST (Govt. of India), Ministry of Science & Technology for building up the infrastructure for postgraduate teaching and research. The UGC has supported the department with the SAP programme since 2002.

So far, about 1543 students have been awarded MSc. Degree. Further, PhD and M.Phil degrees have been awarded to approximately 300 and 50 scholars, respectively.

The department also run a society 'Zoological Society of Assam', which coordinates seminar organizes inter-departmental Quiz competition, debates / discussion and field trip etc. It is important to mention that the Department has received a grant of rupees twenty lakhs from the National Fishery Development Board Hyderabad last year for further development of infrastructural facilities in aquaculture and biodiversity centre of the department about 25 research sponsored by UGC, CSIR, ICAR, DST, DoEn, DBt, ASTEC, DRDO and NHPC have already been completed. These projects have a direct relevance to the socio-economic development of the N.E. region.

The department has so far organized many national symposia, Workshop, regional seminar etc. The faculty has published over 550 research papers in reputed national and international journals, edited books, manuals and monographs. The department publishes one peer reviewed journal 'Tropical Zoology' every year.

International Foundation for Environment and Ecology

International Foundation for Environment and Ecology (IFEE) is an autonomous non government and non political organisation has been established on the auspicious occasion of the World Environment Day on 5th June 2014 based on its incorporation as a Charity under the Central Act II of 1882, Government of India head quartered in Kolkata, West Bengal with the main objective 'To Protect Our Mother Earth'.

The motivation for the establishment of this organisation has been based on the issues of environment protection and education discussed in the deliberations at Founes in 1971 and later at Stockholm in 1972 , Rio de Janeiro in 1992 , Johannesburg in 2002, Copenhagen in 2009 and also on the resolutions and recommendations of the Intergovernmental Conference organised by UNEP and UNESCO.

The activities of IFEE will include the strategies for creating more researches on environment among the globe for ensuring environmental protection and simultaneously encouraging a balanced and a sustainable growth in all countries of the world by using clean as well as cleaning-up technologies through new and emerging techniques for climate change management, environmental and disaster education, , waste management, green business and technologies besides strengthening of diplomatic relations among nations for protecting our Mother Earth.

The idea is also to promote environmental education among the school and the college going boys and girls by "Catching Them Young" and for designing appropriate technologies to ameliorate environmental problems.. This will be possible as IFEE has the qualified inventory of experts for establishing universities, colleges, institutions, schools and other training enterprises in different countries with the latest equipment and infrastructure for conducting formal, informal, open, distance, online, internet and webbased environment-centric programmes in all countries of the world.

Activities of IFEE

IFEE encourages environmental development and protection through the spread of universal quality education and supports the involvement of communities and citizens in the endeavour. The activities of IFEE are discussed below.

1. Consultancy to different institutions and universities at national as well international level with a view to solve environmental problems.
2. Launching of Bachelor's, Master's and Doctoral Degree Programmes through mutual and technical cooperation for initiating study and research based activities in the areas of, geoinformatics, bioinformatics, human rights, disaster management, sustainable development, ecology and environment and other allied fields.
3. Conducting environmental impact assessment along with pollution monitoring and control in sugar, leather, petro-chemicals, pharmaceuticals, cement, paper, rubber, steel, thermal power plants and mining industries.
4. Collaboration for scientific and environmental research work for promoting technological innovations in different fields related to environment.
5. To institute, honour and award persons and institutions for their immense contribution and dedication to protect and conserve the environment and promoting the path of Sustainable Development.

Areas of Activities

1. Scientific, Social & Environmental Research
2. Environmental Education & Literacy
3. Environment and Human Rights
4. Sustainable management of hazardous waste and substances;
5. Enhancing environmental awareness and promoting transparency and public participation in decision-making, and access to justice in environmental matters,
6. Promoting effective engagement of women and youth in environmental activities;
7. Supporting disaster preparedness, prevention, response and recovery at community level as well as at national level

International Conference on Environment and Ecology

IFEE organise every year an International Conference on Environment and Ecology at top-notch universities of India in collaboration with Confederation of Indian Universities (CIU), New Delhi since 2015.

The purpose behind the conference is to generate new knowledge related to understanding the background and causes of different ecological and environmental events and calamities at the local and global levels and at the same time set the groundwork for future conferences and publications on environmental and ecological issues. The conference is an ideal forum and platform where all the environmental experts, students, scholars and academicians come together and unanimously decide for the appropriate technology for protecting the Mother Earth.

In the year 2015 ICEE was organised in Kolkata, 2016 at Bharathiar University, Coimbatore, Tamil Nadu, in 2017 it was organised in ST Xaviers College, Ranchi, Jharkhand and 2018 the 4th ICEE has been organised at Gauhati University, Assam.

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IFEE recognizes the contribution of scientists, academicians, researchers in the field of science and environment. IFEE has instituted several awards to motivate and further the spirit of the talented ones in the field of science and environment. The selection of the awards is considered mainly on the basis of the merit.

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World Environmental Education and Development (WEED) Award

For Individual Category

1. Scientist of the Year Award (Above 45 Years of age)
2. Young Scientist of the Year award (32-45 years of age)
3. Junior Scientist of the Year Award (Below 32 years of age)
4. World Award for Envronmental Research and Development
5. Environment Excellence Award
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Cold Water Aquatic Habitat and Fish Diversity in Indian Himalayan Region

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The Indian Himalayan Region (IHR) has a complex mountain topography creating a living enclave subsisting with rich repositories of biodiversity and ecosystem service and therefore considered as one of the biodiversity hot spots in the world. The IHR endowed with high potential aquatic resources in the form of 8,243 km long streams and rivers, 20,500 ha natural lakes, 50,000 ha of reservoirs both natural and manmade and 2500 ha brackish water lakes at high altitude inhabits large population of indigenous and exotic coldwater fish species. The coldwater fisheries in upland areas particularly in Northeast region are significant both from ecosystem and economic point of view and play a crucial role in the nutritional security of the upland areas. Altogether, 422 fish species, belonging to 133 genera and 38 families from Northeast India has been documented including both warm water and coldwater fish species. In the absence of major industries and trades, the people of mountain areas have to depend on the natural resources and subsistence farming. Any change in availability of food and quality of water due to changes in environmental components may lead to the elimination of a fish stock living there. Besides, the natural populations of fishes have declined due to various anthropogenic activities such as loss of habitat due to river impoundments, excessive fishing pressure and pollution. These changes in the species compositions, distribution and productivity of food web components will not only affect the fisheries but also the livelihood to local communities. Under such impending threats, attempts have been taken by ICAR-DCFR to map and document the available fishery resources as well as to monitor the aquatic ecosystem in order to formulate conservation policies and adaptive measures. Recreational or sport fishing is another most sought after adventure tourism in IHR. This economic activity is particularly beneficial to rural tourism by connecting upland aquatic resource with fish and tourists. Coldwater region of India in this aspect is goldmine for fish based ecotourism as this region is home for 258 fish species belonging to 21 families and 76 genera inclusive of some of the important sport fishes, the mighty mahseer of genus Tor (Gray), Neolissochilus (McClelland) and Naziritor (McClelland), the trout Salmo trutta fario (brown trout) and Oncorhynchus mykiss (rainbow trout), the indigenous snow trout (Schizothoracids) along with several carps and catfishes. The hydrobiological conditions varies from severe cold to mild with the temperature range from below 0O C to 20O C; higher D.O concentrations above 8 mg/l; pH values ranging from slight acidic to slight alkaline and medium alkalinity; total hardness of soft to moderately hard water, indicating a conducive environment for the coldwater fisheries. Efforts from ICAR-DCFR to establish trout hatcheries based on these favourable climatic conditions in Arunachal Pradesh and Sikkim, mahseer hatcheries in Assam, Arunachal Pradesh, Meghalaya and Nagaland has added an advantage to successfully rehabilitate the fish stock and to develop fish based ecotourism based on fish angling, fish watch, pay fishing, fish sanctuaries, as outlined, has also positive indirect and direct consequences towards the conservation of fishes and restoring the environment.

Keywords: *Coldwater, eco-tourism, IHR, aquatic diversity and conservation.*

Food Security and Safety under Climate Variables

Polyols as Alternative Sweeteners: Current Status and Future Prospects

Garima

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The quality of food depends mainly on nutrients, but also on foreign substances such as food additives. Alternative sweeteners are food additives. They duplicate the effect of sugar (sucrose) in taste either alone or in combination with each other, but usually have less food energy. Epidemic obesity and diabetes encouraged the changes in population lifestyle and consumers' food products awareness. Food industry has responded people's demand by producing a number of energy-reduced products with polyols as sweeteners. These compounds are usually produced by a catalytic hydrogenation of sugars, but they can be also found in nature in fruits, vegetables or mushrooms as well as in human organism. Due to their properties, polyols are widely used in food, beverage, confectionery and pharmaceutical industries throughout the world. They have found use as bulk sweeteners that promote dental health and exert prebiotic effect. They are added to foods as alternative sweeteners what might be helpful in the control of calories intake. Consumption of low-calorie foods by the worldwide population has dramatically increased, as well as health concerns associated with the consequent high intake of sweeteners. The polyol sweeteners market is projected to reach USD 3.30 Billion by 2022 at a CAGR of 5.9% from 2017 to 2022. This paper provides an overview of the role of commonly used polyols such as erythritol, isomalt, lactitol, maltitol, mannitol, sorbitol and xylitol as sugar replacers in food industry.

Keywords: *Alternative sweeteners, Natural sweeteners, Xylitol, High glycemic sugars, White sugar, Aspartame.*

Estimation of Vitamin C in some Sour Fruits Locally Available in Barpeta District of Assam

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Vitamin is an organic compound which cannot be synthesized by the organism and is required in limited amounts. Thirteen vitamins have been recognized till date. Some are water soluble and rests are fat soluble. Vitamin C is a water soluble vitamin. It is an essential nutrient in humans as it functions as a cofactor in several vital enzymatic reactions. It is widely known that deficiency of Vitamin C would lead to scurvy in humans. Vitamin C also has other beneficial effects to our body, such as preventing common cold, heart diseases and strengthening human immune system. However, human beings cannot synthesize Vitamin C by themselves and should obtain it from other sources. The richest natural sources of Vitamin C are fruits and vegetables. Sour fruits are thought to be the richest source of Vitamin C. The present investigation was aimed to estimate the amount of Vitamin C in different kinds of sour fruits available in Barpeta district of Assam. Barpeta district is one of the richest districts of producer of fruits and vegetables in Assam. Fruits and vegetables are cultivated both domestically and commercially in this district. To initiate the study, fruits which are known to have sour taste were collected in fresh condition from both local markets and houses. They were scientifically identified in the laboratory by scientist from Botany Department of BBK College, Nagaon, Barpeta, Assam. Vitamin C was estimated following standard protocol by titration method. Fresh fruit juices were prepared which were used for titration for estimation of Vitamin C. In the present investigation, 11 different fruits which are sour in taste were selected and studied for the estimation of Vitamin C. Titration was done for three times for each fruit and the average value was taken as result. Results revealed maximum amount of Vitamin C content in Emblica among all the fruits under study. The present investigation was concluded with the result that the fruits under study were good source of Vitamin C and further study is essential to explore more fruits from this region with rich content of Vitamin C.

Keywords: *Vitamin C, Sour, Fruits, Titration, Fruit juices.*

Nutraceutical Potential of some Wild Edible Fruit Plants in Sikkim, Himalaya, India

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The Sikkim Himalayas, a part of Indo-Malayan Biodiversity Hotspot harbors many fruit plants of potential in nutritional importance to indigenous communities. In the present study fruit samples were collected randomly from localities of Rumtek, Sang, Nazitam, Tingbong, Gyathang, Lingdong, Geyzing, Namthang and Turung of Sikkim state of India to analyse their chemical properties and physical characteristics. Maximum fruit weight was recorded for *Ficus roxburghii* (186.5 g) while the lowest of 2.46 g/100 seeds were recorded for *Rubus ellipticus*. *Machilus edulis*. *Passiflora edulis* were recorded as largest fruits while *Rubus ellipticus* and *Duchesnia indica* were smallest. *Castanopsis hystrix* had lowest acidity (0.5 %) while *Elaeocarpus sikkimensis* with 4.2 % *acidity* was highest followed by *Terminalia chebula* and *Spondias axillaris* with 4.0 % acidity. Maximum TSS was recorded in fruits of *Diploknema butyraceae* (18° Brix) and *Elaeocarpus sikkimensis* (17° Brix). Highest total sugar was recorded in fruits of *Morus alba* (20 %) while *Machilus edulis*, *Spondias axillaris*, *Terminalia chebula*, *Castanopsis hystrix* and *Elaegnus latifolia* had least total sugar (3 % each). Lowest fat was estimated for *Passiflora edulis* (0.2 %) while in remaining fruits it ranged from 0.2 to 10.0 %. Carotenoid of fruits ranged from 0.1 to 63.0 mg/100g fresh weight. Such wild fruits of Sikkim if studied on nutritional properties and other bioactive compounds may fulfill nutritional requirements at local and find place in the global markets.

Keywords: *Indigenous; food; nutrient; chemical; antioxidant*

Effect of Enriched Jatropha Biocompost on Growth and Yield of Maize (*Zea mays* L.) under Field Condition

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The *Jatropha curcas* as one of the biofuel plants gaining momentum for alternative fuel in recent times. One tonne of jatropha seeds generate about 350 litres of oil and 2.40 tonnes of hulls. However, disposal of jatropha hulls will create lot of environmental problem as well as transport them over long distances for processing at economic interest. Finding a lower cost, environmentally sustainable, long-term solution for handling jatropha hulls is therefore of critical importance. As jatropha hulls are resistant for decomposition and hence the present investigation is proposed to enhance the process of decomposition using microbial cultures viz., *Trichurus spiralis*, *Phenerocheate chrysosporium and Trichoderma* sp. and study the effect of enriched jatropha biocompost with beneficial microorganisms on growth and yield of Maize (*Zea mays* L.). Field experiments were carried out through RCBD with five treatments viz., T1: Control, T2: Farm Yard Manure (FYM), T3: Jatropha Compost (JC), T4: Recommended Dose of Fertilizer (RDF) and T5: RDF + FYM using Maize variety NH - 2049 as test crop at Biofuel Park, Madenur, Hassan district of Karnataka. Observations on growth parameters like germination, plant height and number of leaves as well as yield data (grain and straw) were recorded and analyzed with appropriate statistical tools. Results indicated that the highest germination percentage was recorded in T3 with JC (98.1 %) which was on par with T2 with FYM (98.1 %), T4 with RDF (96.8 %), T5 with RDF+FYM (95.6%) and the least germination percentage was recorded in T1 with control (90.0 %). The highest plant height recorded in T5 with RDF + FYM (201.2 cm) followed by T4 with RDF (192.5 cm) and JC alone (181.2 cm) which was on par with T2 with FYM (183.1cm). The least plant height was recorded in T1 with control (162.3cm). The highest number of leaves was recorded in T5 with RDF + FYM (11.4) which was on par with T4 with RDF (11.2), T3 with JC alone (11.0), T2 with FYM (10.9). The least number of leaves was recorded in T1 with control (10.3). There was a significantly higher grain yield recorded in T5 with RDF + FYM (57.7 q/ha) followed by T4 with RDF (55.9 q/ha) and T2 with FYM (51.9 q/ha) which was on par with T3 with JC alone (50.7 q/ha). The least grain yield was recorded in T1 with control (42.3 q/ha). Further, highest straw yield was recorded in T5 with RDF + FYM (86.6 q/ha) followed by T4 with RDF (81.7 q/ha), T2 with FYM (74.0 q/ha), T3 with JC alone (69.0 q/ha). Significantly lowest straw yield was recorded in T1 with control (59.2 q/ha). Thus, there were not many differences in growth parameters as well as yield of Maize due to application of enriched jatropha bio-compost and was comparable to FYM or RDF. Therefore, the study revealed that the plant growth and yield of maize was significantly influenced by the enriched jatropha biocompost and hence it may be recommended for crops as biocompost.

Keywords: *Jatropha compost, Microbial cultures, FYM, RDF, Maize, Growth, Yield*

Post-harvest Application of Titanium Dioxide for Ensuring Safety and Shelf life Extension of Tomato Fruits

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The present investigation was undertaken to study the effect of application of titanium dioxide (TiO_2)-based materials with photo-catalytic activity under UV light on postharvest quality and shelf life extension of tomato fruits in order to ensure the safety and quality of tomato fruits under variable climatic conditions. The freshly harvested matured tomato fruits obtained from local market of Aurangabad city were washed, cleaned and treated with fungicide at 500 ppm concentration for 10 min. The washed fruits were then exposed to different concentrations of titanium dioxide (TiO_2)-based emulsion treated glass bids with photo-catalytic activity under UV light viz. 1000, 1500, 2000 and 2500 ppb for 24 hr at 20°C in an airtight chamber containing emulsiontreated glass bids. The effect of TiO_2 treatments on the physico-chemical and organoleptic qualities of fruits were studied in detail. The study revealed that the tomatoes treated with 2500 ppb concentration and exposed for 24 hr at 20°C storage temperature recorded higher shelf life of 27 days with better physico-chemical characteristics with increase in Total Soluble Solids (TSS) and surface colour. However, the treated fruits showed decrease in titrable acidity and ascorbic acid content as compared to control tomato fruits and rest of the treatments respectively.

Keywords: *Tomato, Titanium dioxide, UV light, Photo-catalytic, Shelf life*

Diversity of Agri-Horticultural Crops in Arunachal Pradesh-Impact of Climate Change

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Arunachal Pradesh situated between latitude of 26^0 30' to 29^0 28' North and longitude of 91^0 25' to 97^0 24' East stretching over 83,730 sq.km is the largest state area wise in North Eastern Region and blessed by nature with one of the richest flora and fauna on the earth. The state of Arunachal Pradesh has a wide range of climatic condition because of its unique position in the Indian subcontinent. Its unique phytogeographical positions, topography and high degree of precipitation are some of the important factors which are mainly responsible for its enormous biological diversity. It has humid subtropical or nearly tropical plains which receives high rainfall, temperate climate as well as snow covered high mountains. Varying range of climate and soil condition, moderate temperature and plenty of rainfall are conducive for growing an array of agri- horticultural crops. Harnessing these resources with proper location specific farming activities has comparative advantage in relation to the plains. Based on the agro climatic condition of Arunachal Pradesh, the state has been divided into various zones. There is a great impact of climate of climate change in the diversity of agricultural crops including horticultural crops. Most of the crops species gradually loss their variability and extinct with time. There is need to conserve the species diversity incorporating new technologies into the existing farming system for sustainable development. Considering topo-sequence and agro-climatic condition, there is wide potentialities exists for achieving higher economic growth and creating job opportunities in this sector. The paper will present genetic diversity of agri-horticultural crops in Arunachal Pradesh and impact of climate change on these crops.

Keywords: *Crop diversity, climate change, agro-climate*

Green Synthesis of Biologically Active Tetraaza Macrocyclic Complexes of Divalent Tin

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Bioligically active tin(II) complexes of tetraaza macrocycles have been synthesized by microwave assisted template synthesis using acetonylacetone with 2,3 DAP; 2,6 DAP; 1,2 DAB and 1,3 DAB. The complexes have been characterized by elemental analysis, molecular weight determination, conductance measurements, Infrared and ^{1}H NMR spectral studies. The elemental analyses are consistent with the formulation of the complexes as $[Sn(Ma)Cl_2]$. The monomeric nature of the complexes is indicated by their molecular weights. The spectral studies confirm the proposed framework of the new macrocyclic complexes. An octahedral geometry has been proposed for these complexes. The biological activities of the complexes have been studied against athogenic bacteria.

Keywords: *electronic spectra, mass spectra, magnetic measurements, microwave irradiation, divalent metal salts, template synthesis.*

Survey on the Difference in Feeding Habits of Local, Broiler and Kuroiler Chickens and A Comparative Protein Estimation of The Flesh of The above Three Breeds

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The importance of poultry in India, in raising the low nutritional standard of its population is very high. More than 50 billion chickens are raised annually as a source of food for both meat and their eggs; it is taken as a major protein source of food of an average healthy diet. Every 100 grams of chicken meat contains an average of 27g of protein(54% of the daily value on a 2000 calorie diet) while every 100 grams of chicken egg provide an average 13g of proteins (i.e. 26% of the daily value on a 2000 calorie diet). Thus both chicken meat and chicken eggs are considered as complete sources of protein. The demand for eggs and chicken has given birth to a variety of pure breed, import breed, breed for higher egg production, for rapid growth or for quality of meat. The present study was carried out to investigate the difference in the feeding habits of 3 of the most common breeds of chicken, both commercially and for consumption purpose found in Assam and to make an estimation of the protein content of their meat in order to assess the quality of the meat to a certain extent. Investigation of feeding habits was carried out by interaction and field collection of information from managers, workers, breeders and rearers of selected areas while the estimation of protein was done by standard Lowry method (Lowry et al, 1951). The study revealed that the feeding of local and kuroiler chickens are almost similar and thus ideal for domestic rearing; they are active scavengers. Besides, the Kuroiler serve as a dual purpose breed reared commercially by feeding with conventional feed. On the other hand the Broilers are completely commercial breeds of chickens reared exclusively for their meat. Their feed composition is different, complicated and costly compared to the other two varieties. While the protein concentrations in 1% homogenate of the flesh of Broiler, Kuroiler and local chicken was found to be 51.16 µg, 82.27µg and 145.61 µg respectively. It was thus evident that the local indigenous variety of chicken is the best in terms of protein content and can be termed as a superior protein food in comparison to the Kuroiler and the Broiler varieties. Since Broiler has the least protein concentration, therefore it can be termed as the least source of protein while Kuroiler is the intermediate.

Keywords: *Nutrition, diet, commercial, rearing, food*

Climate Resilient Breeding for Root Traits in Maize (Zea mays L.)

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Root traits influence the amount of water and nutrient absorption, and are important for maintaining crop yield under drought conditions. Drought tolerant maize parents were known for several agro-ecological conditions. The objectives of this research were to characterize variability of root traits among maize parents and hybrids. The experiment was done in Birsa Agricultural University, Ranchi under 7 sets of moisture stress consisting of normal irrigation (NI), rainfed (R) and intermediate stress (IS) in 2013 and NI, IS, mild severe stress (MSS) and severe stress (SS) in 2013-14. The experiment was carried out in randomized complete block design with three replications. Observation were recorded on six root traits number of nodes having brace root (NBR), root number (RN), root fresh weight (RFW), root dry weight (RDW), root length (RL), root volume (RV), grain yield, modified stress tolerance index (KisTi) and yield index (YI). Eight maize lines (3 known for drought tolerant) were grown under field condition and rainout shelter for root traits study. The variation under normal irrigation and stress condition was prominent for all the characters. The drought tolerant parents had higher NBR, RL, RV, GY/P, KiSTi and YI under stress condition than the NI indicating the importance of root traits for performance in grain yield. Under NI (pooled) condition 8 non-drought tolerant parents showed non-significant association between GY/P with root traits while significantly negative with RV; three drought tolerant parents showed significant association between GY/P and other root traits except RDW. However under low moisture stress condition (pooled of R, IS, MSS & SS) 8 non-drought tolerant parents showed non-significant association between GY/P with root traits, whereas 3 drought tolerant parents showed significant association between GY/P and other root traits except RFW and RL. The drought tolerant parents have better root architecture than non-drought tolerant inbred. The RN was the most important trait for drought tolerance ability in drought tolerant parents and non-drought tolerant inbred under moisture stress condition.

Keywords: *Maize, Root Traits, Association Analysis, Drought*

Evaluation of the Agrarian Ecosystem of Sagar Island, West Bengal under Variable Climate: An Exercise through Constructing Vulnerability Index and Crop Water Balance

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Linking Principal Component (PCA) and Equal Weight (EW) methods with aggregated bio-physical and socio economic parameter aided in assessing vulnerability of the agrarian ecosystem of Sagar Island, India under variable climate. Beside, estimation of crop Evapotranspiration (ETc) and crop water balance (CWB) helped in identifying water stress condition during sensitive growth stages of *Kharif* rice in the uncertainties of monsoon rainfall. Results revealed that, life subsistence agriculture in 11.8% geographical area (2829 hectare) of the Island along the western coast falls under very high vulnerable zone (VHVZ: VI of 84-99%) to climate variability. Comparatively higher values of exposure (0.53 ± 0.26) and sensitivity (0.78 ± 0.14) sub-indices affirmed that, the VHV zone is highly exposed to climate stressor with very low adaptive capacity (ADI= 0.24 ± 0.16) to combat vulnerability to climate variability. Hence, food security for a population of >22 thousands comprising >3.7 thousand agrarian households are highly exposed to climate variability. Another 17% area comprising 17.5% population covering 20% villages in north-western and eastern parts of the Island also falls under high vulnerable (VI= 61%-77%) zone. The monsoon variability and CWB studies exhibited that, effective monsoon rainfall starts at 24th MW (rainfall 92.7mm, p>56.7% for 50 mm rainfall) and terminates by the end of 40th MW (rainfall 90.7mm, p<59.6% for 50 mm rainfall). During crop growth periods (seed to seed: 21st to 45th MW), the Island receives an average weekly rainfall of 65.1±25.9 mm while the corresponding weekly CWR was 47.8 ±5.4 mm. Despite net water surplus of 353.9 mm during crop growth periods, there was a deficit of 159.5 mm water during MW of 18-23 (seedling raising) and MW of 41-45 (flowering to maturity stages). Water stress was observed in early lag vegetative stage of crop growth (32nd MW). Thus the information generated may be useful in devising area specific planning (adaptation and mitigation strategies) to address the climate change impact implications as well as crop planning under monsoon variability for sustaining rainfed rice production, food and livelihood security in vulnerable Islands of coastal ecosystem.

Keywords: *Variable climate, Sagar Island, Agriculture, Vulnerability, Adaptation.*

Environmental Biotechnology and Microbiology, Bioremediation

Bioremediation of PAHs: A Green Approach to Clean up the Environment

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The emission of toxic pollutants during the past few decades in the environment due to the expansion of industrialization has become a great concern of the researchers. A variety of pollutants like heavy metals, PCB, pesticides and PAHs are released in enormous quantities that are harmful to mankind and nature. Polycyclic aromatic hydrocarbons (PAHs), are a class of toxic organic pollutants found almost in every environment. are highly persistent, extensive and obstinate contaminants, which are released mainly due to the incomplete combustion of fossils. Sixteen PAHS have been listed as priority pollutants in USEPA (United States Environmental Protection Agency). Naphthalene is the simple, basic and a common pollutant of potable water. Which has been studied most among the total enlisted sixteen PAHS, So that it could serve as model for rest of the PAHs. Large amount of PAHs present in the soil are taken up by plants and enter our food chain thereby causing serious health problems.Thus to degrade these toxic substances is the need of hour for which microbial bioremediation has turned out as a promising process to clean up these pollutants. Because of being an environment friendly, its cost effectiveness besides other physiochemical and biological methodslike phytoremediation. Bioremediation requires special kind of bacteria and special operative conditions to accelerate natural degradation rates by overcoming the limiting factors. Microbial bioremediation has many advantages over other methods of treating pollutants like low cost, reduced health and ecological ramifications. Many bacteria have been identified to be active in bioremediationof PAHs, Where a large no. belongs tothe Genus *Pseudomonas*and *Bacillus.*Therefore,bioremediation is a green approach to clean up the environments with organic pollutants as well other inorganic substances. However, there is a need to explore it.

Treatment of Waste Water Using Bacterial Cellulose Obtained from Bacteria Isolated In Bangalore Region

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Cellulose is an organic compound produced mainly in plants. While cellulose is a basic structural material of most plants, it is also produced by bacteria. Bacterial, or microbial, cellulose has different properties from plant cellulose and is characterized by high purity, strength, foldability and increased water holding ability. In natural habitats, the majority of bacteria synthesize extracellular polysaccharides, such as cellulose, which form protective envelopes around the cells. By controlling synthesis methods, the resulting microbial cellulose can be tailored to have specific desirable properties. With advances in the ability to synthesize and characterize bacterial cellulose, the material is being used for a wide variety of commercial applications including textiles, cosmetics and food products, as well as medical applications.

Wesuccessfully isolated cellulose from bacteria and analyzed its characteristics for optimized growth. The screened microbial culture was utilized for to purify waste water obtained from the sewage line, sugar industry effluents and paper industry white water. The main objective of research work was to grow the cellulose in natural media and utilize the cellulose in fields like textiles or biomedicine.

A brief methodology of the paper includesthe isolation and verification of cellulose producing bacteria, namely; *Acetobacter xylinum, pseudomonas sp RV14 and Rhizobium* from samples obtained locally from regions of Bangalore, Karnataka, India and to the Optimization of media conditions for starter culture using Placket Burman method. The Study of growth of the bacteria as well as bacterial cellulose under parameters such as pH and temperature were one of the objectives. To test the biological, mechanical and chemical properties and characteristics of the obtained bacterial cellulose and the media in which it was grown.
The successful isolation of bacteria from local sources produced very little bacterial cellulose to allow it to undergo further mechanical and chemical tests. The bacterial cellulose was produced by *acetobacter* and *rhizobium* and not by *pseudomonas sp*. even after mutation by UV.*Rhizobium* grew better when isolated by bleaching methodology and the cellulose was produced when the flask was static as compared to the shake flask and the The growth of the cellulose was relative in the waste water treatment but only seen in acetobacter Xylinum.

Keywords: *white water, rotten apple, filaments, media, Pseudomonas Sp., Rhizobium*

Isolation and Molecular Characterisation of Aflatoxin B1 Degrading Bacteria

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Aflatoxins are highly toxic polyketide secondary metabolites produced mainly by *Aspergillus flavus*. The human health impact of AFB1 exposure is widespread in developing countries. It is known that AFB1 causes teratogenicity, immunotoxicity, hepatotoxicity and even death in humans and farm animals (Abhishek *et al*., 2015). Various physical and chemical methods have been developed to eliminate the aflatoxins, but these methods have many limitations, such as loss of product nutrition, organoleptic qualities, undesirable health effects, and high cost of equipments. These disadvantages encouraged recent emphasis on biological methods of degradation of aflatoxins (Gao *et al*., 2011).Considering the disadvantages of various physical and chemical methods, the present investigation made an attempt to isolate and characterize the soil and animal fecal bacteria having AFB1 degrading potency. Several bacterial strains were isolated by soil and animal fecal samples based on their ability to grow on media containing AFB1. Further, all the bacterial isolates were screened for their ability to degrade AFB1 in peptone broth. A significant degradation was showed by bacterial isolates S4, Rb3 and Rt2 in peptone broth containing AFB1 as carbon source, on comparison with other isolates. The morphological and genomic analysis showed that the AFB1 degrading isolates are *Acinetobacter radioresistens* (S4), *Pseudomonas* sp. (Rb3) and *Corynebacterium* sp. (Rt2). Spectro-densitometric analysis of the eluted chromatograms revealed the percentage degradation of AFB1 by the bacterial isolates. Maximum degradation of AFB1 was observed in *Pseudomonas sp*. (Rb3) treatment which accounted to an approximate 98.64% degradation at 72h incubation, followed by *Corynebacterium* sp. (Rt2) with a capacity of 95.23% degradation and *Acinetobacter radioresistens* (S4) showed least ability within the three isolates with 54.98% degradation. The literature survey revealed no previous reports on aflatoxin degradation activity of *Acinetobacter radioresistens*, although it has been previously reported in the biodegradation of aromatic compounds like phenol, benzoate, toluene, *etc* (Abdel-El-Haleem, 2003). The soil isolate of *P. aeruginosa* has been previously reported for degradation of AFB1 upto 72.5% AFB1 after 72h incubation and *Corynebacterium rubrum* have been previously reported in the biodegradation of aflatoxin (Mann and Rehm, 1975; Sangare *et al*., 2014). Compared to the previous reports, our results are prominent and these two can act as potential candidate for AFB1 degradation and also *Acinetobacter radioresistens* can be utilized in biodegradation of AFB1.

Keywords: *Aflatoxin, Fungi, Bacteria, Degradation, Aspergillus flavus.*

In Silico Comparison of Sulfur Oxidation and Reduction Mechanisms for Better Apllication in Environmental Industry

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Introduction: Sulfur cycle is one of the important biogeochemical cycles in the world. Chemotrophic or phototrophic proteobacteria through dissimilatory pathway use sulfur molecules as electron donors or acceptors to gain energy by either reductive or oxidative mechanisms.Sulfur oxidizing prokaryotes (SOPs) gain energy chemolithoautotrophically or photolithoautotrophically through oxidative dissimilatory sulfur metabolisms, where reduced sulfur compounds or elemental sulfur serve as electron donors.

Allochromatium vinosum(A. vinosum) which belongs to the class of ã-proteobacteria, family Chromatiaceae, is the dominant member of anoxygenic photosynthetic purple sulfur bacteria and it possesss sulfur oxidizing operons (sox) forthe oxidative sulfur metabolism. During sulfur oxidation it produces elemental sulfur in the periplasmic space as an obilgatory intermediate in the form of sulfur globules as Sox(CD)2proteins are absent. Furthur oxidation process is carried by Dsr proteins expressed from dsr operonin A. vinosum. In both sulfur anion oxidizing and reducingmicroorganisms possessdissimilatory sulfite reductase(DsrAB) protein complex and plays a vitalrole whereas reverse DsrAB (rSiR) is expressed from dsrAB genes of A. vinosumfunction in opposite mechanism. A.vinosum can grow lithoautotrophically in absence of light and thus can be used for biological desulfurization process and the use of this organism isadvantageous than other phototrophic species for lesser operational cost due to light in fermenter. Bio-hydrogenproductionfrom anoxygenic phototrophic bacteria is still in an exploratory stage in bio-energy production researchunlike biogas and alcohol production. A.vinosum has long been used in various biotechnological applications pertaining to waste remediation and removal of toxic compounds, e.g. odorous sulfur compounds like sulfide or even explosives. It is also used in the production of industrially relevant organo-chemicals such as vitamins or insecticides, along with their potential use as bio-fertilizers.Bio-derived and biodegradable plastics i.e. in the form of poly-3-hydroxybutyrate (P3HB) common form of polyhydroxyalkanoatewas isolated from A. vinosum.

On the other hand, Desulfovibrio vulgaris (D. vulgaris), the sulfate anion reducer, is used as a model organism for sulfate-reducing bacteria. The main importance of this organism lies in its ability to be involved in bioremediation of toxic metal ions. The sulfur reduction reactions are the main anaerobic processes for the bio-mineralization of the organic matter in sediments and nearly 50% of the total degradation of the sulfur containing organic matters in marine sediments is mediated by D. vulgaris.The completeunderstanding of the sulfur oxidation mechanism and its comparative study with sulfate reduction is really essential for better application of this industrialy and environmentally important and abundant proteobacteria A.vinosum.

Objective: Tillnow no three dimensional structure of rSiR is available in PDB so it was a challenge to build the structure and study the molecular insight of DsrAB from A.vinosum. Themechanism of sulfur oxidation process is different from the sulfate reduction reactions.The structure function study and to compare between them would be useful to predict the hitherto unknown molecularmechanism of sulfur oxidation process from A. vinosum.

Methodology: The crystal structure of the DsrAB protein complex from sulfate reducer D. vulgaris was found to be available from the PDB (ID: 2V4J). But no such 3D experimental

structures were available for the DsrAB protein from A. vinosum. In order to study the difference in the mechanism of sulfur anion oxidation and reduction processes, the three dimensional structures of the DsrA and DsrB proteins from A. vinosumwere to be built using the X-ray crystal structure ofDsrAB from D. vulgaris as templates by homology modeling in MODELLER. The built models were refined by MM simulations using Steepest Descent followed by Conjugate Gradient protocols applying CHARMm force fields. The docking of DsrA and DsrB proteins was performed using ZDOCK present in Discovery Studio 2.5.To study the macromolecular interactions between DsrA and DsrB proteins,DsrA, DsrB and DsrAB protein complex were simulatedin GROMACS.The DsrAB protein complexes of sulfatereducer (D. vulgaris) and sulfur oxidizer (A. vinosum) were docked with different sulfur anion ligands,viz., sulfate, sulfite, thiosulfate and sulfide inAutoDock4.2.Non-bonded interaction energies i.e. vander Waals and electrostatic energy values were calculated from the energy minimized docked complexes.

Results: The protein model validation serverSAVES indicated good quality homologymodels.The superimpositions of the backbone atoms of the modeled proteins with their respective templatesshowed the RMSD values of 0.8 Å for DsrA and 0.9 Å for DsrB. The MD simulation indicated that the DsrAB protein complex was held together by strong intermolecular non-covalent forces and provides a highlystable complex to fit for possible involvements in sulfur anion oxidation reactions. The binding interface of the DsrAB protein complex in sulfur oxidizer A. vinosumwas highly charged and the interface was stabilized mainly by charged residues. On the other hand, the binding interface of the DsrAB protein complex in sulfatereducer D. vulgariscontainssome non-polar amino acids. The sequence alignment result revealed the differential structural aspects of DsrA and DsrBproteins from A. vinosum with those of D. vulgaris that mostly basic amino acidresidues, viz., Arg77, Arg95, Arg165, Lys206, Lys208, Lys210, Arg224, His359 andArg361 from DsrA protein and Arg60, His132 and Asp 134 from DsrBwould create apositive environment in the protein complexes to bind the oppositely charged sulfuranions.The structural comparison of theDsrAB protein complex of A. vinosum with that of D. vulgaris showed the RMSdeviations between the backbone atoms of the proteins were 31.469Å. The docking study of DsrAB with sulfur anions revealed that in A. vinosum, there were 5 positivelycharged basic amino acid residues (Lys206, Lys208, Lys313, Arg314 andArg361 from DsrA) that were found to be present in the thiosulfate binding regionwith maximum interaction energy. On the other hand, the sulfate reducer D. vulgaris interacts maximally withsulfate and sulfite and minimally with thiosulfate and sulfide.
Conclusion:The constant recycling of thesulfur anions maintains the environmental sulfur balance. The interaction scheme of sulfur oxidation as well as reduction mechanism will be helpful to utilize these organisms to create an environment friendly industry.

Keywords: *Anoxygenic phototrophic bacteria,dsr (dissimilatory sulfite reductase) operon, DsrAB redox enzyme, sulfur oxidizer Allochromatium vinosum,sulfate reducer Desulfovibrio vulgaris, biological desulfurization processes, waste remediation, homology modeling, molecular docking, molecular dynamics simulation*

Studies on Antibacterial Activity of Rhamnolipid Biosurfactant Against Staphylococcus Aureus

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Introduction: Skin is the first line of defence in animals that defend the body from various physical, chemical injuries as well as from radiation. However if the integrity of the skin is breached due to any sort of damage caused to it, it would result to a wound. A normal wound heals in around six weeks. Wound healing is a complex procedure of tissue regeneration which involves inflammation, tissue formation and tissue remodelling. However wound healing is delayed due to various environmental as well as biological factors such as chronic diseases, host immunity. Occasionally infection could be one of the factors accounting to hindrance in wound healing. Out of numerous infectious micro-organisms, Staphylococcus aureus is one of the opportunistic pathogen; a member of normal micro flora, known to inhabit various sites of human body without presenting any pathogenicity. However due to alteration in environmental factor or host immunity, this pathogen over-colonises causing infection. Staphylococcus aureus is known to cause ranges of infection such as mild boils, pimple to severe infection such as bactericimia, sepsis etc. A lot of chemically synthesized drugs such as General cephalosporins (cefazolin, cephalothin and cephalexin) clindamycin, lincomycin and erythromycin, vancomycin, teicoplanin are known to be used for the management of Staphylococcal infection. However these drugs are reported to pose health threats and evoke the immune system accounting for hypersensitivity, thus limiting their uses in ceratin cases. Also emergence of resistant strain of Staphylococcus aureus against certain anti-staphylococcal drugs such as Methicillin resistant S.aureus (MRSA), Vancomycin resistant S.aureus (VRSA) are new threat to medical world. In such circumstances, a potentially safe and effective therapeutic alternative is necessary which doesn't have adverse effect on the patient body and doesn't not evoke immune response. Biosurfactants proves to be a prominent candidate as they have no or less toxicity toward human cells as well as in animal models. Biosurfactants are surface active agents with immense application in agriculture and pharmaceutical purposes as an alternative to various pesticides, chemical substitutes, as well as in food corporation, laundry food additives and emulisifiers. Classified as glycolipid, lipopeptides, fatty acids, polymeric and surfactant particles out of which Glycolipid are majorly studied biosurfactant. Glycolipid is further classified as Rhamnolipid, Sophorolipid, Trehalose Lipids and Mannosylerythritol lipids. Rhamnolipid is the most extensively studied glycolipid due to its high effectivity against plant as well as human pathogen.

Objective: Aiming at the exploration of biosurfactant for its anti-staphylococcal activity, the present study is conducted to investigate the in-vitro anti-bacterial activity of rhamnolipid biosurfactant produced by Pseudomonas aeruginosa strains against Staphylococcus aureus.

Methodology: Three strains of Pseudomonas aeruginosa viz. SS14, SR17 and JS29 were obtained from germplasm of IASST. The bacterial strains were cultured in nutrient broth at 35±2?C at 180 rpm and their potentiality to reduce surface tension was determined using kruss tensiometer till 72 hrs. The 48 hrs cultures of individual strain were centrifuged at 10000 rpm, 4?C for 20 mins and the cell free supernatants were obtained. The cell free supernatants were used to investigate the anti-staphylococcal activity. Sterilized cell free supernatants supplemented with nutrient agar (13g/L) were plated and upon solidification, the plates were

spreaded with Staphylococcus aureus and incubated at 35±2?C for 24 hours. The cell free supernatant of 48 hrs culture, obtained by centrifugation was de-proteinized by heating at 110?C, acidified to pH 2 by adding 6N HCl at room temperature and kept overnight at 4?C for precipitation. The precipitate is then extracted in rotary evaporator at 40?C using ethyl acetate as solvent. These extracts were then used to evaluate the effective concentration of crude rhamnolipid against Staphylococcus aureus by well diffused agar plate method.

Results: The bacterial isolates SS14, SR17 and JS29 have the potentiality to reduce surface tension from 72 mN/m to 30.1 mN/m, 27 mN/m and 28.3 mN/m respectively. The yield of SS14, SR17 and JS29 was found to be 3g/L, 4g/L and 3.2g/L respectively. The cell free supernatants of all the isolates were potent in inhibiting growth of Staphylococcus aureus. However well diffused agar plate method showed that the crude extract of SR17 at a concentration 2g/L is potent to inhibit Staphylococcus aureus resulting in a zone of 15mm.

Conclusion: The finding of the present study suggests that the crude extract of rhamnolipid of SR17 have the potentiality to be used against Staphylococcus aureus. The crude extract needs to be purified, and a comparative study of effect of purified rhamnolipid and commercially available medicine is mandatory. The work needs further study to ensure its therapeutic application against Staphylococcus aureus infection.

Keywords: *Wound healing, Rhamnolipid, Pseudomonas aeruginosa, antibacterial, Staphylococcus aureus*

Biochemical Analysis of Pila Globosa Living in Different Habitat

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Pila globosa is a common edible mollusk. It is amphibious and can be found in both water and land. They are not found in rapid flowing streams and at low pH. They are used for medicinal purposes and as food for fishes, birds and humans. They are the cheapest source of protein. In the present study, protein, glucose, glycogen is estimated in Pila globosa collected from ponds and lands. The above parameters are also assessed in laboratory conditions. 20 animals were put in aquarium and 20 animals in moist soft soil. Besides that glutamic dehydrogenase, succinic dehydrogenase, catalase was analyzed. For laboratory assessment, 10 liters of water were put in each aquarium and 20 animals were put. 6 Kg of humus rich soil were used in which approx 2 liters of water were added. 20 animals were then put in tub containing mud and covered with net to prevent their escape. The whole animal tissue has been used for biochemical analysis. In another set of experiment foot, muscle and liver has been used for biochemical analysis. It has been observed that the level of protein was almost constant but the level of glucose and glycogen varies considerably. The level of enzymes did not show any particular trend and it requires further analysis before conclusion. From the present study, it has been concluded that there is fluctuation in metabolism between animals living in different environmental condition. It may be a way for them to get acclimatized in different ambience.

Keywords: *Pila globosa, aquatic, terrestrial, biochemical parameters*

Soil of Dibrugarh District.Assam: An Unexplored Source of Potent Antibiotics

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Naturally soil is rich in microorganisms capable of antibiotic synthesis but the frequency with which synthesis occurs at ecologically significant levels in has been much less clear. Over the past decade, however, genetic and molecular techniques, have been applied to demonstrate that microorganisms synthesize a variety of antibiotics. Antibiotics are the important secondary metabolites of almost all types of microbes.The process of antibiotic production by microbes is known as antibiosis where the metabolic products of one organism directly inhibit or kill other pathogenic organisms. North eastern region of India is well known for its biodiversity hotspot with so many unexplored economically important microorganisms. The aim of the current study is to detect the antimicrobial activity of soil isolates from Dibrugarh district,Assam. Soil samples from different parts of Dibrugarh district has been collected and screened for antibiotic producing microorganisms by agar sensitivity assay. Out of 160 isolates collected 148 were identified as bacteria and other 12 are fungi. Bacterial colonies were identified by their cellular characteristic and colonial morphology . Out of 160 isolates 50 isolates showed prominent activity against 4 test isolates viz. B. subtilis (MTCC 121), Pseudomonas aeroginosa (MTCC 4673) S. cerevisiae (MTCC 3090) and E.Coli (MTCC 40). From the 50 isolates 2 bacterial isolates showed strongest activity and were identified as Enterobacter cloaca strain and Klebsiella pneumonia strain on the basis of 16S rDNA sequencing and other biochemical tests on the basis of Bergey's manual of systematic bacteriology. These results indicate that the areas of Dibrugarh District soil microorganisms could be an interesting source of antibacterial bioactive substances.

Keywords: *Klebsiella pneumonia, Enterobacter cloaca, antibiotic producing soil, 16S rDNA sequencing, North East India*

Comparative Modeling of Structure and Sequence Analysis of Myosin Heavy Chain 6 in Two Freshwater Pipefish Species, Microphisdeocata and Oostethusbrachyurus

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Myosins are a large superfamily of motor proteins that move along actin filaments, while hydrolyzing ATP to different forms of mechanical energy that can be used for a variety of functions such as muscle movement and contraction. The myosin heavy chain 6 gene encodes the alpha heavy chain subunit of cardiac myosin. In thisin silico study, it was attempted to analyze the nucleotide and protein sequence as well as modeled protein 3D structures of two freshwater pipefishes, Microphisdeocata and Oostethusbrachyurus, predicted based on the sequences. The gene and protein sequences were retrieved from NCBI.Analysis using CLC Genomic Workbenchsuggested that there were minor variations in molecular weight, melting temperature, atomic composition and nucleotide distribution in the myosin heavy chain 6 gene in both the species. However, the total length of the nucleotide and protein sequencesof both the species were same. Protein statistics showed minor differences in molecular weight, aliphatic index, atomic composition and amino acid distribution. The isoelectric points, extinction coefficient, count of hydrophobic and hydrophilic residues were found to be similar in myosin heavy chain protein in both the species. Gene sequences of both the species were GC rich. Protein 3D structures were predicted by MODELLER 9.19. The validity of the structures was done by PROCHECK and RAMPAGE. The minimization of energy and refinement of protein structures were checked using Discovery Studio 4.0. Refined structures were evaluated using PROSESS. Ramachandran plots of myosin heavy chain 6 protein in both the species were plotted using Discovery Studio 4.0. The structure of myosin heavy chain 6 can be helpful in structural biology for further investigations on active sites, molecular mechanism of function and structure based phylogeny.

Keywords: Microphisdeocata, Oostethusbrachyurus,Myosin Heavy chain 6, Nucleotide, Protein, Sequence, Comparative modeling, MODELLER, Discovery Studio 4.0.

Isolation, Characterization and Evaluation of Antifungal Activity of Lipopeptide Biosurfactant Produced By Bacillus Altitudinis Ms16

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Background: In context of mounting demand for crop production, to nourish the ever increasing human population globally, chemical fungicides and pesticides have been used substantially over the past few decades. However, the recurrent and unwarranted use of these chemical fungicides and pesticides in horticultural production systems pose a deleterious effect on the environment affecting the health of terrestrial and aquatic ecosystem. Moreover, these chemical residues on food as a consequence of customary usage against plant pathogens pose severe menace towards human health. Comprehending the toxic, perilous effects of chemical fungicides and pesticides on environment and human health, there prompted the urge of using microbial bioactive metabolites or biosurfactants as an alternative. Biosurfactants are a heterogeneous group of structurally diverse surface active primary or secondary metabolites produced by a wide array of microorganisms. The eco-friendly and non-toxic nature of microbial biosurfactants in addition to its' distinctive, prominent and compelling efficacy against a broad range of phytopathogens reflect its competency over its chemical counterparts.

Objective: Owing to the efficacy and potentiality of biosurfactant against a wide range of phytopathogens, the current study was conducted to isolate biosurfactant producing bacterial isolate and to characterize and evaluate the antagonistic activity of the biosurfactant against Sclerotinia sclerotiorum, a well known phytopathogen of economically beneficial crop plants around India and around the world.

Materials and methods: Biosurfactant producing strains were initially isolated from the root rhizosphere of different crop plants followed by its screening for biosurfactant production. Preliminary screening for biosurfactant production was assayed through estimation of surface tension reduction of the culture broth, followed by drop collapse and emulsification index assay. The potential biosurfactant producing strain was checked for its antifungal activity against the fungal pathogen Sclerotinia sclerotiorum by dual culture plate assay. Identification of the bacterial strain was done through morphological and physiological studies and the phylogeny of the strain was determined by sequence analysis of 16S rRNA gene. The growth and biosurfactant production profile were evaluated by growing the isolate in Minimal Salt medium with 2% glucose, at 35℃, 200 rpm, with an airflow rate of 1vvm in a Modular Baby fermentor (Model MBF-3). The biosurfactant produced was extracted through solvent extraction and the yield of the crude biosurfactant was expressed in g/L. Stability of the extracted biosurfactant was evaluated at different NaCl concentration ranging from 2 to 10% and over a wide range of temperature from 40, 50, 60,….120℃ each for a duration of 30m. The crude biosurfactant was column purified using 35 × 1.0 cm glass column, packed with a slurry containing silica gel 60120 mesh in chloroform using different solvent gradient system (CHCl3, 95:5, 90:10, 75:25, 70:30, 50:50 (v/v) of CHCl3: CH3OH solvent and 100% CH3OH). The column purified biosurfactant was subjected to TLC and FT-IR studies for its compositional analysis.

Results and Discussion: A total of twenty isolates have been isolated, of which three isolates viz. MS16, MS19, and MS20 showed promising results for biosurfactant screening tests. Among them, MS16 was found to be the most efficient biosurfactant producer which led to a maximum reduction of surface tension of the medium i.e. from 71.4 to 32 mNm-1 after an incubation period

of 48h. The potential biosurfactant producing (MS16) showed significant emulsification activity of 98.5% and 77.6% after 24 hours of incubation and emulsion stability of 100% after 168h of incubation against crude oil and used engine oil respectively. The bacterial isolate (MS16) showed effective antagonistic activity against the tested pathogen Sclerotinia sclerotiorum in dual culture plate method. After 24h of incubation, the bacterial isolate showed profuse growth on the agar surface inhibiting the growth of the fungal pathogen. The plates were observed each day for 10 days time period, and it was revealed that in due course of time the fungal mycelial plug couldnot grow in the presence of the bacteria, as a result of which its size shrinked indicating the death of the fungus. Considering the efficient and potential antagonistic effect of the isolate MS16 against the phytopathogen Sclerotinia sclerotiorum, the isolate was further identified through morphological, physiological and molecular approach. Morphological and physiological studies showed that the isolate share a high degree of similarity with the members of the genus Bacillus. Results of 16S rDNA sequencing supported by BLAST search with the already available sequences in NCBI database revealed 99% similarity with Bacillus altitudinis 41KF2b(T) strain. Based on the results obtained, the bacterial isolate MS16 was identified as Bacillus altitudinis MS16 (Genbank accession no. MG066459). The growth and the surface tension reduction profile was studied and was observed that the particular isolate showed a growth with a lag time of 12h followed by exponential phase that lasted up till 48h. Surface tension reduction was found to be maximum at 30h of incubation. Optimum growth temperature was found to be 35℃ and can tolerate a salinity concentration of 9%. The produced biosurfactant was extracted using ethyl acetate and the yield obtained was 2.76g/L. The column purified surfactants showed two prominent spots on developed TLC plate on spraying with 0.2% Ninhydrin reagent indicating its lipopeptide nature. Infrared absorption showed similar results with other lipopeptide biosurfactant such as surfactin and iturin proving it to be a lipopeptide.

Conclusion: Based on the in vitro results, we can conclude that Bacillus altitudinis MS16 showed impending antifungal activity against the fungal pathogen Sclerotinia sclerotiorum by production of secondary metabolite lipopeptide. Further studies are required to confirm the potentiality of the metabolite produced by Bacillus altitudinis in purified form and also under field conditions.

Keywords: *Lipopeptide biosurfactant, Bacillus altitudinis, Sclerotinia sclerotiorum, antifungal activity*

Study of Microbial Succession on Vegetable Tanned Leather of Goat During Fungal Infestation Under Varying Climatic Condition and Storage Period

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Fungal infestation of leather is concerned with interaction of leather with fungi. Thus leather, fungi and environment, all intimately concerned in infestation. So, the climate of storage place is of great importance to the activity of fungi on stored leather. Therefore, it is quite necessary to investigate various types of leather infesting fungi, their succession and ecological conditions which play an important role in the development of these organisms on such products. In the present study attempts have been made to study the succession of fungi on vegetable tanned leather of goat under varying storage conditions. The conducive factors which are taken into consideration include varying level of the relative humidity and storage conditions at suitable temperature. Thus during present studies three basic attempts were taken under consideration (i) Qualitatively- what kind, (ii) Quantitatively how many living microbial form inhabit the leather and (iii) how do, relative humidity and duration of storage affect fungi.

Keywords: *Infestation, Fungi, Succession, Climatic conditions.*

Antibacterial Effects of Ethanolic Extract of Saraca Asoca leaves on Escherichia Coli and Staphylococcus Aureus

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The ethanol leaf extracts of Saraca asoca showed significant antibacterial activity against Escherichia coli and Staphylococcus aureus. In an experimen design, the Escherichia coli and Staphylococcus aureus were collected from the IMTECH, Chandigarh. Antibacterial effects of the leaves extract against these bacteria were evaluated by well diffusion method and resistance of antibiotics against isolates was evaluated by using hexa UTI disc 4 (Himedia pvt limited). Ampicillin, gentamycin, nitrofurantoin, ciprofloxacin, nalidixic acid, co-trimoxazole were the antibiotics present in hexa UTI disc-4, tested against E. coli and S. aureus. Among these ciprofloxacin showed greater zone of inhibition compared to ethanolic extract of guava leaves. Today, detection of antibiotic resistance against isolates is important in prevention and control of infection. In this study, the extracts of Saraca asoca were found to the second higher antibacterial agent against isolates. Increasing bacterial resistance against antibiotics is an emerging problem for human health. Therefore, this study was aimed at using ethanolic extract of leaves of Saraca asoca and assessing their effect in vitro on bacterial agents infections, and also compared the effect of these extracts with common antibiotics.

Keywords: *Saraca asoca, Ethanolic leaf extract, Agar well diffusion method, Antibacterial properties, Zone of inhibition.*

In silico Protein Modeling and Sequence Analysis of Cytochrome C Oxidase in Wild Tasar Silkworm, Antheraea Frithi

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Proteins are inimitable as principle functional agents of living system. Therefore, comprehension of protein sequence and structure and its co relation with its function is equivalent to deciphering almost all of fundamental features of any biological system. Understanding and regeneration of protein function requires comprehension of reliance between protein sequence and its structure, its localization in cells and its interaction with other functional partners.Cytochrome c oxidase is a large integral membrane protein and is the last enzyme in the respiratory electron transport chain of mitochondria located in the mitochondrial membrane. Despite the importance of Cytochrome c oxidase protein its structure have not yet determined experimentally in Antheraea frithi, the source of wild tasar silk which is an indigenous wild silk moth of north-east India. In the present study an attempt was made to modela 3D protein structure and also analyze the nucleotide and protein sequence of Cytochrome c oxidase of Antheraea frithi.The3D Structure was modeled using Modeller 9.19 using the template 1v54 which has 84% identity with the target.The model Structure was validated using Procheck and Rampage Server. Both the nucleotide and Protein Sequence of Cytochrome C oxidase of Antheraea frithi were retrieved from NCBI having accession numberAY605248 and AID58017 respectively and these sequences were analyzed in CLC Genomic work bench. The 3D model of the protein gave us information on Helix%, Beta Strand %, turn % and Coil % .The analysis of the nucleotide sequence and Protein Sequence revealed information's such as melting temperature, nucleotide composition, isoelectric point, molecular weight, count of hydrophobic and hydrophilic residues and it was found to be AT rich sequence.Thus the predicted structure can be used for further investigations in structural biology of the species.

Keywords: *Antheraea frithi, cytochrome c oxidase, comparative modeling, modeler, CLC genomic work bench*

Studies on the Effect of Organophosphate Insecticides on the Performance of Conventionally and Genetically modified Cotton (Bollgard) with special reference to Bollworm (Helicoverpa armigera) and Lint Quality Characteristics of GM (Bollgard®) Cotton

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The Genetically modified cotton acreage has Predominantly and increased in dramatically the last six years. The Reports of variable results in fiber quality as well as the yield have arisen regarding the transgenic cultivars. The present study has been conducted under the field and the greenhouse conditions to investigate the performance of transgenic and conventional cotton and determine the efficacy of OP and NP treatments on growth characteristics, yield, and the fiber quality of cotton.The Report shows that Cotton lint yield in the field study has been substantially affected by cultivar. RASI BG II has produced greater lint yields than RASI BG I and NH44.The Application of IR treatments has exerted some influence on lint yields in the field study. Although the differences are not very significant at the 5% level, there has been an evidence that cotton treated with FP has responded with a yield increase compared to NP and OP treatments.

Studies on Phytochemical Analysis and Screening for Active Compounds in some Ferns of Ranchi and Latehar Districts

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The principle objective was to evaluate chemical constituents of some locally and wildly grown fern plants of Ranchi and Latehar districts. Fern plants are growing under different environmental conditions. The aim of the present study was to evaluate the chemical composition of essential oils from two chemically unexplored fern ses of Ranchi and latehar district. So, the content of different bio-macromolecules and secondary metabolites are different in these plants. Ferns are least exploited group of plants in India, when compared to other countries of the world. Phytochemical studies of the two plants under investigation are important while evaluating plant wealth of the region under study.

Lygodium flexuosum was growing in areas under comparatively less water availability whereas Ampelopteris prolifera was growing under high water and moisture content. Lygodium flexuosum and Ampelopteris prolifera contains lots of pigments, carbohydrates, amino acids, proteins, lipids and several secondary metabolites. The present study was made to find out the chemical composition (in case of rhizome, fronds, and petiole of the two ferns) and their relationship with antimicrobial activity of these two plant species. Methanol extract showed maximum numbers (eight) of the compounds. Reducing sugars are present in petroleum ether extract and methanol extract of Lygodium flexuosum and in Ampelopteris prolifera it is present in the methanol extract only. Alkaloids are present in the benzene extract and methanol extract of L. flexuosum and in A.prolifera these compounds are present in methanol extract only. Lygodium flexuosum rhizome extract possessed more anti bacterial principles (than Ampelopteris prolifera, when compared), soluble in methanol and acetone which suppressed the growth and multiplication of the tested bacterial species than leaves and petiole. The presence of phenolics, flavonoids and triterpenoids in acetone extract might be responsible for its maximum anti bacterial activity in Lygodium flexuosum and little in Ampelopteris prolifera. Petroleum ether extract did not show the presence of chemicals tested in Ampelopteris prolifera. Methanol extract showed the presence of flavonoids and phenolics. The anti bacterial activity of different plant parts of these two ferns and their active constituents would be helpful in treating various kinds of diseases. Lygodium flexuosum is potential anti bacterial agent for the bacteria causing eczema, dysmenorrhoea and spermetorrohea and leaf and petiole extract is effective in jaundice and gastro intestinal ailments. The results confirm the presence of constituents which are known to exhibit medicinal as well as physiological activities.

Keywords: *Flavonoids, rhizome, petiole, methanol, benzene and phytochemical Extract, Lygodium flexuosum, Ampelopteris prolifera.*

Characterization and Uranium (VI) Bioadsorption Profiling of Pseudomonas Aeruginosa Wild Isolates from Uranium ore Deposit

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Domiasiat of Meghalaya, India is blessed with rich deposit of uranium (U) ore with 0.1% U3O8 and is considered as the largest and near-surface sandstone type U ore bearing site so far reported in India. Uranium tolerant bacteria were isolated from uranium rich Domiasiat area and among them sixteen wild isolates of Pseudomonas aeruginosa were selected and characterized for their diversity and uranium bioadsorption potentials in present study. Characterization was based on growth on selective medium and 16S rRNA gene study. Diversity among the isolates was assessed using Ribosomal Intergenic Spacer Amplification (RISA) and Randomly Amplified Polymorphic DNA (RAPD). In RISA, all the isolates were found to produce a band of about 700bp and their sequences were submitted to GenBank and accession numbers were received. However, BLAST results and Neibour joining tree produces little evidence of ITS polymorphism. In RAPD analysis out of ten primers only four produced consistently reproducible banding patterns and were considered for analysis. U(VI) bioadsorption study of these isolates was performed along with the reference culture Pseudomonas aeruginosa ATCC 15442. The study revealed the superiority of wild isolates in compare to the reference culture in their ability to remove 90-94% (21.4-22.5 mg/L) and 45-72% (214.2-342.7 mg/L) of U (VI) when challenged with 100µM (23.8mg/L) and 2mM (476mg/L) uranyl nitrate solutions within 1 h of incubation at pH 3.5. The wild isolates indicate potentials for in situ bioremediation Uranium contaminated and nuclear waste sites.

Keywords: *Domiasiat, Diversity, Bioremediation, 16S rRNA gene, RISA, RAPD*

Biodiversity Dynamics and Crisis

The Study of Periphyton Diversity and Macro-Benthic Faunas in the Wetlands of Upper Brahmaputra Valley, Assam

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Periphyton contributes a major share of food for many aquatic animals including fish. The study of periphyton communities has the added advantage in relation to the increasing eutrophication of aquatic environments as they are one of the best biological indicators of the water quality because of their tremendous adaptive qualities and universal distribution. The periphyton samples were collected by rock scrapings from different points every month. The data were finally pooled together to obtain a representative sample. The samples were thoroughly centrifuged to obtain the sediment biomass. It is then transferred to a measuring cylinder and made the volume of the sample to 100 ml. from this sample 1 ml was drawn and the counting was done with the aid of a Sedgwick Rafter plankton counting cell. For macrobenthic study sediment samples were collected monthly. The submerged plants were collected in plastic bags immerged in 4% formalin and identified by Needham et.al (1962) and Patil and Gouder (1989). Molluscan shells collected washed preserved and identified by Fernando (1963) and Patil and Gouder (1989).Diptera, Oligocheata, insect species, chironomidaes, gastropods, Pelecypoda etc. were found in the study areas. This paper deals with the study of periphyton and their relation with macrobenthic population from 2011 onwards. Statistical analysis was done by SPSS software programme.

Keywords: *Aquatic environments, Sediment biomass*

School Damage in Forest-Fringe Area: An Impact of Man-Elephant Conflict in Jalpaiguri District, West Bengal, India

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Man-animal conflicts are common in various parts of Duars region of WestBengal.Elephant and Leopard are the most conflict-prone species in this region. Many forest-fringe school authorities cut their jackfruit and mango tree due to melt off the possibility of the school damage in jackfruit-mango season. School property damage by elephant has been seen more in recent time than the past ten years. According to respondents maximum school damage incidents have been observed in summer season. According to respondent's food scarcity in the forest, increasing elephant population, human encroachment towards the forest, the poor mitigation measures are responsible for the increasing incidence of man-animal conflict in this region. As a result the incidence of the school damage also increasing day by day. The elephant target school locates nearer to forest due to the easy access of food like rice, flour, pulses and vegetable during summer season and winter season. Tandu Tea Garden Junior High School and Mech Busty Forest Village Primary School are badly affected by elephant attack in recent time. Percent of students missing more than 10 days of school are more in Tandu Tea Garden Junior High School and Saraswati Banabusty Primary School due to elephant attack in their house premises last night. According to local people, the broken school building due to elephant attack has been reconstructed during the election as the school is selected for pooling booth.

Keywords: *School damage, Students absenteeism, Mid-day meal induced elephant attack, Forest-fringe school*

Multiple Correlation Coefficient of the Length of Primary Rachis, Length of Secondary Rachis (basal and apical), Number of Leaflets in the Primary and Secondary Rachis and the Diameter of the Pulvinus of the leaf of Peltophorum Pterocarpum Collected from Marine Lines, Mumbai using PSPP Software

Jessica Rene Hansdah

Peltophorum pterocarpum, a deciduous tree found throughout India, is easily identified by its bipinnate leaves. The aim of the paper is to observe the correlation (if any) between the length of primary rachis, length of secondary rachis (basal and apical), number of leaflets in the primary and secondary rachis and the diameter of the pulvinus, with the help of PSPP software. All variables show positive correlation with the length of the primary rachis. With respect to length of the primary rachis, the diameter of the pulvinus shows the highest positive correlation (.9), followed by the basal secondary rachis (length and number of leaflets) (.76). The number of leaflets in the apical secondary rachis gives a moderate positive correlation (.57) while the length of the apical secondary rachis shows negligible positive correlation (.07).

Keywords: *Peltophorum pterocarpum, primary rachis, secondary rachis, no. of leaflets, diameter of pulvinus, PSPP*

Maggots in the Mouth, Oral Myiasis a Rare Case Report from Bundelkhand Region of Uttar Pradesh

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The present investigation on oral Myiasis parasites of Bundelkhand region of Uttar Pradesh. The patients reported were laborer residing in rural area, with low socioeconomic background and lack of awareness on oral health. It is primarily caused by the invasion in the human body tissues by larvae of Dipteran flies. It is associated with poor oral hygiene, alcoholism, senility, severe halitosis, hemiplegia patients and mouth breathing during sleep. Here we reported the oral Myiasis, in 61- 69 years old patients in various parts of Bundelkhand region of Uttar Pradesh, India.

Keywords: *Parasites, Oral Myiasis, Bundelkhand Region, U.P.*

Diversity of Psyllid Galls with Special Reference to The Biology and Ecology of Two Gall Inducing Psyllids on Terminalia Arjuna W & A.

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The ability to induce gall is a specialized behaviour within the broad context of insect phytophagy. Psyllids, or jumping plant lice, form a group of sternorrhynchous plant bugs with many gall inducing species.

In India over 100 species are on record on about 95 species of trees and other vegetations growing in the forest. Of these 18 species under 7 genera are found to be gall formers. Altogether 17 host plants harbor these gall inducing psyllids in India. It has been observed that psyllids can induce various types of galls like fold galls, leaf roll galls, pouch galls, rosette galls, pit galls, rinden galls, atriate galls, erineal galls etc. Feeding by the nymphal instars is responsible for gall initiation and development. Oviposition may also initiate gall formation. Within all the families of Psylloidea, Triozidae presents the largest number of gall inducers while the families Psyllidae and Phacopterinidae induce relatively few. Gall inducers are almost absent in other families of Psylloidea. Most species of Psyllids are narrowly host specific. The effects of their feeding range from simple distorsion of plant to the formation of structurally complex galls. Psyllids usually show a high degree of specificity with respect to the site of gall formation, wheather it be on a leaf, flowers, stem or root.

The present study deals with the biology and interaction of two psyllids species viz., Trioza fletcheri minor Crawford and Trioza hirsuta (Crawford) inducing blister galls and caterpillar galls respectively on the leaves of Terminalia arjuna W & A. which is a very important medicinal plant. The galls induced by the two above mentioned psyllids differ in their sites of occurrence, shape and colour. During this study an attempt has been made to observe the morphological variations of the above mentioned galls as well as the difference between the life cycle patterns of these galls inducing psyllids.

Keywords: *Diversity, Psyllid, Galls, Trioza fletcheri minor, Trioza hirsute*

Impact of Forest Fragmentation on the Behavirioral Ecology and Demography of Wild Golden Langur Populations

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Nonhuman primates, our closest biological relatives, play important roles in the livelihoods, cultures, and religions of many societies and offer unique insights into human evolution, biology, behavior, and the threat of emerging diseases. They are an essential component of tropical biodiversity, contributing to forest regeneration and ecosystem health (Estrada et al, 2017).

The Golden langur Trachypithecusgeei is an Endangeredcolobine monkey with a very restricted range, being confined to western Assam in India, and Bhutan. At the time of discovery in early 1950s, it was believed that it is confined to the forests along India Bhutan border only but in fact it was found all over the western Assam as is apparent from its present extent of occurrence. In India, its entire population is restricted to a forest belt in western Assam between the Manas River in the east, Sankosh in the west and Brahmaputra in the south along the Indo Bhutan border. Its distribution in Bhutan is limited to the foothills of the Black Mountains 27º30´ N, east of Sankosh river, east of Mangde River (Srivastava et al. 2001).

The Golden langur is in real danger all over its range in India. Never before had it faced such dangers- from rapid loss of habitat, occasional poaching and unreported accidental deaths. Although the local tribes, mostly Bodos usually do not kill langurs but some new generation youths have developed taste for its meat. Some Langur has even started raiding crops due to loss of habitat. The population in India is highly fragmented, with the southern population completely separated from the northern population due to the effects of human activities.

At least 19 fragmented areas now hold the species in India, which was originally a single habitat. Except for Manas, Ripu and to some extent Chirang, the remaining populations have no link with the larger and more secure Bhutanese populations. Many of these fragmented populations have little possibility of long-term survival. Thus primates that specialize in one primary habitat are more likely to go extinct.

Keywords: *RipuChirang, Nayekgaon, Kakaijana RF, Habitat, Activity.*

Ginkgo Biloba L. (Maidenhair Tree): A Living Fossil with Multiple Uses

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Ginkgo biloba L., the maidenhair tree and a living fossil that survived the first atomic explosion in Japan reminds us with hope of survival. It is the single surviving species of the Order Ginkgoales that has restricted wild distribution in China. The Gingko biloba has multitude medicinal, spiritual and horticultural importance worldwide. It is amongst few plant species that have been traditionally or scientifically used and evaluated for their possible medicinal applications. Its usage has been documented in traditional Chinese medicine since 5000 years. Now, it is one of the most widely prescribed herbals or pharmaceuticals in the western world. In spite of its rarity , long reproductive cycle and low rate of natural regeneration, the tree has been exploited indiscriminately due to its high medicinal value, forcing it to face a high risk of extinction. Unfortunately, despite of having huge medicinal properties and ornamental value, the species still has not received much conservation attention. Considering the international importance and conservation value of Gingko biloba multi-strategic efforts are required involving all stakeholders. In addition to its in situ and ex situ measures, environmental legislation and government planning is also essential to ensure adequate conservation of this living fossil plant.

Keywords: *Ginkgo biloba, Conservation, Biodiversity, Maidenhair tree*

Deforestation: Natural Disaster Invited-Cause, Effect and Mitigation

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The Year 2011 Was 'The International Year Of Forests'. This Designation Has Generated Momentum Bringing Greater Attention To The Forests Worldwide. The Year Aimed To Promote Awareness And Understanding Of Forests And Forestry Issues. Sufficient Evidence Is Available That The Whole World Is Facing An Environmental Crisis On Account Of Heavy Deforestation. Deforestation At The Hands Of Humans Has Been Occurring Since The Hunter-Gathers But Has Accelerated Since The Age Of Agriculture. However Extensive Tropical Deforestation Is A Relatively Modern Event That Gained Momentum In The 20th Century. Deforestation Is No Longer Significant In The Developed Temperate Countries Now. The Reasons For The Crisis Are Many But Fundamental Reason Is The Huge Proliferation In Human Numbers And That Too, A Sizeable Quantity Living In Abject Poverty. Forest Is Being Cleared To Provide Land For Agriculture To Feed An Increasing Population And To Raise Their Standard Of Living And Per Capita Consumption. Direct Agents And Causes Of Deforestation Are Relatively Easy To Identify But The Indirect Causes Which Are Usually The Main Divers Of Deforestation Are The Ones Those Cause Most Disagreement And The Ones That Are Hardest To Quantify. The Effects Of Deforestation Range From The Global Level To The Local Level. One Of The Most Important Ramifications Of Deforestation Is Its Effect On The Global Atmosphere. Forests Especially Those In The Tropics Serve As Storehouses Of Biodiversity And Consequently Deforestation Destroys The Biodiversity, Some Of Which Have Still To Be Catalogued. Ways To Reducing Deforestation Must Go Hand In Hand With Improving The Welfare Of Cultivators At The Forest Frontier. Any Policy That Does Without The Other Is Unacceptable. All Strategies Require Cooperation And Goodwill. Overall, The Paper Will Detail The Global Deforestation, Its Cause, Effect And Strategies To Control It.

Keywords: *Deforestation, Forest Resource, Biodiversity, Climate Change, Forest Frontier*

Effect of Pre-sowing Treatment on Germination and Initial Seedling Growth of Saraca Asoca: A Vulnerable Tree Species

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Saraca asoca is commonly known as 'Ashoka or Sita Asoka' is a medicinal tree species that have been traditionally and scientifically used and evaluated for various medicinal applications. The evergreen nature and colourful flowers makes the tree attractive for avenue planting and gardening. Destructive collection methods and over exploitation has reduced its population drastically to vulnerable status. Hence, urgent attention is required for conservation. With the above back ground a study was conducted to study the effect of different pre sowing treatments on germination and initial growth of seedlings of Saraca asoca at Pundibari, West Bengal during May to December, 2017. Significantly better germination was obtained when the seeds were mechanically scarified as compared to other treatments. Significantly better initial seedling growth was also recorded with this treatment. However no germination was recorded in H2So4 treated seeds.

Keywords: *Pre sowing Treatment, Germination, Initial Seedling Growth*

Status, Distribution and Floristic Analysis of Eastern Himalayan Forests of Arunachal Pradesh, Northeast India

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In the present study, vegetation have been surveyed in 354 belt transects (500 x 10m each in size) along an elevational gradient ranging from 87 m through 4161 m. A total of 482 (458 identified, 24 unidentified) plant species including various endemic and non-endemic were recorded in the present study, of which 153 non-woody herbs and grasses (145 identified) belonging to 55 families and 329 woody trees and shrubs (313 identified) belonging to 74 families. The 458 identified species is belonging to117 families and 251 genera, of which 94.10 % phenerogams (Angiosperms: 421 spp. and Gymnosperms: 10 spp.) and 5.90 % cryptogams (Pteridophytes: 27 spp.). Maximum diversity of species is contributed by the family Fabaceae with a total of 27 plant species (Papilionaceae: 10 spp., Mimosaceae: 09 spp. and Caesalpinaceae: 08 spp.) followed by Poaceae (21 spp.), Ericaceae (20 spp.), Asteraceae (18 spp.), Lauraceae (17 spp.), Euphorbiaceae (16 spp.), Urticaceae (15 spp.) and 49 families are represented by single species. The Eastern Himalayan forests in Arunachal Pradesh, Northeast India is rich in terms of various bamboos and a total of 14 different bamboos are recorded in present study including Dendrocalamusstrictus, Bambusatulda, B. pallida etc. The area is also rich in terms various IUCN red listed species including Aquilariamalaccensis,Begonia tessaricarpa, Gledetsiaassamica, Gymnocladusassamicus, Livistonajenkinsiana, Rhododendronmeddenii, Rhododendron thomsoniicollected from Dirrang, Tawang, Yamcha, Itanagar, Along and Mebo areas of Arunachal Pradesh.The most dominant trees areCastanopsisindica (24individuals ha-1), followed by Quercussemicarpifolia (12 individuals ha-1) and Pinusroxburghii(12 individuals ha-1) after some bamboos (Dendrocalamusstrictus: 69 individuals ha-1; Bambusapallida: 16 individuals ha-1). The results of the present study show that species richness generally decreases with the increasing elevation, and species richness and distribution patterns of plants are largely regulated by the altitude and environmental factors.This study confirms that the Eastern Himalayan forests are highly rich in endemic as well as non endemic species,which needintensive monitoringandmanagement to conserve the fragile ecosystems from ever increasing anthropogenic pressure and changing climaticconditions.

Keywords: *species richness, endemic species, forests ecosystems, Eastern Himalaya*

Diversity of Odonates (Dragonflies and Damselflies) of Serampore College Campus, Hooghly, West Bengal, India

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Odonates comprising damselflies and dragonflies play crucial role in ecosystem functioning and can be used as biological indicators ofenvironmental quality. Although much work have been carried out regarding the abundance anddistribution of insect orders in different districts of West Bengal,data on the diversity anddistribution of Odonata still remains insufficient. In the present study an attempt has been made to study the diversity andabundance of odonatesin Serampore CollegeCampus, Hooghly, West Bengal, India. This college, named after the great visionary and naturalist William Carey, boasts of stretches of natural habitats of a number of organisms belonging to different taxa. A total of 30 speciesof odonates were recorded from the study area during the period ofFebruary to June, 2016 [post-winter to pre-monsoon] when the highest abundance of them is recorded. The family Libellulidaewith 19 species was the most dominant among the Anisoptera (dragonflies) followed by Gomphidae (1sp.) and Aeshnidae (1 sp.). Among the Zygoptera (damselflies), the 9 species recorded belong to thefamily Coenagrionidae. From the available data, we propose to declare the campus as an area of significant diversity of odonates and proper measures of conservation of this ecologically important group of organisms may be initiated within the campus. The diversity in the campus may be attributed to thegrasslands, shrubs and small water bodies inside the campus.

Keywords: *Abundance, diversity, odonates, Serampore College, Hooghly, WestBengal*

Assessment Of Structural Composition and Species Diversity of Nambar Wild Life Sanctuary and Its Westward Extended Forest Site Bornewria Forest, Assam

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The quantitative characters are very important in the analysis of comparative community structure of different forest stand. The present study deals with structural composition and plant species diversity of two forest sites Nambor Wild Life Sanctuary, considered as primary one and Bornewria forest, the westward extended part of original Nambar R.F. of Assam, considered as secondary one. The forests representing Tropical moist semi evergreen and moist mixed deciduous type and entire area was embraced with fragmented block of Gondowana formation. The total forested area of Bornewria forest was adversely affected by shifting cultivation and presently converted to a secondary denuded one.

Phytosociological studies were done by randomly laid quadrats of 10m x 10m and 5m x 5m and 1m x 1m for the tree, shrubs and herbs replicated with 20, 40 and 80 numbers of quadrats respectively for each site and analyzed by using standard methods. The species were categorized as tree (> 3 m height), shrub (height above 0.5 to 3 m) and herb less than that height. Artocarpus chama, Mesua ferrea, Morus laevigata, Phoebe goalparensis, Amoora cucullata were predominant in moist semi evergreen forest. Trees under moist mixed deciduous forest were Haldina cordifolia, Lagerstroemia speciosa, Albizia procera, Bombax ceiba, Schima wallichii, Stereospermum colais etc. along with vascular climbers and epiphytes. There are all together 246 species distributed in the natural forest. Out of which Nambor WLS was comprised of 70 families, 165 genera and 227 species, and the Bornewria forest was comprised of 51 families, 103 genera and 124 species. The top canopy of primary forest predominated by deciduous species with short leaf less period viz. Alstonia scholaris, Artocarpus chama, Morus laevigata, Stereospermum colais, Tetrameles nudiflora, Trewia nudiflora etc. The middle and lower storey were more or less evergreen character. Eleocarpus sikkimensis, E. tectorius, Canarium resiniferum, Castanopsis histrix, Machilus bombycina, Vatica lancaefolia, Mesua ferrea etc. are the important species of evergreen trees. Observation noted that highest number of seeds of Vatica lancaefolia, Mesua ferrea, Hydnocarpus kurzii, Litsaea laeta were germinated and established in the forest floor and better survivability of the seedling were recorded in primary forest strand near the periphery rather than core areas. It may be due to lack of threshold light intensity available to the seedlings. Phytosociological studies in primary forest showed that Vatica lanceaefolia (21.47), Elaeocarpus tectorious (18.32), Castanopsis hystrix (12.97), Mesua ferrea (9.56), Castanopsis armata(9.47) etc. were most dominant trees reaching above 6 feet height. In secondary forest Hydnocarpus kurzii expressed its dominancy with highest IVI values (62.98) followed by Dysoxylum gotadhora (39.12), Mesua ferrea (37.3), Baccaurea ramiflora (32.33) and Stereospermum colais (32.17). Diversity index was invariably higher in primary forest (5.736 for trees, 4.727 for shrubs and 4.143 for herbs) in comparison to secondary forest (4.760 for trees, 4.491 for shrubs and 4.016 for herbs). Higher diversity index indicated maximum species richness considering the population of individual species. The concentration of dominance showed opposite trend of diversity, 0.044 in secondary forest distinction to primary forest (0.039). Number of species were declined in the secondary forest because of ecological destabilization and disturbance in their natural abode.

Keywords: *Vegetation Composition, Species Diversity, Nambar Wild Life Sanctuary, Bornewria Forest, Assam*

Inventory study on habitat used by Mabuya Multifasciata Fitzinger in Darrang District

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Organisms interact with their environment in many levels. The physical and chemical conditions surrounding an organism such as ambient temperature, light intensity, moisture-all influence basic physiological processes crucial to survival and growth. The immediate environment of the individual forms the microhabitat which has high significant in the ecosystem. Because different species of the same genera may have different microhabitat on the same habitat.

The Mabuya skink is a widely distributed species in India as well as in North East India and China(Zhao and Adler,1995; Ngnyen et al.,2009). In fact the species Mabuya multifasciata is commonly found in the open region of villages,secondary forests of different humid regions and in the regions with variable temperature (Ngnyen et al., 2009; Li et al., 2010). In this inventory study, the habitat use by Mabuya multifasciata was investigated keeping various research questions in mind like what is the habitat of the lizard Mabuya multifasciata ; what is the microhabitat of this lizard; how many time spent by this lizard in microhabitat etc.

Keywords: *Mabuya multifasciata, micro-habitat, Darrang District, 2011-2013.*

Diversity of Fungal Entomopathogens in Soils of Tea Plantation Areas of Assam Effective Against Odontotermes Obesus

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The soil environment is an important reservoir for a wide variety of entomopathogenic fungi, which play significant role in the management of agricultural and forest pests. Knowledge on the occurrence and distribution of indigenous entomopathogenic fungal species in a particular area is very essential as they can further use as biocontrol agent against different pests and pathogens.

A survey in tea plantation areas located in two different tea growing areas of Assam was carried out in order to isolate and screen the indigenous effective strains of entomopathogenic fungi against Odontotermes obesus, major insect pest of tea, Camellia sinensis (L.) O. Kuntze. The entomopathogenic fungi were isolated in RBC Ager medium from the soil samples of surveyed areas by using dilution plate method. Screening of pathogenicity of the suspected entomopathogenic isolates was done by following the method described by Singha (2011) and latter confirmed by fulfilling the Koch's postulation. Results confirmed the presence of entomopathogenic fungi in the soil of tea plantation areas. Out of the isolates recovered, five fungal isolates morphologically identified as strain of Metarhizium anisopliae, Purpureocillium lilacinum, Aspergillus flavus, Fusarium oxysporum and Fusarium sp were found to be pathogenic to both castes of the insect pest under laboratory conditions.

Keywords: *Metarhizium anisopliae, Purpureocillium lilacinum, Aspergillus flavus, Fusarium oxysporum, indigenous strain, pest*

Effects of Water Quality Parameters on Macro Invertebrate Fauna of Pagladia River of Assam

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Among the tributaries on the north bank of the Brahamaputra river system of Assam, Pagladia is an important one. A study was under taken during 2016-2017 to investigate the diversity of macro-invertebrate fauna along with water quality parameters. During the study period 24 macroinvertebrate species have been recorded from five study sites of the tributary. Out of these 24 species, 7 belong to Gastropoda followed by Crustacea (5), Hemiptera (5), Bivalvia (3), .Diptera (2) and Odonata (2). Among all the groups of macro-invertebrate fauna Gastropoda were found to be the order with highest species composition (29 %) and Diptera along with Odonata with lowest species composition (8 %) respectively. Seasonal variation was observed during the investigation of different physico-chemical parameters viz. water depth, velocity, temperature, transparency, free carbon di-oxide, total alkalinity, total hardness and total chloride. All these physico-chemical parameters were found to support the permissible limit for healthy aquatic life.

Keywords: *Water quality parameters, macro-invertebrate, Pagladia*

Influence of Water Quality In Diversity of Aquatic Insects of Burhadia River under Nalbari District, Assam

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The aquatic insects are very important bio-indicator of water quality and they have various environmental disturbance tolerance levels. People on globe are under tremendous threat due to undesired changes in the physical, chemical and biological characteristic of air, soil, water. Due to increase human population, industrialization, use of fertilizers and man- made activity water is highly populated with different harmful contaminates due to weathering of rocks and leaching of soil , mining processing etc. It is necessary that the quality of drinking water should be checked at regular time interval, because due to use of contaminated drinking water ,human population suffers from varied of water borne disease. The availability of good quality water is an indispensable feature for preventing disease and improving quality of life. It is necessary to know details about different physico-chemical parameters such as colour, temperature, pH, hardness, turbidity, dissolved oxygen, free carbon di-oxide used for testing of water quality. In the physico-chemical investigation of water, the highest average air temperature [17.90C] is in the month of May where water temperature [25.50C] is also highest. The highest turbidity is 26.2 c.m. found in station A and the lowest in station B [23.7 c.m.]. Dissolved oxygen of the river water is found in highest station C [4.9ppm] and lowest in station A respectively. Highest amount of FCO2 of the water is recorded 2.38 in station respectively. The average pH of the water during the study period was the highest and lowest pH of water [7.6 and 7.2] is found in station D and station C respectively.

Keywords: *Burhadia, Dissolved oxygen , Temparature, Turbidity, Physico-chemical etc.*

Seasonal Fluctuation of Phytoplankton Diversity of Nira left Bank Canal Baramati

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Many minute microscopic plants and animals spend their life in the floating manner in water. These suspended organisms form the plankton. Phytoplankton is the single cell plants are the bases of all other life forms on planet earth and are responsible for making up to 90% of earth oxygen. It is believed that most of the world oxygen comes from tiny oceans plants Phytoplankton are important influence upon the earth climate because they consume CO2. In 2010 group of marine scientist based in Canada reported that phytoplankton has declined globally by 40% since 1950 These scientist suggested that warming of ocean surface due to climate change might have reduced the vertical mixing of the water column reducing the supply of nutrients from deeper water .Nutrients that are essential for phytoplankton growth.

Phytoplankton's are more abundant in areas with high intensity of light as they convert light energy into chemical energy. Phytoplankton growth depends on the availability of co2 sunlight and nutrients .phytoplankton like land plants require nutrients such as nitrates phosphates, silicates and calcium at various levels depending on the species .The tiny organism is able to convert sunlight warmth water and minerals into proteins, Carbohydrates, Vitamins and Amino acid marked the beginning of life . So the study was carried out on the fresh waters of Nira left bank canal diversity with relations to seasonal fluctuations.

Keywords: *Phytoplankton diversity, Atmospheric Temp, light intensity*

Study of Human Leopard Conflict in Human Dominated Areas of India and Case Study on Maharashtra state

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Leopard panther parades fusca or Indian leopard is one of the most successful members of five big cat of India known for its unique skills of climbing trees, jumping and adaptation of city culture. The leopard is one of the five big cats found in India. The species panther paradus is listed in the ICUN Red list because population have distinct following habitat loss and fragmentation poaching for illegal trade of skin and body parts and persecutions due to conflict situations. But in recent years we find leopard have migrated in human inhabitants for food on domestic wealth as due to deforestation and expanding of urbanization and increase in population of humans and leopard is creating a daily conflict in a fight for dominance of area between humans and leopard so study was carried out.

Keywords: *leopard population, no leopard attack on Domestic Wealth, no leopard attack and Migration on Human inhabitans Maharashtra.*

Status and Diversity of Soil Seed Bank in Nambor Reserve Forest: A Tropical Semi-Evergreen Forest of Assam

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Soil seed banks can play a vital role in regeneration of native species and the information on the seed bank composition is important for determining the resilience of plant communities under severe environments. In this study, we examined the Seed storage and species composition of soil seed banks in mixed forests and three plantations (Shorea robusta, Tectona grandis and Lagerstroemia speciosa) sites of semi-evergreen broad-leaved, Nambor Reserve Forest (NRF) of Assam. A total of 76 quadrats (10m x 10m) were established in selected four sites of the forest. Soil samples were collected from sub-quadrates measuring 50 cm x 50 cm. Composition and status of soil seed bank were determined by direct count and seedling emergence technique. The results show the presence of total 18 species, belonging to 13 families and 17 genera in soil seed bank in Nambor Reserve Forest. The maximum number of species was recorded in mixed forest (16) and minimum was in Lagerstroemia speciosa plantation (6). For all sites herb seeds dominated the soil seed bank. Three pioneer tree species were also found in seed bank of NRF. Mean soil seed storage differed significantly between study sites, ranging from 735 seeds/m2 in Lagerstroemia speciosa Plantation to 428 seeds/m2 in mixed natural forest. It was also observed that in all sites density and diversity of soil seed bank decreases along the soil depths. The Sorenson Similarity index between composition of species in standing vegetation and seed banks was low with the lower value in the Teak plantation followed by Lagerstroemia speciosa plantation. Our findings suggest that the regeneration potential of the soil seed banks is limited to some of the species. Therefore, for the conservation of other species (which don't able to form seed bank) a greater proactive and enhanced conservation efforts are thus needed.

Keywords: *Seed Bank, Semi-evergreen Forest, Nambor Reserve Forest, Conservation, Seed density.*

Vulture Population Trend Study Indicates Gradual Ebbing Population in D'Ering Memorial Wildlife Sanctuary in Arunachal Pradesh

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The continues survey since 2012 to assess the population status of vultures in Arunachal Pradesh result in regular records of vultures in D'Ering Memorial Wildlife Sanctuary. Total 49 individuals in 2012, 38 Individuals in 2013, 28 individual in 2014, 29 individuals in 2015, 29 individual in 2016 and 28 individual in 2017 were sighted and recorded from D'Ering Memorial Wildlife sanctuary. The 49 individuals recorded in 2012 included 4 White- rumped Vulture (WRV) Gyps Bengalensis, 6 Slender-billed Vulture (SBV) Gyps tenuirostris, 8 Indian Vulture (IV) Gyps indicus, 27 Himalayan Griffon Vulture (HGV) Gyps himalayensis, 6 Eurasian Griffon (EG) Gyps fulvus, 1 Cinereous Vulture (CV) Aegypius monachus. Likewise, 4 White-rumped Vulture (WRV), 5 Slender-billed Vulture (SBV), 6 Indian Vulture (IV), 21 Himalayan Griffon Vulture (HGV) and 2 Eurasian Griffon (EG) were recorded but Cinereous Vulture (CV) was not recorded in 2013, 4 WRV, 4 SBV, 6 IV and 14 HGV were recorded but EG and CV were not sighted in 2014, 4 WRV, 4 SBV, 5IV and 17 HGV were recorded but again EG and CV not sighted in 2015, 3 WRV, 3 SBV, 3 IV and 19 HGV were recorded but again EG and CV were not sighted in 2016 and 4WRV, 2SBV, 2 IV, 20 HGV were recorded but again EG and CV were not sighted in 2017. The survey showed locality disappearance of two species namely Cinereous Vulture and Eurasian Griffon and overall decline of vulture population in D'Ering Memorial Wildlife sanctuary. Though not drastic but gradual decline of 66.67%, 75%, 25.9%, 100% and 100 % have been observed in Slender-billed Vulture, Indian Vulture, Himalyan Griffon Vulture respectively only White rumped Vulture maintain a stable population. In case of CV and EG, it seems a case of abandoned of the winter site as these two species are not resident of D'Ering Memorial Wildlife sanctuary. The overall population decline is estimated to be 42.8 %, in the last five years. Though the overall population decline is not drastic but sliding down population is an alarming situation for the vulture. The reasons for the decline of population in the sanctuary is not yet properly understood but the abandoned of winter site by Cinereous Vulture and Eurasian Vulture indicated that D'Ering Memorial Wildlife Sanctuary gradually offers less suitable habitat conditions for the vulture,with course of time. Other Vulture like slender- billed Vulture, Indian Vulture and Himalayan Griffon Vulture might move to nearby more suitable habitat. Overall vulture population decline and presumed abandon of the sanctuary is a serious conservation issue which need to be monitored for few more years before proper conservation intervention is done to stabilize or increase the population in D'Ering Memorial Wildlife Sanctuary in Arunachal Pradesh.

Keywords: *Vulture population, D'Ering Memorial Sanctuary, Decline, Habitat.*

Impact of Climate Change on Migratory Birds

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Animals cannot spread their roots in one place and synthesize their own food like plants. Birds with their fantastic ability to fly and with their unparalleled mobility, have explored almost the entire globe searching for food, territory, nesting sites and other necessities for survival. Because of their high metabolism and equally high energy consumption, bird must have abundant and unfailing sources of rich food. It commonly happens that in region with seasonal climatic and ecological changes occur which may require the birds to move away to survive by migration. The earth's climate has been changing throughout time. Climate change is likely to impact migratory birds in a number of different ways. Increased storm frequency, sea level rise, lowered water tables, higher drought frequency and habitat shifting resulting from climate change could all have a dramatic impact on migratory birds. Global warming influences the routes of many migratory birds and their annual migratory rhythm. Generally short and middle distance migratory birds can adapt to climate change whereas long distance migrants are at a disadvantage. Climate change affects the environment by adding to the disarrangement of ecological balance. It is not only in the interest of migratory birds but also our own interest to protect all species against the impact of climate change. Different management plants are introduced that will maintain the migratory species in a favourable conservation status and also taking interest and concern of various stakeholders and other people.

Keywords: *Migration, Metabolism, Territory, Stakeholders.*

Redescription of Cocalus Murinus Simon 1899, A Lesser Known Salticidae

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Genus Cocalus C.L. Koch, 1846 a lesser known genus of spider has only five accepted species worldwide as per World Spider Catalog 2017. Out of five species, only one species of Cocalus murinus Simon, 1899 has been reported from West Bengal, India. This species is nocturnal and is found on tree twigs at a height of 8ft. It is distinguished from its congeners by the hairy body, distinctive bump at the front ocular region and structure of epigyne. This paper redescribes the spider on the basis of specimen collected from Jharbari Reserve Forest, Assam, India.

Ecological Importance of Bats

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Climate change and habitat deterioration still continue to have unprecedented effects on the biological diversity of our mother earth. Hence we need to understand the effects of these factors on complex biological communities, leaving no animal group from the purview. Order Chiroptera is the second most diverse and abundant order of mammals with significant physiological and ecological diversity. Bats have many important ecological roles, such as arthropod suppression, seed dispersal, pollination, material and nutrient distribution, and recycling. They also have economic importance in terms of biological pest control, plant pollination, seed dispersal, guano mining, bush meat and medicine, aesthetic and bat watching tourism, and education and research. There are many species of bats which are endangered and their populations are declining presumably due to habitat destruction and fragmentation, disturbance to caves, depletion of food resources, overhunting for bush meat and persecution, increased use of pesticides, infectious disease, and wind energy turbine. Conservation of these bats is not only important for biodiversity but also they provide ecological services essential for human. In particular, bats are very useful for the control of insect populations and specifically pests to agriculture. A study in North America suggested that loss of bats could lead to agricultural losses estimated at more than $3.7 billion/year. A better understanding of bat biology and ecology is therefore essential to fully appreciate their role in nature.

Keywords: *Climate change, habitat destruction, pest control, ecological importance, bat conservation.*

Assessment of Phytosociological Aspects and Diversity of Forest Stand

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India is bestowed with rich biodiversity of various floral and faunal species extending from eastern Himalayas to Western Ghats region. To access the biodiversity of a particular area, it is essential to know the phytosociological aspects of various tree species present in the forest through various sampling methods. A study was conducted in Waghai Forest Range in the Dang district, Gujarat to estimate the phytosociological aspects of the forest stand such as tree density, frequency, abundance, relative dominance, Importance Value Index (IVI) and diversity (Simpson's Diversity Index) of various tree species by quadrate sampling method. The species were studied in three different quadrates of size 20m x 20m where the total number of tree species along with the number of individuals of all species occuring in each quadrate were recorded. The tree parameters such as diameter at breast height (dbh), girth at breast height (gbh) and total height were measured and noted down. A total of six tree species were found to be dominant in the study area namely Tectona grandis, Madhuca latifolia, Terminalia tomentosa, Lagistromea lanceolata, Butea monosperma and Wrightia tinctoria. Out of all the species, Tectona grandis occurred in all the three quadrates and recorded highest density (3.67), relative frequency (23.08%), abundance (3.67) and relative dominance (50.85%) and IVI (116.24). The Simpson's Diversity Index of all the species was found to be 0.77. The results revealed dominance of deciduous tree species in the forest with Tectona grandis as the dominant tree species and high diversity.

Keywords: *Biodiversity, Phytosociology, Tectona grandis, Quadrate*

Diversity of Phytophagous Mite (Acari: Eriophyoidea) Infesting Medicinal Plants in Serampore College Campus, Hooghly, West Bengal, India

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Among the Acarieriophyoid mites are second largest group with regard to their economic importance as phytophagouspests throughout the world (Lindquist et al., 1996). The great diversity of these tiny plant feeders is related to their extreme hostspecificity and intimate host relationships. Several of them are directly responsible for developing various disease symptoms in plants viz. blisters, galls,erinea, big bud, rusting fruits, spoiling blossoms, blasting buds, Besides direct injury they are also known to transmit viruses to the plant body.

The presentwork deals with the systematic study of eriophyoids mites infesting medicinal plants made during the period from December 2016 to December 2017 in Serampore college campus, West Bengal, India. The objective of this work is to explore the medicinal plants infesting eriophyoidmite of the area, to provide a taxonomic account of these mites and to record nature of damages inflicted by these mites to their host plants.

The systematic account of these mite species, their period of infestation, nature of damage and host association are discussed in this paper.

Keywords: *diversity, eriophyoid mite, systematic account, West Bengal, India.*

An Overview of the Effect of Chemical Pollution on Population of Ganges River Dolphins

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The riverine ecosystem is in close proximity to human activities and, therefore, is an ultimate sink for the discharge of sewage and industrial wastewater that emanates from human activities. The Ganges River basin is the most densely populated basin in the world and is heavily polluted by fertilizers, pesticides, industrial chemicals, and domestic effluents. Exposure of dolphins to toxic chemicals can affect their reproduction and survival. In the Ganges River food chain, the dolphins, as an apex predator, have been shown to accumulate high levels of persistent and toxic chemicals in their tissues. Several studies conducted by different research research group have reported elevated levels of DDT in the blubber of Ganges dolphins (Kannan et al. 1994; Senthilkumar et al. 1999) (Table 6). Notable levels of immunotoxic chemicals, such as butyltins and perfluorinated chemicals, have been found in the tissues of Ganges dolphins (Kannan et al. 1997, 2005; Yeung et al. 2009). Heavy metals, including cadmium and lead, have been measured in the livers of Ganges dolphins (Kannan et al. 1993).Although levels of the some of the toxicants were relatively low, based on the analysis of the metabolic index (see details in Kannan et al. 1994), it was found that Ganges dolphins have a low capacity to metabolize some toxic pollutants. In addition to the contaminants studied thus far, other emerging contaminants that arise from sewage pollution and diseases in river dolphins should be examined in future studies.The proximity to intense pollution sources and low capacity to metabolize pollutants make the Ganges dolphins vulnerable to the effects of chemical pollution. Thus, studies are needed to assess the impact of pollutants on the health of river dolphins. Recommendations have been made for the protection and developing strategies for the conservation of this Endangered and endemic sub-species.

Keywords: *Ganges dolphins, toxic chemicals, pollutants, DDT, protection, conservation.*

Effect of Edaphic Factors on the Diversity of Soil Microarthropods in Rubber and Acacia Plantation

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Microarthropods dwelling in the soil play a vital role in increasing the water holding capacity, aeration and drainage of the soil. These soil fauna are mainly responsible for the litter decomposition process and thereby maintaining the fertility of the soil. In this study, we investigate the effect of soil physico-chemical properties on soil inhabiting microarthropods in rubber and Acacia plantation of Cachar District, Assam. Monthly wise (December, 2016 to November, 2107) soil samples were collected from the selected sites by using a standard soil corer and the extraction of the soil inhabiting microarthropods was done by using the Tullgren funnel apparatus. The edaphic factors were analyzed following standard laboratory methods. Shannon-Wiener index of diversity and Pielou's index of evenness were employed to study the diversity and evenness of the microarthropod community. Results of this study revealed that among all the extracted soil dwelling microarthropods, collembolans were the most dominated groups followed by oribatid mites. Diversity in rubber and Acacia plantation was found higher in the month of April, 2017 (2.04) and August, 2017 (1.93) respectively. Regression graph between the soil temperature in both the rubber ($r= -0.64$, $p<0.01$) and Acacia ($r= -0.58$, $p<0.01$) plantation showed negatively significant effect on the total microarthropod population. Conversely, soil moisture especially in Acacia plantation ($r= -0.52$, $p<0.01$) showed negatively significant effects on the microarthropod population. Soil pH in Acacia plantation, ($r= 0.65$, $p<0.01$) showed positive and significant influence on the soil inhabiting microarthropod population. Whereas, in rubber plantation ($r= 0.35$, $p>0.05$) showed insignificant effect. The organic carbon content of the soil in Acacia plantation ($r=0.43$, $p<0.05$) showed positively significant effects on the soil microarthropod population. The result indicates that the edaphic factors have a significant effect on soil microarthropod populations in both the selected plantation sites. In addition the study interpreted a prominent link between the soil microarthropods and all the analyzed edaphic factors positively or negatively.

Keywords: *Soil fauna, Collembola, Oribatid, Evenness*

Timing of Reproduction Iin Variable Environment: Bird Perspective

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Birds experience daily and seasonal changes in various environmental factors like photoperiod, temperature, rainfall, humidity, food availability etc. It is important for them that they adapt to their temporal environment, which exhibits distinct periodicity. Of all the environmental factors which a bird is exposed to, changes in photoperiod is the most consistent and reliable. So the role of photoperiod is very important in timing bird's reproduction. The present eexperiments were done to see the role of daylengths in regulation of reproduction in both the sexes of Eurasian tree sparrow (Passer montanus L.). In 1st experiment, various combinations of duration of light and dark in 24 h cycle with increasing proportion of light period (viz. 9L/15D, 10L/14D, 11L/13D, 12L/12D and 14L/10D) were used to see the least required day-length for gonadal growth. In 2nd experiment, photostimulated birds under 14L/10D (long day) for 30 days were transferred to different light and dark cycle of 24 h combinations to either increasing (16L/8D, 18L/6D) or decreasing (9L/15D, 10L/14D, 12L/12D) day length while one group of 14L10D was kept as control to see whether the withdrawing long day effect the timing of reproduction. It was found that the light falling for 11 h or more is important in inducing testicular as well as follicular growth and also the hormone secretion (testosterone and 17â-estradiol) in sparrows as daily photoperiods of 10 h and less failed to induce gonadal growth and hormonal secretion while the birds experiencing 11 h of light per day responded significantly. Thus, tree sparrow in the present study may have a photoperiodic threshold equal to or even bit less than 11 h. Moreover, the extant of responses was greater in the birds held under longer photoperiods. The above results suggest that both the sexes have a similar photoperiodic threshold to their gonadal sensitivity that seems to lie between 10-11 h of light per day. Birds showed faster response in gonadal growth and hormones secretion when transferred to long day lengths of 16L/8D and 18L/6D after photo stimulation in 14L/10D while the birds transferred to short day (9L/15D and 10L/14D) showed gonadal regression and decrease in hormonal secretion. Further, birds transferred to 12L/12D showed slower gonadal growth and hormonal secretion as compared to control group. The involvement of other hormone like GnIH has also been reported in the present experiment. Thus, longer the day length the birds are exposed to faster is the gonadal response. There is no difference in the gonadal and hormonal response under both the short days. These results clearly suggest the involvement of endogenous circadian rhythm and its interaction with the day length in timing of reproduction in the tree sparrow. They are in agreement with the Bunning hypothesis and conform to an avian external coincidence model of photoperiodic time measurement.

Keywords: *Circadian rhythm, Eurasian tree sparrow, day-length, gonads, hormone, photosensitive.*

Biodiversity and Its Conservation

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Biodiversity (Biological diversity) is the key component of an ecosystem. It is an irreplaceable resource providing raw material for introduction, domestication as well as improvement programmes in agriculture and forestry. Without biodiversity, natural evolutionary adjustment of a system to the changing environmental and biological conditions would be impossible.

Conservation and use of biodiversity for sustainable ecosystem or agro-ecosystem should be continuous to meet food, clothing, shelter, economic and health requirement of growing population of India. By integrating sustainability into business and reducing carbon emissions, the manufacturing sector has indirectly got itself involved in the process.

The conference of the Parties (COP) to the convention on the Biodiversity adopted a Strategic Plan for the Convention including the target to achieve a significant reduction in the current rate of biodiversity loss as contribution to poverty alleviation and to the benefit of all life on earth. This target was subsequently endorsed by Heads of Government at the World Summit on Sustainable Development and the United Nation General Assembly.

The objectives set by Strategic Plan for the Convention reflect the importance of private sector based on the biodiversity and its components in the implementation of convention. There is need for conservation of the world's biodiversity to maintain the resource that has sustained human health and food.

Litter Production and Leaf Litter Decomposition of Selected Tree Species in a Tropical Semi Evergreen Forest of Assam, Northeast India

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Leaf litter dynamics and, effect of soil properties and microclimate condition on decomposition rates and nutrient release pattern of leaf litter of the four selected tree species were studied in a tropical semi evergreen forest of Assam, northeast India. The average annual litterfall and the mean standing crop of litter were recorded as 7.74 Mg ha-1 yr-1 and 3.79 Mg ha-1, respectively. Significant differences were found among the three types of litter categories ($p<0.01$) i.e., leaf litter, woody litter and miscellaneous litter. Foliar litter contributed highest to the annual litter production. Litter production showed a peak during dry season and standing crop was lowest during rainy months due to high decomposition. The annual litter decomposition coefficient () value was calculated as 2.04. The annual decomposition constants (k) ranged from 3.23 to7.8 yr-1 in under canopy (site 1) and for open area (site 2) it varied from 4.01 to 11.11 yr-1. The rate of decomposition of leaf litter was higher in open area (site 2) than under canopy (site 1) for all species. Lagerstroemia speciosa was fond to be the fastest decomposing species in both sites. Faster decay was associated with initial high N content and low C:N ratio of foliar litter. Seasonality of the area influenced the litterfall pattern and the standing litter crop. The differences in decay rates may also be related to morphological structure along with nutrient concentration of leaf litter and the environmental factors. K was released rapidly from decaying leaf litters than N and P. Decomposition rate was influenced by positive correlation with soil and climatic variables and the nutrient cycling was rapid in this forest as decay constant values were fairly high.

Keywords: *Decomposition, litterfall, leaf litter, nutrients, soil*

Climate Change in Relation To Aphid (Insects: Hemiptera) Biology

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Aphids are small, soft bodied hemipteran insect pests found throughout the world but mostly prevalent in temperate climate. These insects are obligatory plant parasites and suck plant sap causing damage to their hosts and sometimes inflict economic losses. Some of these aphid species are also vectors of several plant viruses. Aphids possess several biological peculiarities such as extreme polymorphism, parthenogentic and sexual reproductions, viviparity, and host alternation. Some species show extreme polyphagism while many are monophagous and host specific. A little over 5000 species of aphids worldwide and 825 species from Indian subcontinent are known. About 450 species have been recorded from crop plants. Of these about100 have successfully exploited the agricultural environment to such an extent that they are of significant economic importance through out the world.

Aphids, like all insects, are poiikilothermic and have a large surface volume ratio compared to larger animals, making temperature regulation a challenge. Temperature is probably the single most important environmental factor affecting aphid biology, ecology and behaviour. The other factors are light, particularly day length, rainfall and host quality. Aphids are good models for studying the effects of environmental change because of their short life cycles, having several generations per year and high rate of fecundity. In general, enhanced CO2 level, besides elevation of temperature, increases photosynthesis, growth yield and C: N ratios in most plant species that may affect the quality and quantity of food available to insect herbivores. If there is any change in any of the above parameters in climate, aphids respond very quickly and that affects the individuals having repercussions on their diversity and populations dynamic. Varied effects were noted by different workers on different species of aphids at different concentration of CO2.

Here, some of the most empirical and long time studies on effects of environmental changes on aphids affecting the fecundity, population and migration of aphids - a very important agricultural insect pest are discussed.

Prevalence of Sugarcane Nematodes in Different Localities of Jalna District (M.S.) India

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The present study is based on the survey accompanied and assessment made by the frequencies of occurrence of economically important plant nematodes in different region of Jalna district. Samples were collected from roots and soil from eight different places of Jalna district. The frequency of occurrence and populations varied from place to place which is simply indicative of the fact that the studied area is highly infested with different varieties of nematode genus i.e. Hoplolaimus, Helicotilancus, Mylonchulus, Longidorus, Xiphinema, Dorylaimus, Acrobelus and Monhystera.

Keywords: *Jalna, Nematode, Prevalence,Sugarcane.*

Seasonal Dynamics and Diversity of Phytoplankton with Correlation of Water Quality Parameters of Lower Dudhana Dam, Dist-Parbhani (M.S) India.

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The present study deals with phytoplankton diversity, density and there correlation with water quality parameter of lower dudhana dam at eight different sampling station (A.B,C,D,E,F,G and H) from January to December -2013.The total 23 species were recorded from 04 orders belongs to Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae among these Chlorophyceae was found dominant followed by Bacillariophyceae, Cyanophyceae and Euglenophyceae. The phytoplankton shows seasonal dynamics, maximum population recorded in summer season and minimum population recorded in monsoon season .Diversity indices indicated that lower dudhana dam although not immaculate, was not polluted.

Keywords: *Chlorophyceae, Bacillariophyceae, Cyanophyceae, Euglenophyceae, Lower dudhana dam, Diversity indices.*

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 (R1) and Menhinick index (R2) 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 () 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.

Keywords: *Zooplankton, biodiversity indices and percentage wise composition*

Fish Diversity of Bhima River

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The present study deals with the fish diversity of Bhima River (District Pune, Maharashtra) during January 2013 to December 2014. The study revealed occurrence of 28 fish species belonging to 5 orders, 11 families and 18 Genera. The predominant orders were Cypriniformes, Siluriformes and Perciformes. Eleven species were recorded from order Cypriniformes.

Keywords: *Bhimariver, Cypriniformes, Bhigwan, Fish fauna.*

Ichthyofaunal Study of Kasura Dam, District Jalna, (M.S.) India

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Present Ichthyofaunal study was carried out during January 2014 to Dec 2014. This Fresh water body used for drinking, domestic, agriculture and fisheries purposes by Tq-Partur Dist-Jalna.. The results of present study reveal the occurrence of ichthyofauna belong to 07orders 10 families, and 21 species, out of 21 species Cyprinidae family was dominant of all with 9 species.

Keywords: *Ichthyofauna, Variety, Abundance, dominant and Kasura dam.*

Analysis of Herbaceous Diversity in Homegardens of Ranchi, Jharkhand

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The present work aim to study the herbaceous diversity in Homegarden of Ranchi,district, Jharkhand. The role of homegarden is to household food security, nutritional security, socio-economic significance and conservation of plant species. The study was conducted in randomly selected household in four panchayat of Angara Block Viz. Singari, Gutidih, Janum and Rangamati, respectively. All herbaceous species counted and recorded in 1x1 m quadrate of selected household. A total of 48 herbs belonging to 24 families were recorded. In herb layer, most dominant family were Poaceae, Cucurbitaceae, Amarantaceae and Solanaceae. Herb density varies from 26370 - 102320 ha-1. Among the Panchayats, the basal cover of herbs varies from 37.52 to 64.98 m2 ha-1. According to diversity indices of different villages of study area the Shannon index of herb layer varies from 3.01 4.22. Similarly, Simpson's index of herb layer 0.08 to 0.21. Species Richness of the herb layer having between 1.77 3.00.Equitability ranges from 1.02 - 1.21 whereas, Beta diversity of herb layer varies from 1.39 - 2.42. Homegarden has a crucial role in the improvement of livelihoods to small scale farmers in the study area through direct subsistence production, indirect subsistence production (such as foods, fuel wood, fodder and shade to the cultivators) and income generation. Furthermore, it has helped to conserve many species of plants in a small areas with providing diversify needs to the farmers. Our findings also suggest that households consider a number of attributes in making decision to homegarden agroforestry practice.

Keywords: *Diversity, Structure, Herb, Homegarden, Jharkhand*

Assessment of Roadkill Animals on National Highway- 37 Passing Through Kaziranga National Park Due To Vehicular Traffic

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Linear infrastructures such as roads and railways play an important role in transport, and are integral part of human economy. When such structures pass through a protected landscape, it creates an unending linear barrier for the wild animals. Thus, effecting flora and fauna adversely, following the discontinued habitats. The NH- 37 passes through a stretch of 64 km along southern boundary of Kaziranga National Park (KNP). The vehicular density is much higher, as it connects upper Assam to state capital and also to neighboring country, Myanmar (AH-1). Wild animals crossing road are often hit by high speed passing vehicles. Our study tries to assess the adverse impacts of vehicular traffic on four taxa; Amphibia, Reptelies, Birds, and Mammals. The study will help in understanding the severity of the situation for long term conservation actions. Hence, even if we cannot stop mortality, we can at least make efforts to reduce them. Nevertheless, this study indicates that roads have a high impact on wildlife.The study was carried out from October, 2016 to June, 2017, for 12 days every month using a motorbike at a steady speed of 25 35 km/h. On each encounter with a carcass, species, number of individuals and status of the kill (fresh/old) were recorded. Carcasses were photographed and identified to the lowest possible level using fieldguides and were then removed from the road to avoid double counting and causing ecological trap for other animals. All the analysis were done using LibreOffice Calc. We found a total of 3,778 roadkill individuals during the study period belonging to 57 species. The most affected group was found to be the Amphibians 55.8% (n =2,111) followed by reptiles 23.5% (n =888), birds 9.76% (n =369), and mammals 9.02% (n =341). However, 1.82% (n =69) roadkills remained unidentified because of their extreme bad condition. Common Indian Toad Duttaphrynus melanostictus 63.56% (n = 2111), Oriental Garden Lizard Calotes versicolor 24% (n = 890), and Common Myna Acridotheres tristis 27.2% (n = 261) were dominant in each class of Amphibia, Reptilia, and Aves respectively. Mortality rate (kills/day) was found to be 35.50 (n = 3926), and mortality rate per kilometer (kills/day/km) was 0.5547 (n = 13,392 km) for the overall study period. Herpetofauna is found to be the most affecetd group, with Amphibia being the most affected taxa. Common Indian Toad mortality(Amphibia) seemed to increase with increase in rainfall and temperature (more in summer than in winter), due to the onset of their breeding season, which might have led to their propensity of crossing the road. Amphibia and reptiles are slow moving animals as compared to Mammals and Birds, hence are more prone to roadkill. Also Reptiles uses the paved road for basking and crossing for potential breeding and feeding necessities. Birds majorly fall as ecological traps and also collides because of their low level flight.

Keywords: *Ecological trap; Mortility; Barrier; Herpetofauna; Road ecology; Vehicle.*

Water Quality and Zooplankton Diversity of River Siang of Arunachal Pradesh, India

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Growing populations may put stresses on natural waters both the quality of the water and hydrological budget. River Siang is the main river of East Siang district and also it is one of the most important tributary of the mighty River Brahmaputra drainage system. Potable quality of river water is affected by seasons and other factors.

Zooplankton is a group of micro-organisms which do not have strong power of locomotion and usually move by being drifted by water current. In up-stream region of River Siang, they were less in numbers in most of the sampling sites. During the study period, 24 different genera of zooplankton were recorded from the River Siang. The recorded zooplanktons were classified into 5 different groups, among which, Protozoans were represented by 6 genera (22%); Rotifera by 7 genera (30%); Cladocera by 5 genera (22%); Ostracoda by 1 genus (4%) and Copepoda were represented by 5 genera (22%).

Keywords: *Zooplankton; Seasonal Variations; Diversity; River Siang; Arunachal Pradesh*

Ethnobotanical Knowledge of Rural Communities in Gwalior District, Madhya Pradesh, India : Basis For Biodiversity Conservation

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The home and kitchen gardens in rural areas serve as an important source of traditional medicinal plants for day to day treatment of certain common diseases. Several species of plants such as tulsi, neem, dhatura, akh, onion, garlic,bottle gourd, bitter gourd,papaya, guava, mango, lemon,drumsticks,etc. are found growing very commonly in these gardens.The knowledge about the medicinal uses of these plants is nowadays limited to only a few people among these communities and it is diminishing day by day.Also due to environmental pollution,increasing population growth and over demand of medicinal plants without knowledge of conservation many of the medicinal plants are under threat. Thus there is need to preserve this traditional knowledge which may be a basis for biodiversity conservation.The present paper deals with the study of ethnobotanical knowledge of people in rural communities in Gwalior district of Madhya Pradesh. A total number of 26 plant species from 22familes were found to have ethnobotanical importance.

Keywords: *Medicinal plants,traditional knowledge,biodiversity conservation, rural communities, ethnobotanical knowledge.*

Ichthyofauna Diversity and Beel Management of Dhir Beel in Assam

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The richness of the Aquatic flora and fauna of north eastern India is well known to all. Starting from Hamilton (1822) till date, the region has discovered about 360 species of fishes (Vishwanath et al., 2014). Wetlands since time immemorial have been perceived as life sustaining units of the world. They are considered as future food and fodder resources for human population and its related allies. Ecologically, wetlands are of great significance as they support varied food chains and food webs, regulate hydrological cycle, recharge ground water and maintain its quality by acting as filters, provide refuge to a large number of endangered flora and fauna help in trapping of energy and carbon dioxide and in nutrient cycling treatment of waste water and provide natural check to floods. Wetlands also have great recreational and aesthetic values. As a part of the non traditional agriculture the wetlands also support agricultural economy. Around 6.4% of the earth's surface is covered with wetlands. They are continuum of rivers and are locally known as beels, pats, mauns, jheels etc and are biologically sensitive ecosystems which play a vital role in the inland fish production of the eastern and northeastern part of the country.

The present investigation was undertaken to study the ecological parameters and formulate a general management measures for optimizing fish production from such waters. In order to gather systematic information the beels, The Beel is situated at latitude 26016'54.65'' North and longitude 90023'21.52'' East and altitude 34 m ASL and covers an area of about 689 hectare of land a floodplain lake of the river Brahmaputra is situated near Chapar town at about a distance of 5 km. The present investigation deals with the fish diversity of the beels, the qualitative and quantitative biotic communities present in the system, fish production potential together with various management measures for optimizing fish production from such systems.

Keywords: *Aquatic flora, Wetlands, food webs, hydrological cycle etc.*

Argiopepulchella Thorell, 1881 (Araneidae: Araneae): A Potential Synanthropic Species

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Species living in close association with human being acquire direct or indirect benefits from humans. Altered landscapes due to anthropogenic activities create new microhabitats for species that cohabits with human. Such species occurs at high disturbance level but may or may not act as synanthropic species. ArgiopepulchellaThorell 1881, commonly known as garden orb weaver is widely distributed in Kamrup Metropolitan district of Assam. This paper attempts to recognise A. pulchella, a common species found in our study area as a potential synanthropic species. We recorded a total of 67 A. pulchella in the study area of which 90 % of adults, 86% of sub adults and 83% of juveniles were found in human altered habitats types such as roadside drains and domestic sewage, garbage dump areas, roadside areas, forest areas, forest edge and garden areas. Adult spiders were highly abundant (40%) were near roadside drains and domestic sewage followed by garbage dump (30%), roadside (10%), forest (10%) and forest edge (5%) habitat types. Sub adult spiders were found abundantly near roadside drains and domestic sewage (36%), and garden (22%). Juveniles were found highest in garden (25%), roadside drains and garbage dump areas (22%), forest (17%) and along forest edge (8%). The study reveals that A. pulchella was more abundantly found in disturbed habitats in comparison to undisturbed forest areas.This qualifies this species as a partial synanthropic species since its breeding populations are generally established in peri-domestic habitats.Such a species can act as a good biocontrol agent as they have the potential to keep insect pest populations at lower levels.

Keywords: *Argiopepulchella, synanthrope, Assam, India*

Impacts of Climate Change on the Plants and Vegetation

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Changing climate is posing threats to the plants and forests all over the world. In present paper, the different probable effects of climate change that can function at species, community, ecosystem and biomes, remarkably showing that species can respond to climate change challenges by shifting their climatic position have been studied.

The major specificities and cautions of the most common approaches used to estimate future of biodiversity at global and sub-continental level. Ultimately, paper shows that current estimates are very variable, depending on the method, taxonomic group, biodiversity loss metrics, spatial scales and time periods considered. Yet, the majority of models point out alarming consequences for biodiversity, with the worst-case situations leading to extinction rates that would qualify as the sixth mass extinction in the history of the earth.

Keywords: *Climate change, plants and vegetation.*

Histopathology of Intestinal Tissue From Capra Hircus L. Caused By Genus Moniezia (Blanchard 1891)

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Goats have enormous potential to boost economy of developing countries like India and can be major source of income especially to marginal farmers and landless laborers. The present work deals with histopathological study of intestinal tissue of Capra hircus infected with Genus Moniezia (Blanchard 1891). It is observed that Moniezia sp shortened and flattened villi and create local haemorrhages in the intestinal tissue of Capra hircus. The luminal site of the duodenum was found to be depressed like cavity because of Moniezia sp.

Keywords: *Histopathology, Moniezia, Capra hircus*

Studies On Phytoparasitic Nematode Xiphinema Spp. (Cobb, 1913) Inglis, 1983 From Sangli Region (M.S.) India

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The present study is the redescribtion of plant parasitic nematode Xiphinema Spp. It was established after examination of 6 female and morphological variation was evaluated from various localities of Sangali region. The morphological and morphometric characteristics of these species are presented. Head not offset, long stylet (odontostyle). Nucleus of the dorsal oesophageal gland located from the anterior end of the bulb. Vulva a transverse slit situated near the middle of the body.

Keywords: *Phytoparasites, Nematodes, Xiphinema spp.*

Diversity of Ants (Hymenoptera: Formicidae) in Kholahat Reserve Forest in Winter Season

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Ants are one of the most ubiquitous, widespread and abundant groups of animals on earth. In terrestrial ecosystem ants plays an important role in recycling nutrients, dispersing seeds, engaging in mutualistic associations with other organisms and serving as predators and scavengers. The present study is undertaken to know the ant diversity of Kholahat Reserve Forest, Nagaon. The study has been carried out during the winter season from December 2017 to January 2018. Kholahat Reserve Forest is located in Nagaon district, Assam at geographical location of 9200'-93030' E longitude and 25030'-26030' N latitude. The total geographical area of this reserve forest is 60.92 km2. The ants are collected from three different habitats including grassland, forest and human habitats area by using different sampling techniques such as leaf litter sampling, soil sampling, beating vegetation, sugar baiting and hand sampling. A total of 20 species of ants belonging to 4 subfamilies i.e. Formicinae, Pseudomyrmicinae, Myrmicinae and Ponerinae are recorded. The diversity of ants are found highest in the forest area followed by grassland area and least in the human habitat area.

Keywords: *Diversity, Ants , Hymenoptera, Assam.*

Estimation of Length-Weight Relationship and Condition Factor of Channa Stewartii (Assamese Snakehead)

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The present study attempts to develop Length weight relationship and relative condition factor (kn) of Channa stewartii collected from Dibrusaikhuwa of New Tinsukia District of Assam. Length-Weight relationship of fishes can indicate species status in an environment and characterized pattern of growth. Channa stewartii (Assamese snakehead) is a member of snakehead group and it is categorized as Least concern (LC) species according to IUCN Red List. Very limited data is available for this species so there is scope for investigation. No data regarding it's growth pattern is yet recorded. According to the present study made on Channa stewartii to find out the LW relationship the value of the exponent 'b' in the equation W=aLb was found to be 2.768 for the species C. stewartii. The computed correlation coefficient (R) was found to be 0.98 indicating that there is a high positive correlation between length and weight in the species. The relative condition factor (Kn) remained greater than 1 for the species indicating their general well being to be good in the habitat.

Keywords: *Length-weight relationship, Channa stewartii, Relative condition factor, Correlation coefficient, Growth*

Diversity and Abundance of different Ant Species (Hymenoptera: Formicidae) in Gauhati University Campus

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Ants are known to be ecologically significant invertebrates in many ecosystems.Since most ant species are stationary and have a perennial nest with a restricted foraging range; these are also useful as indicators of environmental conditions.Gauhati University campus is a significant reservoir of biodiversity. A study on diversity of ants was carried out as there was no adequate information pertaining on ant diversity in this region. The campus area was divided into three distinct zones and a total of eight line transects were established. The survey was carried out at morning (7am-9am) and evening (4pm-6pm), on an average two times in each week from February to May. Various methods were employed for collection of the ant fauna including all out search (hand collecting), pitfall and bait methods.Ant species were collected using brush and forceps and preserved in alcohol. The specimens were photographed and identified.To analyse the diversity index of ant species in the different study zones, Shannon Weiner Diversity Index (1949) formula was used. Comparison of diversity among the samples was done using 'biodiversity pro' software. A total of 315 individuals were captured representing 11 species belonging to 8 genera and three subfamilies fromthe study zones of the university campus. The most abundant subfamily was Formicinae followed by Myrmicinae and Pseudomyrmicinae. The most species rich genera were Camponotus followed by Monomorium. The most abundant genus was Camponotus with percentage of occurrence 37.8% and the least abundant species found was Meranoplus with percentage of occurrence 3.8%. Ant species composition in different zones was significantly different. The diversity of the ant species increased towards the more diverged and undisturbed habitats. Although it was found that some of the ants were dominating in all the three selected zones, on the other hand some are found only in specific habitats.Camponotus compressusand Tetraponerarufonigra were found in all the three zones. Ants circulate and aerate more soil in the tropics than do earthworms, thus moving nutrients throughout the landscape. The present study has yielded valuable information on persistence of different ant species in this region and their abundance reflect the quality of the environment.

Keywords: *Ant, Diversity index, Formicinae, Camponotus*

Tracing Straying Routes of Rhinoceros in Kaziranga National Park, Assam

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The population of the Great one-horned rhinoceros, Rhinoceros unicornis has been gradually increasing in the park. So, the tendency of the rhinos to stray out of the park particularly during winter season due to food search is increasing. A detailed study was done from 2016 to 2018 in Kaziranga National Park. To mark the routes used by rhinos to stray out of the park is done by using GPS and remote sensing based mapping. During the field study, it was find that an average 10-20 rhinos strayed out from the park between November and March. The routes were mapped to assist the park manager to initiate remedial measures.

Termite Species Recorded in Dhupguri Kalbari of Baksa District of Assam, India

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Termites are very small, polymorphic and social insects belonging to the order Isoptera of the class Insecta. They generally have contrasting roles of both beneficial as decomposers and harmful as pest in different terrestrial ecosystems. However, the harmful role of termites has gained more attention than their beneficial role in the ecosystem.

The present study aims to discover different species of termites with their nature of mound construction and to explore the traditional methods of their control in Dhupguri Kalbari of Baksa District of Assam, India. The termites (soldiers and workers) are collected from different locations of the study area by random sampling. The method of collection and preservation given by Pearce (2006) is followed. Identification of termites is done with the help of taxonomic keys of Roonwal & Chhotani (1989) and Chhotani (1997).

Only three species of termites are found in the study area during the present survey. The identified species are Odontotermes feae , Odontotermes horni and Odontotermes giriensis. The species Odontotermes giriensis is widely distributed while the species O. feae and O. horni are found to have limited distribution in the area. Out of these three species only O. giriensis is found to construct mounds. O. feae and O. horni are found underground and on the earth surface and on the surface of other plant materials making mud tubes or soil tubes. Their morphological differences are studied with reference to key parameters. The total body length of soldiers of O. feae, O. horni and O. giriensis are found in the range of (6.5-8.5) mm, (6.9-8.5) mm and (4.1-5.2) mm respectively The head indices of soldiers of O. feae, O. horni and O. giriensis are found in the range of (0.79-0.82), (0.74-0.76) and (0.84-0.90) respectively. The number of antennal segments of soldiers of O. feae and O. horni is 17 while that of O. giriensis is 16. Soldier of O. feae has one tooth at the middle of the left mandible and the other at the basal third of the right mandible while O. horni has one tooth at the base of middle third of the left mandible only. The left mandible of soldier of O. giriensis bears one tooth at its distal fourth while the right mandible has one tooth at its basal fourth. Size of soldier of O. feae and O. horni is found larger than that of O. giriensis. No effective method of traditional control of termite has been observed.

Keywords: *Odontotermes feae, Odontotermes horni, Odontotermes giriensis, Mound.*

A Preliminary Study on Ichthyofaunal Diversity of Bogori Beel of Sonitpur District Of Assam, India

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A survey was conducted on diversity of fish fauna of the Bogori beel from January 2016 to December, 2017. Fish samples were collected from various stations of the fish landing site of the study area. The present study deals with the ichthyofaunal diversity of Bogori Beel of Sonitpur District, Assam, India where 54 species belonging to 7 orders and 18 families. Among the recorded fish species 3 species is recorded as vulnerable,1 species are data deficient, 5 species are near threatened, 20 species are least concern, 23 species are not evaluated and 2 species are lower risk near threatened (LRnt).The 18 different families recorded in the study are Cyprinidae which represents 18 species (32.72%) followed by Channidae 6 species, Belontidae and Chacidae each 4 species (7.27 %), Chandidae and Siluridae each 3 species (5.45%), Cobitidae, Nandidae, Notopteridae and Mastercembelidae each 2 species (3.63%), Anguillidae, Anabantidae, Heteropneustidae, Gobiidae, Synbranchidae, Siluridae, Claridae, Schilbeidae, Chacidae each 1 species (1.81%). The present study shows that Cyprinidae is the most dominant family with 18 number of species of the 18 recorded family followed by Channidae with 6 number of species.The study also reveals that the Bogori beel is rich in fish diversity.

Keywords: *Ichthyofaunal diversity, Vulnerable, Bogori Beel, Sonitpur District*

Study on Macrobenthos and Macrophytes in Govindgarh Lake of Rewa, Madhya Pradesh (India)

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Structural characteristics of aquatic plants create spatial interaction in water bodies; spatially patchy aquatic habitats provide variation in microhabitats, so there is more diverse community. This study was for macrobenthos and macrophytes of Govindgarh Lake, a small irrigation reservoir of distt Rewa of Madhya Pradesh of India, situated 22 km south of Rewa town (24° 24'N and 81° 15'E) having 307 ha water spread area. This study was carried from 2013-15 for finding abundance of aquatic weeds and macrobenthos. The abundance of benthic macro invertebrates in the lake ranged from 217 to 3652 u/m3 (2013-2014) and 240-4832 u/m3 (2014-2015). It was comparatively in high range. Annual average (3233 u/m3 to 3990 u/m3) was recorded. Minimum was in summer (Month of May and June) maximum in winter (2142 um-2, December and January) and moderate in monsoon 873 um-2 for 2013-14 and minimum 531 um-2 in summer, maximum 3211 um-2 in winter and moderate 885 um-2 in monsoon in 2014-15 . Annual average were 1177 um -2 1542.3 um -2 Minimum was in summer (May and June) and maximum in winter (December and January). The Abundance was Gastopods> Peleceypods> Oliggochaets> Chironomous & other miscellaneous. Study for Macrophytes reveal that the lake harbours a total 39 aquatic plants. Out of these 9 belong to floating hydrophytes (FH), 16 Submerged anchored hydrophytes (FAH), 5 floating leaved anchored hydrophytes (FLAH), Suspended hydrophytes (SH) and remaining 4 were emergent anchored hydrophytes (EAH). study of abundance of aquatic weeds including floating as well as submerged rooted and root emerged weeds were recorded with higher composition of Spp. Chara, Hydrilla, Nitella, Potomageton, Myriophyllum Azolla, Vallisnaria, Typha, Salvinia Eichornia and Pistia, Nymphia, Nymphoides cristetum growing profusely in littoral zone. Seasonal blooms of profusely grown Azolla pinnata, Spirodella, Lemna minor, Lemna major, Hydrilla, Chara were recorded. Abundance and density of macrobenthos and macrophytes indicates that Govindgarh lake is towards road of eutophication.

Keywords: *Govindgarh lake, Macrobenthos, Macrophytes Bioindicator, Eutrophcation, Rewa (Madhya Pradesh)*

Natural and Anthropogenic Hazards : Threats to Fish and Fisheries of North East India

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The north eastern region has been identified as the global hotspot for freshwater fishes. This region of India is richly endowed with numerous water bodies including hill streams,rivers, lakes and beels which serve as congenital habitats for the indigenous fishes. The varied climatic condition of this region supports rich species diversity which provide conducive ecological condition. The drainage system of N.E region is mainly the Barak River and the Brahmaputra River whichforms the life line and it ultimately drains into Bay of Bengal. The present investigation is based on the effects of natural and anthropogenic hazards over fish fauna of N.E India. A number of species of conservational importance 182 Endangered , 513 Vulnerable, 351 Near Threatened , 519 Least Count , 46 Data Deficient , 88 Not Evaluated species : IUCN 17 has been documented from this region. But it is unfortunate that the same fish population is facing serious threats regarding their sustenance or propagation due to natural and anthropogenic hazards .Thenatural hazard includes earthquake , floods, draught, cloud burst, frequent changes of river courses, erosion, open cast mines. Man made threats are encroachment, sand digging, use of pesticides, agricultural activities. Among all the anthropogenic hazards it has been seen that the most adverse effect is due to hydroelectric power project dam which affect the migration of fish, breeding and loss of habitat. The affected fish species are Tortor, Tor progenies, Chagunauschagunio, sisorids, pangasidae, cyprinids.The use of ladder in the dams can mitigate the effects to a greater extent.

Keywords: *Anthropogenic,Endangered, Hydroelectric power,IUCN, North eastern region.*

Plant Diversity and Regeneration Potential of Sacred Natural Sites (SNS) in Western Himalaya, India

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Article 8 (j) of the convention on Biological Diversity calls for respecting, preserving and maintaining knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of Biological diversity according to the national legislation. In this context, sacred conservation practices assume particular importance. The sacred/ protected groves of Garhwal Himalaya are very important from the conservation viewpoint of plant species diversity. These sacred protected groves are the monuments of conservation outside protected area network managed by both local communities as well as by government officials. The present study has been carried out in six sacred/ protected groves of Garhwal Himalaya to estimate the plant diversity and regeneration status. A total of 254 plant species representing 179 genera belonging to 77 families were recorded from the six studied sacred/ protected groves. Of these 49 were trees representing 38 genera under 26 families. Eighty species were shrubs belonging to 58 genera from 28 families. The number of herbaceous species was 125 representing 92 genera under 44 families. Asteraceae with twenty five species was the dominant family. Maximum number of species (119) was found in Ansuiya Devi whereas lowest number of species (80) was found in Chanderbadni. Distribution and density of individuals was maximum in lower girth classes which decreased with the increase in size of girth class in all study sites. The reverse J shaped curve was observed in all the CBH classes. The maximum portion of the curve was constituted by 0-15 CBH class across different study sites. Present study highlights the importance of identifying the areas under sacred conservation practices, because there is potential for future conflicts of interest within these Sacred Conserved Areas. In the present study assessment of floral diversity was done to highlight the importance of these sacred groves in conservation of flora and fauna as these can be strong candidates to be declared as community or conservation reserve to expand the protected area network.

Quantifying Diversity, Usesand Services of Woody Perennials in Academic Landscapes: A Study From Pundibari, Campus of Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar (W.B), India

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Quantification of species richness is important for addressing the saturation of local communities colonized from regional source pools. Tree species richness in any area develops the locality factors for other organisms to develop, breed and play an important role in increasing biodiversity. The present study reports the tree diversity, their uses and ecosystem services from Pundibari, campus of Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar (W.B), India. A total of 1816 numbers of individuals with dbh = 10cm of 95 woody perennials species were documented from the present study. These documented species were belonging to 79 genera and 38 families. The contribution among number of individuals was dominated by Mangifera indica with (9.19%), Terminalia arjuna (6.66%), Gmelina arborea (6.27%), Tectona grandis (5.23%) and Heavea braslensis (5.17%). The overall dominant family was Fabaceae represented by 11 species followed by Arecaceae with (7) Meliaceae (6), and with (5) species of Euphorbiaceae, Myrtaceae and Moraceae. Among 97 species 53 were Evergreen and 45 Deciduous and 2 species were Semi deciduous. Out of 95 species, the contribution was dominated by 52 forestry tree species belonging to 43 genera and 27 families. In the present study, majority of the species (54) were of timber value, followed by food (50), fodder (36), Fuel wood (36), ethno-medicine (39), Apiculture (22), tannin (17), gum and resin (06) spices (05) and for Plywood and Latex (02) species. Based on the contribution to ecosystem services all the 95 species are helpful for mitigating global climate change due to their ability of sequestrating carbon in their biomass. The second dominant ecosystem service was of 46 species to provide beautification in the form of avenue /ornamental/road side/ beautification, followed by shade providing ability of 27 species, intercropping (20), reclamation (15), erosion control (13), boundary /support (10), nitrogen fixing (07), soil improver (05), pollution control (03) and one species of wind break and poisonous character. The present study can be a baseline study to provide insight of the academic landscapes for plant diversity conservation and for providing ecosystem services.

Traditionally Used Medicinal Plants of Morigaon District, Assam

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The present ethno-botanical study was conducted from January 2016 to December 2016 in four different villages in Morigaon district of Assam. A total of 78 species of traditionally used medicinal plants were documented, belonging to 70 genera under 41 families. Out of these 78 species, 43.56% are herbs, 26.92 % are shrub, 11.54% grass, 10.26% tree and 5.13% are climbers. Maximum number of medicinal plants i.e. around six species each was recorded from Asteraceae, Fabaceae, Poaceae, Apiaceae, Amaranthaceae, Lamiaceae, Zingiberaceae and Musaceae family. Followed by Apocynaceae, Liliaceae, Myrtaceae, Oxalaceae, Solanaceae, Polygonaceae, Papilionaceae, Piperaceae and Chenopodiaceae family, all of which recorded two plant species each. The most commonly used plant part recorded were leaves but almost all plant parts and their extracts were found to be used as medicine. And maximum phyto species are used against multiple afflictions such as cough, diarrhea, dysentery, diabetes, jaundice, fever, menstrual problems, skin diseases, tonsillitis, etc.

Keywords: *Ethnobotany, traditional medicine, folk healers, Morigaon.*

Ethnomedicinal Plant Resources in Home Garden of North Bengal

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Home gardens are man-managed micro-environments with high energy subsidy, complex structure and multiple functions containing high levels of species and genetic diversity within larger farming systems and common features of sub-humid climatic conditions. Majority of the rural population in India was reported to utilize wild plants for fruits, medicinal, vegetable and fuel wood as primary source of energy obtained from home garden. Medicinal plant species was identified as one of the key characteristics of traditional home gardens they are either deliberately cultivated or they come up spontaneously as wild and weedy species. Home gardens of terai region of West Bengal was diversified with varied type of resources and act as a small conservation unit and maintained by family labour. Present paper discussed about diversity and utilization pattern of the fuel wood based energy resources and traditional application and utilization pattern of ethnomedicinal plant species.

Keywords: *Homegarden, Diversity, Fuelwood, Ethno-botany*

Bamboo: Diversity, Uses and Its Carbon Storage Potential

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Bamboo a woody perinnial grass or frequently known as poor man's timber could become the poor people's carbon sink and act as 'Green Gold'. Bamboo can play a significant role in linking climate change mitigation to sustainable economic development in the developing countries as it is a valuable sink for carbon storage. This is because it is the most productive and fast growing plant on the planet with its decay resistant litter. Globally, bamboo covers an area of 36 million hectares. With 11.4 million hectares, India is the major bamboo producing country in Asia. In West Bengal, bamboos occur mostly as under storey vegetation in forests and grown in home gardens mostly in sub-humid climatic condition of the country. The present paper discussed in detail about bamboo diversity, uses and other environmental benefits.

Keywords: *Bamboo, Carbon sequestration, Biomass, Terai region, Diversity.*

Positive correlation between Indian Sarus Crane and Agriculture

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The Indian sarus crane, Grus antigone antigone is the 'State Bird' of Uttar Pradesh. It is the monogamous, non-migratory and world's tallest flying bird. This is the only resident breeding crane of Indian sub continent, prefers open habitat like marsh areas, abundantly irrigated paddy fields, grass land and wetland. It has been categorised globally as 'vulnerable' by International Union for Conservation of Nature in its Red List because of its rapid population decline, which is projected to continue, as a result of widespread reductions in its wetland habitats. The cranes are well known for their faithfulness and living togetherness. Present exploration is aimed to compare the population of sarus crane from 2012 to 2016 in and around the Alwara Lake of district Kaushambi (Uttar Pradesh). A positive correlation was observed between the crane occurrence and the wetland during the study period.

Keywords: *Sarus crane pair, wetland, habitat, vulnerable and conservation.*

Study of Net Primary Production of A Grassland Community of Kaptipada Forest Range of Mayurbhanj District in Odisha, India

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The net primary production of a grassland community of Kaptipada Forest Range (210 51' N; 860 53'E) of Mayurbhanj district in the state of Odisha was studied during 2015-2016. The productivity of various compartments i.e. live green, standing dead, litter and below ground was determined from the positive increment of respective biomass values. The total live green production was found to be high during June and low in the month of May. The standing dead production exhibited maximum and minimum value in the month of October and July respectively. A very small amount of litter production was exhibited from August to May. No litter production was observed during June and July. Below ground production on the other hand showed maximum during July and minimum in the month of June. The total net primary production of the community was found to be 1706.03 g m-2 yr -1 of which 88.74% was contributed by above ground parts and 11.26% by the below ground parts. The net primary production of this study showed variation compared to other grassland communities as reported by various workers. The topography, geographical distribution, phenology, soil characteristics, climate condition etc. might be responsible for such variation in net primary production of the community.

Keywords: *Live green, standing dead, litter, below ground*

Diversity of Wild Edible Mushrooms in Mayurbhanj District of Odisha, India

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An extensive field study was carried out to document the wild edible mushrooms diversity in Mayurbhanj district of Odisha from May 2017 to December 2017. A total of 14 wild edible mushroom species belonging to 5 families i.e. (Lyophyllaceae, Volvariaceae, Russulaceae, Amanitaceae, Diplocystaceae) were recorded. Species richness was found to be higher in the rainy season. 11 species were found from the soil, two species from decaying paddy straw, and one species from the termite nests. Out of 14 species, 10 species were observed at the local markets and considered as prime adible. However, the demands of wild edible mushrooms are very low because of ignorance among the people of their use and edibility. Due to depletion of forest areas and changing lifestyles of people, the diversity of edible and medicinal mushroom is under threat and efforts should be made for its conservation and propagation.

Keywords: *Wild edible mushroom, diversity, documentation, Mayurbhanj.*

Study of Live Green Biomass of A Grassland Community of Similipal Biosphere Reserve, Odisha

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The live green biomass of a grassland community in Podadiha Forest Block (86o 27' E ; 21o 33' N) of Similipal Biosphere Reserve was studied from July 2015 to July 2016. Short term harvest method of Odum (1960) was employed for the determination of various compartmental biomass values. The live green biomass of the community showed gradual increase in biomass value from July to August, then to September, October and November, and attained a peak during December (255.88 g m-2). Thereafter, the value started a decreasing trend till May (72.92 g m-2). Again an increasing trend of value was observed till the end of the sampling period. The mean live green biomass of the community was found to be 125.34 g m-2. Compared to other grassland communities the mean value of the community did not show any similarity with the value of others. The variation of live green biomass of a grassland community from place to place and from time to time might be due to the variability in climatic condition, topography, soil characteristics, microbial activities in the soil as well as the biotic interference of the locality.

Keywords: *Biomass, live green, grassland, community.*

Impact of Forest Degradation Oon Tropical Forest Butterflies: A Case Study in Nameri National Park, Assam, India

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Study examines the hypothesis, whether the diversity of Nymphalid butterflies in tropical undisturbed tropical forest of Nameri National Park is associated with vegetation structure and canopy openness and that this relationship differs between butterfly taxa in relation to phylogenetic differences in light and shade preferences. Study has emphasized whether the increasing diversity of butterflies in disturbed tropical forest is associated with the loss of species with restricted geographical distribution. Study considered altogether eight habitat variables and the t-test using equal variance, Spearman rank correlation and multiple regressions were used for statistical analyses. Species diversity was analyzed using Margalef'sD indices that indicate both the species richness and abundance. Bootstrap method was used to compare the diversity among samples. PCA was done to examine the relationship between vegetation structure and species diversity in primary and degraded forest. The relationship between vegetation factor scores and species diversity in each sampling station in Undisturbed and disturbed tropical forest was analyzed using stepwise multiple regression. Study indicates that, the butterflies species sampled in undisturbed forest had more restricted geographical distribution than those being sampled in disturbed forest. The species with greater light preference had significantly wider geographical distribution, whereas the species with greater shade preferences had significantly narrower geographical range. The stepwise analysis of multiple regressions between the diversity indices of shade groups of butterflies and vegetation density of closed forest shows a significant positive relationship, but the relationship was negative when similar analysis was carried out between species diversity indices of light preferred groups and vegetation density. Majority of undisturbed butterflies were sensitive to changes in moisture availability and humidity. Thus, changes in canopy cover and light penetration through microclimatic changes on adult and larval survival does have an impact on butterfly distributions. While the species richness and diversity are higher in degraded forest, the conservation value of primary forest lies more in the presence of species with restricted ranges. Owing to loss of diverse vegetation in degraded forest, the dense canopy cover and transparent ground cover has been reduced and thus leading to decline of forest butterflies species. Study has clearly indicated the strong and significant relationship that exists between the species of narrow range of geographical distribution and species shade preference. The restricted ranges species are affected due to forest degradation. Thus, clearly bringing into light, that increasing diversity in degraded forest is associated with the loss of species with restricted geographical distribution.

Keywords: *Nymphalid butterflies, forest disturbances, Undisturbed forests, conservation value, endemic species, geographic distribution range, light and shade, phylogeny, tropical forests.*

Effect of Climate Change on Avian Fauna in Tropical Forest of Assam, Northeast India: Case Study in Nameri National Park

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The effects of Climate Change on tropical forest birds and its level of responses to each phylogenic group has been studied in details in Nameri national Parks, Sonitpur Assam from 2000 to 2012. We hypothesized that the relatively undisturbed forest has higher avian diversity and richness than those of degraded forest. It Also investigated the various feeding group, affected due to tropical forest degradation. Again, the changes in avian diversity in disturbed forest are associated with the species of restricted geographical distributions and whether the endemism is directly related to tropical undisturbed forest. Altogether Eight field trips, covering 64 field days were made in degraded and close canopy tropical forest of Nameri National Park of Assam, Northeast India to collect avian data. Nine randomly selected stratified transects were established in three categories of forests habitat (three transects in each habitat): relatively undisturbed, moderately disturbed and disturbed forest. The birds species data were obtained in a belt of 20 meters either side in each transect. Flush light was used for night surveys in each transect. We estimated the diversity in terms of species richness and evenness, as well as using the Shannon-Wiener index. Species evenness was estimated using Simpson's index and bootstrap method was used to calculate 95% confidence intervals for Simpson's and Shannon-Wiener's indices. In order to test for differences in diversity between habitats, pair-wise randomization tests were carried out based on 10,000 re-samples of species abundance data. The transect data of three habitat studied viz., relatively undisturbed, moderately disturbed and disturbed habitats were computed to evaluate the proportional abundance to undisturbed habitat. The Propound (proportional abundance) data were arcsine transformed for analysis and analysis of variance and t-test were performed using SPSS statistical software. The numbers of species were highest in undisturbed forest than disturbed and moderately disturbed forest. The Shannon-Wiener estimate of diversity was significantly higher in the undisturbed and moderately disturbed habitat than disturbed habitat, but results were not significant between undisturbed and moderately disturbed habitat. Birds species sampled in undisturbed forest had more restricted geographical distribution than those sampled in disturbed and moderately disturbed forest habitat. There was a significant relationship between undisturbed habitat preference of birds and its geographical distribution ranges. The preferences of closed canopy forest by endemic or narrow range species was significantly high than wide range species. The species with narrow geographic distribution ranges tend to be confined on closed canopy forest, whereas species with wider geographical ranges have more often found in the disturbed forest. Majority of the short-range forest birds were frugivorous, omnivorous or insectivorous. The tropical forest disturbances mainly effected the canopy feeding frugivorous, forest middle story insectivorous, necterivorous and omnivores bird species, whereas, granivorous birds have gained for disturbance. There was a significant phylogenic relationship with undisturbed forest habitat and avian species. The order Piciformes, Galiformes, Gruiformes and Passeriformes has a tendency to prefer undisturbed habitat than other two habitats.

The species diversity is significantly high in undisturbed forest habitat than disturbed forest habitat. The birds species sampled in undisturbed forest have more restricted geographical distribution than those sampled in disturbed and moderately disturbed forest. Most of the narrow geographical ranges middle story Passeriformes birds have concentrated in the close canopy patches within undisturbed habitat associated with heavy growth of climbers. Whereas, the non

forest birds, especially the granivorous and open-ground zone feeding guild insectivorous birds with wide ranges Passeriformes have occupying the disturbed habitat. Again, the most characteristic primary forest inhabitant bird fauna has the smallest geographic ranges, whereas, the opportunist or generalist bird species with wide geographic distribution, most of them either locally or long distance migrants have associated with disturbed habitat. The habitat conservation priority of endemic or short geographical range forest bird species, associated with the unique primary tropical forest is become apparent from the study. The high species diversity of the forest bird community in comparison to the undisturbed forest is striking. This pattern of climax community with high species diversity than a disturbed habitat is supports our hypothesis, which was expected. Most of the canopy feeding frugivorous birds, primarily the Brucerotidae and Columbidae are declining from the disturbed forest owing to canopy loss. The large frugivorous birds are also confronting severe threats of large hole bearing nesting tree due to selective logging of tall mature trees. The omnivorous and insectivorous species using the ground and middle layers of forest habitats are particularly affected for habitat disturbance. Habitat loss has encourages to increase the probability of encounter with potential predators. The major ground dwelling omnivorous birds of forest floor, especially, the species of Phasianidae have almost completely vanished from the disturbed habitat of study area. The omnivorous and insectivorous forest birds that feed on forest floor insects and drop down seeds of under story vegetation are mostly affected owing to foliage loss in the logged close canopy forest. The declination of leaf litter deposits in the forest floor resulted to dramatic changes of humus deposition in the forest ecosystem and thus leading to encourage the situation of changing animal community within forest floor. Again, the loss of species diversity in forest bird is alarmingly high in the tropical forest owing to elimination of large climbers that supported by tall trees in the climax close canopy forest. The endemic and nearly endemic birds species are the first group of forest bird to extinct due to tropical close canopy forest degradation, as they are merely specialist of the close canopy forest habitat and could not cope with any short of habitat modification owing to forest annihilation. Again, the Phasianidae are another group of forest-floor dwelling omnivorous birds species to be lost in the tropical close canopy forest degradation. The species Polyplectron bicalcaratum, Arborophila mandelii, A. torqueota, A. rufogularis and A. atrogularis are the forest interior species spread only in close canopy forest and are very sensitive to disturbance. Again the forest interior species Cairina scutulata is more vulnerable to forest fragmentation in the tropical forest ecosystem of south east Asia as their nesting habitat is situated within dense close canopy forest. The conservation priorities of tropical forest avifauna represents first of all by steno topic restricted ranges species, for the reason that, more than 71% global endemic species are close forest birds and major threat to the conservation of close forest endemic avian species are due to moderate habitat loss caused by selective logging, agriculture, overgrazing and hunting.

Keywords: *Tropical forest, closed canopy forest, endemic species, Climate change, habitat disturbances, conservation, geographical distribution ranges, restricted ranges, feeding guild*.

A New Record of Trematode Parasitic Form, Found in Freshwater Crustacean Hosts In Assam

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Crabs are used as local delicacies and in few traditional medicines by several tribes in Assam and other Northeastern States of India as well. They are also responsible for the lungfluke infection of the genus Paragonimus which is a zoonotic parasite causing paragonimiasis in man globally for which crabs serve as the transmitting agents (second intermediate host). Symptoms of Paragonimiasis mimics tuberculosis. This crustacean-borne infection is prevalent in South Asia including NE states.

During a pilot survey in selected pockets of Nagaon District, edible crabs are found to harbor some metacercarial forms, which are different from the earlier reported forms. On the basis of morphological criteria, the metacercarial form was revealed to belong to the trematode family Microphallidae, following standard literature. The crustacean species reported here is identified as Barytelphusa lugubris mansoniana. In other crustacean species no infection was recorded. Snails were also surveyed in those areas where crustaceans were infected to ascertain any other intramolluscan stages.

To supplement this morphological information, molecular characterization with suitable markers is suggested. This is the 2nd report for recovery of Microphallid parasitic material from freshwater crustaceans. As adult form microphallid can infect birds and few other warm blooded animals, chance of human infection can't be ignored. Snails were also screened for the recovery of intra-molluscan stages where the crabs were found to be infected.

Keywords: *Metacercaria, Crustacea*

Day Night Activity Budgeting of Great Indian One Horned Rhinoceros in Kaziranga National Park

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Kaziranga National park is probably the only place to hold the highest population (2400+) of Great Indian One Horned Rhinoceros. A study was conducted during the period 2016-17 on the behavioral aspects of Rhinoceros. Activity budgeting gives the overall map of behaviors of an organism. Standard methods were used for the study. The Indian Rhino diurnal activity budgeting was done on its activity and events from "Dawn to Dusk" by using Scan Animal Sampling and Ad. Libitum Samplings (Altman, 1974) in the interval of 5 minutes. Survey was conducted from 6.00hrs to 18.00hrs. The ethogram constructed during the pilot survey, was used for the data collection. As there is no permission to conduct survey at night, photos of the camera trap were used to find the behavioral activity at night. During data collection, the uniformity was maintained to represent all age and sex compositions as well as all habitats of Indian Rhino.

The day night activity budgeting showeda flow chart of behaviors of 24 hrs. The Great Indian One Horned Rhinoceros spends most of the time in feeding followed by resting and then others.. Although there is no fixed time of feeding they generally prefer certain specific time. Feeding was found highest in the early morning and in the late evening. On the other hand resting was found highest during late morning and in the mid night. Other behavior also follows certain sequence. These timings are actually controlled by different environmental parameters.

The population of Rhinoceros in Kaziranga National Park is day by day increasing. Hence it is very important to study the behavioral aspects for a better management and for the better survival of these threatened species.

Keywords: *Rhinoceros, Activity budgeting, behaviour*

Study on Food Preference of Lasius sp and Paratrechina Longicornis with Reference to Sweetness

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Ants belonging to the order Hymenoptera of the class Insecta are one of the dominant organisms living in the soil. Ants are generally observed to get attracted to sugar. Both sugar and aspartame are sweet in taste but aspartame is not a carbohydrate. The present study aims to investigate whether they are attracted to carbohydrates or sweetness. Two species of ants, Lasius sp and Paratrechina longicornis are selected for the study. The two species of ants are kept in terrarium each with two feeding stations, one containing 20% sugar solution and the other containing 20% aspartame solution under normal room temperature and light. The food preference of both the ant species are observed at an interval of one hour for 12 hours in a day for a period of 30 days. Their food preference is estimated in terms of number of ants in the feeding site following the method given by Ashraf et al, (2013). It has been observed that Lasius sp moves to aspartame in the initial hours but during the later hours it moves over to sugar for feeding. On the other hand Paratrechina longicornis quickly avoids aspartame and moves to sugar and remains there for a long time. It has been observed that both the ant species prefer carbohydrate to aspartame as aspartame has no calorific value. The difference in the sensitivity of the sense organs of the ant species may be assumed to be the cause of their varied food preference. A further study on their food preference might reveal how their sense organs can detect the difference between sugar and aspartame, thereby giving an insight to their physiology.

Keywords: *Lasius sp, Paratrechina longicornis, food preference, sugar, aspartame*

Studies on the Diversity of Avian Fauna in Panpur and Giladhari Range of Kaziranga6th, Edition, Sonitpur, Assam

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The present study emphasizes the avian diversity of Panpur and Ghiladhoria range of Kaziranga National Park from January 2017 to January 2018. The study area covers above 55 km2 that consists grasslands, woodlands and wetland habitats. There are many species of wetland birds found in that area either as residential or migratory species. The main objectives of the study were to find out the diversity and conservation threats of the avian fauna in the study area. The line transects methods, distant sampling and photographic techniques were used to collect the data. Field data were collect during early hours and late evening hours of the day and altogether 18 field days were devoted to collect the data. The bird species were identified using the available literature and hand Books. Study encountered altogether 110 species belonging to 41 families. Of which, the most important species sighted was critically endangered Grassland Bird species Bengal Florican-Houbaropsis bengalensis, (as per IUCN), and other birds like Black Stork-Ciconia nigra, Lesser adjutant stork- leptoptilos javanicus(vulnerable) , Himalayan Griffon vulture, Red Avadavat, and Wooly necked stork-Coconia episcopus. Recordings of critically endangered and threatened species indicated the habitat potentiality of the study area for avian fauna.. Study also indicated that, the area has a high potentiality in terms of tourism and avian research. But most importantly this has led to the realization of the position this area holds in providing the suitable environment for breeding, survival and migration to the species of birds found. Findings also indicated that the area needs immediate attention to protect the threatened avian species for long term conservation action.

Keywords: *Critically endangered, Avian fauna, Grassland birds, Bengal Florican, Storks, Conservation.*

Prevalence, Intensity and Abundance of Argulus Japonicus Thiele, 1900 in Lebeo Rohita (Indian major carp) in Assam, North-East India

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Argulus japonicus (Crustacra: Branchiura), or fish louse, are commonectoparasite of fresh water fish species. Clinical signs in infected fish include scratching on aquarium walls, erratic swimming and poor growth. It has also caused pathological changes due to direct tissue damage and secondary infections. A total of 200 specimens of Labeo rohita were collected from December 2016 to December 2017 for examination, out of which the scales from 23 (11.5%) specimens were found to be infested by the parasite and 177 (88.5%) not infested. In the present investigation, Argulus japonicusreported on L. rohitais the first record in Assam, northeast India. Prevalence, intensity and abundance of the infestation exhibited monthly fluctuation and recorded to be maximum in the month of February .According to the present study , it is clear that A. japonicus can act as a potential risk factor for natural ecosystems and native fish population of India and other countries, that should be mentioned to prevent the burst of new parasitic fauna to India and different countries as well as stop direct economic losses caused by mortality derived from infestation with this ecto-parasite.

Keywords: *Ectoparasite, lebeo rohita and northeast.*

Morphological Characterization of Different Dry Season forms of Polyphonic Butterfly Melanitis leda (Lepidoptera: Nymphalidae) Barpeta, Assam, India

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Butterflies are one of the most important assemblages of insect that act as a biodiversity indicator as well as have great economic and ecological value to human society. Due to habitat destruction for developmental activities in urban environmental and unscientific management of natural resources much of our native butterflies are fast disappearing. Common evening brown (Melanitis leda) is an polyphonic butterfly which show seasonal variation. Depending upon the eyespots presence or absence on the ventral side of wings they are named as dry season form and wet season form. In the present investigation, initially a pilot survey on different dry season forms of Melanitis leda butterfly was carried out in Bajali sub-division, Barpeta, Assam, India. The phenotypic differences between the seasonal forms when considered in relation to the basic model implies that selection for crypsis is very strong in dry and weaker in the wet season form when selection favors.

Keywords: *Polyphonic butterfly, Bajali sub-division, Eye spots, seasonal variation.*

Air, Water, Soil and Noise Pollution and Control Strategies

Ambient Black Carbon, PM2.5 and PM10 at Patna: Influence of Anthropogenic Emissions and Brick Kilns

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Particulate Matters like Black Carbon, PM2.5 and PM10 present in atmosphere not only poses a threat to human health but also contributes to near-term regional and global atmospheric warming. There has been a large concern of this kind of pollutants in Indo-Gangetic Plains (IGP). Hence, an attempt has been made to see the impact in one of the highly developing city of IGP as Patna. This city has been ranked among the top 100 air polluted cities in the world. To establish role of BC, PM2.5 and PM10 on local air quality, continuous measurements were conducted at seven locations of Patna from January to December, 2015. The seasonal mass concentration of BC were 13.92 ± 3.48 ìgm-3 in the winter, 9.65 ± 3.0 ìgm-3 in the pre-monsoon, 5.83 ± 1.90 ìgm-3 in the monsoon and 7.86 ± 3.66 ìgm-3 in the post-monsoon. Similarly, the seasonal average concentrations of PM2.5 (PM10) were 68.86 ± 18.83 ìgm-3 (108.13 ± 21.49 ìgm-3) in the winter; 64.62 ± 18.76 ìgm-3 (93.45 ± 18.42 ìgm-3) in the pre-monsoon; 37.83 ± 11.27 ìgm-3 (62.82 ± 14.81 ìgm-3) in the monsoon and 40.14 ± 16.66 ìgm-3 (64.72 ± 22.40 ìgm-3) in the post-monsoon. About 76.67% of PM2.5 and 87.78% of PM10 concentrations were greater than NAAQ Standards in the winter on daily basis and 46.74% and 36.96% in the pre-monsoon season. The backward trajectory analysis was also carried out through HYSPLIT model which suggests that the additional source of these pollutant during the winter and pre-monsoon season from the northwest and northern region of Patna. The ratios of PM10/PM2.5 observed at brick kilns cluster monitoring locations during the brick manufacturing period were significantly higher (0.87-4.48 ìg ìgm-1) than other monitoring sites and increase level of these pollutants over the city.

Monitoring of Air Quality in Eastern India and its Exposure to Population

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Air pollution levels were monitored during Nov, 2016 along near-highway (ShramikChowk, Dhaiya Gate,Tata Motor Govindpur and Govindpur), over a wide range of traffic using a fix monitoring platform in urban areas of Dhanbad city, Jharkhand India. Concentrations of particulate matter (PM10 and PM2.5), Sulfur dioxide (SO2) and Nitrogen dioxide (NO2) were monitored over successive periods of about 24 hours by using, high volume air sampler. The PM10 and PM2.5 are categorized by their aerodynamic equivalent diameter <10 and < 2.5 µm respectively. The Concentration of PM10 and PM2.5 were found above the prescribed limits given by Indian national ambient air quality standards (NAAQS 2009) at each location due to the continuous movement of vehicles. At ShramikChowk and Govindpur the concentration of NO2 was found above the prescribed limit due to heavy traffic, while SO2 concentration was not cross the limit at all sampling locations. As per CPCB 2014, the air quality index (AQI) of ShramikChawk and Govindpur were falling under the very poor category, whileDhaiya Gateand Tata Motor Govindpurunder poor category. According to CPCB 2014 very poor air quality may cause respiratory illness to the people on prolonged exposure at above mentioned location. Effect may be more pronounced in people with lung and heart diseases.

Keywords: *Particulate Matter, Air Quality, Air Quality Index, Traffic Sulfur dioxide, Nitrogen dioxide.*

Removal of Lead (Pb) From Aqueous Solution Using Fresh Biomass, Acid Treated Biomass and Biochar Of Locally Available Plant Centella Asiatica And Their Equilibrium and Kinetic Studies

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Assam is rich in plant biodiversity. In this work, a locally available plant Centella asiatica has been studied for its heavy metal removal potential with the help of batch experiments. The heavy metal that was used for the study was lead. Three different samples of fresh biomass, acid treated biomass and biochar were taken. The result obtained from the study shows that this plant has the potential to remove heavy metal from aqueous solution containing the metal salts. The effect on the adsorption of various parameters, such as contact time, adsorbent dose, initial metal ion concentration, pH and shaking speed were also studied. To know their effect over rate and extent of adsorption, different isotherms like Langmuir, Freundlich and Temkin isothermic models and kinetic models like Pseudo First Order, Pseudo Second Order and Elovich kinetic models were used. The adsorbate was analysed in ICP OES and the functional group present in the adsorbent responsible for biosorption was studied by using FTIR and RAMAN Spectrometer. The surface microstructures were studied with the help of SEM. The carbon, hydrogen and nitrogen percentage of the samples were also determined using CHN analyser. The removal of lead ions by fresh biomass, acid treated biomass and biochar of C. asiatica proved high effectiveness in removal of lead from aqueous as well as natural water source. Biochar proved to be the most effective. Removal percentage increased with increase in contact time and dose. Removal percentage decreased with increase in metal ion concentration. Optimum pH was found to be at 6.5. Removal percentage increased with increase in shaking speed. Fresh biomass, acid treated biomass and biochar was found to follow Freundlich isothermic model. The FTIR and Raman gave us clear idea of the functional groups present. Carbon percentage was found to be quite high in the samples during CHN analysis. SEM analysis gave us images of the binding of metal to the adsorbents after adsorption by batch experiments. Location and distribution of such useful flora needs further studies in the future using other metals. For future research purpose, other species of plants and their different parts can be used for the adsorption purpose of the heavy metal.

Keywords: *Biosorbent, Lead, Batch experiment, Isotherms, Kinetics*

A Promising Alternative to the Problem of Delhi Haze

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The capital of India, New Delhi has been in the limelight since past many years due to the worsening air quality. Year 2017 was no different. The air pollutants, especially the particulate matters both PM2.5 and PM10 reached the levels where the whole city was covered in a thick layer of smog thereby reducing the visibility and posing a serious threat to the health and safety of about 19 million people living in the national capital. On November 8, 2017, pollution surged so high that some monitoring stations reported an Air Quality Index (AQI) of 999, way above the upper limit of the worst category, Hazardous (AQI=500). The Delhi smog as per the policy makers was due to colder weather, stagnant winds trapping the various sources of smoke with the majority of such sources being those from the burning of crop stubbles, lit garbage and road dust. This was in addition to the everlasting automobile exhaust, industrial pollution and indoor pollutants. One of the major culprits for this smog was the burning of crop stubbles from farms in the nearby states of Punjab, Haryana, and Western Uttar Pradesh. With the rice harvest over, farmers burn the stubbles of rice crop to prepare the fields to plant wheat and return nutrients to the soil. A promising alternative to this problem may be diverting the rice straw to the renewable energy or bioenergy production. There may be many options for this viz., 1. Bioethanol production 2. Hydrogen rich fuels via microwave induced pyrolysis 3. Production of bio oil from fast pyrolysis of straw, and 4. Solid fuel briquettes. Rice straw briquettes or pellets are a promising technology because pelletization of rice straw is a form of mass and energy densification, which leads to a product that is easy to handle, transport, store and utilize because of the increase in the bulk density.

Keywords: *Delhi smog, rice straw, bioenergy, rice briquettes*

Assessment Of Tap Water And Oxalic Acid As Electrolyte For The Removal Of Chromium From Tannery Sludge By Electrokinetic Process

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The performance of tap water over oxalic acid as an electrolyte for the Electrokinetic process for removal of Cr(III) from tannery sludge was assessed. Tap water (TW) and Oxalic acid (OA) both shows appreciated average Cr(III) removal, i.e. 30.54 and 60.69 % respectively. The possible mechanistic approach for the removal efficiency of TW may be attributed as TW have sufficient conductivity and tap water attributed dissolution capacity during EK process. While OA exhibited maximum Cr(III) removal efficiencybecause of high conductivity and high dissolution capacity. The tannery sludge using OA and tap water after application of electrokinetic process varied from slightly acidic to mild alkaline, acidification of sludge was not observed, which was a problem associated inelectrokinetic process suggested the sludge can be reuse Therefore, OA can be considered as a promising electrolyte for electrokinetic treatment of tannery sludge.

Keywords: *Sludge, Electrokinetic Remediation, Oxalic acid*

Performance Evaluation of Polyelectrolyte as A Coagulant Aid Forpre-Treatment Of Tannery Wastewater By Coagulation-Flocculation Using Aluminium Sulphate

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Aluminium sulphate is a well-known coagulant for the treatment of tannery wastewater, but its performance in terms of Chromium(VI) and Sulphate removal is not sufficient which causes hindrance for biological treatment system. The objective of the present study wasto assess the efficiency of Cyamopsistetragonolobaas a coagulant aid for the treatment of synthetic tannery wastewater. Aluminium sulphate was used as a primary coagulant and Cyamopsistetragonolobaas a coagulant aid. It was found that aluminium sulphate removal efficiency with respect to Cr (VI), sulphate, COD, and turbidity are 70%, 30%, 50% and 72%, respectively, while the coagulant aid surpassed it with 24%, 20%, 25% and 21% respectively. Possible mechanistic approach to the coagulation property of aluminium sulphate and guargum(Cyamopsistetragonoloba)could be sweep coagulation and inter particle bridging.Therefore, Aluminium sulphate with Cyamopsis tetragonoloba (poly electrolyte) as a coagulant aid could be a promising coagulant for the pre-treatment of tannery wastewater.

Keywords: *Cyamopsistetragonoloba, Aluminium sulphate, inter particle bridging, sweep coagulation, Chromium (VI).*

Comparative Study of Soil Microarthropods in Agricultural Land and Waste Disposal Land

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The soil arthropods are important and most species rich component of any terrestrial ecosystem. Arthropods are one of the major groups of soil fauna and these are integral to a functioning ecosystem and perform key roles as detritivores, herbivores, predators and prey. Microarthropods in particular acari (mites) and collembolan are the most abundant and diverse group of soil arthropod community living in soil and litter environments. Acari are essential for efficient decomposition and nutrient cycling (Seastedt, 1984) and these are sensitive to soil disturbances (Clappertonet al., 2002). The fertility of soil is an important factor for cultivation of different crops. But in agricultural fields, due to application of different fertilizers and also by crop rotation, tillage, irrigation etc, the natural soil conditions and natural microarthropods and their ecology are affected (Sarkeret al, 2007). Due to urbanization and rapid population growth, there is production of bio-degradable as well as non-bio-degradable wastes. Their disposal in the soil affects the soil faunas which in turn may affect the maintenance of soil fertility in the soil ecosystem obviously. Monitoring the environmental impact of anthropogenic disturbances on soil ecosystem is of great importance for optimizing strategies for soil use, conservation and remediation. Soil microarthropods fauna (Orbatid and Collembola) of municipal solid waste treated soils may serve as bio-indicators to evaluate the role of waste application on the soil habitat. The various chemical substances play an important role in the life cycle of soil microarthropods. The co-relationship of chemical factors with the soil fauna have been studied by many workers (Mukherji and Singh, 1970). This paper deals with the following objectives: To survey the type and extent of municipal wastes in dumping site, to study the faunal make-up of microarthropods in relation to physical factors of soil & to study the physio-chemical properties of soil. Two different spots were chosen from the district which are Purbasha, Palta and Duttapukur, Barasat and from there, three and four agricultural fields were taken as study sites respectively. Four sites from solid waste disposal land were chosen from Serampore. Soil samples have been collected for a period of three months from all three study sites ie. fromPalta, Barasat and Serampore. Soil samples were taken from the study sites from 10-20 cm depth,extraction was done using Tullgren funnel. The collected specimens were observed and identified up to order. Soil temperature and various fertility factors of soils were measured. These physical factors were measured in order to understand whether there is any kind of correlation between these factors and the abundance of soil microarthropods. The species richness and evenness indices (Krebs, 1999) were calculated for three different study sites. The Shannon diversity index was applied to estimate soil microarthropod diversity along the study sites (Shannon and Wiener 1949). Finally it can be concluded as the soil is a physically and chemically diverse environment that is used by a wide variety of invertebrate animals and microorganisms. Soil mesofauna, which includes soil organisms ranging from 0.1 to 2 mm in body width, are normally dominated by Acari (mites) and Collembola (springtails) but also include Protura, Diplura, Symphyla as well as smaller forms of millipeds, centipeds, spiders, potworms and pseudoscorpions. In most soils, about 90% of the microarthropod population is composed of Acarina (mites) and Collembola (springtails) and are involved in decomposition of organic matter, the regulation of microbial activity and in nutrient cycles for the exchange of energy and matter. The role of microarthropods in decomposition and nutrient cycling has been long established and due to their importance in decomposition and distribution of organic matter, soil and litter arthropods have been suggested as useful bioindicators of the effect of land management on nutrient dynamics.

Keywords: *Arthropod, soil microarthropod, terrestrial ecosystem, agricultural field, solid waste disposal, land management, soil fertility factors, mites, collembolans.*

Catabolism of Phenanthrene and Simultaneous Production of Rhamnolipid Biosurfactant

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Introduction: Polyaromatic hydrocarbons (PAHs) are one of the major groups of pollutants that have become a cause of prime concern as they are not easily eradicated from the environment due to their recalcitrant and persistent nature. They are a vital component of crude oil, creosote, asphalt, and coal tar. The extensive exploration of fossil fuel in order to meet the increasing demands of fuel energy has led to the emancipation of large amount of crude oil in the nature. PAHs are ubiquitous in nature and hence their widespread nature in the environment is of great concerns, since many of them have been shown to be toxic, mutagenic, and carcinogenic Among other PAHs, phenanthrene is one of the simpler PAHs which is a tricylic compound containing three fused rings of benzene. It is also a member of the PAHs group belonging to one among the 16 PAHs that are classified as priority pollutants by Environment Protection Act of United States. Phenanthrene has often been used as a model substance for microbial metabolism of "bay-region" and "K-region"containing carcinogenic PAH. Bioremediation is considered as one most efficient and green approach to detoxify or remove PAHs from the environment. But the major curtailment in the bioremediation is the poor bioavailability of the PAHs. Biosurfactant are surface active molecules produced by microorganisms which reduces the interfacial tension between two immiscible phases and enhances the availability of hydrophobic compounds.

Objective of the study: The aim of the present study is to degrade phenanthrene by a Pseudomonas aeruginosa SR17 and to investigate the production of biosurfactant simultaneously.

Methodology

A previously isolated bacterial strain Pseudomonas aeruginosa SR17, was utilized to investigate its potential to degrade phenanthrene. The degradation study was carried out in in-vitro culture using Bushnell Haas media and adding phenanthrene as the sole carbon source for the growth of the bacteria. The optimum concentration of phenanthrene was evaluated by using different concentrations of phenanthrene- 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7 and 0.8 %. The degradation experiment was conducted for seven days and the degradation percentage was obtained gravimetrically, followed by GC-MS analysis to identify the degradation intermediates generated. The production of biosurfactant during the degradation study was also investigated by measuring the surface tension reading of the culture medium. The biosurfactant was extracted from the culture medium using solvent extraction procedure and purified by column purification technique. The biosurfactant was characterized by biochemical analysis (molisch test, emulsion test, and rhamnose test) and spectral approach including FTIR (Fourier Transform Infrared Spectroscopy) and LC-MS.

Results: In the study, it was observed that the bacterium Pseudomonas aeruginosa SR17 could grow optimum at 0.4 % of phenanthrene although it could tolerate 0.7 % of phenanthrene in the medium. The maximum degradation of phenanthrene was observed at the 6th day of the culture and the degradation percentage was calculated to 82 %. GC-MS analysis revealed the

production of degradation intermediates such as salicyclic acid, catechol, phenanthrenol etc. It was observed that during the degradation process, the bacteria produced surface active compounds, i.e. biosurfactant since the surface tension reading of the medium reduced to a minimum value of 32.8 mN/m from 69 mN/m. The biochemical analysis revealed glycolipid nature of the biosurfactant. The molisch's test revealed the presence of carbohydrate moiety whereas the emulsion test depicted the presence of lipid component in the biosurfactant and the rhamnose test showed the presence of rhamnose sugar. Spectral analysis further confirmed the rhamnolipid nature of the biosurfactant. FTIR analysis revealed the presence of ester bond at 1729 nm-1 which is a significant bond of rhamnolipid biousrfactant. Again, LC-MS analysis confirmed the rhamnolipid nature of the biosurfactant with six congeners that are an amalgamation of both mono and di rhamnolipid.

Conclusion: In our study, it was revealed that bacterial strain P. aeruginosa SR17 could well utilize phenanthrene and led to a maximum of 82% degradation after 6 days of culture. It was also observed that the bacterium could efficiently produce biosurfactant by utilizing phenanthrene as the sole carbon source. The biosurfactant produced in the medium provides a suitable condition for the bacterium to cause the degradation of the hydrophobic phenanthrene by reducing the interfacial tension between the immiscible phases. Further optimization of culture condition and application in field can lead to efficient remediation of PAHs contaminated environment. Moreover application of such potent bacteria in PAHs contaminated sites, will lead to biosurfactant production by the utilization of naphthalene present in the PAHs contaminated sites. The biosurfactant will further help in solubilisation of other PAHs which will result to a rapid degradation of PAHs in the contaminated environment.

Keywords: *PAHs, bioremediation, Pseudomonas aeruginosa SR17, biosurfactant, bioavailability.*

Assessment of Aluminium Oxide Nanoparticles For Arsenic Removal

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Among different heavy metals such as arsenic, lead, cadmium, chromium, and mercury, arsenic possesses maximum health risk through arsenic contaminated drinking water. The severity of arsenic toxicity is found more in South Asian countries such as Vietnam, Bangladesh, China and India due to their natural geological condition and existence of arsenic-bearing minerals in the local bed rocks. The states West Bengal, Jharkhand, Bihar Uttar Pradesh, Assam, and Manipur of India are the worst affected by this menace of groundwater arsenic contamination. These states have groundwater arsenic concentrations above permissible limit of 10 ìgl-1 set by the WHO. Drinking of arsenic contaminated water leads to several health effects such asdermal, cardiovascular,respiratory, gastrointestinal, endocrinological disorder, neurological, reproductive and developmental ailments and cancer. There are several conventional methods for arsenic removal from aqueous solution such as coagulation-flocculation-filtration, oxidation, nanofiltrationand ion exchange. However, these conventional methods are associated with several disadvantages such as high cost, high sludge production and membrane fouling. Adsorption is considered as one of the most popular, efficient and economical methods for arsenic removal from aqueous solution. The distinctive properties of nanoparticles are small size, catalytic potential, large surface area, high reactivity, and large number of active sites that facilitate better arsenic removal efficiency compared to other available adsorbents. The present study is focused on removal of arsenic [both Arsenite (As III) and As (V)] from aqueous solution using ?-aluminium oxide (Al2O3) nanoparticles. The nanoparticles were characterized using zeta potential analysis, Dynamic Light Scattering (DLS), Field Emission Scanning Electron Microscopy (FESEM) and Energy Dispersive X-ray Spectroscopy (EDX), Fourier Transform Infrared Spectroscopy (FTIR) and X-ray Diffraction (XRD). The adsorption study was carried out in batch mode by optimizing each parameter such as equilibrium time, stirring speed, initial arsenic concentration, adsorbent dose, pH fixation, adsorption isotherms, adsorption kinetics and thermodynamic study. Effects of competing ions and regeneration study were also done for the present study using 0.5 N NaOH solution to raise the pH of the adsorbent above pHzpc of 7.8. The zeta potential value of +32.4 mV represented moderate degree of stability of ?- Al2O3 in aqueous solution.DLS and FESEM results showed the size range of 60-80 nm, with an average size of 77 nm and irregular surface morphology. The presence of the elemental aluminium and oxygen were observed from EDX analysis. FTIR spectra revealed some strong peaks in the region of 3000 - 3600 cm-1 due to stretching vibration of OH group. Some weak peaks appeared in 1100 -1500 cm-1due to Al-O bands. XRD results confirmed that the nanoparticles were in gamma (?) phase. Optimized batch adsorption parameters were observed as contact time of 2 hr, stirring speed of 150 rpm, initial arsenic concentration of 300 ppb and adsorbent dose of 0.75 gl-1, 0.5 gl-1 for removal of As (III) and As (V)respectively.Langmuir isotherm was the best fitted model based on the R2 values.Pseudo-first-order, pseudo-second-order kinetic model, intra particle diffusion model and liquid film diffusion model were employed for adsorption kinetic studies for both the arsenic species. Pseudo-second-order kinetic model was the best fitted with R2 values of 0.99 for removal of both arsenite and arsenate. Liquid film diffusion was rate determining step having higher R2 than intra particle diffusion model. Thermodynamic studies were conducted for finding the values ofGibb's free energy (ÄG°), standard enthalpy (ÄH°) and entropy (ÄS°) for As (III) and As (V) at four different temperatures of 298 K, 308 K, 318 K and 328 K. The negative values of ÄH° in both the cases (- 29.12 kJmol-1, - 35.55kJmol-1 for arsenite and arsenate respectively)indicated that the adsorption was exothermic in nature for

removal of botharsenite and arsenate by ?-alumina. The negative values of ÄS° (0.077 kJmol-1K-1 and 0.088 kJmol-1K-1) confirmed decrease in the entropy of the system as a result of increase in arsenic concentration on the adsorbent surface and reduction in the mobility of the adsorbate. The negative values of ÄG° implied spontaneous and favorable nature of the adsorption process and the magnitude of ÄG° decreased with the increase in temperature that confirmed the adsorption process was less effective at higher temperature. In the study of effect of competing anions such as bicarbonate, chloride, sulphate, nitrate and phosphate on adsorption process, it was observed that removal of arsenite was reduced by 7.78 %for As (III) and 10.51 % for As (V) due to the presence of phosphate ions. The highest interfering effect of phosphate could be due to the formation of surface complexation of phosphate with the nanoadsorbents. The ?-Al2O3 nanoparticles exhibited a good regenerating efficiency. The present study showed that ?-Al2O3 efficiently removed 89.02 %arsenite and 94.96 % of arsenate with adsorbent dose of 0.5 gl-1 and 0.75 gl-1 respectively for an initial concentration of 300 ppb at 25 ℃. The adsorbent worked well in the drinking water pH range (6.5-8.5). With all optimized adsorption parameters, ?-Al2O3 removed arsenite and arsenate below WHO permissible limit of 10 ppb from 100 ppb and 250 ppb for arsenite and arsenate solutions respectively. There is no requirement of external energy source as the adsorption process was spontaneous and exothermic. Regeneration study established that ?-aluminium oxide nanoparticles can be regenerated easily to achieve economic application in real-world problems.

Keywords: *Adsorption,Arsenate, Arsenite, ?-Al2O3 nanoparticles, Kinetic studies, Langmuir isotherm,Removal efficiency.*

Performance Evaluation of Selected Tree Species Growing Alongside State Highway, Himachal Pradesh, India

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Plants are essential component of all the ecosystems which are most likely to be affected by air pollution. The leaves, abundant and primary receptors of the air pollutants, are more evidently affected by the global menace. Plants have been categorized based on their level of tolerance towards air pollutants. These levels of tolerance vary from species to species, depending on the ability of plants to withstand the effect of pollutants by simply impeding few of their physiological processes. The response of plants to air pollution at physiological and biochemical levels can be understood by analyzing the factors that determine resistance and susceptibility. Thus field study helped in understanding the seasonal variation in the biochemical parameters and evaluating the performance of the common tree species growing around the Nauni-Solan State Highway of Himachal Pradesh.Vegetation distribution on the both sides of the selected stretch was studied by a preliminary survey using quadrat method. The six plant species namely Toona ciliata, Pinus roxburghii, Grewia optiva, Celtis australis, Jacaranda mimosifolia and Pistacia integerrima found commonly occuring on the study site were selected for the study. The impacts of vehicular activities on the plants were studied on the horizontal distances of 0-5m and 5-10m on both sides of the road. Two sesaons viz post-monsoon (October-November) and pre-monsoon (April-May) were considered. In total there were 24 treatment combinations which were replicated thrice under RBD factorial. In the selected species chlorophyll content and leaf abstract pH varies from 0.56-2.26 mgg-1 and 3.99-6.93 respectively which increased with increasing distance from the highway. Whereas relative water content and ascorbic acid decreased with increasing distance from the road with respective values 54.72-80.87% and 1.33-4.06 mgg-1 .The APTI of selected plant species varied from 6.79-10.40. The trend of APTI of the selected plant species was Toona ciliate(10.40) > Pinus roxburghii(9.92) > Pistacia integerrima(9.01) > Celtis australis(8.31) > Jacaranda mimosifolia(6.97) > Grewia optiva(6.79). The selected plant species growing at a horizontal distance of 0-5m were observed to have higher APTI as compared to those at 5-10m.The assessment of the API with respect to the selected plant species was observed to lie in the range poor to excellent. Among the selected species the order of API was: Toona ciliata >Pinus roxburghii = Pistacia integerrima > celtis australis = Jacaranda mimosifolia = Grewia optiva. The Variation in the biochemical, physiological and tolerance level of the selected plant species growing alongside the State Highway indicated that vehicular pollution emitted on the roads have started impacting the vegetation growing alongside the road. However, certain plants like Toona ciliata have shown their adaptability to the stress caused by the pollution. Hence, Toona cliata with higher tolerance and anticipated performance index can be suggested for plantations alongside the State Highway so as to intercept the air pollutants which are hazardous to human and other living organisms.

Keywords: *APTI; Biochemical parameters; Chlorophyll content; Leaf abstract Ph; Relative water content; Ascorbic acid content, API*

Behavioural and Biochemical Changes in Channa Punctatus Exposed to Arsenic and Its Possible Revival with Turmeric

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Introduction: In present day world, arsenic toxicity is posing a great threat to mankind. Some of the areas of lower Assam indicated high level of arsenic in drinking water as reported in the survey conducted by the PHE department. The freshwater bodies are the main source of storage of arsenic and the rising levels of arsenicals in aquatic ecosystem and their effect on the aquatic organisms has now been recognized as a serious environmental threat. Arsenic can exist both in organic or inorganic form in nature. In general inorganic arsenicals are more toxic than organoarsenicals. Arsenic binds with sulfhydryl groups and disrupts sulfhydryl containing enzymes. Arsenic poisoning interferes with cellular longevity by allosteric inhibition of an essential metabolic enzyme pyruvate dehydrogenase (PDH) complex, which catalyzes the oxidation of pyruvate to acetyl CoA by NAD+. Arsenic has the ability to react with protein and non protein thiol groups leading to an alteration of cellular pathways. The arsenite may indirectly produce excess of reactive oxygen species (ROS), thus may result in partial oxidative stress. To assess the impact of arsenic toxicity in laboratory conditions, experiments were carried out taking Channa punctatus which is a commonly available freshwater fish in India. In the laboratory, they were treated with different concentrations of sodium arsenite (NaAsO2) to determine lethal and sublethal doses. The toxic effects of arsenic might have been neutralized if the cell is provided with exogenous antioxidant compounds. One of the most sought after natural antioxidant molecule bearer is turmeric which contain curcumin, a powerful antioxidant, can scavenge reactive oxygen species and thus initiates an antioxidant response. Thus turmeric might be helpful in the revival of arsenicosis.

Aim and Objective of the Study: The aim of present study was to investigate the behavioural and biochemical changes in freshwater teleost, Channa punctatus (Bloch) exposed to arsenic and to assess the effect of turmeric in the revival of arsenic induced toxicity with the following objectives:

- To study the behavioural responses in the arsenic exposed fish.
- To study some selected biochemical parameters of arsenic exposed fish.
- To study the possible revival of arsenic induced behavioural and biochemical changes by using turmeric.

Materials and methods: The fish Channa punctatus measuring 10 to 12 cm in length and 7.5 to 8 gm in weight were used in the experiment. Sodium arsenite (NaAsO2) was used for the experiment. The 96-hr LC50 of sodium arsenite in the present study was found to be 45.96mg l-1. The fishes were divided into three groups. The first group of fishes were exposed to 1/10 th of 96 hr LC50 i.e., 4.6 mg l-1 of sodium arsenite. The second group of fishes were exposed to turmeric (1%) extract. Whereas the third group of fishes were subjected to turmeric treated water post 96 hours of arsenic exposure.

Behavioural responses in fish of sodium arsenite exposed group, turmeric control group, post arsenic turmeric treated group and in control group were observed daily and recorded after 24 hour, 48 hour, 72 hour and 96 hour.

For biochemical studies, the fishes were at first anesthesized and then from each fish gill, liver and muscles were secluded. The tissues were blotted and weighed. Then the tissues were homogenized in cold distilled water using glass homogenizer. The tissue homogenates were

centrifuged twice (4000 rpm) for 5min.The tissue supernatants were separated to be used for the determination of enzymes activities and metabolites contents. Total protein content was estimated by the modified method of Lowry et al., (1951). The activity of alanine aminotransferase (ALT) and aspertate aminotransferase (AST) were determined by the method of Reitman and Frankel (1957).

Results: When the fishes were exposed to sublethal concentration of sodium arsenite, they showed an abnormal behavior pattern. Mucus was secreted all over the body surface and gill surface to protect itself from toxic environment. But fishes showed a sign of relaxation when were placed in turmeric treated water post 96 hours of arsenic exposure. Fishes exposed to only turmeric treated water showed similar behavioral pattern like that of the control fish.

A significant increase in the activities of alanine aminotransferase and aspertate aminotransferase in gill, liver and muscle were observed in the arsenic treated fishes as compared to control fishes. But the activities of these enzymes were found to be decreased compared to the arsenic treated ones when subjected to turmeric treated water post 96 hours of arsenic exposure. A significant decrease in the total protein content in gill, liver and muscle were observed in arsenic treated fish as compared to control fish, while that increased in the fishes subjected to turmeric treated water post 96 hours of arsenic exposure. The activities of these enzymes and the total protein content were almost similar like that of control values in turmeric treated fishes.

Conclusion: The present study clearly revealed the toxic nature of arsenic even in its sublethal concentration to the experimental fish Channa punctatus which was evident in its behavioural and biochemical aspects. The present study also revealed the protective nature of turmeric against arsenic toxicity. Curcumin which is the main component of turmeric has a strong antioxidant and free radical scavenging properties. The phenolic group of curcumin provides strong antioxidant and anti-inflammatory properties to turmeric. The ketonic group and double bonds of curcumin have metal chelating property. Because of these properties, turmeric might have resulted in the revival of arsenicosis in Channa punctatus. Thus it may be concluded from the basis of the present experimental findings that arsenic is dangerous to aquatic life which can also affect other organisms including human through food chain and turmeric can be used as a remedial measure of arsenicosis.

Keywords: *Organoarsenicals, sulfhydryl, allosteric inhibition, PDH, ROS, sodium arsenite, AST, ALT, LC50, arsenicosis.*

Trace Gases and Major Ions at A Traffic Dominated Site

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Introduction: The rapid urbanization and industrialization in the last few decades have led to a significant increase in emissions of gaseous pollutants and particulate matter (PM). Urban centers and surrounding regions suffer from severe air pollution.

Atmospheric particulate matter refers to liquid and solid particles suspended in air. PM is ubiquitous in the atmosphere and is formed from a variety of anthropogenic and natural sources.

Atmospheric fine particulate matter (particles with aerodynamic diameters less than 2.5 ìm; PM2.5) have long atmospheric lifetimes and are the focus of environmental regulation. PM2.5 affects Earth's energy balance through the scattering of solar radiation (direct and indirect effects), contributes to acid and nitrogen deposition to sensitive ecosystems, reduces visibility through the formation of haze, provides surface area for heterogeneous chemical reactions in the atmosphere and adversely affects human health. Several recently published studies have linked PM2.5 exposure to pulmonary disease and reduced lung function, cardiac arrest and in some cases premature death. Sources, characterization and health effects of fine atmospheric aerosols significantly differ from coarse particulates. Fine particulate matter, can penetrate deeper into the human respiratory-tract, thus increasing the risk of pulmonary and mutagenic diseases. Hence, understanding the physical and chemical processes that affect the formation, chemical composition and removal of PM2.5 from the atmosphere is of significant interest.

For a better understanding of climate forcing, air quality and for taking mitigating measures, knowledge of chemical constituents of PM2.5 is essential depending on the location. Sulphate and nitrate contribute more to particulate mass than other components. In addition, Na+, Cl-, Ca2+, Mg2+ and K+ may also be present associated with crustal and sea-salt sources. These species exist in aqueous phase or solid form depending on ambient temperature and relative humidity and some can get partially volatilized as NH3, HNO3 and HCl vapours. Some studies have reported simultaneous measurements of gases and particulate matter but only a few of these studies have been conducted in India.

Objective: Hence in this study, chemical characterization of PM2.5 and trace gases was conducted at a traffic site (Khandari Crossing NH-2) of Agra with the following objectives.

1. Spatial and Seasonal variation of important pollutant gases: SO2, NO2, NH3 and HNO3
2. Spatial and Seasonal variation of PM2.5 with respect to:

   Major anions (Cl-, NO3- and SO42-)

   Major cations (Na+, K+, NH4+, Ca2+ and Mg2+)
3. Simultaneous measurement of gaseous NH3, particulate NH4+ gaseous SO2, particulate SO42-, gaseous NO2, HNO3 and particulate NO3- to elucidate gas to particle conversion chemistry.

Methodology

Sampling Site: Sampling was carried out on the roof of a building (10 meters above the ground) near Khandari crossing situated about 400 meters away from NH-2. The highway is constantly busy with light and heavy vehicles (>106 vehicles/day) throughout day and night of the order of more than 106 vehicles /day.

Sampling: PM2.5 samples were collected using Fine Particulate Sampler (Envirotech APM 550) operated at a constant flow rate of 16.6 Lmin-1 on pre-weighed 47 mm quartz fibre filters (Pallflex, Tissue quartz).

Major anions (F-, Cl-, NO3- and SO42-) and major cations (NH4+, Na+, K+, Mg2+ and Ca2+) were determined by using Dionex ICS 1100 Ion Chromatograph system (Dionex Corp, Sunnyvale, CA). For cation analysis, the system is equipped with guard column (CG12A), analytical column (CS12A) and cation self-regenerating suppressor (CSRS 300 4mm) and 20mM Methane Sulfonic Acid is used as eluent. Major anions were separated by guard column (AS11A), analytical column (AS11) and anion self-regenerating suppressor (ASRS- ULTRA 4mm) using 6 mM 50% NaOH as an eluent.

Gaseous SO2, NO2, NH3 and HNO3 were collected by impinger technique using a low volume sampler comprising a diaphragm reciprocating type of air pump (Envirotech) for 2 hours at flow rate of 2 L/min.

1. Sulphur dioxide was estimated by West and Gaeke (1958) method.
2. Nitrogen dioxide was estimated by using sodium arsenite method.
3. Nitric acid was estimated by ion chromatography method using Dionex ICS 1100 Ion Chromatograph system (Dionex Corp, Sunnyvale, CA) equipped with guard column (AS11A), analytical column (AS11) and anion self-regenerating suppressor (ASRS-ULTRA 4mm) using 6 mM 50% NaOH as an eluent.
4. Ammonia in samples was estimated by indophenol blue method.

Result & Discussion

Particulate Matter: PM2.5 samples were collected at Traffic site Khandari Crossing NH-2, in Agra. During the study period PM2.5 mass ranges from 145.0 to 318.0ìg/m3 with an average of 273.2±36.5ìg/m3. Very high levels of particulate mass at traffic site may be attributed to anthropogenic emissions from vehicles and resuspended road dust.

At the traffic site in PM2.5, the sum of the water-soluble ionic species (WSIS) ranged from 21.5 to 97.8ìg/m3 with an average of 55.4 ± 20.0ìg/m3. The sum of WSIS contributed an average of 20.3% of PM2.5 mass concentration.

The results of the t-test, showed that PM2.5 mass concentration was not statistically significant. The absence of significant seasonal variation at traffic site is in accordance with site characteristics as emissions from traffic on NH-2 remain almost the same throughout the year. (NH-2 being a major National Highway connecting New Delhi to Kolkata). Over the past decades, a specific interest in water soluble ions (WSIS) has developed because they are ubiquitous with high mass concentrations in particulate matter (PM) over large regions of the Earth; they affect climate and other environments. WSIS, such as NO3-, Cl-, SO42-, Na+, NH4+, K+, Mg2+ and Ca2+ are significant components of atmospheric particles, with concentrations dependent upon the particle sources.

Gaseous Pollutants: Gaseous pollutants (SO2, NO2, NH3 and HNO3) were measured simultaneously along with PM2.5 at traffic dominated site. At the traffic site the annual average concentration of gases SO2, NO2, NH3 and HNO3 were 11.5±6.0, 18.1±0.6, 6.6±1.1 and 1.7±0.7 ppb. Among all these gases concentration of NO2 was highest concentration at the traffic site while at the rural site NH3 showed maximum concentration. The conversion mechanisms and rates for the formation of particulates from precursor gases are important factors in controlling concentrations of these pollutants. Source apportionment was elucidated by correlation and principal component analysis.

The main sources at traffic site are biomass burning, SIA formation, combustion, vehicular emission and burning while at rural site SIA formation, soil dust, combustion and biomass combustion are the main contributors.

Keywords: *Particulate Matter, Water Soluble Ions, Gaseous Pollutants*

Physico-Chemical Analysis of Potable Water in the South Eastern Region of Kolasib District, Mizoram

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The term quality of water refers to the relationship between the composition of water and their contamination with human activities and other natural processes. Due to increase human population, agricultural activities like use of fertilizers, pesticides, manures, and industrial chemicals, wastes and other anthropogenic activities, sewages, etc introduced more and more harmful pollutants to the sources of potable water. The process of natural filtration is being strongly depleted due to the practices shifting cultivation and land modification by human activities, which results in the downward movement of water into subsurface formations through large openings such as animal burrows, fissures and bedding plane in rocks, and manmade excavations. Thus, the degree and extent of pollution depend primarily on the quantity and concentration of the pollutants and the porosity, permeability, hydraulic gradient, depth of water table, storage capacity of the aquifer as well as the time factor. Monitoring the quality of water is thus pre-requisite for establishing pollution. It is vital for human to have the knowledge of environment, sources, and rock-water interaction of potable water as is directly linked to the health of the people. Majority of the people in the study area have been consuming water directly without any safe household water treatment practices. The data findings through this analysis will quite informative and helpful to the people of study area. The present study mainly focused on the Physico-chemical characterization of sub-surface water during monsoon season (August) in 2017. Water samples from Springs, hand pumps and water supplied by Public Health Engineering Department at various locations within the study area were collected and analyzed. Total Iron content was measured by using the Water Testing Kit and for pH, Turbidity, Total Dissolved Solids and Electrical Conductivity values, digital instruments were used. Nitrate concentration was done by uv-spectrophotometric method. Total Hardness, Calcium, Magnesium, Total Chloride, Total Alkalinity and Sulphate were analyzed by titrimetric method. Bicarbonate (HCO_3^-) determination was carried out using acid titration. For anion and cation, piper and ternary diagrams are plotted in order to classify the facies and water belongs to Ca-Na-HCO_3 type. The results revealed that all of these water samples were well within the permissible limits established by World Health Organization and Bureau of Indian Standards and hence suitable for drinking purposes. However, magnesium contents at few sites are found exceeding the permissible value of 30 mg/l. The hardness of water mostly falls within very soft (0-75 mg/l) and moderately hard (75-150 mg/l),but, sample from hand pump at N.Chaltlang marked profoundly very high hardness of 364 mg/l of $CaCO_3$. Water of very soft hardness are likely to cause corrosion of metals ,though they are preferred for domestic uses, extremely hard water are not desirable as they are likely to have scaly deposit inside the tanks and pipes due to their rich mineral contents. Almost all samples from Kawnpui town, and Lungmuat, Bukpui, Nisapui, N.Chaltlang villages are characterized by acidic water; most of them fall within the safe range for domestic uses i.e. pH range between 5.5 and 9, samples from three sources are found to have high acidity ranging less than 5.5. The acidic water is very corrosive and may cause leaching of metals and premature damage to pipelines. Water sources of high acidity are found to have excessive amounts of Iron content usually associated with reddish stain. Relative high alkanity is observed from hand pump and Lengleh spring from N.Chaltlang village, alkanity in most natural surface and groundwater is primarily derived from the dissolution of carbonate minerals, and from CO_2 present in the atmosphere and in soil above the water table. Three carbonate species (HCO_3^-,H_2CO_3,CO_2) contribute to alkanity and their relative proportions being dependent on pH and temperature, within these two sources the water are of near neutral-

pH values i.e. 6.19 and 6.92 respectively, hence, high alkanity is found to be associated with the presence of dominant bicarbonate ion (HCO3-). Turbidity values of 6.5 exceeding permissible limit of 5 is observed from Midum lui, Zanlawn village. It is found to be associated with improper drainage system and high rainfall within the monsoon season. From the above overall results obtained from the physico-chemical studies, it is concluded that water of the study areas are safe for domestic use such as for cleaning, bathing and washing, but not for drinking purposes without boiling. Appropriate treatment of water is suggested for neutralizing slightly acidic, alkaline and relatively hard water. Implementation of proper drainage system and channels is advice as well to prevent contamination that is prevalent during rainfall season.

Keywords: *hardness; physico-chemical parameters; piper tri-linear diagram; ternary diagram; Standard levels*

Assessment of Surface Water Quality of Damodar River Using Heavy Metal Pollution Index (Hpi)

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Today, the deterioration of river water quality causes a great concern. The major factors of diminishing river water qualities include continuous discharge of mining waste, industrial waste and other anthropogenic activities like urbanization, population growths and land development along river basin is one of the major concerns throughout the world. Mining and its associated industrial activities, particularly thermal power plants and open-cast coal mines made extensive of heavy metal pollution of surface water, groundwater, soils, air,and vegetation. Being a peninsular Indian river, the Damodar tributaries are used for variety of purposes, including drinking, recreation, agriculture, and industry. Such an indispensable vital water course is affected by the changing land use pattern, together with the discharge of excess amount of industrial effluents and wastes from coal mining activities. Therefore, the present study was focused on to assess the variations in the water quality and dissolved metal load in the Damodar River. To quantify the variations of metal contamination in water was done using pollution indicating indices (HPI) and their impact on the local population.

For the current study grab, water samples were collected from 5 locations of the Damodar covering approximately 54 Km of the stretch. The water samples were collected approximately 30 cm below to the water surface and stored in 1L high-density polyethylene bottles. The unfiltered river water samples were preserved using nitric acid (HNO3) to lower the pH to less than 2. The samples thus preserved, were brought to the laboratory for heavy metals (Co,Fe,Mn, and Zn) and physical parameter (pH, EC, and TDS) analysis. The status of pollution was found through the heavy metal pollution index (HPI).The HPI is based on weighted arithmetic quality mean method and developed in two steps. First by establishing a rating scale for each selected parameter giving weightage and second by selecting the pollution parameter on which the index is to be based. The HPI model can be expressed with following formula-

HPI =

where Qi is the sub-index of the ith parameter. Wi is the unit weightage of the ith parameter and n is the number of parameters considered. The sub-index (Qi) of the parameter is calculated by-

Qi =

where Mi is the monitored value of heavy metal of ith parameter, Ii is the ideal value of the ith parameter and Si is the standard value of the ith parameter. The sign (-) indicates numerical difference of the two values, ignoring the algebraic sign. The critical pollution index of HPI value for drinking water is 100. However, a modified scale using three classes as low, medium and high for HPI values <15, 1530 and >30, respectively.

The pH value of river water in the study area ranges from 6.5 to 7.4 (mean 7.03), indicating an acidic to neutral type of river water in monsoon season. The values of conductivity ranged from 212.5 to 283.5 with an overall mean of 250.37 ìScm-1 in monsoon season. The high level of electrical conductivity at the discharge point is mainly attributed to mining and industrial waste discharge in the river water. TDS in the study area varied in the range of 141.3193.4 mgl-1 with an overall mean value of 163.86 mgl-1 in the study period.

The four heavy metals viz. Co, Fe, Mn, and Zn were detected in most of the samples in the range of 0.0010.002, 2.36-6.12, 0.0210.034, and 0.06-0.17 mgl-1 with an overall mean of 0.001, 4.04, 0.026, and 0.12 mgl-1, respectively in monsoon season. The mean values of metal concentrations can be arranged in the order Fe >Zn> Mn >Co. The values for most of the parameters in the river water were found to be much lower than those of Indian water quality standard except for Fe. In river water,the raw effluent as pollutant may break down or become diluted due to self-purification or natural processes. However, the recalcitrance and consequent persistence of heavy metal concentrations in surface water which are not very high, in dilute and undetectable quantities, exhibited toxic characteristics.The maximum value of HPI was observed as 31.85, which is less than the critical value of 100. So it can be inferred that the composite influence of all the considered metals on the overall quality of the water is alarming owing to the mineralization, mining and industrial activities near some of the locations that can be visualized while evaluating the HPI for each location.

Distribution characteristics of metal concentrations and consequently the water quality of the Damodar River basin is the result of combined influence of natural conditions, i.e. geological backgrounds and human activity. Taking into account of the HPI value is less than the critical value of 100, while the overall quality of water in regard to metals falls in the high class (HPI >30). Hence, it can be concluded that the investigated river basin is moderately polluted with metals. In general, the contamination of Zn was more serious than that of Co, Fe,and Mn, whereas the presence of Fe, Mn might be primarily from natural sources. Thus, it is reasonable to conclude that the increased concentrations of metals in the water of the Damodar river is considerably due to direct discharge of industrial, urban and mining wastes into the river. The results of this study indicate that monitoring and immediate managerial measures must be taken to avoid further potentially toxic metal pollution of river water.

Keywords: *Heavy metals, Damodar River, Water quality parameters, Heavy metal pollution index (HPI)*

Effect of Fly Ash and Organic Manure on Growth of Tree Borne Oilseed Simarouba Gluca Seedling and Properties of Potting Mixture

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Fly ash is an amorphous mixture of ferro-aluminosilicate minerals generated from combustion of powdered coal. Fly ash is composed predominantly of small, glassy, hollow particles with low to medium bulk density ranging from 0.98 to 1.33 g cm-3 (Adriano et al., 1980) with an average high surface area and light texture. Approximately 90-99% of fly ash consists of Si, Al, Fe, Ca, Mg, Na and K. Major matrix elements in fly ash are Si and Al together with significant percentage of K, Fe, Ca and Mg.Fly ash positively influences the micro ecology and chemistry of soil in addition to physical properties such as water holding capacity, bulk density and soil structure.

Since fly ash is a storehouse of macro and micronutrients, the development of proper technologies for disposal of this solid waste in an eco-friendly manner becomes essential to derive maximum benefit from its heterogeneous nature. In conjunction with organic manure, microbial inoculants or fertilizers, fly ash can be used to design a soil beneficiation strategy, which can help in improving soil properties and enriching its nutrient status.

Simarouba (Simarouba gluca) is a ecofreindly tree with well-developed root system and with evergreen dense canopy efficiently checks soil erosion, recharges ground water supports soil microbial life, and improves soil fertility. Further, its cultivation effectively combats desertification of wasteland, by improving the bio productivity and economic productivity, thus facilitates the wasteland reclamation. Keeping the above factors in mind a comprehensive study on characterization of fly ash as a pot mixture for its physico-chemical properties, the effect of fly ash added pot mixture on growth and development of tree borne oilseed nursery seedlings of Simarouba (Simarouba gluca) and the status of soil properties and nutrient status of fly ash mixed pot mixture at final stages of seedling growth of Simarouba (Simarouba gluca). The experiment was conducted at Agro Forestry nursery at MARS, UAS, Dharwad Karnataka during 2016-17. Fly ash based pot mixture containing organics viz., Farm Yard Manure (FYM) and Vermicompost (VC) are mixed in 9 different ratio combinations on w/w basis with and without soil including two controls.

Fly ash was mixed with farmyard manure, vermicompost and soil on a w/w basis in different proportions, ie., FA+FYM and FA+ VC in 1:0, 1:1, 1:2, 1:3, 0:1, 2:1, 3:1 ratios. And FA+FYM +SOIL and FA+VC +SOIL in 1:0:1, 1:1:1, 1:2:1, 1:3:1, 0:1:1, 2:1:1, 3:1:1 ratios as per treatment details and prepared the pot mixture for further pot culture study.

The texture of fly ash used was silty loam having the water holding capacity 28.90 per cent and bulk density was 0.98 Mg m-3.The reaction of fly ash was neutral and salinity was low. The organic carbon content was 1.20 g kg-1 and the nutrient elements N, P and K were measured in the order of N=K>P. Calcium was higher than the sulphur followed by Mg. The microbiological activity was quite negligible in fly ash.

The data on bulk density, water holding capacity and organic carbon content of fly ash based mixture in different treatment combination differed significantly. And the values are 0.61 Mg m-3, 69.34 per cent and 15.29 g kg-1 respectively in pot mixture containing fly ash, FYM/VC and soil in different proportions. The growth parameters viz., plant height, number of branches, root length and total dry biomass improved significantly and the average nursery seedling height was

enhanced to 120 per cent in the treatment receiving fly ash, FYM/VC in 1:2, 1:3 and 1:2:1, 1:3:1 with soil over the control and other treatments. The study indicates that the Simarouba gluca had high potential for nutrient uptake due to high biomass production during seedling growth besides fast growth. There was increased uptake of N, P, K, Ca, Mg, S and micro nutrients in all the treatment combination receiving fly ash based pot mixture containing organics with or without soil. Variations in the concentration of nutrient elements in the plants and uptake by the leaves and stem of nursery seedlings was observed for major N.P.K nutrients which varied as N=K>P, secondary nutrients varied as Ca>S>Mg and micro nutrients varied as Fe>Mn>Zn>Cu. However, there was marginal variation in the physic-chemical properties of pot mixture over a period of 150 days after the growth of nursery seedlings.

There was significant improvement in physico-chemical properties and nutrient status of pot mixture containing farmyard manure, vermicompost and soil used for raising nursery seedlings of Simarouba gluca and had positive influence. The plant height of nursery seedling in Simarouba gluca was enhanced by as much as 16.27 cm in treatment T4 with fly ash, VC and soil in 1:3:1 ratio to 35.97cm. Similar trend of enhanced growth was recorded in the all other treatments. The average increase in seedling height over initial height was 120 per cent. The average seedling height increased over a period of 150 days of Simarouba ranged from 10.41 to 31.7cm and it was higher in presence of fly ash incorporated with organic substrates and soil. For forest species the soil acts synergistically towards growth and biomass production of nursery seedlings. It was observed that the dry biomass of Simarouba gluca was increased with increasing proportion of in fly ash to organic substrates or soil. Incorporation of fly ash in pot mixture with organic substrates resulted in a concentration dependent improvement in dehydrogenase activity in pot mixture

Fly ash based pot mixture with organic substrate in 1:1, 1:2, and 1:3 ratio on w/w basis with or without soil was optimum for use as a pot mixture for raising nursery seedling of Simarouba gluca. Also as an amendment for improving physico-chemical properties and acting in a synergistic manner for maintaining the nutrient balance and fertility of pot mixture.

The study indicates the positive role of fly ash as on alternative to soil for pot mixture alone or co-mixed with farmyard manure or vermicompost.

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.

Keywords: *physico-chemical parameters, seasonal variations, ANOVA, Pollution.*

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.

Keywords: *Physico-chemical Parameters, Pollution and Pardeswadi lake.*

Phytoremediation Potential of Aquatic Macrophyte Spirodela Polyrhiza with Reference to Cadmium and Chromium

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The present study examine the potential of Spirodela polyrhiza- a free floating aquatic plant, to phytoremediate Cd and Cr from aqueous solution. Spirodela was exposed to three different cadmium and chromium concentrations, such as, 2.0, 4.0 and 6.0 ppm and the experiment was conducted for 28 days. At the end of the experimental period, plant samples were harvested from each enclosure and accumulated cadmium and chromium content was measured. Experimental results revealed that Spirodela polyrhiza was capable of removing considerably high cadmium and chromium concentrations (56.77-85% and 66.66-79.17%). Bioconcentration factor demonstrated that Spirodela polyrhiza has more accumulation potential of Cr over Cd except at lower concentration. The present study revealed that Spirodela polyrhiza was moderate accumulator of these two heavy metals.

Keywords: *Spirodela polyrhiza, cadmium, chromium, bio-concentration factor, phytoremediation*

Critical Limits of Phosphorus In Soil And Pea Plant Grown in Acid Soils of Senapati District of Manipur, India

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A pot culture study was conducted in 20 acidic soils of Senapati District of Manipur, India during rabi season of 2013-14 to estimate the critical limit of P in soil and pea plant for predicting the response of pea (Pisum sativum L.) to P application as well as to study the effect of P application on dry matter yield and uptake of nutrients in pea crop. The experimental soil was acidic in nature, electrical conductivity of the soil was in safe limit for crop growth. The organic carbon status was almost high and soil was clay in textural class. Pot culture studied showed that the application of phosphorus @ 60 kg P2O5 ha-1 significantly superior (85 %) of the studied soils to any other treatments and 40 kg P2O5 ha-1 was significantly (15 %) to the total soils in dry matter yield of Pea variety Arkel. The critical limit of the P concentration in the pea was found 0.42 per cent . It was revealed that the critical level of phosphorus in the soils for growing of pea plants varied with the methods of phosphorus extraction. The critical level of soils ranged from 14.30 to 25 kg P2O5 ha-1 depending upon the methods of phosphorus extraction.

Keywords: *Phosphorus, critical limit, acidic, soil, pea*

Report on Hydrometeorology of Chitapur Taluk, Kalburgi District, and Karanataka, India

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Rainfall data of past hundred 30 years of Chithapur taluk, source collected from central round water board. The data revealed that the average rainfall of CGWB report is 1 mm spread over 30 years. Received from south west monsoon (June-September), north east (October-December), summer (March-May) and winter season (January -February) respectively. Rainfall receiving more than 100 mm of rainfall can be expected only at. The water scarcity and groundwater pollution are the major problems faced by the community of the Chithapur taluk. Shortage of rainfall, industrialization, urbanization, use of pesticides and fertilizers in agriculture results in poor quality and quantity of groundwater. The study area Chithapur with an average temperature of about 340c. . The successive failure of rains occurred during the year 1972 and 1973, when large numbers of people were affected. We have to adopt necessary methods to conserve the quality and quantity of groundwater. To minimize the problems caused by water scarcity we have to follow certain technological procedures like irrigation, regulated consumption of ground water, sprinkler irrigation, contour farming, crop rotation, rainwater harvesting, recycling of drainage water etc. Rainfall is the most important natural hydrologic event and is a unique phenomenon varying both in space and time, the rainfall distribution is very uneven and it not only varied considerably from place to place but also fluctuates from year to year. The rainfall is one of the most important and governing factor in the planning and operation strategies of any agricultural programmer for any given area. As such, proper and specific information about the rainfall distribution pattern over a period for a particular place is inessential for proper and optimal planning of requisite irrigation system and cropping pattern. Indian subcontinent gets around 75% of annual rainfall during monsoon period, which lasts from June to September i.e. four months. Theme share of conjunctive water-need of the country during entire calendar year is met by the rainfall, which occurs in the monsoon period. There is large variation in distribution of rainfall from year to year. In our country swallowing floods and thirstily droughts at the results of spectacular extremities of the rainfall distribution.

Keywords: *Drought, Flood, Frequency, Urbanization, Groundwater.*

Soil Micronutrient Status of Irrigated Soils in Upper Dudhana Basin in Aurangabad District (Maharashtra), India

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Soil health is the basis for crop production, assumes greater significance from the livelihood view point of millions of Indian farmers. To overcome the adverse effect of current cultivation practices, sustainable agricultural practices should be adopted. The evaluation of soil health status of Aurangabad district has been carried out with 28 surface soil samples from 3 villages. The soil is analyzed for various soil fertility parameters such as pH, EC, organic matter and availability of NPK and micronutrients. The soils of Aurangabad district are moderately alkaline in nature with a mean value of pH 8.2. The soils are good soil with EC ranging from 0.21 to 1.84 dS/m with mean of 0.61 dS/m in Aurangabad district. The organic carbon content of soils of Aurangabad is low, mean value being 0.48 %. The available nitrogen and phosphorus of soils of Aurangabad is high, with mean of 381.82 kg/ha, 45.05 kg/ha whereas a mean value of Potassium is 346.79 kg/ha. The mean value of Cu is 3.84 ppm; Fe is 1.24; Zn is 0.31 and Mg is 14.88 ppm. Intensive farming is responsible for deterioration of soil quality. The increased pH and lowered organic carbon resulted into fixation of Phosphorus. There is dire need of improvement in soil organic carbon by using organic manures including intercropping, mixed cropping and adopting Integrated Nutrient Management program.

Keywords: *Crop, Fertilizers, Farmland, Macronutrients, Minerals.*

Removal of Cu(II) from Waste Water by Calcium Silicate Precipitation Tube (CaSPT)

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Gravity defying self organized tubular structures developed through precipitation reaction of metal salt crystals with aqueous sodium silicate is commonly known as “silica garden or chemical garden”. Calcium silicate precipitation tube (CaSPT) has synthesized by “silica garden” route.

Calcium silicate precipitation tubes (CaSPT) are hierarchically built from smaller interconnected tubes of about 20 nm diameter. CaSPT has fairly high surface area(141.5 m2g-1). The Isoelectric point (IEP) has been observed at pH 3.41 which indicates that the surface is suitable for adsorbing cationic species.

Calcium silicate precipitation tube (CaSPT), prepared through 'silica garden' route, was investigated as Cu(II) adsorbate in aqueous medium. Batch adsorption studies were carried out with Cu(II) in the concentration range of 50-300 mg l-1 using CaSPT as adsorbent. Cu(II) loading on CaSPT was dependent on initial Cu(II) concentration. Experimental adsorption data were modelled using Freundlich and Langmuir isotherm equations. Cu(II) loading capacity of CaSPT was estimated at 262.9 mg g-1 , which ranks high amongst efficient Cu(II) adsorbents. Adsorption kinetics follow pseudo second order model with activation energy (17.1KJ mol-1) typical for physisorption process.

Keywords: *Silica Garden, Adsorption, Copper, Waste water treatment*

Soil Management in Angami Agroforestry Practices

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Soil management is a part of agroforestry practices which helps to maintain soil fertility soil and control soil erosion. Adoption of modern agriculture and use of so called high yielding varieties of crops are contributing to decline of Angami traditional agroforestry. The present study aims to document the Traditional Ecological Knowledge (TEK) of management of soil in Angami agroforestry practices for amelioration of jhum land and the potential of agroforestry in conservation of soil. Group discussion, personal interview (semi-structured) and personal observation were included in the study design. Angamijhum fallow management involves the selective of plant, mainlyAlnus nepalensis. Other species used by Nagas in fallow managementin different altitude of tropical and sub-tropical forests of Nagaland areMacaranga denticulate, M. indica and M. pelteta.Soil fertility is maintained using biomass of the jhum fields in the form of green manures and ashes. Growing of Alnus nepalensisin the jhum fields help to enrich soil fertility through biological nitrogen fixation and its leaves serve as green manure while the root systems control soil erosion.Macaranga also helps to enrich soil fertility and retain water in the winter. There is a sincere need for the documentation of soil management in jhum cultivation and validation by scientific investigation. Proper soil management can decrease soil erosion and increase jhum cycle which in recent decades has decreased to 2 or 3 years. This in turn will augment agrobiodiversity production and contribute to sustainable development.

Keywords: *agroforestry, TEK, soil management, agrobiodiversity, sustainable development*

Pollution Load in River Hughli From Bandel To Kolkata And Its Socio Economic Impacts

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With the growth of population in Bandel to Kolkata region the quantity of waste water is also increasing in addition to the production of large quantities of sewage. Sewage contains decomposable organic matter and exert an oxygen demand on the receiving waters. Industrial activities generate a wide variety of waste products, which are normally discharged into water courses. Major contributors are the pulp and paper, chemicals, agrobased, soda water, cotton textiles, jute and jute based, leather, chemical and rubber industry and all of them discharge their waste water and other effluents, directly or indirectly, into the river, resulting in the pollution to such an extent that is causing health hazards and other problems.. Hepatitis, cholera, dysentery and typhoid are the common waterborne diseases, which has affected the inhabitants of this region. Apart from diarrhoea, and breathing problems, drinking polluted water has lead to skin diseases. The polluted water has become breeding grounds for mosquitoes .and many other parasites. The research paper is a genuine endeavour to explore the pollution load in river Hughli from Bandel to Kolkata and analyse its socio economic impacts.

Keywords: *pollution, impacts, Hughli, socio-economic*

Environmental Toxicology and Human Health Issues

Efficacy of Harmalol inhibiting Environmental Pollutants (DEN+CCl4) Promoted Hepatocarcinoma: Biochemical, Histopathological and up-regulation of p53 and Caspase 3 expression

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Introduction: Liver is one of the vital organ of our body and metabolism. In Asia and Africa, hepatocarcinogenesis is one of the major causes of cancer deaths. Hepatocellular carcinoma (HCC) involves multistep processes which are correlated with different genetic alterations that ultimately lead to malignant transformation of the hepatocytes.

Among several liver cancer inducing agents, diethylnitrosamine (DEN) often induces malignant tumours in target organ and is species specific. DEN is a potent hepatocarcinogenic and genotoxic compound, present in tobacco smoke, water, foods, cosmetics, agricultural chemicals and pharmaceutical agents. As preservatives, nitrites and nitrite salts are used in numerous foodstuffs in food industry since 1920 and to preserve the natural color of meat and typical taste of processed, smoked and cured meat and meat products. Meat proteins especially amines can react with the nitrites and produce N-nitrosamines, one of the harmful compounds, a product of nitrosation. Nitrites are also formed by enzymatic reduction reaction from nitrates as present in foods of plant source. The traces of DEN (414 parts/109) are found after baking, frying and cooking. Cigarette smoking, drinking water, living environment, buying goods and even taking drugs push in to the direct exposure to N-nitrosamines. Exposures to smokeless tobacco with highly concentrated nitrosamine have induced cancers mainly in the head-neck region. Although the pathway of N-nitrosamine formation in meat products has not been fully known but dried, smoked, salted, and pickled products are all harmful. Temperature is found to play a major role in the production of N-nitrosamines during frying, roasting and storage of meat products. Concurrent administration of fish meal and sodium nitrite exerts strong renal carcinogenicity in rats. According to few previous literatures the N-nitroso compounds enriched food sources are bacon, luncheon meats, sausage, and hot dogs. The second highest food origin of N-nitroso compounds is from fresh and smoked seafoods and low to moderate sources are grains and dairy products, oils, liquor and wine. It is reported that N-nitroso compounds are also found in soya beans and pulses, roots, vegetables, and fats. As nitrosamine is found in food preservatives as environmental dietary carcinogen, intensive study has been conducted on DEN induced hepatocarcinoma in mouse model as a potent genotoxic agent. Female mice have been reported to be resistant to hepatocellular carcinoma (HCC), hence only male mice were used and analyzed in this study. Initially rapid killing of hepatocytes was induced by DEN alone. Since liver is capable of natural regeneration of lost tissue, increased hepatocytes death resulted in a more extensive compensatory proliferative response that enhanced the formation of HCC in DEN exposed mice. Here we have highlighted HCC, through hepatoprotective nature of natural â-carboline alkaloid, harmalol. The aqueous and alcoholic extracts of Peganum harmala seeds have been reported to have potent antitumor and antiproliferative activity. P. harmala extract caused a significant improvement in liver and kidney function in mice administered methotrexate drug, since this extract modulated the liver enzymes and kidney function with both pre and post-treatment. The seed extract of Peganum harmala and other â-carboline derivatives have been reported to show potent antitumor, antiproliferative activity as well as putative hepatoprotective effect. Harmalol, one such natural alkaloid, showed intercalative mode of binding and also showed binding specificity with hetero GC by various photophysical and calorimetric studies, and molecular docking experiment. Poly(dG-dC).poly(dG-dC) showed non cooperative binding with a binding constant of 4.2 ± 0.07x106 M-1. Harmalol application showed in vitro ROS dependent

p53 and caspase3 mediated chemopreventive effect against HepG2. It is found that harmalol is very much active against hepatocarcinoma in mice model.

Objectives: Food preservatives containing nitrate and nitrite salts react with proteins especially amines to produce N-nitrosamines. Diethylnitrosamine (DEN) is one such compound to induce hepatocarcinoma (HCC) and our objective is to elucidate the effect of harmalol against DEN induced HCC in mice model.

Methodology: DEN initiated-CCl4 promoted, HCC is studied in seven groups of male Swiss albino mice. Different stages of liver tissues and serum from different experimental groups were collected before and after harmalol treatment to determine its therapeutic effect by quantitative and qualitative study of liver marker enzymes, histopathological studies and apoptotic markers by RT PCR and Western blot analysis.

Result: I.P. of harmalol, before and after DEN+CCl4 injection showed significant reduction in hepatocellular foci, nodules or carcinoma. Hepatoprotective effect exerted by specific dose of harmalol by estimating the lactate dehydrogenase (LDH), alkaline phosphatase (ALP), aspartate aminotransferase (AST) and alanine aminotransferase (ALT) activities and the bilirubin level in the blood was determined. Histopathological examination, general body-liver weight, mRNA and protein level expression of p53, caspase 3 and cytochrome C revealed that the signs of HCC in the post treated group of mice with harmalol (80/mg/kg) at 21st weeks were almost healed up and became near normal like control group.

Conclusion: Utilization of harmalol as effective and potential drug against hepatocarcinoma is possible due to its non toxic and proper biotarget identification by in vivo study.

Keywords: *Harmalol, histopathology, DEN, CCl4, HCC, Caspase3, p53.*

Source Apportionment and Toxicity of PAHs in the Atmosphere of Guwahati, India

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Polycyclic Aromatic Hydrocarbon (PAHs) are a group of organic compound containing two or more aromatic rings made up of carbon and hydrogen in linear, angular, or clustered arrangements. PAHs are inevitable by-products of any kind of combustion activities including organic matter and are therefore ubiquitous in nature. Once released into the atmosphere, PAHs get partition between gas and particle phase and in the course of time deposited on earth surface as dry, wet or bulk deposition. PAHs are of major concern among the researchers due to their carcinogenic and mutagenic properties. Concentration of PAHs in atmospheric bulk deposition was estimated in the capital city Guwahati, Assam. It was revealed that ?PAHs concentration was maximum in the institutional site-Gauhati University while minimum concentration was observed in the urban forest site- Basistha with concentration levels of 226.17 ng/ml and 26.72 ng/ml respectively during the month long sampling from five different landuse type. However, the maximum concentration value (3.15 ng/ml) of Benzo(a)pyrene (BaP) was found in the industrial site- Noonmati. Percentage of carcinogenic PAHs was also revealed with maximum value of 84% in the industrial site. Toxicity Equivalency Factor (TEFs) value in terms of BaP was also assessed in the study to estimate health effects due to PAHs. TEFs value of ?PAHs was in the decreasing order of institutional>industrial>residential>commercial>urban-forest site showing high exposure risk at institutional site which is near to the junction for the entry to Guwahati city from rest of India. Diagnostic analysis for source apportionment revealed mainly pyrogenic sources of diesel and gasoline engined vehicle as major source of PAHs emission in bulk deposition of Guwahati. Although emissions and permissible concentrations of PAHs in the atmosphere are now regulated in developed countries, many areas in developing countries remained as black box regarding PAHs monitoring. Therefore, the levels and source of PAHs in bulk deposition could provide as a source of information for planners and policy makers and thus during environmental regulation.

Keywords: *PAHs, BaP, Bulk Deposition, Toxicity, Source apportionment*

Effects of Heavy Metal Toxicity on Human Health

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Heavy metal toxicity has proven to be a major threat for human health. Extensive anthropogenic activities such as industrial operations particularly mining, agricultural processes and disposal of industrial waste materials have raised their concentration to dangerous levels. According to World Health Organization the major heavy metals of noteworthy are cadmium, copper, lead, chromium, mercury, zinc and arsenic. Though small amount of these elements are common in environment and diet and are actually essential for good health but large amount of any of them may cause acute or chronic toxicity resulting in excessive damage due to oxidative stress induced by free radical formation, lower energy levels, and damage to blood composition, lungs, kidneys, liver, and other vital organs. Various public health measures have been undertaken to control, prevent and treat metal toxicity occurring at various levels, such as occupational exposure, accidents and environmental factors. Metal toxicity depends upon the absorbed dose, the route of exposure and duration of exposure that is, acute or chronic. This communication, therefore, details about some heavy metals and their toxicity mechanisms, along with their health effects on human beings.

Keywords: *Heavy metal, Toxicity, Human health*

Lethal and Sublethal Effects of Malathion on Tadpoles of Indian Cricket Frog Fejervarya Limnocharis

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Malathion is one of the commonly used non-systemic organophosphate insecticides in agriculture and residential gardens. Therefore, the aquatic environments are often contaminated with malathion to varying degrees to which many different non-target organisms are exposed to. Amphibians constitute one of the major components of wetland biota. The anuran amphibians are highly vulnerable to such chemicals as their glandular and permeable skin allows easy absorption of any contaminants prevailing in its habitat. In the present study, we evaluated the toxic effects of malathion on survival, growth and metamorphosis of F. limnocharis tadpoles. The tadpoles were exposed to five different concentrations of malathion (0.5, 1, 2, 4 and 8 mg/L) along with an unexposed control group. Malathion at different concentrations caused mortality in tadpoles and based on the mortality, LC50 values were determined at different time intervals. Malathion decreased the percentage survival of F. limnocharis tadpoles in a concentration dependent manner. The metamorphosis time was altered in comparison to the control group and in higher concentrations, the tadpoles died before metamorphosis. The various parameters like body weight, snout to vent length and limb lengths were also affected following malathion exposure at sub-lethal concentrations. The present findings indicate that malathion could alter the life history traits of F. limnocharis tadpoles in their natural habitats and could contribute towards their population decline.

Keywords: *Malathion, Fejervarya limnocharis, metamorphosis, lethal concentration.*

Phenanthrene Alters Survival, Growth, Metamorphosis and Induces Cardiac Rhythm in Tadpoles of Indian Cricket Frog Fejervarya limnocharis

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Phenanthrene (PHE), a tricyclic aromatic hydrocarbon is the most abundant and emerging priority pollutant ubiquitously present in aquatic environments. The lipophilic nature of PHE facilitates its accumulation in fatty tissues of exposed organisms causing multiple effects at the cellular and sub-cellular level. Anuran amphibians are likely to be adversely affected by PHE since aquatic ecosystem is their primary habitat for breeding and larval development. In this study, we evaluated the toxic effect of PHE on the tadpoles of Fejervarya limnocharis. Tadpoles belonging to the Gosner 26 stages were exposed to different concentration of PHE (0, 6, 8, 10, 12, and 14 mg/L) and the LC50 values at different time points were determined. PHE induced significant mortality in F. limnocharis tadpoles in a concentration and time dependent manner. PHE exposure resulted in concentration dependent delay in the time to metamorphosis of the tadpoles. The average metamorphosis time for the tadpoles receiving higher concentration (3mg/L and 4mg/L) was significantly lower as compared to control group. During the experiments, all the tadpoles of the control groups survived and metamorphosed. However, in all the treated groups, the percentage of survival till metamorphosis was significantly lower which was concentration dependent. The average body weight of the metamorphosed individuals was significantly reduced ($p < 0.01$) in the PHE exposed group compared to the control. In addition, PHE treatment also significantly reduced the snout to vent length (SVL) of the exposed individuals. The length of both fore- and hind limbs were analyzed to determine the possible toxicity of PHE on limb development. It was observed that the forelimbs as well as hind limbs showed highly significant difference from the average limb length of the control group. The minimal concentration of PHE also altered the heart rate of the exposed tadpoles. The average heart rate of the PHE treated tadpoles increased in a concentration and time dependent manner. The results clearly indicated that PHE exposure alters the biomarkers of life history traits (survival, growth and development) and could perturb the cardiac functions. Hence PHE at sub-lethal concentrations may reduce the ecological fitness of the tadpoles of F. limnocharis and may have similar effects in other aquatic organisms affecting the ecosystem structure and functions.

Keywords: *Phenanthrene, Fejervarya limnocharis, metamorphosis, cardiac function.*

Effect of Butylparaben, an Environmental Endocrine Disruptor on Uterine Histoarchitecture and Serum Cholesterol in Ovariectomised Mice

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Environmental contaminants with endocrine disrupting property have been of increasing concern to the scientific community due to association of these compounds to wide variety of diseases in human, their livestock and wildlife. Butylparaben (BuPben) is a widely used preservative in food stuffs, cosmetics and medicines including baby food products. BuPben has been reported in many studies to have estrogenic properties and induce adverse effect on reproduction.

In this study sensitivity of butylparaben exposure on uterus of ovariectomised C3H albino mice was studied considering BuPben dose of 10 mg/kg bodyweight, 50 mg/kg bodyweight and 100 mg/kg bodyweight. 17 â estradiol (E2) was used as a positive control and olive oil was used as control. Following 21 day exposure to the chemical at dose 50 mg/Kg bw and 100 mg/Kg bw increase in uterine wet weight similar to the E2 treated was observed. Various environmental estrogen are reported to cause increase in uterine weight in different studies. Thus the increase in uterine weight in ovx mice in the present study is found to be concordant with studies on different xenoestrogen which shows the estrogenic potential of BuPben. BuPben dose of 50 mg/Kg bw and 100 mg/Kg bw showed significant increase in total uterine tissue protein in ovx mice when compared to both control and vehicle control group following 7 days exposure. Similar result was also obtained for the E2 treated group. Ovx adult mice were exposed to BuPben dose of 50 mg/Kg bw and 100 mg/Kg bw and significant decrease in total serum cholesterol was observed when compared to control and vehicle control group. This results obtained in the BuPben treated group were found be similar to the E2 treated group which was used as a positive control in the present study. In 100 mg/Kg bw dose of BuPben similar to E2 treated group increase in lumen size was observed along with increase in number of uterine glands were observed following 7 days and 21 days exposure. Increase in thickness of endometrium and myometrium was also found in these groups. Adverse effects on uterine histology was reported following exposure to different xenoestrogen in various studies conducted. These changes have been related to hyperplasia and can lead to occurrence of cancer in some studies conducted by various scientist.

In ovx mice, BuPben was found to induce increase in uterine wet weight, total uterine tissue protein and decrease in total serum cholesterol. Adverse effect of BuPben on uterine histology was also observed in the present study.

The adverse effects of the chemical on uterus observed in the experiments is a matter of concern and these effects can adversely affects reproduction and lead to sterility. Even though this compound is found to show low estrogenic activity but the broad use and long term use of this compound has drawn attention of the scientific community to analyze the effects of the compound.

Keywords: *17 â estradiol; estrogenic; reproduction; xenoestrogen*

Antifungal Property of Biosurfactant Against Plant Pathogenic Fungi Colletotrichum Gloeosporiodes And Corynespora Cassiicola

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Introduction: To control the fungal diseases of economically important crops, several chemical fungicides have been used extensively. These chemicals are hazardous. The residues of these pesticides may enter intothe body of theanimals including human being through thefood chain and causes several health-related problems. So, searching alternatives to these chemicals is an important area of research. Biosurfactants are microbial metabolites and have tremendous applications in various fields. There are several reports that biosurfactants can be used to control plant pathogenic fungi. Keeping this in mind, an in vitro investigation was carried out to study the antifungal property of biosurfactant against plant pathogenic fungi of Colletotrichumgloeosporiodes and Corynesporacassiicola.

Objectives : The present experiment was carried out with the objectives to screen the in vitro efficacy of biosurfactants obtained from different strains of P. aeruginosafor the inhibition of the fungal pathogens C. gloeosporiodesand C. casiicola.

Methodology : Three strains of P. aeruginosa SR17, SS14 and JS29 were collected from germplasm of IASST and inoculated in suitable mineral salt media at 150rpm, 34±1℃for production of biosurfactant. The bacterial culture is centrifuged after 48 hrs of incubation at 10000 rpm for 20 mins. in 4℃ and theircell-free supernatant (CFS) was obtained. For rhamnolipid extraction, the CFS was deproteinized at 110℃ for 15-20 mins, acidified till pH 2 and kept at 4℃ for overnight for precipitation. Biosurfactant is extracted from the acidified CFS in arotary evaporator at 40℃ by using ethyl acetate as the solvent.The obtained extract is then dried and the yield ofbiosurfactant is determined in g/L unit.Inhibition of crude biosurfactant from SR17, JS29 and SS14 on the growth of C. gloeosporiodesand C. cassiicola at a concentration of 500 mg/L was assayed. After evaluating the most potent biosurfactant producing strain, its effective concentration against C. gloeosporiodesand C. cassiicolain vitrowas determined. The different concentrations used against C. gloeosporiodes were 100 mg/L, 200 mg/L, 300 mg/l, 400 mg/Land against C. cassiicola were 600 mg/L, 700 mg/L, 800 mg/l, 900 mg/L and 1 g/L.

Results : At a concentration of 500mg/L, crude biosurfactants from all the three strains of P. aeruginosa viz. SR17, SS14 and JS29have the potential to inhibit the growth of the pathogens, out of which, crude biosurfactant of SR17 showed the maximum inhibition against the two pathogens.SR17 inhibited the growth ofC. gloeosporiodesup to 71.7% followed by the biosurfactant from JS29 (71.2%) and SS14 (63.4%). In case of C. casiicola, the inhibition by biosurfactant of SR17 was 29% followed by JS29 (26%) and SS14 (10%). After evaluating the crude biosurfactant from SR17 in adifferent range of conc. against the two pathogens, different percentage of inhibition was observed. It can inhibit the growth of C. gloeosporiodes up to 61% at a concentration of 400 mg/L and the growth of C. casiicola up to 61% at a concentration of 900 mg/L.

Conclusion : The crude biosurfactant obtained from P. aeruginosaSR17 has the maximum ability to inhibit the fungal pathogens, C. gloeosporiodesand C. casiicolain vitro.The in planta study of inhibition of pathogens by applying biosurfactant has to be carried out to ensure its use as a potential fungicide in theagricultural field.

Keywords: *Rhamnolipidbiosurfactant, Pseudomonas aeruginosa, Colletotrichumgloeosporiodes, Corynesporacasiicola.*

Lead Nitrate Induced Acute Hematological Responses in An Indian Snake Headed Murrel, Channa Punctatus (Bloch)

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The impact of acute toxicity of lead nitrate on certain hematological parameters of the Indian snake headed murrel, Channa punctatus (Bloch) has been observed. In this experiment, earlier, the average median lethal concentration of 96hr-LC50 of lead nitrate using various methods was calculated to be 165.0+177.8+208.0+167.5=179.575 or 180 mg/L for Channa punctatus. Two sublethal concentration (1.8 and 9.0 mg/L, 1% and 5% of LC50 value) of lead nitrate for 24, 48 and 96hr was decided for this study.

The values of total erythrocyte count (TEC), total leucocytes count (TLC), hemoglobin concentration (Hb) and packed cell volume (PCV) or haematocrit (HC) were observed 2.962±0.084×106/mm3 and 2.625±0.117×106/mm3, 4.72±0.18×103/mm3 and 5.24±0.16×103/mm3, 7.806±0.261g/100ml and 10.945±0.343g/100ml and 37.741±0.439% and 35.709±0.814% respectively at the end of 96 days of exposure.

The results of relative hematological indices were found to be 127.41±3.856µm3 and 136.034±0.686µm3 for mean corpuscular volume (MCV), 26.35±0.476pg and 41.695±0.422pg for mean corpuscular hemoglobin (MCH) and 20.683±1.045% and 30.650±0.324% for mean corpuscular hemoglobin concentration (MCHC).

All these changes in comparison to controlled corresponding controlled values except PCV were found statistically significant ($p<0.05$).

The present findings are clearly indicating severe fish anemia due to the lead salt exposure. Lead bioaccumulation in the blood tissue of the fish increased progressively with increased period of exposure. The continued lead toxicity might be a cause for the loss of weight as well as weakness in the fish.

Keywords: *Channa punctatus, Hematological indices, Lead nitrate, Acute toxicity*

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 LC50 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.

Developing A Machine Learning Based System For Earlydiagnosis Of Asthma

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Asthma is an incessant chronic issue of the airways described by a deterrent of wind stream, which might be totally or halfway turned around with or without particular treatment.

Heightening expense of treating chronic diseasesrequest that they be,to the extent possible, self-guided by the patients. In self-management of infection a basic is to foresee, the conceivable future condition of bleakness. Aftereffect of different investigations demonstrate that asthma is as a rule underdiagnosed particularly in developing nations, on the grounds that of constraints on access to restorative experts and laboratory facilities.

Machine Intelligence assumes an essential part in the outline of master frameworks in therapeutic conclusion.Subsequently, one of the driving aspirations of Artificial Intelligence (AI) has been to create PCs that can learn from experience..The finding of asthma should be possible in two courses 1) through survey and 2) through clinical information.We considered both ways to deal with plan the master framework for finding of asthma. The accessibility of electronic wellbeing information together with the utilization of Artificial Intelligence (AI) when all is said in done and Machine Learning (ML) strategies specifically propose the potential important utilization of this information to improve healthcare quality and lessen cost. Methods: The proposed expert system consists of four stages. At first stage the data is collected,a total of 56 restorative reports were collected and were further utilized forneural network training. The second stage consist of applying data sampling on these dataset. At third stage the classification is achieved by using machine learning classifiers.
We have picked some machine learning algorithms, for example,K-Nearest Neighbor (KNN), Multilayer Perceptron (MLP), Radial Basis Functional Network (RBFN) and Support Vector Machines (SVM) and Probabilistic Neural Network (PNN). Finally at the fourth stage the execution assessment of the framework is evaluated. It compares the classification technique and create the outcome based onaccuracy level. It is observed that the accuracy level of SVM was found to be 93.88 % in comparison with the other standard classifiers.

Keywords: *Asthma diagnosis, Expert systems, Machine Intelligence algorithms, Radial Basis Functional Network (RBFN), Support Vector Machines (SVM).*

Altered Haematological and Enzymatic Parameters in Fresh Water Mud Eel (Monopterus Cuchia) Following Short Term Exposure To Sublethal Concentration Of Glyphosate

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The present study was aimed to evaluate the toxicological effect and the oxidative stress in Monopterus cuchia induced by commercial formulation of Glyphosate EXCEL MERA 71. Commercial formulation of Glyphosate is more toxic due to the existence of the surfactant such as polyethoxylene amine (POEA) to aquatic organism. In the study, fish were exposed to sub-lethal concentrations of 1mg/L and 2mg/L. LC50 value for glyphosate at 96 h exposure was unable to determined, because no fish mortality was observed even at the maximum concentration tested 200mg/L. After 6h, 24h, 96h and 7days of exposure, there were significant decrease in the level of red blood cells (RBC), haemoglobin (Hb) concentration and a significant increase in white blood cells (WBC) count in both treated groups. Alanine aminotransferase (ALT), aspartate aminotransferase (AST) and alkaline phosphatase (ALP) were also analysed in the serum. The enzyme ALT decreases whereas the enzyme AST and ALP increases in comparison with the control. The fish showed transient decrease in the superoxide dismutase (SOD) and catalase (CAT) activities and the non-enzymatic antioxidant reduced glutathione (GSH) showed repressed activity after glyphosate exposure. However, Glutathione- S- transferase (GST) activity was significantly increased in kidney and intestine and decreased in the liver treated groups. Thus, the changes observed during the study period establish that the chemically treated fish showed defensive action against the elevating levels of reactive oxygen species (ROS) upto to a certain degree, but ultimately failed to withstand the toxicological stress.

Keywords: *Glyphosate, Hematology, Antioxidant and Histoarchitecture.*

Studies on Toxicological Responses of The Herbicide Paraquat Dichloride on Monopterus cuchia (Hamilton)

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Paraquat dichloride is a non-selective (contact) herbicide, considered to be highly toxic in nature, but which is used widely in India. The objectives of this study were to investigate the toxicity induced by Paraquat on Monopterus cuchia exposed to the sub-lethal concentrations of 2 mg/L and 4 mg/L respectively. The study was conducted with emphasis on the haematological parameters, activities of the antioxidant enzymes and the histopathological alterations generated by the herbicide. In the fishes exposed to the chemical, concentration dependent respiratory stress, erratic swimming pattern and lethargy were some of the observations recorded. Hematological indices like the total erythrocyte count, hemoglobin concentration and Mean Corpuscular Hemoglobin showed significant reduction, while the total leucocyte count significantly increased on exposure to both high and low concentrations of Paraquat when compared to the control. Histopathology of liver, kidney and intestine exhibited alterations such as hepatocyte hypertrophy, melanomacrophage aggregation and distortion of tubular structures along with the formation of oedema and disruption of villi structure in treated groups. After seven days of exposure, the fish showed significant reduction in the activities of superoxide dismutase, catalase and reduced glutathione in contrast to the control. However, glutathione S transferase activity has increased in the treated fish when tallied against the control. Thus, the changes observed during the study period establish that the chemically treated fish showed signs of resistance against the elevating levels of reactive oxygen species up to a certain extent, but ultimately failed to withstand the toxicological stress.

Keywords: *Hematology, reactive oxygen species, superoxide dismutase, catalase, glutathione S transferase, reduced glutathione, histopathology.*

An Assessment of Impact of Environemntal Pollution on Health

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Health is a state of total well-beingphysical, mental and socialhelping us both survive and thrive in our everyday lives. A clean environment is essential for human health and well-being. However, the interactions between the environment and human health are highly complex and difficult to assess. Effective health promotion strikes a balance between personal choice and social responsibility, between people and their environments.

Over the last three decades there has been increasing global concern over the public health impacts attributed to environmental pollution, in particular, the global burden of disease. The World Health Organization (WHO) estimates that about a quarter of the diseases facing mankind today occur due to prolonged exposure to environmental pollution. Most of these environment-related diseases are however not easily detected and may be acquired during childhood and manifested later in adulthood. Improper management of waste is one of the main causes of environmental pollution and degradation in many cities, especially in developing countries since these cities lack solid waste regulations and proper disposal facilities. Poor waste management poses a great challenge to the well-being of city residents, particularly those living adjacent the dumpsites due to the potential of the waste to pollute water, food sources, land, air and vegetation. The poor disposal and handling of waste thus leads to environmental degradation, destruction of the ecosystem and poses great risks to public health.

This research has been undertaken to assess the impact of environmental pollution which is aggravating and taking an alarming form on public health.

Keywords: *Health hazards , environmental pollution, impact , management*

Studies on Toxicological Responses of The Herbicide Paraquat Dichloride on The Air Breathing Singhi Catfish, Heteropneustes Fossilis

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Paraquat dichloride (PQ),chemically known as 1, 1?-dimethyl-4, 4?-bipyridinium dichloride is a toxic contact herbicide. Ithas been proved to be highly toxic to humans and animals and many cases of acute paraquat poisoning have been reported over the past few decades. Superoxide and singlet oxygen catalysed lipid peroxidation is the possible biochemical mechanism of its toxicity. Due to its high water solubility and extensive it may enter surface water as a result of spray drift, leaching from soil and water and from agricultural runoff. It has a long half-life and exhibits poor bioavailability to aquatic organism and resistance to microbial degradation, which make paraquat a potent environmental hazard. The aim of this study was to investigate the toxicity induced by Paraquat on Heteropneustes fossilis exposed to the sub-lethal concentrations of 6 mg/L and 12 mg/L respectively. The study was conducted with the objectives to determine LC-50 value of paraquat for 7days and 14 days, effects on RBC, WBC, Haematocret, Haemoglobin, oxidative stress marker enzyme assay and lipid peroxidation from liver, kidney and intestine tissue of the fish exposed to 6hours, 24hours, 48 hours, 5days, 10 days and 14days for both high and low concentrations of Paraquat.Haematological indices like the total erythrocyte count, hemoglobin concentration and Mean Corpuscular Hemoglobin showed significant reduction, while the total leucocyte count significantly increased on exposure to both high and low concentrations of Paraquat when compared to the control. The fish showed increased activity of glutathione-S-transferase, specifically after 5days and 10days in the treated fish when tallied against the control.Significant differences were also observed in the activities of superoxide dismutase, catalase and reduced glutathione and lipid peroxidation in contrast to the control. Thus, the changes observed during the study period establish that the chemically treated fish showed signs of resistance against the elevating levels of reactive oxygen species to a great extent.

Keywords: *Oxidative stress marker enzyme, Lipid peroxidation, Reactive oxygen species, Haematological indices.*

Evaluation of Efficacy of Pinene Compounds as Mosquitocidal Agent Against Aedes Aegyptilinn. (Diptera: Culicidae)

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Different plant derived terpene compounds encompasses diversity in their structure and have many functions in nature. After realizing the protectant nature of terpene compounds in plant body these compounds have been tried to incorporate in pest control programme including vector control.Pinene (C10H16) is a bicyclic terpene compound present in various essential oils mainly in most coniferous trees and eucalyptus trees and reported to provide defense against herbivorous insects In the present studybiological activities of two isomers of pinene compoundi.e. á- pinene and â- pinene against different developmental stages ofAedes aegypti were assessed. The results revealedâ- pineneas the more effective against egg and larval stages with LC50 value of 21.02 ppm and 108.39 ppm after 72 hour exposure time respectively than á-pinene while against adult stage of the insect á- pinene (LC50 value 73.30 ppm) was more effective than â- pinene (853.84ppm). Variation in the position of alkene bond in the structure of these two compounds might be the probable cause associated with the different toxicity against the same insect. To compare the efficacy of this terpene compound with commercially available synthetic insecticides two organophosphates namely temephos (as ovicidal and larvicidal) and malathion(as adulticidal) were considered for bioassay. As ovicidal and larvicidal agent, Temephos was found more effective than both pinene compounds as it bears 0.16 ppm and 0.23 ppm LC50 value after the same exposure time. Again as adulticide,malathione also showed more efficacy than both tested pinene compounds having 3.25 ppm LC50 value. Though, temephos and malathione was found more effective against the laboratory reared Aedes aegypti, butresistance development against these products already have been reported from various parts of the globe.Therefore, it can be concluded that though both isomers of pineneshowed comparatively less efficacy but as natural product it could further used in control of dengue by targeting the different developmental stages of Aedes aegypti.

Keywords: *Pinene, Vector control, Aedes aegypti, Temephos, Malathione*

Evaluation of the Efficacy of Essential Oil from Citrus Sinensis (leaves) against Filarial Vector, Culex Quinquefasciatus, Say (Diptera:Culicidae)

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From very ancient to modern times mosquitoes have remained a health hazard in almost all parts of the world except in Iceland. Lymphatic filariasis, 'a neglected tropical disease', which is caused by the parasitic infection (e.g. Wuchereria bancrafti) and transmitted by Culex quinquefasciatus can affect the lymphatic system of human beings causing permanent disability of the affected person. About 1.10 billion people are threatened by this disease in 58 countries throughout the world. To control such mosquito-borne diseases, although certain medicines and vaccinations are available, control of vector mosquitoes is the most promising one. The vector control strategy is mostly relied on the use of synthetic insecticides which generally provide immediate and effective results. But their harmful effects on human health and other animals, high rate of cost, non-bio degradability nature, development of resistance by target organism make their uses limited. Therefore, natural products having insecticidal properties is gaining importance for controlling pest of public health importance as they are comparatively safe to user, target specific and less chances of the development of resistance by the targeted pest. In the present study, an attempt was made to evaluate the ovicidal, larvicidal and adulticidal activities of the essential oil from the leaves of Citrus sinensis against Culex quinquefasciatus. C.sinensis (sweet orange) is produced in many countries around the world, especially in warm and tropical weathers. It is one of the world's major fruits with its global availability. It is not only popular in human diets or in the treatments of human diseases, but also used in controlling several agricultural pests. In the current study, bio-efficacy of the essential oil was evaluated under laboratory conditions against different developmental stages of the mosquito species. Results revealed that the oil was the most effective as larvicide having LC50 dose of 74.71 ppm at 24 hour. As ovicidal it showed LC50 dose of 474.82 ppm at 72 hour after exposure period. The LC50 dose for adulticidal activity of the oil was recorded as 657.96 ppm after 24 hours. Thus, it can be inferred that the essential oil of C. sinensis is a potential candidate for controlling C. quinquefasciatus to minimize the health problems like occurrence of lymphatic filariasis.

Keywords: *Lymphatic filariasis, Culex quinquefasciatus, Insecticide, Citrus sinensis*

Study on the Repellent Activity of Nine Essential Oil of Rutaceae Family Against Aedes Aegypti Linn. (Diptera: Culicidae)

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The threat of mosquito transmitted diseases, with their associated mortality has posed a serious threat worldwide. To avoid mosquito bite, people are using numerous synthetic repellents despite their adverse side effects. However, development of resistance by the mosquitoes against those commercially available synthetic products gradually makes their use ineffective against the target mosquitoes. So, the plant based products for the control of vector is expanding and is now widely accepted in the society for being non toxic to the non target organisms, environment friendly, and having a considerable efficacy. In the study undertaken, repellent properties of nine essential oils under Rutaceae family was investigated against adult Aedes aegypti, for their high afficacy and easy availability. Plants under Rutaceae family are highly appreciated for their edible and medicinal value. Most species under this family are aromatic with glandular organ on their leaves and peels. For bioassay essential oils from the selected plants were extracted by hydro distillation method using Clevenger apparatus. Experiments were done using human volunteer by arm-in-cage method. The highest protection time against the target insect was recorded in the essential oil extracted from the leaves of Citrus grandis (2 hours) while no protection time was recorded in the essential oil of the leaves from Citrus aurantifolia and Citrus sinensis. The rest of the six essential oils showed low to moderate repellent action against Aedes aegypti. To compare the effectiveness of the essential oils with synthetic repellent products, odomos (12% DEET) was applied by using the same method. The result revealed more protection time of Odomus in comparison to the essential oil tested. But reports of various side effects of DEET on human skin have already been documented by various authors. Hence, natural products are considered safe, can be exploited through further research for protection against the mosquito bite.

Keywords: *Repellent, Rutaceae, Essential oil, Aedes aegypti*

Analysis of the Heavy Metals in Borsola Beel, Guwahati City, Assam

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Borsola Beel is a notable wetland which was once a home for a large number of flora and fauna. Of late it has become gradually polluted due to urbanization and industrialization and turned into a dumping ground for municipal and industrial wastes. Heavy metals like copper, iron and zinc are essential for living organisms but become toxic when they are present above the permissible limit while some others such as mercury, cadmium, arsenic and lead have no known biological role in living system and are toxic at quite low concentrations. Heavy metals enter into aquatic environments through industrial processes, sewage disposal, soil leaching and rainfall. The heavy metals concentrations are sub-lethal or lethal for aquatic organisms in chronic exposure. The present study dealt with the detection of the concentration level of heavy metals in the water sample collected from the wetland. The concentration was in the order Pb>Cr>As>Cd>Ni>Cu>Hg.

Keywords: *Heavy metal, Wetland, Borsola Beel, toxic.*

Evaluation of Toxic Effect of Deltamethrin on Muga Silkworm Larva, Antheraea Assamensis (Lepidoptera; Saturniidae)

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Muga silkworm (Antheraea assamensis) is semi domesticated and multivoltine insect indigenous to Northeast India, especially Assam. It produces the famous muga silk which have a special status throughout the world due to their golden colour. Northeast India occupies a king position in the world sericulture map for the production of muga silk and Assam alone contribute the highest percentage of total production. Since time immemorial rearing of muga silk worm and extraction of silk thread from cocoons and their fabrication has been associating as an inseparable part of socio economic status of this region. Most of the sericulture field in Assam located near tea garden. The growing use of synthetic insecticide in tea garden adversely affects the neighbouring sericulture farm due to insecticide drift. Pesticides once having entry to an environment either gets into the complex web of life through food chain or different components of the environment through physical passages like drifting by air and aquatic runways. Deltamethrin, an organophosphate is one of novel pesticide used in tea garden which has been approved by Central Insecticide Board (CIB). The present study was aimed to comprehensively evaluate the toxicity of Deltamethrin on development and survival of A. assamensis. The effect of sub lethal concentration 0.05% of Delatamethrin on 5th instar larvae was studied on the basis of differential haemocyte count (DHC) and histopathological alteration of midgut after an interval of 24-hour, 48-hour, 72-hour and 96-hour of treatment. Exposed larvae develop intoxication symptom including feeding cessation, body blackening and melanisation of haemolymph. Deltamethrin cause a significant alteration in differential haemocyte count and also in morphology of mid gut, compared to control indicating that muga silk worm is highly sensitive to Deltamethrin.

Keywords: *Antheraea assamensis, haemolymph, melanisation, haemocytes, midgut.*

Influence of Environmental Hypertonicity on Gluconeogenesis in The Air-Breathing Singhi Catfish, Heteropneustes Fossilis

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The present study was aimed to determine the effect of hypertonicity on gluconeogenesis in air-breathing Singhi cat fish (Heteropneustes fossilis). In situ exposure to hypertonic saline solution (150mM NaCl) led to significant stimulation of gluoneogenic fluxes from the perfused liver after 7 days of exposure, followed by further increase after 14 days in presence of 3 different potential gluconeogenic substrates (lactate, pyruvate and glutamate). This was accompanied by significant increase of activities of 3 key gluconeogenic enzymes, namely phosphoenolpyruvate carboxykinase (PEPCK), fructose-1,6-bisphosphatase (FBPase) and glucose-6-phosphatase (G-6-Pase) by about 2-4 fold in liver, 3-5 fold in kidney and 2-7 fold in muscle. Hypertonicity also led to a significant elevation in the level of PEPCK enzyme protein in liver, kidney, muscle and brain by about 2.8 fold, 2.5 fold, 2.7 fold and 2.35 fold respectively after 14 days of exposure. Similarly, the abundance of G-6-Pase enzyme protein also increased by 2.2 fold in liver and 2.8 fold in kidney after 14 days of exposure.

Keywords: *Hypertonic stress, Phosphoenolpyruvate carboxykinase, Glucose-6-phosphatase, Fructose-1, 6-bisphosphatase, Gluconeogenesis, Heteropneustes fossilis*

Sustainable Utilization of Marine Waste For Oyster Mushroom Cultivation

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Mushroom is a macro fungus with a distinctive fruiting body. Mushroom harbors good quality of protein and is devoid of cholesterol. It has high fiber and good quality of vitamins and minerals. Mushroom cultivation is an important activity in different parts of our country. It generates employment opportunities for farmers and fisher-women. In mushroom cultivation, three factors such as spawn, good substrate and proper environment have to be satisfied. Main substrates for the cultivation of Pleurotus are paddy straw, wheat straw, corn cobs and hard wood sawdust. To reduce the cost and improve the productivity, there is a need to select cheaper raw material which is available locally as substrate for the production of oyster mushroom.

Mushroom culture aids in proper recycling of agro waste and marine waste. The marine wastes are dumped in the near shore regions causes various environmental issues such as higher rate of mortality of marine organisms due to the production of H2S, harbors various pathogenic microbial communities that intern infects the coastal people, spoil the water table column and makes it inconsumable etc. So the use of these wastes as a substrate for mushroom cultivation will play a vital role in their utilization as well as degradation thereby all the above said problems can be overcome. Moreover, these resources are easily available at very negligible amount, thereby reducing the investment. The mushroom hut doesn't require large area, higher amount of investment, physic work on the other hand it has advantages over quick return, highly profitable, effortless maintenance.

Edible mushroom cultivation is a profitable cottage industry, in which oyster mushroom occupies a prominent place in India. A good substrate is a key factor that determines the profitability of the mushroom cultivation. Marine waste were evaluated for the production of oyster mushroom as a means of managing the vast amount of organic waste that are being generated by fast growing seafood industries. In the present study, sustainable utilization of marine bio-waste for the cultivation of oyster mushroom (Pleurotus florida) and the standardized technology was transferred to scheduled caste population in and around Parangipettai, Tamil Nadu, India. The experimental work was designed with Completely Randomized Design (CRD) with four treatments (375 g of paddy straw with 125 g of fish waste, shell waste, seaweed and seagrass amended separately) and a control (500 g of paddy straw) with three replications. The nutritive value and biological activities of oyster mushroom cultured on different marine waste was evaluated. Average yield was tested in three flushes of P. florida on four different substrates with control. Among various substrates, maximum yield (498.11 ± 7.80 g) was recorded in fish waste. However, minimum average yield (266.91 ± 4.35 g) was recorded in seaweed. The biological efficiency was recorded in four different substrates along with control. Among these, fish waste exhibited highest biological efficiency (99.62 ± 1.56 %). Very least efficiency was observed in control (53.38333± 0.86784 %). The proximate composition such as moisture, protein, carbohydrate, total lipid, crude fiber, amino acids and vitamins were estimated in P. florida which harvested from five different substrates. The highest moisture content (90.71 %) was recorded in paddy straw and the least value (82.97 %) was recorded in shell waste. The highest content of protein was found in fish waste (23.52 %) and the lowest protein was found in seaweed (17.18 %). The lowest lipid percentage was observed in fish waste (4 %) and the highest lipid percentage was observed in paddy straw (8 %). The lowest percentage (22.09 %) of carbohydrate was observed in seaweed substrate and the highest carbohydrate percentage was observed in fish waste (36.54 %). The maximum percentage of crude fiber was observed in fish

waste (14.67 %) and minimum in seaweed (8.75 %). Fish waste substrate was identified to enhance the protein and carbohydrate content in P. florida, so this substrate may be adopted for â-glucan isolation commercially. In vitro study of â-glucan showed moderate cytotoxicity in MCF-7. To the best of our knowledge this is the first study conducted in India, to utilize the marine resources as substrate for mushroom cultivation and hence the waste can be a alternate substrate to grow P. florida commercially.

Moreover, this technology has to be successfully transferred to the fisherwomen and we organized 10 training programmes (380 participants) for scheduled caste women, farmer and research students on mushroom culture using marine waste sponsored by the DST, NFDB, MHRD, and UGC. Continuous hands on training were given to the participants on cultivation of oyster mushroom using marine bio-wastes as supplementary substrate along with paddy straw. During this one month training, the participants understand the technology thoroughly starting from the substrate preparation and processing, spawn handling, mushroom bed preparation, continuous monitoring of the culture environment, harvest, value addition and marketing etc. Currently, two women self help groups have been involved in continuous mushroom production in the culture facility established through DST SEED funded project and they are earning Rs.2000/month as an additional income. It is interesting to note that the oyster mushroom cultivation using marine waste as supplementary substrate along with paddy straw not only increase the yield and nutritional quality but it could be an alternative livelihood and enterprenerial opportunity.

Keywords: *Mushroom, marine waste, proximate composition, alternate livelihood*

Environmental Impact Assessment, Environmental Auditing and Life Cycle Assessment

Paper & Pulp Mill Effluent Induced Alterations in The Haematological Profile of Fingerlings Of Colisa Fasciatus (Bl. & Schn.)

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Present study has been undertaken to record the impact of paper and pulp mill effluent at various concentration levels (5, 10 & 20%) on the hematological profile of fingerlings of a freshwater perch Colisa fasciatus (Bl. & schn) after long term exposure of 30 days. Results reveal that 5% of effluent concentration exerted least significant alterations in various hematological profile except for clotting time and also immature erythrocytes. However, 10% effluent concentration brought significant alterations in hematocrit as well as clotting time and 20% of effluent concentration produced highly significant alterations in most of the hematological parameters except for hemoglobin percentage.

Keywords: *Paper mill effluent; Colisa fasciatus; Fingerlings; Hematology; Leuncopenia.*

Perceptional And Theoretical Reviewof Tourism Impacts On Environmental Attributes And Environmental Sustainability-A Geographical Case Study Of Temple Town Bishnupur, Bankura District, West Bengal

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In recent globalized world tourism plays an important role in economic enhancement. The progression of tourism industry having its two sides- on the one side of the coin it has its positive role in conservation through eco-tourism and other side of the coin it made destructions to the environment. The nature and attributes of the quality environment, in form of natural and anthropogenic is very essential for tourism development in a region. However the relationship nature between tourism and natural environment is very complex. Some attributes having its own adverse influences on tourism. Such effects include like the excessive price hiking of land resources, detrition of air, water, and soil conditions, destabilization of landscapes, abrupt production of garbage's and wastes, loss of endogenetic flora and fauna species, forest fires, loss of biodiversity, increase in prostitution and drag abasement.These reverse impacts are somehow linked with construction of hotels, roads, amusement parks, cafeteria and other man made sculpture that directly or indirectly hampers the green coverage and landscape versatility. The adverse situation of environment declines the tourism potentialities in concern region. On another sides, tourism having its largest positive impacts that governing economic accelerations, financial up gradations, environmental awareness, values to the natures, eco-tourism and bio-diversity conservations. In this paper, it reflects how cultural tourism at Bishnupur temple town, located in Bankura district of west Bengal influences natural resource base, physical environment and environmental degradations and finally in which way it can contribute the environmental sustainability and conservations.The religious and cultural tourism in Bishnupur affects the local environment through actively, inactively and cumulatively which is related to the sustainable condition of this places and related participatory functions. The principal objective of this paper is to find out and assesses the level of positive and negative impacts made by tourism in the environment of Bishnupur, to delineate the direct impact of tourism in the concurrent environment, to point out some theoretical suggestions and recommendation of this situations. A descriptive and analytical approach is taken as a research methodology for present research paper. The primary data are taken by field interview, questioner survey, community perception, observations and secondary information's are taken through various books, magazines, journals, archives.Web documents. Various environmental analysts and specialist persons are taken to interview for collecting and accumulating this kind of information's. The opinions of local residents showing the impact of tourism on physical environment in this proposed study area has been conducted a three point likert scale on each single parameters. After collecting the numeric data it is compiled by calculating the arithmetic mean and standard deviation for those selected parameter's value. Finally the Index Mean and Standard deviation also calculated for evaluating the level of individual status of these selected parameters. The Environmental Impact Assessment (E.I.A) is also taken as amost valuable tools to measures the environmental conditions in these concern study areas. The present study shows the potential reverse influence of tourism in physical environment includes depilation of natural resources, loss of bio- diversity, high level of pollution and wastes in this temple town. From the major findings of the above stipulated surveying it can be assessed that Air Pollution, noise pollution,Sewerage, Waste productions having the high valuesin percentage (nearly 20%), rest are remaining at a moderate and insignificant values as per pollution level. The physical impacts of tourism on residents are assessed in likert scale, in which the mean values and standard deviation are calculated. The highly impacts are found in road congestion, civic amenities, sewage and garbage disposal, air

pollution etc. The culturalTourism havean adverseimpact on the surrounding environment through pollution made by hotels and tourist lodges , human intrusions in the core of natural forests by tourism activities.Conversant stakeholders of tourism industry need to pay their conscious attention on this issues to protect the environment in this tourist place. At the end it can be said that Tourism has its double sided role on physical and human environment. on the singe side it shows the international relationship, peace and integration, on the another side it has a threat to human life and environment, a physical impacts in human dignity, privacy, authenticity and a destroyer to human cultures. Sometimes tourism may influences the catastrophic situation that extinguishes local cooperation and participation. Therefore everybody remains conscious about the negative impacts of tourism. Thus government and other organization need to pay attention to resolve the adverse impacts of tourism on environment. Some special techniques and management goals need to be adopted that may be environmental friendly, economically viable and socially acceptable.

Keywords: *Cultural Tourism, Environmental Degradation, Environmental Impact Assessment, Eco-Tourism, Bio-Diversity Conservation.*

Assessment Of Environmental Impactsusing Lca For Recycling Of Polyethylene And Polyethylene Terephthalate

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Rapid population growth, urbanization and economic development are often accompanied by the generation of enormous amount of municipal solid wastes (MSW) that must be properly managed.Current MSW management system in India cannot cope with the volumes of wastegenerated and this affectsthe environment and public health adversely. Plastic wastes fractionaccount for around 10.11% (by weight) in MSW generated in India. Plastic wastes are the mostneglected part of MSW.According to a survey carried out in 60 cities of the country, the quantum of plastic waste generation is estimated to be 15,342 tons per day. Out of this, recycled plastic is estimated to be 9205 tons per day and 6137 tons remained uncollected (CPCB, 2015).The plastic waste constitutes two major categories of plastics: (1) thermoplastics and(2) thermoset plastics. Thermoplastics, constitutes 80% and thermoset constitutes approximately 20% of the total post-consumer plastics waste generated in India (CPCB, 2016).The Thermoplastics are recyclable plastics which include Polyethylene Terephthalate (PET),Low Density Polyethylene (LDPE),Polyvinyl Chloride (PVC), High Density Polyethylene(HDPE), Polypropylene(PP), Polystyrene (PS), Polycarbonate (PC)etc.Polyethylene (PE) which includes LDPE and HDPE and PETwastes together contribute about 75% of plastic wastes in India (CPCB, 2015). Recycling of plastic wastes is considered as the most environmentally preferred plastic waste management option worldwide.Recycling of PET bottles in India is mostly carried out by informal sectors (mainly collection and segregation) and recycling rates are also higher when compared to other countries. PE wastes such as milk pouches, shopping bags are recycled in the form of flakes for the preparation of PE sheets. In India, the whole process of PE recycling is carried out by informal sectors.A Life Cycle Assessment (LCA) approach is a tool that can be used to evaluate the potentialenvironmental impacts of a product, material, process, or an activity.

The goal of this LCA study is to evaluate the environmental impacts of recycling of PET waste bottles for the preparation of Polyester staple fibre (PSF) wastes andrecycling of PE wastes for the preparation of PE sheets. Another objective is to compare the two-differentplastic waste recycling process in order to identify the best scenario with least environmental impacts. Methodology includes study area survey which is Dhanbad city in the present study, selection of system boundary and scenarios, life cycle inventory (LCI) and life cycle impact assessment. Intensive study area survey was carried out in the different regions of study area to obtain the general information on plastic waste collection, the actors involved and the probable routes of plastic waste recycling. For this interaction, interview and questionnaire survey were carried out and data were collected from several waste pickers (rag-pickers/scavengers), itinerant waste buyers (IWB's) also called kabari walas and scrap dealers. System boundary includes various processes of PET and PE recycling based on these two scenarios for this study. Scenario 1 (S1) is PE recycling and scenario 2 (S2) is PET recycling. Data collected from the PE and PET recycling industries related to raw materials and resources involved in the recycling processwere used for LCI analysis. Life cycle impact assessment was carried out using SimaPro software version 8.03 using the CML 2 baseline 2000 method in which environmental impacts were evaluated on 11 different impact categories.

The results of study area survey and questionnaire survey revealed that each of the rag-pickers collects on an average about 21 kg plastic wastes per day which includes 9.91 kg of PET bottles, 4.57 kg of HDPE wastes, 1.83 kg of LDPE wastes and 4.69 other plastic wastes (PVC, PS, PP, PC). Each of the IWB's collects/buys 52 kg per day which includes 21.89 kg PET bottle wastes, 13.21 kg HDPE wastes, 3.22 kg LDPE wastes and 13.65 kg other plastic wastes. Whereas each of small and medium scrap dealers collects/buys about 381 kg of plastic wastes which includes 137 kg PET bottle wastes, 108 kg HDPE wastes, 46 kg LDPE wastes and 90 kg other plastic wastes. While each of large scrap dealers collects/buys 668 kg of plastic wastes per day which includes 247 kg of PET bottle wastes, 194 kg HDPE wastes, 71 kg LDPE wastes and 156 kg other plastic wastes. It wasobserved that the collection/purchase of LDPE wastes were much less when compared to PET bottle wastes, it is due to very less mass of LDPE bags when compared to its volume and also due to less price per kg.

The LCA impact assessment characterization results for each of the impact categoriesfor PE recyclingand PET recycling showed that scenario S1 (PE recycling) had highest impacts on 3 impact categories and scenario S2 (PET recycling) had higher impacts on the remaining 8 impact categories. Scenario S1 had higher impacts on Abiotic depletion impact category (4.66E-04 kg Sb eq.) than scenario S2 (1.70E-04 kg Sb eq.) due to use of ultramarine pigment which is a zeolite-based mineral for coloring the recycled PE flakes for the preparation of PE sheets.S1 also had the higher impacts on fresh water aquatic ecotoxicity impact category (3.37E+02 kg 1,4-DB eq.) and on terrestrial ecotoxicity impact category (2.78E+00kg 1,4-DB eq.). Scenario S2 had higher impacts on abiotic depletion(fossil fuels) impact category (1.60E+04 MJ)due touse of fossil fuels such as coal to provide energy for the boiler and due to use of diesel within PET recycling industry for logistic purpose. S2 also had higher and significant impacts on global warming potential impact category (1.02E+03kg CO2 eq.) due to high consumption of thermal electricity in PET recycling.Scenario S2 was found to have the highest impact on marine aquatic ecotoxicity impact category (1.48E+06 kg 1,4-DB eq.) due to high consumption of thermal electricity, utilization of coal and use of diesel within the PET recycling industry. Results of the present study concluded that PE recycling is more environmentally preferable option than PET recycling.In future, these recycling industries should think of utilizing alternative energy sources instead of thermal energy.

Keywords: *Impact categories, Plastic wastes, Polyester staple fibre, Questionnaire survey, System boundary.*

Effect Of Management And Altitude On Understory Vegetation In Quercus Leucotrichophora Forests Of North-West Himalaya, India

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Oak species assume considerable significance in the Himalayan region as they are providers of numerous ecosystem services and serve as a lifeline for the local communities. There are 16 oaks species growing in India, ten in the Eastern Himalaya and six in the Western Himalaya. Thus, the oak species particularly Quercus leucotrichophora A. camus, commonly known as ban oak, belonging to the family Fagaceae, occupy sizeable area in the Western Himalaya and is intricately associated not only with agro-ecosystem but also with the life support systems of the inhabitants of the hills of the Himalaya. It is a stable climax community of its zone, thus grows in pure stands with number of broadleaved and conifers associates that changes with elevations, stage of succession and biotic interferences. Forest composition, species richness, diversity pattern, and spatial or temporal distribution are important ecological attributes significantly correlated with prevailing environmental as well as anthropogenic variables. Investigations into floristic composition and structure of forests are essential for providing information on plant species richness and the changes that they undergo can be potentially useful for most management principles besides opening vistas of knowledge on ecosystem functions. Understanding the link between plant diversity and its function is critical to have an insight on the mechanism by which plant communities modulate. Latitudinal and altitudinal gradients are also seen as two important factors that bring conspicuous patterns of diversity. Vegetation analyses along an altitudinal gradient had been conducted in India particularly in western Himalayas by many scholars yet study pertaining to understory layers in pure Quercus leucotrichophora forests under different management strategies is still meagre and inadequate. Hence, the present investigation was carried out in differently managed pure Quercus leucotrichophora forests along an altitudinal gradient for floral composition and diversity comparison of understory shrub and herb vegetation. Thus, the study was conducted in Rajgarh Forest Division in Sirmour district of Himachal Pradesh which lies between longitude 77°-1'-5" to 77°-26'-13" East and latitude 30°-38'-40" to 31°-1'-14" North in the northwest Himalaya, India. In Rajgarh Forest Division, Quercus leucotrichophora forests are managed as: 1) Reserved Forests (RF) in these forests there is no biotic or anthropogenic interference 2) Protected Forests (PF) in these forests there is limited biotic or anthropogenic interference 3) Unclassified Forests (UF) - in these forests there is moderate biotic or anthropogenic interference and 4) Musterqua Forests (MF) in these forests there is unlimited biotic or anthropogenic interference as per the requirements of local inhabitants. Therefore, the comparative analysis of these four differently managed Q. leucotrichophora forests were done by delineating three elevations ranges as; E1 < 1650 m, E2 = 1651 to 1900 m E3 >1900 m. For vegetation sampling and data analysis, four 0.1 ha sample plots were demarcated in each type of forest at different elevations wherein two sub-plots of size 5m x 5m were marked inside each sample plot to study shrub parameters. Three quadrats of size 50cm x 50cm from each sample plot in every forest were harvested to study herb parameters. The diversity (H') was determined by using Shannon Weiner index (1963) as: H'= -?(Ni/N) × ln (Ni/N), Where, H'=Shannon Weiner index; Ni=Total no. of individuals of all the species; ni=Total no. of individuals of ith species. Simpson's diversity index (Simpson, 1949) was calculated as D: 1-Cd, Where Cd = Simpson's concentration of dominance = (Óni/n)2. The Species richness was calculated by using the method 'Margalef's index of richness' (Dmg) (Magurran, 1988) as: Dmg = (S-1)/ln N, Where, S= Total number of species. N= Total number of individual.

In this present investigation, among these differently managed forests we found that in totality, 22 families with 32 genera and 33 plant species that included 10 forbs, 5 grasses, 2 sedges, 2 ferns and 14 shrubs were recorded under this tree canopy. 23 plant species was recorded in Reserved Forest, 19 in Protected Forest, 20 species in Unclassified and 17 in Musterqua Forest. However, there was no definite pattern of distribution of species (shrubs & herbs) along the altitudinal gradient. More species was recorded in Reserved Forest among all the studied forests. Shannon Wiener index values varied from 1.25-1.81 for shrubs and 1.31-2.08 for herbs vegetation. Simpson's diversity index for shrubs varied from 0.66-0.82 and for herbs it varied from 0.72-0.87. Species richness in different forests varied from 0.79-1.72 for shrubs and 0.84-3.88 for herbs. However, the change in these indices along an elevation did not follow any regular trend. All vegetation indices viz., Shannon Weiner, Simpson's diversity and Species richness for shrubs and herbs layer, exhibited maximum values in Reserved Forest followed by Protected Forest, Unclassified Forest and Musterqua Forest These differences in distribution pattern in species with respect to forest and elevation among different forest types could be related to environmental heterogeneity in the form of patchy light availability, spatial heterogeneity in soil resources.

The present study highlights that lower elevations (E1 and E2) had comparatively higher number of species richness than lower number of species at higher elevation (E3) which implies that higher forest types should be conserved with necessary implementation. Among the four differently managed forests type, Reserved Forest have maximum floral composition and diversity of understory shrubs and herbs vegetation which is a direct reflection of having no biotic or anthropogenic interference in this forest while, Musterqua Forest has the least because of its unlimited biotic or anthropogenic interference as per the requirements of local inhabitants as anthropogenic disturbances changes ecosystem functioning, change in plant structure, density, diversity, composition and regeneration leading the species to become threatened and on the verge of extinction. Our findings, suggests that the distribution and species richness pattern of different species are not only regulated largely by altitude and climate factors but also through management practices followed in the area.

Keywords: *Musterqua Forest (MF), Oak, Protected Forest (PF), Quercus leucotrichophora, Reserved Forest (RF), Unclassified Forest (UF), Vegetation indices.*

A Future Discourse of Conservation of Environment in Himalaya Region with Rapid Growing Tourism Industry: A Case Study of Sikkim

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Tourism is the fastest growing industry in 21st century and also considered as a smokeless industry. The travel and tourism contributed in world economy, taking account of its direct , indirect and induced impacts in 2011 was US$6.3 trillion in GDP. This contribution represented 9 percent of GDP, 1 in 12 jobs, 5 per cent investment and 5 percent exports. Physical environment is fundamental and driving force for tourism. Man has always been fascinating mountain, forested areas, green valley, meandering source of water, wilderness, wildlife, terrain etc. Tourism also usually encourages and protects environment but in due course of time tourism activities deteriorate environment. The relation between tourism and environment is very complex. Distinct environment attracts tourism and it needs to be protected for sustainable tourism. There are many evidences across the world how physical environment are being degraded due tourism activities in the countries where tourism is main revenues. Government and others bodies try to implement rules and regulations for the protection of environment. In this protection initiatives again hamper tourism expansion and retard pace of revenue. There are many forms of tourism like eco-tourism which has least impact on environment. Such forms of tourism are implemented in many places. Himalaya region is also very fragile. In recent years, there is rapid infrastructure development for tourism in the region. That has brought an adverse impact on fragile ecology of Himalayan region mostly on periphery areas. It has been extending towards the interior part too due to some form of tourism activities like tracking, mountaineering, adventure etc. Both central government and concern states regularly prepare rules to conserve environment. At the same time, its their obligation to bring welfare to people who resides in this region. In this contradictory sense of protection of biodiversity of the region and welfare of people activities which degrades environment, tourism is one of growing industry in this region. In this paper an attempt has been made on how tourism development in this region bring more inevitable damage on environment or more sustainable development for both people and environment. This assessment of tourism development on the quest of protection of environment and enhancement of people's livelihood was carried out in Sikkim state during 2015-16. Both primary and secondary data were used. Primary data were collected through scheduled questionnaire and group discussion with local policy planners, tourist, agency etc. Google map and GIS software were also as data source and analyzing. Its been concluded that number of town and city are growing very fast due to tourism and damage environment in around the town and city. On other hand government also taken steps to protect environment by increasing allocation of fund, sensitizing awareness amongst people, people participation and policy like implementation of organic farming in the state.

Keywords: *Himalaya, tourism, globalization, climate change, livelihood*

Increasing Seismic Vulnerabilities for Bengal Basin & the Northeast India : Environmental Impact of Ground Water Depletion

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Earthquake is caused from tectonic activity deep inside the earth. The effect is the shaking of ground and everything on the ground resulting in large-scale devastation. The main geological feature is the fault-rupture in any direction away from the epicenter and soil stratification. Seismic hazards, the outcome of earthquake, result in slope instability, ground collapse or subsidence, liquefaction of soil base, structural destruction, tsunami etc. in the near-field, as well as, far-fields along line of faults. Seismic vulnerability analysis defines the damage prognosis in the light of potentiality of an earthquake in seismically active locations. While an earthquake at any region cannot be avoided being a natural phenomenon, the anthropogenic environmental impacts can advance the clock and increase the possibility of far major devastations from the quake. This present study, based on secondary data, tries to find the potential vulnerabilities of unrestricted groundwater extraction and the resultant increase in vulnerabilities of soil liquefaction and ground collapse from any major earthquakes passing through the traversing fault-lines, from the Northeast to the Bengal Basin or vice versa.

The convergence of Indian and Eurasian plates has developed a mountainous topography and led to occurrences of earthquakes in the region. According to widely accepted model of earthquake occurrences at this collision-plate boundary, this convergence is accommodated on the Main Himalayan Thrust Front. The detachment is the surface between the underthrusting Indian shield rocks and the overlying Himalayan rocks. Bureau of Indian Standards marked the Indian landmass into three tectonic provinces, viz. Himalayan region, Indo-Gangetic basin and Peninsular India. Four seismic zones are designated as II, III, IV and V. The peak horizontal acceleration (PHA) and spectral accelerations for periods 0.1s and 1s have shown high seismic hazard in most parts of the Northeast and the Bengal Basin. While the region close to the Bay of Bengal is placed under Zone III, the most parts of the northeast of Indian region has been placed in zone V, the highest level of seismic hazard potential in Seismic Zonation Map of India. There have been two great earthquakes in 1897 (Shillong) and 1950 (Assam) in the region. Global Seismic Hazard Assessment Programme (GSHAP) also classified this zone under high seismic risk with peak ground acceleration values 0.35 0.4g. According to subsequent studies, the last major quake of April, 2015 near Kathmandu (Nepal) did not generate high-frequency waves and unzipped only a small part of the locked energy from the lower edge of the Main Himalayan Thrust Front. The Western Nepal, as well as the areas under north and northeast of India thus remained under potentially increased risk of any major quakes in future.

While the sub-Himalayan region extending from the Northeast of the country to the Bay of Bengal is seismically active, the potential vulnerabilities from earthquake for this geographical region can be anticipated from any of these two directions

(a) through fault-lines emanating tectonic impulse from Himalayan Thrust Front and its translation through Eocene Hinge Zone, and
(b) the quakes extending from Sumatran Subduction Trench, stretching along Lesser Sunda Islands off southern coast of Sumatra to Andaman Islands.

Geological and geophysical studies indicate evidence of seismic activity for these divergent margins where the seismic zones orient in NE-SW direction. Study of seismicity and fault planes of the past earthquakes in the Bay of Bengal region also focuses attention on deformations of the northern Indian plate. It provides evidence that the intra-plate region of the entire Bay of Bengal and peninsular India over the Indian plate is seismically active. In particularly, the Gangetic delta show higher seismicity in comparison to eastern plate boundary close to the seismically active arc of the eastern Himalayas. While the entire region is formed by sedimentary and saturated alluvial deposits of BarakBrahmaputraGanga river systems, the soil deposits are soft, erratic and geomorphologically divided into fluvial plain, tidal flat, natural levee and fed by numerous channels. The soil stratum covers alternate layers of clay, silt and sand horizons.

The recent studies on the last major earthquake of Kathmandu (Nepal, 2015) showed a major contribution of groundwater extraction to trigger enhancement of the devastations. Enormous extraction of ground water, far exceeding the recharge potential, is creating formation of void space below overburden soil-stratum has resulted in the entire area of the Northeast and the Bengal Basin. Confined groundwater is increasingly under pressure due to weight of the overburden and is further pressed by piling of deep columns for high-rise concrete structures for developmental activities. The overburden pressure has been increasing below that region. Due to over-extraction, water-level of underlying aquifers vis-à-vis porewater pressure is depressing year after year, while due to changing rainfall pattern and reducing tree-cover, the possibility of normal recharge is being restricted. These anthropogenic environmental impacts are likely to enhance the scale of devastations in the event of an earthquake episode, which would act as catalysts for large-scale soil liquefaction and structural devastations.

Keywords: *Himalayan Thrust Front, Eocene Hinge Zone, Sumatran Subduction Trench, Soil Liquefaction*

A Study on Biomedical Waste Management In 4 Hospitals of West Guwahati

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The present study reviews biomedical waste management practices currently prevailing in West Guwahati. Bio- medical waste of the hospitals and nursing homes being generated from their canteens, mess, offices and others usually consist of soiled cotton wool, bandages, and expired medicines. The proper disposal of waste of any kind is essential for the preservation of the living environment and the maintenance of a high level of public hygiene. Waste management practices in three government hospitals and one Nursing home of West Guwahati namely- Central hospital N.F. Railway Maligaon, Mohendra Mohan Choudhury Hospital- an annexe of GMCH, Greater Pandu first referral Unit, Sanjeevani hospital, were studied. Data were collected with the help of personal observations of the waste treatment and disposal practices and assessment of knowledge, attitude and practices of working personnel with the help of questionnaires. The study confirmed that the waste management practices were inadequate and rudimentary. While the disposal of solid biomedical waste in hospital was carried by landfilling, the liquid biomedical waste generated was discharged directly to public sewers. The drains in the hospital were full of contaminated wastes, raw sewage, bio-medical waste and other objectionable materials. Person responsible for disposal of wastes in all hospitals under study, lack knowledge of proper disposal method. It is confirmed from the study that neither partial nor complete treatment is provided in any of the hospitals. All the Hospitals lacked proper storage area where awaited its removal. There was no segregation of biodegradable and non-biodegradable wastes. The study also probed the level of awareness on waste management among the biomedical waste producers, and found it to be very inferior. Finally based on the findings, the current study postulates guidelines for sustainable biomedical waste management towards its proper handling, packaging, transportation, treatment and disposal. The study recommends focus on periodic, producer commitment, infrastructure availability, process planning, education and training, and a higher community awareness level, to make the biomedical waste management successful in Guwahati.

Keywords: *Incinerator, SWTP- Sewage Treatment Plant, ETP- Effluent Treatment Plant.*

The Threat of Space Debris To Environment

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Space debris represents a growing threat to the operation of man- made objects in space. In the past years, significant debris-generating events as well as improved tracking abilities have encouraged the recognition of space debris as a significant threat. The impact of space debris on space security is related to a number of key issues, including the amount of space debris in various orbits, space surveillance capabilities that track space debris to enable collision that track space debris to enable collision avoidance, as well as policy and technical efforts to reduce new and old debris. The Space Debris consist of satellites, solar panels, rocket bodies, fragments from space shuttles and disintegration, erosion and collisions which have polluted the space environment.

The pollutants of space environment is matter of urgent importance as it has many negative impact like increase in the velocity of atmospheric drag which has increased the reentry of debris in earth's atmosphere. It affects the space weather, earth's rotation and changes the ionospheres currents leading to the decrease of velocity and atmospheric pressure. Nuclear fuel used in the space mission can harm the health of living beings. Moreover, dependency on satellites for the communications and other human activities will be affected. The debris endangers the lives of astronauts in their mission and it also adds to the enhancement of ozone hole. The future exploration will add more quantity to space waste. There is uncertainty of debris mitigation. While the existing international space law is widely considered outdated and insufficient to address the current challenges to space security posed by space debris. This paper outlines the problem of space debris and gives an overview of the current event of space debris.

Keywords: *Space debris; leap year; space environment; mitigation; Kessler syndrome; space terrorism; orbital environment; space warfare; space weapon; anthropocene*

Natural Resource Management for Sustainable Development

Vegetable Grafting The Key To A Sustainable Agriculture

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Vegetable grafting is an urgent need for low input sustainable agriculture due to this increase in vigor and disease resistance. To increase domestic and sustainable vegetable production grafting is a new technology by using resistant rootstock to improve yield and quality of produce. It was first started in Japan &Korea . Currently most solanaceae crops are grafted before being transplanted in the green house or in the field. The purpose of grafting also has been greatly expanded to various type of stress tolerance, increasing plant vigor, yield and duration of crop. Vegetable grafting has potential to promote cultivation of the vegetables under non-traditional conditions. The experiments were carried out to study tomato grafting. By using the method of grafting, gain a large outcome of seedling as well as grow healthy and sound plants without disease & viruses.

Keywords: *grafting, scion, rootstock , Tomato*

Dependency On Ntfps For Livelihood Security In Sub-Himalayan Region Of West Bengal

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The present study has reported the relationship of the socio-economic profiling with NTFP dependency and has accessed the gap between prices of NTFP items at household level and in local markets around the fringe villages of Jaldapara National Park in sub-Himalayan part of West Bengal, India. A total of 146 NTFPs species were documented from the present study with only 43 of economically/commercially important for local communities. These documented species include 26 plant based NTFPs, 13 animal based and 4 species of fungus. The households were living as far as 2.5 km away from the forest or just near the forest with a mean distance of 1.01 km from the forest. All the responding households were collecting NTFPs from the forest spending about 1 to 6 hours daily during collection period. In terms of occupation, about 87 % of the households whose livelihood depends on agriculture were more or less dependent on NTFPs as they were subsistently agrarian. Overall, irrespective of the different levels of these variables, more than half of the households (58 %) were earning 10 to 30 % of their total monthly income (moderate) from NTFPs. There exists a huge potential of utilizing traditional ecological knowledge that indigenous communities possess about wild plant resources, their use and management for achieving sustainable NTFP production.

Keywords: *Income, collection, moderate, Fungus, Commercial, prices*

Effect Of Different Doses Of Npk On The Growth Parameter Of Desmodium Gangeticum (L.) Dc

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Desmodium gangeticum (L.) DC is an endangered plant belongs to a family Fabaceae, commonly known as 'shalparni' or 'ticktree' is a valuable small perennial shrub of tropical region.This shrub is packed with innumerable Ayurvedic properties. It is used an important ingredient of many famous Ayurvedic drugs like 'Dashamoolarishta', 'Chyavanaprasha', etc. Keeping in mind of its importance an experiment on effect of different doses of NPK on the growth parameter of Desmodium gangeticum were carried out at Uttar Banga KrishiViswavidyalaya, Pundibari, Cooch Behar, West Bengal. Results shows that N:P:K dose of 0.5:0.5:0.5 gm significantly influence the growth parameters like height, diameter and number of branches of Desmodium gangeticum as compared to control.

Keywords: *Shalparni, Ayurvedic, Chyavanaprasha, Growth, Shrub*

Traditional and Sustainable Natural Resource Management System of the Apatani tribe of ziro valley in Arunachal Pradesh

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The Apatani cultural landscape identified by the wet rice cultivation system which combine rice,millet and fish cultivation system in the form of sedentary agriculture in the valley illustrate the utility value of the traditional knowledge system with economical and ecological efficiencies. ”Paddy cum Fish Culture” is considered as the economicalally viable and hence sustainable farming too.The entire farming process takes place without the use of any animals and machines. Domestic waste such such as rice bran, animal excreta, decomposed straw and remains of burnt straw after the harvest are used to enhance soil fertility and also serve as feed to the fishes. It is not paddy and fish but every inch of land is used. Millet are grown on bunds constructed in between paddy field. The most unique feature of the irrigation system is that only one small river irrigates the entire paddy fields of the valley through a network of irrigation channel.Resource conservation is not limited to land only but also forest. There is a traditional practice of protection of forest by these indigenous communities which is a reflection of their socio-ecological system where they are strongly aware of meeting their basic need on sustainable basis, without destroying the nature. The “sacred Groves” of Apatani serve as a very good example of community based traditional practice where a patch of virgin forest near the village is declared as “sacred” and protected on ground of socio cultural belief.

The paper reveals the indigenous land use knowledge system of the Apatanis which has not been affected by ever-growing science and technology

Keywords: *Apatani, Indigenous, Sustainable, Rice cum fish culture, sacred groves*

Integrated Approach Of Utilizing Water Hyacinth To Develop Valuable Products: Biodegradable Film, Biogas And Vermicompost

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Water hyacinth is dangerous invasive weed species and is not being utilized in any form in the country. It is a matter of great importance to utilize this aquatic weed in some useful applications.

The aim of this study is to determine the feasibility of water hyacinth in multiple applications. This floating perennial plant has been used in aquatic systems for waste water purification for many years worldwide. A lot of interests have been shown for this plant in last few years in India and aboard. Water hyacinth is very efficient in removing vast range of pollutants, from suspended materials, BOD, nutrients, organic matter to heavy metals and pathogens. At the same time Eichhornia crassipes (known as water hyacinth) is one of the most notorious weeds worldwide. When introduced to aquatic ecosystem it spreads very quickly due to its high reproduction potential. Therefore water hyacinth tends to eliminate all other living organisms in surroundings. An integrated approach has been proposed in the study to undertake the development of some valuable products like biodegradable cellulosic film and production of biogas & vermin-compost using water hyacinth as the raw material.

Pond Hyacinth Based Nanocellulose For Eco-Friendly Nanobiomaterial Applications

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Pond Hyacinth plant, an agro-waste, is largely available in the North Eastern part of India and is of very limited use. Water hyacinth in tropical weather conditions is a major problem in open water bodies like power generation, irrigation and boating. Being inspired from its rich fiber content, the main objective of the present paper is to isolate and characterize nanocellulose from this aquatic plant. Nanocellulose was isolated from the uniformly sliced hyacinth stems by alkali treatment technique at 85±50C followed by bleaching and finally sulfuric acid hydrolysis. Acid hydrolysis was performed at 45±30C by using 60% sulfuric acid solution for durations of 60, 90 and 120 min under mechanical stirring conditions followed by sonication. The isolated nanocelluloses were characterized by crystallinity index determination, XRD, FTIR and TG analysis. Morphological evaluation was done by SEM and TEM techniques. After proper optimisation, the study showed a diameter of ~30 nm and length of ~210 nm for the nanocellulose obtained by acid hydrolysis of 90 min duration. The study concludes that the nanocellulose derived from pond hyacinth, an agro-waste of North Eastern India, with renewable potential have tremendous scopes to be utilized as very good reinforcing agents for production of eco-friendly nanobiomaterials.

Keywords: *Hyacinth, Nanocellulose, Sustainable, Acid Hydrolysis, Nanocomposite*

Quality Analysis Of Selected Drinking Water Of Kolasib District, Northern Mizoram (India)

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People on globe are facing tremendous threat due to undesired changes in the physical, chemical and biological characteristics of air, water and soil. Drinking water is highly polluted with different harmful contaminants due to Increase human population, use of fertilizers, pesticides, manures, anthropogenic activities etc. Natural water resources are being contaminated due to weathering of rocks and leaching of soil, mining processing etc. For mankind, knowledge of quality of potable water is vital and is directly linked with human warfare. It is a must that status of drinking water quality should be checked at regular time interval to prevent various waterborne diseases. The dilemmas of drinking water viz. scarcity, processing before use probable contaminations etc. in local and in regional water sources are more common in study area. The need for safe and sufficient drinking water has to be ensured from its sources and though Public Health Engineering Department (PHED), its supply to long distance or remote areas particularly, which are inaccessible. Depending on local availability, drinking water is derived from a variety of sources: Surface water (rivers, lakes, reservoirs and ponds), sub-surface water (tuikhurs), groundwater (hand pumps, seepage and well) and rain water. It is believed that our drinking water, far from being pure, may contain hundreds of deadly commercial chemicals. Being disregarded by our recent developed technological society, the demand of fresh water has to be fulfilled from its indigenous resources. Since people of the study area directly consume water for their drinking and domestic purposes without any treatment, a township at remote area in northern Mizoram has been selected for the present study. The purpose of the work is to establish Physico-chemical characterization of potable water sources, to demarcate water sources which are not within the standards specified by Bureau of Indian Standards (BIS) and World Health Organization (WHO) and to understand the sources of various contaminants in order to suggest remedies. The water samples were collected in the post-monsoon season 2017 from the selected locations. Out of 30 samples, 12 samples are from tuikhur, 4 samples are from hand pump and 14 are from supply water. The selected drinking water samples are collected from different locations of Kolasib district, Mizoram, India. The collected samples were analyzed as per standard methods (American Public Health Association, American Water Works Association and Water Environment Research Foundation) to determine the concentration of Physico-chemical parameters to assess water quality. Therefore, water samples from sub-surface (tuikhurs), groundwater (hand pumps) and supply water by PHED at various sites in the area were collected and analyzed for different parameters including pH, Total Dissolved Solids (TDS), Electrical Conductivity (EC), Turbidity, Total Alkalinity, Hardness, Iron, Magnesium, Calcium, Nitrate (NO3), Bicarbonate (HCO3), Sulphate (SO4), and Chloride (Cl). The results revealed that all of these water samples were well within acceptance/ permissible limits established by WHO and BIS and hence suitable for drinking purposes. However, Iron contents at few sites are found exceeding the permissible value of 0.3 mg/l. For anion and cation, piper and ternary diagrams are plotted in order to classify the facies and water belongs to Ca-Na-HCO3 type.

Keywords: *Ground water; Physico-chemical; Piper tri-linear; standards*

Influence Of Shoot Pruning And Nutrient Management On Assam Lemon (Citrus Limon Burm.)

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Citrus is economically important fruit crop rich in vitamin C and different minerals grown throughout the world. It was observed that the declining of the productivity of the plant is unbalanced overcrowded, malnourished orchard which also resulted in high disease-pest infestation. Pruning is necessary to maximize sunlight penetration which not only influences the flowering and fruit set but also enhances fruit quality and colour development. As lemon plants bears three times in a year, proper manuring and fertilization has also to be resorted for obtaining highest yields and quality production. The experiment was laid out in two factorial Randomized Block Design with four levels of pruning, seven levels of nutrients and their interaction to study their effect on 7 years old Assam lemon plants during 2013 to 2015 at Instructional farm of Uttar Banga Krishi Viswavidyalaya, Cooch Behar, West Bengal, India. There were 4 levels of pruning, namely P0- No pruning (Control), P1- 25 cm pruning from the terminal portion of the shoot, P2- 50 cm pruning from the terminal portion of the shoot, P3- 75 cm pruning from the terminal portion of the shoot and 7 treatments of nutrient management viz. N1- 100% Recommended Dose of Fertilizer (N@210g/plant- P@140g/plant- K@210g/ plant), N2- Vermicompost (20kg/plant) + Azotobacter (18g/plant) +Vesicular Arbuscular Mycorrhiza (150g/plant), N3- Vermicompost, N4- 75% RDF+Vermicompost +Azotobacter + VAM, N5- 75% RDF+Vermicompost, N6- 50% RDF+ Vermicompost +Azotobacter + VAM and N7- 50% RDF+Vermicompost were applied alone and in combination with different levels of the pruning. Reproductive parameters viz. number of flowers per plant, fruit set (%), fruit retention and fruit yield were recorded. Analysis of variance for each parameter was performed using ProcGlm of Statistical Analysis System (SAS) software (version 9.3). The investigation revealed that the flowering parameters were found highest in T11 (P1N4) at Ambe, Mrig and Hasth bahar respectively. Number of flowers per plant (454.33, 424.67 and 320), fruit set percentage (69.11%, 52.51% and 48.75%), fruit retention percentage (90.76%, 70.85% and 40.38%) and fruit yield (35.17 kg/plant, 20.86 kg/plant and 8.07 kg/plant) were found highest in lightly pruned plants feed with 75% RDF + Vermicompost + Azotobacter + Vesicular Arbuscular Mycorrhiza (P1N4) at Ambe, Mrig and Hasth bahar, respectively. Among the three season of cropping Ambe bahar recorded the best result in respect to yield followed by Mrig and Hasth bahar. Present results suggest that integrated application of inorganic fertilizers, organic and biological sources of nutrients reduce the sole dependence on inorganic fertilizers and also influences the flowering-fruiting in lemon. Besides, pruning has also significant effect in fruit yield. Among several levels pruning and nutrients application, light pruning (25 cm pruning from the terminal portion of the shoot) along with integrated use of fertilizers viz. 75% RDF +Vermicompost + Azotobacter Vesicular Arbuscular Mycorrhiza proved as best in terms of quality lemon production.

Keywords: *Lemon, Nutrient management, Pruning, Flowering, Fruiting.*

Recovery Of Petroleum Hydrocarbons From Refinery Sludge By Rhamnolipid Biosurfactant Producing Bacterial Consortium

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Introduction: Petroleum industries all over the worldgeneratea large amount of solid and semisolid wastes in several steps of petroleum production and refinery processes known as refinery sludge which poses some serious environmental problem as it contains numerous hazardous and recalcitrant petroleum hydrocarbons. As conventional techniques for sludge treatment like incinerations are not environment friendly due to the presence of toxic hydrocarbons, it's very essential to recover the hydrocarbons from the refinery tank bottom sludgewith the help of microorganisms before its disposal to environment. As biosurfactant reduces the viscosity and promotes theformation of oil/water emulsion which triggers oil recovery from refinery sludge, biosurfactant producing microbes are considered as potent candidate for hydrocarbon recovery from sludge.

Objective: The main purpose of this work was to develop an alternative process for recovery of petroleum hydrocarbons fromrefinery sludge by employing efficient biosurfactant producingbacterial strains individually and as a consortiumand explore the biosurfactantsproduced by the bacterial strains and consortium for their composition and stability.

Methodology: In this microbial enhanced oil recovery (MEOR) effort, two efficient biosurfactant producing bacterial strains, namely, Bacillus pumilus KS2 and Bacillus cereus R2 were employed individually and as a consortium. For the laboratory scale investigation, refinery sludge was mixed separately with clean river sandto adjust sludge concentrations 5%, 10%, 15% and 20% by w/w. For each treatment fifty grams of sterilised sand-sludge mixtures containing the various sludge concentrations were added to each 100 ml sterilized mineral salt medium (MSM) taken in 500 mlErlenmeyer ?asks. Both the bacterial strains were inoculated individually and as a consortium in respective flasks and were incubated at 35 ºC and 200 rpm consecutively till 4 weeks.From each treatment flasks and the controls, the petroleum hydrocarbon that was emulsified in the culture brothwas subsequently recovered every week of incubation by solvent extraction method using dichloromethane (DCM). Biochemical, LC-MS, and SEM-EDS analyses were carried out to characterize the biosurfactants produced by both the bacterial strains and their consortium. To determine the stability of the biosurfactants, emulsification index (E24) of the biosurfactants produced by both the bacterial strains and their consortium were also estimated by standardized protocol.

Results: The recovery of petroleum hydrocarbon was found to be comparatively higherwith the treatment of the consortium consisting of both the bacterial strains than the treatment of the individual strains. Maximum hydrocarbon recovery was recorded to be 84.5±2 % from 20% sludge containing flask after 14 days incubationusing the consortium, whereas highest hydrocarbon recovery using individual bacterial strain Bacillus pumilus KS2 and Bacillus cereus R2 were found to be 76.75±2 % and 71.5±3 % respectively. Biochemical, LC-MS, and SEM-EDS analyses revealed that the biosurfactant produced by both the bacterial strain and their consortium are rhamnolipid in nature comprising of various mono and di rhamnolipid congeners.Emulsification index (E24) of the biosurfactant produced by both the bacterial strain and their consortium were recorded to be94.25, 81.74 and 98.48 % respectively when it was estimated by taking crude oil as water immiscible substrate.

Conclusion: From the above results it becomes clear that the bacterial consortium comprising of Bacillus pumilus KS2 and Bacillus cereus R2 strainsexhibitssignificant practical potential for recovery of petroleum hydrocarbon from refinery sludge. Further, the stability of the biosurfactant produced by the bacterial consortium reveals the possibility of its use in actual field conditions like higher temperature, pH etc.All the probable uses of recovered petroleum hydrocarbonsmay open up new a horizon in the petrochemical and energy segments.

Keywords: *Refinery sludge, Rhamnolipid biosurfactant, MEOR, Bacillus pumilus KS2, Bacillus cereus R2.*

Efficiency of Eichhornia Crassipes Synthesized Iron Nanoparticles For Nitrate And Phosphate Removal From Wastewater

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Water contamination due to the excessive presence of nutrients such as nitrate and phosphate has become a prime concern in water quality. The high concentrations of these nutrients in water bodies pose serious threats by causing eutrophication. Hence, its eradication from water bodies is important at large scale. Therefore, the present study proposes that iron nanoparticles (Fe NPs) synthesis using aquatic weed Eichhorniacrassipes (E. crassipes), extract, which is regarded as cleaner productions and can be used for the efficient removal of nitrate and phosphate from waste water. The E. crassipes extract was prepared on the dry weight basis. As prepared extract was mixed with the 0.1 M FeCl3 salt solution at a volume ratio of 1:1 at room temperature. After the addition of the extract and iron (III) solution, the flask was capped, to avoid the reactivity of atmospheric oxygen. The appearance of black colour indicated the formation of iron nanoparticles. The reactant mixture containing iron nanoparticles were centrifuged at 10,000 rpm for 10 min., which formed the pellets of nanoparticles and it was re-dispersed in distilled water. The procedure was repeated to ensure better separation of biomolecules from iron nanoparticles. Further, the FeNPs were washed with anhydrous ethanol and dried at 333 K. The UV-vis spectra was recorded for comparison of absorption peaks of the synthesized iron nanoparticles, the extract of E.crassipes, and the metal salts used for synthesis of iron nanoparticles (NPs). Comparing the spectra of iron salt and the colloidal solution of FeNps showed a slightly broadening or absence of absorption band at 274 nm. Similarly, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), and X-ray energy dispersive spectrometer (EDS) and FTIR confirmed the successful synthesis of spheroidal iron nanoparticles. Particle size analysis of the synthesized nanoparticles using dynamic light scattering (DLS) confirmed 40-60 nm of size distribution. The phase analysis using X-ray diffraction revealed the amorphous nature of nanoparticles. A less obvious characteristic peak of zero-valent iron (á-Fe) was observed at about 2è at 44.9°. These results confirmed the findings of SAED pattern of iron nanoparticles. The TEM micrograph indicated the prominent capping layer of polyphenols around the nanoparticles. This suggests the formation of Fe0 -iron oxide core-shell nanoparticles (FeNPs) with polyphenols as a capping/stabilizing agent.The TEM micrograph of Eichhorniacrassipes revealed that FeNPs are spherical in shape with moderate variation in particle sizes. According to the size distribution, most of the nanoparticles ranged from 20 to 60 nm. Further, the reactivity of synthesized iron nanoparticles for nitrate and phosphate removal was evaluated on real collected samples of dairy wastewater containing substantial amount of nitrate and phosphate. The characterization of collected wastewater showed concentration of 14.77 mgl-1 and 23.50 mgl-1 for nitrate and phosphate respectively. A control experiment was also performed by chemical synthesis of iron nanoparticles. Chemically synthesized FeNPs removed 85.27 % of nitrate, while E. crassipesFeNPs showed 74.52% of nitrate removal. Overall, these synthesized FeNPs showed better removal of nitrate than the phosphate. Nevertheless, reactivity of nano zerovalent iron (nZVI) decreased by 22 % after 15 days of synthesis, whilst extract mediated Fe-NPs did not vary much. The present study showed that E. crassipessynthesized FeNPs are more stable than the chemically synthesized FeNPs. The findings of the current study are in good agreement with the previous studies on green synthesis of iron nanoparticles. The applications of these as-prepared green FeNPs in dairy wastewater demonstrated a promising environmental pollution management option for large scale wastewater treatment.

Keywords: *Aquatic pollution; Characterization; Nutrient removal; Synthesis; Weed*

Sustainable Development Strategy of Pharmaceutical Industries In Assam

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There are more than 50 pharmaceutical companies are manufacturing pharmaceutical products in Assam. As we know that Govt. of Assam (GOA) is also motivating to start more such companies in Assam. As per the tradition most of the companies are focusing on rapid growth instant of sustainable growth. Hence, this research is aiming to develop a strategy to help the pharmaceutical companies to focus on sustainable development by integrating Environment, Economy and Social system for meeting the needs of the present without compromising the ability of future generations to meet our needs or more simply putliving of Earth's income, not its capital. The main objective of the study is to integrate three factors Environment, Economic and Social system to develop a sustainable development strategy for pharmaceutical companies of Assam.The research will suggest that pharmaceutical industry does care its social system and environment. An excellent sustainable development strategy is a paramount to the pharmaceutical industries success. A study has been conducted in Pharmaceutical companies of Assam. Where data collected from 34 companies (both primary and secondary) are analyzed carefully, which is 68% of the whole population.

We subscribe to the view that a sustainable development strategy should be considered excellent if it is in the streamline with business strategy.The business objectives of the pharmaceutical industry include the need to ensure that the drugs are protected from adulteration and counterfeiting, removed and destroyed in a safe and environmentally friendly manner, and made available to patients at all time and at a reasonable price. Clearly, these are not commonly used metrics to assess the performance of a company or a sustainable development strategy. Instead, characteristics that have direct impact on the long term financial well-being of the company, such as reduced waste (Environment Factor), increased profitability (Economic factor), development of stakeholders (Social System)and lower cost (Customer) are the ones that take precedence.

The aim of the research to develop economically viable environment friendly strategy like adopting greener approaches, socially justifiable economic strategy and socially acceptable environment friendly strategy. Thus this cross factor analysis help us to obtain the excellent sustainable development strategy for the pharmaceutical industry. The framework was derived by utilizing interdisciplinary academic theories, mixing behavioral science to business management, analyzing the three factors and develop a standardize methods for wealth maximization in a socially helpful environment friendly ways.

Keywords: *Pharmaceutical, Sustainable growth, Social System, Environment, Economic, wealth maximization, Green Chemistry,etc.*

Resource Recovery From Solid Waste Employing Earthworm Gut Isolated Bacteria: A Step Towards In-Situ Waste Degradation System

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The major goal of this work was to utilize earthworm gut isolated bacterial inoculums for rapid production of quality composts from biowastes. Inoculums of four efficient nutrient mobilizing strains of gut-bacteria (Burkholderia vietnamensis, Burkholderia spp, Bacillus cereus, Serratia marscescens) were employed in presence and absence of Eisenia fetida in composting reactors prepared with vegetable waste (VW), Rice straw (RS) and cowdung (CD) in 2:2:1 ratio. Significant improvement in regard to nutrient availability (N, P, and K) and enzyme activity was recorded under EW+ inoculum treatment. Moreover, EW+I4 treatment was found to be superior than other treatments with respect to compost quality and time economy. However, among the four inoculums combination, I4 (Bacillus cereus and Serratia spp) was the best performer.

In addition, strains of prolific cellulolytic bacteria and fungi were identified from the EW, EW+I4, EW+I3 and EW+I2 inoculated feed mixtures.

Keywords: *Biowastes, earthworms, composting, gut-bacteria*

Hydrophonics - A Modern Day Farming Style

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Hydrophonics is the simple technique of soil-less gardening. It involves growing plants without the application of soil medium, instead uses a nutrient like a mineral rich water solution. Hydrophonics gardening is a step towards sustainable approach to resource wage than the usual growing methods. This approach eliminates the need of herbicides and pesticides compared to traditional soil gardening. Hydrophonics vegetable gardening is like a boon to any plant. Plants not only grow faster and bulkier but they retain all the necessary nutrients and provide immense health benefits. There are different methods of growing veggies hydrophonically. All methods differ in their composition and medium but they all work on hydro principle that is they are water dependent. The advantage of hydrophonics farming is that it uses less water as compared to traditional farming methods thus saving substantially for the farmers and hydrophonics gardening provides bulky growth it provides to crops. Many researchers were of view that water nutrients culture is far effective than soil culture. Hence developed countries went on extensive usage of this technique under controlled conditions.

Keywords: *hydrophonics, boon, hydro*

Rubber Plantations Developed Over Natural Forests May Require 90 Years To Attain Equilibrium In Soil Organic Carbon Stock

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Land use conversion through forest degradation has been the vital human driven atmospheric carbon loading process. Globally rubber (Hevea brasiliensis) plantations are managed on ~10 million ha (M ha) land and in Asia especially it has been planted by clearing natural forests. As among all the terrestrial systems, forest soil contains the high soil organic carbon (SOC), we therefore in this paper studied whether or not rubber plantations developed over natural forests can restore SOC stock equivalent to that under natural forest soil. Present study was carried out in the Karimganj district of Assam by selecting four different aged rubber plantation (6, 15, 27 and 34 yr. old) and estimated for SOC stock and compared with that under natural forest soil. Study suggests although SOC stock under rubber plantation increases with increase with age from 109 Mg ha-1 under 6 yr. to 130 Mg ha-1 under 34 yr. old plantations, it failed to attain equilibrium with that under natural forest (185 Mg ha-1). The SOC stock under rubber plantation after 34 yr. of plantation development was ~30% lower than that under natural forest soil. It was further projected that rubber plantation development by clearing nature forest will require~90 yrs. to attain equilibrium in SOC stock with that under natural forest soil.

Keywords: *Assam, land use conversion, plantation, SOC stock*

A Critical Analysis On The Awareness Of Local Resources Among Urban People: A Case Study Of Several Parts Of South Kolkata

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Human evolution followed by civilization had been a long process since ancient time to this present day situation. Human race survived and get developed through time depending on the supply of natural resources from their environments. Going through this evolution, human turned themselves into a proper functional resource unit who could gather the elements of nature, make them function properly and even increase their accessibility. We could say that the core element of this development had been natural resources and human capabilities to access them properly through inventing technologies. But there was a loop hole introduced in this growing process where human get more and more anxious and greedy and end up exploiting their natural environment. Not only that the lack of proper awareness of their available local natural resources also helps to turn this mutual balance at risk.

Keywords: *Environment, Local Resources, Human Civilization, Awareness, Degradation*

Shrinkage of East Kolkata Wetlands and its Effect

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East Kolkata wetlands is a complex natural and human made wetlands lying east of Kolkata,covers 125 sq. km. of area which include salt marshes ,salt meadows, as well as sewage farms and settling ponds.It is the largest sewage fed aquaculture of the world. It is designated a "Wetlands of International Importance" under Ramsar convention on 19th August 2002. The Ramsar Convention describes EKW as one of the rare examples of environmental protection and development management" where city's sewage is treated through a network of canals and fishponds,more over,it is the ground of waste water pisciculture. This system is so effective that Kolkata was not provided funds for setting up conventional sewage treatment plant under the Ganga Action Plan.

Now, a part of EKW is used by Kolkata Municipal Corporation as a dumping ground of solid-waste. The problem is that the wetlands are shrinking because of various reasons, such as-rapid urbanization, excessive silting, human habitation etc. The results are obvious- pollution, loss of biodiversity.

In this present paper the focus will be on the reasons for the shrinkage of East Kolkata Wetlands and the effect on biodiversity loss and most importantly the possible suggestions to overcome this problem.

Keywords: *shrinkage, East Kolkata wetlands, biodiversity*

Phyto-Diversity Characterization And Assessment Of Soil Organic Carbon In Home Gardens Of Upper Assam, India

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Home Gardens are unique natural resources and integral part of the indigenous village ecosystem of Assam that have stemmed out of the indigenous knowledge and species selection of plants with social and cultural significance. These agroforestry systems with a dynamic structure provide subsistence to the dependents and harbor exclusive and at times rare species of crop plants, also of significance from the parlance of carbon sequestration. There has been an increasing interest in home gardens as sustainable repositories of biodiversity conservation in the tropics. This interest has been piqued owing to the multi strata vegetation composition of these dynamic agro forestry systems which are deliberately planned to mimic a natural forest. In this study we aimed at studying the home gardens of the seven districts of Upper Assam documenting the phytodiversity and the status of Soil Organic Carbon (SOC). Phyto-sociological analysis was done following standard ecological protocol whereas soil samples were collected and analyzed from three depths (0-15, 15-30, 30-45 cm). 101 numbers of tree species, 28 numbers of shrub species and 38 numbers of herb species were recorded in the home gardens of upper Assam. The Soil organic carbon (SOC) was found to be 29.58 tC ha-1. A shift of the home gardens structure from a multi species biodiverse system to a single species, market oriented system is also evident from this study. This shift has lead to shrinking home gardens, affecting the biodiversity of the system as a whole which is a matter of great concern that needs to be addressed and remedied effectively and immediately for sustainable management of this important recourse.

Keywords: *Natural Resource management, Agro forestry, Sustainable Management, Natural Forest.*

Conversion Of Forests Into Shifting Cultivation And Its Impact On Soil Organic Carbon Budget Of Nagaland, India

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The North East Indian state of Nagaland is an important part of the Eastern Himalayan Biodiversity hotspot region and is endowed with rich diversity. The traditional agriculture system of the state is shifting cultivation which is locally referred to as jhum. In recent years the jhum cycle has shortened from 10-15 years to a meager 4-5 years owing to demographic pressures. This has become one of the major drivers behind the conversion of primary forests to shifting cultivation. Land use changes in such a highly diverse region not only affect the overall biodiversity but also alters the soil organic carbon budget of the ecosystem. This study attempted to estimate the changes in carbon stock in two contrasting land uses viz. 'forest' and 'shifting cultivation' following standard protocols. 156 soil samples from both the land uses were collected from three depths 0-15, 15-30 and 30-45cm and SOC was estimated following the Walkley and Black method. The carbon stock in the forest has been recorded to be 61.66 t C ha-1 whereas in the shifting cultivation it was estimated to be 51.94 t C ha-1.This study reflects on dwindling natural resources owing to reduction in forest cover. Thus, this change in land use dynamics has serious implications in the overall carbon budget in Nagaland and needs to be addressed effectively to prevent further loss of this rich, immense natural resource.

Keywords: *Land use change, Sustainable management, Forest cover, Carbon stock, natural resource.*

Carbon Sequestration efficiency of Acacia nilotica (Black Babul) Tree Species from Aurangabad City of Maharashtra, India

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Urbanization has the tendency to disturb ecosystems, enervate ecosystem function and possibly jeopardise the human wellbeing. While sufficient integration of nature into the city scenario can pragmatically ameliorate environmental challenges in the city, particularly those related to climate change and the ecosystem degradation. The study was carried out in Aurangabad city to know the CO2 sequestration by Acacia nilotica (Black babul). Assessment of carbon sequestration of urban trees was carried out through biomass estimation and quantification. Biophysical measurements were recorded using ground measurements in terms of Diameter at breast height and height of tree. Wood density is used from Global wood density database. Theodolite instrument was used for height measurement. In the present research work estimation of carbon and carbon dioxide sequestration was carried out by nondestructive method. It is found that Acacia nilotica sequestered 1545. 33 kg/tree above ground biomass, 401.79 kg/tree below ground biomass, 1947.11 kg/tree total biomass, 973.55 kg/tree carbon, 3569.35 carbon dioxide kg/tree. Total tree count of the city area is 1635. Total CO2 sequestered by the Acacia nilotica is 598.69 tonnes in the 181.56 square kilometer of the city. Humanity has unquestionably entered an urban age, as most people live in cities and the urban population keeps growing on a global scale. The impacts of this ongoing process on the environment need to study. To protect the nature from adverse effects of artificially created ecological issues, the sustainable management of urban trees is the need of the time.

Keywords: *carbon, biomass, height, sequestration.*

Estimation Of Carbon Sequestration Potential By Syzygium Cumini (Jambhul) Tree Species Of Aurangabad City, Maharashtra

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Tree species around buildings, whether deliberately cultivated or allowed to grow naturally, have been identified as an essential feature of human settlements. In urban regions, plant communities provide a wide range of ecological services including the conservation of biodiversity, soil and air pollutant removal, carbon sequestration, oxygen renewal, ground water recharge and urban cooling effects. The study was carried out in Aurangabad city to know the CO2 sequestration by Syzygium cumini (Jambhul). Assessment of carbon sequestration of urban trees was carried out through biomass estimation and quantification. Biophysical measurements were carried out in terms of Diameter at breast height and height of tree. Theodolite instrument was used for height measurement. Wood density is used from Global wood density database. In the present research work estimation of carbon and carbon dioxide sequestration was carried out by nondestructive method. It is found that Syzygium cumini sequestered 1259.64 kg/tree above ground biomass, 327.51 kg/tree below ground biomass, 1587.14 kg/tree total biomass, 793.57 kg/tree carbon, 2909.47 carbon dioxide kg/tree. Total tree count of the city area is 868. Total CO2 sequestered by the Syzygium cumini is 243.898 tonnes in the 181.56 square kilometer of the city. Cities are generally expected to keep on growing in the future. While this is true on a global scale, a process that is rarely associated with cities and even less often studied by ecologists is urban shrinkage and decline. More efforts needed to protect nature from the ever increasing population and urbanization by the sustainable management of trees.

Keywords: *urban, diameter, tree, carbon*

Evaluation of Villages From Jalna District Maharashtra, India With Respect To Sustainable Development Goal

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Maharashtra Human Development Report 2012, says that the HDI index of Jalna District in the year 2011 was 0.663, which was an improvement from the year 2001 mentioned 0.554. But it is still relatively low in the category list, because for high HDI the figure needs to cross 0.701.The SWOT analysis is a valuable step in situational analysis. Assessing village's strengths, weaknesses, market opportunities, and threats through a SWOT analysis is a very simple process that can offer powerful insight into the potential and critical issues affecting a venture. This paper focuses on the SWOT analysis of 5 villages that are Matrewadi, Najik Pangari, Hiwara, Ujjainpuri and Padali and it has been connected to the Sustainable Development Goals which will brief the focusing objectives for overall development of the particular district. The main objective of the paper is to increase the quality of life and living standard of the people.

Keywords: *Crop, Fertilizers, Farmland, Macronutrients, Minerals.*

An Appraisal Of Ethical Knowledge Of Medicinal Plants As Anticancer Agents From Himachal Pradesh, India

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Cancer is a abnormal malignant growth of body tissue or cell. A cancerous growth is called a malignant tumor or malignancy. Cancer is threat to human existence if it's not cured on time. At this moment, cancer is one of the biggest reasons of human mortality rate. Plants with loaded with chemical with chemo protective activities of some of them are undergoing clinical trial. Inhibition of angiogenesis is a novel process of cancer therapy. The selected and careful use of this plant may definitely in anti-angiogenic therapy and thus in cancer management. The principles underlying herbal medicines are relatively simple. India is a rich source of medicinal plants and a number of plant extracts are used against diseases in various systems of medicine such as ayurveda, unani and siddha. Only a few of them have been scientifically explored. Plant derived natural products such as flavanoids, terpenes, and alkaloids and has received considerable attention in recent years, due to their diverse pharmacological properties including cytotoxic and cancer chemo preventive effects. Ethical knowledge of use of plants for various dieases is been dying in today's google world. So, in order to document the ethical knowledge of medicinal plants, present review has been undertaken.

Keywords: *Anticancer, phytochemicals, medicinal plants, Himachal.*

Nest Tree Use And Nesting Success Of Greater Adjutant Leptoptilos Dubius In Human Settlements And Home Gardens In Brahmaputra Valley, Assam

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Greater Adjutant use human-modified habitats, such as agricultural fields, artificial wetlands, for foraging and scavenges on garbage and discarded wastes. They also nest close to human settlements and home gardens on the horizontal branches of tall trees, large girth, and wide canopy. The study was carried out in Brahmaputra river valley in Assam state, India, over three breeding seasons of Greater Adjutant (2013 14, 2014 15, and 2016 17). This study area spreads over 1.6 km² area in six villages, Pub-Dadora, Pachim Dadora, No. 1 Singimari, Na-para Pacharia, Pacharia Dalar Pahar, and Pacharia 26.21° 26.23° N to 91.62° 91.64° E, 50 m above mean sea level (msl). The villages are surrounded by agricultural lands predominantly with paddy Oryza sativa cultivation. Apart from agricultural lands, people also have home gardens of fruit trees such as Mango Mangifera indica, Jackfruit Artocarpus heterophyllus, and Black Plum Syzygium cumini, and traditional agroforestry containing trees like Kadam Neolamarckia cadamba, Coconut Cocos nucifera, Areca Palm Areca catechu, Bamboos Bambusa bambos in association with domestic animals. We surveyed for nest trees in the study area during the middle (November February) of the breeding season extensively covered on foot and by vehicle and all nests, which were usually easily visible on trees, were located. Measurements on nest tree and architecture in relation to cardinal orientation, and number of nestling were recorded for all the nests across three years. A total of 92 nest trees (including trees used more than once for nesting) found to be used in the study area. During the first year (2013 14) 51 trees were used, which increased to 65 nest trees (2014 15), and 88 trees (2016 17) in the subsequent years of study, respectively. The number of nest trees, nests, and nestlings also increased in successive years. The average clutch size per nest was found to be 1.48 and per nest tree was 2.95. The average number of nests per tree was found to be 2.03 across the three years of study. Average height of the nest trees found to be 20 m in height with canopy diameter of about 13 m for nesting. There were no significant differences in nest tree characteristics or nesting parameters such as number of nests or juveniles per between Neolamarckia cadamba and other nest tree species. The Generalised Linear Model (GLM) results showed positive correlation between average number of nests and height of nest tree across three years. Whereas the average number of nestlings found to be positively correlated with the Girth at Breast Height (GBH) of the nest tree. Nest positions on individual trees found to be reused with preferences of central positions 13.9% (n = 62 of 446 nests), followed by northeast 11.2%, and southwest 10.7%, southeast 9.4%, and northwest and South-southwest 9.1% directions for the peripherial nests. Chi-square test (÷² = 33.72, df = 15) for the distribution of nests with respect to cardinal orientation was found significantly different from expected random distribution.

Keywords: *Stork, Nest ecology, Ciconiidae, Cardinal orientation, Avian fauna.*

Public Participation For Sustainable Development Of The Environment: Need Of Today

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Quality of environment is deteriorating day by day over past few decades. Present scenario of environmental degradation is taking height. Air we breathe, food we eat, water we drink all have pollution problems. As the nations are developing, they are leading to more pollution therefore sustainability of environmental system are under threat. Some of them are using sustainable developmental measures, using appropriate technology, environmental education, balanced resource utilization etc. In making decision about these environmental problems, Governments are becoming involved at International, National and Local levels. All of us have started thinking that how our participation in sustainable development of environment can be of some help. Participation of public for sustainable development of environment is the need of today and our duty also for the sustainability.

Keywords: *Environment, Sustainable, Degradation, People, Need.*

Achieving Mitigation And Adaptation To Climate Change Through Sustainable Agroforestry Practices

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Climate change is one of the major challenges of our time and adds considerable stress to our societies and to the environment. From shifting weather patterns that threaten food production, to rising sea levels that increase the risk of catastrophic flooding, the impacts of climate change are global in scope and unprecedented in scale. Without drastic action today, adapting to these impacts in the future will be more difficult and costly. Agroforestry is an ecologically sustainable land use system which integrates trees and shrubs on farmlands and rural landscapes to enhance productivity, profitability, diversity and ecosystem sustainability. It plays a crucial role in climate change mitigation especially due to its tree component. Trees accumulate CO2 (which is the most predominant GHG) in their biomass. Agroforestry not only helps in climate change mitigation but also climate change adaptation. It is an established fact that despite our present effort at climate changes mitigation (GHG reduction), there is a more pressing need to cope with the impact of climate change (adaptation). Agroforestry produces food, fuel, fodder, timber, fertilizer and fibre, contributes to food, nutritional and ecological security, sustains livelihoods, alleviates poverty and promotes productive and resilient cropping and farming environments.

Agroforestry has the potential to enhance ecosystem services through carbon storage, prevention of deforestation, biodiversity conservation, and soil and water conservation. In addition, when strategically applied on a large scale, with appropriate mix of species, agroforestry enables agricultural land to withstand extreme weather events, such as floods and droughts, and climate change. Agroforestry can generate significant employment opportunities to rural and urban population through production, industrial application and value addition ventures. Current estimates show that about 65 % of the country's timber requirement is met from the trees grown on farms. It is also recognized that agroforestry is perhaps the only alternative to meeting the target of increasing forest or tree cover to 33 per cent from the present level of less than 25 per cent, as envisaged in the National Forest Policy (1988). Agroforestry interventions can be a potent instrument to achieve significant growth in agriculture to meet country's population demand for food, fodder, firewood and timber, against a backdrop of shrinking land and water resources for agriculture and the threat of climate change. In short, trees on farm or agroforestry are uniquely place for achieving multiple objectives, especially the food, nutrition, employment, health and environmental security.

Keywords: *Agroforestry, Climate Change, Mitigation and Adaptation.*

Documentation And Status Of Ntfps In Buffer Zone Of The Khangchendzonga Biosphere Reserve, Sikkim, India

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Non-Timber Forest Products (NTFP's) have always been and will continue to be an important element of the forests resources. Sikkim Himalayas is bestowed with abundant herbs, shrubs, bamboo, and medicinal plants. The present study was conducted in Kangchendzonga biosphere reserve Sikkim, in the following areas under biosphere reserve viz. Passingdang, Lindong, Tanek and Gur. The survey was carried out in the year 2016 to find out the utilization and status of the non-timber forest product (NTFPs) by taking personal interview using questioner method. The present study recorded 96 numbers of NTFPs from the study area. NTFPs like wild vegetables, fodder, fuel wood, medicinal, mushroom and fruits. Among all the utilization the medicinal plants was found highest with 20 species followed by fodder 18 species, fuel-wood 15, wild vegetables 12, mushroom 11, wild fruits 10 and bamboo/canes 10 respectively. In the study area 16.66 % species was recordedrare and 17.70 %declining whereas 27.08 % and 38.54 % species are common and abundant. The study revealed that villagers are well aware of collecting seasons and use of specific products of many NTFP species. The recorded rare and declining species should be conserved for the upcoming generation and such indigenous knowledge should be tapped and documented.

Keywords: *NTFPs, Wild food, Uses, Sikkim*

Urban Green Space Act as Climate Change Mitigation Tool

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Climate change is the major global problem of the 21st century especially in the dense populated cities due to transport sector, industrialization and decreasing urban green space as compare to population. The parks or green space are the smallest ex situ conservation unit in the urban landscape for their critical role in biodiversity conservation. Social and urban forestry are the branch of forestry science and basically responsible for maintaining the roadside plantation and urban park for improving the aesthetic beauty, reduce pollution provide common space for the residents and provide various direct and indirect ecosystem service to the urban population. The present paper discussed in details about various services received by the urban resident from the urban green space and overall management strategies of the green space.

Keywords: *Climate change, Park, Roadside plantation, Urban area*

Promoting Gender Sensitization And Women Empowerment For Sustinable Development

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Gender equality refers to a condition in which neither gender is discriminated. Gender sensitization intends to change the perception that men and women have of each other. It creates a mindset in men that no longer sees in women the stereotypical image. Gender equality is a vital factor for various developmental goals, such as poverty reduction and sustainable development. Gender equality has been enshrined as a human right in the Rio+20 documents. Adebisi 2014 identified women as key agents of sustainable development and rural women in particular as the key targets of empowerment.

In recent decades gender equality, women's empowerment and the realization of women's rights is worth pursuing; as women's empowerment is a means in promoting sustainable human development. Women play an essential role in the management of natural resources, including soil, water, forests and energy and often have a profound traditional and contemporary knowledge of the natural world around them.

The objective of the present study is to focus the relationship between gender equality and sustainable development. The importance of women and their empowerment towards sustainable development.The paper is based on primary and secondary data collection.Traditional agricultural system a key driver of food and livelihood security among the tribals of Meghalaya. Personal interview was conducted for collection of primary data from ladies working in the Mawlong Village Shillong (East Khasi Hills)in the month of April,May and June 2017. Women in the village are responsible of seeds, fertilizers and pesticides and maintenance of productive soil to nourish seedlings and plants. Women are also users, preservers and managers of biodiversity.The ladies face a lot of difficulty for e.g. there are no permanent jobs and they are paid meagerly which leads to poor living conditions and are ignored due to illiteracy. Most women have multiple roles to perform within their family and community. Women empowerment and gender equality is recognized as a stepping stone for sustainable development. A number of studies indicate that gender inequality are extracting high economic costs and leading to social inequalities and environmental degradation around the world. Implementing curriculums on gender sensitization which will enable students to learn that gender roles are interchangeable and that they are free to choose what they want to become or do depending on their likes rather their biological make up.

Gender sensitization should spread at all levels at household, organization and institutions. A sustainable development pathway must be established which has an explicit commitment to gender equality and seeks to enhance women's capabilities, respect and protect their rights and reduce and redistribute their unpaid care work. To ensure sustainable development it is important to recognize the importance of the two sexes (male and female).Without including the ideals of gender equality into all aspects of development we cannot achieve sustainable development.

Impact of Changing Environmenton the Production Of Quality Silk thread of Mugasilk Worm (Antheraeaassamensis Helfer)

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The rearing of commercially important silk moths for large scale production of natural quality silk fibre is called sericulture. Out of the six varieties of rearing season of muga silkworm one commercial (Kotia crop-Autumn season) and one seed crop (Jarua cop-Winter crop) has been carried out. The optimum climatic conditions in the commercial crops are 20-31ºC and relative humidity 65-95% but it may lead to produce poor yield of the crop due to fluctuation of the optimum temperature in present condition. Global climate seems to be changing with the evidence that raise in global mean surface air temperature over the last century range between 0.3ºC-0.6ºC, the recent years being particularly warm. In present investigation, changing climatic condition (temp: 10-36 ºC:Rel.Hum: 48-100%) was effected on the moisture content (4.61-6.99%), mineral content (5.88-7.20%), protein (12.26-13.78mg), lipid(7.66-9.81mg) and carbohydrate (50.32-52.50mg) content of the host plant Perseabombycina which lead to the quality of the Muga silk thread like tenacity, strain, young modulus and toughness . The higher trend in temperature attributes for production of a lesser yielding crop proving as a loss to rearers as well to the economy. The higher trend in temperature attributes for production of a regarding crop proving as a loss to rearers and weavers as well to the economy.

Keyword: *Antheraeaassamensis, moisture, mineral,Content, tenacity, strain.*

Comparative Lab Scale Study For Effective Biogas Generation At Institutional Campus

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Sustainability is the word of the decade. With United Nations coming up with sustainable development goals (SDGs), 2030, the viewpoint of world leaders is clear. It is now imperative to focus our attention and efforts in the direction of sustainable development. Educational institutes have a big role to play in this regard and have to lead the way for zero waste assembly. A biogas plant is modern energy source and is suitable to the necessities of the future. With the appropriate application of the digestion technology, the development of economically feasible biogas digesters systems is not beyond the capability of any college. The central purpose of the study is to outline if any, the conditions under which biogas digesters would be feasible for colleges across Delhi-NCR.

In JSSATE there are three canteens having separate mess which generate ample amount of food waste to be used effectively and efficiently for biogas generation. The institute also has a temple in campus from which good amount of flower waste is obtained. The availability of cow dung is met by the cow husbandry in the campus. This paper deals with the design and fabrication of a food waste blend with flower waste biogas generation system. A combination of these mixed with effective micro-organisms (made from common household products)in one cycle and another mixed with cow dung in second cycle was tested for biogas production at room temperature in laboratory (small scale) reactor (20L capacity). The rate of production was determined at laboratory scale using the simple digesters. An experimental setup was designed and implemented in 2 phases.

During the course of the first cycle it was observed that due to addition of effective micro-organisms the pH level in the digester was decreasing drastically. From results it was observed that pH was reducing as the cycle made progress. The reason for reduction in pH was concluded to be due to the bacteria lactobacyillus which was producing fatty acids. Here methanogens bacteria which utilize the fatty acids, were acting at a slower rate whereas hydrolysis and acidogenesis reaction were occurring at a faster rate. In order to increase the pH and maintain it to a desired level of 7-8, lime was added to the digester. However, the addition of lime was not able to control the continuously decreasing pH. Tire tube was inflated and flame test was conducted. A very weak flame was observed. The second cycle was run using slurry mixed with cow dung, which is the conventional method for biogas generation, and it was found that during the course the pH first decreased up to 3 days, to which water was added to increase the pH. The tire tube was observed to be inflated completely and flame test was conducted. The flame was stronger and blue at the core, indicating presence of methane.

The study showed that generation of biogas can be done easily at the college campus. This small scale generator depicts that the college has ample resources to generate considerable amount of gas, replacing LPG cylinders at the mess and canteen can be by biogas as fuel. In order to obtain only methane gas from the biogas it is required to remove other gases from gas being generated. The pure methane obtained can be made useful in several applications such as cooking, using in mantle lamps and in automobiles as fuel. This alternate fuel is useful in many ways and it also overcomes the energy crisis. Further the digested slurry is a useful resource in form of manure. Further studies are being carried out to replace cow dung, which may not be easily available in metro cities these days.

Keywords: *Biogas, Food waste, Cow dung, Effective micro-organisms, Sustainability*

Environmental Sustainability & Water Resource Management Through Decentralised Safe Drinking Water Project With Special Emphasis To Arsenic Contamination Of Ground Water In North Eastern States

Dipankar Adhya

Ceo Adhiacon

Environment & Ecology encompasses a host of things, of which second most important is water. Its meager availability and unchecked exploitation is one of the reasons of naturally occurring arsenic contamination of ground water, drinking which more than 80 million people are at risk of dying in cancer and other related diseases in West Bengal, Jharkhand, Assam, Arunachal Pradesh, Tripura, Nagaland and Manipur in Eastern India and Bangladesh alone. This was termed as the greatest environmental disaster in 20th century.

This unsustainable water exploitation has not only triggered the inorganic contamination like arsenic but also broken the geographical bearer of public health hazard from drinking arsenic contaminated ground water , by entering into the food chain.

With no means of physical delectability, manifestation of arsenic poisoning which takes even up to 8 to 15 years, taking its toll physically, financially and socially in rural and semi urban population.

When Government is working towards safe drinking water to people and 100% coverage is still a distant dream, System losses through piped water supply does not contribute towards developing an ideal water management module and environmental sustainability through optimum utilisation, conservation, harvesting and recharge of this scarce resource.
This requires a movement through community participation in water management more specifically drinking water management. To make this approach a holistic one, rural decentralised drinking water project module was initiated in 2003 and replicated since then. It not only provides safe drinking water to the community but also generates employment, thereby improving general health conditions by reducing medical expenses, loss of man days and contributing greatly in reduction of water loss. This is contrary to large scale adaptations of RO technology for decentralised projects, which gives little thought to its design & its long term ill effects on human health and on quantity and quality of future water resources. This is a grave concern to present day water scientist world around. In case RO is favoured as purifying technology for decentralised drinking water project then it should be complemented with suitable design and community sanitation to make both complimentary to each other. As it is found that one of the main reasons for failure of rural sanitation is the lack of water availability at the toilets.

The arsenic contamination in groundwater of North Eastern States are alarming. In Assam, arsenic contamination of groundwater in 21 of the 27 districts has been detected, Affected districts are Sonitpur, Lakhimpur, Goalpara, Nagaon, Nalbari, Barpeta, Hailakandi, Jorhat, Karimganj, Cachar, Golaghat, Darrang, Bongaigaon, Sivasagar, Dhubri, Dhemaji , Kamrup, Kokrajhar, Tinsukia, Morigaon and Baksa, In Tripura 3 districts out of 4 districts that is West Tripua, Dhalai and North Tripura and in Arunachal Pradesh 6 districts out of 13 districts i.e. Papum Pare, West Kameng, East Kameng, Lower Subansiri, Dibang Valley and Tirap , in Nagaland 2 district out of 8 districts i.e. Mokok Chong and Mon and in Manipur 1 district out of 9 districts i.e. Thoubal where groundwater found to be contaminated with arsenic contamination more that 50 ppb. If safe surface water sources are not readily available then decentralised self

sustained safe drinking water project modules would be most desired alternative with multiple benefits.

Out of many successful installed projects in India and Bangladesh, a successful implementation of such module self sustainable drinking water project is set up with community participation at Rajamayong in Morigaon Dist. Assam.

These self sustained drinking water projects motivates and influence the rural users in optimum utilisation of water as a significant step towards environmental sustainability.

Keywords: *decentralised drinking water project, arsenic contamination, Reverse Osmosis, Community participation,*

Sustainable Utilization Of Marine Waste For Oyster Mushroom Cultivation

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Mushroom is a macro fungus with a distinctive fruiting body. Mushroom harbors good quality of protein and is devoid of cholesterol. It has high fiber and good quality of vitamins and minerals. Mushroom cultivation is an important activity in different parts of our country. It generates employment opportunities for farmers and fisher-women. In mushroom cultivation, three factors such as spawn, good substrate and proper environment have to be satisfied. Main substrates for the cultivation of Pleurotus are paddy straw, wheat straw, corn cobs and hard wood sawdust. To reduce the cost and improve the productivity, there is a need to select cheaper raw material which is available locally as substrate for the production of oyster mushroom.

Mushroom culture aids in proper recycling of agro waste and marine waste. The marine wastes are dumped in the near shore regions causes various environmental issues such as higher rate of mortality of marine organisms due to the production of H2S, harbors various pathogenic microbial communities that intern infects the coastal people, spoil the water table column and makes it inconsumable etc. So the use of these wastes as a substrate for mushroom cultivation will play a vital role in their utilization as well as degradation thereby all the above said problems can be overcome. Moreover, these resources are easily available at very negligible amount, thereby reducing the investment. The mushroom hut doesn't require large area, higher amount of investment, physic work on the other hand it has advantages over quick return, highly profitable, effortless maintenance.

Edible mushroom cultivation is a profitable cottage industry, in which oyster mushroom occupies a prominent place in India. A good substrate is a key factor that determines the profitability of the mushroom cultivation. Marine waste were evaluated for the production of oyster mushroom as a means of managing the vast amount of organic waste that are being generated by fast growing seafood industries. In the present study, sustainable utilization of marine bio-waste for the cultivation of oyster mushroom (Pleurotus florida) and the standardized technology was transferred to scheduled caste population in and around Parangipettai, Tamil Nadu, India. The experimental work was designed with Completely Randomized Design (CRD) with four treatments (375 g of paddy straw with 125 g of fish waste, shell waste, seaweed and seagrass amended separately) and a control (500 g of paddy straw) with three replications. The nutritive value and biological activities of oyster mushroom cultured on different marine waste was evaluated. Average yield was tested in three flushes of P. florida on four different substrates with control. Among various substrates, maximum yield (498.11 ± 7.80 g) was recorded in fish waste. However, minimum average yield (266.91 ± 4.35 g) was recorded in seaweed. The biological efficiency was recorded in four different substrates along with control. Among these, fish waste exhibited highest biological efficiency (99.62 ± 1.56 %). Very least efficiency was observed in control (53.38333± 0.86784 %). The proximate composition such as moisture, protein, carbohydrate, total lipid, crude fiber, amino acids and vitamins were estimated in P. florida which harvested from five different substrates. The highest moisture content (90.71 %) was recorded in paddy straw and the least value (82.97 %) was recorded in shell waste. The highest content of protein was found in fish waste (23.52 %) and the lowest protein was found in seaweed (17.18 %). The lowest lipid percentage was observed in fish waste (4 %) and the highest lipid percentage was observed in paddy straw (8 %). The lowest percentage (22.09 %) of carbohydrate was observed in seaweed substrate and the highest carbohydrate percentage was observed in fish waste (36.54 %). The maximum percentage of crude fiber was observed in fish

waste (14.67 %) and minimum in seaweed (8.75 %). Fish waste substrate was identified to enhance the protein and carbohydrate content in P. florida, so this substrate may be adopted for â-glucan isolation commercially. In vitro study of â-glucan showed moderate cytotoxicity in MCF-7. To the best of our knowledge this is the first study conducted in India, to utilize the marine resources as substrate for mushroom cultivation and hence the waste can be a alternate substrate to grow P. florida commercially.

Moreover, this technology has to be successfully transferred to the fisherwomen and we organized 10 training programmes (380 participants) for scheduled caste women, farmer and research students on mushroom culture using marine waste sponsored by the DST, NFDB, MHRD, and UGC. Continuous hands on training were given to the participants on cultivation of oyster mushroom using marine bio-wastes as supplementary substrate along with paddy straw. During this one month training, the participants understand the technology thoroughly starting from the substrate preparation and processing, spawn handling, mushroom bed preparation, continuous monitoring of the culture environment, harvest, value addition and marketing etc. Currently, two women self help groups have been involved in continuous mushroom production in the culture facility established through DST SEED funded project and they are earning Rs.2000/month as an additional income. It is interesting to note that the oyster mushroom cultivation using marine waste as supplementary substrate along with paddy straw not only increase the yield and nutritional quality but it could be an alternative livelihood and enterprenerial opportunity.

Keywords: *Mushroom, marine waste, proximate composition, alternate livelihood*

Invention of Waste Assimilator for Biodegradable Solid Waste Management and Organic Farming

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Present scenario of mixing of plastic waste along with the biodegradable solid waste are ruined the entire solid waste management activities and developing huge 'waste land' and 'toxic land' day by day in India. To fulfill the requirement, a “Waste Assimilator” is invented (Patent Application No. 1352/KOL/2014) to produce 'bio-pest repellent' and 'organic manure' in the form of Macro & Micro 'Plant nutrients', 'Vermiwash' and finally 'Vermicompost' at household level by utilizing all type of daily generated biodegradable solid waste including Kitchen waste, Fruit and Vegetable waste, Meat & Fish waste, Agricultural waste, Garden waste, Forest waste, Water hyacinth etc. The invention is now generating the concept of solid waste management and 'organic farming' including 'organic Tea gardening' which is also opening a path for economic growth and health benefits out of the waste resources. Through the use of “Waste Assimilator”, up to 80% domestic solid waste problem can be solved and a significant reduction of the roadside dumps including clogging of drains can be achieved. On the other hand, bigger size community “Waste Assimilator” can manage the community or market generated biodegradable solid waste which can inspire large scale organic farming in rural areas.

Keywords: *Solid waste, biodegradable solid wast, Waste Assimilator, plant nutrients, organic farming, organic Tea gardening.*

Aquatic Resource Management

The Study Of Ecology And Conservation Of Wetland Eco-System In Dibrugarh

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A large number of wetlands are present in varying sizes. These wetlands are very important in restoring the biodiversity of the region. Most of these wetlands are small sized. Inspite of the small size the slight variation in climate topography, physico-chemical parameters enhances and encourage the wide range of species diversity in these wetlands and swamps. Lack of fisheries management and widespread illegal fishing is causing great concern to wetland Fisheries of the country. The wise use of wetland and sustainable utilization of the resource for the benefit of mankind is a way compatible with the maintenance of the natural properties of the ecosystem.. These natural properties of the ecosystem were physical, biological and chemical compounds, such as soil, water, plants, animals, nutrients and the interactions between them.

The present paper deals with study of ecology and conservation of the wetland. The wetland selected for the study is Maijan beel (Open beel) connected to river Brahmaputra. Study was conducted from the year 2011 which includes the availability of phyto and zooplankton macro benthic fauna, wetland birds and fishes etc.

Keywords: *Productivity, Environment, Maijan beel.*

Production Of Monosex Tilapia Seeds: From Synthetic Androgens To Phytochemicals

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Developments in manipulation of the reproductive system provide options to enhance production in aquaculture. The use of monosex fish is intrinsically desirable in a variety of fish species including tilapia in a range of aquaculture production systems. Tilapias are currently the second most farmed group of fish (behind carps) with an annual world production of 2.5 million tons and are likely to be the most important cultured fish in the 21st century. Sex-specific differences in growth are significant in Oreochromis sp. where males grow significantly faster, larger and more uniform in size than females. Various methods such as hybridization, hormonal sex reversal, use of nonsteroid aromatase inhibitor and chromosomal manipulation are adopted for induction of sex reversal to produce all male tilapia. Among the methods, hormonal sex reversal using the synthetic androgen 17á-methyltestosterone (17áMT) is regarded to be the most effective. The embryonic tilapia gonad is bipotential, and subsequently follows sex differentiation pathways oriented either towards ovary or testis development. Here, estrogens and androgens play a critical role in gonadal sex differentiation and exogenous sex steroids administered at the time of sex determination can strongly influence the course of sex differentiation. During the specific critical periods of early gonad development, changes in sex hormone levels can affect the final sex independently of the genetic sex.

Three-day-old mixed-sex tilapia juveniles were treated with differential dose (0, 5, 10, 20, 30 mg/kg diet) and duration (0, 15, 30, 45, 60 days) regimes of 17áMT. Treatment regimes 10, 20, 30 mg/kg-30, 45, 60 days showed ~95% males, while 0 mg/kg-0 days (control) showed ~50% males ($P<0.01$). Considering the results of that experiment, the 10 mg/kg-30 days 17áMT treatment was determined to be effective, practical, and economically viable optimum hormone treatment regime under Indian pretext.

However, due to consumer concerns and strict regulations in many countries, the use of synthetic chemicals, hormones and antibiotics is becoming unviable and natural compounds are more acceptable to the public. A wide variety of chemical compounds such as alkaloids, flavonoids, pigments, phenolics, terpenoids, steroids and essential oils are found in plants, and many of them have been shown to have beneficial effects on appetite, growth and the immune status of fish. The phytochemicals may also act as endocrine modulators that can be applied for production of monosex tilapia population as a potential alternative to 17áMT. Different mechanisms such as the effects at the steroid receptor level, effects on steroid synthesis, distribution and excretion, actions on the hypothalamuspituitarygonad axis have been postulated for the reproductive endocrine disruption in fish populations by phytochemicals. But, there are significant variations regarding the efficacy of different phytochemicals for production of all-male fish population and the potential anabolizing and virilizing effects of such plant extracts needs to be clearly documented.

Plants such as Basella alba (leaves), Tribulus terrestris (seeds), Mucuna pruriens (seeds) and Asparagus racemosus (roots), which have reported aphrodisiac effects in males are selected to find a suitable alternative for 17áMT to induce sex reversal in tilapia. Several studies are being conducted to determine the ideal mode of administration, suitable solvent for extraction of active constituents, dose and duration of treatment with the plant materials for procurement of all-male tilapia seeds. Treatment with all the plant materials showed no adverse effect on general fish

health and survival percentage. Dietary administration of the powdered plant materials and immersion of fish in aqueous extracts of the plant resulted in significantly ($P<0.05$) higher percentage of males compared to that in control fish. For dietary administration of B. alba leaves, the highest percentage of males (83.2±0.7) was obtained by treatment with ethanol extract at the concentration of 1.0 gm/kg feed, while with T. terrestris seeds, the highest percentage of males (88.9±1.1) was obtained with ethanol extract at the concentration of 1.5 gm/kg feed. Immersion treatment with aqueous extract of A. racemosus roots at a concentration of 0.015 g/L produced the highest percentage (90.60±1.56) of males.

Though the initial results with the plant materials are encouraging, it is early to conclude that phytochemicals from the selected plants would replace dietary administration of 17áMT as the most suitable method for monosex tilapia production. However, it may be mentioned that even treatment with 17áMT has failed to achieve 100% sex reversal in Oreochromis sp. Thus, further research in this regard may provide the necessary insight to find a suitable plant material as a sustainable alternative to the synthetic androgen.

Keywords: *17á-methyltestosterone, Sex reversal, Oreochromis sp., Basella alba, Tribulus terrestris, Mucuna pruriens, Asparagus racemosus*

Taxonomic Study Of An Interesting Rare Tapeworm From Fresh Water Edible Fish Of Central India

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During the cesto-piscian study of Central India. We come across this very important district Jalaun.Twenty two fresh water fish, Heteropneustesfossilis (Bloch.) were examined at Yamuna river, Kalpi region district Jalaun (U.P.) India, four of them yielded six parasites in its intestine. Parasites were unsegmented tapeworms which were preserved in 5% formalin in the laboratory these parasites were thoroughly washed, stained, mounted and ultimately identified as new member of family of familyCapingentidae Hunter,1930; order PseudophyllidesCarus, 1863.

Keywords: *Taxonomic, rare tapeworm, Fresh Water Fish, Capingentidae, Central India*

Pesticide-Induced Alteration In Neurological Enzymes And Antioxidant Status In Notopterus Brain

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Extensive use of pesticides and insecticides in agriculture is emerging as a major threat to the ecological balance in aquatic environments. These chemicals cause adverse effects by disturbing the physiological and behavioral coordination of non-target aquatic organisms such as fish, throughout the world. Therefore, the presence of such chemicals in the environment is a global issue which may pose a threat to fish. The mechanism of pesticide-induced impairment of nervous system function, particularly in fish, remains unclear till date. Therefore in this study, Notopterus sp., a widely used model in aquatic toxicology and an important economic fish, was exposed to permethrin to determine its chronic effects on biochemical and physiological responses in fish brain. The objectives of the present study were to gain insight into the mechanisms underlying pesticide-induced neural toxicity in fish by assessing oxidative stress indices, Na+-K+-ATPase activity and neurological parameters. Adult Notopterus (Mean wt. 110 ± 3.4 gm) (n=6, 3 replicates) were exposed to permethrin at 0 µg/l (control), 1/10th (0.64 µg/l) and 1/20th (0.32 µg/l) of LC50 for 14 days. After 14 days of pesticide treatment, brain tissue were collected to measure the levels of different enzymatic [superoxide dismutase (SOD), catalase (CAT), glutathione S-transferase (GST) and glutathione reductase (GRd)] and non-enzymatic antioxidants [malondialdehyde (MDA) and glutathione (GSH)]. Activity of brain enzymes (Na+-K+-ATPase, acetylcholine esterase, monoamine oxidase and nitric oxide) were also evaluated. Pesticide treatment caused significant ($P < 0.05$) decrease in the levels of glutathione, monoamine oxidase, nitric oxide, Na+-K+ ATPase and acetylcholine esterase in both treatment doses compared to those in control. Stress marker malondialdehyde level increased significantly ($P < 0.05$) for both experimental doses than control. However, levels of SOD, CAT, GST and GRd were noted to increase at the low dose but decrease at the higher treatment dose. It was evident from the results that the pesticide permethrin caused considerable neural damage with alteration of its redox state and neurological enzymes.

Keywords: *permethrin, oxidative stress, redox state, neural damage*

Pesticide-Induced Toxicity In Gills Of Notopterus Sp. Study On Some Enzymatic And Non-Enzymatic Stress Markers

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Use of non-degradable pesticides and insecticides in agriculture is one of the most important threats to the aquatic environments. The toxicity of these anthropogenic agents reflects out an unfavorable condition for various non-target aquatic organisms such as fish by disrupting their physiological and behavioral harmony. Fish gill, the multifunctional organ supporting gas exchange, ion transport, excretion of nitrogenous waste and osmosis is one of the major target site of these pesticides as the organ remain in direct contact with water. In the present study, Notopterus sp., a widely used model in aquatic toxicology was exposed to permethrin to evaluate the chronic effects of this widely used pesticide on fish gill. Aim of the present study was to understand toxicity in fish gill exposed to the pesticide by measuring the length specific oxygen consumption (LOC) rate and activities of different oxidative and non oxidative enzymes in fish gill. Adult Notopterus sp. (Mean wt. 110.0 ± 3.4 gm) (n=6, 3 replicates) were exposed to permethrin at 0 µg/l (control), 1/10th (0.64 µg/l) and 1/20th (0.32 µg/l) of LC50 for 14 days and the oxygen consumption rate was measured on each day for both the doses and control. Significant variability ($P<0.05$) in oxygen consumption rate was observed between the control and pesticide treated groups. After 14 days of pesticide treatment, gill tissues were collected to measure the levels of different enzymatic [superoxide dismutase (SOD), catalase (CAT), glutathione S-transferase (GST) and glutathione reductase (GRd)], non-enzymatic [malondialdehyde (MDA) and glutathione (GSH)] antioxidants, and activity of Na+-K+-ATPase was also evaluated. Oxygen consumption rate of permethrin treated fishes were much less compared to that in control. Stress marker malondialdehyde level increased significantly ($P< 0.05$) for both experimental doses than control. Pesticide treatment caused significant ($P< 0.05$) decrease in the levels of Na+-K+ ATPase in both treatment doses compared to those in control. However, levels of SOD, CAT, GST, GRd and GSH were noted to increase at the low dose but decrease at the higher treatment dose. It was evident from the results that the pesticide permethrin caused gill damage and an oxidative stress via products from lipid peroxidation and impairing functions of antioxidant systems in gill tissue of Notopterus sp.

Keywords: *permethrin, oxygen consumption rate, antioxidant, redox state*

Administration Of Basella Alba Leaves And Tribulus Terrestris Seeds For Monosex Tilapia Production

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The Nile tilapia is a widely-studied, fast-growing and well cultured fish species. Currently it is ranked second only to carps in global production and is likely to be the most important cultured fish in near future. Rapid growth, efficient food conversion, ease of spawning and good consumer demand makes tilapia a suitable fish for culture. Female tilapias have a high fecundity and exhibit stunted somatic growth at higher densities, while male tilapias exhibit faster growth rates and are often the preferred gender for aquaculture. 17á-methyl testosterone is commonly used to induce sex reversal in tilapia but because of the potential environmental issues concerning the use of synthetic steroids, use of natural phytochemicals is a potential alternative to be explored. Plant extracts containing alkaloids, flavonoids, pigments, phenolics, terpenoids and steroids have been reported to promote various bioactivities in fish culture. Phytochemicals are also reported to block biosynthesis and also the action of estrogen by either acting as aromatase inhibitors or antagonists to nuclear estrogen receptor. Hence plant extracts may be considered as potential mean for inducing sex reversal in fish. Basella alba has been reported to increase testosterone production in adult male rat testes during in vitro studies. Tribulus terrestris also has been reported to raise testosterone levels in fish when administered through immersion technique. The objective of the present study was to investigate the potential effect of both the plants on the masculinisation of Nile tilapia, compare direct feeding and immersion techniques as methods for in vivo application, and determine the ideal concentration for each application method. The mixed sex juveniles of Nile tilapia were subjected to dietary treatment containing powdered B. alba leaves and T. terrestris seeds at concentrations (0.0, 5.0, 10.0, 15.0 g/kg feed) and immersion treatment with aqueous extracts of both plant materials at concentration (0.0, 0.05, 0.1, 0.15 g/l). There was no significant difference ($P>0.05$) in survival percentage between different treatment categories for both treatments. Dietary treatment with both plant materials produced significantly higher percentage ($P<0.05$) of males compared to that of control groups. There was no significant difference ($P>0.05$) in male percentage between treatments with B. alba and T. terrestris during dietary and immersion experiments. For dietary treatment, the highest percentage of males (76.6±0.5) was observed with T. terrestris at the concentration of 15.0 g/kg, while immersion treatment with T. terrestris aqueous extract at a concentration of 0.15 g/l showed the highest percentage of males (81.4±0.5). Preliminary screening revealed the presence of tannins, saponins, steroids and alkaloids in both plants. These phytoconstituents might render the androgenic activity of the extracts. The study indicates that T. terrestris can be regarded as a potential alternative for induction of sex reversal as it produced higher percentage of males compared to B. alba by both treatment methods.

Keywords: *Phytochemicals, Dietary treatment, Immersion treatment, Sex reversal, Methyl testosterone, Aromatase*

Production Of Monosex Nile Tilapia, Oreochromis Niloticus Using Roots Of Asparagus racemosus

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The Nile tilapia is a widely cultured fish species because of its growth, disease resistance and good consumer acceptance. Monosex culture of male tilapias is preferred as male tilapias exhibit faster growth rates. Use of steroid hormones to produce monosex tilapia populations is well documented. Due to the ecological and health hazards speculated with the use of such synthetic steroids, plant materials are considered a potential alternative for monosex tilapia production. Phytochemicals have been reported to affect the steroidogenic pathway of fish by inhibiting aromatase. Hence phytoconstituents may be considered as potential mean for inducing sex reversal in fish. Asparagus racemosus is reported to have aphrodisiac effects in mammals. It was also reported to stimulate growth in fish. The objective of the present study was to evaluate the efficacy of A. racemosus root extract for masculinisation of Nile tilapia during its in vivo application through immersion technique. Three days old mixed sex juveniles of Nile tilapia (mean weight 0.025 ± 0.009 g; mean length 1.25 ± 0.012 cm) were treated by immersion method with aqueous extract of the plant roots at the concentration of 0.0 (control), 0.01, 0.015, 0.02 g/L for four weeks. Treatment with concentration 0.015 g/L showed the highest survival percentage (95.56±1.12). Groups treated with the plant extract resulted in significantly higher ($P<0.05$) percentage of males compared to the control groups. The highest male percentage (90.60±1.56) was obtained in 0.015 g/L group, which was significantly higher ($P<0.05$) compared to all other category. The highest percentage of females (56.92±3.07) was observed in the control group and it was significantly higher ($P<0.05$) than all the treatment categories. The control diet fed group showed no intersex fish while the highest percentage of intersex fish (1.45±1.44) was observed at the concentration of 0.02 g/L of immersion treatment with A. racemosus. The roots of A. racemosus contain saponin, steroid/terpenoid and tannin. These phytoconstituents might be responsible for the masculinisation effect of the extracts. The study indicates that A. racemosus aqueous extract might be used as a potential alternative of synthetic steroids for production of all-male tilapia population.

Keywords: *Monosex, Sex Reversal, Phytochemicals, Aromatase, Saponin*

Influence of Dietary Supplementation of Botanical Additives on Growth And Colouration of Ornamental Fish Species of Assam

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Maintenance of diseases and retention of body colouration of native aquarium fishes are two major challenges faced by the entrepreneurs. The study focused on maintenance of the two fish species Macrognathus pancalus and Botia dario in captive condition by treating with herbal extracts. Fish feed were prepared with Ocimum sanctum (Tulsi), Azadirachta indica (neem), Allium sativum (garlic), Zingiber officinale (ginger) plant extract and some carotenoid source such as marigold petal and carrot. By oral administration of the formulated feed with these plant extracts at different concentrations, control of fish pathogens, enhances the growth and retention of body colouration of selected ornamental fish species have been achieved to a large extent in captive condition. The survival and growth of the experimental fishes were highest with T4 treatment (with 2% medicinal plant extract) compared with the other treatments. The secondary metabolites of plant products have been found eco friendly, cost effective and more importantly, readily prepared which is an added advantage for the rural entrepreneurs. In view of deteriorating effects on aquaculture due to use of synthetic products, the researchers are emphasizing the need for natural product which will act as alternative to synthetic chemicals.

Keywords: *Macrognathus pancalus, Botia dario, herbal extracts, captive condition*

Consequences of Metal Toxicity on Status of Antioxidative And Mitochondrial Parameters In Muscle of Oreochromis mossambicus

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In current scenario, presence of different metals in aquatic environment poses considerable threat to ecosystems and inhabiting populations. Rapid urbanization and industrialization mainly contribute to the metal loading status of different aquatic ecosystems in recent times. Oreochromis mossambicus is a preferential food fish due to its high fecundity rate, low culture cost and major source of protein at low price.The fish is often cultured in sewage-fed aquaculture ponds and thus is exposed to different metals at high concentrations. Present study investigates the effects of accumulation of five different metals [Lead, Copper, Cadmium, Nickel and Zinc] on antioxidant system and mitochondrial enzymes functionality in muscles of Oreochromis mossambicuscollected from waterbodies in and around Kolkata. Water and fish were collected from waterbodies at Diamond Harbour and Nalban Bheri. Concentrations of the five metals were measured in water and fish muscles from the two sites. Activities of different muscle mitochondrial enzymes [Ca2+ATPase, Lipoamide reductase, Lactate dehydrogenase, Succinate dehydrogenase, AMP deaminase, Aldolase, Cytochrome C oxidase, Acetycholiesterase], different enzymatic [Superoxide dismutase, Catalase, Glutathione reductase, Glutathione peroxidise, Glutathione S-transferase] and non-enzymatic [Reduced glutathione, malonaldialdehyde] oxidative stress parameters were measured in the fish muscles from both sites. Concentrations of all metals in water and fish muscles were found to be significantly higher ($P<0.05$) at Nalban Bheri compared to those at Diamond Harbour. Metal accumulation in fish muscle significantly upregulated ($P<0.05$) stress marker malondialdehyde denoting higher lipid peroxidation. The activity of antioxidative enzymes also increased significantly ($P<0.05$) in fish with higher metal concentration in muscle. Metal exposure to fish muscle downregulated the activity level of different mitochondrial enzymes. Except succinate dehydrogenase, lactate dehydrogenase and Ca2+ATPase, all mitochondrial enzymes showed positive correlation with GSH, GPx and GRd level but negative correlation with other antioxidants and stress marker. Analysis of these biomarkers clearly indicates the change in oxidative status in muscle tissues and provides insight to muscle response to the metal exposure. Therefore, the study outlines the potential use of biomarkers in context of muscle mitochondrial enzymes relating to oxidative changes that take place in the muscle of Oreochromis mossambicus following metal exposure and toxicity.

Keywords: *Fish, Metals,Antioxidants, Muscle, Mitochondrial enzymes*

Phytoremediation Potential of Aquatic Macrophyte Spirodela Polyrhiza with Reference to Cadmium and Chromium

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The present study examine the potential of Spirodela polyrhiza- a free floating aquatic plant, to phytoremediate Cd and Cr from aqueous solution. Spirodela was exposed to three different cadmium and chromium concentrations, such as, 2.0, 4.0 and 6.0 ppm and the experiment was conducted for 28 days. At the end of the experimental period, plant samples were harvested from each enclosure and accumulated cadmium and chromium content was measured. Experimental results revealed that Spirodela polyrhiza was capable of removing considerably high cadmium and chromium concentrations (56.77-85% and 66.66-79.17%). Bioconcentration factor demonstrated that Spirodela polyrhiza has more accumulation potential of Cr over Cd except at lower concentration. The present study revealed that Spirodela polyrhiza was moderate accumulator of these two heavy metals.

Keywords: *Spirodela polyrhiza, cadmium, chromium, bio-concentration factor, phytoremediation*

Effect Of Heavy Maetals On Physiology Of Fresh Water Fish: Rasbora Daniconius

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Heavy metals pose a great threat to aquatic organism not only because they are highly toxic in low quantity but also because of their potential characteristic of combining with biological moleculs. Metals like mercury, cadmium and lead all show a great affinity for sulfhydryl (-SH) groups and exert toxic effects largely by combining with such groups on proteins. One of the most significant effect of metallic pollution is that aquatic organisms can absorb and accumulate concentrations in their tissues. For example, there may be up to 15 times as much mercury present in fish. The LC10 and LC50 values for heavy metals were summarized in (Table No 03).The LC10 of lead acetate for 24, 48, 72, and 96 hours were 3.34,3.80, 1.99 and 1.90 ppm respectively. The LC10 of zinc sulphate for 24, 48, 72 and 96 hours were 6.64, 5.71, 2.99 and 1.99 ppm respectively. The LC10 of nickel chloride for 24, 48, 72 and 96 hours were61.07, 18.63, 23.09 and 9.29 ppm respectively. The LC50 of zinc sulphate for 24, 48, 72 and 96 hrs were 14.6, 12.65, 9.38 and 6.26 ppm respectively and LC50 of nickel chloride for 24, 48, 72 and 96 hrs were 82.78, 69.15, 44.86 and 29.22 ppm respectively. Where as in preset study no such behavioral changes were noticed in the control fish, which remained active and healthy throughout the experimental period.

Keywords: *Heavy metals, Rasbora daniconius, Toxicity.*

Prospects Of Freshwater Shell-Fish And Threatened Fin-Fish Culture In Cages In West Bengal, India

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Fingerlings of Puntius sarana (0.86g), Mystus vittatus (3.77g) and Macrobrachium rosenbergii (2.70g) were cultured in three experimental cages (size: 2m x 1.5m x 1m) in duplicate of each installed in an earthen pond for a period of 150 days with uniform stocking density (50 Nos./m2) without hampering the existing culture practices. Supplementary feed was applied daily @ 10% of the body weight for initial 15 days and then @ 5% of the body weight splitting into 2 times in a day. The water quality parameters (pH, dissolve oxygen, hardness, conductivity, transparency, PO4-P and NO3-N) of the cage water were estimated fortnightly and found within the acceptable ranges for freshwater fish culture. Length and weight was strongly related with each other but the condition factor (K) of the fin-fish and shell-fish decreased with the increase in the culture period that indicated their well adaptation in the new system. The percentage of average growth of P. sarana (7.23±1.96% to 10.39±0.54%) and M. vittatus (5.39±5.12% to 8.19±0.41%) were near about similar pattern. However, in M. rosenbergii, it was little high (8.96±5.96% to 27.82±0.51%) and increased sharply. The specific growth rate (both length and weight per day) decreased from 15 day to 150 day in all the cages. The maximum survival percentage observed in P. sarana, M. vittatus and M. rosenbergii were 88±2.83%, 93±2.83% and 85±7.07% respectively. However, the maximum production observed in M. rosenbergii (1.90±0.16 kg/m2) followed by M. vittatus (0.75±0.01 kg/m2) and P. sarana (0.73±0.02 kg/m2). In the economic point of view, the maximum profit achieved in M. rosenbergii (INR 1,435/-) followed by M. vittatus (INR 167/-) and M. sarana (INR 104.6/-) after 150 days of culture. The production may be increased further by enhancing the stocking density and intensification of the culture method through management of feed and water quality parameters, which may accelerate the net profit also in addition to the existing farming income.

Keywords: *Cage culture, Puntius sarana, Mystus vittatus, Macrobrachium rosenbergii Condition factor, Growth, Survival, Production*

Socio-Economic Importance Of Coastal Wetlands Of Sundarban And Possible Threats

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Wetland ecosystem provides many ecological services that contribute to human wellbeing and poverty alleviation. More than 75% of commercial fish species require wetlands to complete part of their life cycle. Yet, wetlands are endangered and under-valued.

Anthropogenic interference in Sundarban is achieving high economic profit at the cost of high ecological loss. The aquatic resources of the Sundarban Mangrove Forest (SMF) are an important component of its biodiversity and are an important source of food and income for human populations.

A study has been carried out on two estuarine wetlands of Nakhana and Gangadharpur area of Sunderban coastal region from March 2016 to March 2017. Basic water quality parameters, important for the aquatic system were measured and were found to be within the range of the accepted standard values. Fish diversity, catch data, weight, size were monitored in different seasons. Day catch and night catch were also measured to assess the existing fishery resources in the study area. A large variety of edible and ornamental fish species was observed. Different shellfish and prawn species were found to draw large attention to the fisher folk community for good economic earning. The socio-economic survey revealed that a large number of individuals and whole family member are engaged in collecting the fishery resources from the coastal wetlands round the year, and the number of people increases with increasing availability of the fishery resources during peak season. The ratio of men and women fishermen was almost equal in both study area.

Various types of fishing gears are employed to catch fishes and the type of gears changes with size of the species, their seasonal availability and also with time of collection. Being motivated by probable higher income, poor people rush for wild fish seed collection. Many poor females and minors of Sundarbans are sustaining on unscientific collection of prawn seedlings by mosquito nets. They destroy all other juvenile species while sorting out prawn seedling alone, that are to be sold to commercial bheri-owners. The prawn seedlings fetch a higher price compared to adults of some other fish species. This may be alarming for the ecology and economy of the Sunderban. Survey into ecologically as well as economically resourceful area of Sundarbans should be conducted and conservative use of aquatic resources might be regarded as the best way to achieve environmental sustainability in Sundarbans. Research works must consider ensuring protection, conservation and better management of resources but that must not debar people from using these resources. It should aim at a particular pattern of use of resources so that these will neither be exhausted, nor polluted or destroyed. Fish productivity, abundance, and distribution, biophysical and socioeconomic condition of the local communities are likely to be impacted by climate change. Small-scale fishing communities are considered especially vulnerable to the negative impacts of climate variability and change. Impacts on catch and processing will ultimately influence employment, income, and nutrition of fishery-dependent households and communities.

Keywords: *fish diversity, fishing gear, market demand, socio-economic survey*

Effects Of Wastewater Toxicity From An Urban Water Channel Of Bharalu River On Some Haematological Parameters Of Channa Punctata (Bloch)

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The Bharalu River, a small southern tributary of the Brahmaputra River has been transformed into a drainage channel of Guwahati city. The aim of the present study was to evaluate wastewater toxicity from an urban water channel of Bharalu River on certain haematological parameters viz: Total erythrocyte count (TEC), Total leukocyte count (TLC), Haemoglobin content (Hb)) and Differential leukocyte count (DLC) in Channa punctata (Bloch) in laboratory condition. After detecting the LC50 fishes were treated with one sub- lethal concentration of wastewater for 5, 10 and 15 days and simultaneously one control group was maintained. Blood samples were collected from each species treated for specified days. It has been observed a significant decrease ($p<0.05$) in Total erythrocyte count (TEC), Haemoglobin content (Hb) and increase in the Total leukocyte count (TLC) in treated fishes comparison to the fishes of control group.

Keywords: *Bharalu River, wastewater, haematological parameters, Channa punctata.*

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.

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

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.

Keywords: *Organophosphate insecticide, Sukhana river, rogor, Channa striatus, proteins.*

Frp Carp Hatchery: A Tool For Supplying Quality Seed For Aquaculture in North-East Region of India

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Fish played key role in the nutrition security of the North Eastern India constituting eight states due to availability of water resources and food preferences. NE states share 1.2% of national population, but around 9.2 million fish consumers (3.1% of fish consumers of the country) consume at the rate of 10.9 kg per capita per year. Though consumption rate is comparable, the potential level of consumption is very high looking at the price and preferences for fish. In recent times, population pressure and reduced capacity of capture fisheries resources created imbalances in the demand supply situation in fish and fisheries products leading to rise in the prices and heavy inflow of the fishes from other regions.

The future demand shall increasingly be met from aquaculture. In the region about 0.35 million ha of ponds and tanks are available, which is 14.3% of national aquaculture resources, but the productivity is very low (1.25 t/ha/yr) compared to national average (2.90 t/ha/yr). The region has the yield gap of 4.75 t/ha/yr considering achievable productivity of 6.0 t/ha/yr. There is a scope to increase productivity at about 4 times, which shall increase availability of fish by 4 times in the region. Such large opportunity for the development of freshwater aquaculture creates golden opportunity for aquaculture development in the region.

The data on the production from aquaculture is not available; however, the inland fisheries production can be taken as proxy to assess performance of the sector. During the period of 2000-2015, the fish production has doubled growing at the rater of 4.3% per annum compared to the national growth rates of 4.0%. Looking at the growth potential, the sector can grow at the rate of more than 10% per year. The state like Tripura is able to grow at the rate of 7.7% per annum and has shown feasibility of achieving such growth rates. Within the region, Assam contributes 70% and Tripura 15.8%, indicating lope-sided development of the sector in the region. All the other states together contribute only about 16% of fish production. States like Sikkim, Meghalaya and Nagaland have shown the promise by reporting higher rates of growth. Therefore, the potential for growth in the region in general and smaller states in particular is very high and has the scope of growing at more than 10% per year.

The major constraint in aquaculture is the availability of quality fish seed in adequate quantity. Historically, NE states were dependent upon West Bengal and neighbor country for fish seed, but in recent times seed production scenario has improved. At present whole region produces about 5.6% of national production, out of which 81% and 13% are produced by Assam and Tripura, while other NE states produce only 6% of seed. Despite higher demand, the seed availability is low and not able to meet the requirement for aquaculture development. Therefore, the production of large quantities of fish seed in diverse locations is important for the self-sustaining aquaculture in the region. Availability of good quality seed requires scientifically managed seed production system.

ICAR-All India Coordinated Research Project (AICRP) on Plasticulture Engineering and Technology (PET), centre at ICAR-CIFA, Bhubaneswar has designed and developed a complete set of hatchery system in fibre-reinforced plastic (FRP) for fish breeding and seed rearing. The hatchery has been found to be a suitable gadget, as the users can easily install and operate it anywhere in India. It requires less space (6.0 x 3.0 m) for installation and can even be placed on a pond dyke; easy to repair and replace minor fittings; less weight and durable for 15 years. In one run 1.0-1.2 million carp spawn can be produced from the system. The system is suitable in field conditions for breeding most of the cultured Asiatic carps viz., rohu (Labeo rohita); catla (Catla catla); mrigal (Cirrhinus mrigala); kalbasu (Labeo calbasu); fimbriatus (Labeo fimbriatus); silver carp (Hypophthalmichthys molitrix);

grass carp (Ctenopharyngodon idella); and common carp (Cyprinus carpio). In lean season the system can be used for ornamental fish rearing or common carp breeding or water storing.

Within a short span of time (from 2006), the dissemination of the technology has been quite remarkable. By 31 March 2017, there are 362 hatchery units established in India and out of that 186 in NE region (Assam 65, Arunachal Pradesh 21, Mizoram 10, Sikkim 2, Tripura 28, Nagaland 6, Meghalaya 31 and Manipur 23). This accounts 51.38% of total installations of the country. The most important users of the technology are the KVKs, ICAR institutes, Universities, Corporates and State Governments.

National Fisheries Development Board (NFDB), Ministry of Agriculture and Farmers Welfare, Govt. of India, Hyderabad in 2013 has intimated different State Governments of the country for adoption of FRP Carp Hatchery Technology in their policies. Working Group on Agriculture Research and Education for the Eleventh Five Year Plan (2007-2012), Government of India, Planning Commission stated "Installation of FRP carp hatchery and induced fish breeding in some tribal districts of North-East Hill Region would help in enhancing the seed production to at least 50% more". This technology is being introduced in Meghalaya through its Aquaculture Mission. Government of Tripura has introduced the FRP carp hatcheries in its procurement policy and procured 24 units during 2013-2017 for installation under Rashtriya Krishi Vikas Yojana (RKVY). Amalgamated Plantations Pvt. Ltd. (APPL) (A TATA Tea Estate), second largest tea producer in India with support from National Fish Development Board (NFDB) has become the single largest organized producer of freshwater fish in NE Region. It had established five FRP carp hatchery units (at Nonoi, Nahorani, Namroop, Chubwa and Powai T.E.) with the help of ICAR-CIFA. A number of FRP carp hatcheries are being supplied to the farmers of Assam and became a gadget in its Aquaculture Mission for quality seed production. To boost up seed production, 9 FRP carp hatcheries under Rashtriya Krishi Vikas Yojana (RKVY) are being installed in 8 districts covering 9 progressive farmers in Arunachal Pradesh during 12 Five Year Plan.

The FRP hatchery is proved to be an important tool for quality seed production. The establishment of hatchery replaced cumbersome process of construction of cemented hatchery, acquiring technical knowledge and design in development of cemented hatchery, reducing cost and time in hatchery establishment. Moreover, the portable nature of gadget has the advantage of shifting it as per requirements. Along with the hatchery, ICAR-CIFA is also providing the technology of breeding, broodstock management, seed nursing and rearing, which are important to develop a seed production system. The assets along with the knowledge formed the basis for creation of quality seed production system as farmers and operators were able to follow the scientific guidelines in the seed production.

The quality seed production was assured as farmers adopted maintenance of good quality brood stock, providing brood stock feed, maintenance of water quality, using optimum doses of hormone, production of healthy spawn and maintenance of pond environment for seed rearing. This had upgraded quality of the stocking materials produced from the seed production system which has contributed to the better growth and higher productivity of aquaculture. Therefore, the development of the seed production system catered to both quantity and quality issue of carp fish seed in the areas of adoption of FRP hatchery.

Keywords: *FRP hatchery, carp seed production, quality seed, NE region*

Productivity Status Oof Selected Tribal Fish Ponds Of Ganjam District, Odisha, India

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Aquaculture provides cheap animal protein and livelihood support to the rural population in India. Ganjam District, Odisha is situated in between 19.4^0 - 20.17^0 North Latitude and 84.7^0 - 85.12^0 East Longitude. Agriculture is the backbone of the economy and around 80% people of the district depend on it. In Department of Science and Technology (DST), Govt. of India sponsored project at ICAR-CIFA, four C.D. Blocks namely, Khallikote, Kukudakhandi, Digapahandi & Sanakhemundi of the district were selected for the present study. Total 16 ponds were selected from these four blocks. Kukudakhandi, Sanakhemundi, Digapahandi and Khalikote have 4, 4, 5 and 3 numbers of ponds with WSA of 2, 1.6, 7.2 and 0.8 ha respectively. Status of physico-chemical parameters and plankton productivity of these selected fish ponds were studied during June-December 2017. Samples were collected bi-monthly from the selected fish ponds. Water temperature, pH, DO, total alkalinity, total hardness, ammonium, nitrite, nitrate, and phosphate were analyzed following standard laboratory procedures. To assess the productivity status of ponds, quantitative estimation of plankton was done for each pond right in the site during sampling. The range and mean of the water parameters and plankton quantity of these fish ponds are given in the table below:

	Kukudakhandi		**Digapahandi**		**Sanakhemundi**		**Khalikote**	
Parameters	**Range**	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**	**Mean**
pH	6.85-8.4	7.69	6.49-9.73	8.13	7.21-8.6	7.85	7.6-7.8	7.65
Temperature (^{0}C)	23-31.2	27.6	28-30.9	29.46	26.3-30.2	28.9	26.3-29.8	27.5
Conductivity (mS/cm)	129-461	293.0	67.7-306	175.3	102-393	277.1	210-289	246.3
TDS (mg/l)	132-328	225.1	47.5-216	126.8	106-277	213.9	110-241	158
DO (mg/l)	3.20-12.8	6.27	4-24	12.62	3.2-5.6	4.50	3.2-4.8	4.26
Alkalinity (mg/l)	100-200	132.5	72-180	111.3	100-192	141	109-112	110
Hardness (mg/l)	75-135	105.6	40-125	77.9	100-200	151	90-113	105
NH_4 (mg/l)	0.05-1.134	0.50	0.155-1.962	0.67	0.056-1.52	0.52	0.926-1.102	0.988
NO_2 (mg/l)	0.02-1.255	0.60	0.025-1.549	0.52	0.156-1.579	0.74	0.865-0.985	0.907
NO_3 (mg/l)	0.01-1.306	0.53	0.0023-1.41	0.36	0.003-1.421	0.61	0.364-0.890	0.570
PO4 (mg/l)	0.00-0.977	0.30	0.001-0.228	0.08	0.001-0.977	0.23	0.128-0.525	0.278
Plankton volume (ml/50 l of pond water)	0.80-2.2	1.48	0.8-1.8	1.32	0-1.4	0.64	0.8-1.1	0.66

Total 12 types of major phytoplankton species and 6 types of major zooplankton species were found in all the collected pond water samples. The plankton species recorded in the adopted ponds are Blue green algae (*Anabaena*, *Rivularia*) Green algae (*Ankistrodesmus*, *Protococcus*, *Microspora*, *Botryoccous, Spirogyra*); Diatoms (*Melosira*, *Diatoma*, *Navicula*, *Synedra, Frustulia*) and the zooplankton species (*Diaptomous, Daphnia, Copepods, Cladocerans, Cyclops, Monia*). From quantitative analysis of plankton, it was found that the ponds of Kukudakhandi Block were more productive than the ponds of Digapahandi, Khalikote and Sanakhemundi in that order. Most of the ponds were seen below the normal productivity level of 2 ml plankton/ 50 l of water. The ponds were prepared for freshwater fish culture based on the available chemical and biological data, and better management practices (BMP) were followed accordingly.

Keywords: *Phytoplankton, productivity of pond, physico-chemical parameters, fish culture, livelihood support*

Length-Weight Relationship and Condition Factor of Laubuka laubuca and Devario Devario (Hamilton,1822) from Lower Brahmaputra Drainage in Assam, North-East India

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The study describes some biological parameters including length weight relationship and condition factors of two fish species Laubuka laubuca and Devario devario (Hamilton, 1822) collected from Kamrup district of Assam, North-East India. The total 121 specimens (76 for L. laubuca and 45 for D. devario) were monthly sampled during April 2016 to January 2017.Length (mm) and weight (g) were measured following standard equipments. Length weight relationship was described by equation W=aLb while condition factor was determined using the equation K=100(W/L3). The regression coefficient 'b' for L. laubuca and D.devario were respectively 3.45 and 3.14 having the r2 values respectively 0.94 and 0.95. general well being of the fishes were found to be good as indicated by the mean value of condition factor (1.27±0.17 for L.laubuca and 1.36±0.08 for D.devario).The objective was to evaluate the pattern of LWR and condition factors of the two freshwater fish species to provide baseline information and important contribution for future research.

Keywords: *LWR, condition factor, L. laubuca and D. devario.*

Jhora Pond Fishery And Its Management in Darjeeling Hills Of West Bengal

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The northern part of the state of West Bengal, particularly Darjeeling hills has been bestowed with plenty of perennial rivers and small streams with tremendous scope for fishery development. Till 1980, there was no incidence of organized fish culture approach in the Darjeeling hill areas. In 1981, the Department of Fisheries, Government of West Bengal, stepped towards popularization of fishery in Jhora ponds, in Darjeeling hill areas through scientific management of economically viable species of carps suiting the agro-climatic conditions of the region. The encouraging results promoted State Fisheries Department to construct 4193 Jhora fishery units with the assistance of Fish Farmers Development Agency (FFDA) programmes. But, over the years, there has been a lack of proper research and extension support. As a result, most of the Jhora fishery units were subjected to unscientific fish culture. Therefore, with the aim of improving the socio-economic condition of weaker sections (mainly SC/ST) of Darjeeling hills integrated farming and management of fish with livestock and horticulture was initiated in Jhora ponds of Pemling village under Kalimpong sub-division and Bunkulung village under Mirik sub-division of Darjeeling hills. The results of water quality parameters analysed according to the standard methods revealed conducive for fish culture. Culure species comprised of indigenous coldwater fish, Katli or Neolissocheilus hexagonolepis (McClelland) in Pemling village and two exotic carps, Grass Carp (Ctenopharyngodon idella Val,) and Common Carp (Cyprinus carpio L.) in Bungkulung village for a period of six months. The growth rates of the fishes were found quite significant in terms of body mass. Also, a three months culture of ornamental fishes having high market value like Gold fish (Carassius auratus) and Milky carp (Cyprinus carpio) was carried out in Bungkulung village. Integration was achieved through livestock-cum-fish-cum-horticulture, forming a recycling ecosystem, with the end or waste product of one system serving as substrate for the other. The products of cattle rearing, harvested fishes and horticulture were sold at profitable price. Thus, converting “Waste into Wealth” and thereby proving Jhora pond fishery to be a promising approach for the livelihood of Darjeeling hill people using the resources available.

Keywords: *Jhora ponds, integrated farming, livelihood sustenance, waste recycling.*

Impact of Environment on the Reproduction of Bivalve

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The Environmental constituents shown cyclic changes in reproduction of bivalves (Lamellidiens marginalis) due to great amount of energy to be canalized to the gonad during reproduction (Muley, 1988). This is reflected in the deposition of depletion of the nutrients with the advent or departure of Reproductive period (Lambert and Dehnel, 1974). Due to the commercial importance and edibility value of number of species of bivalves the aspect of energy metabolism has been reported by a number of workers but the relative influence of gonad development on the distribution in different body parts has been examined in only a few cases Dezwaan, 1983 have reviewed much of the work on bio-chemical changes in bivalves mollusca particularly with reference to the carbohydrates metabolism. Kulkarni et.al. (2005) reported that the no significant change in total lipid content in foot for each exposure period was observed when compared with control and no significant changes in total lipid cointent in hepatopancrease also at each exposure period was control and same results was observed in gills.

In the present investigation the bio-chemical analysis were made for lipid content in different soft body parts like from mantle, hepatopancreases, gonad and gill due to the effect of environment is occur in lipid in winter increases in caused due to decreased during summer than monsoon and winter.

Keywords: *Impact, Environment, Reproduction, Bivalves.*

Effect of Environmental Hypertonicity on The Expression of Aquaporins In The Air Breathing Singhi Catfish Heteropneustes fossilis

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Environmental salinity is a consequence of both natural and anthropogenic causes. Fertilizers, surface runoffs and urban wastewater discharge are among the main sources for the increasing presence of salts in the water of rivers, streams and lakes. Drought intensifies the salt concentration. The Heteropneustes fossilis is a hardy fish which inhabits ponds, marshes, swamps ditches, beels, and muddy rivers. Its air breathing apparatus enables it to survive in almost any kind of water. This fish is frequently being challenged by several environmental stresses in their natural habitat throughout the year. During the dry seasons Singhi lives in semi-liquid and semidry mud, and even when the mud dries up they seek refuge in the bottom of fissures and crevices formed by the cracking mud. Singhi is known to be a champion in tolerating a very high environmental salinity (upto 300 mM mannitol) for several months.In high environmental salinity, fishes get dehydrated due to osmotic water loss and to diffusive ion gain which allows both ion and water uptake across the intestine with excess ions being excreted though the gills. The physiological role of aquaporin, a water channel, appears to be particularly important in certain osmoregulatory organs of fish, such as the gill, kidney and gut. Aquaporin is a small transmembrane channel protein of approximately 30 kDa that transports water in all life forms. Some isoforms are also involved in the transport of several other molecules like ammonia, gases, urea etc. Since aquaporins are involved in osmoregulation by transport of water and ions inside and outside of the cell, they play a significant role in maintaining homeostasis in times of stresses in aquatic animals.Different aquaporins exhibit different patterns of expression under hypertonic stress to maintain homeostasis in the body of the fish.The objective of this study was to investigate effect of hypertonic stress on the pattern of expression of aquaporins in Heteropneustes fossilis at 100 mM concentration of NaCl. The study was conducted to observe the pattern of expressions of Aqp1, Aqp3,Aqp8, Aqp11, and Aqp12 in tissues of Liver, kidney, Gills, Intestine, stomach, muscle, and brain of H fossilis. qPCR analysis of the mRNA transcripts of the aquaporins showed variable results at different duration of exposure. Aqp 1,3,11,&12 were upregulated in most of the tissues.Liver, kidney, gills, intestine, stomach showed marked increase in all the Aqp levels at 7th day and significantly decreased at 14th day in comparison to control tissues. Muscle exhibited a downregulation in all the Aqps except Aqp1. Thus the study establishes that aquaporin expression is affected by environmental hypertonicity with both upregulation and downregulation in different tissues of H. fossilis.

Keywords: *Hypertonicity, aquaporins, osmoregulation, fish, environmental salinity, Aqp.*

An Investigation on Haematological Parameters of Pangshura Tentoria

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Haematology profile are generally used to assess the physiological status of vertebrates such as fish, amphibian, reptile and bird. Comparative studies of diseased and healthy turtles provide information related to the management and conservation of turtles. Therefore, an attempt has been made to investigate the haematological parameters of Pangshura tentoria for certain baseline values. The following objectives have been targeted to achieve the baseline values of haematology of the species. Turtles are very sensitive to the slightest variation in their habitat apparatus; therefore it is very clear by checking and evaluating certain blood parameters the exact state of health physiology could be judged. As well these parameters might of use in determining the environmental conditions. Thus the aim of this investigation has been attempted for certain haematological parameters Pangshura tentoria during pre and post reproductive period with the following objectives to evaluate certain haematological parameters.

Haemoglobin concentration was recorded to be 6.55 g/l to 15.50 g/l during pre reproductive period and 5.10 g/l to 7.40 g/l during post reproductive period. Hb irrespective of season was 7.31g/L, 8.45g/L and 6.45g/L in male, female and juvenile was noted. Hematocrit was achieved to be 20.61%, 21.60% and 17.42% in male, female and juvenile irrespective of seasonality. RBC count was recorded to be 0.34 X 1012/l to 1.30 X 1012/l during pre reproductive period and 0.21 X 1012/l to 1.07 X 1012/l during post reproductive period. RBC count was measured at 0.63 X 1012 /L in male, 0.80 X 1012 /L in female and 0.85 X 1012 /L in juvenile irrespective of period. Total WBC for male (4.66 X 109 /L) for female (5.19 X 109 /L) and for juvenile (6.45 X 109 /L) was achieved irrespective of season. MCV was calculated to be 36.86 fl, 21.45 fl ($P<0.05$) and 35.45 fl irrespective of period in male, female and juvenile. Total MCH was calculated to be 13.29 pg, 8.16 pg ($P<0.05$) and 15.25 pg was found in male, female and juvenile. The MCHC was calculated at 36.91%, 38.98% and 37.64% in male, female and juvenile. Total platelet for male, female and juvenile was recorded to be 1.48 X 103 /L, 1.35 X 103 /L and 0.93 X 103 /L respectively. In differential WBC count, Heterophils was recorded at 13.42%, 14.98% and 8.18%, Monocytes was recorded 4.81%, 6.55% and 8.45%, Lymphocytes 32.59%, 27.77% and 28.45%, Eosinophils was 12.76%, 9.26% and 9.15% and Basophils was found to be 21.25%, 19.75% and 14.75% ($P<0.05$) in male, female and juvenile respectively. The present study for the first time reports on the haematological as well as biochemical parameters of Pangshura tentoria. The study establishes the baseline blood health indices of the species.

Keywords: *Hematocrit, Turtle, Erythrocytes, Leukocytes*

Physico-Chemical Parameters And Fish Biology Study Of Two Botia Loaches In Captivity, West Bengal, India

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Botia dario and Botia lohachata are classified as aquarium fish due to their beautiful colouration, small size, bright bands, blotches, peaceful nature. Captive condition water was soft and alkaline in nature with high dissolved oxygen and medium productive condition. The temperature was good for growth of the fishes. Condition Factor or K- factor for Botia dario was 1.788 and Botia lohachata was 1.538.The length- weight relationship was calculated by Coefficient of Correlation (r). The Coefficient of Correlation of Botia dario was 0.802 and Botia lohachata was 0.753 respectively and Botia species indicated positive allometric growth. The average Gonado-somatic Index data of Botia species revealed to be 8.34±5.4 for Botia dario and 13.86±11.50 for Botia lohachata. Average fecundity of Botia dario and Botia lohachata 22573 and 18053, respectively. The present work contributed to the deficient information on the fish biology of Botia dario and Botia lohachata.

Keywords: *Physico-chemical parameter, Fish biology, Botia species, Captivity.*

Effects of Acidic pH Responses in Fish Monopterus Cuchia (Hamilton, 1822)

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Fish health and survival depends on a large number of aquatic parameters. The obligatory air breathing mud eel (Monopterus cuchia) is being exposed to acute low pH (acidic) conditions in artificial conditions for a time period of 5 days and 10 days respectively. The present study investigated the effect of acidic conditions on the haematological parameters of the fish, activities of the anti-oxidant enzymes like catalase (CAT) ,glutathione-s-transferase (GST) and superoxide dismutase (SOD) and non- enzymatic anti oxidant parameter, glutathione reductase (GSH) in the liver, kidney and intestine of the fish respectively. The plasma enzyme assay (ALT and AST) and the lipid peroxidation assay (MDA) was studied in the liver of the fish. In the fishes exposed to low pH concentration for the particular period , disturbances in the fish swimming behaviour and lethargic movement of the fishes were some of the observations recorded. The haematological parameters like the total erythrocyte count (TEC), haemoglobin (Hb) concentration, mean cell haemoglobin concentration (MCHC), showed a significant decrease of 2,1.41 and 3 folds in the treated fish as compared to the control. On the other hand the total leucocyte count(TLC), packed cell volume(PCV), mean corpuscular volume(MCV) and mean cell haemoglobin(MCH) showed a subsequent increase of 2, 2, 4 and 1.4 folds as compared to the control. The anti-oxidant enzymes catalase, glutathione-s-transferase concentration showed a decrement of 5.1,3.2, 2.1 and 3,2 and 1.8 folds whereas superoxide dismutase showed a subsequent increase initially followed by a marked 3,2 and 2.2 folds decrease in liver, kidney and intestine tissues respectively. The non enzymatic marker reduced glutathione showed a decrease of 2.8 folds. In the plasma enzyme ALT and AST and the lipid peroxidation marker MDA there was a significant increase of 2.3, 3 and 1.4 folds as compared to the control. Thus the changes observed during the study period establishes that the fishes were exposed to acute stress under a low pH condition and it also establishes that change in a single parameter can affect fish health to a great extent.

Keywords: *low pH , fish blood , oxidative stress biomarkers , plasma enzymes*

A Preliminary Study on The Hillstream Fishes of Kameng River With Their Morphological Adaptation

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The River Kameng, a snow fed river of Arunachal Pradesh is a global hotspot for fish faunal diversity harbouring both hillstream and plain water fish species. Hillstreams poses harsh living conditions to the fishes because of varied topography, torrential water currents coupled with a variety of substratum. The most important characteristics in response to these conditions are the integumentary modifications in the form of an adhesive disc, sectorial disc usually situated on the ventral surface of the body between mouth and pectoral fins. A total of 28 typical hillstream fishes belonging to 16 genera and 7 families were recorded in the Kameng River. The most abundant family was Cyprinidae (10 species), followed by family Sisoridae (6 species). Hill stream fishes belonging to almost all the major families were recorded. Some of the major genera were- Neolissocheilus, Tor, Schizothorax, Barilius, Glyptothorax, Garra, Schistura etc. Physico-chemical parameters like pH (6.94-7.26) DO (10.19 mg/l to 12.03 mg/l), FCO2 (1.25mg/l to 1.63 mg/l), Alkalinity (121.25 mg/l to 138.75 mg/l), etc., were found conductive in all the sampling sites.

Keywords: *hillstream, integumentary, adhesive disc*

Impact of Duck Droppings on Pond Productivity and Growth of Fish

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The study was conducted in a Society Pond of Malegarh village of Bongaigaon, Assam, India to assess the impact of duck droppings on pond productivity and growth of fish. The pond was integrated with duck to obtain the benefit of duck droppings on the pond productivity and fish growth. The mean dry weight of 80 duck excreta was estimated at 4,235 kg/ha/day, discharging into the pond 5200 fingerlings. Indian major carps along with few exotic carp were stocked in the month of April, 2014. It was observed that duck droppings at both the levels did not degrade the physico -chemical properties (pH, dissolved oxygen and alkalinity) of water. The nutrient (phosphates and nitrates) level of water was higher in duck droppings treated pond. Further, plankton levels (phytoplankton and zooplankton) were also significantly higher in duck droppings treated pond. All the studied physico-chemical parameters like(pH, Dissolved oxygen, Alkalinity, turbidity etc) were found within the permissible limit and the growth of fishes was also satisfactory. The maximum growth was recorded in Catla and Rohu was significantly more in the pond followed by silver carp, common carp and Mrigala.

Keywords: *Duck droppings, productivity, fish growth*

Captive Breeding Of Angelfish (Pterophyllum Scalare) And The Study Of Its Different Embryonic Developmental Stages

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Angelfish (Pterophyllumscalare) is very beautiful exotic aquarium fish which belongs to family Cichlidae and fetch a great demand due to its beauty, reproductive capacity and adaptability to captivity andthe economic potential of this species is also very high. Angelfish require fairly soft and somewhat acidic water having pH 6.8-6.9 and temperature 25-27o C for breeding. In the present study an attempt was made to develop a body of knowledge regarding breeding and rearing of Angelfish under local hardy environmental conditions. This experiment had two broad parts the first part was collection of brooders and their breeding in captivity and the second part is the study of the embryogical developmental stages. Angelfish brooders were collected, acclimatized and breeding pairs were selected. The breeding pair exhibits courtship behaviour and the male fish defends its partner and territory by showing aggressive behaviour towards other invading males. The various parameters of water such as temperature, pH, CO2 content, DO and alkalinity were determined daily during breeding period. Each female lays about 150 eggs at a time. The eggs laid by the female are fertilised by the male by releasing its milt. The amber-coloured angelfish eggs were oval in shape with average diameter of 1.4mm. The developmental stages were studied after 2hr, 24hr, 48hr, 72hr and 96hr. The quality and quantity of feed are also important factors affecting growth and reproduction in fishes.

Keywords: *Angelfish, Breeding, Water parameters, Embryonic development*

Length-Weight Relationship and Condition Factor of Danio Dangila (Hamilton, 1822) From Jatinga River, Northeast India

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Fishery biology is devoted to the use of appropriate indices for the determination of the condition of a fish population across different habitats or seasonal variations. Whereas length-weight relationships (LWRs) and condition factor are important in assessment of well-being of individuals within or separate stocks of a particular species, no such data exist for Danio dangila (Hamilton, 1822) an important ornamental fish from the Brahmaputra and Barak drainages in Northeast India. The present study provides LWR and condition factor for this species from the Jatinga River, a tributary of the Barak in Assam. A total of 64 specimens (3.88.1 cm total length; 0.76.0 g body weight) were collected monthly using caste nets (2.5 m, 1m; 1015 mm mesh size) and gillnets (30 × 0.9 m; 515 mm mesh size) from May 2017 to December 2017. The calculated 'b' value (=3.082) in the LWRs was statistically significant ($p<0.001$) with r2 higher than 0.95. The condition factor, K was recorded 1.107±0.12, indicating a good level of feeding and suitable environmental conditions. The present data, however, can serve as a baseline datum only for fishery biologists as the results obtained were over an 8-month period only, and therefore studies demand covering a broader geographical range for all the available populations of the species for its conservation and management.

Keywords: *Danio dangila, fish population, growth coefficient, Jatinga River.*

Study of Breeding Behaviour And Parental Care of Naturally Bred Channa Stewartii (Assamese Snakehead) in Captivity

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The study has been made on one of an important species of snakehead family, Channa stewartii which has high ornamental demand in both domestic and international market as well as it has also high demand as food fish. Snakeheads of the family Channidae are distributed in tropical Africa, parts of the Middle East and Asia, and inhabit a wide variety of freshwater habitats ranging from hill streams to derelict swamps. However in the early literature altogether 29 species of the Channid species are described valid, while the recent database shows 38 valid species under Snakehead fish group. In Assam, the most common channid species so far recognized are Channa marulius, Channa striata, Channa punctata and Channa gachua while the very rare species are Channa barca, Channa stewartii, Channa aurantimaculata and Channa bleheri. According to Red List category and criteria of IUCN 2010, Channa stewartii is found to be Least Concern (LC). Data regarding the growth pattern, breeding behavior and breeding biology of Channa group is very limited. No literature is available on breeding behavior and parental care of Channa stewartii. So there are many scopes for investigation. The study of spawning behavior and parental care has been investigated by direct visual observation method. The brooders are acclimatized to the tank condition for about 1 month and were fed with chopped earthworm, mosquito larva, small fishes etc. Mature healthy fishes were selected by sexual differentiation. Sexual differentiation was determined by visual inspection of the head part, belly part, genital opening and distance between the genital openings to anal fin region. The water analysis of the tank has been monitored in a regular basis using digital water quality monitoring meter YSI PROFESSIONAL PLUS. The male showed more active participation in mating. It was observed during study that Channa stewartii formed a nest in the tank in the bottom. In Channa striatus it was documented that the eggs after released were fertilized by the males and the fertilized eggs were floated and adhered to each other and hatchlings were released from the eggs after 24 hours. It has been observed that like other Channa species Channa stewartii is also mouth brooder. During early stages they used to stay together in groups but after attaining a length of about 6-8 cm (fingerlings) they move separately. C.stewartii displays parental care behavior and both the parent involves in the process that helps in increasing the hatchling rate and development of healthy fries. Bi-parental care by C.stewartii helps in keeping the eggs prevented from fungal infection and from predators.

Keywords: *Channa stewartii, Sexual differentiation, Courtship, Spawning, Mouth brooders, Parental care.*

Therapeutic Analysis of Herbal Extract on Fish Disease

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Purpose: Aquaculture has the potential to make significant contribution to the increasing demand for aquatic food in most world regions but their productivity greatly affected by different disease. Fish in freshwater systems are susceptible to a number of bacterial, viral and parasitic diseases. The disease of fish leads to huge loss of revenue for aquatic farmers leading to poor economic development.

Significance of research: The fish disease is a threat to all the aquatic farmers. The present research study involves collection of disease fish from the local water resource. The microbes responsible for the disease has been isolated and characterized by standard biochemical test. Methanolic extract of Annona reticulata, Brucea javanica and Ricinus communis was made and their phytochemical screening was performed. The methanolic extracts were screened for the anti-microbial action against the cultured microorganism obtained from the diseased fish lesion. The anti-microbial efficacies of the plant extract were evaluated against the isolated microorganism strain keeping an established anti-microbial drug as standard.

Finding of importance: After performing the biochemical screening the microbial strain was found to be of genus Staphylococcus. The methanolic extract showed the common presence of alkaloid and flavanoids in all the three plant leaves extracts, whereas saponins and tannins were found only in Annona reticulata and Brucea javanica respectively. Anti-microbial property of Annona reticulata and Ricinus communis found to be highest in 100% concentration with an effective zone of inhibition area of 1.13 cm2 and 1.538 cm2 respectively. In case of Brucea javanica it shows similar antibacterial property in 10%, 75% and 100% with the same effective zone of inhibition area of 0.78cm2. From the present study we can conclude that, the green herbs can be used as an alternate source of anti-microbial for combating microbial infection in aquaculture.

Keywords: *Annona reticulata, Brucea javanica, Ricinus communis, anti-microbial, cat fish.*

A Study on the Tail and Fin Rot Disease of Channa Punctata (Bloch, 1793)

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Wetland (commonly called as "Beel") plays a vital role in inland fish production of the North-Eastern part of India (Vinci, 2002), particularly in Assam. Various physico-chemical and biological factors may directly or indirectly affect the quality and consequently suitability of an ecosystem for the distribution and production of fish (Moses, 1983). The development of disease reflects the interaction between the host, the disease causing situation and stressors (Austin and Austin, 1993). The tail and fin rot disease in C. punctata (Bloch, 1793) is a major concern particularly during the month of October to February in Assam which enhances the mortality rate, and ultimately reduces production. Present study reports the causative organism of the disease as Pseudomonas aeruginosa along with studying the influence of different physicochemical parameters with the occurrence of the disease in two wetland ecosystems (Deepor beel and Inte beel) of Assam, India. Non-optimum and poor water quality may induce stress in fish which makes it weaker and eventually produce greater risk of susceptibility to bacterial infections (Escher et al., 1999). Parameters such as water temperature, Dissolved Oxygen, Oxygen Reduction Potential and pH were found to have negative co-relation whereas Biological Oxygen Demand and ammonia were found to be positively co-related with the occurrence of the disease.

Keywords: *C. punctata, Pseudomonas aeruginosa, water quality*

Environmental Geography, Remote sensing and GIS in environmental management

Remote Sensing Applicability In Redd Mrv

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Reducing Emissions from Deforestation and Forest Degradation (REDD) is an effort to create a financial value for the forest sequestered carbon, providing incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development. The basic steps required for successful implementation of a viable REDD regime include the assessment of forest carbon stocks and their change over time; quantifying the amount of reduced carbon dioxide (CO2) emissions, which qualifies for accounting; identifying and ranking of the relevant causes for human impact in order to derive effective measures to combat the degradation of forests; defining a baseline against which the changes of carbon stocks in forests are set off; and finally implementing a scheme for the transfer of benefits to local actors. Robust, transparent, replicable and longterm monitoring systems are needed for REDD where satellite remote sensing technology play a significant role in broader monitoring, assessment, reporting and verification context that needs to be better articulated, understood and agreed. Accurate quantification of forest aboveground biomass (AGB) is required in order to account for any change of CO2 emissions from forests. Remote Sensing (RS) proves beneficial over conventional methods in providing cost and time effective means for accurate temporal monitoring over large synoptic extents at local to global levels. Synthetic Aperture Radar (SAR) has exceptional characteristics that overcomes the limitations of optical RS sensors and reveals superiority over them. In this study, optical RS data from Landsat TM and SAR data from ALOS PALSAR (L-band) are used singly and in combination to derive regression based models for retrieving AGB over tropical deciduous mixed forests located in Munger (Bihar, India). The results using Landsat TM showed poor correlation (R2 = 0.295 and RMSE = 35 Mg/ha) when compared to HH polarized L-band SAR (R2 = 0.868 and RMSE = 16.06 Mg/ha). However, the prediction model performed even better when both the optical and SAR were used simultaneously (R2 = 0.892 and RMSE = 14.08 Mg/ha). Incorporation of optical information from Landsat TM resulted in improving SAR estimates from ALOS PALSAR for forest biomass assessment. 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 and REDD monitoring via developing an efficient measurement, reporting and verification (MRV) assessment system.

Keywords: *Forest, Biomass, Carbon, SAR, Optical, Geospatial, MLR model.*

Vulnerability Assessment of Channel Shifting of The Gumti River of Tripura, India Using Remote Sensing And Gis

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River channel shifting due to erosion has emerged as a serious environmental issue in Tripura. The present study is an attempt to assess the pattern of channel shifting of the lower Gumti River and its impact on local inhabitants. For this study Survey of India topographical sheet and Landsat 8 imagery were used to derive the vector layer of the river channel of 1932 and 2016 respectively. Both the layers were superimposed and divided into four reaches of equal length. Different sections were drawn over the superimposed layers to measure the length of shifting during this period. Moreover, cross sections were taken across the Gumti River in different erosion prone sites during 2015 and 2016 and overlaid to derive the amount of soil loss. Survey was carried out on the local people to assess the vulnerability of river channel migration. The whole study reveals that large scale shifting of the Gumti River was took place during the period 1932 to 2016. Maximum length of shifting was found to be 533.42 m in Kushamara Village. One of the major reasons for this shifting is the sandy and sandy loam nature of bank soil. The amount of soil loss in different erosion prone sites ranging from 602.5 to 3195.66 metric tonnes was measured during 2015-16. Shifting creates adverse socio-economic problem as 73.53 percent and 26.17 percent of the surveyed victims have shifted their houses partially and permanently respectively due to this problem. Moreover shifting leads to loss of productive agricultural land. Around 27.78 percent of the surveyed victims have lost more than four acres of agricultural land for the migration of the lower Gumti River most of which is double cropped in nature.

Keywords: *Gumti River, Bank erosion, Channel shifting, Soil loss, Socio-economic condition*

Application of Remote Sensing And Gis In Water Resource Management In Watershed Perspective: A Case Study In Jamuna Watershed, Assam

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Water resource is the procreator, primeval source and cradle of life on the surface of the earth. But this vital resource is under tremendous stress due to increasing biotic pressure. In recent years, watershed is considered to be an ideal unit for the management of natural resources. Remote sensing and GIS have emerged as powerful tool in resource management as it provides valuable and up-to date spatial information on natural resources and physical terrain parameters. In the present study, sustainable water resource management plan was developed for Jamuna watershedbased on certain parameters. Remote Sensing data along with other fieldand collateral data on lithology, soil, slope, well inventory, fracture have been utilizedfor generating land use/land cover and hydro geomorphology of the study area, whichare essential prerequisites for water resources planning and development.

Keywords: *water resource,watershed management, remote sensing, GIS, Jamuna watershed*

Finding Of Unidentified Flying Objects & Aliens Are Great Opportunity And Challenges Today

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Introduction: Now a day's Aliens are a major threat to our world. Because we human are always fighting each other, we trend to use technology for war not protecting the earth. If we want to protect our earth need great research for unidentified flying objects. Most UFOs are later identified as conventional objects or phenomena (e.g. Aircraft, Astronomical objects, Weather, Balloons, and Clouds). Some of them are not identified, either because of lack of evidence or because of no conventional explanation can be found despite extensive. Many research centres and research persons now research in this area but nobody could find Aliens and their habitat. So in this view we discover powerful radar which can identify the Aliens and protect our earth.

Keywords: *Aliens, Unidentified flying objects, Conventional objects*

Application of Geospatial Technologies for Assessing the Impact of Urbanization on Groundwater Resources in Ranchi urban Region, India

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The rapid urban and population growth has increased pressure of human activities on hydrogeomorphologic system, often result in modification of the existing recharge mechanism and influence the quantity and quality of both the surface and groundwater resources. In the present study, groundwater potential (GWP) zones in Ranchi urban region (Jharkhand) was delineated and groundwater trend was analysed. Groundwater level (GWL) and itsfluctuations were estimated using time series regression and employing sum of least squaremethod. The groundwater potential zones were delineated using severalcontributory topographicfactorsand modelled using analytical hierarchical process (AHP) in geographic information system (GIS) environment. The study exhibits that the GWL declined by 316 m reflecting reduction in groundwater recharge and over-exploitation of the groundwater resources during 20012010. The study exhibits that the high rate of built-up growth (39.0%) and population growth (32.6%) increased thepressure over existing groundwater resources in Ranchi urban region during 20012010. This is substantiated by significant negative correlation of average GWL with built-up increase (R2=0.997) and with population increase (R2=0.974) over the said periods. The groundwater potential of aquifers was affected due to hard rock geological settings coupled with increasing urbanization with high built-up density, which retarded groundwater recharge to aquifers. The study exhibited the severely critical to moderately critical conditions of groundwater level during pre-monsoon periods (May) over urban areas, which necessitate adoption of groundwater recharge mechanism by roof-top water harvesting. The study revealed that the centralparts are largely covered by built-up land (7.35%) and have very low GWP and also encountered severe watercrisis in recent years. The northern (17%), south-western parts (13%), southern (8.07%) and eastern (9.61%) parts havehigh to very high GWP with less groundwater fluctuation and shallow GWL resembling suitable site forfuture built-up development in view of groundwater resource availability. The groundwater conditionsuggested adoption of site specific methods to recharge and replenish groundwater within the urban milieu.

Keywords: *Groundwater Potential Zones, Urban Growth, Groundwater Trends, AHP, Remote Sensing.*

Gis Approach For Groundwater Quality In Siwani Block, Bhiwani District, Haryana

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Water is prime requirement for human beings for survival. In arid to semi-arid regions of the world, groundwater is one of the major source for drinking, agriculture and industrial purposes. The present study has been carried out to study the groundwater quality in Siwani block in Bhiwani district. In the study, 20 groundwater samples have been collected from different locations in plastic bottles. The location of sample sites were stored in Garmin 72 H GPS. The groundwater samples were analysed using field water testing kits prepared by Tamilnadu Water Supply and Drainage Board, Chennai for twelve parameters viz. pH, alkalinity, hardness, chloride, total dissolved solids, fluoride, iron, nitrate, nitrite, ammonia, phosphate and residual chlorine. The study shows that pH ranges from 6.5 to 8, alkalinity varies from 100 mg/l to 400 mg/l, hardness varies from 80 mg/l to 6050 mg/l, chloride varies from 10 mg/l to 1500 mg/l, TDS varies from 468 mg/l to 9144 mg/l, fluoride varies from 0 mg/l to 5 mg/l, iron varies from 0 mg/l to 2 mg/l, ammonia varies from nil to 5 mg/l, nitrate varies from 20 mg/l to 100 mg/l, residual chlorine varies from 0 mg/l to 0.2 mg/l, phosphate nil at all the sample locations and nitrite varies from 0.2mg/l to 1mg/l in the study area. The data were entered in ArcGIS software and inverse distance weighted (IDW) interpolation technique was applied to get spatial distribution of quality parameters in the study area. GIS (Geographical Information System) gives the glimpse view of chemical parameters in the study area in map form which is easy to understand and represent data in meaningful way. The study shows that in the study area, pH, phosphate, residual chlorine, nitrite and ammonia falls under desirable limit of drinking water; alkalinity falls under desirable and permissible limit of drinking water; hardness, chloride, total dissolved solids and fluoride falls under desirable, permissible and non-potable limit of drinking water and iron falls under desirable and non-potable limit of drinking water in the study area. The study is highly useful for groundwater quality planning and management in the study area.

Keywords: *GIS, groundwater, quality, semi-arid, Siwani, Bhiwnai, Haryana*

Environmental Policies, Laws and Legislations

The Judicial Approach towards Protection of Taj Mahal

Anupam Naskar

The Taj Mahal is an immense mausoleum of white marble, built in Agra between 1631 and 1648 by order of the Mughal emperor Shah Jahan in memory of his favourite wife, the Taj Mahal is the jewel of Muslim art in India and one of the universally admired masterpieces of the world's heritage. Ambient air around Taj Mahal is polluted primarily from sources and has adverse impacts on building material by alteration of marbles and sandstone during winter months due to the frequent conditions restricting vertical dispersion. On NEERI (national environment engineer research institution, Nagpur India) has revealed that the black soot on the marble of taj mahal contains 0.06% calcium and traces of sulphate. The soots are formed due to sulphur di oxide which emits from the refinery and local industries. Firstly a crust is formed due to acid rain and that crust after some period exfoliates due to mechanical stress. In case of marbles exposed to rain , gradual reduction of material occurs. The supreme court after proper justification of the report of those NEERI committee came to a decision that shifting of industries to the outside of Taj Mahal area for their emission of sulphurdi oxide and ash in air. The objective of the study is to analyze the role played by the judiciary of India to protect Taj Mahal, the world heritage.

Keywords: *Taj Mahal, pollution, judiciary, protection.*

Pollution of The Ganges Efficacy of The Ganga Action Plan

Sneha Chatterjee and Subhadip Chakraborty

Pollution of the Ganges (or Ganga), the largest river in India, poses significant threats to human health and the larger environment. Severely polluted with human waste and industrial contaminants, the river provides water to about 40% of India's population across 11 states serving an estimated population of 500 million people or more, more than any other river in the world.

Today, Ganges is considered to be the fifth most polluted river in the world. A number of initiatives have been undertaken to clean the river but failed to deliver desired results. For ages the Ganga has remained the lifeline of India. Water of the river has been used for drinking, farming, washing, navigating etc. so much so that a sentimental bond has grown up with the river .People love and respect the river, and even worship it as divine entity. A large number of religious centres have grown up all along the length of the river viz., Gomukh at the point of origin and Kapil Dham (i.e., Ganga Sagar) at the final destination.

In between there are important places like Hardwar; Varanasi, Prayag in Allahabad, Patna and Kalighat in Kolkata city. The flow of the river has beenextremely reduced over the years due to creation of dam and high rate of water abstraction in upstream of river. As such, the pollution problem of the river enhanced manifold.

Considering these facts, the Government of India constituted the Central Ganga Authority in February 1985 to evolve a long term programme for restoring the quality of the river. The Ganga Action Plan launched in 1986 by the Government of India has not achieved any success despite expenditure of approximately 2,000 crore rupees. Even though the government claims that the schemes under the Ganga Action Plan have been successful, ground realities tell a different story. The failure of the GAP is evident but corrective action is lacking. The research project is a genuine endeavour to analyse and examine the efficacy of GAP in reducing pollution level of river Ganga and restoring its quality.

Keywords: *Pollution, Ganga, failure,Ganga Action Plan*

Role of NGOs to Protect Environment

Need Of Mass Awareness And Participation In Conservation Of Fishes In Aquatic Ecosystems

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The need of mass awareness and people participation is felt noteworthy in the field of fish culture. The evolution of fish culture has left the poor and the rural people of the country backwards and because they still use the old fashioned and primitive technique of fish culture. The result is low production and dissatisfaction and finally less number of aquatic ecosystems in the country. It is still a problem before them as how to increase the fishes in number as well as maintain them in ponds. They are still unknown about the environment and physiological conditions of fishes and hence the process of fish culture was unsuccessful. Besides the Government, the NGOs and co-operative societies must take initiative to make them know about the morphology, physiology, histology, habit and habitat of fishes. They have the right to know how fishes are growing and breeding themselves. These findings will prove to be a keynote and will encourage them to think about the fish culture at commercial level. People are still unaware about the cultivation of a number of economically useful fish species, artificial fertilization, induced breeding etc. which will open a new era in the fish culture.

The continuous extraction of fishes by capture fisheries will one day lead to extinction of many indigenous species of fishes. However, without proper knowledge of the subject they will be unable to provide any help. They must be made known about the culture of these extinct and rare species.

Keywords: *NGO, low production, capture fisheries.*

Role Of Ngo To Protect Environment

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Environmental protection is a practice of protecting the natural environment and its resources by an individual or an organization for the benefit of both the environment and human beings. But only by state or central departments it is not possible to maintain or look after those resources in the best possible manner. Non-governmental Organizations (NGOs) are organizations run by a group of focused people who extend beyond their own community and can reach places where governmental agencies cannot sometimes reach.With a mission to help in redressing various social and environmental problems many NGOs are working at the international, national and regional levels.They are creative in approach, flexible in functioning and innovative in methods and technologies. NGOs being one of the most effective media to reach the people these days may play a significant role in environment protection. The fundamental objectives of NGOs are to act as catalyst in bringing about local, national and international initiative and community participation in overall improvement in quality of life. 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 create awareness among the public on current environmental issues and solutions. They also transfer information through newsletters, brochures, articles, audio visual etc. They help villagers, administrative officials in preparation, application and execution of projects on environmental protection. India has a number of NGOs that work in the field of environment protection. This research paper outlines the important role that has been played by an NGO, Nature Mates-Nature Club based on Kolkata, West Bengal in helping to tackle environmental issues in India towards environmental protection and wildlife conservation.

Keywords: *NGO, Environmental issues, Wildlife conservation.*

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