

Two-Day National Seminar on
**“Popular and Basic Sciences: A Quest
Towards Foundation of Science”**

Organized by:

Sarat Centenary College, Dhaniakhali, Hooghly, WB, PIN-712302



Sponsored by:

Department of Science & Technology and Biotechnology (DSTBT),
Govt. of West Bengal

Venue: Sarat Centenary College, Dhaniakhali

Date: 23-24 September, 2022

Book of Abstracts

WBDSTBT Sponsored Two-Day National Seminar
Organised by Sarat Centenary College
On
Popular and Basic Sciences: A
Quest Towards Foundation of
Science

23 & 24 September, 2022

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<saratcentenary@gmail.com>, Sarat Centenary College <sccollegednk.ac.in>,
at Dhaniakhali
on 23 September 2022

Prologue

The word ‘Science’ is synonymous to searching truth which provides explanation of different natural phenomena and simultaneously it led to asking questions. Earlier it was believed that the earth was the centre of the universe. Afterwards, those hypotheses had been proved wrong. The sun may be the centre of our solar system, but it is not the centre of the universe. Newton’s universal law of gravitation was able to explain all the other planets in the solar system but the orbit of Mercury was a bit different and for long time no one knew about it. Later, Einstein came to solve that problem with his great general theory of relativity. *Philosophiae naturalis Principia Mathematica* by Isaac Newton tells us about the theories of classical mechanics and theory of relativity coined by Einstein. So, there are so many classical laws in Physics that opened new vistas in science for clear understanding of physical events in the universe. In this backdrop, we are going to organise this seminar on popularisation of science trying to create capacity building program unveiling mystery and application of science at grass-root level before students of these areas. We are going to present before them the unsolved problems, the new challenges, current health issues, cyber security, and also will attempt to address their Mathematics phobia.

From the Indian perspective, in some domains we have significant contribution and there are domains where we need to achieve more. For this, we need to look towards the prospective students who will take the challenge to progress further from the present stage. Academicians also need to update their knowledge so that they can play a pivotal role in creating awareness and to enhance the curiosity to learn the subject.

Hence our aims to organize this seminar are:

- (i) To provide a platform to know different directions of science from the expert that includes the present state of research, the challenge ahead and the interdependence of science, technology and society for the students as well the academicians
- (ii) To develop inquiring minds and curiosity about science and the surrounding natural world among students
- (iii) To popularize science and technology amongst the younger generation

This two-day seminar will address different topics of Basic and Popular Science including Mathematics.

Starting with a preliminary level, the speakers shall address the present state of research in respective topics, so that students/academicians become aware of the latest development. It will be a very good opportunity to the students/academicians belonging to Dhaniakhali and surrounding rural area who hardly get the chance of listening/interacting with the renowned researchers/ educators of this state. Lecture on History of Science will help to make them understand the gradual development of a theory/invention and the underlying philosophy, hypotheses. Lectures on Mathematics will illustrate that Mathematics can also be fun and its connection with nature and our daily life. Also the seminar will provide a platform to share experience among the academicians, how different tools, techniques can be used to popularize a scientific topic among students and common people.

I am proud of my all colleagues and students for their tireless efforts to make this program a great success. I would like to extend my sincere gratitude to invited eminent speakers and experts for sharing their knowledge in front of audience. I extend my heartiest congratulations to young researchers presenting their research papers. The all-out support from our Honorable President and members of Governing Body are humbly acknowledged. We are grateful to WBDST-BT, GoWB for financial support. Finally, never-the-less we are grateful to Smt. Asima Patra, MLA of Dhaniakhali constituency for her all-round support and encouragement for successfully organizing this seminar.

My hearty welcome to all of you participating in the seminar.

Dr. Sandip Kumar Basak, Principal, Sarat Centenary College

TWO DAY NATIONAL SEMINAR ON “POPULAR AND BASIC SCIENCES: A QUEST TOWARDS FOUNDATION OF SCIENCE”

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Venue – Sarat Centenary College, Dhaniakhali, Hooghly

Date – 23rd September & 24th September, 2022

PROGRAMME SCHEDULE

23rd September (Day-1)

<i>Registration Desk Opens at 10.00 am and closes at 12.00 noon</i>
INAUGURAL SESSION (10:30 A.M. to 11:15 A.M.)
Inaugural Song
Greeting the Delegates
Welcome Address by the Principal
Chief Guest's Speech
Session Concluding speech by Dr Ujjal Kumar Mukherjee
TECHNICAL SESSION (11:30 P.M. to 12:15 P.M.)
Keynote Address by Professor Gautam Kumar Das, IIT Guwahati
PRESENTATION SESSION- 1 & 2 (12:30 P.M. to 2 P.M.)
Oral Presentation by participants
LUNCH BREAK (2 P.M. to 2:30 P.M.)
PRESENTATION SESSION- 3, 4, 5 (2:30 P.M. to 3:30 P.M.)
Oral Presentation by participants

Date: 23.09.2022 **Presentation Session: 1**

Venue: A P J Kalam Auditorium

Time: 12:30 PM

Chairman/ Chairperson: Professor Gautam Kumar Das

Session Coordinator: Dr Bidyut Santra

Sl. No.	Paper Presenter	Title of the Paper
1.	Sohan Kumar Jha	Lorentz violation and non commutative effect on the shadow of Kerr-like black hole
2.	Kalan Mal	Microwave controlled optical switching in inverted-Y type atomic system
3.	Dr. Malay Krishna Dutta	Late time acceleration in f(G) model
4.	Sayan Das	Renewable energies: hidden cost
5.	Dr. Naba Kumar Ghosh	Food Security and Its Global Impacts
6.	Nabajit Mondal	The Sentinel of our Healthy Brain is Microglia: the immune cell of CNS

Date: 23.09.2022 **Presentation Session: 2**

Time: 12:30 PM

Venue: Smart Classroom (J C Bose Building)

Chairman/ Chairperson: Dr Jagannath Chattopadhyay

Session Coordinator: Dr Suparna Sadhu

Sl. No.	Paper Presenter	Title of the Paper
1.	Dr. Chittaranjan Das	Decomposition of forest waste and nutrient release of selected species in a subtropical region, West Bengal
2.	Sohaniya Mandal	Propagation of water waves along the off-coast of Digha, a Coastal station of West Bengal, India
3.	Md. Hasanur Jaman	Land Suitability Assessment for Agricultural Sustainability of the Kumari River Basin, Eastern India
4.	Priyanka Mandal	Mosquito larvicidal activity of fruit extract of <i>Casearia tomentosa</i> on <i>Culex quinquefasciatus</i>
5.	Dr. Bikash Kumar Panda	The Impacts of Climate Change on Environment and Living Beings
6.	Manali Dutta	Mosquito larvicidal efficacy of the seed extracts of <i>Michaelia champaca</i> against <i>Aedes albopictus</i>

Date: 23.09.2022 **Presentation Session: 3**

Time: 2:30 PM

Venue: A P J Kalam Auditorium

Chairman/ Chairperson: Dr Satyabrata Bhattacharya

Session Coordinator: Dr Bidyut Santra

Sl. No.	Paper Presenter	Title of the Paper
1.	Syamdas Bandyopadhyay	Multiple faces of engineered-CD154
2.	Monali Chakraborty	Prevailing Maternal Health Status – A Comparative Study on Maternal Health Conditions in Urban and Sub-urban areas
3.	Rajesh Kumar Malla	Green synthesis of silver nanoparticles using leaf extract of <i>Diospyros montana</i> and evaluation of its larvicidal potential against <i>Aedes albopictus</i> mosquitoes
4.	Dr. Subarna Bandyopadhyay	Food security in the perspective of Land-use change -- ----- A village level study in Nadia District
5.	Bishnu Goswami	Evolving scopes of Information Technology and social inclusion for vector-borne disease elimination

Date: 23.09.2022 **Presentation Session: 4**

Time: 2:30 PM

Venue: Smart Classroom (J C Bose Building)

National Seminar on “Popular and Basic Sciences: A Quest Towards Foundation of Science”

Chairman/ Chairperson: Dr Quazi Taheruzzaman

Session Coordinator: Dr Suparna Sadhu

Sl. No.	Paper Presenter	Title of the Paper
1.	Tirthankar Dalui	Evaluation of larvicidal efficacy of selected plant extracts against mango fruit borer <i>Autocharis albizonalis</i> Hampson (Pylalidae; Lepidoptera)
2.	Shubhaisi Das	Determination of <i>in-vitro</i> Bactericidal Activity of <i>Callistemon linearis</i> Floral Extracts
3.	Pinaki Roy	Turritellid species from Miocene of Kutch, Gujarat and its Palaeobiogeographic Implications
4.	Debdeepa Mukherjee	The Pythagorean theorem: two non-conventional approaches

Date: 23.09.2022 **Presentation Session: 5**

Time: 02.30 PM

Venue: Room No.- 406 (J C Bose Building)

Chairman/ Chairperson: Dr Ujjal Kumar Mukherjee

Session Coordinator: Dr Raj Kumar Kundu

Sl. No.	Paper Presenter	Title of the Paper
1.	Prof Sankardeb Mondal	পরিবেশবিদ রবীন্দ্রনাথ ঠাকুর
2.	Dr Ramanuj Konar	Role of Science Fiction in Science Popularisation
3.	Dr Bidyut Santra	Visualizing Mathematics: a Review
4.	Basudev Halder	Growth and Distribution of Census Towns of Hooghly District during 2001 to 2011
5.	Jayanta Manik	Comparison of Basic Reasons Behind the Formation of Census Towns in Balagarh Block and Serampore-Uttarpara Block of Hooghly District
6.	Dr Satyabrata Bhattacharya	Nanoscale materials and devices for future communication network
7.	Dr. Veera Renuka Lobo	Principle Strategy of Waste Management in India: An Exposure
8.	Tarakanath Mukherjee	Development and Political Science: Making Change Happen

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PROGRAMME SCHEDULE

24th September (Day-2)

TECHNICAL SESSION (11.00 A.M. to 1:30 P.M.)
Invited lecture by Amiya Kumar Kalidaha, DSTBT, Govt. of West Bengal
Invited lecture by Professor Biswaranjan Mistri, Burdwan University
Invited lecture by Professor Bijan Sarkar, Kalyani University
LUNCH BREAK (1:30 P.M. to 2 P.M.)
PRESENTATION SESSION-6 & 7 (2 P.M. to 3:30 P.M.)
Oral Presentation by participants
Interactive Session between Experts and School Students (2 P.M. to 3:30 P.M.)
VALEDICTORY SESSION (3:30 P.M. to 4 P.M.)
Valedictory Address: Prof. Krishna Roy
Vote of Thanks & Certificate Distribution

Date: 24.09.2022 **Presentation Session: 6**

Time: 2:00 PM

Venue: Room No. - 406 (J C Bose Building)

Chairman/ Chairperson: Professor Biswaranjan Mistri

Session Coordinator: Dr Raj Kumar Kundu

Sl. No.	Paper Presenter	Title of the Paper
1.	Sri Prasenjit Pal	Factors influencing productivity of small farmers in the world of VUCA – A study in West Bengal
2.	Dr. Tanmoy Dhibor	Impact of irrigation from surface and sub-surface sources on local ecosystem: a micro level study on Hugli and Haora districts, West Bengal
3.	Dr. Oindrila Mondal	Photoluminescence of materials and the controlling factors
4.	Shailen Bhakat	Extracellular polysaccharides of desiccated cyanobacteria of West Bengal
5.	Jagriti Banerjee	<i>Coriandrum Sativum</i> root extract as a potential mosquito larvicide against <i>Aedes Albopictus</i>

Date: 24.09.2022 **Presentation Session: 7**

Time: 2:00 PM

Venue: Smart Classroom (J C Bose Building)

Chairman/ Chairperson: Prof. Krishna Roy

Session Coordinator: Dr Suparna Sadhu

Sl. No.	Paper Presenter	Title of the Paper
1.	Subhajit Saha	In spite of different environmental barriers reproductive ecology of mangroves of Indian Sundarbans indicates Xenogamy as preferred mode of successful reproduction
2.	Anup Mandal	Importance of metagenomic surveys of soil bacterial communities in monitoring mangrove forest health
3.	Hemendra Nath Kotal	Diethyl phthalate, no more a xenobiotic compound for plant species is widespread in mangrove species of Indian Sundarbans and its relevance of presence
4.	Chayan Kumar Giri	Climate change affects the diversity of Indian Sundarbans: Restoration attempts of this lost diversity with reference to conventional and non-conventional techniques
5.	Arkarup Gangopadhyay	The Juxtaposition of Science in Sukumar Ray's Rhymes and Fictions
6.	Joseph Hansda	A Symbiotic Relations of “Santal Tribe” with Nature and Their Immense Knowledge on Herbal Remedies- A Study

Keynote address

Algorithms: A Mathematician View

Gautam K. Das

Department of Mathematics
Indian Institute of Technology Guwahati

Abstract: In this talk, we first define notion of algorithms and its correctness as well as complexity. For better understanding of the notion of algorithms, we consider some easy algorithms followed by their correctness and complexity. Next, we discuss **dispersion problem** and propose algorithm to solve the problem.

(Dispersion Problem) Let $P = \{p_1, p_2, \dots, p_n\}$ be a set of n points and a positive integer $k \in [\gamma + 1, n]$. For a subset $S \subseteq P$, we define the γ -dispersion cost of a point $p \in S$, $cost_\gamma(p, S)$, as the sum of Euclidean distances from p to the closest γ points in $S \setminus \{p\}$. We also define the γ -dispersion cost of a subset $S \subseteq P$ as $cost_\gamma(S) = \min_{p \in S} \{cost_\gamma(p, S)\}$. The objective is to find a subset $S \subseteq P$ of cardinality k such that $cost_\gamma(S)$ is maximized. We consider both 1-dispersion problem and 2-dispersion problem in \mathbb{R}^2 .

For 1-dispersion problem, we present an algorithm that produces 2-factor approximation result in polynomial time [7, 8]. For the 2-dispersion problem, we present an algorithm that produces $2\sqrt{3}$ -factor approximation result in polynomial time. Finally, we provide some open problems and important references.

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Invited Lecture

Students Success thru' Innovative Thinking

Amiya Kumar Kalidaha

Senior Scientific Officer, Department of Science & Technology and Biotechnology,
Govt. of West Bengal, Vigyan Chetana Bhavan, DD-26/B, Salt Lake, Kolkata-64

Abstract

Research & Development (R&D), Innovation and Popularisation in Science & Technology (S&T) accounted for more than half of the World's economic growth over the past 50 years, but India's stand in S&T Popularisation and R&D in general and S&T Innovation in particular, at present, is really very low compared to other parts of the World. The present WIPO-Global Innovation Index (2021) of India is 46 compared to 12 of China with Switzerland at rank-1. S&T in the 21st century are transforming people's life and work in an unprecedented way. The employers now want each of their employees to be STEM (Science, Technology, Engineering and Mathematics)-educated problem solvers. Any business expects employees at all levels to identify problems, think through solutions and alternatives, and explore new options if their approaches do not plan out.

In today's climate of intense competition, we must find ways to develop 'Integrative Innovative thinking' - the thinking that leads to new ideas, especially in S&T. Integrative Innovative thinkers turn challenges into real opportunities through their ability to think critically, analytically and with imagination. The problem, of course, is in education. And it's more than just the fact that although our students are good in Mathematics and in Science, they have never learned how to focus on the important problems - we haven't adequately taught them how to 'Think'. Our Science education has traditionally focused on memorizing discrete facts rather than understanding larger concepts and how they are connected to one another to create the exciting 'Big Ideas'. Likewise, laboratory experiences have focused on following stepwise procedures rather than emphasizing on how to organize mass amounts of information to solve complex scientific problems. Strong Science teaching supports learning of all subjects as Science provides a foundation for the development of language, logic and problem-solving skills.

Now a day everything is getting advanced in second of time. Every day starts with something new. Whatever be the field, it is getting advanced very fast. Lots of researches and studies are carried out in various subjects around the world which cannot be included in the student curriculum very immediately. So, we must include the 'arts in education' of Science, if we need to truly develop whole brain integrative and imaginative thinking. Art and Science have always informed and inspired each other. Innovators in both spheres require imagination, curiosity, creativity, ability to observe, questions, assumptions and make novel connections from diverse stimuli. Not confined to a particular subject, they sometimes prefer to discuss in a broader way with lots of practical day to day examples so that it reaches to them in a 'lighter manner but deep into their brain'. Actually the students need a lot of motivation and inspiration which they can relate with their surroundings and environment. 'Students Success thru' Innovative Thinking' may be a novel way to attract the young students at an early age with a focus to show them the excitements of creative pursuit of Science as a career and thereby strengthening and expanding the Science & Technology base in India.

Invited Lecture

Innovative Teaching Pedagogy at Digital age

Bijan Sarkar

Professor, Dept. of Education, University of Kalyani

Abstract

Pedagogy means the science of teaching. Teachers should have not only the knowledge of the content but also have the knowledge of pedagogy. If we consider the age of digital learning, teachers should have the knowledge and competence of technology. This type of knowledge needed for teachers is called Techno-pedagogical content knowledge (TPACK). Educationists always try to explore and innovate new ways to teaching to make learning effective and enjoyable. Considering the latest documents of NEP-2020, NCF-2005, we may find the pedagogy as constructivism, experiential learning, playway method as different approaches of learning. At the age of digital learning, experts suggest different innovative teaching pedagogy like Flipped learning, Connectionist learning etc. During and after the lockdown period due to Covid-19, different teaching methodologies like Blended learning, Hybrid learning, mobile learning are not only known to us but also we are habituated to use these approaches in our daily activities. Today's learners are known as digital learners. Characteristics of digital learners are quite different from traditional learners. Hence we have to explore different approaches of pedagogy in present day context. Accumulation of knowledge is now easier and students gather knowledge from different open sources. Considering this context, teachers should think about different innovative ways of teaching.

Paper Presentation

Multiple faces of engineered-CD154

Syamdas Bandyopadhyay, PhD

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Abstract: A key obstacle in CD154-based therapy is its physiological stability. The regulated effect of the engineered ligands establishes that one single ligand could be manipulated for multiple therapeutic solutions. Subsequently, we demonstrate a mutant of CD154, 129E→V with higher affinity leads to a stronger pro-inflammatory signal owing to binding to a different pocket in CD40 relative to the wild type or 128S→V, later being strongly anti-inflammatory.

Key words: CD154, CD40, Cell surface receptor, inflammation.

List of Abbreviations: CD: Cluster of Differentiation.

Evaluation of larvicidal efficacy of selected plant extracts against mango fruit borer *Autocharis albizonalis* Hampson (Pyralidae; Lepidoptera)

Tirthankar Dalui^{1,2*} and Subhankar Kumar Sarkar²

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Mango (*Mangifera indica* L.) is one of the important fruit crops in India and contributes significantly to the country's overall agricultural wealth and economy. Mango fruit borer (*Autocharis albizonalis*) commonly known as red banded mango caterpillar (RBMC) is a major pest responsible for severe losses to mango fruits. In India, synthetic pesticides are used as a major tool in RBMC control. However, in recent years, the use of synthetic insecticides to control RBMC has been restricted due to lack of environmental sustainability, high cost, and harmful effects on human health and non-targeted animals. With this in mind, we searched for a natural, eco-friendly biodegradable pesticide to reduce larval population under damage threshold. Leaves of four common medicinal plants, namely, *Trema orientalis*, *Piper longum*, *Mikaria micrantha* and *Justicia gendarussa* were collected from field. The shade dried leaves were mechanically powdered using a blender and subjected to successive extraction in methanol for three days with periodic shaking in a rotary shaker. After that, the extracts were filtered through Whatman No. 1 filter paper, and the filtrates were collected. The extracts were evaporated to dryness at room temperature. The substance present in the powdered form is the solvent free extract of the samples. The solvent free methanolic extract was scraped out from the petri plate and measured. From the stock solution, different concentrations of each extract were prepared for toxicity testing. Healthy 3rd instar larvae of RBMC were collected from mango orchards for larvicidal bioassay. The control was set up with water and methanol. Batches of larvae were prepared and tested in different concentrations of leaf extracts. After 24 hours of exposure, the percentage mortality was calculated from the average of three replications. The result showed that the leaf extracts of *Justicia gendarussa* have an effective larvicidal potential than the other three which showed moderate toxicity against larvae of the mango fruit borer.

Key Words: Justicia, leaf extract, Fruit borer, Pesticides, Larvicidal, Toxicity.

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Lorentz violation and noncommutative effect on the shadow of Kerr-like black hole

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We consider a Lorentz violating non-commutating Kerr-like space-time. We study the different aspects of the black hole shadow associated with a generalized Kerr-like space-time metric endowed with the corrections linked with Lorentz violation and non-commutativity effect jointly. We investigate the deviation of shape, and size of the ergosphere, and black hole shadow in this generalized situation and study their variation taking different admissible values of Lorentz violating parameter l and non-commutative parameter b . We observe that with the increase in Lorentz violating parameter l , the size of the black hole shadow increases, and with the increase in the non-commutative parameter b , the size of the black hole decreases. The ergosphere lies between static limit surface and the event horizon. Energy can be extracted from ergosphere through Penrose process. Our investigation concludes that the shape and size of the ergosphere depend on rotational parameter a , non-commutative parameter b , and Lorentz violation parameter l . The size of the ergosphere increases with the increase of b and l .

Microwave controlled optical switching in inverted-Y type atomic system

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Abstract

A four-level inverted-Y type atomic system¹, interacting with four electromagnetic fields is considered. with the atomic system. Dipole approximation² and rotating wave approximation² are used to derive the sixteen optical bloch equations (OBE) from the Master equation². These OBEs are solved under steady state condition by numerical method under the condition of population conservation to determine the probe coherence term. The line parameters of the ⁸⁷Rb $5S_{1/2} \rightarrow 5P_{3/2} \rightarrow 5D_{5/2}$ (Tr – I) , $5S_{1/2} \rightarrow 5P_{3/2} \rightarrow 7S_{1/2}$ (Tr-II) and $5S_{1/2} \rightarrow 5P_{3/2} \rightarrow 44D_{5/2}$ (Tr-III)³ have been used in the simulated results. In presence of the microwave field, the simulated probe response shows electromagnetically induced gain for stationary atoms as well as under Doppler broadened condition. The power of the applied microwave field plays a crucial role in switching the probe field propagation from subluminal to superluminal. The band width and sharpness also depends on the power of the microwave field. The impact of wavelength mismatching between the control field and the repump field on the switching has been also observed.

References:

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Evolving scopes of Information Technology and social inclusion for vector-borne disease elimination

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Vector borne diseases have been plaguing humanity since the dawn of civilizations. However, significant scientific progress have been made in the last few decades to combat them. In this paper we discuss our recent approaches using software applications to explore mosquito breeding habitats and finding ways of social inclusion from the affected society to combat the menace.

Objectives: In the social inclusion part, social perception was measured from NSS Volunteers and villagers regarding the use of software applications, be it in the scope of being the consumers, being the providers of field data or being the coders themselves. On the fieldwork scope, code created using our Bongojontro software were used to highlight the topical breeding grounds and show them on maps, which shares some scope with geospatial technologies. Using that data, fieldwork was done on those locations by the author.

Results: The survey returned very positive results. Volunteers and residents reported to be highly amicable to the concept of incorporating themselves in vector-borne disease elimination strategies. In the fieldwork, areas reported by the Bongojontro code-base using mathematical methods to have a high chance of mosquito larval presence was found to be true in most cases. Physicochemical parameters including TDS, temperature, electrical conductivity, pH and concentrations of various ions form the water-bodies in the region also showed some correlation to larval presence.

Conclusion: Our study hints that research and development in using software technologies and social inclusion holds ample promise for the future.

Land Suitability Assessment for Agricultural Sustainability of the Kumari River Basin, Eastern India

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Abstract

Land suitability classification (LSC) is a significant soil evolution method, developed by Food and Agricultural Organization (FAO), which measures the degree of appropriateness of a land and grouping of specific areas in terms of their suitability for a specific kind of land use. It is worth mentioning that FAO does not specify a specific index range for classifying land as S1, S2, S3, and N1. Index selection and its ranges are space and time-specific. Therefore, in this study, the LSC has been determined with respect to a variety of factors at local and regional scales, including physiographic, climatic, pedologic and a host of socioeconomic and infrastructural determinants. Since the relative importance of each factor is space and time specific, multi-criteria decision making techniques (MCDM) has been applied in this paper for ascertaining the agricultural LSC. The Kumari River Basin in Eastern India has been selected for this analysis and the multi-component Principal Component Analysis has been amalgamated with the Analytical Hierarchy Process (AHP) for determining the spatial variation of the agricultural land suitability. It is observed that 21.15 % area of the basin is characterized by very low ALS whereas 14.67 % and 14.07 % area of the basin is characterized by the high and very high ALS. Sub-basins and villages in the lower domain of the basin is characterized by the greater ALS as compared to the upper domain of the basin, whereas, isolated areas of higher ALS are observed in upper and middle domain of the basin. Most important factors contributing to variation in ALSI include slope (topographic), potential evapotranspiration (climatic) and soil fertility (pedologic).

KEY WORDS: Land suitability classification (LSC), Multi-criteria decision making (MCDM), Analytical hierarchy process (AHP).

Turritellid species from Miocene of Kutch, Gujarat and its Palaeobiogeographic Implications

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Abstract: The Tertiary deposit of the Kutch basin rich in macro fauna such as Mollusc (particularly pelecypods and gastropods), Echinoids and Cnidaria Fossils. Primary work on fossils molluscs occurring in the Tertiary sediment of Kutch provided by Sowerby, way back, 1840. The present work concerns systematic description of the species belonging to family Turritellidae, and the regional biogeographic correlation works extend to relate to different sections of Chhasra Formation, namely Chhasra section and Bhadra dam section. The possible morphological variations or similarity have been enumerated between the Turritellidae species of the two section. Both the section belongs to lower Miocene epoch (Burdigalian). The Chhasra section being relatively younger than the Bhadra dam section; morphological variations as well as variation in faunal occurrences have been studied. A relation between similar species of Turritellidae family from different basin of the world as well as faunal correlation at the species level among different basins of the Indian peninsula to that of the Kutch basin is also presented here.

The present study is the further elaboration of previous classics of Vredenburg (1928) and Sowerby (1840). The intra-basinal correlation based on Turritellid species described here clearly indicates increase in size of *T. narica* and *T. pseudobandonensis* from older Bhadra dam section to younger Chhasra section (Lower to middle Miocene). The low Jaccardian correlation co-efficient suggests that each region has its own endemic species and relative endemism varies from place to place. Among the six Turritellid species; *T. narica* and *Z. angulata* are cosmopolitan in nature, however *T. narica* is strongly endemic to the Indian subcontinent. The high endemism of the early paleogene Turritella species of the Kutch basin in general might have resulted from low dispersal potentials of majority of the species. This may also happen due to restricted faunal mixing.

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CORIANDRUM SATIVUM* ROOT EXTRACT AS A POTENTIAL MOSQUITO LARVICIDE AGAINST *AEDES ALBOPICTUS

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Mosquitoes are deadly insects that belong to Family *Culicidae*, Class *Insecta* and Phylum *Arthropoda*. It acts as a carrier for the pathogens of many fatal diseases. *Aedes albopictus* acts as a vector for diseases like yellow fever, dengue fever chikungunya fever, Zika fever etc. These mosquito-borne diseases cause many casualties throughout the world. Hence it is high time to think about stringent and efficient mosquito control mechanism. Conventional methods include: physical control, genetic control, biological control and chemical control. While Chemical control has its own side effects, it is difficult to get satisfactory result from other methods in a big country like India. Hence alternative environment friendly effective strategy is necessary. In this situation plant products seemed to be one of the best alternatives. In this study we propose *Coriandrum sativum* root extract as potential green larvicide against *Aedes albopictus*. The experiments were performed using standard WHO protocol. Graded concentration of Crude (0.1% to 0.5%) and solvent extracts (25-125 ppm) of *Coriandrum sativum* root were prepared. Non polar to polar gradient was maintained during solvent extraction. All four larval instars of *Aedes albopictus* were treated with the graded concentrations of these extracts (both Crude and solvent) for 24, 48 and 72 hours. 100% larval mortality was observed at 0.5% concentration of crude extract after 72 hours of exposure in case of 3rd instar larvae. Methanol extract showed best result amongst all the solvent extracts. Cent percent mortality was observed against 2nd and 3rd instar larvae at 75 ppm concentration after 72 hours of exposure for methanol extract. *Chironomus* larvae were treated with the same extracts to see the effects of the same on non target organisms. No harsh effect observed. Hence our finding suggests extracts of *Coriandrum sativum* root extract to be a potent green larvicide against *Aedes albopictus* larvae.

Keywords: *Coriandrum sativum*, *Aedes albopictus*, *Chironomus*, non-target organisms, Green larvicide

Present Cosmic Scenario of the Universe in Modified $f(G)$ theory

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Abstract: Late time transition is obtained with a function of Gauss Bonnet curvature $f(G)$ in the Einstein Hilbert action with a matter field in a FLRW spacetime assuming an ansatz without a specific $f(G)$. Late time accelerating expansion is either a phantom era without Big Rip singularity or a quintessence era or a de-Sitter era of expansion. The equation of state parameter, jerk and snap parameters support observational data and the function $f(G)$ obtained from the solution supports earlier works.

Keywords: Cosmology · Late time acceleration · Function of Gauss–Bonnet curvature.

Determination of *in-vitro* Bactericidal Activity of *Callistemon linearis* Floral Extracts

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Bacterium is a minute organism that causes various health hazardous throughout the animal and human population of the world. But they become resistant due to indiscriminate use of commercially available antibiotics. To overcome these problem researchers are involved in investigating new drugs from botanical source because, plant derived products are less harmful in compared to chemically derived drugs. *Callistemon linearis* (Narrow leaf bottlebrush) is a medium size evergreen tree under the medicinally important family Myrtaceae. The present study was aimed at evaluating the *in-vitro* antibacterial potentials of the floral extract (hexane and acetone) of *C. linearis*. Antibacterial activity was determined by Agar well diffusion method against some human and fish pathogenic bacteria. An attempt was also made to document plausible phytochemical analysis and Fourier Transform Infrared (FTIR) to determine the functional groups responsible for antibacterial activity. Among two different extracts best antibacterial potentiality were found in hexane against Gram-positive bacteria *Bacillus subtilis* followed by *Staphylococcus aureus*. Among Gram-negative bacteria *Escherichia coli* showed good result followed by *Pseudomonas putida*. Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) were done to establish the bactericidal activity of the extract. Presence of phytochemicals such as tannins, terpenoids and functional groups like alcohol, aromatics, esters, etc. were detected by preliminary phytochemical test and FTIR analysis respectively. In summary, *in-vitro* bactericidal activity of floral extract of *C. linearis* were established and hexane was identified as much potential antibacterial compound which may be used as an antibacterial to treat infectious diseases.

Keywords: *Callistemon linearis*, Antibacterial activity, MIC, MBC, Bactericidal, FTIR

Mosquito larvicidal activity of fruit extract of *Casearia tomentosa* on *Culex quinquefasciatus*

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Mosquitoes are one of the deadliest animals on earth and are distributed all over the world. They are carriers of many human diseases including malaria, yellow fever, dengue, chikungunya, filariasis etc. Their ability to transmit and spread diseases to humans causes millions of deaths each year. Concerns like environmental pollution and the development of insect resistance to chemical larvicides have prompted the search for natural plant-based insecticides. Present study was conducted to evaluate the mosquito larvicidal efficacy of fruit extract of *Casearia tomentosa* against *Culex quinquefasciatus*. Following the standard protocol of WHO, larval mortalities of *Culex quinquefasciatus* were observed against all the larval instars using five graded concentrations of methanol extract 40 ppm, 80 ppm, 120 ppm, 160 ppm and 200 ppm. Regression and log-probit analyses were performed to determine the LC₅₀ and LC₉₀ values. Phytochemical analysis of solvent extract revealed the presence of terpenoids, alkaloids, flavonoids and coumarin. Fourier transform infrared analysis confirmed the presence of alcohol, carboxylic acids, imides, ester aromatics and amine salts as functional groups. Cent percent larval mortality was observed at 200 ppm concentration of solvent extract after 72 hours of exposure in all instars. No adverse effect was found in non-target organism like *Chironomus* sp. larva throughout the experiment. Thus, the study indicates that methanolic fruit extract of *C. tomentosa* can be a potent larvicidal agent against filarial vector *Culex quinquefasciatus*.

Keywords: *Casearia tomentosa*, *Culex quinquefasciatus*, larvicidal efficacy, phytochemical analysis, FT-IR

PROPAGATION OF WATER WAVES ALONG THE OFF-COAST OF DIGHA, A COASTAL STATION OF WEST BENGAL, INDIA

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ABSTRACT

Inundation of sea beaches, forests, cultivated lands, and even human dwellings, is a very common environmental incident adjacent to coastal areas of densely populated country like India, due to the propagation of large sea waves generated by storm surges and tidal bores every year. Tsunami is another event that creates havoc along the coastal countries of the world especially adjacent to the Pacific, and the Boxing Day 2004 Tsunami of Bay of Bengal recorded 2,27,898 deaths of people in 14 countries not only surrounding the bay but few also situated as far as east coast of Africa, and India alone accounted for 16,269 deaths. Therefore, a detailed roadmap of wave propagation and knowledge of increment of wave height with time is very essential information for West Bengal which has about 160 km of shoreline border with the Bay of Bengal. This article considers a linear shallow water model in one dimension to simulate interaction of waves with the bathymetry of the off coast of Digha, using the Crank-Nicolson scheme of Finite Difference Method. Computational results of interaction are obtained and demonstrated using MATLAB. Bathymetric data of the off coast of Digha are obtained from the publicly available dataset of GEBCO 2020. The simulation is performed by approximating the raw bathymetry of 72 km of continental shelf from Digha coast by piecewise linear function and using closed boundary conditions. Generation of successive wave crest towards land is noted after 15 min. and 30 min. time span respectively. Computation is carried out by neglecting as well as by considering the non-linearity in the conservation of momentum part of shallow water equations and comparison of the results have been demonstrated.

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Decomposition of forest waste and nutrient release of selected species in a subtropical region, West Bengal

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Abstract

Forest waste particularly leaf litter research is an interesting aspect due to its significance in nutrient cycling and for long-term functioning and appropriate management of the forest ecosystem. The present experiment was carried out to examine inter-specific differences in the rate of decomposition and nutrient release of the leaf litter utilizing five species (*Tectona grandis*, *Albizia lebbeck*, *Shorea robusta*, *Anacardium occidentale* and *Eucalyptus citriodora*). The field study was conducted with a standard litterbag technique to monitor the decomposition rates of the leaf litter for one year. Nutrient concentrations (N, P, and K) of the litter were assessed by standard methods. Results revealed that the decay rate constant (k) was highest for *T. grandis* (1.556 yr^{-1}) and lowest for *E. citriodora* (0.946 yr^{-1}). Initial litter chemistry of lignin, nitrogen, carbon/nitrogen and lignin/nitrogen ratios showed a significantly correlated with decay rate. The concentrations of nutrients decreased with time and the mobility of nutrients showed a similar pattern (Potassium > Nitrogen > Phosphorous). Among the studied nutrients potassium was released rapidly from all experimental species during decomposition. However, *T. grandis* decomposed faster and released relatively more nutrients than other experimental species. Moreover, higher rates of decay and nutrient release in *T. grandis* and *S. robusta* litter indicated the potential use of these species as nutrient inputs in forest systems. Overall, it is concluded that different species exhibited various decay rates and nutrient release patterns due to different litter quality. However, further studies are needed particularly on the effect of species and climate factors on plant litter decomposition in various types of forest ecosystems.

Keywords: Decay constant, leaf litter, litter chemistry, nitrogen, *Tectona grandis*

Food security in the perspective of Land-use change ----- A village level study in Nadia District

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Concept of food security is the burning issue in human society for ever. It is the prime among the basic needs to sustain, so from the very beginning of human civilization in fact all the wars and extension of conquered land are basically related to food production and availability of food. Whenever we concentrate on the issue of food security the related issues included are production of food and its consumption which itself is related to economic status. From nutritional point of view it is only in secured condition when satisfies required calorie level.

Now the production level of food itself is dependent on several factors like availability of fertile land, supporting climate, production technique, conservation of produced items, but the basic need of course is of suitable land. As per the Malthusian¹ concept growing population is causing greater demand with lesser cultivable land. Present paper runs with an objective to highlight land-use change and its impact on food production in selected villages in Krishnagar Sadar Sub-division, Nadia, West Bengal. Here the methodologies included are study of land-use map to highlight on change detection, questionnaire survey and their analysis to depict the scenario at grass root level. Alarming fall of agrarian land and alteration of crops with traditional crops for temporary benefit are the major findings of this work. Unplanned growth of non-agrarian land over agrarian land is an obvious threat for future food-security both at Local and Global scale, proper planning could manage the situation to some extent.

Keywords: Land-use, Crop, Food-security.

(Michael Whiterick, 2000)¹

Renewable energies: hidden cost

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Abstract

In modern society, a huge amount of energy is required to run the industries, home and agricultural sector. Most of the energy is produced by burning fossil fuel. This burning of fossil fuel releases carbon in the atmosphere which in turn causes global warming. One of the promising solutions to the problem is introducing a sizable portion of renewables in the energy mix. However, contrary to popular belief, renewables are not completely emission free. Renewables such as solar or wind energy do have carbon emission associated with them. In this article, the source of such emission and the ways to nullify them will be discussed.

MOSQUITO LARVICIDAL EFFICACY OF THE SEED EXTRACTS OF *Michaelia champaca* AGAINST *Aedes albopictus*

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Mosquito, being one of the most notorious insects of the world, transmits various deadly diseases like malaria, filariasis, Japanese encephalitis, dengue etc. Among these *Aedes albopictus* transmits dengue, yellow fever, zika, chikunguniya etc. along the tropical realms of the world. Previously, chemical pesticides had been charged on them for their eradication, which proved to be hazardous for human and other life forms. Thus, mosquito larvicides of botanical origin would be safer, target specific and eco-friendly. In this study, the seed extracts from *Michaelia champaca* showed effective mosquito larvicidal potential against *Ae. albopictus* larvae. Following the standard protocol of WHO, larval mortality was determined against all the four larval instars of *Ae. albopictus* using the graded concentrations of crude extract (0.5-0.9%), hot and cold aqueous extracts (50-250 ppm) for 24, 48 and 72 hours of exposure. Using regression and log-probit analyses LC₅₀ and LC₉₀ values were determined. *Chironomus* larvae were treated as non-target organism. Cent percent mortality was observed at 0.7% concentration of crude extract and 200 ppm concentration of cold aqueous extract against 2nd and 3rd instars larvae after 72 hr of exposure. Hot aqueous extract did not show promising results. No adverse effect was found against the non-target organism. Thus, selective seed extractives from *M. champaca* can be used as potential larvicidal agent against *Ae. albopictus*.

Keywords: *Michelia champaca*, *Aedes albopictus*, *Chironomus*, mosquito larvicide

Extracellular polysaccharides of desiccated cyanobacteria of West Bengal

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Abstract

Ancient archaeological and historical sites have widespread biofilm-forming cyanobacteria. Cyanobacteria plays an essential role as a pioneer in establishing life on bare inorganic support and producing considerable biomass. In natural habitat, many cyanobacteria form visible colonies that consist of biochemically complex extracellular matrices and cellular filaments embedded within extracellular polysaccharides (EPS), accounting for 60–80% of the dry mass. We have isolated many potential biofilm-producing cyanobacteria and optimized extraction of cyanobacterial exopolysaccharides from them. Sixteen isolated species of the cyanobacteria were screened for their extra cellular polysaccharide. Among the sixteen species, maximum CPS was produced by *Anabaena* sp. (VBCCA 052 009) with 261 µg/ml followed by *Lyngbya* sp. (VBCCA 052 019) (212 µg/ml) and *Stigonema hormoides* (VBCCA 052 017), (191 µg/ml) and *Nostoc ellipsoporum* (VBCCA 052 023) produce the least CPS (5 µg/ml). However, in *Anabaena* sp. (VBCCA 052 002), the highest released polysaccharides (222 µg/ml) were found, followed by in *Anabaena sphaerica* (VBCCA 052 010) (220 µg/ml), and the least RPS was observed in *Scytonema* sp. (VBCCA 052 016), (6.8 µg/ml). Details of the exopolysaccharides in these cyanobacteria will be discussed.

Photoluminescence of materials and the controlling factors

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Photoluminescence is a process in which a molecule absorbs a photon in the visible region, exciting one of its electrons to higher energy state, and then radiates photon while returning to lower energy state. Photoluminescence spectroscopy is a powerful, non-destructive technique of probing the electronic states, defect states as well as surface properties and is widely used for material characterization. Semiconducting materials produces luminescence which is usually attributed to the interband transition or exciton combination. Synthesizing the material in nanometer dimension, introducing dopants in the materials and creating defects within the crystal structure, induces unusual visible emissions. Moreover, synthesizing nanomaterials with different morphologies is an effective method to produce interesting photoluminescent properties. In this paper, we shall focus on the effect of morphology and dopant on photoluminescence properties of ZnO, and photoluminescence of graphene synthesized by mechanical milling method. Various proposed mechanisms for the photoluminescent properties of the materials are transitions between defect states mainly donor to acceptor level, zinc and oxygen vacancies, interstitial zinc and oxygen, surface defect states due to ligands, and antisite oxygen. The origin of visible emission of graphene is the radiative recombination of the electron-hole pair, which was generated in the defect sites, which served as the localized states in the system.

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Green synthesis of silver nanoparticles using leaf extract of *Diospyros montana* and evaluation of its larvicidal potential against *Aedes albopictus* mosquitoes

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Abstract

Nanoparticles are the particles of atomic and molecular scale, ranging from 1 to 100 nm in size. They have many interesting physical, biological, catalytic and optical properties that draw the attention of advanced research thinking. Recently the use of phyto-reduced silver nanoparticles as mosquito larvicide has been well established. Present study aimed at synthesizing silver nanoparticles using leaf extract of *D. montana* which showed promising larvicidal effect. The said extract act as reducing and stabilizing agent during nanoparticles formation. The characterization of the synthesized nanoparticles was done by UV-VIS-spectrophotometer, X-RAY diffraction (XRD), and scanning electron microscopy (SEM). According to the standard protocol of WHO, bioassay was performed against all the four instars of *Ae. albopictus* and mortality was noted after 24, 48, and 72 hours of exposure. Cent percent mortality has been noted at 10ppm concentration of nanomaterial after 72 hours of exposure against 3rd instar larvae. LC⁵⁰ and LC⁹⁰ values were determined from log-probit analysis. Very low toxicity was recorded against non- target organism when treated with these green synthesized nanoparticles. Hence, the green synthesized nanoparticles from *D. montana* could be used as an effective larvicide against *Ae. albopictus* mosquito.

Key words: Nanoparticles, *Diospyros montana*, Larvicide, *Aedes albopictus*

Factors influencing productivity of small farmers in the world of VUCA – A study in West Bengal

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Abstract

India's population is expected to surpass that of China by 2022 and reach 1.5 billion in 2030, according to the UN Population Prospects 2019. In India, the average household spends forty-five percent of income on food. However, for almost the last two decades, agriculture has experienced significantly slower growth than that recommended by NITI Aayog. This has grave implications for the nation's food security in the coming days. One immediate solution to the problem is to increase agricultural productivity. Even though small farmers are more productive than large farmers, they face severe threats to their livelihood because they work in the VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) environment. This paper examines, using a multiple regression model, how various socioeconomic factors influence the productivity of small farmer households in West Bengal. A survey was conducted using a systematic multistage random sampling design, and the responses of one hundred and sixty small farmer households were recorded using a pretested structured questionnaire. According to the study, productivity increases with increased fertilizer use, access to credit, farmers' connection to the nearest wholesale market, and crop insurance purchase, but it decreases with non-farm income. The study suggests that the government play an active role in raising awareness about the use of organic fertilizer to maintain soil health and crop insurance to promote an insurance culture among farmers, extending the institutional sources of credit for small farmers and create facilities that encourage skill formation for employment in the non-farm sector. Furthermore, the study calls for the abolition of intermediaries and commission agents who stand between farmers and final customers in the case of agricultural marketing.

Key Words : Productivity, Small farmer, Socioeconomic, VUCA.

IMPACT OF IRRIGATION FROM SURFACE AND SUB-SURFACE SOURCES ON LOCAL ECOSYSTEM: A MICRO LEVEL STUDY ON HUGLI AND HAORA DISTRICTS, WEST BENGAL

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Abstract

The provision of water from the rivers is essential to the agrarian economy of a riverine plain. The lower reaches of the rain-fed monsoon rivers experience seasonal variations in the amount of water they transport. The main and diversion channels are dug up by the farmers, who then reroute them for irrigation purposes. The river network will change as a result of this diversion. Since, many agricultural patterns of the very region cannot be supported by water from surface channels and water bodies, groundwater intervention is the only remaining option.

There is a lack of water for agriculture from surface water sources including rivers and streams as well as a decline in the ground water table in the Districts of Haora and Hugli, which are situated at the lower stretch of the Damodar. The local aquatic ecology has been wedged by an increase in water demand, a corresponding rise in irrigation costs, and a slow but inevitable desiccation of soil moisture.

On the basis of the facts, this paper makes an effort to assess the rate of stream diversion and lowering of ground water table due to over use of water for irrigation in the districts and offers some potential options for the use of irrigation water.

Key Words: *Irrigation, diversion of river, surface and ground water, agrarian economy, local ecosystem*

Food Security and Its Global Impacts

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ABSTRACT

According to the United Nations’ Committee on World Food Security, Food security means that all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life.

Over the coming decades, a changing climate, growing global population, rising food prices, and environmental stressors will have significant yet uncertain impacts on food security. Adaptation strategies and policy responses to global change, including options for handling water allocation, land use patterns, food trade, postharvest food processing, and food prices and safety are urgently needed. Several works on food security includes analysis of cash transfers, promotion of sustainable agricultural technologies, building resilience to shocks, and managing trade-offs in food security, such as balancing the nutritional benefits of meat against the ecological costs of its production. Research has found that food insecurity is associated with increased risks of some birth defects, anemia, lower nutrient intakes, cognitive problems, and aggression and anxiety. The food system is under pressure from non-climate stressors (e.g., population and income growth, demand for animal-sourced products), and from climate change. These climate and non-climate stresses are impacting the four pillars of food security (availability, access, utilization, and stability).

The Impacts of Climate Change on Environment and Living Beings

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ABSTRACT

In the current era of globalization and the industrial revolution, Earth's climate has been incessantly changing. The climate change which is a result of an imbalance between incoming and outgoing radiation in the atmosphere and is considered as a serious threat to ecosystem, biodiversity, and health. Climate change is greatly caused due to human activities especially through increased emissions of greenhouse gases. The extensive uses of fossil fuel (oil, charcoal, and gas), fertilizers in agricultural fields, deforestation, automobiles and different industrial processes release a large amount of carbon dioxide (CO₂) and other greenhouse gases (such as methane, CFCs, nitrous oxides) into the atmosphere, which concentrate, and warm the planet. It impacts plants and animals, with consequences for the survival of the species. In humans, climate change has multiple harmful consequences. Climate change creates water and food insecurity, increased morbidity/mortality, and population movement. Vulnerable populations (e.g., children, elderly, indigenous, and poor) are disproportionately affected. Personalized adaptation to the consequences of climate change and preventive measures are key challenges for the society. Policymakers must implement the appropriate strategies, especially in the vulnerable populations. However, it is threatening the existence of several life forms that have to endure this climate change coupled with other human-induced changes. All these factors combined may soon affect us, too. For instance, the availability of food may be drastically reduced. There are many things everyone can do to help slow the climate change and life form extinctions in the near future.

The Sentinel of our Healthy Brain is Microglia: the immune cell of CNS

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Abstract

Brain is the centre of all living activity in organisms. Thus the health of the brain is an important part for the immune system. In animal body the immune system is mostly blood borne, while the brain is lacking blood influx. Only specific nutrients and other elements can cross the blood brain barrier (BBB) and able to enter in the CNS. Microglia is identified as the only residential immune cells originating from blood. In 1920, microglia cells were first identified and designated as residential immune cells by Pio del Rio Hortega. Microglia cells are monocytic in origin at the early stage of organogenesis and during brain development, the blood borne monocytic lineage cell are migrated and colonised in the brain. 5 to 20 % of total glial cells are composed of microglia cells, and they are mostly present in all region of the brain. Detection of pathogenic invasion, injuries and other abnormal activities in brain are scanned by the microglia cells. Immediate after the detection microglia becomes activated in brain, shows phagocytic response, oxidative burst and may cause inflammation in many cases. As phagocytic cells, they actively phagocytose abnormal cells, debris, sometimes healthy cells also. Apart from immune-inflammatory activity they can widely participate in neurogenesis, brain development and neuronal network formation and its maintenance. There are some negative impacts of microglia which have been detected in many occasions like Alzheimer's disease or in glioma, a type of brain tumor. So, microglia is considered as the double edged sword in brain, which can protect CNS with its natural function, but can be detrimental in specific occasions. Thus the health of the brain is widely depends on the microglia, and study of its activity is important.

Keywords: *Microglia, Blood Brain barrier, Inflammation, Phagocytosis, Glioma.*

The Juxtaposition of Science in Sukumar Ray’s Rhymes and Fictions

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Born in an elite Brahmo family, Sukumar Ray had an early exposure with science in the ambience he got by birth. His academic career, stretching from Presidency College in India to School of Photo-Engraving and Lithography in London, consisted Physics, Chemistry and Lithography – the studies in mainstream science. On a pole-apart note, his literary career principally comprised the *nonsense* ideas, having no external link with that of logical and reasoned pedagogies. However, going deeper a reader sees his hyper-sensitive views and imaginations which were justly reconciled with the mainstream scientific mind. Added to this, a colonial reign and religious exposure also embodied into the Sukumar Ray’s literary writings, which created a dialectic juxtaposition of science. The famous periodical *Sandesh* beheld his various pedagogy of science that he wanted to circulate among juvenile and adolescent minds. A contrasted polyphony of imagination and science thus makes Ray’s fiction and rhymes a subject of broader aspect. This article will focus on the said features of his writings.

Keywords – *juxtaposition, imagination, contradiction, culture, pedagogy*

The Pythagorean theorem: two non-conventional approaches

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ABSTRACT

The Pythagorean theorem is a primitive yet non-trivial exposition of a basic relationship among the three sides of a right-angled triangle. It is important both from philosophical and utilitarian standpoints. Our sense organs are so designed that they can only feel linear relationships. So, touching this type of nonlinearity is an example of extraordinary human intellect and brilliance. From practical consideration, this theorem is the cornerstone of our distance measure in the flatland. Conversely, a flatland can be characterised with this relationship also. It is so fascinating and novel to a curious mind that Albert Einstein himself constructed a proof of this theorem by dissection. We demonstrate here two separate non-conventional proofs of this fundamental result for educational and entertainment purposes. These proofs are already in the literature, we just demonstrate and elaborate them to share our joys and delights with the audience.

পরিবেশবিদ রবীন্দ্রনাথ ঠাকুর

শংকরদেব মন্ডল

বাংলা বিভাগ, শরৎ সেন্টিনারী কলেজ

রবীন্দ্রনাথ বাংলা সাহিত্যের সকল অঙ্গনেই নটরাজ। তাঁর সাহিত্য রচনায় বৈজ্ঞানিক সচেতনতা লক্ষ করা যায়। তিনি ভুবন বিখ্যাত কবি। কবি-স্বভাব অনুসারে তাঁর কাব্যে নিসর্গ প্রীতি অবিরল ধারায় প্রতিফলিত হয়েছে। শুধু ভালোলাগার আত্মভোলা আবেগপ্রবণতাই তাঁর কবিতা-শরীরে নেই। মন্বয় গীতিকবি প্রকৃতির সঙ্গে, এই পৃথিবীর সঙ্গে পরম আত্মীয়তায় একীভূত হতে চেয়েছেন ‘সোনার তরী’ কাব্যের ‘বসুন্ধরা’ কবিতায়। কারণ, কবি মনে করেন যে, একসময় পৃথিবীর সঙ্গে তিনি এক হয়ে ছিলেন ; যা নৃতত্ত্বগতভাবে সত্য।

‘বলাই’ ছোটোগল্পে গাছের সঙ্গে মানুষের একাত্মতা খুবই স্পষ্টভাবে প্রতিফলিত হয়েছে। গল্পের প্রধান চরিত্র বালক বলাই-এর বালকসুলভ খেয়ালিপনায় গাছকে বন্ধু বলে মনে করা বাহ্য-দৃষ্টিতে অগভীর একটি বিষয় বলে মনে হতে পারে। কিন্তু প্রকৃতই গাছে-মানুষে এবং অন্য প্রাণীতে জন্মসূত্রের আত্মীয়তাকে অস্বীকার করা যায় না। বিবর্তনের ধারায় বিচ্ছিন্ন হয়ে গিয়ে আমরা সমগ্র উদ্ভিদ জগৎকে দূরের বলে, অনাত্মীয় বলে ভাবি। এই দূর বলে ভাবাটা নিতান্তই ভুল ; আর তার সমাধান বড়ই শক্ত। মানুষ যদি নিজে বুঝতে চেষ্টা না করে, তাহলে কোনোভাবেই গাছের সঙ্গে মানুষের আত্মীয়তার কথা উপলব্ধি করিয়ে দেওয়া সম্ভব নয়। উল্লিখিত গল্পের বর্ণনায় রবীন্দ্রনাথ চিরকালের সত্যের সন্ধান দিলেন, -

“কালের পথে সমস্ত জীবের অগ্রগামী গাছ,
বিশ্বপ্রাণের মূক ধাত্রী এই গাছ নিরবচ্ছিন্ন কাল ধরে দু্যলোককে দোহন করে; পৃথিবীর অমৃতভাণ্ডারের জন্যে প্রাণের তেজ, প্রাণের বাণীকে অহর্নিশি আকাশে উচ্ছ্বসিত করে তোলে, ”

প্রাণের অস্তিত্ব রক্ষার জন্য উদ্ভিদের রক্ষণাবেক্ষণের বিকল্প নেই। রবীন্দ্রনাথ এ ব্যাপারে বাস্তব পদক্ষেপ গ্রহণ করেছিলেন। তাঁর ‘বৃক্ষরোপণ’ উৎসবের প্রবর্তনা এক্ষেত্রে এক বিশেষ দিকচিহ্ন নির্দেশ করে।

‘ধরণীর ছায়াবিস্তৃত আঁচল’ অরণ্যকে আশু ধ্বংসের হাত থেকে না বাঁচালে আমাদের অস্তিত্ব থাকবে না - এতে আজ দ্বিধা করা চরম অমানবিকতা। অরণ্যসৃজনে বিমুখ ব্যক্তি স্বার্থপুষ্ট মানসিকতা ভয়াবহ মানবহীন পৃথিবীর দিকেই সভ্যতাকে ক্রমশ এগিয়ে দিচ্ছে। রবীন্দ্র চেতনাপ্রসূত বনসৃজন ও বৃক্ষরোপণ শুধু কবিজনোচিত খেয়ালমাত্র ছিল না। পরিবেশ রক্ষায় রবীন্দ্রনাথের বিজ্ঞান চেতনাকে কাজে লাগাতে হবে। ‘বনবাণী’ কাব্যের ‘বৃক্ষবন্দনা’ কবিতায় পাই, -

“ওগো সূর্যরশ্মিপায়ী,
শত শত শতাব্দীর দিনধেনু দুহিয়া সদাই
যে তেজে ভরিলে মজ্জা মানবেরে তাই করি দান
করেছ জগৎ-জয়ী, দিলে তারে পরম সন্মান,”

In spite of different environmental barriers reproductive ecology of mangroves of Indian Sundarbans indicates Xenogamy as preferred mode of successful reproduction

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Mangroves have been recognized as highly productive, diverse, crucial bio-resource in the coastal environment and it act as the buffer zones between the land and sea. Present degradation of mangrove forests due to anthropogenic, environmental and climate change factors are not only closely linked with its loss of adaptability, but also greatly affects the reproductive mechanisms of mangroves which lead towards species loss in the long run. As the mangroves mainly propagate through sexual reproduction, study of reproduction in mangroves with quantifying the effective fruit-set, is a prerequisite of immense importance that mainly contributes to sustenance and development of a pristine mangrove forest. The success of sexual reproduction in mangroves is linked to flowering timings, pollinators’ abundance, unhindered movement of pollinators etc. and the failure of this pollinator-mediated reproductive process to cope with environmental and climate changes is one of the fundamental reasons for species loss. Mangroves are considered to have generalized pollination system in which generalist pollinators like honey bees, yellow wasps, lady bird beetles, sweet bees, snail epifauna traverse vast spectrum of mangrove flowers as their reward resources. The mangrove species are reported in general to be self-incompatible and crosspollinating, thus avoiding inbreeding depression, which causes low intra-population genetic diversity. We generated data on major reproductive ecological components of mangrove species of Indian Sundarbans viz. floral morphology, pollen load, success of artificial pollination (autogamous, geitenogamous and xenogamous modes), a comparative time-dependent data of histology of ovary after pollination through xenogamy, geitenogamy and autogamy using *Bruguiera gymnorhiza* as a model species. It becomes evident from all these results that mangroves are mostly self-incompatible and xenogamy is the preferred mode of sexual reproduction in Sundarban mangroves.

Importance of metagenomic surveys of soil bacterial communities in monitoring mangrove forest health

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Abstract

Next-Generation Sequencing (NGS) of 16S rRNA gene of V3-V4 region using Illumina MiSeq platform is now one of the most widely used applications to investigate at the genus-level sensitivity for metagenomic surveys of bacterial populations at any biome level. NGS is more sensitive, time and cost saving than traditional culture methods (TCMs), albeit while NGS displays the both cultivable & non-cultivable microbial scenario in a particular biome, TCMs are the only option to obtain the cultivable microbe to fulfill its fullest utilization objectives. Knowledge of the composition and abundance of soil bacterial communities can be used to predict soil physicochemical trends, hence presuming the cryptic stressors present in any ecosystem. Plants and their associated microbes in the surrounding niches interact with each other and together form an assemblage of species in the phyllosphere, rhizosphere and plant endospheric compartments acting as “holobiont”. Selective external environmental pressure on holobiont components has great potential to shape both the ecosystem and the resident plant-associated microbial communities to impact plants' fitness in three major ways- (1) primarily, increasing the bioavailability of soil-borne nutrients (2) outcompeting pathogenic microbial strains and finally (3) re-orienting the hormonal signalling of plants towards better resilience. Estuarine mangrove environments are one of the most productive ecosystems on earth, resulting in maximum carbon sequestration both in above and below ground plant biomass. Our research group is dealing with 30 degraded sites (covering ~60 hectares) of Indian Sundarbans with the aim to ecologically restore these degraded mangrove ecosystems. The relative abundance of bacterial communities in between pristine and degraded sites reveals the role of microbes in restoration of mangrove forest in a scientific way making it a little more than a simple large scale tree plantation or afforestation program. The major bacterial communities like Alpha and Gamma Proteobacteria, Planctomycetes, Actinobacteria and Firmicutes and their relative abundance is a key fine-tuning criterion in transforming the degraded mangrove sediments slowly and gradually towards pristine mangrove sediment-like condition as evidenced from our ecological restoration of degraded mangrove ecosystem research explorations executed till date.

Diethyl phthalate, no more a xenobiotic compound for plant species is widespread in mangrove species of Indian Sundarbans and its relevance of presence

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Phthalic acid esters (PAEs) are common plasticizers which are added to polymeric materials to improve their flexibility and workability. Phthalic acid esters (dialkyl or alkyl aryl esters of 1,2-benzenedicarboxylic acid), usually called PAEs, phthalate esters, or just phthalates, are a group of important derivatives of phthalic acids which are synthesized from phthalic anhydride and specific alcohols by Fischer esterification. The conventional view is that PAEs are continuously released to the environment via industrial effluents. Therefore, the presence of phthalates in plants used to be considered as a result of environmental pollution. However, this concept is no more valid and literature surveys explicitly revealed that PAEs are biogenic secondary metabolites accumulated in different plant parts like in stem, leaves, roots and fruits. Di-butyl phthalates and di-ethyl phthalates are the most abundant PAEs in plant species. Our research studies find that most of the mangroves and mangrove associates from Indian Sundarbans are synthesizing these phthalates as secondary metabolites. At first PAEs have been detected via GC/MS in the organic extracts of these mangrove plant species. Later on GC/FID and spectrophotometric analyses reconfirmed also the abundance of phthalates in the leaves and roots of different mangrove species. Nevertheless, the biosynthetic pathway of these PAEs in plants was rarely studied. It was initially speculated that the shikimic acid pathway might be responsible for these PAE biosynthesis. Some researchers have been able to demonstrate PAE biosynthesis by shikimic acid pathway with D-glucose as substrate and protocatechuic acid as an intermediate product which later esterifies with n-ethyl or n-butyl alcohol to eventually generate PAEs. The PAEs in plants are considered to have two major relevances. Firstly, like any other secondary metabolites, these PAEs act as defense molecules for plants against invading pathogens. Secondly, the PAEs excreted in the litter and root exudates of plants, are considered as allelochemicals to the external environment that affect neighbouring plants' growth, an obvious physiological dominance establishing mechanism adopted by many invasive plant species. PAEs are shown to interfere with N-metabolism of many plant species, that results in suppression of seed germination, growth inhibition, phthalate-induced stresses limiting plant growth and development via affecting photosynthesis and reducing carbon assimilation ability of plants. Our hunch is whether plant excreted PAEs have any role in creating monotypic forests, by allowing just one or two species to multiply.

Climate change affects the diversity of Indian Sundarbans: Restoration attempts of this lost diversity with reference to conventional and non-conventional techniques

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Abstract

Indian Sundarbans is the largest most productive wetland ecosystem in the world and a rich abode of almost 60 species of true mangrove plants and mangrove associates out of which about 20-22 species either belong to IUCN globally threatened list or under Least Concerned category with major declining trend of population threat. Dependent upon the niche of this eco-physiologically specialized converged evolution and heterogeneous halophytic assemblage of plant species, highly acclimated in Indian Sundarbans mangrove ecosystem, a diverse epifaunal assemblage and unique near-shore fish community has also developed at the intertidal zones. Soil microbiota has also diversified appropriately depending on this typical floral and faunal assemblage, in a unique style, having little similarity with other mangrove niches across the world. In this era of climate change this largest estuarine mangrove ecosystem is continuously losing its biodiversity. Loss of biodiversity reduces the ability of an ecosystem to function properly in an effective manner and also reduces nature's resilience to adversities. Our quadrat analyses data from several fringe mangrove patches of high ecological significance (outside protected area) and some parts of protected forests of Sundarban Biosphere Reserve has shown that these fringes once a hub of diverse mangrove species, are now simply dominated by only 3 species of *Avicennia* spp. as well as dioecious *Excoecaria agallocha*. Even the natural secondary regeneration in these areas is limited into only these referred species. Under this back group, our group is trying to restore this diversity of mangrove species at least at the fringe mangroves outside protected areas. We are generating saplings of these threatened taxa by adopting conventional seeds and propagules based multiplication as well as following a non-conventional seed ball technology.

Prevailing Maternal Health Status – A Comparative Study on Maternal Health Conditions in Urban and Sub-urban Areas

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Abstract

Reproduction and nurturing of the progeny organisms has always been the charismatic way of nature to sustain existence of species generation after generation. So mothers hold immense responsibilities and their good health plays pivotal character in shaping a better world. Hence, health facilities provided to the pregnant women can be the scale of judging a state or a country. Many mothers suffer from lack of access to health, poor conditions and poor quality of life – especially in developing countries. According to the UNICEF, a statistical analysis shows, a woman dies from complications during childbirth every minute – about 529,000 each year – the vast majority in developing countries. So, WHO is supporting countries to deliver integrated and cost-effective care for mothers and babies during pregnancy, childbirth and the postpartum period as a ‘Millennium Development Goal 5’ to improve maternal health. In this independent project we have targeted two different government hospitals, one from a metropolitan city and another one from suburban area and examine the actual scenario of our state hospitals in light of maternal health status. It uses unique set of questionnaire and statistical analysis to draw almost accurate results obtained from the raw data. Result indicates a contrast in maternal health, adolescent pregnancy, fertility rate, age-range of pregnant women, major diseases faced and socio-economy position of the targeted group.

Key words: Maternal health status, urban and sub-urban hospitals

Visualizing Mathematics: A Review

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Abstract

As a part of innovative classroom practices, visualization now a days is an essential component. In the teaching and learning of Mathematics, various educators recommend increased visualization. In this review work, several examples on visualizing Mathematics is presented. Some of them needs no technological support- can be described with traditional chalk-blackboard method. Examples cover results from Geometry, Trigonometry, Inequalities, Limit of functions, Sequences, Infinite series, Integer sums and differential equation.

Key words: Visual Proof, Proofs without words, Mathematics Education

Nanoscale Materials And Devices For Future Communication Network

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Abstract

Nanotechnology is pertinent in communication engineering and has a plethora of uses. Nanotechnology has the potential to significantly impact the telecommunications industry. Breakthroughs in nanometer-scale materials are expected to play an essential role in addressing current and forthcoming communication challenges. Devices and systems for high-speed short-range and long-range communication links, energy-saving and portable computing devices, high-density memory and logic, high-speed connectivity, and energy harvesting equipment automatically sure to access necessary information, and information of the surrounding environment, depend heavily on the success of next-generation nanomaterials and devices. Future intelligent communication networks have the potential to be significantly changed and developed thanks to the use of nanomaterials. Devices like nano transistors, paper batteries, nanorobotics, nanosensors, wireless technology, nano communication, and networks are some of the most latest advancements in nanotechnology. It focuses on how this technology is anticipated to enable it possible to fabricate smaller, less expensive, and more powerful electronic gadgets with improved levels of efficacy.

Keywords: Nanotechnology, devices, communication, information, nanomaterials

Development and Political Science: Making Change Happen

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This article looks at the potential benefits of a more symbiotic relationship between Education for Sustainable Development (ESD) and Political Science, both in terms of theoretical understanding and practice. In a previous issue of policy and practice, Selby and Iagawa (2011) highlighted the need for both ESD and development education (DE) to ask the big political questions and to engage more critically with the current economic and political hegemony. With this in mind we examine here the mutual benefit of a closer engagement between ESD and Political Science. This article is the result of a collaboration between a Political Scientist (Hugh Atkinson) and an experienced ESD academic and practitioner (Ros Wade), and is a culmination of discussions which have taken place over the last two years. It has been developed from our experiences over three years at the Political Studies Association (FSA) Annual Conference where sustainable development was barely on the agenda. As a result of this, for the last three years we have run a FSA panel on ‘Politics and ESD’ which has attracted growing interest and has now developed into a specialist group. ESD and Political Science in context The 1987 Brundtland Report defined sustainable development as ‘meeting the needs of the present without compromising the ability of future generations to meet their own needs’ and since then the concept has continued to be critiqued and to evolve. Central to sustainable development is the urgent need to tackle climate change which Giddens (2009) has described as a more important policy challenge than social justice. There is a close link between sustainable development and education for sustainable development: ESD can be viewed as the learning (Formal, non-Formal and in Formal) that is necessary to achieve sustainable development (UNESCO, 2007). This covers a very broad spectrum from formal sector education to community activism, social learning, organizational learning and awareness raising. This presents immense challenges and hence ESD needs to draw on a wide range of disciplines.

ESD and the political context

The world is facing some very serious social and environmental challenges over the next fifty years. These include climate change, global poverty and inequality, war and conflict, and peak oil, all set against a backdrop of highly consuming lifestyles and a growing world population which is likely to reach nine billion by the end of the century. Yet governments have been extremely slow to address these issues. One of the obstacles to change has been a reluctance or an inability to integrate social and environmental concerns into policymaking and practice. Politicians have been slow to take up the challenge, both from lack of understanding and a piecemeal approach to policy and from a lack of political will. Discussions in one of the high-level groups during the UNESCO (United Nations Educational, Scientific and Cultural Organization) ESD mid-decade Bonn Conference underlined this issue when delegates identified politicians and policy makers as a key target for ESD (Wade, 2009).

The UN Decade of ESD 2005 2014

A consortium of NGOs also lobbied governments to make good their commitments at international level through the UN Commission for Sustainable Development (CSD) which was set up to monitor progress on Agenda 21. However, initial progress was slow in achieving this. So, with the strong support of a few governments like that of Japan, lobbying was successful in giving education for sustainable development the status of a UN Decade from 2005 to 2014. Education is now viewed as a prime lever for social change, described by UNESCO in the implementation plan for the Decade of Education for Sustainable Development (ESD) in the following way: ‘it means education that enables people to foresee, face up to and solve the problems that threaten life on our planet’ (UNESCO, 2005).

A Symbiotic Relations of “Santal Tribe” with Nature and Their Immense Knowledge on Herbal Remedies- A Study.

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Abstract

The Santals are one of the oldest and largest ethnic groups in India. They were living in the inaccessible jungles amidst inhospitable climate governed by whims of natural agencies like Sun, rain and wind in the remote past. They were leading an unsecured life devoured by the wild animals. They believe in number of superstitions and are highly ritualistic people. Living in the bossoms of the nature they depended on the mercy of the unseen powers and the forces which guide them in every walks of their life. As a primitive people they were afraid of two things, the disease and ghosts. So many of the diseases are attributed to the evil spirits. All primitive tribes consider disease as pernicious and detrimental to the normal life. Santals believed that disease is something foreign and inimical to man.

Usage of herbal remedies by Santal tribe is common phenomenon in the countryside. The herbal medicine practitioners are addressed in Santali language as “*Raranko*” (Medicine Man). The knowledge of herbal medicines is acquired by them from the ancestors by the word of mouth. As the inherited knowledge is transferred to next generation by orally, proper documentation is rare. The objective of this paper is to pinpoint closeness of “Santal tribe” with the nature and their interdependency with it to lead a healthy and better life.

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Principle Strategy of Waste Management in India: An Exposure

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Abstract

Indian waste management rules are founded on the principles of "sustainable development", "precautionary" and "polluter pays". With rapid urbanisation, the country is facing a massive waste management challenge. Over 377 million urban people live in 7,935 towns and cities and generate 62 million tonnes of municipal solid waste per annum. Only 43 million tonnes (MT) of the waste is collected, 11.9 MT is treated and 31 MT is dumped in landfill sites. Solid Waste Management (SWM) is one among the basic essential services provided by municipal authorities in the country to keep urban canters clean. However, almost all municipal authorities deposit solid waste at a dump yard within or outside the city haphazardly. Experts believe that India is following a flawed system of waste disposal and management.

These principles form an integral part of Indian environmental law jurisprudence, as observed by the Supreme Court of India in various decisions. Some of the laws regarding waste management are Bio-medical Waste (Management and Handling) Rules, 1998, The Batteries (Management and Handling) Rules, 2001, The Plastic Waste (Management and Handling) Rules, 2011, The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008, Solid Waste Management Rules, 2016 are trying to solve the huge problem of Indian dumping ground. Waste segregation at source is mandatory. Households are required to separate waste into three streams – Organic or Biodegradable waste, Dry waste (such as plastic, paper, metal, and wood), and Domestic Hazardous waste (diapers, napkins, mosquito repellents, cleaning agents. No person should throw, burn, or bury the solid waste generated by him, on streets, open public spaces outside his premises, or in the drain, or water bodies. To do this will from the part of the individual and society at large is crucial than mere laws on the paper.

Studies based on cytogenetics in few high altitude herbs

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A study on chromosome number, morphology, in situ nuclear DNA content and mitotic cell cycle duration was carried out in few high altitude herbs. The herbs studied in the investigation are diploid as well as polyploid. The herbs exhibited wide differences in in situ DNA content per nucleus, while the differences decreases per chromosome number and per unit length and volume of chromosome. The mitotic cell cycle duration is more or less constant in these herbs. It is not positively correlated with chromosome number and size.



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**Organised by Sarat Centenary College
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