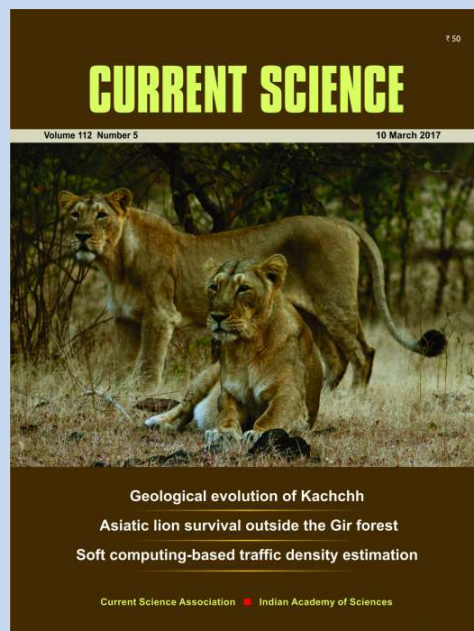


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Oxidative potential of ambient aerosols: an Indian perspective

Neeraj Rastogi and Anil Patel

Keywords: Ambient aerosols, oxidative potential, reactive oxygen species, pollutants sources.

Abstract

Aerosols are tiny particles suspended in ambient air and therefore follow the air transport pathway. Many species present in ambient aerosols such as transition metals or some organics have the potential to generate reactive oxygen species (ROS) in situ. These ROS affect oxidizing capacity of the atmosphere. On inhalation, aerosols can generate ROS in the respiratory system of humans, which may result in a variety of cardiopulmonary diseases. Further, ROS can also affect plant growth and productivity. India has a wide variety of pollutant sources with perennial emissions. Although there are reasonable number of studies on the physical, chemical and optical properties of aerosols, virtually no information is available on the oxidative potential of ambient aerosols and its consequences. Therefore, it is important to assess the oxidative potential of ambient aerosols on a temporal and spatial scale over sites dominated by different emission sources and meteorological conditions in India.

Impacts of traditional shore seine operation along the Tuticorin coast, Gulf of Mannar, southeast India

K. Diraviya Raj, S. Monolisha and J. K. Patterson Edward

Keywords: By-catch, juveniles, livelihood, mesh size, shore seine.

Abstract

Fishing pressure on marine ecosystems has increased drastically all over the world, especially in developing countries and particularly in India. Shore seine, a traditional fishing method, involves bottom trawling which makes huge impact on the ecosystems and consequently on fishing yield. It was observed that important habitats such as seagrasses and coral reefs are affected severely by this shore seine operation. Most of the catch was observed to be juvenile in nature or very small in size. Immediate measures are needed to check this operation by creating awareness among the fishermen coupled with providing alternative livelihood options.

Application of DInSAR in mine surface subsidence monitoring and prediction

S. G. Ishwar, and Dheeraj Kumar

Keywords: Interferometric techniques, synthetic aperture radar, surface subsidence, underground mines.

Abstract

Most studies of surface subsidence and its impacts have been done on underground coal mines. There are few studies on the occurrences of surface subsidence in underground metal mines, particularly in India, even though the fundamental subsidence engineering principles are the same for both coal and metal mines. The current ground-based measurement techniques monitor ground subsidence on a particular point and are time-consuming as well as costly. To study hardrock mine surface deformation due to underground mining, new and effective technologies must be adopted. The spaceborne subsidence monitoring has emerged as a better technique after the development of satellite radar interferometry. The technology is fast improving with enhanced synthetic aperture radar (SAR) sensors on different spaceborne platforms. Differential interferometric SAR techniques are widely used to measure the topographic profile and surface deformations. This article reviews the applications of spaceborne SAR interferometric techniques in the prediction and monitoring of surface subsidence due to underground mining.

Conservation agriculture – a panacea to improve soil physical health

A. K. Indoria, Ch. Srinivasa Rao, K. L. Sharma and K. Sammi Reddy

Keywords: Conservation agriculture, conservation tillage, crop residues, crop rotation, soil physical health.

Abstract

Maintenance of soil physical health at its optimum level is essential for sustainable crop production and rational use of natural resources without jeopardizing their quality. The ongoing conventional tillage practices for crop production using intensive ploughing and removal of crop residue from the field have resulted in an increase in surface crusting, soil compaction, soil erosion, decrease in water infiltration and ultimately aggravation of the overall soil physical health deterioration. In recent years, many agricultural scientists across the world have recommended conservation agriculture as a solution to overcome the adverse effects of conventional tillage practices on soil physical health. Conservation agriculture is mainly an integration of three crop management practices, viz. minimum or no-tillage, permanent retention of crop residue and crop rotation. The present data indicates that conservation agriculture can improve soil physical properties and associated processes especially, soil water infiltration and storage, soil aeration, soil structure and soil porosity. It reduces soil erosion, soil compaction and crusting, and optimizes the soil temperatures for successful crop production. This article reviews the role of conservation agriculture in improving soil physical health and its associated processes.

Evaluation of offshore wind power potential in the western coast of India: a preliminary study

Garlapati Nagababu, Surendra Singh Kachhwaha, Vimal Savsani and Ranajit Banerjee

Keywords: Bathymetry, fixed-bottom foundation technology, offshore wind potential, wind turbines.

Abstract

The possibility of locating wind turbines on the seabed can open up a new frontier for wind power as a significant domestic renewable energy source along the western coast of India. Space for much larger projects is available in shallow coastal waters compared to land. To assess wind power potential in the western coast of India, first the bathymetric data are divided into three regions, i.e. 0–10, 10–20 and 20–35 m respectively, suitable for fixed-bottom foundation technology. Next, the wind data of several meteorological stations are collected from WindSat satellite. For a given bathymetry, using the characteristics of wind turbine, calculations are made for estimating average wind speed, wind power density and average output of wind turbine. Results of the preliminary study show that there exists a total available area of 67,622 sq. km (up to a depth of 35 m), suitable for installation of offshore wind turbines. Further, results reveal that within the total effective area, the average annual power generation of 477 and 437 TWh respectively, could be achieved using GE 3.6s and Repower 5M commercial offshore turbines.

Performance of the operational and experimental long-range forecasts for the 2015 southwest monsoon rainfall

D. S. Pai, A. Suryachandra Rao, Soma Senroy, Maheswar Pradhan, Prasanth A. Pillai and M. Rajeevan

Keywords: AISMR data, long-range forecasts, IMD, monsoon rainfall.

Abstract

India experienced deficient monsoon rainfall in 2015 that followed the deficient monsoon of 2014. India Meteorological Department (IMD) correctly predicted the large rainfall deficiency (86% of long period average) in 2015. Incidentally, this was the first ever deficient monsoon forecast issued

by IMD, though it had earlier issued below-normal rainfall forecasts in the previous two deficient monsoon years (2009 and 2014) and was partially correct. The fact that there were only three previous occasions of consecutive two deficient monsoon years during the last 114 years (1901–2014) was itself a challenge to IMD to issue the forecast in 2015. It may be mentioned that IMD persisted with the deficient monsoon forecast for 2015, even though there were predictions from private agencies for a normal monsoon and apprehensions from the press and media about the low probability of two consecutive deficient years. IMD was also able to correctly predict the regional distribution of seasonal rainfall during the season. IMD's first deficient monsoon forecast was based on the state-of-the-art operational statistical forecasting system, which was introduced in 2007. IMD was further confident for a deficient monsoon due to the clear indications of a strong El Niño event by June itself. Forecasts from high-resolution coupled forecasting system (CFS) developed by the Indian Institute of Tropical Meteorology, Pune, under the Monsoon Mission also suggested a deficient monsoon in 2015. In this article we provide details of the operational forecasting models and verification of these forecasts. Brief description about the experimental CFS developed under the Monsoon Mission and CFS forecast for the 2015 southwest monsoon season is also presented.

FAO-CROPWAT model-based estimation of crop water need and appraisal of water resources for sustainable water resource management: Pilot study for Kollam district – humid tropical region of Kerala, India

U. Surendran, C. M. Sushanth, George Mammen and E. J. Joseph

Keywords: Crop water requirement, CROPWAT, evapotranspiration, effective rainfall, irrigation demand.

Abstract

An effort has been made to calculate the water needs for various crops in different agro-ecological units (AEUs) of Kollam district (a humid tropical region of Kerala) using FAO-CROPWAT. The major cultivated crops are rice, coconut, rubber, pepper, banana, brinjal, tomato, tapioca, cardamom, tea, etc. The gross water required for these crops has been computed in various AEUs using meteorological parameters. Using evapotranspiration and effective rainfall in each unit, a water balance has been worked out. An overall water balance of the district has been attempted by considering irrigation, domestic and industrial demand of AEUs, under current scenario and future demand. The gross irrigation demand for the currently irrigated area in the district at 70% efficiency is 1045 mm³, of which 920 mm³ is supplied from surface water sources and 125 mm³ from groundwater sources. The projected future total water demands for irrigation, drinking and industrial purposes will be 2667 mm³. However, the utilizable water resource from all river basins of Kollam is only 1117 mm³. The above data shows a deficit of 1550 mm³ and it will be difficult to arrive at requirements with the existing water resources at a given point of time. We infer that if the total area is brought under irrigation, there will be water scarce years, and hence decreasing irrigation or the command area needs to be adopted to manage this shortfall and sustain production. We have also discussed several options/strategies for better water management under these changing climatic circumstances to provide water to meet the demands of all the users.

Distribution and source identification of heavy metal concentration in Chilika Lake, Odisha India: an assessment over salinity gradient

Satabdi Banerjee, Arnab Pramanik, Sanghamitra Sengupta, Dhruvajyoti Chattopadhyay and Maitree Bhattacharyya

Keywords: Heavy metal, lagoon, pollution load index, salinity.

Abstract

Extent of heavy metal contamination in Chilika Lake was assessed to conserve the eco-dynamics of the lake. Distribution of heavy metals, cations and total organic carbon were analysed in the sediment samples collected from three sites that represent a salinity gradient. Analysis of environmental indices, viz. enrichment and contamination factors, geo-accumulation (Igeo) and pollution load indices showed that the concentrations of Cd and Hg were significantly high with geoaccumulation index being greater than one in all three stations. Levels of Pb and Co were also found to be elevated with Igeo value of 0.025 and 0.048 respectively. Among the three sampling stations, Kaluparaghat witnessed the highest pollution load index followed by Balugaon and Rambhartia. Principal component analysis revealed that the high-salinity zone was associated with high concentration of Hg and decreased concentration of other toxic metals, indicating that source of pollution of Hg is different from that of other metals.

Micro-irrigation in rainfed pigeonpea – Upscaling productivity under Eastern Gangetic Plains with suitable land configuration, population management and supplementary fertigation at critical stages

C. S. Praharaj, Ummed Singh, S. S. Singh and N. Kumar

Keywords: Critical stages, Indo-Gangetic Plains, microirrigation, pigeonpea, planting configurations, rainfed pigeonpea, supplementary fertigation

Abstract

Water – a critical input for sustained crop production – is becoming limiting both under rainfed and irrigated condition. It calls for an effective on-farm management of water in field crops through microirrigation (drip-fertigation) that could take care of both drainage during rainy months and supplementary life saving irrigation thereafter. Therefore, the present field study involving three planting configurations and five drip-fertigation schedules were taken up in pigeonpea (long duration) during 2010–12 under Eastern Indo-Gangetic Plains at Kanpur, Uttar Pradesh, India. Significant grain yield advantage (19.6%) was with single drip-fertigation with half of N + K fertilizer at branching over farmers' practice (rainfed pigeonpea, 2858 kg/ha). Drip-fertigation at both branch and pod development also out-yielded (3468 kg/ha) over improved practice (furrow irrigation, 3262 kg/ha). These yield levels realized were close to potential yield (2.5–3.0 t/ha). Twice drip-fertigated plots also had higher yield attributes (pods/plant, 100 seed weight and harvest index), lower water use, greater soil profile water content and water use efficiency (65.1 kg/hacm), higher plant nutrient (N, P and K) uptake with improved soil nutrient availability and greater net return (INR 9650/ha) over farmers' practice. A case study on a micro-scale was also given which could explore the possibility of out-scaling the technology.

Impact of projected climate change on rice (*Oryza sativa* L.) yield using CERES-rice model in different agroclimatic zones of India

P. K. Singh¹, K. K. Singh, S. C. Bhan, A. K. Baxla, Sompal Singh, L. S. Rathore and Akhilesh Gupta

Keywords: Agroclimatic zones, climate change, crop simulation models, rice.

Abstract

Climate change is projected to alter the growing conditions of rice crop in different regions of India. Crop growth simulation model (DSSATv4.6) was calibrated and evaluated with four rice cultivars: PR 118 in Amritsar, Ludhiana; HKR 126 in Hisar and Ambala; Pant 4 in Kanpur and Sugandha-1126 in Modipuram on different sowing dates. The average yield of the selected optimum dates was 6391, 6531, 7751, 7561, 4347 and 4131 kg/ha for Amritsar, Ludhiana, Hisar, Ambala, Modipuram and Kanpur respectively. Both temperature and CO₂ have increased. The combined effect of

temperature and CO₂ indicates decreased yield rate in the future decades. The present study shows that rice yield will decrease in the future and this may be due to increase in temperature. According to projection results, for all the locations average yield is higher in the decade 2010, except Amritsar in the decade 2030 and Ludhiana in the decade 2050. The average yield at Hisar, Ambala, Modipuram and Kanpur in 2010 was 7744, 7654, 4347 and 4021 kg/ha respectively. Amritsar and Ludhiana showed maximum average yield of 6880 and 6877 kg/ha respectively, in the decade 2030. Such yield reductions in rice crops due to climate change are mediated through reduction in crop duration, grain number and grain filling duration. These projections nevertheless provide a direction of likely change in crop productivity in future climate change scenarios.

Temporal composition and distribution of benthic macroinvertebrates in wetlands

Onkar Singh Brraich and Rajwinder Kaur

Keywords: Abundance, biodiversity, macroinvertebrate, wetlands.

Abstract

Studies on the composition, distribution and seasonality of the benthic invertebrates of the Nangal wetland were undertaken for two years from February 2013 to January 2015. Twenty-four genera of benthic macroinvertebrates were recorded, out of which five belonged to Ephemeropteras, two to Plecoptera, five to Hemiptera, three to Diptera, two to Tricoptera, two to Coleoptera, one to Araneae, one to Odonata, two to Annelida and one to Gastropoda. The range, mean and standard deviation of macrobenthos have been recorded. The abundance of macroinvertebrates ranged between 79 and 534 individuals/m² (mean 297 [RS1]individuals/m²) during 2013–14 and 109–612 individuals/m² (mean 400 individuals/m²) during 2014–15. Statistical relationship between different physico-chemical parameters and macroinvertebrates was also computed. The Simpson's index ranged from 0.9428 during 2013–14 to 0.9493 during 2014–15. The Shannon index was 3.117 during 2013–14 and 3.154 during 2014–15, which indicates that the wetland is moderately polluted that further affects the occurrence of benthic macroinvertebrates.

Dynamic genetic algorithm-based feature selection and incomplete value imputation for microarray classification

R. Devi Priya and R. Sivaraj

Keywords: Microarray dataset, feature selection, missing values, genetic algorithm.

Abstract

Large microarray datasets usually contain many features with missing values. Inferences made from such incomplete datasets may be biased. To address this issue, we propose a novel preprocessing method called dynamic genetic algorithm-based feature selection with missing value imputation. The significant features are first identified using dynamic genetic algorithm-based feature selection and then the missing values are imputed using dynamic Bayesian genetic algorithm. The resulting complete microarray datasets with reduced features are used for classification, which results in better accuracy than the existing methods in eight microarray datasets.

Exposure to particulate matter in different regions along a road network, Jharia coalfield, Dhanbad, Jharkhand, India

Shiv Kumar Yadav and Manish Kumar Jain

Keywords: Open cast coal mining, particulate matter, road network, traffic volume count.

Abstract

Occupational particulate matter (PM) concentrations were measured during November 2014 along a road network in the mining and non-mining areas at Jharia coalfield, Dhanbad, Jharkhand, India.

The monitoring was conducted for a week in the peak time using a portable GRIMM (model 1.109) aerosol spectrometer. Measured PM was designated as inhalable, thoracic and alveolic particles for aerodynamic diameter 10–34, 4–10 and less than 4 μm respectively. The main sources of PM along the roadside in the study area were mining operations as well as heavy traffic and resuspension of road dust. Concentration of inhalable particles was maximum at Bankmore (BMO), whereas concentration of thoracic and alveolic particles was maximum at Katrasmore (KMO) in the mining area. Concentration of all three types of particles was minimum at the Indian School of Mines in the non-mining area. The distribution curves of inhalable particles were positively skewed and platykurtic in nature, whereas for thoracic and alveolic particles these curves were positively skewed at all locations, except BMO and also platykurtic in nature, except Godhar (GDR). Contribution of alveoli particle sizes for 0.375 and 2.750 μm was observed to be significant in the mining area, whereas thoracic particle size for 5.750 μm and inhalable particle size for 22.500 μm were also observed to be higher in the mining area, except Matkuria check post and Kustaur. The results reveal that residents and local passengers were exposed to a prodigious amount of inhalable, thoracic and alveolic concentrations in the mining area, mostly at BMO, GDR and KMO.

Nature of suspended particles in hydrothermal plume at 3°40'N Carlsberg Ridge: a comparison with deep oceanic suspended matter

Durbar Ray, E. V. S. S. K. Babu and L. Surya Prakash

Keywords: Deep-oceanic particulates, geochemistry, hydrothermal plume, micro-texture, suspended particulate matter.

Abstract

Suspended matter from hydrothermal plume at 3°40'N Carlsberg Ridge was studied for microtexture and geochemistry. Characteristics of these plume particles were compared with deep-oceanic particulates from different depths. Compared to fine, deep-oceanic suspended matter ($\leq 2.0 \mu\text{m}$), some particles in the plume were larger ($\geq 20 \mu\text{m}$) and had irregular shape and surface. These plume particles were mostly composed of Fe-oxides and silicates. Bulk composition showed that plume particles were relatively enriched with Fe, P, Mn, rare earth elements (except Ce) and U, but had other trace element concentration analogous to that found in deep-oceanic suspended matter. Efficient scavenging of elements from hydrothermal fluid and sea water makes geochemistry of plume particulates different from common oceanic particles.

Apple CALCINEURIN B-LIKE PROTEIN10 genes have evolved to be novel targets of miR167s through sequence variation

Ashutosh Kumar and Ananda K. Sarkar

Keywords: Arabidopsis thaliana, CNBL10, miR167, Malus domestica (apple), miRNA evolution.

Abstract

The miR167s and its target ARF6/8 are relatively conserved among diverse plant species and have been implicated in reproductive and root development in Arabidopsis. Here we show that some of the CNBL family members have evolved to be targets of miR167s in apple. Despite strong conservation between apple and Arabidopsis CNBLs, AtCNBLs are not miR167 targets. The sequence variation in apple-miR167a and MdcNBLs has created target sites for apple-miR167a in MdcNBL10s. Therefore, we suggest that during the course of evolution, natural selection through sequence variation played a crucial role by choosing different targets among plant species for the same miRNA.

Dissecting parameters associated with sheath rot (*Sarocladium oryzae* [(Sawada) W. Gams & D. Hawksw]) disease in rice (*Oryza sativa* L.)

C. Mahadevaiah, M. K. Prasanna Kumar and Shailaja Hittalmani

Keywords: Dissecting parameters, *Oryza sativa*, *Sarocladium oryzae*, sheath rot.

Abstract

Accurate measurement of parameters contributing to diseases and their symptoms is important for identification of resistant genotypes. Present sheath rot scoring system such as disease incidence scoring system accounts for only percentage of disease incidence and not the disease severity. Disease severity scoring system is based on combined features of panicle exertion and lesion size, very laborious and less accurate in field condition. Existing disease index requires assigning of incidence-severity scores for each and every tillers in a plant and has greater difficulties in evaluation of large number of plants or breeding pools. Hence, we propose phenotypic parameters such as proportion of panicle exertion, proportion of diseased and healthy sheath and modified disease severity scoring system for accurate measurement of disease. A high-throughput and simple disease indices (severity index, lesion index, detached lesion index and panicle discoloration index) are proposed for accurate identification of resistant-susceptible genotypes.

Manganilmenite in the magnetite ore body from Pokphur area of Nagaland, North East India and the possibility of microdiamonds in the ophiolites of Indo-Myanmar ranges

Bibhuranjan Nayak and Franz Michael Meyer

Keywords: Diamond indicator mineral, ophiolite, magnetite ore body, manganilmenite.

Abstract

Manganilmenite is found to be associated with the magnetite ore body of Pokphur area in the Nagaland ophiolites, North East India. There is perhaps no earlier description of the mineral from the Indian subcontinent. It occurs as an accessory mineral with magnetite and Fe-chlorite (chamosite). Electron probe micro-analytical data reveal that the mineral contains 5.6–8.5 wt% MnO and traces of MgO, ZnO and Cr₂O₃, while the TiO₂ content remains within narrow limits of 50–53 wt%. The calculated pyrophanite end-member varies from 13% to 18%. Although the magnetite body of Pokphur has been reasonably proved to be a hydrothermally altered product of basic and ultrabasic igneous rocks, and most of the minerals in the magnetite body are supergene in nature, different end-member compositions of mangan–ilmenite indicate that it has originally crystallized with the basic suite of rocks and has survived the alteration process with only marginal effects. Since manganilmenite has been considered as a diamond indicator mineral and ophiolites are a newly documented host of microdiamonds elsewhere in the world, the presence of manganilmenite in the Pokphur magnetite hints towards occurrence of microdiamonds in the ophiolite suite of rocks of the Indo-Myanmar ranges.

Haemocyte morphology and differential haemocyte counts of giant ladybird beetle, *Anisolemnia dilatata* (F.) (Coleoptera: Coccinellidae): a unique predator of bamboo woolly aphids

J. Majumder, D. Ghosh and B. K. Agarwala

Keywords: *Anisolemnia dilatata*, bamboo habitat, differential haemocyte count, giant coccinellid predator, woolly aphids.

Abstract

Changes in haemolymph characteristics such as differential counts of haemocytes have direct bearing on the general performance of insects. The present study was carried out to generate data on the morphology of different haemocytes and their differential counts of giant ladybird predator, *Anisolemnia dilatata* (F.), unique to woolly aphid pests of bamboo habitat. Five types of

haemocytes, viz. prohaemocytes, plasmatocytes, granulocytes, spherulocytes and oenocytes were morphologically characterized in the haemolymph of larvae, pupae, virgin females and males. Among these, plasmatocytes were dominant followed by granulocytes, prohaemocytes, spherulocytes and oenocytes. Granulocytes showed consistency in numbers in all life cycle stages from first instar larva to adults of males and females of the giant ladybird.

Comparative blood cell morphometry and differential leukocyte count of two breeds of turkey, *Meleagris gallopavo* (Linnaeus, 1758)

A. Bhattacharjee, P. K. Mohanty, B. K. Mallik, S. Nanda and J. Munda

Keywords: Blood cell, differential leukocyte count, turkey, *Meleagris gallopavo*, morphometry.

Abstract

Morphometry of erythrocytes and leukocytes and differential leukocyte count of two breeds of adult turkey (24 birds) were performed with respect to sexual dimorphism. Except nuclear length of erythrocytes, other parameters show highly significant difference at $P < 0.01$. Leukocytes reflected significant difference at $P < 0.01$ among and between breeds with respect to their dimensions. In case of DLC, except eosinophils, all leukocytes show significant difference ($P < 0.01$) among and between breeds. Morphometry of blood cells of two breeds of turkey is within the range mentioned for avian species, but the differential count revealed some abnormalities which might be due to stress or infection.

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ISRO's technical prowess through the prism of patents

Swarnil Dey and Tarakanta Jana

Keywords: ISRO, open innovation, patent analysis, space research.

Abstract

The present article primarily analyses the patenting trends of the Indian Space Research Organization (ISRO) since its formation. The social dimensions and technical prowess of ISRO are well known, but till date no work has been done in analysing its patent portfolio, to let the people be aware of its development, through the prism of patent analysis. This article reports ISRO's patenting activities over the past four decades and has mapped the areas in which patents have been granted. Further, it also discusses how ISRO can be part of the era of open innovation and use its inventions economically.

Determinants of research productivity of agricultural scientists: implications for the national agricultural research and education system of India

S. Paul, K. Vijayaragavan, Premlata Singh, R. Roy Burman and V. P. Chahal

Keywords: Agriculture, determinants, productivity, research, scientists

Abstract

A micro level analysis for understanding the major determinants of research productivity of individual scientists in the National Agricultural Research and Education System of India was undertaken. A sample of two hundred scientists was drawn through multistage disproportionate stratified random sampling from a high performing and a low performing agricultural institute in India. Forced choice Q-sort technique was employed to record perception of respondents regarding relative influence exerted by selected variables on their research productivity and a factor analysis using principal component method with varimax rotation helped in extracting 11 major factors determining research productivity of agricultural scientists, namely, organizational research

environment, creativity, perseverance and commitment, research facility, ability to work under constraint, incentive policy, proactiveness, purpose-driven orientation, achievement motivation, involvement in teaching and job satisfaction. The apparent uniformity in percentage variance contribution of these 11 factors implies that optimum research productivity of scientists can only be harnessed when personal and organizational factors work in harmony.

An analysis on agricultural sustainability in India

K. Kareemulla, R. Venkattakumar and Manoj P. Samuel

Keywords: Agricultural sustainability, human development index, sustainability index, state-level analysis.

Abstract

Sustainability of agriculture is a matter of concern for various stakeholders. The challenges encountered by Indian agriculture are due to agro-climatic/environmental, social and economic dimensions. The sustainability strength comes due to vibrancy of these dimensions. In order to understand the regional and temporal dynamics of these dimensions, a state-level analysis of sustainability was made for two time-periods. The sustainability index estimation was based on the human development index methodology. Data for two time-periods, i.e. 2001 and 2011 were used to estimate the indices. The results revealed that in general, sustainability did not deteriorate over the reference period, although some states gained and some others lost in terms of change in the level of sustainability.

Revisiting the decoded genomes to promptly reveal their genomic perspectives

Shouvik Das, Deepak Bajaj, S. Gopala Krishnan, Ashok K. Singh and Swarup K. Parida

Keywords: Decoding, food crops, plant genome, translational genomics.

Abstract

Post *Arabidopsis thaliana*, 55 genomes comprising 49 different plant species have been decoded by use of clone-by-clone, whole genome shotgun and nextgeneration sequencing approaches. The structural outcomes of these sequenced genomes shed light on their genomic constitution, particularly the way genes, transposable elements and genetic markers are organized within the genomes. The functional outcomes provide a brief account of specific phenotypic trait characteristics of crop genomes by digging deep into the genetic make-up of transcription factors, regulatory elements and gene families governing multiple agronomic traits in these crop plants. The comparative and evolutionary outcomes deduce the genetic basis of biological diversity and basic process of genome evolution by analysing the syntenic relationships among genes and genomes/chromosomes of the sequenced crop plants. Therefore, a revisit to published genome sequence landmarks in 30 major cultivated food crops constituting major groups (cereals, legumes, vegetables, fruits, oilseeds and fibres) would significantly assist us to gain a detailed insight into their genome organization and dissect the structural, functional, comparative and evolutionary intricacies for identifying species- and lineage-specific genes controlling multiple characteristics in crop plants. The essential inputs obtained will be helpful in devising efficient strategies to develop high-yielding climateready crop varieties through translational genomics.

Coastal inundation research: an overview of the process

R. Gayathri, Prasad K. Bhaskaran and Felix Jose

Keywords: Coastal inundation, coupled models, storm surge, tropical cyclones.

Abstract

Coastal inundation is the flooding of coastal zone resulting from increased river discharge, spring tides, severe storms, or generation of powerful waves from tectonic activity (tsunami). This article discusses the critical factors that contribute to coastal inundation. Among the probable factors that cause coastal flooding and destruction, storm surge is the most frequent, and hence this article provides a detailed evaluation of the progress made in storm inundation research. Recent advances in coastal inundation modelling include efforts to understand the nonlinear dynamic interaction of near-shore waves, wind and atmospheric pressure with still water sea level and coastal currents, and their combined effects on storm surge along the coast and interaction with coastal morphology. An advanced storm-surge model comprises different modules, viz. an atmospheric component, and two ocean components for surge and wave simulations; these modules are coupled with each other. The nesting of regional coastal model with an ocean-wide model captures the far-field boundary forcing of extreme events that usually originate from the warm open ocean. Even though significant advancements reported on the efficiency and accuracy of storm surge and inundation prediction, further studies are required to understand the nonlinear interaction of storm surge with coastal landforms and their vegetation (land cover). In the context of rising sea level, increased tropical cyclone activity and rapid shoreline change, it is pertinent to evaluate the future flooding risk associated with landfall of tropical cyclones in densely populated coastal cities.

Impact of noni juice on myelin components, neurotransmitter and behavioural status in rats exposed to immobilization stress

Gangadharan Thamizhoviya, Perumal Pillai Kirjayini and A. J. Vanisree

Keywords: Immobilization stress, myelin, noni juice, neurotransmitters, rats.

Abstract

Several reports indicate that psychological stress and depression are detrimental to health and that chronic stress implicates pathophysiology of mood and anxiety-related disorders, thus leading to several stress-related complications. The present study focuses on behavioural status and neurochemical variations in myelin of rat brain exposed to chronic immobilization stress and evaluates the effect of fruit juice of noni over changes in the myelin content of forebrain (FB) and midbrain (MB) regions of rats exposed to stress. Immobilization stress (IS) strategy was utilized to induce stress in Wistar rats. Myelin protein was isolated from the MB and FB regions of rats. Assessment of activities of membrane bound enzymes, levels of neurotransmitters (dopamine, serotonin and glutamate of FB and MB) and lipid profile of myelin in addition to behavioural analysis were carried out. The membrane-bound enzymes such as ATPases, 5'-nucleotidase and acetylcholinesterase exhibit significant decrease in their activities both in the FB and MB regions on stress induction, when compared to that of control. The neurotransmitters and lipid profile also show similar pattern among the experimental group. However, administration of noni juice (NJ) in ISexposed rats can significantly alter the activities of myelin-associated enzymes and levels of neurotransmitters and lipid content of myelin ($P < 0.05$) along with improvement in the behavioural pattern when compared to those of IS rats. These preliminary results set targets for further authentication of the use of NJ against stress. This NJ could become one of the ideal supplements for management of stress-induced neurological disorders.

Biodiversity's hidden treasure: biodeteriorated archaeological tombstones of Serbia

Milica Ljaljević Grbić, Gordana Subakov Simić, Miloš Stupar, Aleksa Jelikić, Marko Sabovljević, Maja Đorđević and Jelena Vukojević

Keywords: Biodeterioration, cultural heritage, cyanobacteria, fungi, subaerial biofilms.

Abstract

In the present study, biological colonization on medieval tombstones from archaeological sites in Serbia has been investigated. Chemical analyses showed that the stone substrata were mostly of calcium carbonate, which is highly bioreceptive. Large areas of tombstones were covered with epilithic lichenized fungi and mosses, and microbiological analyses showed the presence of micromycetes and cyanobacteria. The dominant group of fungi recorded on tombstone surfaces was microcolonial fungi, now recognized as primary colonizers of stone substrata.

Measurement of productivity and liability level of crops

Soham Biswas

Keywords: Crop productivity and liability, developmental strategies, farm environment, yield achievement and deficit.

Abstract

Crop productivity is the capacity of an area to produce crops; a manifestation of complex interaction of various factors of production that together determine the existing condition of the farm environment. Without proper idea of the present productivity level, effective measures for further improvement cannot be initiated. Geographers and agricultural economists have long been engrossed in measuring agricultural productivity. Here I discuss a new method of measuring crop productivity, i.e. determining crop productivity level of an area with respect to the maximum achievable productivity limit under existing conditions of the farm environment. The method also measures the productivity deficiency level of various crops which makes the selection of liable crops much more sound and logical, and is helpful to formulate both the overall and crop-specific developmental strategies. Standard classes of crop productivity, yield achievement, yield deficit and crop liability levels have been prepared separately based on their index values.

Computational analysis reveals industrial natural products and toxins in charcoal rot pathogen, *Macrophomina phaseolina*

Sharuti Thakur and Tarakanta Jana

Keywords: Computational tools, *Macrophomina phaseolina*, polyketide synthase, phylogenetics.

Abstract

The fungal polyketide synthases (PKS) are responsible for the biosynthesis of several polyketide natural products, mycotoxins, pigments, etc. In the present times, we use computational tools to gain insight into polyketide natural products that may contribute to the metabolic versatility of this important phytopathogenic filamentous fungi. In total, we have identified 17 type-I PKS related gene clusters from the *Macrophomina phaseolina* genome. Among these 27 ketosynthase (KS) domains have been retrieved and used for the study. The study reveals that genome of *M. phaseolina* comprises non-reducing (NR), partially reducing (PR) and reducing (R) type of polyketides, and are clustered into three clades and several subclades. The phylogenetic analysis of KS domain sequences of *M. phaseolina* indicates that some PKS sequences are most closely related to polyketide natural product homologs such as lovastatin diketide, mycotoxins (fumonisin, citrinin and patulin) and pigment melanin. We also found eight orphan KS domains from three reducing PKS, i.e. MPH10374, MPH10375 and MPH10376. The study represents a potential novel source of industrially important polyketide natural products.

Impact analysis of multiple parameters on fracture formation during volume fracturing in coalbed methane reservoirs

Tingting Jiang, Jianhua Zhang and Hao Wu

Keywords: Coalbed methane reservoir, fracture network, numerical simulation, volume fracturing.

Abstract

Uniaxial and triaxial compression, Brazilian splitting and three-point bending tests have been carried out to determine the mechanical parameters of the coal reservoir in Jiaozuo coal mining district, Henan Province, China. Based on the experimental results and combined with the target reservoir geological characteristics, a 3D geological mechanical model has been established to analyse the hydraulic fracture propagation during volume fracturing using MEYER software. Effects of the modulus of coal rock, difference between horizontal principal stresses, fracturing fluid viscosity and fracturing fluid injection rate on the fracturing network geometry are studied. Results show that fracturing network development intensity in the coalbed methane (CBM) reservoir is determined both by the geological conditions and the hydraulic fracturing parameters. The intensity of fracturing in the CBM reservoir is positively related with the elastic modulus of the coal rock, and is inversely proportional to the difference between the two horizontal principal stresses. Increasing fluid viscosity reduces the fracturing area. Low injection rate is beneficial to improving hydraulic treatment areas when it is larger than that required to guarantee that the crack extends. The results can provide a case reference for optimization design of volume fracturing and productivity prediction analysis of CBM reservoirs.

Submagmatic fabric in the 2.6 Ga Bundelkhand granitoid, India: evidence from microstructure

Goutam Sarkar, Abdul Matin and Sarajit Sensarma

Keywords: Igneous rocks, microstructure, submagmatic fabric, syntectonic emplacement.

Abstract

Primary foliations in igneous rocks are the key to understanding processes within the magma chamber, cooling history, paleostress regime and strain during emplacement of granitoid plutons. In the 2.6 Ga Bundelkhand granitoid rocks, weak to moderately strong regional fabric is the result of submagmatic grain-supported flow during syn-kinematic emplacement of the magma. Microstructural and outcrop-scale evidences provide an excellent record for interpreting the significance of this fabric development vis-à-vis rheological state during fabric formation. Preferentially oriented tabular feldspar phenocrysts in the granitoid show deformation such as reformed shape, marginal fragmentation and recrystallization, whereas the finer interstitial grains of quartz remain undeformed or mildly deformed. On the basis of the characteristic foliated structure of the Bundelkhand granitoid and the specific contrasting deformation characteristics of feldspar and quartz grains, we propose that the fabric is submagmatic in origin and perhaps formed during syn-emplacement deformation environment of the granitoid.

Progressive seismic failure of a highway bridge, including abutment–backfill interaction

Mouloud Ouanani and Boualem Tiliouine

Keywords: Abutment–backfill soil interaction, highway bridges, nonlinear dynamic analysis, seismic failure.

Abstract

Current engineering practice pays little attention, if any, to nonlinear abutment–backfill soil interaction (ABSI) effects on seismic behaviour of bridges. The primary focus of this article is to assess the influence of ABSI on the progressive seismic failure of bridge structures. Emphasis is placed on the significance of ABSI effects, including abutment behaviour and backfill soil

flexibility. Nonlinear dynamic analysis is performed using a bilinear hysteretic model for the bridge superstructure and nonlinear characteristics of the expansion joint. Results indicate that ABSI has a significant effect on the seismic response in the longitudinal direction and can effectively reduce bridge seismic demands. ABSI affects rotational ductility demand at pier ends of the bridges, relative displacements, pounding and axial forces in the restrainers. Thus, it is essential that numerical models used in seismic assessment of bridge structures properly consider abutment–backfill interaction.

Synoptic situation associated with the heat wave condition during 17 May to 1 June 2015 over India

Smitha Nair, P. Chandrasekhara Rao and D. S. Pai

Keywords: Air temperature, heat waves, geopotential height, precipitable water.

Abstract

Heat wave conditions from 17 May to 1 June 2015 caused deaths of over 2000 people, especially in the south Indian states of Andhra Pradesh and neighbouring Telangana. This study comprises the analysis of synoptic features associated with this deadly heat wave. It was found that the presence of large amplitude anticyclonic flow in the upper levels, above normal 500 hPa height values, above normal lower tropospheric temperatures, below normal precipitable water and higher outgoing longwave radiation (OLR) values are major factors associated with the occurrences of heat wave.

Global retrospective analysis using NGFS for the period 2000–2011

V. S. Prasad, C. J. Johny, P. Mali, Sanjeev Kumar Singh and E. N. Rajagopal

Keywords: Global data assimilation and forecasting, monsoon season, numerical weather prediction models, retrospective analysis.

Abstract

The National Centre for Medium Range Weather Forecasting (NCMRWF) conducted its first global data retrospective analysis (reanalysis) for the period 1 January 2000–31 March 2011 using its GFS based system (NGFS). This reanalysis is called NGFS-R and the main objectives of this effort are to address issues for studying decadal variability of the Indian summer monsoon, high-resolution global analysis fields to study the Indian monsoon and to provide short-term mean fields for its seasonal/long-term forecasts by ensemble methods. NGFS-R has been conducted with the T574L64 version of the Global Data Assimilation and Forecasting System of NCMRWF that is operational as of May 2015, and using CFS-reanalysis data dump. With this effort, a high-resolution global data analysis at 6 h intervals is made available for about 16 years (2000–2015) for various uses and applications.

Assessment of climate change impact on water diversion from the Bago River to the Moeyingyi wetland, Myanmar Manish Shrestha, Sangam Shrestha and Avishek Datta

Keywords: Climate change, hydrological analysis, water diversion, wetlands.

Abstract

Originally built for flood control, the Moeyingyi wetland, Myanmar now provides valuable resources such as fishery, irrigation water and tourism, and is also home to many rare species and migratory birds. This is the only wetland in Myanmar listed as a Ramsar Site. Bias-corrected climate data from three general circulation models under two emission scenarios of IPCC Assessment Report 5 (AR5), namely RCP 4.5 and RCP 8.5 were used to forecast temperature and rainfall. Future climate scenarios were predicted for three future periods as 2020s (2021–30), 2030s (2031–40) and 2040s (2041–50). The Soil Water Assessment Tool (SWAT) was used for hydrological analysis to predict water availability. Analysis suggests that the discharge is expected to decrease

during dry season, which can have a negative impact on the diversion of water from the Bago River to the Moeyingyi wetland. On the other hand, discharge is likely to increase during July and can further worsen the recurring floods. Similarly, inflow at the Moeyingyi wetland is expected to decrease in future. Hence, robust adaptation strategies should be formulated to cope with the negative impact of climate change.

One-step microwave-assisted green synthesis of luminescent N-doped carbon dots from sesame seeds for selective sensing of Fe(III) V. Roshni and Ottoor Divya

Keywords: Carbon dots, fluorescence, sesame seeds, microwave pyrolysis, metal ions, quenching.

Abstract

The present study focuses on the green synthesis of nitrogen-doped carbon dots (C.dots) from sesame seeds using microwave pyrolysis method. The C.dots obtained were characterized and extensively studied using transmission electron microscopy (TEM), UV/ visible spectroscopy, fluorescence spectroscopy and Fourier transform infra-red spectroscopy (FTIR) techniques. The results indicated the presence of highly fluorescent, aqueous soluble and significantly photostable C.dots with a quantum yield of 8.02%. The average size distributions of C.dots were found to be 5 nm. These C.dots were effectively applied as a selective sensor for Fe(III) as the fluorescence intensity was significantly quenched with increasing metal concentrations. The limit of detection (LOD) was found to be 2.56 μM of Fe(III). This study demonstrates a low cost, environmental friendly and waste recyclable synthetic method for preparation of C.dots and its application as a selective Fe(III) sensor.

Biocompatibility of synthetic and bio-material fusion

Deepak Pant and Virbala Sharma

Keywords: Biocompatibility, carbon transformation, drug delivery, sequestration, synthetic–natural fusion.

Abstract

This communication proposes methods to improve the biocompatibility performance of synthetic materials for biological and biological material for synthetic applications. π -cloud extension by suitable ligand– ligand/metal–ligand interactions can make the synthetic–biological fusion suitable for such applications. The judicious use of ligands for π -cloud extension can be applied to carbon transformations and target-oriented drug delivery systems. Embedded metal-centre catalysts for synthetic–biological fusion include: (i) axial coordination via bridging ligands; (ii) ligands with weak to intermediate field strength and multidentities; (iii) design of inert complexes, and (iv) development of multi-nuclear complexes.

Isolation and characterization of endophytic bacteria associated with roots of jojoba

(*Simmondsia chinensis* (Link) Schneid)

Keywords: Endophytic bacteria, plant growth promoters, *Simmondsia chinensis*, seed oil.

Abstract

In this communication, the diversity and beneficial characteristics of endophytic bacteria have been studied in *Simmondsia chinensis* that has industrial importance because of the quality of its seed oil. Endophytes were isolated (N = 101) from roots of the jojoba plants collected, of which eight were identified by partial sequencing of the 16S rDNA gene. The isolated bacteria were *Bacillus* sp., *Methylobacterium aminovorans*, *Oceanobacillus kimchi*, *Rhodococcus pyridinivorans* and *Streptomyces* sp. All isolates had at least one positive feature, characterizing them as potential plant growth promoting bacteria. In this study, *R. pyridinivorans* and *O. kimchi* are reported as plant growth promoters.

**Deserted nineteenth century Paliwal villages around Jaisalmer, western Rajasthan, India:
historical evidence of palaeoseismicity**

AB. Roy, Harsh Bhu, Pankaj Sharma and Kishan Vaishnav

Keywords: Deserted Paliwal villages, evidence of recent tectonics, earthquake related destruction, historical evidence of earthquake, palaeoseismicity.

Abstract

Seismicity or seismic susceptibility implies proneness to earthquake incidence in a region. For this we cannot depend entirely on instrumental records, because this facility was almost unknown about 70-odd years ago, whereas the 'period of quiescence' between two successive major earthquakes in a region may be hundreds of years and sometimes more. This places a severe constraint on the understanding of the regional variability of seismic susceptibility or the proneness of any particular region to the occurrence of an earthquake. In such cases, the necessity is to look for evidence of palaeoseismicity in historic/pre-historic and archaeological records, and for much older events the different fault features preserved in geomorphic features. Here we cite an incidence of seismic event based on the examination of a large number of deserted early nineteenth century houses scattered around Jaisalmer region in western Rajasthan, India. Lying unoccupied for about 190 years or more, evidence of destruction is observed in each and every house, which is not generally witnessed in disused old houses standing for hundred years or more. Looking into the nature of collapse-related flattening features such as collapsed roofs, fallen joists, lintels and pillars in all these houses, we suggest that these are manifestations of earthquake-related destruction. Such an assumption finds strong support from the observed evidence of recent tectonic activities and from the observed ground movements along several major faults in the region covering Jaisalmer and the adjoining areas.

**Silicate and sulphide mineralogy, and conditions of equilibration of ultramafic rocks of the
Indo-Myanmar ophiolite belt between Tusom, Manipur and Shomra village, Myanmar
Nirupama Khwairakpam, Maibam Bidyananda and Sanjenbam Shyamson Singh**

Keywords: Abyssal peridotite, equilibrium temperature, pentlandite, metal alloys, oxygen fugacity, partial melting.

Abstract

The northeast-India ophiolite complex is exposed in many parts of Nagaland and Manipur, with particularly well-preserved mantle-sequence peridotite present in its southern section in Manipur state. We present the results of an investigation into the petrology and constituent mineral chemistry of this peridotite, which is associated with the Indo-Myanmar ophiolite located between Tusom, Ukhrol District (Manipur) and Shomra village (Myanmar). Mineral compositions indicate that it is an abyssal peridotite that has undergone minimal partial melting (1–5%). Equilibration probably occurred in the upper mantle at a temperature of 1080–1240°C, a pressure of 23– 24 kbar, and an oxygen fugacity between 0.303 and 0.580 log units above the FMQ buffer. Primary and secondary sulphide phases in the studied peridotites have also been analysed. Pentlandite ((Fe,Ni)₉S₈) was found to be the primary sulphide mineral, which occurred in association with orthopyroxene and awaruite (Ni₃Fe). Cu-rich alloys and magnetite occur as secondary minerals that developed during later serpentinization.

Virtual herbarium of Kerala Forest Research Institute, Peechi, Kerala, India

V. B. Sreekumar, K. H. Hussain and C. Renuka

Keywords: Flowering plants, open-source software, plant diversity, virtual herbarium.

Abstract

A virtual herbarium of the specimens preserved in the Kerala Forest Research Institute, Peechi, Kerala, India has been created. Herbarium specimens were digitized using an image station and a website was developed using open-source software like Apache, MySQL and PHP. The database provides a total of 5718 records representing 203 plant families. The predominant families with maximum records represented are Areaceae (1167 records), Poaceae (381), Orchidaceae (347), Fabaceae (270), Euphorbiaceae (239) and Rubiaceae (217). Details such as collection number, name of collector, date of collection, collection location, brief description of the habitat, phenology, besides the binomial as recorded on the herbarium specimen label are further computed and shown along with digitized specimens for each species on the species page. The 'digital herbarium' is rendered accessible at <http://kfriherbarium.org/>. The data presented are informative, user-friendly and easily accessible. The initiative is a gesture of sharing information on plant diversity of Kerala that was gathered by several researchers who have also contributed to building the herbarium.

Farm ponds for climate-resilient rainfed agriculture

Ch. Srinivasa Rao, R. Rejani, C. A. Rama Rao, K. V. Rao, M. Osman, K. Srinivasa Reddy, Manoranjan Kumar and Prasanna Kumar

Keywords: Climate change, drought management, farm ponds, rainfed agriculture, supplemental irrigation.

Abstract

This article summarizes the utility of farm pond technology as an adaptation strategy to overcome water shortage due to several reasons, including climate change. This technology has the potential to increase availability of water for supplemental irrigation, increase in cropped area and productivity leading to increase in net returns from crops. Farm pond offers a solution to overcome the increased frequencies of drought, particularly mid-season and terminal drought under climate change scenario. The article advocates for policy intervention to promote one pond for each farm holding having an area of 2.0 ha at individual farm level or on community-sharing basis. Constraints for large-scale implementation of farm pond technology are also discussed.

Antisense oligonucleotides as therapeutics and their delivery Bhagyashree Gurav and Ganga Srinivasan

Keywords: Antisense oligonucleotides, delivery strategies, gene expression, modulators, therapeutics.

Abstract

Antisense oligonucleotides are novel, highly selective inhibitors or modulators of gene expression. Attention is now being paid for the use of these agents not only in the treatment of genetic disorders but also for nongenetic disorders, where the treatment involves modulation of gene expression. However, antisense oligonucleotides face immense challenges for their use as therapeutics and successful application of these agents requires appropriate design and delivery strategies to increase their stability and intracellular uptake.

Developments in vibration control of structures and structural components with magnetorheological fluids K. Rama Raju and D. Vineeth Varma

Keywords: Automobile brakes, magnetorheological fluids, structure and structural components, suspension systems, vibration control.

Abstract

Vibration isolation and control of structures subjected to different types of dynamic loads due to periodic forces, impact and shock type forces and earthquake forces is an important area in structural engineering. The structures can be machine foundations, buildings, bridges, towers, automobiles, ship structures, military tanks and aeronautical structures. Some of these devices used are elastic springs, viscoelastic dampers, viscous fluid dampers, magnetorheological dampers and friction dampers. This article gives latest developments in vibration control of structures and structural components using magnetorheological fluids. The current status of technology and further research requirements to be studied in these areas are highlighted.

A paradigm shift in agroforestry practices in Uttar Pradesh

Pooja Verma, Arvind Bijalwan, Manmohan J. R. Dobriyal, S. L. Swamy and Tarun Kumar Thakur

Keywords: Agro-climatic regions, agroforestry, paradigm shift, productivity, tree–crop interaction.

Abstract

Agroforestry is a dynamic and sustainable land management system of deliberately growing woody perennials along with agricultural crops on farmlands to secure both tangible and intangible benefits to the farmers. Uttar Pradesh (UP), one of the largest and densely populated state of India in the Indo-Gangetic Plain with large agrarian communities, had a paradigm shift in the adoption of agroforestry. After successful adoption and commercialization of poplar and eucalyptus-based agroforestry models over two decades in western UP, other parts of central and eastern UP have also been attracted towards remunerative agroforestry projects in the past few years. In UP, agroforestry practices vary according to different agro-climatic zones, land capability and socio-economic status of farmers. The variation is reflected in terms of diversity in agroforestry practices, and comparative advantage prompted a renewed interest to harness the vivid potential. Drawing on the representative literature, we have reviewed the status and pattern of tree–crop combinations of agroforestry practices across various regions of the state as well as productivity under different agroforestry systems, which shows traditional agriculture transforming to multifunctional agroforestry in UP.

Implementation of stochastic approach for vessel and ridge studies in retinopathy of prematurity screening

S. Prabakar, K. Porkumaran, Parag K. Shah and V. Narendran

Keywords: Isotropic undecimated wavelet transform, retina vessel and ridge, retinopathy of prematurity, tortuosity.

Abstract

The retinopathy of prematurity (ROP) is an ocular pathological disorder of retinal blood vessels in premature infants and low birth weight infants. The medical professional who is taking care of premature infants should know who is at the risk of this disease and its exact severity stage. It is also important to decide when screening must begin and how often these infants need to be examined as disease progression leads to a more severe stage causing blindness. The contrast stretching method has been utilized to enhance the ROP colour image. Then an automatic isotropic undecimated wavelet transform (IUWT) scheme has been proposed to extract the abnormal retinal blood vessel and measure its width and tortuosity. The ridge formation of this pathological disorder has also been extracted by IUWT. The quantitative measurements of mean diameter, standard deviation,

tortuosity, length of retinal blood vessel and ridge have been considered and computed to find the exact severity stage of ROP. The proposed methods for ROP stage screening system have been validated through machine vision techniques. This proposed system improves the optimum time utilization for ophthalmologists; ophthalmic technicians can provide exact ROP stage and deliver better accuracy and sensitivity in diagnosis.

An improved chemical reaction-based approach for multiple sequence alignment

Rohit Kumar Yadav and Haider Banka

Keywords: Bioinformatics, chemical reaction optimization, multiple sequence alignment, population diversity.

Abstract

In bioinformatics, multiple sequence alignment (MSA) is an NP-hard problem. Nature-inspired approaches can provide an approximate solution compared to conventional approaches. In this article, the MSA problem is dealt with using chemical reaction optimization (CRO). The limitations of CRO are slow convergence and low population diversity. Therefore, the initialization process is improved by pairwise alignment technique which maintains diversity. In the performance analysis, we have taken benchmark datasets from Bali base version 2.0. The Bali score of the proposed approach is compared with those of the existing approaches such as SB-PIMA, SAGA, RBT-GA and GAPAM, HMMT. Simulation results confirm the superiority of the proposed approach over others.

Biodegradation of crude oil using marine *Bacillus* species from Vadinar coast, Gujarat, India

Najmuddin Mulani, Abhay B. Fulke, Edna D'Souza, Anirudh Ram, Aayushi Maloo, Faraz Sayed and S. N. Gajbhiye

Keywords: Bioremediation, crude oil, lipase, marine bacterial isolates, spectrofluorometer.

Abstract

The marine environment is open to large sources of toxic organic waste in the form of accidental oil spills. Therefore, it is important to study microbial degradation processes that help reduce the damage caused to the environment. Universally, oil spills produce enormous public anxiety and highlight the need for cost-effective, indigenous and environmentally acceptable bioremediation technologies. In recent times, advanced remedial techniques have been opted, such as solidifying, skimming, controlled burning and bioremediation. The present study aimed to isolate crude oil-degrading marine bacteria from Vadinar coastal area of Gujarat, India. Among seven isolates, three potential bacterial strains were chosen for crude oil and petroleum hydrocarbon (PHC) degradation, which were analysed by UV spectrophotometric and fluorometric analysis. These bacterial cultures were verified by 16S rRNA gene sequencing and identified as *Bacillus* species. Phylogenetic analysis was carried out to confirm the evolutionary relationship with existing oil-degrading species. In the present study, drop collapse, oil spreading and emulsification assay were performed to detect biosurfactant production. *Bacillus* sp. NM1 KT354277 was capable of degrading 50% of PHCs at the end 72 h for one week under rotary incubation in ONR7a medium. Among the studied strains, *Bacillus* sp. NM3 KT354278 showed promising lipase activity, viz. 60.72 and 61.19 U ml⁻¹ for 2% of olive oil and tributyrin respectively. Thus, the present study explores indigenous marine isolates that could be utilized as a potential alternative for oilspill remediation in future.

Growth, lipid productivity and cellular mechanism of lipid accumulation in microalgae *Monoraphidium* sp. following different phosphorous concentrations for biofuel production

Saumya Dhup, Dheeban Chakravarthi Kannan and Vibha Dhawan

Keywords: Lipid accumulation, *Monoraphidium* sp., phosphate concentration, nutrient removal efficiency, transmission electron microscopy.

Abstract

Stress to an algal species can be caused by several factors ranging from temperature extremes to varying light intensities under which they accumulate lipids. Stress caused by nutrient limitation is known to induce maximum lipid accumulation in microalgae. In order to obtain an appropriate phosphate concentration exhibiting both high biomass and high lipid contents, four different concentrations of phosphate were implemented. Mechanism of lipid accumulation was also studied. Of the tested concentrations, no significant difference between growth rates was observed. Cultures with phosphate concentration 2.7 mg/l exhibited maximum increase in biomass productivity compared to control. But phosphate concentration 0.5 mg/l demonstrated the highest lipid productivity (8.75 mg/l/day), in accordance with lipid content (21.8%). Further, representation of TEM and fluorescent microscopic images depicted differences in lipid accumulation and sub-cellular ultrastructure at different concentrations of phosphate. Disappearance of phosphate and nitrate from the medium was also evaluated to study the efficient nutrient concentration and to better understand mechanism of lipid enhancement.

Geospatial multicriteria approach for solid waste disposal site selection in Dehradun city, India

V. V. Sai Krishna, Kamal Pandey and Harish Karnatak

Keywords: Geospatial techniques, multi-criteria analysis, suitable site, urban solid waste.

Abstract

Solid waste generation is increasing rapidly in urban areas of India as well as globally. As land resources for waste disposal are limited in highly populated countries like India, identification of solid waste disposal sites in urban centres is a challenging task, as this involves physical, socio-economic and environmental factors. Dehradun, the capital city of Uttarakhand at present has only one disposal site which is not having good spatial accessibility for all the locations in the city and also it is an environmentally vulnerable site. The present study aims to find suitable sites for decentralized solid waste disposal using geospatial techniques with multi spatio-temporal remote sensing data. A geospatial multicriteria analysis was performed with weighted overlay technique by considering various criteria such as physical, social and demographic aspects of the city for locating the solid waste disposal site(s).

Groundwater assessment in a canal command area for sustainable irrigation in a part of the Indo-Gangetic alluvial plain P. K. Srivastava and Raj Mohan Singh

Keywords: Conjunctive use, cropping intensity, groundwater assessment, irrigation.

Abstract

The growing dependence of irrigation on groundwater and its excessive use for other purposes has an adverse impact on the resource domain. This has resulted in unsustainable over-extraction and subsequent lowering of the groundwater table. The present study shows that groundwater levels can be kept near stable even with more extraction for increased cropping intensity of up to 222% by opting conjunctive use, as against the present intensity of 163.1%. In addition, the groundwater sustainable area increased from 65% to 92% and the groundwater depletion area decreased from 30% to 7%. The waterlogged area also reduced from 5% to 1% in a period of three years, thereby

increasing gross margins. Groundwater system simulation shows that groundwater level will remain sustainable even after 10 years at 222% cropping intensity by adopting conjunctive use of groundwater with canal water.

Analysis of historical trends in hydrometeorological variables in the upper Cauvery Basin, Karnataka, India B. C. Kumar Raju and Lakshman Nandagiri

Keywords: Climate change mitigation, historical climate trends, hydrometeorological trends, statistical analysis.

Abstract

The present study examines the significance and magnitude of trends in the monthly rainfall, monthly mean maximum and minimum daily temperatures and streamflow in the Upper Cauvery Basin, Karnataka for a 30-year period, i.e. 1981–2010. Using observed data from 33 rain gauges, 6 climate stations and 4 stream gauging sites, statistical parameters –coefficient of variation (CV) and percentage departure have been calculated for average monthly values separately for three decades. As expected, CV of rainfall showed large variations from December to March, while the percentage departure also varies during these months for different decades. Statistically significant trend was observed in maximum temperature for Chikmagalur and Hassan stations. CV of minimum daily temperature showed large variability from November to March for all climate stations and also a significant increasing trend for Hassan and Bengaluru stations, while for Madikeri a decreasing trend was observed with a variation of $-0.16^{\circ}\text{C}/\text{year}$. Not much variation was found for streamflow, except in K. M. Vadi and T. Narasipur gauge sites, which showed significant decreasing trend of $-0.778 \text{ m}^3/\text{s}/\text{year}$. Long-range dependence analysis revealed a weak persistence for both rainfall and streamflow of the basin. Results provide information regarding historical climate trends in the Upper Cauvery Basin, which can form the basis for projecting likely future trends and preparing plans for climate change mitigation and adaptation.

Coding the encoded: automatic decryption of kaTapayAdi and AryabhaTa's systems of numeration R. Anusha, C. Nithya, R. Venketeswara Pai and V. Ramanathan

Keywords: Ancient number systems, automatic decryption, encoding numbers, linguistic phrases, transliteration.

Abstract

AryabhaTa's and kaTapayAdi systems of encoding numbers in Sanskrit words have been in vogue since antiquity in Indian science. The process of decryption and decoding such numbers from the verses has been achieved only manually hitherto. Automating this process has been the focus of this communication. The process of decryption was achieved using a code written in LabVIEW platform of programming.

Recognition of hydrocarbon microseepage using microbial and adsorbed soil gas indicators in the petroliferous region of Krishna–Godavari Basin, India

M. A. Rasheed, M. Lakshmi, M. S. Kalpana, D. J. Patil and A. M. Dayal

Abstract

The present study aims at exploring the possible correlation between adsorbed light gaseous hydrocarbon distribution pattern and the hydrocarbon oxidizing microbes present in the sub-soil samples. To establish the role of the latter in identifying the upward migration of hydrocarbons, especially a known petroliferous Krishna–Godavari Basin has been investigated. Soil samples from oil and gas fields of Tatipaka and Pasarlapudi areas of the basin show the presence of bacterial population for methane ($3.46 \times 10^5 \text{ cfu/g}$), ethane ($3.85 \times 10^5 \text{ cfu/g}$) and propane ($3.04 \times 10^5 \text{ cfu/g}$)

oxidizing bacteria in soil samples. Gas chromatographic analyses of adsorbed soil gases show the presence of C1 to C4 hydrocarbons. The concentration of adsorbed soil gases ranged for methane (C1) = 1 to 115 ppb, ethane (C2) = 1 to 99 ppb, propane (C3) = 1 to 34 ppb, butane (nC4) = 1 to 9 ppb and $\Sigma C2+$ = 1 to 115 ppb. The scatter plots between C1 and C4 components depict a linear trend indicating that all gases are from the same source. The total organic carbon (TOC) content of the soil samples ranges from 0.18% to 1.34%. Pearson correlation analysis shows that the concentration of $\Sigma C2+$ does not show any correlation ($r = 0.1$) with TOC, suggesting that the adsorbed gases are not derivatives of the organic carbon. Moreover, the values for methane $\delta^{13}C_1$ varied from -39.9‰ to -19.9‰ (V-PDP) Vienna PeeDee Belemnite indicate thermogenic origin. The integration of geomicrobial prospecting method together with adsorbed soil gas and carbon isotope studies shows a good correlation with the producing oil and gas fields of Krishna–Godavari Basin. **Keywords:** Adsorbed soil gas, bacteria, hydrocarbon exploration, microseepage.

Mahi: a unique traditional herbal ink of early Assam

Barsha R. Goswami, Monoj K. Das, Pranjal P. Das, Tapas Medhi, Anand Ramteke Simanta Hazarika and Robin K. Dutta

Keywords: Ancient manuscripts, physico-chemical properties, spectroscopic analysis, traditional herbal ink.

Abstract

Mahi, a unique herbal ink prepared with cow urine as extractant, was used for manuscript writing in early Assam. The ink had a deep and fast colour and was persistent on Sancipat manuscripts due to its resistance to aerial oxidation and fungi. It was also noncorrosive unlike the corrosive acidic iron gall ink of contemporary Europe. The present study was aimed at analysing the physico-chemical properties of Mahi, including its special properties. The study includes phytochemical analysis, antimicrobial assay, UV visible with fluorescence analysis, iron and copper estimation and identification of some polyphenols by HPLC-UV.

Climate change-driven shifts in elevation and ecophysiological traits of Himalayan plants during the past century

Priyanka Agnihotri, Tariq Husain, Pramod Arvind Shirke, Om Prakash Sidhu, Harsh Singh, Veena Dixit, Anzar Ahmad Khuroo, Devindra Vijay Amla and Chandra Shekhar Nautiyal

Keywords: Climate change, distributional shift, $\delta^{13}C$, Himalayan plants, metabolites, stomatal density.

Abstract

As broad-scale distributions of plants are shaped by climatic conditions, changes of climate necessarily result in shifts of distributional limits. These shifts are closely coupled with changes in plant ecophysiology, growth and productivity. Among environments subjected to the highest increase in temperature in the last decade and the greatest expected warming predicted for the future, high-mountain biomes belong to the most frequently considered. Evidence for distributional shifts has been mostly documented in European and American mountains, while the largest and highest mountainous areas are located in Asia. The present study aims to detect climate change-driven shifts in elevation and ecophysiological traits of endemic herb species of Himalaya with the help of herbarium specimens as potential tool. We observed significant rapid upward elevational shift of 55.2 m/decade compared to average global shifting of 6.1 m/decade and impulsive variations in secondary metabolite concentration. Significant negative relationship was found for stomatal density, $\delta^{13}C$ with the lapse of years. Analysis of instrumental temperature data reveals an increase of 0.31°C in mean maximum and 0.79°C in mean minimum temperature during the last century.

Influence of density of emulsion explosives on its velocity of detonation and fragmentation of blasted muckpile A. Mishra, M. Rout, D. R. Singh and S. Jana

Keywords: Blasted muckpile, detonation velocity, emulsion explosives density, opencast mines.

Abstract

Opencast mining accounts for about 86% of the produced coal in India. Most of the opencast mines in the country use bulk emulsion explosives. The total consumption of explosives in India is around 550,000 tonnes annually. It has been shown that detonation velocities vary with the density of the emulsion explosive. Here we describe experiments that have been conducted to understand the influence of velocity of detonation of emulsion explosives on fragmentation of blasted muckpile over a range of densities. The density of explosives was varied from 0.6 to 1.1 g/cc which resulted in the variation of detonation velocity from 3262 to 4624 m/s.

Record of post-collisional A-type magmatism in the Alwar complex, northern Aravalli orogen, NW India Parampreet Kaur, Nusrat Eliyas and Naveen Chaudhri

Keywords: A-type granites, post-collision, Aravalli orogen, Alwar complex, whole-rock geochemistry.

Abstract

The Alwar complex is situated in the northern part of the Aravalli orogen, NW India and contains A-type granites of late Palaeoproterozoic age. The current study focusses on the Harsora and Dadikar plutons to characterize and constrain the tectonic setting of Palaeoproterozoic felsic A-type magmatism in this crustal segment using whole-rock geochemical data. The rocks studied are metaluminous to slightly peraluminous A-type ferroan granites. The granites are generally characterized by strongly fractionated LREE patterns with nearly flat HREE profiles and show moderate to strong negative Eu anomalies, in addition to prominent negative anomalies in Ba, Nb, Sr, P and Ti. The results show the post-collisional setting of A-type granites in the northern Aravalli orogen and signify that A-type granites may not only form in anorogenic setting. This study provides a new dimension to the understanding of palaeoproterozoic geodynamic evolution in the Aravalli orogen.

Conservation of jack wood (*Artocarpus heterophyllus* Lamk.) sculptures in an ancient temple in Kerala, South India: identification of heritage wood samples, neem gum–cashew nut shell liquid application in consolidation and preservation

M. P. Sujith, L. Rajeswari, T. Sreelakhmi and E. V. Anoop

Keywords: Conservation, CNSL, heritage wood, preservation, wooden sculptures

Abstract

This present communication deals with the anatomical identification of wood samples of an ancient archaeological monument in India, Sri Vishnu temple, Kadavallur in Thrissur (Kerala) and the consolidation of fissures and cracks formed due to seasoning over a period of time using neem gum and preservation using cashew nut shell liquid extract. Neem gum which has anti-bacterial qualities and CNSL organic extract which has anti-termite and anti-fungal preservative action are found suitable for conservation and preservation of these sculptures. The active ingredient in organic preservative, CNSL, was analysed using HPLC and compared using UV spectra. The peaks of monoene, diene and triene in anachardic acid are visible in the spectra. The preservative, CNSL, also enhanced the aesthetic appeal of the jack wood sculptures. CNSL-coated jack wood had lower moisture absorption as demonstrated by Karsten tube experiment. The results imply that the strength of the material formed out of neem gum and wood powder used for filling of cracks and fissures can be modified as per requirement using distilled water and that the application is reversible. This method of conservation was found suitable under warm and humid conditions to which these sculptures are subjected to.

Antiproliferative effects of fluorine substitute 3,5-di-tert-butylphenol bearing Schiff bases using CFSE-based cell proliferation assay

Ali Osman Gurol, Veli Kasim and Faruk Suzergoz

Keywords: Cancer, CFSE, doxorubicin.

Abstract

The determination of antiproliferative properties of compounds on tumour cells is important for assessment of their efficacy in cancer treatment. CFSElabelled K562 cells were incubated with doxorubicin and ortho- or para-fluorosubstitute Schiff bases (compounds 1 and 2 respectively). CFSE intensities were analysed using flow cytometry. K562 cells treated with doxorubicin resulted in homogeneous high intensity fluorescence after 96 h of incubation. Schiff bases exhibited antiproliferative effects, but lower than doxorubicin. Our results reveal that CFSE assay can be used for determining in vitro antiproliferative features of anticancer drugs and/or compounds from herbal or chemical sources.

Comparative analysis of digestive amylase activity in some tropical and temperate breeds of mulberry silkworm, *Bombyx mori*

L. N. A. Ganie, Afifa S. Kamili, K. A. Sahaf, Imtiyaz Murtaza, K. A. Dar and M. A. Malik

Keywords: Amylase activity, *Bombyx mori* L., diapausing and non-diapausing strains, maltose, survival.

Abstract

In the current study amylase activity was carried out by analysis of digestive fluid in diapausing and nondiapausing strains of mulberry silkworm, *Bombyx mori* L. Six different breeds, viz. Pure Mysore, Nistari, NB4D2, SH6, SKAUR6 and SKUAST28 were selected for the study. The average digestive amylase activity was found highest in Nistari during spring (664.82 μg) and summer (993.97 μg) seasons. However, among the bivoltine breeds SKUAST-28 with the average amylase activity during spring (148.47 μg) and summer (144.04 μg) seasons was found to be a superior breed with respect to this parameter. The amylase activity in tropical non-diapausing breeds is higher than that in the bivoltine breeds of silkworm which is responsible for their higher survival rate under unfavourable conditions.

Silent foray of three soft scale insects in India

Sunil Joshi and A. Rameshkumar

Keywords: Distribution, natural enemies, plant host, scale insects

Abstract

This study documents three scale insects, viz. *Kilifia acuminata* (Signoret) (Hemiptera: Coccidae), *Trijuba oculata* (Bain) (Hemiptera: Coccidae) and *Protopulvinaria longivalvata* Green (Hemiptera: Coccidae) from India as new entrants. All these insects are polyphagous and attack several economically important plant species. *K. acuminata* has been reported from important plant genera like *Artocarpus*, *Eugenia*, *Psidium*, *Syzigium*, *Passiflora*, *Coffea*, *Citrus*, *Litchi* and *Manilkara*, while *T. oculata* has been reported to infest *Annona*, *Ficus* and *Vitis*. *P. longivalvata* has been recorded on important crops, viz. *Mangifera*, *Psidium*, *Syzigium*, *Piper*, *Coffea*, *Citrus* and *Camelia*. Brief diagnostic characters in live and mounted condition are provided. Information about host range, distribution and natural enemies of these scale insects is also furnished. New plant host records for scales and new host-parasitoid association have been documented. Possibilities of these scale insects becoming serious pests and a threat to economically important plants are also discussed.

Identification of generalist and specialist phenotypes of the peach-potato aphid *Myzus persicae* (Insecta : Hemiptera : Aphididae) in agroecosystem of northeast India

Basant K. Agarwala and Parna Bhadra

Keywords: Population diversity, life history traits, *Myzus persicae*, crop plants, northeast India.

Abstract

Different phenotypes of the peach-potato aphid, *Myzus persicae*, with prominent differences in ecological and biological performances were identified on mustard, eggplants and potato plants in the agroecosystem of Tripura, north east India. Asexual clones of *M. persicae* on mustard plants were consistently light green in colour and their adults were heavier than the greenish yellow to light pink coloured aphids of this species that occurred on eggplants and potato plants in the same geographical area. Life history traits, like population growth rate, carrying capacity of respective plants, mean relative growth rate, intrinsic rate of increase and net reproductive rates differed between the three plant species. Differences in life history traits persisted in reciprocal host plant transfer experiments; aphid clones from mustard plants when transferred to eggplants and potato plants did not survive but those from the latter two plant species survived and colonized well on mustard plants. Results showed that *M. persicae* in the agro-ecosystem of Tripura consisted of at least two distinct phenotypes, the 'specialist' phenotypes from mustard plants and the 'generalist' phenotypes from eggplants and potato plants. These results may have significant implications for designing crop-specific measures for the management of *M. persicae*.

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Mind the gap: reflections on the art of science

Ravi Subrahmanyam

Keywords: Art of science, pathways in science, technique of science.

Abstract

Scientific research in India has for too long been conducted at a distance from the public, within gated communities of select and chosen few. Fundamental research in basic science, which is the essential groundwork that eventuates in all of the advancements in technology and medicine as well as empowering economic development, goes uncommunicated outside the peer group and is often considered uncommunicable. The translations that approach the lay public also often continue at a distance and, consequently, the outreach that places the product in the public domain is restrained. This article attempts to explore many of the issues around the communication gap, questioning perceptions and convictions in the science-society landscape.

Should Indian researchers pay to get their work published?

Muthu Madhan, Siva Shankar Kimidi, Subbiah Gunasekaran and Subbiah Arunachalam

Keywords: Article processing charge, hybrid OA journals, institutional repositories, OA policy, open access journals.

Abstract

Paying to publish is an ethical issue. During 2010–14, Indian researchers have used 488 open access (OA) journals levying article processing charge (APC), ranging from US\$ 7.5 to 5,000, to publish about 15,400 papers. Use of OA journals levying APC has increased from 242 journals and 2,557 papers in 2010 to 328 journals and 3,634 papers in 2014. We estimate that India is potentially spending about US\$ 2.4 million annually on APCs paid to OA journals and the amount would be much more if we add APCs paid to make papers published in hybrid journals open access. It would be prudent for Indian authors to make their work freely available through interoperable repositories,

a trend that is growing in Latin America and China, especially when funding is scarce. Scientists are ready to pay APC as long as institutions pay for it and funding agencies are not ready to insist that grants provided for research should not be used for paying APC.

Optical nanoscopy tools for biologists: advancements of fluorophores and optics for high resolution and live imaging

Dhermendra K. Tiwari, Manisha Tiwari and Bikash R. Sahoo

Keywords: Fluorophores, live cell imaging, optical nanoscopy, optical setup.

Abstract

Optical nanoscopy has emerged as an important tool for live cell imaging at the nanoscale resolution in the field of life sciences. The 2014 Nobel Prize in Chemistry for this invention proves its importance in multidisciplinary areas of science. Several optical nanoscopic methods have been introduced in the past decade to achieve diffraction-unlimited resolution by implementing new optical setup or utilization of unique photoswitchable fluorophores, or both. In this review we extensively discuss the biological importance of nanoscopy and the latest advancements and types of fluorophores needed for imaging. This review will be a starter-kit for biologists working in the field of bioimaging.

A bibliometric review of research trends in neuroimaging

Andy Wai Kan Yeung, Tazuko K. Goto and W. Keung Leung

Keywords: Bibliometrics, impact factor, neuroimaging journals, research evaluation.

Abstract

Neuroimaging is one of the important medical imaging domains that help diagnose and manage diseases. This study describes the neuroimaging publication outputs sorted by journals, countries, authors and institutions, and evaluates journal performance using metrics based on publication data from 2003 to 2014 indexed in the Web of Science and Journal Citation Reports. There has been a significant growth in the neuroimaging literature with North America and Europe being the main contributors. Magnetic resonance imaging is the most popular imaging modality, and brain connectivity is one of the hotspots. Top journals within the field have improved performances over the study period.

Sonochemical preparation of Ag₂O–PVA nanocomposites: study on pertinent structural and optical properties and exploring the effect of gamma and neutron irradiation

B. Behmanesh, D. Rezaei-Ochbelagh, Y. Azizian-Kalandaragh and Gh. Imanzadeh-Karkaragh

Keywords: Ag₂O–PVA nanocomposites, FT-IR, neutron and gamma irradiation, XRD.

Abstract

In the paper, Ag₂O–PVA nanocomposites have been prepared by ultrasound-assisted method and the effect of gamma and neutron irradiation has been studied on their optical and structural properties. X-ray diffraction patterns and thermogravimetric analyses also confirm the formation of silver oxide nanoparticles in polyvinyl alcohol polymer. The optical changes in the samples induced by gamma and neutron irradiation were revealed through Fourier transform infrared and diffusive reflectance spectroscopy. Surface morphology of the as-prepared, irradiated and nonirradiated samples has been studied by scanning electron microscopy. The results confirm the observed changes in both optical and structural properties.

Ab initio and DFT study of prototropic and metallotropic 1,5-shifts of isolobal cyclopentadienyl derivatives Zahra Javanshir, Saeed Jameh-Bozorgi, and Ali-reza Namdari

Keywords: Ab initio, cyclopentadienyl, isolobal, metallotropic, prototropic, sigmatropy.

Abstract

The structures, energies and sigmatropic behaviour of η^1 -cyclopenta-2,4-dienylborane (1) and η^1 -cyclopentadiene-three carbonyl cobalt (I) (2) were examined using DFT-B3LYP/6-311+G** level of theory. Both BH₂ and Co(CO)₃ fragments in these compounds are isolobal. Results indicate that –BH₂ and –Co(CO)₃ in sigmatropic shifts had similar behaviour. Furthermore, in compounds 1 and 2, prototropic shifts have similar mechanisms. In compounds 1 and 2, metallotropic shift acts faster than prototropic shift. Migration of proton and Co(CO)₃ took place through suprafacial [1,5]-sigmatropic mechanism, but –BH₂ shift took place through antarafacial [1,3]-rearrangement. The barrier energies of prototropic shift in compounds 1 and 2 are 15.94 kcal mol⁻¹ and 33.13 kcal mol⁻¹ respectively. These energies are lower than those of brotropic shifts in compound 1 (0.16 kcal mol⁻¹) or migration of CO(CO)₃ in compound 2 (3.76 kcal mol⁻¹).

A concept of knowledge and technology enabled empowerment of rural Indian villages Anil Kakodkar, Babruvahan Ronge, Ajit Patankar, Smita Mule and Prashant Pawar

Keywords: Digitally connected villages, knowledge and technology, livelihood generation, rural empowerment.

Abstract

The objective of rapid development of rural population in a sustainable manner with a view to bridging the urban–rural divide would require leveraging knowledge and technology in an environment conducive for innovation. The concept of a CILLAGE that incorporates the best of a city in a village is developed with this objective in mind. A CILLAGE is a knowledge-based ecosystem for integrated education, research, technology development and deployment as well as capacity building in rural areas. The focus of research work at a CILLAGE is on regional problems. CILLAGE activities also include a comprehensive engagement with people in the neighbourhood for demonstration and deployment of relevant technologies through a number of Advanced Knowledge-based Rural Technology Initiative (AKRUTI) centres located in the neighbourhood. CILLAGE should thus become a centre of innovation in rural areas to solve the problems of the region and disseminate the developed technologies in the region through AKRUTI centres. This article discusses the philosophy of the CILLAGE concept and describes its implementation through an example.

Leaf surface wax composition of genetically diverse mulberry (Morus sp.) genotypes and its close association with expression of genes involved in wax metabolism

H. M. Mamrutha, K. N. Nataraja, N. Rama, D. K. Kosma, T. Mogili, K. Jhansi Lakshmi, M. Udaya Kumar and M. A. Jenks

Keywords: Cuticular wax, moisture retention capacity, mulberry, silkworm, wax genes

Abstract

Silkworm (*Bombyx mori*), the primary producer of silk, has strong feeding preference for most turgid and hydrated mulberry leaves. In a previous study, we showed positive correlation between moisture retention capacity (MRC) of the mulberry leaf and leaf surface wax amount. In the present study, we examined wax constituents in genotypes that exhibited a wide range of leaf surface wax amount and MRC. Gas chromatographic analysis revealed that acids, alkanes, aldehydes, primary alcohols, iso-alkanes, triterpenoids and esters were among mulberry waxes identified and the major being alkanes. The highest total leaf wax amount was 1006.8 $\mu\text{g dm}^{-2}$ in the V1 genotype whereas

S-36 had the least wax at $436.9 \mu\text{g dm}^{-2}$. The alkanes were dominated by those having 25, 27, 29, 31 and 33 carbons, with C31 compounds being the most abundant. RNA-blot hybridization performed with 13 wax biosynthesis associated genes using heterologous probes revealed a close association between surface wax composition and expression levels of genes associated with wax elongation (CUT1, KCS1). The association was also established with homologous probes of KCS1, WAX2, CUT1 and LTP1-like genes. In summary, regulation of early wax precursor metabolism is a likely contributor to the variation observed in leaf wax composition in mulberry.

Paleoarchean zircons from quartzite of South Bundelkhand Supracrustal Complex: origin and implications for crustal evolution in Bundelkhand Craton, Central India

Alexander Slabunov, Vinod K. Singh, Kumar Batuk Joshi and Xiaoli Li

Keywords: Bundelkhand Craton, Girar supracrustal belt, quartzites, rare earth elements, zircon geochemistry

Abstract

The present study reports trace elemental data from 39 Paleoarchean (3.43 and 3.25 Ga) zircons separated from quartzite near Girar, which forms a part of the South Bundelkhand Supracrustal Complex in Central India. The zircons are prismatic, have well-developed oscillatory zoning and their Th/U ratio ranging from 0.27 to 8.62 is comparable to that of typical magmatic zircons. Crystallization temperature of 620–776°C using titanium-in-zircon thermometer, positive slope of zircon REE patterns, positive Ce anomalies along with mineral inclusions like quartz, muscovite, magnetite and monazite suggest a granitic source for these quartzites. Sm–Nd isotopic data (TDM age = 3.29 Ga) along with zircon trace elemental data indicate the presence of granitic continental crust in southern Bundelkhand Craton at least during the Paleoarchean (3.4 Ga).

In situ U–Pb zircon micro-geochronology of MCT zone rocks in the Lesser Himalaya using LA–MC–ICPMS technique

P. K. Mukherjee, Saurabh Singhal, Vikas Adlakha, S. K. Rai, Som Dutt, Aditya Kharya and A. K. Gupta

Abstract

A multi-collector (MC) inductively coupled plasma mass spectrometer (ICPMS) was used in combination with an Excimer (193 nm) laser to carry out in situ U–Pb dating of zircons. High performance two-volume sample cell provided unmatched laser ablated aerosol transportation efficiency resulting in reducing laser-related down-hole fractionation. Three well-characterized natural zircon reference standards (Harvard zircon 91500, GJ-1 zircon, Plešovice) were repeatedly measured in different sessions to evaluate the analytical figures of merits. Precision of <1% was achieved for spot sizes 20 μm with accuracies well within 2% of the reference values for these standards. Zircons from MCT Zone in the inner Lesser Himalaya reveal a highly discordant Palaeo-proterozoic (1901 ± 11 Ma) magmatic crystallization age inferred from the upper intercept in the concordia plot. The $^{207}\text{Pb}/^{206}\text{Pb}$ ages are also internally consistent with the discordia age with a weighted mean of 1900 ± 10 Ma and in turn suggest a major phase of Palaeo-proterozoic magmatic activity along the northern margin of Indian craton, while Early Miocene (~25 Ma) Pb loss in zircon inferred from lower intercept in discordia may be related to tectono-thermal activity along MCT.

Geodynamic significance of the updated Statherian–Calymmian (at c. 1.65 and 1.46 Ga) palaeomagnetic results from mafic dykes of the Indian shield

T. Radhakrishna and Ram Chandra

Keywords: Geodynamics, mafic dykes, orogenic belts, palaeomagnetism, tectonic reconstructions.

Abstract

A reassessment of the recent palaeomagnetic data on Proterozoic mafic dykes in the Bundelkhand and Bastar cratons permits a robust estimate of 1.466 Ga (Calymmian) pole ($\lambda = 49.4^\circ\text{N}$; $\phi =$

132.9°E; A95 = 6.6°; N = 11) for the Indian shield. The pole corresponds to a mean direction of D = 40.5°; I = 56.4° (α_{95} = 5.5°; K = 70). The Indian pole at c. 1.65 Ga (Statherian) is suggested to have been situated at λ = 59.6°N and ϕ = 47.9°E (A95 = 8.1°; N = 6); it is estimated from a mean direction of D = 336.4°; I = 66.0°N (α_{95} = 5.3°; K = 159). The 1.466-Ga-old dykes are confined to the Eastern Ghats orogenic front in the easternmost part of the Bastar craton. Geochemically, the shoshonitic/ high-K calc-alkaline affinity of these dykes is uniquely distinct from the tholeiitic composition found in Mesoor Palaeoproterozoic dykes in other parts of the Indian shield. Testing the existing pre-Rodinia Mesoproterozoic tectonic reconstructions negates the Columbia reconstructions in which the Indian shield is shown in juxtaposition with North China/Laurentia. On the other hand, palaeomagnetic and geological data suggest that the linkages between the Indian shield and Western Australia proposed earlier for the Palaeoproterozoic appear to persist during the Mesoproterozoic as well. The linkages may be further extended into Baltica.

Flood risk assessment of Panchganga River (Kolhapur district, Maharashtra) using GIS-based multicriteria decision technique

S. S. Panhalkar and Amol P. Jarag

Keywords: Flood risk, multicriteria decision, photogrammetry, Radarsat SAR data.

Abstract

Flood hazard causes great loss to lives and properties leading to disturbance in human society. Flood is the single most hydrometeorological hazard causing substantial losses. To gain better understanding of the flood phenomena especially for planning and mitigation purposes, flood risk analysis is often required. For the present study, the middle part of Panchganga river of Kolhapur district, Maharashtra was selected. The main objective of the present study was to evaluate the potential flood risk areas of Panchganga river using GIS-based multicriteria decision analysis. The flood scenario across the Panchganga river was analysed using RADARSAT SAR data of 5 August 2005. To remove the speckle of SAR image, a median filtered technique was used. Thresholding technique was applied on RADARSAT SAR data to segregate flooded areas from non-flooded areas. Factors considered for evaluation of the flood risk analysis were flood layer, elevation, infrastructure and land use/ land cover analysis. The spatial multicriteria analysis with ranking, rating and analytical hierarchy process (AHP) method was used to compute the priority weights of each criterion. Accuracy assessment reveals that AHP is the most accurate technique to assess flood risk of Panchganga river.

Winter fog experiment over the Indo-Gangetic plains of India

Sachin D. Ghude, G. S. Bhat, Thara Prabhakaran, R. K. Jenamani, D. M. Chate, P. D. Safai, A. K. Karipot, M. Konwar, Prakash Pithani, V. Sinha, P. S. P. Rao, S. A. Dixit, S. Tiwari, K. Todekar, S. Varpe, A. K. Srivastava, D. S. Bisht, P. Murugavel, Kaushar Ali, Usha Mina, M. Dharua, Y. Jaya Rao, B. Padmakumari, A. Hazra, N. Nigam, U. Shende, D. M. Lal, B. P. Chandra, A. K. Mishra, A. Kumar, H. Hakkim, H. Pawar, P. Acharja, Rachana Kulkarni, C. Subharthi, B. Balaji, M. Varghese, S. Bera and M. Rajeevan

Abstract

The objectives of the Winter Fog Experiment (WIFEX) over the Indo-Gangetic Plains of India are to develop better now-casting and forecasting of winter fog on various time- and spatial scales. Maximum fog occurrence over northwest India is about 48 days (visibility <1000m) per year, and it occurs mostly during the December–February time-period. The physical and chemical characteristics of fog, meteorological factors responsible for its genesis, sustenance, intensity and dissipation are poorly understood. Improved understanding on the above aspects is required to

develop reliable forecasting models and observational techniques for accurate prediction of the fog events. Extensive sets of comprehensive groundbased instrumentation were deployed at the Indira Gandhi International Airport, New Delhi. Major in situ sensors were deployed to measure surface micrometeorological conditions, radiation balance, turbulence, thermodynamical structure of the surface layer, fog droplet and aerosol microphysics, aerosol optical properties, and aerosol and fog water chemistry to describe the complete environmental conditions under which fog develops. In addition, Weather Forecasting Model coupled with chemistry is planned for fog prediction at a spatial resolution of 2 km. The present study provides an introductory overview of the winter fog field campaign with its unique instrumentation.

Coastal morphodynamics of Tupilipalem Coast, Andhra Pradesh, southeast coast of India

G. Sreenivasulu, N. Jayaraju, B. C. Sundara Raja Reddy, T. Lakshmi Prasad, B. Lakshmana and K. Nagalakshmi

Keywords: Coastal zone, east coast of India, morphodynamics, remote sensing and GIS, sediment dynamics.

Abstract

Coastal zones are dynamic interfaces of land and water of high ecological diversity and critical economic importance. The boundaries, shape and size of this coast change constantly under the influence of both natural and anthropogenic factors. The study area, Tupilipalem is one of the proposal sites for constructing a major port, to be named Dugarajapatnam Port, along the east coast of Andhra Pradesh, India. We have used multitemporal satellite images of IRS P6 LISS-III and Landsat 8 OLI/TIRS data from 2011 to 2015 to delineate changes in Tupilipalem coast. The subsequent short-term lagoon mouth closure and the long-term coastal erosion and accretion rates have been calculated for the periods between 2011 and 2015. Low river inflow, wind, tides, the movement of the waves and littoral currents play a key role in the closure of the lagoon mouth and also for the dynamic activities of erosion and accretion. Moreover, the impact on socio-economy and ecology of the study area during the lagoon mouth closure period has been studied.

In vitro compatibility of fungi for the biosorption of zinc(II) and copper(II) from electroplating effluent

Arifa Tahir, Zunaira Lateef, Ahmed Abdel-Megeed, Essam N. Sholkamy and Ashraf A. Mostafa

Keywords: Biosorption, copper, electroplating effluent, fungal isolates, zinc.

Abstract

The present study describes the potential of mixed fungal isolates, i.e. *Aspergillus niger*, *Penicillium chrysogenum* and *Rhizopus oryzae* for the removal of zinc(II) and copper(II) from aquatic environments. Capacity of mixed fungal biomass to adsorb Zn(II) and Cu(II) were studied in batch sorption experiments as bioremediators. Optimal conditions from contact time, pH, initial metal ion concentration and temperature for remediation of Zn(II) and Cu(II) were studied. Typically, the uptake of Zn(II) and Cu(II) rises with increasing pH up to 4.0. Optimal metal concentration was 150 mg/l when the maximum removal of copper and zinc was 69.5% and 30.3% respectively, was observed at initial metal concentration. Maximum uptake for metals was achieved after 15 min. The maximum biosorption for copper and zinc by selected fungi was achieved at 7.0 g of biosorbent. IR spectrum of three fungal species showed the presence of C=O groups, amine and amide N-H functional stretch.

Two-dimensional imaging of a second-order nonlinear optical process Indrajit Bhattacharyya and Debabrata Goswami

Keywords: Nonlinear optics, nonlinear optical signal processing, nonlinear optical materials, ultrafast lasers.

Abstract

Spatiotemporal imaging of sum-frequency generation process through second-order nonlinear optical interaction in a nonlinear crystal under femtosecond pulsed illumination is presented. Two focal points in the spatial dimension that result from use of widely separated wavelengths (780 and 1560 nm) including their appropriate intensity ratios are captured accurately, emphasizing the sensitivity and robustness of this detection scheme. Most importantly, crosscorrelation width that is used as characteristic measure from such techniques remains constant at the two focal points. However, this highlights the critical role of nonlinear crystal position along beam propagation axis during such collinear intensity cross-correlation measurements involving different wavelengths.

Measurement of CO₂ adsorption using the cost-effective dynamic column breakthrough method Lakshminarayana

Kudinalli Gopalakrishna Bhatta, Seetharamu Subramanyam, Madhusoodana D. Chengala, Umananda Manjunatha Bhatta, Krishna Venkatesh1 and V. Raghavendra

Keywords: Carbon dioxide adsorption, dynamic column breakthrough method, gas chromatography, zeolite and sorbent.

Abstract

The adsorption of carbon dioxide (CO₂) on solid sorbents or any gas adsorption in general can be experimentally determined using various techniques. The present study demonstrates a dynamic column breakthrough method for the measurement of CO₂ adsorption using a cost-effective purpose-built single-column fixed-bed adsorption unit. The CO₂ adsorption capacity is estimated using a graphical method that does not require knowledge of the variation of molar CO₂ flow rate at the column exit. The experimental method is validated using a commercial zeolite 13X adsorbent.

Petrographic texture of sediments vis-à-vis aquifer characteristics from WGAMG'0 watershed, Chandrapur district, Maharashtra, India Y. A. Murkute

Keywords: Aquifer characteristics, petrography, texture of sediments, watershed.

Abstract

The present study deciphers the interrelationship between petrography and texture of sediments with aquifer characteristics. Sandstones representing the aquifers around Minjhari–Murpar village (lat. 20°34'05"N: long. 79°18'05"E), Chimur Tahsil, Chandrapur district, Maharashtra, India corresponding to the watershed WGAMG' have been selected for the study. These sandstones are grouped as arenites and wackes to unravel the aquifer distinctiveness. The values of transmissivity from 102.28 to 450.42 m² / day, and for wackes from 58 to 165.59 m² /day. The values of specific yield (storativity) for arenites range from 20% to 35% and for wackes from 10% to 17%. The computed values of transmissivity as well as specific yield are attributed to the petrographic texture of the rocks. It is propounded that the percentage of detrital grains and matrix is the prime factor that governs the characteristic of aquifers. In addition, it is also found that the sorting of rocks also influences the aquifer performance. The high values of transmissivity and specific yield in arenite aquifer are accountable for higher percentage of detrital grains, lesser amount of matrix and moderate sorting of the grains. Conversely, the lower percentage of detrital grains, higher amount of matrix and poor sorting of the grains are responsible for low values of transmissivity and specific yield in the wacke aquifer.

Long-term exposure to combined treatment of elevated CO₂ and salt induces iron deficiency responses in *Porteresia coarctata*

Deepanwita Purohit, Maganti Sowjanya, Anand Kumar Pal, H. M. Sankararamasubramanian and Ajay Parida

Keywords: Calcareous soil, elevated carbon dioxide, iron-responsive genes, *Porteresia coarctata*, salinity

Abstract

Plants with rising atmospheric carbon dioxide (CO₂) level in the environment may change their nutrient demands to sustain growth. The mechanisms concerning iron dynamics in plants under the interactive effect of salinity and elevated CO₂ are poorly understood. This study examines the effects of long-term as well as short-term growth at elevated CO₂ and salt on iron deficiency-associated molecular responses of *Porteresia coarctata* through analysing the transcript expression of iron deficiency-responsive genes in the leaf tissue. Plants were grown in hydroponic media at ambient or elevated atmospheric CO₂ (500 $\mu\text{l l}^{-1}$), with or without salt, and samples were analysed at three time points, on the 15th, 45th and 90th day. The semiquantitative RT-PCR analysis showed an induced expression of iron deficiency-responsive transcription factor PcIDEF1 and its putative targets OsIRO2-like gene, OsNAAT1-like gene, OsNAS1-like gene, OsYSL2-like gene and PcIRT1 at elevated CO₂ with NaCl. Furthermore, a positive correlation in gene expression was observed between PcIDEF1 and its putative targets in the 15th and 45th day samples. By contrast, in the 90th day sample, correlation in gene expression was less evident. Our findings suggest that the interactive effect of elevated CO₂ and NaCl can induce a set of molecular responses in *P. coarctata* for enhanced iron uptake and utilization, thereby reflecting an iron deficiency like stress under such conditions.

Wind-induced response of half-storey outrigger brace system in tall buildings

Ali Kheyroddin and Hamid Beiraghi

Keywords: Half-storey-outrigger, inter-storey drift, steel frame, wind load

Abstract

In all previous studies, the outrigger arms are symmetric with respect to the centre line of the core. Hence, each outrigger involves two arms at the same level which usually occupy one, two or three stories. In this communication, the innovative idea is to implement the outrigger arms asymmetrically. One main purpose of this study was to investigate the feasibility study of four half-storey outriggers system instead of the corresponding two-storey outrigger system. To study the effects of the newly defined configurations on the global performance of tall buildings, some 30-, 45- and 60-storey two-dimensional steel frames with braced core systems at centre have been analysed and designed under gravity and wind load without outriggers. Later, the outrigger trusses were added in different arrangements at the optimum locations. The results show that the new idea will improve the system efficiency.

Paris Agreement; research, monitoring and reporting requirements for India

N. H. Ravindranath, Rajiv Kumar Chaturvedi and Poornima Kumar

Keywords: Climate impacts, forestry sector, mitigation strategies, vulnerability assessment.

Abstract

Implementation of the Paris Agreement would require transformative technologies, policies and measures to stabilize warming in the range 1.5–2°C. Operationalization of the Paris Agreement would necessitate large-scale estimation, monitoring, modelling, reporting and verification of GHG inventories, mitigation actions and their implications and co-benefits, along with reporting on climate change impacts and adaptation. This article highlights the need for research, modelling, monitoring, reporting and data requirements for India, keeping in mind the need for transparency, accuracy, completeness, consistency and comparability. Further, India will have to initiate largescale research and data generation for operationalization of the Paris Agreement.

Research performance of Indian Institutes of Technology

Sumit Kumar Banshal, Vivek Kumar Singh, Aparna Basu and Pranab Kumar Muhuri

Keywords: Engineering research, IIT, research competitiveness, research performance, scientometrics.

Abstract

This article presents a computational analysis of the research performance of 16 relatively older Indian Institutes of Technology (IITs) in India. The research publication data indexed in Web of Science for all the 16 IITs is used for the analysis. The data is computationally analysed to identify productivity, productivity per capita, rate of growth of research output, authorship and collaboration pattern, citation impact and discipline-wise research strengths of the different IITs. The research performances of the IITs have been compared with those of two top ranking engineering and technology institutions of the world (MIT-USA and NTU-Singapore) and most cited papers from these IITs have also been identified. The analytical results are expected to provide a informative, up-to-date and useful account of research performance assessment of the IITs.

Dispersion of the Asiatic lion *Panthera leo persica* and its survival in human-dominated landscape outside the Gir forest, Gujarat, India

H. S. Singh

Keywords: Dispersion, *Panthera leo persica*, predation, ungulates.

Abstract

Expansion and consolidation of Gir Protected Area, Gujarat, India – habitat of the Asiatic lion, and response of prey and predator to the management and dispersion trend of lions outside the Gir forests are interesting and noteworthy. During the last five decades (1965–2015), an approach for the Asiatic lion conservation is one of the best efforts in the world. Unlike other super predators, the number of lions has increased by 4-folds and wild ungulates by over 13-folds in the Gir forest during this period. The distribution range of lions has also expanded to a large landscape in four districts in the state. The consistent shift in feeding patterns of lions is mainly due to the improved availability of wild prey. Lions were restricted in the Gir forest till 1990, and the dispersion started when their population increased. In two decades, more than 40% of the total number of lions was spotted outside the Gir landscape. It is interesting to know that lions and leopards live in human-dominated landscape outside the Gir forest. Blue bull, wild boar and feral cattle, and carcasses of livestock in the villages are major food for the lions. The prey population, predation behaviour of the lion and acceptance of the lion as honourable animal by the villagers indicate that the present trend may continue in the near future as well.

Associations between longevity and subjective well-being by country

Ge Qian

Keywords: Correlation, human development, longevity, path analysis, subjective well-being

Abstract

This study examines the relationships between longevity and subjective well-being from the social science perspective, using global data, by employing epidemiological methods and data from the Human Development Report 2010. For all countries as a whole and of all the subjective well-being variables in this study, the overall life satisfaction had the strongest positive association with longevity. At this point, the situations are similar for very high and medium human development countries, but quite different for high and low human development countries. The effects of various control variables seemed relatively limited. Path analyses showed that the overall life satisfaction had the strongest effect on life expectancy, while the effect of income was indirect. The number of physicians per 10,000 people, which was the main medical indicator, had neither direct nor indirect effects on life expectancy. In conclusion, the cognitive component of subjective well-being had a stronger impact than the emotional component did on life expectancy. However, subjective and psychological factors play more important roles in prolonging lifespans than objective factors such as economic and medical indicators do.

Technologies, optimization and analytical parameters in gastroretentive drug delivery systems

Mayur Chordiya, Hemant Gangurde and Vijay Borkar

Keywords: Analytical parameters, drug delivery, gastroretentive technologies, optimization studies.

Abstract

Gastroretentive drug delivery systems (GRDDS) can overcome drawbacks associated with oral drug delivery, by defeating natural physiological principles. Various gastroretentive technologies have been developed in the past, but few of them achieved commercial success. Numerous mechanisms like floating, sinking, effervescence, swelling, bioadhesion, magnetic, etc. have been proposed over the years. At present, the polymeric swellings monolithic systems are popular. Dual working technology would be a possible way to overcome drawbacks associated with different GRDDS. Before development of a drug product, the principles of scale-up and process validation must be considered to improve the quality and market availability of GRDDS. Knowledge of all regulatory aspects will help deliver a product to the market within a reasonable time-frame and in a cost-effective manner.

Soft computing-based traffic density estimation using automated traffic sensor data under

Indian conditions Jithin Raj, Hareesh Bahuleyan, V. Ramesh and Lelitha Devi Vanajakshi

Keywords: Automated traffic sensors, artificial neural network, k-nearest neighbour, traffic density.

Abstract

Traffic density is an indicator of congestion and the present study explores the use of data-driven techniques for real time estimation and prediction of traffic density. Data-driven techniques require large database, which can be achieved only with the help of automated sensors. However, the available automated sensors developed for western traffic may not work for heterogeneous and lane-less traffic. Hence, the performance of available automated sensors was evaluated first to identify the best inputs to be used for the chosen application. Using the selected data, implementation was carried out and the results obtained were promising, indicating the possibility of using the proposed methodology for real time traveller information under such traffic conditions.

Therapeutic properties of processed aqueous extract of *Asteracantha longifolia* in the human
G. Satyanarayana Murthy, T. P. Francis, C. Rajendra Singh, K. Somasundar, H. G. Nagendra and N. B. Sridhar

Keywords: A. longifolia, bone marrow, herbal restorative, lymphocytes.

Abstract

Treatment of disease with herbal extracts is common in both Ayurveda and herbal systems of medicine. We have identified that therapeutic activity of *Asteracantha longifolia* is associated with the dialysable portion of the extract. The extract was partially purified by a method using alcohol precipitation. This partially purified A. longifolia extract (PALE) was studied for its therapeutic activity in the human when administered orally. Oral administration of 0.1 ml of PALE (equivalent to 5 ml of original extract) was found to increase haemoglobin and lymphocytes and reduce neutrophils in the blood. The effect was not short term as this profile persisted for as long as 6–8 months, indicating that PALE is an excellent herbal medicament for improving the quality of blood in the human.

Scientometric profile of global rice research during 1985–2014

Bin Liu, Lu Zhang and Xianwen Wang

Keywords: Agronomic traits, bibliometric analysis, CiteSpace, rice research, scientometrics.

Abstract

A bibliometric analysis is conducted to study the history and status of rice research from 1985 to 2014. We find that the number of publications has grown rapidly over the past 30 years, especially in Asia. However, the gap of research output quality between Asian countries/regions and USA is obvious. The keywords co-occurrence analysis shows that the genetic analysis for agronomic traits is a hot topic. It could be expected that more technologies such as metabonomics and proteomics will be integrated to accelerate the comprehensive analysis of rice genome function.

ABCD matrix formalism to determine nonlinear refraction coefficient

Z-scan technique Chakradhar Sahoo, V. Sreeramulu, Sri Ram G. Naraharisetty and D. Narayana Rao

Keywords: ABCD ray matrix, linear optics, nonlinear optics, Z-scan technique.

Abstract

In this study, we revisit the popular method of measuring the nonlinear susceptibility of a material through Z-scan technique, introduced in 1990 by Sheik-Bahae and co-workers through a simple ray optics defined by the ABCD matrix formulation. The work therefore looks at the Z-scan measurement curves analysed through ray propagation in the medium and analysed through an aperture. The transmittance of a sample in the Z-scan technique is measured through a finite aperture in the far field, as the sample is scanned along the propagation direction (Z) of a focussed Gaussian beam. The sign and magnitude of nonlinear refractive index are easily deduced from the transmittance curve (Z-scan) using the theoretical model based on ABCD matrix formalism.

Reducing aircraft radar cross-section with owl wing type serrated trailing edges

T. Sai Teja, Manoj B. Vaghela and Avijit Chatterjee

Keywords: Barn owl, finite volume time domain, Maxwell's equations, radar cross-section, stealth, serrations.

Abstract

Serrations at trailing edges of aircraft wing have long been known to suppress flow noise by suitably altering the flow at the trailing edge. Serrations at trailing edges are now also being used to reduce surface edge return contribution in scattering of electromagnetic waves by combat aircraft wing in

order to reduce detectability by radar. A study was carried out on the efficacy of trailing edge serrations found in the wing of a barn owl, formed by its primary remiges or flight feathers, towards minimizing trailing edge related contributions by a common combat aircraft wing in an electromagnetic field. The barn owl is especially well known for its silent flight which is usually attributed to multiple adaptations in its wings including at the trailing edge. Barn owl type trailing edge serrations are appended to a planar metallic delta wing and subjected to an incident electromagnetic field. Electromagnetic scattering is predicted by numerically solving Maxwell's equations using a finite volume time domain method and the radar cross-section calculated.

Indigenous development of a millikelvin refrigerator at VECC, Kolkata

Nisith Kr. Das, Jedidiah Pradhan, Bidhan Ch Mondal, Anindya Roy, Z. A. Naser and Pradeep Kumar

Keywords: Evaporator, mixing chamber, Millikelvin, 3He– 4He mixture.

Abstract

Technologies related to production of millikelvin temperature have been developed and tested in the laboratory. All the critical components were assembled to make a complete dilution refrigerator. The refrigerator was successfully run and commissioned in VECC. The system involves several advanced cryogenic concepts especially the capillary impedance and heat exchanger. A temperature to the tune of 50 mK has been achieved. This is the first development of its kind in India, and likely to usher a new wave in the research arena of advanced cryogenics.

Flash flood disaster threat to Indian rail bridges: a spatial simulation study of Machak River flood, Madhya Pradesh

K. H. V. Durga Rao, A. Shravya, V. Venkateshwar Rao, V. K. Dadhwal and P. G. Diwakar

Keywords: Hydrological simulation, hydrodynamic modeling, Machak River, rail accident.

Abstract

The recent flood in Machak River, Madhya Pradesh, India is a distinctive paradigm of flash floods that washed off rail tracks and killed a number of passengers besides incredible damage to Indian Railways and to the surrounding villages. This shows the vulnerability of bridges/culverts to flash floods in the country. Flash floods devastated the Machak River during the midnight of 4 August 2015 due to heavy rainfall in the catchment. The duration of flooding was small with less lead-time. Narrow river sections could not accommodate the peak discharge causing severe flooding in floodplains. Hydrological and hydro dynamic simulation was studied in the Machak River using space-based inputs to quantify the causes of flash floods and its impact. Satellite-based rainfall (GPM and IMD's WRF merged product) was used in hydrological modelling in the absence of field rainfall and discharge data. Flood inundation simulations were done using CARTO digital elevation model of 10 m resolution. Inundation extent, depth of inundation, and velocity of flow at different reaches were examined. As the slopes were steep in the upstream catchment area, the lag-time of the peak flood was found to be less and washed off the Machak rail culvert without any alert. The study reveals that quantitative parameters of the disaster are due to high intensity of rainfall, drainage congestion and sudden change of slopes across the catchment.

Spatial and temporal distribution pattern of camptothecin in seeds and fruits of *Pyrenacantha volubilis* Hook. (Icacinaeae) during different fruit developmental stages

Hirenallur Kumarappa Suma, Vadlapudi Kumar, Patel Mohana Kumara, Amitava Srimany, Gudasalamani Ravikanth, Senthil Kumar Umopathy, Thalappil Pradeep, Ramesh Vasudeva and Ramanan Uma Shaanker

Keywords: Camptothecin, distribution pattern, fruit developmental stages, *Pyrenacantha volubilis*.

Abstract

Camptothecin (CPT), a quinoline indole alkaloid, is one of the important inhibitors of eukaryotic DNA topoisomerase I. The highest concentration of this alkaloid has been reported from the fruits of *Pyrenacantha volubilis* Hook. Here we report the spatial and temporal distribution pattern of CPT in seeds and fruits of *P. volubilis*. Temporally, CPT content was highest in mature but unripe fruits compared to ripened fruits. Spatially, cotyledonary tissues of the seed had the highest amount of CPT followed by seed coat and fruit coat. This pattern is best explained by selection to deter fruit predators during fruit development, but attracting the fruit dispersers when fruits are mature and ripe.

Development of a new in ovo model for the assessment of nephrotoxicity and its comparison with an existing in vivo model

Joyani Das, Dinakar Sasmal, Papiya Mitra Mazumder and Kaushal Kumar Singh

Keywords: Chick embryo, kidney cells, mammalian model, nephrotoxic drugs.

Abstract

In this study, the chick embryo model has been used as an alternative to the mammalian model for assessing nephrotoxicity. Resemblance of the chick embryo to mammals in having metanephric kidney has prompted us to explore the possibility of using this system for the assessment of kidney toxicity caused mainly by nephrotoxic drugs, namely gentamicin, cisplatin and doxorubicin. Fertilized hens' eggs incubated at $38^{\circ}\pm 2^{\circ}\text{C}$ and 58%–60% relative humidity, were injected with the above-mentioned drugs on embryonic day 11. A significant decrease in the uric acid level of amniotic fluid was shown by embryos of cisplatin and doxorubicin-treated groups when compared to control. Embryos of the gentamicin-treated group showed significant increase in urea concentration. Alterations in uric acid, urea and creatinine levels were found in all groups. Histopathological study showed nephron degeneration. Similar results were found in a mouse model.

Excellence and diversity mapping of research in IISc, IITs, NUS and NTU

Gangan Prathap

Keywords: Balance, bibliometrics, excellence, research evaluation, size.

Abstract

A three-dimensional evaluation approach is used to decompose the research performance of the two leading research clusters from India and Singapore into three components – size, excellence, and balance or evenness. Data are retrieved from the Excellence Mapping web application. The NUS + NTU cluster from Singapore outperforms the IISc + 7IITs cluster from India on all three counts.

Growth of sculpted forms in bedrock channels (Miño River, northwest Spain)

Miguel Ángel Álvarez-Vázquez and Elena De Uña-Álvarez

Keywords: Bedrock rivers, growth models, potholes, sculpted forms.

Abstract

A total of 216 sculpted forms were registered on the granitic bedrock of the Miño River, northwest Iberian Peninsula. Analysis of in situ measurements (length, width and depth) revealed three general type-sets: incipient forms, longitudinal furrows and circular potholes. Maximum depth and upper

radius (at the incision surface) were identified as key variables to mathematically determine the growth rate in each set. Three regression models are presented revealing that the development of the forms depends on a power law explaining their size and shape. Morphological and dimensional thresholds were established to better identify stages from incipient (active growth) and inherited (stationary growth) forms.

Methane and nitrous oxide emission from Kharif rice field as influenced by nutrients and moisture regimes in new alluvial agroclimatic region of West Bengal

G. Saha, B. Kar and S. Karmakar

Keywords: Agroclimatic region, methane, nitrous oxide, rice field.

Abstract

Crop management practices have a significant impact on greenhouse gas (GHG) emission rates, where methane (CH₄) and nitrous oxide (N₂O) emissions from rice paddy fields are in trade-off association. A field study for two consecutive years (2013 and 2014) was conducted to continuously measure CH₄ and N₂O emissions from rice paddies under various agricultural management schedules like water regimes (irrigated and rainfed), transplanting dates and nutritional amendments (synthetic fertilizer with N as ammonium sulphate, P and K according to recommended dose, and vermicompost). Rainfed situation incurred a drop in CH₄ fluxes triggering substantial N₂O emission. Ammonium sulphate application tended to reduce CH₄ emissions, but significantly increased N₂O emissions. Enhanced CH₄ fluxes were measured during panicle initiation to flowering stage while, maximum N₂O emissions were recorded during flowering to milking stage of rice crop. Significant interrelationship between the gases was evaluated. In addition, seasonal average of CH₄ and N₂O emissions was also correlated with rice production. In conclusion, GHG concentration may control to some extent optimizing rice productivity through implementing and improving crop- and location-specific management practices.

Iron oxide–copper–gold mineralization at Thanewasna, western Bastar Craton

M. L. Dora, K. R. Randive, H. M. Ramachandra and G. Suresh

Keywords: Hydrothermal mineralization, IOCG, mineral chemistry, ore deposits.

Abstract

Iron oxide–copper–gold (IOCG) at Thanewasna, Maharashtra, India is a new genetic type of ore deposit, being reported from the western margin of Bastar craton, based on integrated field, drilling, mineral chemistry and Raman microprobe studies. It is the fourth such IOCG type being reported from India. Hydrothermal mineralization is structurally confined to an echelon dilatational quartz–chlorite veins along NW-SE trending brittle–ductile shear zone hosted in calc-alkaline granitoid. The mineralization is characterized by chalcopyrite, magnetite and barite which occur as dissemination, stringers and veins associated with hydrothermal K-alteration and chlorite alteration. Chemical analysis shows significant amounts of Cu, Fe, Ba and anomalous Au content. Ore petrography and scanning electron microscope and electron probe micro analyser studies show assemblages of Cu–Fe–Au–Ag–Ni–Ba–REE minerals typical of IOCG type deposits at Thanewasna. Ore textures, mineralogy and alteration characteristics are typical of IOCG-type deposits, further supported by mineral chemistry of magnetite (V versus Ti/V) using EPMA, and thus define a IOCG metallogenic province in Thanewasna area with significant implications for future exploration.

Influence of end anchorage on shear strengthening of reinforced concrete beams using CFRP composites Franklin F. R. Frederick, U. K. Sharma and V. K. Gupta

Keywords: CFRP strengthening, external bonded FRP, end anchorage, shear behaviour.

Abstract

The article presents an experimental study on the influence of various end anchorage systems on the shear strengthening of reinforced concrete (RC) T-beams using externally bonded fibre reinforced polymer (EB-FRP) composites. Two different end anchorage techniques namely self-end anchorage (SEA) and sandwich anchorage (SWA) were used. This study mainly focussed on evaluating the effectiveness of these anchorages to eliminate the conventional fibre reinforced polymer (FRP) debonding failure. A total of twelve R.C. T-beams with different strengthening techniques using CFRP including control beams were used. The test results show improved shear strength and better energy dissipation over conventional technique; this authenticates the influence of end anchorage and its effectiveness in improving shear resistance. Also, the enhanced FRP strain at failure proves that the anchorage employed improves the efficacy of FRP strengthening in terms of ductility and damage tolerance.

Geological evolution of Kachchh: an epitome of successive Phanerozoic events

A. B. Roy, Alokesh Chatterjee and N. K. Chauhan

Keywords: Cenozoic depositories, Kachchh, Palaeocene–Eocene thermal maximum, Phanerozoic events, Quaternary

Abstract

Kachchh geological province is conventionally referred to as ‘Kachchh basin’ or ‘Kachchh rift basin’ or even ‘Kachchh aulacogen’. The geological records, however, recount a different history of the diverse depositional environment under diverse tectonic situations. The earliest Phanerozoic event was the deposition of Palaeozoic sediments during upper Permian and lower Triassic. Next event was a major marine incursion along rift zones coinciding with the Gondwana break-up and the initiation of northward drifting of the ‘Indian land mass’. This was followed by the Reunion Plume related magmatism centring on the K– T boundary. Overlying this occur lignite deposits in the Naredi Formation correlatable with the global Eocene excursion. The Cenozoic basin closure corresponds to the major uplift in the Himalayas during the early Quaternary. Finally, the evidence of recurrent youngest block-movement-type active tectonics transformed the terrain into a zone of high seismicity.

A cognitive method for building detection from high-resolution satellite images

Naveen Chandra and Jayanta Kumar Ghosh

Keywords: Building detection, cognitive processes, high-resolution satellite images, urban areas.

Abstract

In recent years, high-resolution satellite (HRS) images have become an important source of data for extracting geo-spatial information. A deep understanding of human cognitive capabilities is required in order to automate the method of information retrieval from HRS images. The aim of this study is to emulate human cognitive processes by integrating cognitive task analysis for information extraction from HRS images. First, the preliminary knowledge about the cognitive processes which human beings acquire during the interpretation of satellite images is collected. Then, knowledge is represented in the form of rules which are based on the visual interpretation of the images by the human beings. During knowledge elicitation these rules are used to extract buildings from HRS images utilizing the mixture tuned matched filtering algorithm. Later, the method is tested using 14 HRS images of an urban area. The average of precision, recall and F-score is computed as 79.45%, 64.34% and 70.28% respectively.

Are small-sized firms really innovative? Understanding the Indian scenario

Debanjana Dey

Keywords: Firm size, innovation propensity, innovation, novelty or newness.

Abstract

This article presents an understanding of innovation in the Indian context by considering the relationship between firm size and innovation. This is based on a major study on innovation where survey of Indian firms was undertaken by the research team to understand the process in the Indian context. In this article the focus is on the relationship between firm size and propensity to innovate. The interesting observation is that the small-sized firms focus mostly on minor or marginal innovations which are either not recognized or go unnoticed in the market. The purpose behind such initiatives is to enable them to sustain in the market. This brings in an interesting dimension of the process of innovation where the firms innovate not to create market, but to sustain themselves in the market. The article presents variation in the innovation activities amongst the firms depending upon their size.

If systems approach is the way forward, what can the ayurvedic theory of tridosha teach us?

Rama Jayasundar

Keywords: Ayurveda, kapha, pitta, systems approach, tridosha, vata.

Abstract

With a shift in focus from genes to cells, systems approach is not only revolutionizing cell biology, but is also providing impetus for clinical medicine to shift from a reductionistic to a holistic approach for efficient disease management. This inevitably brings into focus one of the longest unbroken healthcare systems in the world, namely ayurveda, the medical system indigenous to Indian subcontinent. A distinctive feature of ayurveda is its systems approach to health and disease. Through the theoretical framework of vata, pitta and kapha, ayurveda offers a new paradigm for understanding the human system as a networked functional entity wherein system properties are integral components. An open-minded dialogue between the cell-centric systems biology and organism-centric ayurveda can open new exciting vistas for research beneficial to both sciences, which could leave a major imprint on clinical practice.

Research on literature involving zirconia-based on Pubmed database: a bibliometric analysis

Huiyan Yu, Zhuangzhi Zhi, Chunxia Zhang and Huazhe Yang

Keywords: Bibliometrics, biomedicine, Pubmed, zirconia.

Abstract

Zirconia is an important material for both medical science and chemical industry, and numerous studies on zirconia have been published. It is of great importance to summarize the study trend of zirconia for further studies. In the present paper, articles published during five years, i.e. from April 2009 to April 2014, were collected from the Pubmed database for statistical analysis, and the current situation and research advances of zirconia are summarized and analysed. It is found that an increasing number of articles concerning zirconia have been published every year especially in zirconia as dental materials. Authors are mainly from developed countries and regions, and a developing country such as China is playing an increasing role in this field.

Water quality of River Beas, India

Vinod Kumar, Anket Sharma, Ashwani Kumar Thukral and Renu Bhardwaj

Keywords: Drinking water guidelines, pollution, river water, water quality index.

Abstract

This article is a review of the pollution status of River Beas, India as analysed by different workers over a period of time. River-water pollution is an important environmental problem because it is the main source of water for consumption by humans as well as aquatic species living in the river. Water quality index was determined using nine standard water quality parameters for River Beas and was found to be 60.93. The mean values of dissolved oxygen (DO) (8.82 mg/l), biological oxygen demand (BOD) (0.87 mg/l) and total coliform (1451.60 MPN/100 ml) were found for River Beas in Himachal Pradesh. The mean values of DO (7.29 mg/l), BOD (3.75 mg/l), chemical oxygen demand (COD) (48.89 mg/l) and total coliforms (562.88 MPN/ 100 ml) were also found for River Beas in Punjab. DO, COD, BOD and total coliforms ranges of the river were found above permissible limits of BIS for drinking water.

Correction of Mars Colour Camera images for identification of spectral classes

Kurian Mathew, A. S. Arya, Harish Seth, S. Manthira Moorthi and P. N. Babu

Keywords: Bayer-pattern filters, dust clouds, ice clouds, Mars Colour Camera, spectral overlap.

Abstract

Mars Colour Camera on-board the Mars Orbital Mission makes use of a Bayer pattern detector. Spectral response of RGB (red, green and blue) pixels of Bayer detector shows large overlap which reduces the spectral information content of the image. In the present paper, a simple method is suggested to correct the data for spectral overlap. It is shown that correction process significantly increases the spectral information content of the image and enhances the ability of the sensor to identify different target types like dust clouds and water ice clouds.

DNA methylation changes in a gene-specific manner in different developmental stages of *Drosophila melanogaster*

Chitra S. Panikar, Mandar S. Paingankar, Saniya Deshmukh, Varada Abhyankar and Deepti D. Deobagkar

Keywords: Developmental regulation, DNA methylation, *Drosophila* development, epigenetics, gene-specific methylation, 5 methyl cytosine.

Abstract

Molecular Biology Research Laboratory, Centre for Advanced Studies, Department of Zoology, Savitribai Phule Pune University, Pune 411 007, India Although genomic DNA of *Drosophila melanogaster* has been shown to contain little cytosine methylation, the distribution of this genome-wide methylation patterns in different life stages remains to be elucidated. We have developed an immunochemical method using cDNA microarray to assess methylation. In the present work, this methylation microarray method was employed to identify DNA methylation in and around the genes in different life stages of *D. melanogaster*. This led to the identification of methylated genes in three stages of *D. melanogaster*, viz. embryo, pupa and adult. It is noteworthy that there was differential methylation in genes in different life cycle stages. Remarkably, a few functional annotation clusters showed negative correlation between transcription of a particular gene and its methylation status. In this analysis, some of the genes attributed to characteristic biological processes of particular life stage in *D. melanogaster* were found to be methylated in other life stages. Our analysis while providing a methylation map also suggests that gene-specific DNA methylation is altered during the life cycle stages of *D. melanogaster*.

Changes in vapour pressure deficit and air-to-leaf temperature difference due to the effects of watering frequency and seasonal variation-induced adaptive responses in *Balanites aegyptiaca* in Saudi Arabia

A. A. Elfeel

Keywords: Air-to-leaf temperature difference, *Balanites aegyptiaca*, intraspecific variability, vapour pressure deficit, watering frequency.

Abstract

This study examines intraspecific variability among three sources (KSA, SD5.1 and SD6.2) of *Balanites aegyptiaca* in Saudi Arabia in their response to different watering frequencies and seasonal changes in vapour pressure deficit (VPD) and air-to-leaf temperature difference (ΔT) under field condition. Irrigation was done once a week, once every two weeks or once every three weeks. Traits measured include: tree height, diameter (DM), relative monthly height (RMHI) and diameter (RMDI) increments, stomatal resistance (R_s), specific leaf weight (SLW). VPD and ΔT were measured during the same time of R_s and SLW measurements. Both R_s and SLW directly responded to irrigation treatment and seasonal variation in ΔT and VPD. Interactive effects of hot weather and water stress increased leaf temperature, resulting in less ΔT and more VPD that induced higher R_s and SLW values. SD5.1 accounted for better responses under water stress, due to its higher R_s and SLW in the same time maintained better growth. DM and RMDI were more responsive to watering stress and varied among the sources. Early seedlings root-to-shoot ratio was associated with better growth performance later in the field. The results highlight the role of hot weather and water stress in producing large changes in ΔT and VPD that have a major impact on R_s and SLW. In addition, there is large intraspecific variation in field growth and adaptive responses among seeds brought from different provenances.

Antioxidant and alleviatory effects of hydroalcoholic extract of cauliflower leaves against sodium fluoride-induced cardiotoxicity in Wistar male rats

Raghavendra Mitta, Ravindra Reddy Kandula, Raghuvver Yadav Pulala, Narasimha Jayaveera Korlakunta and Uma Maheswara Rao Vattikuti

Keywords: Antioxidant activity, cardiac markers, cauliflower leaves, hydroalcoholic extract, sodium fluoride.

Abstract

The objective of the present study was to explore the alleviatory effects of hydroalcoholic extract of *Brassica oleracea* var. botrytis (BOB) leaves against sodium fluoride (NaF)-induced cardiotoxicity. Animals served as group I (normal control), group II (toxic control) and groups III–V (treatment groups) received extract at doses of 100, 200 and 400 mg/kg body wt respectively. Group VI served as plant control and received extract at a dose of 400 mg/kg body wt. All groups, except groups I and VI, received NaF (100 ppm) through drinking water for 30 days. Results showed that administration of extract significantly minimized elevated serum levels of CK-MB and LDH, decreased cardiac lipid peroxidation, increased levels of reduced glutathione content and catalase enzyme in a dosedependent manner. The study revealed that BOB leaves show moderate antioxidant and alleviated sodium fluoride induced cardiotoxicity.

Balancing conservation and development in Nandhaur Wildlife Sanctuary, Uttarakhand, India

Michelle Irengbam, Pariva Dobriyal, Syed Ainul Hussain and Ruchi Badola

Keywords: Anthropogenic pressure, community-based conservation, dependent stakeholders, forest corridor, habitat degradation.

Abstract

The Terai Arc Landscape in the foothills of the Himalaya is a critical tiger conservation unit straddling India and Nepal. The Nandhaur Wildlife Sanctuary (NWS) located in the eastern part of this landscape, is an important corridor for the movement of large mammalian species. This landscape is under tremendous pressure due to increased human population and demands for forest resources. The present study (1) assesses the dependence of the local communities on forest resources, (2) identifies concerns and interests of major stakeholders, and (3) assesses the major issues challenging conservation in the NWS. Household surveys and focus group discussions were carried out in 13 fringe villages around the NWS, and key stakeholders were identified and consulted. Risk assessment was done to identify the major issues in the area and their underlying causes. The local communities are dependent on forest for fuel wood (25–40 kg/ household/day) and fodder (20–25 kg/household/day). Low-income groups, displaced groups and the gujjar community emerged as the most dependent stakeholders. Diverse interests arose from the communities having different livelihood patterns. Habitat loss and degradation due to excessive extraction of forest resources, riverbed mining and lack of support of local communities emerged as the major threats hampering conservation in the area. Involvement of local communities in forest conservation along with provision of alternative livelihood is needed. It is critical to develop a consultative framework with the local communities and other stakeholders to explore alternative strategies that meet conservation and development goals.

Macropore flow as a groundwater component in hydrologic simulation: modelling, applications and results

M. Ranjit Kumar, T. Meenambal and V. Kumar

Keywords: Groundwater, hydrologic simulation, macropore flow model, sensitivity, soil types.

Abstract

Macropore flow carries water from the soil surface to deeper profile or groundwater, bypassing the intermediate soil profile. The phenomenon is ubiquitous and not rare. A theoretical framework of this flow has not been perfected so far, but ignoring this process may lead to incomplete conceptualization of soil-water flow. The macropore flow has been modelled based on observed data on morphometry, macropore size distribution and fractal dimensions of soil voids and stain patterns, and incorporated in the Watershed Processes Simulation (WAPROS) model. The performance of WAPROS model was evaluated to be good (NSE – hourly; daily = 0.8578; 0.9020), when applied to a real watershed. The sensitivity of macropore flow submodel showed that the adjustment factor was linearly related to macropore flow. Simulations were performed for five types of soil, namely sandy loam, sandy clay loam, sandy clay, clay loam and silty clay loam (A, B, C, D and E respectively). The values of macroporosity factors and fractal dimensions generated for the five types of soil have been presented. The model generated data for A, B, C, D and E soil types were: the number of macropores: 379, 3074, 3412, 153 and 0; the macropore flow (mm): 1.5121, 9.3667, 15.1728, 4.4055 and 0; the average pore flow (mm/pore): 0.0040, 0.0030, 0.0044, 0.0287 and 0; and the macropore flow to base flow ratio: 0.0055, 0.0474, 0.1908, 0.2759 and 0. The modelling methodology gives encouraging results. The model can be updated as and when better equations are made available.

Inter- and intra-annual variations in the population of *Triplos* from the Bay of Bengal

Rajath R. Chitari, Arga Chandrashekar Anil, Vinayak V. Kulkarni, Dhiraj D. Narale and Jagdish S. Patil

Keywords: Bay of Bengal, currents, dinoflagellates, eddies, monsoon, micro-phytoplankton, *Triplos*.

Abstract

Triplos, a species-rich ubiquitous thecate dinoflagellate, serves as an excellent biological indicator of the water mass in the oceans. The inter- and intra-annual variations in the surface-water distribution of Triplos along the shipping routes of Chennai (C)–Port Blair (P)–Kolkata (K) in the Bay of Bengal was evaluated from October 2006 to September 2011. The highest numbers were recorded during fall intermonsoon (October 2007) in the C–P transect, and southwest monsoon (July 2010) in the P–K transect. In the C–P transect high numbers of *T. furca* can be attributed to mesoscale eddies, whereas in the P–K transect, it can be attributed to riverine discharge. The results point that, Triplos persists throughout the year in the Bay of Bengal and tend to increase with the elevation of nutrients.

Identification of single nucleotide polymorphism from Indian *Bubalus bubalis* through targeted sequence capture

A. B. Patel, R. B. Subramanian, H. Padh, T. M. Shah, A. Mohapatra, B. Reddy, S. J. Jakhesara, P. G. Koringa, D. Dash and C. G. Joshi

Keywords: Exome, gene ontology, quantitative trait locus, single nucleotide polymorphism.

Abstract

Bubalus bubalis (water buffalo) is an agro-economically important livestock species due to its multipurpose use in India and other Asian countries. The aim of this study was to identify single nucleotide polymorphisms (SNPs) from buffalo genome. Genomic DNA was isolated from 24 blood samples of three Indian buffalo breeds and subjected to targeted pyrosequencing, followed by variant calling and annotation. Target probes for enrichment were designed from exome and 5' and 3' untranslated regions of cattle genome. By targeted pyro-sequencing and variant calling from 3.92 Gb data, 923,964 high-quality SNPs were identified. Many SNPs were identified in regulatory regions, leading to conformational changes in factor-binding sites, which play a role in gene expression as in the case of LPL gene from low-milkproducing samples. Gene ontology (GO) enrichment and clustering, resulted in the enrichment of GO terms involved in milk production and transport, and fertility-related categories. Around 75% of SNPs were located on cattle quantitative trait loci, supporting trait-wise sample collection approach. Further, PCA analysis from the identified SNPs also supported sample selection strategy based on contrasting trait performance.

Making scientometric sense out of NIRF scores

Gangan Prathap

Keywords: Bibliometrics, National Institutional Ranking Framework, research evaluation, size-dependence, size-independence.

Abstract

The National Institutional Ranking Framework (NIRF) 2016 rankings have released a wealth of bibliometric data that is otherwise difficult to collect. We have closely examined the top 20 engineering institutions in engineering from the NIRF list from the point of view of research excellence alone, as is done in most international university ranking exercises. Unlike the NIRF score, which is one single number, we now decompose performance into a size-dependent exergy term and a size-independent productivity term. The IITs at Bombay and Kharagpur stand out in terms of research excellence. Another insight is the excellent promise shown by the new IITs at Ropar–Rupnagar and Indore.

Hierarchy of parameters influencing cutting performance of surface miner through artificial intelligence and statistical methods

A. Prakash and V. M. S. R. Murthy

Keywords: Artificial neural network, intact rock, rock mass, surface miner.

Abstract

Applicability of a surface miner (SM) must be based on a careful assessment of intact rock and rock mass properties. A detailed literature review was made to identify different parameters influencing the performance of various types of cutting machines deployed in different parts of the world. The critical parameters influencing the production, diesel consumption and pick consumption of SM in Indian coal and limestone mines, were identified through artificial neural network (ANN) technique and screened by correlation coefficient analysis. Parameters that were common in both ANN and correlation analysis were grouped under critical category and others in semicritical category.

Evaluation of the genetic diversity and population structure in drumstick (*Moringa oleifera* L.) using SSR markers

R. Rajalakshmi, S. Rajalakshmi and Ajay Parida

Keywords: Genetic diversity, *Moringa oleifera*, population structure, SSR.

Abstract

Moringa belongs to the family Moringaceae comprising 13 species of which *Moringa oleifera* is more widely cultivated. It is an economically important multipurpose tree with immense nutritional value and has significant potential to address malnutrition. In the present study, a total of 97 accessions collected from different districts of Tamil Nadu, Andhra Pradesh and Odisha were genotyped using 20 simple sequence repeat (SSR) markers to assess the genetic diversity and population structure. A total of 140 alleles were detected with the polymorphic information content value of 0.6832 and gene diversity 0.7292. Population structure analysis through a model-based approach divided the accessions into two subgroups. Molecular variance analysis using principal coordinate analysis (PCoA) summarized a 18.32% variation in the first 3 axes and analysis of molecular variance analysis indicates a 2% variance among the population with the remaining 98% variance attributed to variation within individuals. Cluster analysis based on unweighted neighbour-joining showed a clear separation of samples into two subgroups. Further comparison of the cluster subgroup showed high consistency with the STRUCTURE pattern and PCoA plot. The findings reveal a high diversity in the analysed genotypes from which a few distinct accessions could be utilized for further exploration based on their nutritional content and for conservation of nutritionally superior germplasm.

An interactive computer vision system for tree ring analysis

S. Subah, S. Derminder and C. Sanjeev

Keywords: Canny edge detection, digital image processing, pixel labelling, tree rings.

Abstract

Tree rings (growth) analysis provides useful information about the age of a tree and the past climatic conditions. Analysis of tree rings manually is a herculean task and requires a domain area expert. The present work proposes a soft technique to analyse tree rings. Effective canny edge detection approach was utilized to process high-quality digital images of tree rings. The developed program successfully performs interactive tree-ring image analysis with MATLAB Image Processing Toolbox. It generates information about the width of earlywood and latewood of the growth ring. The information generated may be further utilized by domain area expert to deduce the age of a tree. The development of such a system will ease the human analysis efforts.

Inferring gene regulatory networks using Kendall's tau correlation coefficient and identification of salinity stress responsive genes in rice

Samarendra Das, Prabina Kumar Meher, Upendra Kumar Pradhan and Amrit Kumar Paul

Keywords: Correlation coefficient, gene regulatory networks, rice, salinity.

Abstract

Salinity is one of the most common abiotic stresses that limit the production of rice. Since salinity stress tolerance is controlled by many genes, identification of these stress responsive genes as well as to understand the underlying mechanisms is of importance from breeding point of view. In this direction, the reverse engineering of gene regulatory networks has proven to be successful. In this study, we construct the gene regulatory network using Kendall's tau correlation coefficient, in order to identify the stress responsive genes. The proposed approach was tested on a rice microarray dataset and 18 key genes were identified. Most of these key genes were found to be involved directly or indirectly in salinity stress, as evidenced from the published literature. Gene ontology analysis further confirmed the involvement of the selected genes in ion binding, oxidation-reduction and phosphorylation activities. These identified genes can be targeted for breeding salt-tolerant varieties of rice.

QTL mapping for early ground cover in wheat (*Triticum aestivum* L.) under drought stress

Biswajit Mondal, Anupam Singh, Aneeta Yadav, Ram Sewak Singh Tomar, Vinod, Gyanendra Pratap Singh and Kumble Vinod Prabhu

Keywords: Digital ground cover, drought tolerance, early ground cover, quantitative trait loci, wheat.

Abstract

Early vigour had been a target trait for developing wheat varieties tolerant to moisture stress. Manifestation of this trait depends on the relative efficiency of a genotype to utilize the residual soil moisture and dew precipitation, thereby developing a good canopy in lesser time after emergence. Lack of proper quantification system had always prevented the use of early vigour as a dependable selection parameter under field conditions. Digital imaging intervention has facilitated phenotyping this parameter in the form of early ground cover (EGC). Utilizing this phenotyping strategy, we have identified a quantitative trait locus for EGC located on the chromosome 6A (short arm) with a significant additive component under moisture stress in the north western plain zone of India.

Estimation of snow accumulation on Samudra Tapu glacier, Western Himalaya using airborne ground penetrating radar

K. K. Singh, H. S. Negi, A. Kumar, A. V. Kulkarni, S. K. Dewali, P. Datt, A. Ganju and S. Kumar

Keywords: Glacier, ground penetrating radar, snow accumulation, snow water equivalent.

Abstract

In this study an airborne ground penetrating radar (GPR) is used to estimate spatial distribution of snow accumulation in the Samudra Tapu glacier (the Great Himalayan Range), Western Himalaya, India. An impulse radar system with 350 MHz antenna was mounted on a helicopter for the estimation of snow depth. The dielectric properties of snow were measured at a representative site (Patseo Observatory) using a snow fork to calibrate GPR data. The snow depths estimated from GPR signal were found to be in good agreement with those measured on ground with an absolute error of 0.04 m. The GPR survey was conducted over Samudra Tapu glacier in March 2009 and 2010. A kriging-based geostatistical interpolation method was used to generate a spatial snow accumulation map of the glacier with the GPR-collected data. The average accumulated snow depth and snow water equivalent (SWE) for a part of the glacier were found to be 2.23 m and 0.624 m for

2009 and 2.06 m and 0.496 m for 2010 respectively. Further, the snow accumulation data were analysed with various topographical parameters such as altitude, aspect and slope. The accumulated snow depth showed good correlation with altitude, having correlation coefficient varying between 0.57 and 0.84 for different parts of the glacier. Higher snow accumulation was observed in the north- and east-facing regions, and decrease in snow accumulation was found with an increase in the slope of the glacier. Thus, in this study we generate snow accumulation/SWE information using airborne GPR in the Himalayan terrain.

Impact of particulate pollution on photosynthesis, transpiration and plant water potential of teak (*Tectona grandis* L.)

P. Anoob, A. V. Santhoshkumar and Paul C. Roby

Keywords: Leaf area measurements, particulate pollution, photosynthesis, teak, transpiration.

Abstract

The study on teak *Tectona grandis* L. under particulate pollution stress caused by deposition of cement dust revealed that various physiological functions were hampered due to these pollutants. The dust accumulation was highest during summer (0.299 mg/ sq. cm) in the polluted plot in comparison to control plot (0.037 mg/sq. cm). The effects of particulate pollution on *T. grandis* also varied with season, with a general trend of particulate pollutants having maximum effect on vegetation during summer and least during monsoon. The rate of photosynthesis was halved due to particulate pollutant deposition. Particulate pollution decreased the water potential of *T. grandis* during summer. The rate of transpiration in particulate pollution-affected trees was highly erratic, being the highest during monsoon and least during summer in comparison to those not exposed to pollution. All these induced morphological changes such as reduced height, girth, etc. and also reduced the effective growing days by shedding leaves in the trees exposed to particulate pollution. Leaf area index, which is an indicator of plant productivity, was almost half in pollution-affected trees than control trees. *T. grandis* can serve as an effective barrier in controlling the spread of pollutants. However, it is ineffective during summer, due the deciduous nature.

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Chemistry research in India: making progress, but not rapidly Subbiah Arunachalam*, Muthu Madhan and Subbiah Gunasekaran

Keywords: Chemistry research, international collaboration, multidisciplinary journals, scientometric analysis.

Abstract

Against the backdrop of comments on chemistry research in India made in three recent reports prepared by Nature Index, Elsevier and Thomson Reuters, we have made a scientometric analysis of contributions from India in leading multidisciplinary chemistry journals over the 25-year period 1991–2015. We have compared India's performance with that of China as a benchmark. Overall, the number of chemistry papers from India increased steadily between 2007 and 2014. The three-year moving average of number of papers during the period grew at a compound annual growth rate of 8.9%, and the overall increase in papers was accompanied by a more than proportionate increase in the leading journals. Also, the average number of cites received by papers with at least one author from India in *Angewandte Chemie International Edition* (*Angew. Chem. Int. Ed.*) and *Accounts of Chemical Research* was higher than the world average. Despite its huge share of the world's population (~17%), India continues to be poorly represented in the top journals: the country's share of papers in the *Journal of the American Chemical Society* is 0.7% compared to 58.4% for USA,

7.6% for Germany and 5.1% for China, and its share in *Angew. Chem. Int. Ed.* is 1.2% compared to 28% for Germany, 25.3% for USA and 9.9% for China. This could be due to the fact that till recently Indian universities did not encourage mobility across disciplines. That only a small number of Indian researchers and institutions publish in leading journals is also a matter for concern. India accounts for only a small number of papers in the top one percentile of the most highly cited chemistry papers, whereas China leads the world. Only 2.3% of the 2234 papers published in 2014 that are in the top one percentile is from India compared to 38% from China.

Impact of employees' training programmes on job satisfaction

Ana-Maria Bercu

Keywords: Employees, job satisfaction, training, skills.

Abstract

The main aim of this article is to analyse the attitude of employees from wood-industry companies in the Northeast region of Romania about the training programmes that they have attended, consequently explaining the relationship between training and job satisfaction. The results show that it is necessary to implement high-quality training programmes because it has a positive connection with ethical rules, work recognition, supervision and commitment to work.

Redesigning nature: to be or not to be?

Jayashree Das, Pritha Dey and Pradipta Banerjee

Keywords: Designer babies, genome editing, patent rights, redesigning nature.

Abstract

The concept of designer babies' is indeed intriguing, wherein offspring characteristics can be modified in the embryonic stage by gene editing. Genome editing has got an immense boost with the advent of the Cas/CRISPR technology that utilizes proteins from a bacterial immune system to remove defective genes and replaces them with a rectified edition. The technique is proving to be successful in fighting a host of genetic diseases, including cancer and has even made headway with HIV. The technology has sparked a revolution in genomics with a storm brewing over its patent rights.

Gravitational waves in an interferometric detector

Archana Pai

Keywords: Binary black holes, Fabry–Perot cavity, gravitational waves, interferometric detectors, LIGO detectors.

Abstract

Detection of gravitational waves by two LIGO detectors has begun a new exciting era of gravitational wave astronomy. Following the two detections, India has stepped in the global effort towards gravitational wave observation via her involvement in the LIGOIndia project. The LIGO-India project will open up new opportunities in the cutting edge and challenging field of gravitational wave detection. This article provides a background about gravitational waves and interferometric detector.

Quantum entanglement and its applications

Aditi Sen (De)

Keywords: Entanglement, quantum correlations, quantum communication protocols, quantum dense coding, quantum teleportation.

Abstract

Quantum correlation, such as entanglement, is one of the important ingredients in most of the known quantum communication schemes. In this article, we first introduce the concept of entangled states and then discuss the communication protocols without security, both in a two-party and in a multiple-party domain.

Manipulating cold atoms with optical fibres

Shrabana Chakrabarti

Keywords: Anti-Helmholtz coils, atom–photon interactions, cold atoms, magneto optical trap, optical fibres, tapered optical nanofibre.

Abstract

In this article we present some demonstrations of atom–photon interactions at low photon level using optical fibres. We report an experiment on the interaction between cold atoms produced in a magneto optical trap and tapered optical nanofibre and discuss some applications of the same. We then expound our experimental plan to study nonlinear processes such as electromagnetically induced transparency in laser cooled atomic medium confined within a hollow core photonic crystal fibre. Possible applications of this system are also discussed.

Is neutrino its own antiparticle?

Vandana Nanal

Keywords: Antiparticle, cryogenic bolometer, double beta decay, neutrino.

Abstract

Neutrino is a neutral spin $\frac{1}{2}$ particle, discovered through nuclear beta decay, that interacts only through the weak interaction. It is now well established that neutrinos have mass. The mass and nature of neutrinos play an important role in theories beyond the Standard Model. Whether neutrino is its own antiparticle, as proposed by Majorana, is still an open question. At present, neutrinoless double beta decay ($0\nu\beta\beta$) is perhaps the only experiment that can reveal the true nature of the neutrinos. Given its significance, there is a widespread interest in the quest for $0\nu\beta\beta$ employing different techniques. This article presents a brief overview of $0\nu\beta\beta$ experiments and highlights the indigenous effort to search for $0\nu\beta\beta$ in ^{124}Sn using a cryogenic bolometer at the India-based Neutrino Observatory.

Neutrino oscillations

Sandhya Choubey

Keywords: Beta decay, flavour transformation, neutrino oscillations, particle physics.

Abstract

Neutrinos are massless as proposed in the Standard Model of particle physics. However, neutrino experiments in the last few decades have revealed that neutrinos flavour oscillate, a scenario possible only if they have mass and mixing. Existence of neutrino mass was the first conclusive evidence of physics beyond the Standard Model, and explaining the smallness of the neutrino masses and peculiar mixing angles still remains a challenge for model-builders proposing beyond Standard Model scenarios. We give a brief introduction to the phenomenon of neutrino oscillations and showcase some recent work where we look for physics beyond the three-generation neutrino oscillation paradigm and its impact on future experiments.

Non-relativistic fluids

Nabamita Banerjee and Sayali Atul Bhatkar

Keywords: Galilean fluids, Galilean superfluid, null fluids.

Abstract

We present the dynamics of a most generic uncharged dissipative parity, even Galilean fluid, to the first derivative order. The construction is embedded in a symmetry broken phase of one higher dimensional relativistic system, namely the null fluid. Both the null fluid and the Galilean fluid have identical symmetries, thermodynamics and constitutive relations to all order in derivative expansion. Finally, we present the number of transport coefficients for most generic charged Galilean fluid and Galilean Superfluid.

Properties of magnetic shape memory alloys in martensitic phase

Chhayabrita Maji

Keywords: Magnetoresistance, martensitic transition, shape memory alloys.

Abstract

The Heusler alloys that exhibit reversible martensitic transition show multifunctional properties including magnetic shape memory effect. The properties of two kinds of magnetic shape memory alloys are studied, where magnetic field-induced strain is driven by two different mechanisms. The properties differ in martensitic phase with composition and thus they are studied in martensitic phase. The crystal structure (X-ray diffraction), magnetic behaviour (SQUID), transport analysis (four-probe method), magneto-transport trend (up to 8 T), magnetocaloric effect (around room-temperature), electronic structure (X-ray photoelectron spectroscopy and ab initio calculation), surface characterization (ultraviolet photoelectron spectroscopy and inverse photoelectron spectroscopy) are discussed for the martensitic phase. Analysis of the properties reveals alloys with possible applicability at room temperature with low magnetic field.

Peek into the world of materials using thermopower and XAFS as investigative probes

Preeti A. Bhoje

Keywords: Magnetic shape memory alloys, XAFS, thermopower measurements, spin-phonon coupling, magnetic semiconductors.

Abstract

Over the last few decades, there has been growing interest for developing technologies aimed at providing cleaner and more sustainable energy sources. Great efforts are directed towards synthesis of newer functional materials and tailoring the existing ones with an aim to optimize their usability. As materials are being developed with various complexities in their physical properties and forms like single crystals, thin-films, nanostructure and composites, measurement of their basic physical properties is also getting equally challenging. This review deals with a brief summary of our efforts in developing the basic understanding of some functional materials, using experimental tools that are best known to us, viz. measurement of Seebeck coefficient and X-ray absorption fine structure spectroscopy (XAFS). In particular, we discuss the results of our investigation of magnetic shape memory alloy Ni₂MnGa and multiferroic CdCr₂Se₄.

Development of nanoporous aerogel-based thermal insulation products: ‘Make in India’ initiative

Neha Hebalkar

Keywords: Aerogel, energy conservation, industrial applications, silica, thermal insulation.

Abstract

The technology of manufacturing a silica aerogel thermal insulation product has been developed with the objective of indigenization under the ‘Make in India’ initiative. This world class product is now ready for commercial production. It possesses all the features and properties required for any ideal industrial thermal insulation material such as low thermal conductivity, light weight, good compressive strength, moisture, fire, corrosion and chemical resistance, antifungal, low shrinkage, sound-proof, non-toxic and ecofriendly. The increasingly gaining attention towards this highly efficient thermal insulation material is a hope to significantly contribute in achieving targets of energy conservation and saving.

Recent advances in magnetic ion-doped semiconductor quantum dots

Mahima Makkar and Ranjani Viswanatha

Keywords: Dilute magnetic semiconductors, quantum dots, magnetic circular dichroism, spintronics.

Abstract

Dilute magnetic semiconductor (DMS) quantum dots (QDs) have potential to be used as basic working components of spin-based electronic devices. Therefore it is important to study these materials from fundamental and technological viewpoints. Quantum confinement effects are known to enhance exchange interactions and induce properties that were previously not observed in bulk materials. In fact, properties are known to alter dramatically when dimensions are reduced to nanometre size regime. In this review we briefly discuss the recent advances in chemical (synthetic) and physical (properties) aspects of DMS QDs. We first discuss the various issues involved in the synthesis of DMS QDs followed by a discussion of the solutions obtained so far. We then discuss the interesting properties of DMS QDs with emphasis on their magnetic, magneto-optical and magneto-electrical properties arising from the cooperative effects of spinexchange interactions.

High pressure: one of the many tools to study material properties at extreme conditions

Nandini Garg

Keywords: Germanium dioxide, high pressure, material properties.

Abstract

High pressure is a powerful and clean variable, which when applied can bring about large changes in structure and properties of materials. It can be used to simulate the conditions found deep inside the earth or in different planetary interiors. It is widely used in chemical industry, especially when the chemical reaction products have lower volumes than the initial reactants, and also in the food preservation industry, where it ensures that aromas and flavours are not lost even after preservation. Materials under pressure can be studied both theoretically and experimentally. In this article apart from discussing how to set up a basic high pressure experiment using the DAC, some examples have been elaborated to show how both experiments and theory complement each other and both put together can help in a deeper understanding of the changes brought about by application of high pressure.

Computational approaches to understanding the biological behaviour of intrinsically disordered proteins

Sneha Menon and Neelanjana Sengupta

Sneha Menon and Neelanjana Sengupta

Keywords: Chaperones, free-energy, intrinsically disordered proteins, molecular dynamics, Monte Carlo method.

Abstract

Intrinsically disordered proteins (IDPs) represent a class of proteins that lack a persistent folded conformation and exist as dynamic ensembles in their native state. Inherent lack of a well-defined structure and remarkable structural plasticity have facilitated their functioning in a wide range of crucial cellular processes such as signalling transduction and cell cycle regulation as well as responsible for their aberrant toxic amyloidogenic conformations implicated in a wide range of neurodegenerative diseases, cancer, etc. Their ubiquitous presence in nature, role in biological function and diseases have spurred interest in the biophysical and conformational characterization of IDPs. Conventional methods of structure determination are less feasible owing to structural and spatiotemporal heterogeneity of IDPs, which demand the development of novel biophysical methods as well as rigorous computational techniques for their characterization. In this review, we provide a

brief overview of the widely used computational techniques probing the rugged conformational energy landscape of IDPs, their kinetics of structural transitions and molecular interactions key to their functions. Advances in the development of calibrated computational approaches for statistical representation of highly dynamic structural ensemble of IDPs are provided with examples. Challenges in modelling this unique class of proteins as well as the existing and futuristic avenues are also discussed.

Multiscale modelling: hybrid quantum mechanics/molecular mechanics as an example and some recent developments

Debashree Ghosh

Keywords: Biological systems, hybrid quantum mechanics/molecular mechanics, multiscale.

Abstract

Most of the physical phenomena are multiscale in nature and therefore, to depict it properly one requires multiscale modelling techniques, i.e. physical models that are accurate over multiple length and time scales. The seminal work by Warshel and Levitt marks the beginning of hybrid quantum mechanics/molecular mechanics (QM/MM) method as a successful strategy towards the understanding of chemistry and physics in condensed phases and especially in biological systems. Recently, these methods have been extended to problems such as light–matter interaction, where the QM sub-system is excited from the ground to the excited states. The MM environment provides a field that changes the potential energy landscape of both the ground and excited states in a distinctly different way. In this review, we discuss the general strategy of multiscale modelling with emphasis on hybrid QM/MM and the recent developments in excited state QM/MM methods.

A glimpse of shape optimization problems Anisa

M. H. Chorwadwala

Keywords: Comparison principles, isoperimetric problems, moving plane method, maximum principles.

Abstract

In this mini review, we give a glimpse of a branch of geometric analysis known as shape optimization problems. We introduce isoperimetric problems as a special class of shape optimization problems. We include a brief history of the isoperimetric problems and give a brief survey of the kind of shape optimization problems that we (with our collaborators) have worked on. We discuss the key ideas used in proving these results in the Euclidean case. Without getting into the technicalities, we mention how we generalized the results which were known in the Euclidean case to other geometric spaces. We also describe how we extended these results from the linear setting to a non-linear one. We describe briefly the difficulties faced in proving these generalized versions and how we overcame these difficulties.

Cell culture processes for biopharmaceutical manufacturing

Mugdha Gadgil

Keywords: Biopharmaceutical, CHO, cell line development, glycosylation, monoclonal antibody.

Abstract

Chemical Engineering and Process Development Division, CSIR-National Chemical Laboratory, Pune 411 008, India Recombinant proteins manufactured using animal cell culture processes comprise a significant fraction of biopharmaceuticals. With the expiry of patents on this class of therapeutics, there is also a significant interest in manufacture of biosimilar versions of such therapeutics. This article provides a birds-eye view of upstream process development for animal cell culture processes, with a focus on advances pertinent to the development of processes for biosimilars.

Understanding deep earth dynamics: a numerical modelling approach

Srishti Singh, Shubham Agrawal and Attreyee Ghosh

Keywords: Geodynamics, lithosphere dynamics, mantle convection, numerical modelling, seismic tomography

Abstract

Enhancement in computing power and better data availability have paved the way for deciphering the earth's deeper dynamics and have provided viable explanations for various surface phenomena. Tools such as seismic tomography, numerical modelling and geophysical observations such as stresses, gravity anomalies, heat flow, etc. have helped us in addressing the mechanisms of plate driving forces, anomalous geoid variations, cratonic stability, topographic support, intraplate earthquakes and similar outstanding issues in geodynamics. Due to lack of direct observations from deep earth, numerical modelling has aided considerably in learning about subsurface processes. With better algorithms being developed everyday, it is the right time to tap their potential to push the frontiers of human knowledge.

Effective management practices for improving soil organic matter for increasing crop productivity in rainfed agroecology of India

Ch. Srinivasa Rao, A. K. Indoria and K. L. Sharma

Keywords: Crop production, rainfed agroecology, soil organic matter, soil health improvement.

Abstract

To meet the requirement of increasing demand for food and fodder and to ensure food security, it is important to increase the production potential through soil health improvement in rainfed agroecological regions besides the irrigated regions. Degrading soil health because of decrease in soil organic carbon (SOC) and resultant decline in overall soil fertility in rainfed areas is a major threat to sustenance of crop and fodder productivity. In view of the importance of soil organic matter (SOM), and its close relationship with soil health and crop production, its role in carbon sequestration and nutrient cycling has gained much attention in the last few years. Restoration of SOM contents in the soil to optimal levels will not only improve the soil health of rainfed agroecosystem, but will also significantly contribute towards boosting crop production. In this article, we have critically reviewed the impacts of different crop management practices on SOC content and its impact on soil health and crop productivity in rainfed agroecological regions of the country.

Suppression of metal artefacts in CT using virtual sinograms and corresponding MR images

Andras Anderla, Srdjan Sladojevic, Gaspar Delso, Dubravko Culibrk, Milan Mirkovic and Darko Stefanovic

Keywords: Computed tomography, metal artifact, magnetic resonance imaging, virtual sonogram.

Abstract

Medical imaging is invaluable when it comes to gaining insight into the human body. As is well known, medical images need to deal with artefacts. This article presents a modern procedure for metal artifact reduction in computed tomography, which relies on additional information extracted from corresponding magnetic resonance images. We conducted a simulation study so as to compare the resulting images with those corrected, using the baseline linear interpolation method. The outcome indicates that the proposed method incomparably outperforms the baseline and reduces metal artefacts, improving the quality of images, which can be later used in a clinical setting.

Physicochemical properties of insect and plant antifreeze proteins: a computational study

L. Ramya

Keywords: Antifreeze proteins, disulphide bonds, homology modelling, hydrophobicity, thermal stability.

Abstract

Antifreeze proteins are found in cold-surviving organisms. These proteins have greater structural diversity among same and different species. In this study, a total of 14 antifreeze proteins from both insects and plants were selected randomly and their physicochemical characteristics along with their structural features were analysed using computational tools. The results indicate that plant antifreeze proteins are mostly hydrophilic, which can interact with ice/water effectively. The study shows that the thermal stability of plant antifreeze proteins is greater than insect antifreeze proteins. Among the chosen sequences, insect antifreeze proteins were mostly β -sheet and plant antifreeze proteins were α -helix.

Nationwide assessment of forest burnt area in India using Resourcesat-2 AWiFS data

C. Sudhakar Reddy, C. S. Jha, G. Manaswini, V. V. L. Padma Alekhya, S. Vazeed Pasha, K. V. Satish, P. G. Diwakar and V. K. Dadhwal

Keywords: AWiFS, forest fire, forest type, India, remote sensing

Abstract

This study provides application of Resourcesat-2 AWiFS satellite imagery for forest burnt area assessment in India. AWiFS datasets covering peak forest fire months of 2014 have been analysed. The total burnt area under vegetation cover (forest, scrub and grasslands) of India was estimated as 57,127.75 sq. km. In 2014, 7% of forest cover of India was affected by fires. Of the major forest types, dry deciduous forests are affected by the highest burnt area, followed by moist deciduous forests. Among the biogeographic zones, the highest forest burnt area was recorded in Deccan followed by North East and Western Ghats. The highest burnt area was recorded in Odisha followed by Andhra Pradesh, Maharashtra, Chhattisgarh, Tamil Nadu, Madhya Pradesh, Telangana, Jharkhand, Manipur and Karnataka. Spatial analysis shows that 232 grid cells in India have a burnt area greater than 20 sq. km. The database generated would be useful in ecological damage assessment, fire risk modelling, carbon emissions accounting and biodiversity conservation.

Study of channel instability in the braided Brahmaputra river using satellite imagery

Tapas Karmaker, Hemanta Medhi and Subashisa Dutta

Keywords: Braiding index, braided belt, plan form, stream power.

Abstract

In the present study, instability of the river reach of Brahmaputra was analysed for braided belt width changes, braiding index and bar area. The river reach of the Brahmaputra from its confluence of Lohit, Dibang and Dihang to its confluence with the Tista river was studied from 1973 to 2009. The study was carried out using remotely sensed data from Landsat satellites at different dates. Discharge data synchronized with satellite data was collected by maintaining near-similar water level or discharge. Wavelet of the braided belt change was analysed to get the wavelet power and spatial extent of the changes. Finally, stream power was analysed from the average discharge data during the monsoon period to determine its effect on the instability of parameters considered. Results indicate that stream power does not directly relate to local changes in the braided belt or braiding index. However, with decrease in stream power, an increasing trend of bar area was found. Maximum wavelet power within a period showed a threshold behaviour at stream power of 5 W/km, beyond which the wavelet power raised sharply to a high value with increase in stream power. River

response to the stream power was found at a global level rather than local level. Finally, a gradual decrease in stream power over time indicates the stable river reach. However, changes due to local bank erosion cannot be predicted using this analysis.

Protocols for riverine wetland mapping and classification using remote sensing and GIS

Rajiv Sinha, Shivika Saxena and Manudeo Singh

Keywords: Hydro-geomorphology, mapping and classification, waterlogging, wetlands.

Abstract

Wetlands are one of the most important ecological environments that also have high socio-economic importance. India hosts a large number of wetlands, among which most are in the Indo-Gangetic Plains formed by riverine processes. In order to understand the extensive system of riverine wetlands and their distinction from other floodplain water bodies, mainly the waterlogged areas, a mapping and classification system has been proposed and applied for wetlands in the Begusarai district of north Bihar plains, India. The proposed hydro-geomorphic classification system is hierarchical, simple, and robust, and can be implemented through quick processing of satellite images integrated with minimal ancillary data.

Predation to climate change: what does a fossil shell tell us?

Devapriya Chattopadhyay

Keywords: Fossil, mollusca, paleoecology, paleoclimate.

Abstract

Paleobiology is a growing field where researchers are primarily interested to reconstruct the past biosphere using a truly interdisciplinary approach. The effect of biotic and abiotic agents of natural selection influencing an organism's ecology and evolution is a question that intrigued ecologists and paleobiologists alike. Study of such interaction in deep time using the marine fossil record presents some unique challenges. In this article, I have tried to share my personal account of such challenges and subsequent developments where I was involved as a researcher working on this topic.

Modelling of meteorological parameters for the Chorabari Glacier valley, Central Himalaya, India Indira Karakoti, Kapil Kesarwani, Manish Mehta³ and D. P. Dobhal

Keywords: Clearness index, empirical models, global and diffuse radiation, meteorology.

Abstract

In the present study, we have developed empirical relationships to estimate meteorological parameters at the glacier altitude from the data on non-glacier altitude. Meteorological data collected from automatic weather station at Chorabari Glacier from November 2011 to May 2013 are analysed and empirical equations for air temperature, relative humidity and incoming global radiation are proposed. The dataset of one year (November 2011–October 2012) is used in the calibration of models, while data for the next seven months (November 2012–May 2013) are employed to validate the models. Moreover, an analytical study is also conducted on incoming diffuse radiation (estimated through the established model for India). Further, a relationship is established to correlate the diffuse component of two sites. Variation trend of meteorological parameters with altitude is found to be different for each of the parameters, viz. quadratic for air temperature, logarithmic for relative humidity, and linear for global and diffuse radiation. Performance of the generated equations is tested through various statistical methods. The study reveals that developed correlations are able to give a good match with in situ measurements.

Ignition delay study of aluminium oxide liquid nano-fuel in a shock tube

D. K. Tripathi, G. Garg, U. Agrawal, V. Menezes, U. V. Bhandarkar and B. P. Puranik

Keywords: Aluminium oxide, ignition delay, liquid nano-fuel, shock tube.

Abstract

The ignition delay of aluminium oxide (Al₂O₃) liquid nano-fuel was compared with that of base-fuel to study the feasibility of its use for high-speed aerospace applications. The base-fuel was aviation turbine fuel that was mixed with Al₂O₃ nanoparticles to produce a nano-fuel which could be used for regenerative cooling of the combustor walls before injection. The experiments were carried out in a shock tube. The fuel was introduced into the shock tube in the form of a wall droplet. The ignition delay time of the nano-fuel was observed to increase slightly, by about 11% (maximum) in comparison with the baseline, at an equivalence ratio of unity.

Atomic hydrogen storage in a two-dimensional hydrogenated diamond-like carbon film

Nihar Ranjan Ray

Keywords: Graphane, gravimetric density, green fuel, hydrogen storage.

Abstract

The present communication describes the twodimensional hydrogenated diamond-like carbon (2DHDLC) film as a system for storing atomic hydrogen, having hydrogen content in atomic per cent ~37.5 corresponding to gravimetric density of hydrogen ~5.8 wt%.

Abstract

Indigenous development of 320 × 256 focal-plane array using InAs/InGaAs/ GaAs quantum dots-in-a-well infrared detectors for thermal imaging

K. C. Goma Kumari, H. Ghadi, D. R. M. Samudraiah and S. Chakrabarti

Keywords: Focal-plane arrays, infrared detectors, photoluminescence peak, quantum dots, thermal imaging.

Abstract

We report here the indigenous development of a 320 × 256 infrared focal-plane imager fabricated using an InAs quantum dots-in-a-well heterostructure, whose photoluminescence peak is at 1162 nm and activation energy is 187 meV. We discuss the fabrication and characterization of single-pixel detectors that can measure intersubband spectral responses with peak intensity at 9.3 μm. Using the fabricated device, infrared images were captured at 50–90 K. Device optimization led to approximately 95% of the pixels in the imaging array being operational and a reasonably low noise equivalent temperature of approximately 100 mK at 50–60 K.

A simple egg membrane model for understanding diffusion characteristics of nanoparticles and amino acids Deepika Tari, Shalaka Haryan, Kaustubh Patankar, Vinod Jaiswal, Mahesh Samant, S. Sivakami and P. M. Dongre

Keywords: Amino acids, chicken egg shell membrane, diffusion rate, permeability constant, silver nanoparticles.

Abstract

This study reports the passive diffusion (in vitro) of silver nanoparticles (SNPs) and those of the amino acids tryptophan, phenylalanine, tyrosine across a biological membrane model. The experiments were carried out under physiological conditions at pH 7.4. Chicken egg shell outer membrane model was used to study the passive diffusion of the above materials. Passive diffusion was performed against and towards gravitation for 24 and 48 h. Fick's first law of diffusion was adopted for quantification of diffusion coefficient, permeability constant and diffusion rate. The egg shell membrane was characterized using scanning electron microscopy. The SNPs were synthesized

by chemical degradation method and characterized by UV-visible spectroscopy and dynamic light scattering. An average size of nanoparticles obtained was 62 nm. The diffusion rates of amino acids were higher than those of SNPs. However, they were enhanced in their presence. Permeability coefficient and diffusion coefficient were higher for amino acids than SNPs. The possible mechanisms have been explained on the basis of molecular properties.

Behaviour of laboratory-selected Cry1Ac-tolerant strain of *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) on Bt-cotton

Paramjit Kaur and Vinod Kumar Dilawari

Keywords: Bt-cotton, Cry1Ac toxin, *Helicoverpa armigera*, resistant population.

Abstract

The effect of *Bacillus thuringiensis* toxin Cry1Ac on the behaviour of a laboratory-selected resistant population (72-fold) of *Helicoverpa armigera* on Bt-cotton was evaluated. Compared with non-Bt-cotton and Cry1Ac toxin incorporated in semi-synthetic diet, resistant larvae reared on Bt-cotton had only 0.13% survival and slower development. The results suggest that Cry1Ac from Bt-cotton exerts a greater toxic effect in terms of larval mortality coupled with decline in larval growth rate compared to semi-synthetic diet.

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Nanoparticle assembly: a perspective and some unanswered questions

Sanat K. Kumar, Guruswamy Kumaraswamy, Bhagavatula L. V. Prasad, Rajdip Bandyopadhyaya, Steve Granick, Oleg Gang, Vinodhan N. Manoharan, Daan Frenkel and Nicholas A. Kotov

Keywords: Function-driven design, fundamental issues, nanoparticle assembly, practical applications

Abstract

In early 2016, the Royal Society of Chemistry arranged a meeting on the topic 'Nanoparticle Assemblies: from Fundamentals to Applications' which was hosted at IIT-Bombay, Mumbai. The meeting brought several leading nanoscience and nanotechnology researchers to India and is only the second Faraday Discussions meeting to have been held in the country. The papers presented at the meeting and the resulting active discussions have been summarized in a Faraday Discussion issue 1. The broad range of topics discussed at the meeting led to an understanding on where we stand in the field of nanoparticle assembly, and also enunciated some of the outstanding fundamental and practical issues that remain to be resolved before these ideas can be applied to practical situations. Driven by these ideas, here we focus on four topics/questions: (i) Can we achieve function-driven design of nanoparticle assemblies? (ii) What is the minimal information needed to build a desired assembly? (iii) How complex a structure can one build? How can one make it responsive? What are the relative roles of equilibrium versus dynamics in the assembly process, and are we at a point where we can now pursue active assembly as a viable mode for creating complex assemblies? (iv) What are the applications that are being targeted and what are the barriers to implementation? In this perspective, we do not present an exhaustive survey of the vast literature in this area, but indicate overarching themes/questions that require immediate attention, largely based on the discussions at the Mumbai meeting.

Route performance evaluation of a closed bus rapid transit system using GPS data

Ankit Kathuria, M. Parida and Ch. Ravi Sekhar

Keywords: Bus rapid transit systems, GPS data, route performance, statistical parameters

Abstract

GPS-fitted buses operating in bus rapid transit systems (BRTS) of India make it easier to collect a wealth of travel-time data from them. This article evaluates the operational performance of BRTS routes based on GPS data. First, various simplified statistical range parameters, viz. coefficient of variation percentile travel time, travel-time distributions, etc. are selected for route evaluation. Then, two bus routes of the Ahmedabad BRTS are selected as case study to develop and validate a methodology for evaluating the performance of these routes based on selected parameters. Weekday bus travel-time data for one direction accounting for 2124 bus trips are used in the study. The study then compares travel-time reliability-based performance of a BRT and a non-BRT route. Further, the study proposes an approach to measure a shift in BRTS network level of service based on two indices – average travel time per kilometre, and travel-time coefficient of variation. A left shift in cumulative plot indicates an improvement in the BRTS network level of service in the year 2016 compared to 2013. **Keywords:** Bus rapid transit systems, GPS data, route performance, statistical parameters

A bibliometric analysis of highly cited papers from India in Science Citation Index Expanded

Bakthavachalam Elango and Yuh-Shan Ho

Keywords: Bibliometrics, citation impact, highly cited articles, scientometrics, Y-index

Abstract

The aim of the present study is to analyse the highly cited papers from India. The Science Citation Index Expanded database was used to retrieve the related bibliographic records. Grouping and reclassification of institutions with misspellings and variants have been done. The most productive institutions, collaborating partners and Y-index of the contributing authors were examined. Results revealed that all the highly cited papers from India did not receive citations in the early years after publication. Co-authored (or international collaboration) papers received more citation impact than single-authored ones. USA was the preferred collaborative partner for international collaboration. The Indian Institutes of Technology, CSIR organizations, and Indian Institute of Science, Bengaluru were the leading Indian institutions.

Visualization of international environmental DNA research

Li Jiang and Yongqing Yang

Keywords: Citation burst, environmental DNA, scientometrics, visualization.

Abstract

Environmental DNA (eDNA) analysis is increasingly being used in research fields of archaeology, biology and environmental science. In this study, scientometric methods have been used to quantitatively assess the current global research status in the eDNA field based on SCI-EXPANDED and Social Sciences Citation Index databases during the period 1992–2016. CiteSpace software was used to visualize the eDNA knowledge domains. The most productive category and journal are microbiology and Applied and Environmental Microbiology respectively. USA is the leading country, Rockefeller University is the prominent institution and Brady, S. F. is the most productive author. Document co-citation analysis demonstrated that the most recent domain is focusing on using eDNA as a tool to detect species in aquatic environments. These findings may help researchers better understand the current progress as well as identify the latest frontiers in the field of eDNA.

Oxalic acid/oxalates in plants: from self-defence to phytoremediation

Rajendra Prasad and Yashbir Singh Shivay

Keywords: Aluminium toxicity, calcium oxalate, oxalic acid, phytoremediation.

Abstract

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Oxalic acid and oxalates are produced and present in plants in different amounts. Insoluble calcium oxalate plays a key role in regulating calcium concentration, which is important in the functioning of guard cells. Oxalates provide tolerance to aluminium toxicity to plants growing in acid soils. Both oxalic acid and calcium oxalate provide self-defence against insect pests and grazing animals. Oxalates are involved in phytoremediation of soils rendered toxic by heavy metals, like lead, cadmium, zinc, etc.

Chalcone-based aryloxypropanolamine as a potential antidiabetic and antidyslipidaemic agent

Poonam Shukla, Mavurapu Satyanarayana, Prem C. Verma, Jaya Tiwari, Atma P. Dwivedi, Rohit Srivastava, Neha Rehuja, Swayam P. Srivastava, Sudeep Gautam, Akhilesh K. Tamrakar, Anil K. Dwivedi, Hari N. Kushwaha, Nagsen Gautam, Shio K. Singh, Mukesh Srivastava, Chandishwar Nath, Ram Raghubir, Arvind K. Srivastava and Ram Pratap

Keywords: Antidiabetic and antidyslipidaemic activity, chalcone, diabetes mellitus, metabolites, rodents.

Abstract

The hybrid congener 3 derived from hydroxychalcone and pharmacophore oxypropanolamine for adrenergic receptor, along with its enantiomers 9a and 9b were selected from a series of compounds for detailed studies of their antidiabetic profile in sucrose-challenged, low-dosed, streptozotocin-induced diabetic rats and in db/db mice, and antidyslipidaemic profile in high fat diet-induced dyslipidaemic hamsters. The test compounds exhibited significant and consistent antidiabetic and antidyslipidaemic activities in the above models. The pharmacodynamic studies of two metabolites, 10 and 11, were undertaken. Metabolite 10 having greater bioavailability in plasma was synthesized and found to exhibit significant antidiabetic activity. The parent compound together with its active metabolites exhibited significant oral bioavailability, thus establishing compound 3 as a potential lead molecule for further studies.

Microstructuring by two-photon polymerization using a sub-nanosecond laser

Raghwendra Kumar and S. Anantha Ramakrishna

Keywords: Fabrication parameters, photoresists, subnanosecond laser, two-photon polymerization, writing system.

Abstract

A multi-photon absorption-based laser writing system with sub-micrometer resolution has been developed using an inexpensive sub-nanosecond laser for two- and three-dimensional structuring in photosensitive resist materials. New combinations of commercially available photoresists such as SU-8 and AR-N 4340, and a photoinitiator (2, 4, diethyl-9H-thioxanten-9-one) with large two-photon absorption at 532 nm are shown to be effective in obtaining sub-micrometer line or dot resolution. Systematic studies of the resolution on the system and fabrication parameters such as laser power, writing speed, focusing arrangement, etc. have been carried out. The sub-nanosecond-based laser micro writer is an inexpensive alternative with similar capabilities as a femtosecond-based laser writer. This system is comparably effective and has much higher capabilities for 2D structuring in terms of the aspect ratio of the fabricated structures than conventional 2D laser micro writers.

Cultural endophytic fungi associated with *Dendrobium officinale*: identification, diversity estimation and their antimicrobial potential

Zhaoxia Jin , Dandan Li, Tianyi Liu, Fang Yu, Zongshen Zhang, Caixia Su, Yanyan Wang, Qiong Guo and Zhiwen Liu

Keywords: Antimicrobial activity, *Dendrobium officinale*, diversity, endophytic fungi.

Abstract

Endophytic fungi associated with Chinese medicinal plant *Dendrobium officinale* have been revealed using the culture-dependent approach and the diversity and antimicrobial activity have been examined in this study. A total of 105 endophytic isolates representing 16 fungal morphotypes were recovered from the roots, stems and leaves of *D. officinale*. Identification by ITS-rDNA sequencing showed 12 distinct operational taxonomic units, and most of them were classified into species level. Shannon's and Simpson's indices were calculated to quantify fungal diversity. The results demonstrated that endophytic fungi associated with *D. officinale* were moderately diverse, and fungal species among three tissues was also different which exhibited tissue-specificity. The composition of endophyte assemblages from the roots was most abundant and diverse, followed by the stems, while the leaves possessed relatively low isolation rate. *Fusarium oxysporum* (21.0%) and *Xylaria cubensis* (20.0%) were the most dominant species, while *Colletotrichum* sp. and *Pestalotiopsis* sp. were also frequently isolated. Three species (*F. oxysporum*, *Aspergillus niger* and *Aureobasidium pullulan*) showed broad-spectrum antimicrobial activity, and *F. oxysporum* had acute inhibition to pathogens tested. Our systematic study could enrich the current knowledge on diversity of endophytic fungi. The fungal isolates from *D. officinale* may be used for exploration of novel bioactive compounds and have potential as biocontrol agents.

Tropical mangrove swamp metagenome reveals unusual abundance of ecologically important microbes Zahidah Ismail, Choon-Kook Sam, Wai-Fong Yin and Kok-Gan Chan

Keywords: Mangrove, metagenomics, pathogens, soil.

Abstract

The tropical ecosystem is extremely rich in flora and fauna, but the tropical mangrove soil microbial diversity remains illusive. To address this knowledge gap, we characterized the metagenome of a Malaysian mangrove soil sample and its microbial ecological roles via next-generation sequencing (NGS). Shotgun NGS data analysis revealed high diversity of ecologically important microbes from bacteria and archaea domains. Also, an unusually high number of archaea was detected together with high abundance of Deltaproteobacteria. In a functional study by the SEED classification in MEGAN, virulence factor genes were abundantly present, implying that the mangrove soil is a potential reservoir of pathogens.

Automated skin defect identification system for orange fruit grading based on genetic algorithm R. Thendral and A. Suhasini

Keywords: Colour and texture features, genetic algorithm, oranges, skin defect identification.

Abstract

Using machine vision technology to grade oranges can ensure that only good-quality fruits are exported. One of the most prominent issues in the post-harvest processing of oranges is the efficient determination of skin defects with the intention of classifying the fruits depending on their external appearance. Shape, size, colour and texture are the important grading parameters that dictate the quality and value of many fruit products. The accuracy of the evaluation results is increased by proper combination of different grading parameters. This article presents an efficient orange surface grading system (normal and defective) based on the colour and texture features. As a part of the

feature selection step, this article presents a wrapper approach with genetic algorithm to search out and identify the informative feature subset for classification. The selected features were subjected to various classifiers such as support vector machine, back propagation neural network and auto associative neural network (AANN) to study the performance analysis among these three classifiers. The results reveal that AANN classification algorithm has the highest accuracy rate of 94.5% among these three classifiers.

Trends in rainfall and peak flows for some river basins in India Sharad

K. Jain, P. C. Nayak, Yatveer Singh and Surendra Kumar Chandniha

Keywords: Flood peaks, rainfall trends, river basins.

Abstract

The aim of the present study is to examine the trends in magnitude and intensity of precipitation and peak floods of different magnitudes for seven major river basins in India. Data pertaining to daily flows for about 30-odd years and precipitation for 61 years (from 1951 to 2012) were analysed. Linear trends were calculated for the number of rainy days, rainfall intensity and occurrence of flood peaks for all basins. Using the Sen's slope estimator, it was found that annual peak rainfall increases for most of the basins in India. From the Mann-Kendall test and Sen's slope, it was found that the Cauvery and Brahmani and Baitarani basins show a rising trend in the number of rainy days, but the trend was falling for five other basins. When the basins were classified as mountains and plains, it was found that the number of daily rainfall events of different magnitudes was more in the mountains compared to the plains. The rivers which flow from west to east direction have more rainy days compared to those which flow towards the west. It was observed that in general the number of rainy days was falling while the number of intense events was increasing. The number of flood peaks of smaller magnitude in different decades showed slight falling trend. It was also found that there was falling or no trend for severe floods. Anthropogenic activities (construction of storage reservoirs, diversions, urbanization, land-use change, and soil and water conservation measures, etc.) have probably affected the generation of peak floods in the rivers of India. River regulation through storage reservoirs in the past 50 years has resulted in the reduction of peak flows. Hence with the same rainfall, the flood peaks would have increased under virgin conditions.

Understanding the factors influencing quality of writing and wiping for chalk and board system

Rajendra S. Thakur, Jignesh J. Shukla, Girish R. Desale and Pushpito K. Ghosh

Keywords: Calcium carbonate, chalk and board system, dust production, quality of writing, wiping efficiency.

Abstract

This article reports the properties of a calcium carbonate-based writing chalk prepared at the CSIR Central Salt and Marine Chemicals Research Institute (CSIR-CSMCR) and, further, our efforts to understand the process of writing with the chalk on two different boards. The optimum density of the chalk was found to be 1.52 g ml⁻¹, keeping in mind the careful balancing act between strength and dust-free nature of the chalk on one hand, and the ease of particle transfer onto the board on the other. Writing with the chalk yielded thin and compact appearance on a ceramic board, while that on a polymeric board was relatively broad and dispersed. Atomic force and scanning electron microscopic studies were carried out to rationalize the observation by correlating roughness on the board with the distribution of chalk particles. Wiping efficiency of the polyurethane-based duster prepared at CSIR-CSMCR was compared with commercial duster, and the observations rationalized again with the scanning electron microscopy.

Positioning and signal strength analysis of IRNSS and GPS receiver in plain terrain along with foliage loss

K. M. Gayathri, N. Thangadurai and M. P. Vasudha

Keywords: Altitude variation, navigation system, satellite visibility, vegetation effect

Abstract

Navigation systems such as Global Positioning System (GPS) play a significant role in determining the user position. Similar to GPS, Indian Regional Navigation Satellite System (IRNSS) is a navigation system indigenously developed by India to meet the country's needs. Presently, six satellites are in orbit – three in inclined geosynchronous orbit and three in geostationary earth orbit. It is essential to evaluate and upgrade the performance of IRNSS continuously for various applications. One such assignment to characterize the performance of IRNSS is mapping of the Jain University global campus geographical area in Bengaluru. The area for mapping includes a terrain with different features such as plain fields, vegetation fields, power distribution substation, dense trees and a terrain with variation in altitude. The purpose of this study is to analyse the performance of both IRNSS and GPS with respect to carrier-to-noise ratio, altitude variation, satellite visibility and GDOP, and the corresponding observations are recorded and plotted with available maps.

Model for economical and sustainable bioenergy production under greywater irrigation trial

Asha Pandey, R. K. Srivastava and Rajesh Kaushal

Keywords: Bioenergy production, calorific value, carbon dioxide mitigation potential, greywater irrigation.

Abstract

The present study focuses on sustainable utilization of greywater in short-rotation energy plantation – Eucalyptus hybrid, Populus deltoides, Salix alba and Melia azedarach. The dry matter produced by wastewater plots was 143%, 54%, 274% and 321% higher for Eucalyptus hybrid, Populus deltoides, Salix alba and Melia azedarach respectively, than the same plants in control plot. The calorific value of samples ranged from 4037 to 5190 Kcal kg⁻¹ in greywater plots, and 3460 to 4469 Kcal kg⁻¹ in control plots. The carbondioxide mitigation potential was 19, 13, 11 and 29 t ha⁻¹ higher for E. hybrid, P. deltoides, S. alba and M. azedarach trees respectively, under wastewater irrigation.

Prevalence and multiple antibiotic resistance of Vibrio coralliilyticus, along the southwest coast of India Reshma Silvester, Deborah Alexander, Maya George and A. A. M. Hatha

Keywords: Antibiotic resistance, estuaries, plasmid profiling, shrimp pond, Vibrio coralliilyticus.

Abstract

Samples from two different estuaries (Cochin and Kumarakom) and a shrimp farm located along the southwest coast of India were analysed for the presence of Vibrio species. V. coralliilyticus, a global marine pathogen had high prevalence in all the three sources. The incidence of V. coralliilyticus was very high in the Cochin estuary (40%) when compared to the shrimp pond (20%) and Kumarakom estuary (19%). The susceptibility of V. coralliilyticus strains to 20 different antibiotics and their plasmid profiles were also checked. All the tested strains exhibited multiple antibiotic resistance, showing resistance towards 5–9 antibiotics tested. Resistance was shown towards amoxycillin, ampicillin, carbenicillin, oxytetracycline, trimethoprim, nitrofurantoin, furazolidone, sulphamethoxazole, erythromycin, while all the strains were sensitive to streptomycin, gentamicin, amikacin, netillin, tetracycline, chloramphenicol, cotrimoxazole, nalidixic acid, norfloxacin and ciprofloxacin. Multiple antibiotic resistance index varied from 0.25 to 0.55. Forty-three per cent of the isolates harboured 1–3 plasmids, with size ranging from 0.5 to 33 kb. Thus the present study demonstrates the high incidence, multiple antibiotic resistance and plasmid profiling of V. coralliilyticus from the southwest coast of India.

Opportunistic predatory behaviour in *Duttaphrynus melanostictus* (Schneider, 1799) tadpoles

Susmita Mahapatra, Sushil K. Dutta and Gunanidhi Sahoo

Keywords: *Duttaphrynus melanostictus*, predation, tadpole, scavenger

Abstract

We report in situ and ex situ observations on interand intra-specific predatory behaviour in tadpoles of the common Asian toad *Duttaphrynus melanostictus*. In situ *D. melanostictus* tadpoles feed on conspecific eggs, tadpoles of various developmental stages and adult carrion as well as dead heterospecific (*Fejervarya orissaensis* and *Euphlyctis cyanophlyctis*) tadpoles. Predation of weak, feebly swimming larvae and metamorphs in seminatural habitats under optimum conditions seems to be an opportunistic behaviour and diet enrichment, which needs additional support. Our observations support earlier reports indicating gradual desiccation, food shortage, competition and density as the probable factors of predation in temporary habitats.

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Scientometric profile of global male breast cancer research

Sandhya Dwivedi, K. C. Garg and H. N. Prasad

Keywords: Citation analysis, male breast cancer, publication output, scientometric assessment, transformative activity index.

Abstract

An analysis of 4165 papers published during 2005–2014 on male breast cancer and indexed by Science Citation Index-Expanded indicates that the publication output in this nascent field is increasing steadily. The output is scattered among 91 countries, and USA ranks first in the publication output as well as impact in terms of citations per paper (CPP) and relative citation impact (RCI). The global compound annual growth rate during the period of study is 6.2. Change in transformative activity index is highest for the People's Republic of China (PRC). However, impact of research output is low for PRC. The research output is highly scattered in terms of prolific institutions, authors and journals publishing research results. Most of the prolific institutions are located in USA. Among the prolific institutions, the highest value of CPP and RCI was for Massachusetts General Hospital (USA), and among authors the highest value of CPP and RCI was for Thompson D. from the University of Cambridge (England).

GICDB: an oncogenomic database of gastrointestinal cancer

Jyotsna Choubey, Jyoti Kant Choudhari, Ashish Patel and M. K. Verma

Keywords: Gastrointestinal cancer, oncogenomic database, genes and miRNAs.

Abstract

Gastrointestinal Cancer Database (GICDB) is a repository of genetic association studies on gastrointestinal cancer which allows researchers to interpret the risk factors of the disease accurately and provide new insights towards further work. GICDB has been developed to provide a platform to clinicians and researchers for the easy retrieval of appropriate information. All data are stored and managed in MySQL and web interface has been developed in ASP. Currently, the database integrates information of 463 genes and 713 miRNA; these genes are implicated in the diverse phases of various gastrointestinal (GI) cancers. GICDB is distinct from other databases in that: (i) it consists of information on genes and miRNAs involved in various GI cancers; (ii) data in GICDB are linked to other on-line resources such as Entrez, Ensemble, UniGene, Swiss-Prot and On-Line Mendelian Inheritance in Man; (iii) there is information on GI cancer-associated drugs retrieved

from DrugBank, and (iv) it also integrates the information related to medicinal plants and their use in the treatment of different GI cancers with the structure of their chemical constituents. Unambiguously this database would provide a platform to retrieve genuine information for researchers working on GI cancer. GICDB can be freely accessed at <http://gidb.subdic-bioinformatics-nitr.in/>

Reduction in uncertainty in tropical cyclone track forecasts over the North Indian Ocean

M. Mohapatra, B. Geetha and Monica Sharma

Keywords: Cone of uncertainty, forecast, ocean basin, track, tropical cyclone.

Abstract

Over the North Indian Ocean (NIO) basin, the uncertainty in tropical cyclone (TC) track forecast is depicted by constructing a cone of uncertainty (COU) around the forecast track for the benefit of disaster managers in their decision-making, especially with respect to area of evacuation. The COU is constructed by drawing a tangent to the circles with the radii equal to average track forecast errors during the past five years for forecast times of 12, 24, 36, ..., up to 120 h. The COU which is revised periodically to reflect the track forecast accuracy, has been recently revised by India Meteorological Department (IMD) from the post-monsoon season of 2014. Hence, a study has been undertaken to evaluate this newly introduced COU forecast by IMD. The revised radii used to construct the COU have shrunk by 20–30% due to improved TC track forecast in the recent years (2009–2013). For the new COU, the radii of circles for 24, 48, 72, 96 and 120 h forecasts are 65, 105, 140, 170 and 200 nm respectively, against 80, 135, 185, 235 and 285 nm for the previous COU (2009–2013). The accuracy of the newly constructed forecast COU is 70–80% and is comparable with those of other leading TC forecasting centres in the world.

Cancer pathology: panel of diagnostic markers for cancer

Anuj Kumar Gupta and Prashant Khadke

Keywords: Diagnostic marker, glycoprotein, pathogenesis, protein.

Abstract

India Cancer is the second known lethal disorder after coronary heart disease, characterized by the loss of control of cell growth leading to excessive proliferation and spread of cells. Different diagnostic tools and different protein or glycoprotein markers are available for diagnostic utility and prognosis of cancer in patients. Of these, some diagnostic markers are promising but some still need to be validated for their utility. In this study, we demonstrate the pathogenesis of different types of cancer, such as cancer of breast tissue, pancreatic tissue, ovary, prostate, lung tissue and colorectal tract and the utility of a panel of diagnostic markers for them.

An insight into the putative role of victuals like honey and its polyphenols in breast cancer

Aruna Priyadharshni Subramanian, Agnes Aruna John, Muthu Vignesh Vellayappan, Arunpandian Balaji, Saravana Kumar Jaganathan, A. Manikandan and Eko Supriyanto

Keywords: Anti-cancer, apoptosis, breast cancer, honey, phenolic.

Abstract

Diet plays a crucial role in cancer advancement as well as prevention. Breast cancer is the second leading cause of cancer death among women. Recent research links breast cancer with diet and some evidence for the preventive effect of diet against breast cancer was also documented. The growth of cancer cells is influenced by natural sweetener honey and its multitude of phenolic phytochemical components. Honey has been used medicinally by ancient Greeks and Egyptians and also traditionally exploited in Ayurveda and Chinese medicine. In this paper, the anti-cancer

properties of honey and its phytochemical's action against breast cancer have been summarized. They result in apoptosis by enhancing reactive oxygen species level, activating mitochondrial pathway, initiation of pro-apoptotic and anti-apoptotic proteins, induction of p53 pathway that finally cause DNA fragmentation. However, there is a necessity for more proteomic and genetic-based experiments to understand its molecular mechanism to promote honey and its phenolic markers as plausible candidates for breast cancer treatment. Further, there is a need for quality check of honey available in the market, which warrants significant investigation by researchers in the food industry to ensure their attributes.

A comparison between linear programming model and optimal control model of production– inventory system Ali

Khaleel Dhaiban

Keywords: Boundary value problem, deteriorating items, linear programming, optimal control, production– inventory system.

Abstract

Apparatus of Supervision and Scientific Evaluation, Ministry of Higher Education and Scientific Research, Iraq This study compares two models of the production– inventory system – optimal control and linear programming. We derived the optimality conditions of optimal control model and formulated the linear programming model. A new method to determine the theoretical solution of the boundary value problem has been suggested. Our numerical results suggest that control on the inventory level was realized at the end of the planning period, depending on the optimal control model, while in the linear programming model, it was realized from the beginning of the planning period. Also, the method to determine the theoretical solution of the boundary value problem has proven to be efficient.

Estimation of pyrogenic carbon emissions from forests of Sikkim Himalaya, India: a geoinformatics approach Pradeep Kumar and M. K. Ghose

Keywords: Carbon emissions, forest fire, geoinformatics approach, remote sensing.

Abstract

With a view to understanding the micro-level mechanisms and lay the future path for improved carbon emission estimations from forest fires, we estimate fire emissions in Sikkim Himalaya, India. Remote sensing and geographical information system were used for fire scar identification, by mapping the multiple strata-based carbon density and partitioning the forest carbon into multiple pools. Fraction of carbon consumed in fire was further partitioned into the processes of flaming and smouldering. The estimation of trace gases of carbon dioxide, carbon monoxide and methane was made accordingly.

Numerical studies of ventilation effect on methane layering behaviour in underground coal mines

Pradeep Kumar, Devi Prasad Mishra, Durga Charan Panigrahi and Patitapaban Sahu

Keywords: Methane layering, numerical simulation, underground coal mine, ventilation effect.

Abstract

Layering of methane in underground coal mines owing to poor ventilation leads to methane explosion hazard. We study the methane layering phenomenon and the effect of ventilation on dispersion of methane in underground coal mines at air velocities varying from 0.5 to 4.0 m/s. Three-dimensional simulations using CFD code ANSYS Fluent 12.0 were performed assuming the flow to be unsteady, turbulent and incompressible. The study demonstrated that ventilation

significantly affects the behaviour of methane layering and dispersion of methane in underground coal mines. The layering length decreased with increase in air velocity. At air velocity of 4.0 m/s, the methane layering length considerably reduced to a safer level of about 1 m. Moreover, the simulation results showed a good agreement with the experimental results.

Sustaining soil quality, resilience and critical carbon level under different cropping systems in semi-arid tropical Alfisol soils Uttam

Kumar Mandal, K. L. Sharma, K. Venkanna, Pushpanjali, Ravikant V. Adake, Rahul N. Masane, J. V. N. S. Prasad, G. Venkatesh and Ch. Srinivasa Rao

Keywords: Cropping systems, organic carbon stock, soil quality and resilience, sustainable land management.

Abstract

Subsistence agriculture practice and a combination of harsh climate and fragile soils along with increasing demographic pressure are matters of great concern from the viewpoint of resource management and longterm sustainability in the semi-arid tropical Alfisol soils of India. In this study, soil quality index (SQI) has been computed on 190 sites of farmers' fields in southern India to evaluate the possible effect of land management practices on soil degradation and determine the critical levels of soil organic C stock to maintain a desirable SQI and also suggest appropriate management practices. In all, 26 predominant physical, chemical and biological properties of soils were studied and based on principal component analysis, moisture retention at field capacity, available soil N, available P, DTPA-extractable Zn, exchangeable sodium percentage, C-mineralization and bulk density were identified as the key indicators of the study region. SQI was also computed using four soil functions, viz. nutrient cycling, availability of water, resistance of soil to degradation, and salinity and sodicity. Soil resilience index was computed using data on substrate-induced respiration after exposing the soil to heat stress. SQI was highest under paddy followed by permanent fallow, maize, cotton, intercropping, redgram, and was lowest under castor system. Based on the results, it was observed that the soils which had higher SQI were also productive and they exhibited higher resilience capacity. An amount of 8.6 Mg ha⁻¹ soil organic C stock per 15 cm depth was found essential to maintain soil quality and 2.2 Mg ha⁻¹ of organic matter was needed every year to maintain this stock. On-farm participatory research trial was conducted using SQI as a tool for sustainable land-management practices.

Role of tributaries in shaping the middle course of the Himalayan River Teesta after the 1968 extreme floods

Leszek Starkel, Łukasz Wiejaczka and Krzysztof Kiszka

Keywords: Dams and reservoirs, extreme floods, high precipitation, river channels, role of tributaries.

Abstract

Extremely high precipitation is characteristic of the frontal zone of the Himalaya. In this article we study tributaries which supply huge sediment loads to the Teesta river in the Darjeeling Himalaya, India and significantly affect transportation regime downstream the junction of the Great Rangit with the main river. The material supply is also conditioned by 70–80% deforestation of the catchment. Will the deepening of the Teesta river and its tributaries follow tectonic movements? Or will the Teesta follow smaller streams that drain the fringe of the Himalaya, and then will the huge foreland cones penetrate the mountain interiors? These questions are important, especially in the context of construction of dams and water reservoirs along the Teesta river and its tributaries.

System design approach for heartbeat detection and classification of individuals irrespective of their physical condition

Chinmay Chandrakar and Monisha Sharma

Abstract

In an electrocardiogram (ECG), the heartbeat feature QRS is an important parameter for analysis in any heartbeat classification automated diagnosis system. In this communication the method which we have proposed is by using the counter which is used in parallel. The first level is detection of heartbeats, which uses hashing of ECG features. In the second level, the profiler profiles a person's regular and irregular ECG characteristic behaviour. The proposed method works on data related with ECG, instead of particular features of ECG. Because of parallel processing, data storage unit requirements and the processing time are less. The dependent values in the proposed method vary according to the changes in the ECG waveform. Such type of analysis is suitable for detection of heart disease. The most significant application of such characteristic plotting is to generate an alert signal for irregular ECG behaviour in a person. Such automated system will be useful in remote areas where a cardiologist may not be easily available.

A new formulation for determination of the competition coefficient in multispecies interaction for Lotka–Volterra type competition models

Anshuman Swain and Saswata Chatterjee

Keywords: Competition, interspecies interaction, niche overlap, resource utilization.

Abstract

Undergraduate Department, Indian Institute of Science, Bengaluru 560 012, India Determination of competition coefficients constitutes a vital part in the competition-based Lotka–Volterra type population dynamics models. Various models have been proposed for the same, some of which were instinctive formulations, while some others were derived from dynamical and equilibrium relations pertaining to population dynamics. In this work, a new instinctive formulation to determine the competition coefficient has been proposed based on various parameters that determine the intensity of interspecific competition like the availability of resources, relative importance of a particular resource for a species, energy expenditure per resource utilization, etc.

Weeds as emerging threat to biodiversity: a consequence of spread of *Ludwigia peruviana* in Dhansiri and Kopili catchment areas of Assam, North East India

Iswar Chandra Barua, Jayanta Deka, Mitali Devi, Rajib L. Deka and Janmoni Moran

Keywords: Biodiversity loss, catchments areas, invasion, *Ludwigia peruviana*.

Abstract

Wetlands seem to be more vulnerable to invasions compared to terrestrial ecosystems. The alien invasive weed, *Ludwigia peruviana*, invading the wetlands of the Dhansiri catchment and eastern part of Kopili in Assam has threatened the resident biodiversity and has also posed possibilities of spreading to other wetlands of North East India. The present study was conducted to measure the impact of the weed on the biodiversity of this region, to find out the causes for increasing invasiveness and to suggest a suitable management strategy. The weed has already damaged the marshland plant community and offered severe competition to the plants of peatland ecosystems in nearly 700 sq. km in the affected areas. Pre-monsoon temperature and monsoon rainfall had strong positive correlation with the frequency of occurrence of the weed. *L. peruviana* showed the highest (nearly 52%) frequency of occurrence in the wetlands of the area in comparison to other troublesome weeds. It has already formed its pure-stand in the ecotone zone replacing resident vegetation and is severely hampering normal food webs. Birds and animals either nest or graze in *L.*

peruviana-dominant areas, and the abundant waterways exhibit high probability of spreading the weed from the gullies and furrows and settlement areas in the near future. The seriousness of the problem calls for effective and timely management strategy.

District-level crop yield estimation using calibration approach

Kaustav Aditya, Ankur Biswas, Ashok Kumar Gupta and Hukum Chandra

Keywords: Calibration estimation technique, crop yield, two-stage sampling.

Abstract

Estimation of major crop yield rates at the district level using calibration estimation technique is reported here when auxiliary information is available at the unit level only for the selected villages within each district and when the sampling design under consideration is two-stage equal probability without replacement. An estimator was developed for the complex sampling design under consideration using the calibration approach. Through evaluation using real data collected from a pilot survey, we found that the proposed calibration estimator performs better than the usual design-based Horvitz–Thompson estimator under two-stage sampling design.

Estimation of carrying capacity of livestock farm based on maximum phosphorus load of farmland and GIS spatial analysis technology

Bojie Yan, Jingjie Yan and Wenjiao Shi

Keywords: Carrying capacity, farmlands, livestock manure, phosphorus load.

Abstract

To avoid the environmental pollution caused by livestock manure and provide rational layout of livestock farm, we estimated the livestock manure phosphorus load by the excretion coefficient method and have developed a livestock manure nutrient distribution model. The livestock manure phosphorus was distributed to farmlands using this model and spatial analysis technology. The carrying capacity of livestock farms was calculated based on the maximum livestock manure phosphorus carrying capacity of farmlands and expressed in pig for the Shangjie town, China. The results showed that the maximum, minimum, average and total livestock manure phosphorus carrying capacity of farmlands was about 55.97, 0.74, 12.21 and 13,382.90 kg respectively, and the total load of 2854.79 kg manure phosphorus from livestock farms surpassed the carrying capacity of farmlands in Shangjie town in 2011. The results also demonstrated that the maximum, minimum, average and the total carrying capacity of livestock farms was respectively, 792, 10, 157 and 9128 pigs. Most of the livestock farms in the town had carrying capacity of less than 300 pigs and only six farms had carrying capacity of livestock more than 500 pigs. The results could provide decision support for the spatial layout of livestock farms, controlling environmental pollution caused by livestock manure.

Characterization and comparative physico-chemical studies of Manahshila (traditionally used arsenic mineral) and the corresponding polymorphs of realgar (As₄S₄)

Vinamra Sharma, Amiya K. Samal, Anand K. Chaudhary and Rajesh K. Srivastava

Keywords: Alacranite, Manahshila, physico-chemical studies, polymorphs of realgar, mineralogical classification.

Abstract

This communication presents characterization and comparison of the physico-chemical properties of different varieties of Manahshila with the corresponding polymorphs of realgar. Three varieties of Manahshila have been described in Ayurveda, viz. Shyamangi, Kanavirak and Khandakhya; the last two are acceptable therapeutically. Khandakhya contains high percentage of arsenic than Kanavirak.

In this study, both samples of Manahshila have been collected. Their physical and chemical properties have been correlated with the polymorphs of realgar. XRD study classifies Kanavirak as alacranite and Khandakhya as realgar. EDXA study confirms 51.33% and 68.14% of arsenic in alacranite and realgar samples respectively. This work correlates the ancient description of Manahshila with contemporary mineralogical classification (polymorphs) of mineral realgar.

Characterization and testing of fine powder formulation of whole neem fruits

Sonali Tajane, Praful Dadhe, Sayaji Mehetre and Sachin Mandavgane

Keywords: Azadirachtin, characterization, free-flowing powder, particle-size, stability.

Abstract

Azadirachtin (Aza) is a key ingredient of neem-based pesticides. However, use of neem pesticides is limited due to storage instability of Aza. In this work, freeflowing fine powder of whole dry neem fruits (powder neem formulation, PNF) is developed without separately extracting Aza. The optimal particle size was found to be $-44 + 60$ mesh. PNF is characterized by Fourier transform infrared, X-ray diffraction, Brunauer–Emmett–Teller surface area, particle-size distribution and scanning electron microscope. Stability of Aza was found to be improved and it was assessed by studying the effect of particle size, temperature, UV light exposure and release study in buffered and natural water samples.

Distribution and conservation status of the western tragopan *Tragopan melanocephalus* in Jammu and Kashmir, India

Riyaz Ahmad, Narayan Sharma, Upender Pacchnanda, Intesar Suhail, Kasturi Deb, Yash Veer Bhatnagar and Rahul Kaul

Keywords: Conservation status, distribution, hunting, *Tragopan melanocephalus*.

Abstract

In India, western tragopan is reported from Jammu and Kashmir (J&K), Himachal Pradesh and Uttarakhand. We documented the current status and distribution of western tragopan in J&K. We also predicted its potential distribution in the state. We used literature, field surveys and semi-structured questionnaire surveys to ascertain the distribution and conservation status of the pheasant species in J&K. Between 2007 and 2011, we conducted counts of western tragopan in five areas: Tattakuti Wildlife Sanctuary, Khara Galli Conservation Reserve (CR), Limber Wildlife Sanctuary (WLS), Lacchipora WLS and Kazinag National Park (NP) to assess its current status. We estimated 113 callers of western tragopan from Kazinag NP, Limber WLS, Lacchipora WLS, Tattakuti WLS and Khara Galli CR. We also discovered four new sites – Tattakuti WLS and Khara Galli CR (through direct surveys), Noorpur Galli and Narian-Ratannard (through secondary surveys) – of this species. We have confirmed the presence of western tragopan in Lacchipora WLS and re-confirmed its presence in Padder, Bhadarwa and Sudh Mahadev. Our habitat model predicted potential distribution of western tragopan, adding few additional potential sites. There is an urgent need to plan long-term monitoring and initiate appropriate measures to conserve the species.

An innovative approach for delivering academic writing courses

Mihaela Aluas, Camelia Moraru, Markus Rheindorf, Birgit Huemer, Claudiu Filip, Andrei Kelemen and Rodica Loana Lung

Keywords: Academic writing skills, career management, project management, writing instruction.

Abstract

The development of academic writing skills is imperative for graduate students and young researchers who intend to pursue research or a career in academia. However, currently, the curricula in Romanian universities seldom offer support in this area. In this context, we present a four-module programme for delivering academic writing courses that have been successfully implemented in a Romanian university and can be easily replicated. Furthermore, this study provides viable strategies and offers specific and general findings regarding doctoral students' learning needs, challenges and opportunities at the institutional level. **Keywords:** Academic writing skills, career management, project management, writing instruction.

**Advances made in understanding the effects of arsenic exposure on humans Subhajit Das
Sarma, Afaq Hussain and Jayasri Das Sarma**

Keywords: Arsenic, arsenite, arsenate, cytotoxic, genotoxic, carcinogenic.

Abstract

Arsenic contamination of drinking water is a great concern for public health throughout the world. This alarming situation led to many independent research studies but there are only a few studies till date which collectively articulated all studies together with a multidisciplinary approach for better understanding. The present article is an effort towards collating the advances made in understanding the impacts of arsenic toxicity on human beings. It discusses the sources, mobility, sensing and metabolism patterns of arsenic. It also deals with understanding the impact of arsenic toxicity over clinical health, nutritional status, carcinogenicity, genomics, and social and economic status of human beings. Though many evaluative studies have been conducted, there are no easy and effective measures of sensing and remediation available till date. Hence, we conclude that more collective, multidisciplinary, advanced and target-specific studies are essential, the outcome of which can contribute in developing better prevention strategies and technological mitigation programmes for the betterment of human kind.

**Implantation of Heterorhabditis indica-infected Galleria cadavers in the soil for biocontrol of
white grub infestation in sugarcane fields of western Uttar Pradesh, India**

Sharad Mohan, Akanksha Upadhyay, Arohi Srivastava and K. Sreedevi

Keywords: Biocontrol strategy, Galleria mellonella cadavers, Heterorhabditis indica, sugarcane, white grubs.

Abstract

Over the past 10 years, farmers of Uttaranchal and western Uttar Pradesh, India have been fighting a losing battle against the white grub (Coleoptera: Scarabaeidae) infestation of sugarcane crop. Pesticides have failed to address the problem as evident from the observed infestation levels of 10–24 grubs/m². During 2008–2014, the Division of Nematology, Indian Agricultural Research Institute, New Delhi launched a biocontrol project involving treatment of the white grub-afflicted fields with entomopathogenic nematodes (EPNs)-infected Galleria mellonella cadavers. This initiative, spread over the districts of Ghaziabad, Meerut, Amroha, Saharanpur, Gajraula, Bulandshahar and Hapur, was undertaken in collaboration with a non-governmental organization –

the Foundation for Resources Management and Environmental Remediation – and local sugar mills, and by enlisting the active participation of the farming community. It was perceived that this technology had a greater possibility of evolving into a long-term, sustainable biocontrol strategy if the EPNinfected *Galleria* were sourced in each village. Capacity-building programmes were undertaken in the villages with special focus on empowering women, and small and marginalized farmers by educating them on rearing and infecting *Galleria*. This initiative has resulted in an average reduction of 69.1% in the white grub population and an average increase of 60.49 q/acre in sugarcane yield over untreated control.

Microfluidics: a boon for biological research Karthik Mahesh¹ and Sravanti Vaidya

Karthik Mahesh¹ and Sravanti Vaidya

Keywords: Biological research, lab-on-a-chip, microfluidics, microchannels.

Abstract

Microfluidics is an emerging new interdisciplinary field that deals with the manipulation of fluids at the microscale and nanoscale. Having its origins in other areas of science and technology, microfluidics is slowly beginning to make radical changes in various fields of biological sciences. The exclusivity of fluid behaviour at the microscale offers a large number of advantages in biological research such as miniaturization of assays, faster sample processing and rapid detection. This article provides a concise overview of the applications of microfluidics technology in some of the major disciplines of biological research. Furthermore, it also mentions the hurdles that microfluidics is facing and the solutions that are envisaged for the future to make it a widely available, reliable and costeffective technology.

Phylogeny and genetic variation within population of *Tachypleus gigas* (Müller, 1785)

Rengaiyan Periasamy, Baban Ingole and Ram Murthi Meena

Keywords: COI gene, genetic variation, horseshoe crab, phylogeny.

Abstract

Isolated population of Indian horseshoe crabs, *Tachypleus gigas* plays an important role in the ecology of several marine organisms, and is being scrutinized for its abundance and morphology by many researchers. However, limited information is available about its genetic variability and evolution. Samples of horseshoe crab were collected from the east coasts of India and analysed for their phylogenetic relationship, genetic variability and structure within population based on the cytochrome oxidase I (COI) gene sequence. Analysis of molecular variance revealed two groups with significant genetic differentiation indices ($F_{ST} = 0.544$, $p < 0.001$), and the number of migrants (N_m) was estimated as 0.11 individuals per generation. Maximum likelihood results revealed two distinct clusters, showing that the evolution of the Indian population was genetically diverse forming a separate clade from other Southeast Asian populations, moderately with a low gene flow. Considering the ecological, economic and evolutionary significance of *T. gigas* and its declining population, there is a pressing need for conservation measures.

Remote sensing-derived spectral vegetation indices and forest carbon: testing the validity of models in mountainous terrain covered with high biodiversity

Pradeep Kumar and M. K. Ghose

Keywords: Biodiversity, forest carbon, mountain, remote sensing, vegetation indices.

Abstract

Sequestration of carbon through forests is an important aspect in global climate change mitigation. Assessment of carbon in forests using remote sensing and GIS tools is one of the most important

aspects of rapid and verifiable methodologies. A number of studies have shown the utility of spectral (vegetation) indices like NDVI in the assessment of forest carbon. However, there are limitations to this approach. The mountainous topography and high biodiversity affect the spectral values in pixels in multiple ways. The present article aims to test the validity of use of vegetation indices in high-biodiversity forests in mountains by modelling the ground based forest carbon measurement with vegetation indices of NDVI, EVI, SAVI and MSAVI in a multi-sensor, multi-season data environment with multiple regression methods like linear, power, logarithmic, polynomial and exponential. It is found that all the regressions have a poor coefficient of determination not even exceeding 0.2. It is concluded that the remote sensing-based spectral vegetation indices alone cannot be a proxy for forest carbon calculators in high biodiversity mountain forests.

Interactive effects of EDTA and oxalic acid on chromium uptake, translocation and photosynthetic attributes in Indian mustard (*Brassica juncea* L. var. *Varuna*)

Durga Singh, Ashish Agnihotri and Chandra Shekhar Seth

Keywords: *Brassica juncea* L., chromium uptake, chelating agents, photosynthesis.

Abstract

The accumulation and toxicity of chromium (Cr) in Indian mustard (*Brassica juncea* L.) under ethylene diamine tetraacetic acid (EDTA) and oxalic acid (OA) as chelating agents was studied. Plants were exposed to Cr(VI) and chelating agents in four experimental set-ups as Cr(VI), Cr(VI) + EDTA (1 : 1), Cr(VI) + OA (1 : 1) and Cr(VI) + EDTA + OA (1 : 1 : 1), where each set-up comprised of 0, 6.25, 12.5 and 25.0 mg of Cr(VI) and/or chelating agents in 250 g of soil. Results conferred that EDTA augmented bio-concentration factor in all the three doses of Cr(VI), OA considerably increased translocation factor in all the treatments, including control, and the combined application of the two chelates escalated both the aforesaid factors. Moreover, these chelating agents help in ameliorating Cr(VI) toxicity asserted by low degree of lipid peroxidation, insubstantial damage in root and shoot length, fresh and dry biomass, chlorophyll and leaf gas exchange parameters. Besides, plants showed a robust detoxification mechanism primarily by significant ($P < 0.05$) production of reduced glutathione and phytochelatin among other enzymatic and nonenzymatic antioxidants under these chelating agents. The present findings suggest that Indian mustard could be used as a potential phytoremediator of Cr(VI) under the combined application of EDTA and OA.

Lemon cv. Assam lemon (*Citrus limon* Burm.) quality and soil-leaf nutrient availability affected by different pruning intensities and nutrient management

Arkendu Ghosh, K. Dey, N. Bhowmick, S. K. Ghosh, S. Bandyopadhyay, P. S. Medda and A. Ghosh

Keywords: Lemon, nutrient management, pruning, soil-leaf nutrient availability, yield and quality.

Abstract

A field experiment was laid out in two factorial randomized block design with four levels of pruning and seven levels of nutrients, consisting recommended dose of fertilizers and different combinations of organic manure (vermicompost), inorganic fertilizer, bio-fertilizer (azotobacter), mycorrhiza (VAM) and their interaction between 2013 and 2015 on 9-year-old lemon plants. Studies revealed that all physicochemical parameters, viz. fruit weight, puncture force, total soluble solid, total sugar, ascorbic acid were highest in (P3N4) combination of higher level of pruning. However, the maximum availability of leaf and soil nutrients was recorded in N4.

Assessment of climate change impact on rice using controlled environment chamber in Tamil Nadu, India

V. Geethalakshmi, K. Bhuvaneshwari, A. Lakshmanan and Nagothu Udaya Sekhar

Keywords: Ambient and modified environment, climate change impact, elevated temperature, enriched carbon dioxide, rice.

Abstract

Impacts of elevated temperature and carbon dioxide (CO₂) enrichment on rice were assessed by carrying out an experiment with four dates of planting (1 June and 15 June, 1 and 15 July) during 2014 under two different environmental conditions, viz. ambient and modified (climate control chamber) with +4°C compared to the ambient temperature and CO₂ enrichment of 650 ppm. Crops grown under modified environment recorded reduced growth characters (leaf area index, dry matter production, number of tillers m⁻²), lesser dry matter partitioning towards grain, yield attributes (number of productive tillers m⁻², number of filled grains panicle⁻¹) and lower grain yields compared to those grown under ambient condition. Crops subjected to elevated temperature and enriched CO₂ attained panicle initiation, flowering and maturity earlier than those under open ambient condition.

Population differentiation of wheat leaf rust fungus *Puccinia triticina* in South Asia

Pramod Prasad, S. C. Bhardwaj, O. P. Gangwar, Subodh Kumar, Hanif Khan, Shravan Kumar, H. C. Rawal and T. R. Sharma

Keywords: Genetic differentiation, leaf rust, microsatellites, *Puccinia triticina*, virulence phenotype.

Abstract

Leaf or brown rust caused by *Puccinia triticina* (Pt) is one of the most important diseases of wheat. Among the rusts, it is the most ubiquitous in all the wheatgrowing regions and causes considerable yield loss. Microsatellite marker-based genotyping and virulence-based phenotyping of 48 pathotypes of Pt was performed. The pathotypes exhibit low virulence frequencies for Indian leaf rust differentials Lr24, Lr9, Lr10, Lr19, Lr28 and Lr9. Using avirulence/virulence formula six major clusters of pathotypes were observed, revealing high degree of phenotypic variation. Molecular analysis performed using SSR markers showed high genetic diversity among the pathotypes, and grouped them in seven major clusters. The percentage of polymorphic loci ranged from 17.95 to 84.62, Nei's gene diversity from 0.07 to 0.32 and Shannon's information index from 0.11 to 0.47. Analysis of molecular variance revealed significantly high genetic variation within Pt population. Mantel's Z test proved low positive correlation ($r = 0.28$) between virulence and molecular diversity, suggesting independent nature of the duo. These findings offer valuable information for framing suitable disease management strategies through appropriate region-specific gene deployment and improve the understanding of the population biology and evolution of Pt in the Indian subcontinent.

Vision screening results in a cohort of Bhopal gas disaster survivors

Prem Nandhini Satgunam and Leonid Chindelevitch

Keywords: Dry eyes, gas disaster, headache, pinguecula, vision screening, watering.

Abstract

Eye-related symptoms were prominent at the time of and soon after the 1984 Union Carbide gas disaster in Bhopal, India. We conducted a vision screening on the survivors to examine their current ocular status. Fifty-nine patients enrolled. We analysed the results from 48 patients (mean age 51 ± 12 years) who had a documented history of gas exposure. The commonly reported symptoms were vision difficulties (n = 30), watering (n = 21) and headaches (n = 16). Thirty patients needed

spectacles, 30 had cataracts and 17 had pinguecula. We found the prevalence of pinguecula to be significantly higher in this cohort. The need for vision care among this underserved population is highlighted.

Composition and morphology study of acid-digested pond ash

Ritesh Kumar, Sadanand Sharma and Khem Singh

Keywords: Chemical composition, elemental analysis, morphology, pond ash.

Abstract

The present study examines the chemical composition and morphology of raw and acid-digested pond ash samples that were collected from four ash ponds of the Fertilizer Corporation of India Limited, Sindri unit, Jharkhand, India. Scanning electron microscopy and energy dispersive X-ray spectroscopy were used to analyse the four pond ash samples. The aim of the study was to characterize the pond ash samples in order to assess their utilization based on morphological characteristics. Besides, loss-on-ignition and leaching studies (both with distilled water and under acidic medium conditions) were also conducted to understand the mobility of various elements in the leachates. The information provided herein would be useful to clearly understand the difference in the chemical composition and morphology of the raw and acid digested pond ash samples.

Vulnerability of Indian Central Himalayan forests to fire in a warming climate and a participatory preparedness approach based on modern tools

Subrat Sharma and Harshit Pant

Keywords: Climate change, community forest, fire potential index, forest fire, Himalaya.

Abstract

Wildfires have been considered as part of the natural cycle, but the globe is witnessing them more often outside the natural cycle. In recent years, incidences of wild fire/forest fire are increasing globally, and also in India. The Himalayan region is not an exception, where wide inter-annual fluctuations occur in fire events, and a few of them lead to disasters resulting in immediate and cascading social and economic impacts and thus to vulnerability and exposure of Himalayan forests to current climate variability. Mountainous topography and insufficient state resources are a bottleneck to respond to fire disasters. This study analyses the role of climate as a precursor to large-scale forest fires, and the perception of village forest councils on the impact of forest fire and climate change. A framework has been proposed for integration of ground-based observation network and prevailing modern technologies as a mechanism to develop a fire potential index to reduce disturbances and for resource optimization in case of disastrous fires.

Assessment of hailstorm damage in wheat crop using remote sensing

S. K. Singh, Rajat Saxena, Akhilesh Porwal, Neetu and S. S. Ray

Keywords: Crop cutting experiments, hailstorm, rainfall, remote sensing, wheat.

Abstract

Heavy rainfall and hailstorm events occurred in major wheat-growing areas of India during February and March 2015 causing large-scale damages to the crop. An attempt was made to assess the impact of hailstorms in the states of Punjab, Haryana, Uttar Pradesh (UP), Rajasthan and Madhya Pradesh (MP) using remote sensing data. Multi-year remote sensing data from Resourcesat 2 AWiFS was used for the purpose. Wheat crop map, generated by the operational FASAL project, was used in the study. Normalized difference vegetation index (NDVI) deviation images were generated from the NDVI images of a similar period in 2014 and 2015. This was combined with the gridded data of cumulative rainfall during the period. The logical modelling approach was used for damage classification into normal, mild, moderate and severe. It was found that the northern and

southern districts in Haryana were severely affected due to rainfall/ hailstorm. Eastern Rajasthan and western MP were also highly affected. Western UP was mildly affected. Crop cutting experiments (CCE) were carried out in two districts of MP. The CCE data showed that the affected fields had 7% lower yield than the unaffected fields. Empirical yield model was developed between wheat yield and NDVI using CCE data. This model was used to compute the loss in state-level wheat production. This showed that there was a reduction of 8.4% in national wheat production. The production loss estimated through this method matched with the Government estimates.

Parthenium hysterophorus: low cost substrate for the production of polyhydroxyalkanoates

Poorna Chandrika Sabapathy, Sabarinathan Devaraj and Preethi Kathirvel

Keywords: Biopolymer, Bacillus aerophilus, biomass, Parthenium hysterophorus, P3 (HB).

Abstract

Parthenium hysterophorus is considered as one of the most devastating and hazardous weed; abundantly available in several parts of the world, it is utilized as a substrate for the production of polyhydroxyalkanoates (PHA). Bacterial strain Bacillus aerophilus, isolated from oil contaminated soil, was studied for its potential to accumulate PHA. Utilizing this cheap substrate, the highest yield of PHA content obtained was 5.4 g/l PHA with 11.92 g/l cell biomass. PHA produced was extracted using sodium hypochlorite method and the polymer synthesized was characterized as polyhydroxybutyrate (P3 (HB)) by Fourier transform infrared spectroscopy and nuclear magnetic resonance analysis.

Histological localization of fungal endophytes in healthy tissues of Adhatoda vasica

Nees Yash Mishra, Amla Batra and Madan Mohan Sharma

Keywords: Adhatoda vasica, endophytic fungi, histological localization, microtome.

Abstract

A research protocol has been developed to locate endophytic fungi present inside the healthy leaves and stems of Adhatoda vasica using the microtome technique. The surface-sterilized explants after staining with lactophenol cotton blue showed the presence of endophytic fungi in intercellular spaces of ground and dermal tissues. In transverse sections of leaf at 100× magnification, dense blue colonies of endophytic fungi in epidermis and mesophyll region were recorded, while sprinkled colonies were seen in vascular bundles. In transverse sections of stem at 100× magnification, dense colonies of endophytic fungi in phloem and slightly lesser in epidermal region were observed. Scattered colonies were also recorded in xylem and cortex tissues. The fungal colonies were also present in intracellular and extracellular regions of both explants. Further studies will be required to identify these fungal isolates through pure culture on PDA plates to explore their biosynthetic pathway.

Seasonal variation in nearshore wave characteristics off Cuddalore, Southeast coast of Tamil Nadu, India

Basanta Kumar Jena, Sisir K. Patra, K. Jossia Joseph and K. M. Sivakholundu

Keywords: Regression analysis, seasonal variation, spectral energy density, wave characteristics.

Abstract

Wave data collected using wave rider buoy between January 2010 and January 2011 off Cuddalore coast, Tamil Nadu, India, have been analysed season-wise in this study. Wave steepness method was used for the separation of sea and swell wave parameters. Also parameters such as significant wave height of total wave, sea and swell (H_s , H_{sw} and H_{ss}), zero crossing periods (T_z , T_{sw} and T_{ss}) and mean wave directions (θ , θ_{sw} and θ_{ss}) have been studied. The study shows a distinct shift in sea wave direction of about 90° between June and October as well as November and February. Throughout the year, the predominant swell direction remained around 135°. The contribution in

total Hs by Hsw was 76% and the remaining 24% by Hss in the yearly cycle. The sea wave height was dominant by more than 90% during November to May. Regression analysis showed good positive Pearson's correlation of 0.94 between Hs and Hsw; however, it was 0.65 between Hs and Hss. The maximum and significant wave heights of 5.7 and 2.7 m were recorded during cyclone Jal on 7 November 2010.

Mineralogy of the Manipur Ophiolite Belt, North East India: implications for mid-oceanic ridge and supra-subduction zone origin

Thungyani N. Oving, Jyotisankar Ray, Xueming Teng, Biswajit Ghosh, Madhuparna Paul, Proloy Ganguly, Saradee Sengupta and Supriyo Das

Keywords: Mineralogical study, ophiolite belt, pyroxenite mantle dyke, pyroxene thermometry.

Abstract

Mineralogical studies on the mantle and crustal sections of the Manipur Ophiolite Belt (MOB) lead to important findings pertaining to its genesis and controlling tectonic milieu. The wide compositional gap in the Cr# and Mg# content of spinel in the mantle peridotites of MOB implies upper mantle melting in two different tectonic settings. The tectonic discrimination diagrams based on spinel chemistry indicate a midoceanic ridge (MOR) origin for the high-Al spinel peridotites and a supra-subduction zone origin for the high-Cr spinel peridotites. The pyroxenite mantle dyke, ultramafic cumulate and pillow-basalt record temperature in the range of 600–1030°C, 600–800°C and 700–1005°C respectively. Plotting of clinopyroxene composition of pillow-basalt in the TiO₂–Na₂O–SiO₂/100 (wt%) tectonic discrimination diagram, implies a subduction-related origin of the basalts. Experimental studies on the serpentine stability indicate that it was dominantly affected by high temperature/low deformation setting.

Interactions of lion-tailed macaque (*Macaca silenus*) with non-primates in the Western Ghats, India

Joseph J. Erinjery, Honnavalli N. Kumara, K. Mohan and Mewa Singh

Keywords: Inter-specific competition, mixed-species troops, *Macaca silenus*, primate–predator interaction.

Abstract

Primates and non-primates inhabiting tropical forests may interact with each other since they coexist in the same communities. Primates usually interact with their prey, predators, competitors and neutral species. Using 'all occurrence' sampling, we have studied inter-specific interactions of lion-tailed macaques with non-primate species found in their habitat. We observed that the percentage of total time spent on interactions with non-primates was less than 1. Also, the percentage of total time spent in interacting with competitors, predators and neutral species was less than 0.5. The lack of predation pressure and lack of opportunities for mixed-species associations for increasing foraging efficiency appear to be the major reasons for the absence of interactions with non-primates. By comparing with studies from other primate habitat regions, we observed that primates in South Asia interact much lesser with non-primates than those in South America and Africa. A previous study showed that the interactions of lion-tailed macaques even with other primate species in the Western Ghats are less than expected by chance.

Interactive systems regarding global software development and offshoring

Ramzan Talib, Muhammad Yahya Saeed, Muhammad Awais and Kashif Hanif

Keywords: Global software development, information technology, innovation, software services, technology.

Abstract

Modern information technology (IT) methods are reshaping the global market with great success. With today's global software industry, IT has made innovations everywhere, including businesses and consumer practices. This has made developing countries like India and China participate in the global market. This communication focuses on intelligent interacting systems which are present over globe and these are a source of rising the software development cycle with the help of modern communication facilities. Free e-Market globalization is now vital for billions of people. However, IT leadership is not possible without a review of the existing system. The present study is based over the issue of the global market related research, education and investment in IT technology. IT-based-leadership can give sustainable global competitive advantage to our country. So the role of iterative software development is crucial to be targeted in a systematic fashion.

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IBM Fellows – Indian presence

E. C. Subbarao

Keywords: IBM Fellows, Indian presence, research and development, science and technology.

Abstract

Bright researchers with impressive output on a sustained basis need to be identified by clear criteria, encouraged and rewarded with freedom to pursue their interest. How IBM does this is described and naming them IBM Fellows. A remarkable number of IBM fellows is of Indian origin. A road map for progressive Indian industry to encourage innovative research by bright Indians working in India is elaborated as an urgent, worthwhile pursuit to put India and Indian industry on the global innovation map.

Research performance of central universities in India Marisha,

Sumit Kumar Banshal and Vivek Kumar Singh

Keywords: Central universities, publication data, research performance, scientometrics.

Abstract

This article presents the research performance of the 39 central universities in India. The research publication data, indexed in the Web of Science, for the 39 central universities for a 25-year period (1990–2014) are used for analysis. The data are computationally analysed to identify productivity, productivity per capita, productivity per crore rupees grant, rate of growth of research output, authorship and collaboration pattern, citation impact and discipline-wise research strength of these institutions. Research performance of the central universities is measured and compared with two top-ranking world universities, namely University of Cambridge and Stanford University. While older well-established big universities such as University of Delhi and Banaras Hindu University perform better than newer universities, some relatively smaller universities, such as the university of Hyderabad have impressive research performance. What is disturbing is that combined research output of all central universities taken together is less than that of either of University of Cambridge or Stanford University alone. The results also provide discipline-wise research strengths of all the universities.

Adopter categorization of extension professionals vis-à-vis agri-expert systems and factors influencing the adoption

Modem Ravikishore, Purru Supriya and Allan Thomas

Keywords: Adoption stages, agri-expert system, extension professionals.

Abstract

This communication focuses on adoption stages of extension professionals in terms of extent of use of expert systems and factors influencing the extent of adoption of such systems by them, with special reference to agri-expert systems 'KAU-Fertulator' and 'e-Crop doctor' developed by Kerala Agricultural University. A survey was conducted among three targeted segments of Kerala extension professionals with a total of 100 respondents who were actively involved in the field of agriculture, to evaluate questions about the adoption stage of respondents in using agri-expert systems and factors influencing the extent of adoption. Results showed that, extension professionals categorization based on the stage of agri-expert system adoption process. Based on the stage of adoption, respondents were categorized into different adopter categories, which led to comparison with Roger's adopter categorization. Also, innovation proneness was positively and significantly related with extent of adoption expert system among all three categories of respondents. Based on the results, it is imperative to boost the adoption of agri-expert systems by streamlining the basic expert system applications for ease of use.

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Bright researchers with impressive output on a sustained basis need to be identified by clear criteria, encouraged and rewarded with freedom to pursue their interest. How IBM does this is described and naming them IBM Fellows. A remarkable number of IBM fellows is of Indian origin. A road map for progressive Indian industry to encourage innovative research by bright Indians working in India is elaborated as an urgent, worthwhile pursuit to put India and Indian industry on the global innovation map.

Mephedrone – an emerging drug of abuse in India

Ankush Laxman Rathod, Sandeep Singh Sahota and Rakesh Kumar Garg

Keywords: Drug abuse, mephedrone, synthetic cathinone, traffickers.

Abstract

Mephedrone (MEPH) is a synthetic derivative of cathinone, an alkaloid extracted from plant khat. Developed countries like UK, USA, Australia and Israel are the main places of MEPH abuse. Abuse of cathinone and MEPH in India has started recently. The young generation in metropolitan cities like Delhi, Mumbai, Ahmedabad and Panaji is being affected by its abuse. The increasing misuse of MEPH in India was due to its non-inclusion in the Narcotics Drugs and Psychotropic Substances (NDPS) Act, 1985 earlier. Due to the threat of MEPH abuse in the country, the Government of India included it in the NDPS Act from February 2015. Since then, the law enforcement agencies have taken strict action against MEPH users and traffickers. In India, new drugs are rapidly emerging in the market and posing challenges for forensic toxicologists and law enforcement agencies. The seized drugs, urine and blood samples of the abusers are sent to forensic science laboratories for analysis. These samples are first screened by thin-layer chromatography, and then the confirmation and quantitation are done using modern instrumental methods. However, no studies are available in the literature on drug detection in saliva, sweat and other biological materials. Therefore a suitable technique needs to be developed for its detection in biological matrices. Particularly so for a country like India, this drug abuse is constantly increasing. In this article, we deal with the chemistry, pharmacodynamics, drug–herb interaction, metabolic fate (pharmacokinetics), related fatalities, abuse, effects and detection methods of MEPH, to create awareness about this drug abuse in India.

Computational study of intermolecular interactions between α -synuclein fibrils and Tau protein propagating Tau aggregation

Airy Sanjeev and Venkata Satish Kumar Mattaparthi

Keywords: Fibrils, microtubules, intermolecular interactions, neurodegenerative disorders.

Abstract

α -Synuclein is the principal component responsible for the onset of Parkinson's disease, a neurodegenerative disorder. It has been recently suggested that α -synuclein fibrils probably interact with Tau protein, inhibit its function to stabilize microtubules, and also promote Tau aggregation, leading to dysfunction of neuronal cells. Here, we have studied the interactions between α -synuclein fibrils and Tau protein. The results show that the basic region of Tau protein strongly interacts with the C-terminal acidic regions of α -synuclein fibrils, and undergoes conformational change resulting in the formation of seed for assembly of Tau into amyloid-like fibrils.

Comparative analysis of Asian main iron and steel countries' total factor energy efficiency

Chuan Zhang, Weida He and Rong Hao

Keywords: Iron and steel enterprises, total factor energy efficiency, Asian countries, SBM-undesirable DEA model.

Abstract

This article evaluates the total factor energy efficiency, energy conservation potential and emission reduction potential of the typical enterprises in the main iron and steel-producing countries such as China, India, Japan and Korea by applying the SBM-desirable DEA model and the SBM-undesirable DEA model. The findings are beneficial for understanding the development status of the main Asian iron and steel-producing countries. The empirical results indicate that the Chinese iron and steel enterprises in the sample made great progress in terms of the total factor energy efficiency. Korea's POSCO and Japan's JFE Group and Nippon Steel enterprise performed the best in terms of

energy efficiency, energy conservation and emission reduction. The total factor energy efficiency value of India's Tata Steel is comparatively well. It has completed Jamshedpur Works' brownfield expansion project, which help it add eco-efficient products to its portfolio while using fewer natural resources, less energy and less water per tonne of steel produced.

Conceptualization of community-based integrated farming system model design with multi-objective optimization management

Uday Mandal, Rabindra K. Panda, Prasanta K. Mishra, N. M. Alam and Gouranga Kar

Keywords: Integrated farming system, land and water resources management, linear goal programming, multiobjective optimization.

Abstract

Effective utilization of land and water resources is attempted in the present study through an integrated farming system and multi-objective optimization management framework model using goal programming algorithm in a coastal waterlogged paddy area in Odisha, India. A methodology is developed to identify the water harvesting structure locations in the study area using spatial science tool. Due to the uncertainty of parameters and control variables, development of management framework was considered with 85% and 75% probability of rainfall occurrence and runoff generation. To incorporate the uncertainties, a multi-objective linear goal programming optimization model is developed considering the objective of maximizing the net annual return and production subject to optimal allocation of land. While evaluating the model for different water resources scenarios, the net annual return is found to be Rs 4,343,474 and maximum production is 10,424 q from scenario I, whereas maximum production of 10,980 q is obtained in scenario II. Tomato and rice cultivation area increased from 11.47 to 21.43 ha and 8.82 to 10.48 ha respectively in scenario II. The developed methodology shows the potential applicability in similar farming situations in other areas.

A feature extraction method for shearer cutting pattern recognition based on improved local mean decomposition and multi-scale fuzzy entropy

Lei Si, Zhongbin Wang, Chao Tan, Xinhua Liu and Xihua Xu

Keywords: Feature extraction, local mean decomposition, multi-scale fuzzy entropy, shearer cutting pattern.

Abstract

Aiming at accurately identifying shearer cutting patterns, this article proposes a new feature extraction method based on improved local mean decomposition (LMD) and multi-scale fuzzy entropy (MFE). The cubic trigonometric Hermite interpolation was used to calculate local mean and envelope estimate functions to improve LMD decomposition results and a sum of product functions was acquired. Furthermore, MFE, referring to the calculation of fuzzy entropy over a range of scales, was designed to measure the complexity and self-similarity of vibration signals and extract the features from the decomposition results. Subsequently, the obtained feature vectors were fed into two classifiers of support vector machine and back propagation neural network to realize the cutting pattern recognition. The experimental results indicate the applicability and effectiveness of the methodology and demonstrate that the proposed algorithm could perform better in identifying different cutting categories of shearer.

Active northeast monsoon over India during 2015 – an assessment of real-time extended range forecast

D. R. Pattanaik and M. Mohapatra

Keywords: Bi-model average, climate forecast system, extended range forecast, floods, northeast monsoon.

Abstract

Associated with strong El Niño, the southwest monsoon rainfall over India during June to September 2015 was deficit, while the northeast monsoon (NEM) during October to December 2015 over the southern peninsula was very active, particularly during November and early December. Associated with the active phases of NEM, southeast India, especially Tamil Nadu (TN) and Puducherry experienced unprecedented rainfall activity leading to devastating floods over TN, with the megacity of Chennai being the worst affected. The present study discusses the performance of operational extended range forecast (ERF) up to three weeks of this unprecedented NEM rainfall activity over the southern peninsula and TN using the bi-model average (BMA) ERF based on outputs from the Japan Meteorological Agency Ensemble Prediction System and National Centre for Environmental Prediction's (NCEP's) latest version of Climate Forecast System (CFSv.2) coupled model. The BMA forecast captured the likely delay in the onset of NEM over meteorological (met) subdivision TN and associated weak phase of monsoon during October 2015. Similarly, the BMA forecasts also captured the active phases of NEM during November and early December 2015. Although it is difficult to capture the actual magnitude of observed high-rainfall departure over a smaller domain of met-subdivision scale, the BMA-based ERF could capture the active phase of NEM over southern peninsular India, including the met-subdivision TN with a lead time of 1–2 weeks. Quantitatively, the excess NEM rainfall spells during 2015 and particularly that during 5–11 November and 12–18 November 2015 are reasonably well captured in the BMA forecast, although forecast rainfall departure was lower than the actual departure.

Evolution of wetlands in lower reaches of Bagmari–Bansloi–Pagla rivers: a study using multidated images and maps

Debabrata Mondal and Swades Pal

Keywords: Ahiran wetland, fragmentation, green revolution, hydrological alteration, landsat image.

Abstract

Numerous seasonally flooded wetlands in the lower Gangetic floodplain offer unique natural habitat for many migratory bird species due to their geographical location and hydro-ecological functioning. The various developmental projects change the riverine flow regime and cause hydro-ecological modification in the Gangetic floodplain wetland system. This study presents a comprehensive spatio-temporal monitoring of wetland dynamics in the lower segment of the Bagmari–Bansloi–Pagla sub-basin of the Ganga– Bhagirathi rivers using image classification technique and some fragmentation indices. Our results reveal that the land-use conversion and fragmentation processes that affect the wetland landscape are generally represented as the evolution, and consecutive drying and squeezing of wetland patches over the study area. The water-spreading area of the wetlands was highest during 1975 after the construction of the Bhagirathi feeder canal. The situation has worsened since 1980 due to cumulative effects of agriculture after the Green revolution, and the whole landscape has become a fragmented, isolated and agronomically managed wetland.

Estimation of strong ground motion in Southern Peninsular India by empirical Green's function method

K. Sivaram, Maheshreddy Gade, S. T. G. Raghukanth, Utpal Saikia and Nagaraju Kanna

Keywords: Empirical Green's function, ground motion, peak ground acceleration, response spectra, stochastic finite fault model.

Abstract

In the present study, strong motions are estimated at 17 stations in Southern Peninsular India (SPI) for the 7 February 1900 Coimbatore earthquake (Mw 6) using the empirical Green's function (EGF) method. The broadband recordings of three small earthquakes of ML 3.5, 2.9 and 3.0 respectively, are taken as EGFs to simulate ground motion. The slip distribution of the main event is considered as a von Karman random field. The stress drops of the three small events estimated from finite fault stochastic seismological model lie between 130 and 140 bars. The peak ground acceleration (PGA) values, an ensemble of acceleration time histories and response spectra, are estimated at all the 17 stations using corresponding EGFs, and the mean response spectra are reported. Another estimate of PGA is also obtained using the stochastic seismological model. The estimated PGA values from the two methods are compared to check the consistency of the results. It is observed that the mean PGA values are within the bounds of the maximum and minimum PGA values obtained from the EGF method, while the differences at some stations can be attributed to the local site conditions. The ground motions simulated in the present study can be used to perform nonlinear dynamic analysis for future and existing structures in the SPI region for any event of magnitude Mw 6.

Comparative analysis of spectral characteristics of EO-1 ALI and Landsat 8 OLI imagery

Xuehong Zhang and Lixin Shi

Keywords: Top-of-atmosphere reflectance, spectral characteristics, image pairs, vegetation index.

Abstract

Landsat 8 (L8) is the only normally operating Landsat satellite at present, and the Earth Observing One (EO-1) Advanced Land Imager (ALI) was the prototype for operational land imager (OLI) on-board the L8 satellite. To comprehend well the differences in spectral characteristics between the two sensors, six nearly simultaneous image pairs were selected, which included five land-cover categories: water, bare soil, vegetation, manmade and rock. Moreover, comparisons of spectral characteristics were made through orbital parameters, imaging parameters, spectral response characteristics and spectral characteristics. Finally, the mutual quantitative relations were built up among these image pairs. The results demonstrate that Landsat 8 OLI and EO-1 ALI have similar orbital parameters. With regard to the imaging and spectral response characteristics, the top-of-atmosphere (TOA) reflectance and normalized difference vegetation index (NDVI) of EO-1 ALI are slightly different from those of L8 OLI, but there is a high correlation between EO-1 ALI and L8 OLI of TOA reflectance and NDVI, with the coefficients of determination ranging from 0.962 to 0.994. Therefore, the TOA reflectance and NDVI images from the two sensors are complementary.

Geomorphic evidence of late Quaternary displacement of the Karakoram Fault in Nubra and Shyok valleys, Ladakh Himalaya

Wataro Imsong, Falguni Bhattacharya, Rajeeb Lochan Mishra and Sarat Phukan

Keywords: Alluvial and bedrock streams, geomorphic evidence, morphometry, right lateral displacement.

Abstract

The present study ascertains the spatial variability in the extent of activity of the Karakoram Fault (KF) in Nubra and Shyok river valleys (Karakoram), which was known to be active during the

Holocene. Towards this we have used conventional morphometric indices supported by geomorphological observations on the pattern of alluvial and bedrock streams, alluvial fan geometry and moraines. The right lateral displacement associated with KF is geomorphologically expressed by the lateral deflections of the bedrock and alluvial streams toward northwest–southeast as they cut across the Fault. Indirect age estimates inferred based on slip rate of KF suggest that the deflection of bedrock streams with prominent shutter ridges is the cumulative expression of activity of KF since the middle Pleistocene, which continued till the late Holocene.

Magnetic susceptibility as a proxy for pollution in Triveni-Bandel area, Hooghly district, West Bengal, India

Supriya Mondal, Saurodeep Chatterjee, Rimjhim Maity, Debesh Gain, Ayanangshu Das and Saikat Sinha

Keywords: Bandel, fly ash, magnetic proxies, magnetic susceptibility, pollution.

Abstract

Department of Geological Sciences, Jadavpur University, Kolkata 700 032, India This study aims at tracing the distribution and concentration of contaminants in fly ash along roads and highways with appreciable traffic by using magnetic proxies. Magnetic susceptibility is used for pollution mapping in the field. The distribution of susceptibility values represents polluted areas strongly influenced by traffic frequency, roadside topography, meteorological conditions (e.g. wind direction) and other factors. A magnetic phase was found to be responsible for the enhancement of magnetic signal in roadside ash. Magnetic methods provide effective tools for delineation of industrial pollution such as fly ash. In the area studied, magnetic susceptibility proved to be an excellent proxy for analysis of intensity of pollution yielding interesting results.

Generation and evaluation of nanoparticles of supernatant of *Photorhabdus luminescens* (Thomas and Poinar) against mite and aphid pests of cotton for enhanced efficacy

Ramesh A. Kulkarni, A. Prabhuraj, J. Ashoka, S. G. Hanchinal and Sharanagouda Hiregoudar

Keywords: Aphid, cotton, mite, nanoparticles, *Photorhabdus luminescens*.

Abstract

Cell-free supernatant of *Photorhabdus luminiscens* was converted to nanoparticles (NPs) using a spray dryer fitted with ultrasonic nozzle. NPs were characterized by both scanning electron microscopy and zeta size analyser, and found to have average particle diameter of 89 nm. While converting to NPs, gum arabica @ 3% was used to eliminate hygroscopic property. Nanoparticulated supernatant exhibited superior pesticidal property against serious sucking pests of cotton, viz. *Tetranychus macfarlanei* and *Aphis gossypii*. On mites, NPs of *P. luminiscens* recorded lower median lethal concentration (LC50 : 0.0001 ppm) compared to normal form (8.36×10^2 ppm) within 12 h of exposure. Similarly, on aphids, lower LC50 (LC50 : 0.0027 ppm) was recorded by NPs compared to normal form (LC50 : 2.12×10^3 ppm). High mortality coupled with quick action emphasizes the potential of nanotechnology in enhancing the pathogenicity of a microbial pesticide.

Detection of harmful adulterants in milk supplied to Delhi, India

Brototi Roy, Jyoti Singh, Sonali Sunsunwal, Gunjan Dayal, Binduma Yadav, Chitra Bhardwaj and Ankita Teotia

Keywords: Adulteration, ammonium sulphate, detergent, neutralizer, skimmed milk powder, urea.

Abstract

Milk adulteration is a serious problem in developing countries. It cheats the consumers and poses a serious threat to their health. The present qualitative analysis was undertaken to study the presence

of adulterants in milk supplied to Delhi and adjoining regions (Faridabad, Gurgaon and Noida). A comparative analysis was carried out for the extent of different adulterants present in both packaged and locally available milk samples. Seventy five milk samples were tested for the presence of neutralizers, skimmed milk powder, urea, detergent and ammonium sulphate. Most milk samples collected from Delhi and adjoining regions tested positive for neutralizers and skimmed milk powder. In addition, some samples also tested positive for detergent, urea and ammonium sulphate. Considerable number of unpackaged milk samples showed presence of ammonium sulphate and detergents compared to packaged ones. Surprisingly, urea was present only in packaged samples.

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Plagiarism, research publications and law

R. Saha

Keywords: Copyright, intellectual property, law and ethics, plagiarism, scientific research.

Abstract

Plagiarism in scientific research has, in recent times, become a topic of discussion and concern in India. The core level of discussion has largely been driven by ethical considerations rather than by the relevant laws existing in the country such as the Copyright Act. Ethics can mean different things to different people and therefore issues related to legitimacy of one point of view as against another will always remain debatable. Punitive actions purely based on ethics may not be acceptable to all and may be difficult to implement, unless supported by law. Plagiarism is stealing someone's intellectual property, which is legally and morally untenable. In addition, it can cause economic disadvantage to the original author. The issue of plagiarism needs to be handled at a much higher level of academic, legal, political and social debate for enhancing the image of Indian research.

Towards health for all: cost-effective and innovative treatment of diabetes shows the pathway

P. C. Kesavan and M. S. Swaminathan

Keywords: Adverse side effects, anti-diabetic drugs, cost-effective treatment, diabetes type-1 and 2, grand health insurance model, health for all, TAG-voluntary health service.

Abstract

While the M.S. Swaminathan Research Foundation (MSSRF) has been developing and refining ecofriendly and socially inclusive strategies to achieve a 'zero hunger' India, the 'Voluntary Health Service' (VHS) in the neighbourhood of MSSRF has been focusing on providing quality health care to patients who are too poor to get medical treatment as those with adequate means. On the food front, it is remarkable that India has implemented the 'Right to Food Act 2012' with homegrown food through scientific endeavours and accomplishments. The situation with health care and medical treatment is quite different with the drugs developed by multinational companies, their undesirable side-effects as well as their cost beyond the means of millions of Indians. Under these circumstances, particularly with regard to the treatment and management of both type-1 and type-2 diabetes, the TAG-VHS Chennai, has already made remarkable progress. Towards the goal of successful treatment and sustainable management of diabetes, the TAG-VHS has introduced cost-effective integrative system of medicines (ayurveda, dynamic acupuncture mediated metaphysical energy-healing therapies and limited use of relatively safer allopathic drugs). The validation of the effectiveness of various combinations and modalities of the systems of medicine is based on the 'treatment outcome' without adverse side effects. The limitations of randomized clinical trials are discussed with examples and scientific references. Even though TAG-VHS employs cost-effective treatment schedules, there is still the need for necessary financial base. In

order to create this financial support base, it has also innovated a scheme called the 'Grand Health Ensurance' (GHE) that is a revolutionary, completely transparent and inclusive health ensuring model where the affordable persons pay 1% of their total income per annum which automatically covers Health Ensurance of 1–2 persons for 1 year. This paper discusses how the cost-effective, harmful sideeffects-free integrative systems of medicine coupled with GHE would provide a sustainable path to achieve the goal of 'health for all'.

Production and conservation of medicinal plants in understory of degraded Chir pine forests using sustainable techniques

Chandra Shekhar Sanwal, Raj Kumar, Sneha Dobhal, Sushma Kerkatta and S. D. Bhardwaj

Keywords: Chir pine, degraded forest, medicinal plants, production and conservation, sustainable management

Abstract

In general, little emphasis is given on the production of medicinal plant species for sustainable harvest and conservation in the understory of degraded forests. For instance, forests like chir pine which are not managed to grow any medicinal plants, offer an opportunity to produce and conserve native medicinal plants. This article highlights a study focusing on the production of medicinal plants in association with Chir pine forests, involving sustainable management techniques like minimum tillage and selecting suitable aspects for the sustainable harvest and conservation of plants under the canopy of trees. The medicinal plants were grown on three topographical aspects – Northern, NorthWestern and Western by adopting three tillage depths, viz. minimum (0 cm), medium (up to 10 cm) and deep tillage (up to 15 cm), in open and below tree canopy conditions. From yield and economic point of view, *Andrographis paniculata*, *Mucuna pruriens*, *Solanum khasianum* and *Spilanthes acmella* were found to be better yielding and more remunerative in comparison to *Withania somnifera*, *Cymbopogon nardus* and *Ocimum basilicum*, when grown outside the tree canopy adopting deep tillage on the Western aspect in Chir pine forests. The study can also be applicable to the other parts of the country to produce and conserve native medicinal plant species using sustainable management techniques like minimum tillage in blank patches or understory of the degraded forests.

Role of soil physical properties in soil health management and crop productivity in rainfed systems-I: Soil physical constraints and scope

C.K. Indoria, K. L. Sharma, K. Sammi Reddy and Ch. Srinivasa Rao

Keywords: Rainfed agriculture, soil physical properties, soil physical constraints.

Abstract

Soil physical degradation has become a serious problem in both rainfed and irrigated areas of India. According to an estimate, about 90 m ha area is experiencing soil physical constraint in the country. In rainfed regions, among several other constraints related to crop and climate, soil physical constraints are the key which severely limit crop productivity. The predominant soil constraints which are governed by the principles of soil physics include subsurface hard pan and compactness, crusting and hardening, slow and high permeability, non-optimal porosity, poor soil structure, poor water receptivity, retention and transmission, etc. It is now well-established that unless the soil physical environment is maintained at its optimum level, the genetic yield potential of a crop cannot be realized even when all the other requirements are fulfilled. The optimum soil physical environment creates a suitable condition for better crop production both in irrigated and rainfed regions. Rainfed agriculture, often referred to as dryland agriculture, is practiced in areas that are relatively warmer (arid, semi-arid) and dry sub-humid regions of the country. These regions are

highly diverse, ranging from resource-rich areas with good agricultural potential to resource-constrained areas with a much more restricted potential. These regions represent a wide variety of soil types, agroclimatic and rainfall conditions. This article discusses the soil physical constraints in rainfed regions of India.

Wound healing materials – a perspective for skin tissue engineering

Poulami Basu, U. Narendra Kumar and I. Manjubala

Keywords: Extra cellular matrix, polymer dressings, skin injury, wound healing.

Abstract

Skin injury and wound healing are complex biological and intricate processes that involve activation of intercellular pathways, co-ordination of tissue integrity and homeostasis. The wound can be acute and chronic depending upon the nature and depth of the injury. A wide variety of dressing materials is available to enhance the wound healing process. An ideal dressing should act as a three-dimensional template which can mimic extracellular matrix, be biologically stable, flexible and can remove wound exudate by providing a moist environment to the wound site. It should form a protective bed to cover the wound from external hazards. This article presents a review of wound dressings made of natural and synthetic polymers or a combination of both. A variety of commercial wound healing materials is discussed briefly.

Soil degradation effect on soil productivity, carbon pools and soil enzyme activity Narendra

K. Lenka, S. P. Jaiswal, J. K. Thakur, S. Lenka, A. Mandal, A. K. Dwivedi, B. L. Lakaria, A. K. Biswas, A. K. Shukla and D. S. Yashona

Keywords: Labile carbon, soil degradation and productivity, soil microbial biomass, soil physical properties.

Abstract

Land degradation is one of the major causes of decline in soil productivity. However, the quantitative relationship between degradation and productivity is not fully understood in soils of India. Thus, an experiment was conducted under a range of native soil organic carbon (SOC) levels in two soil types (Inceptisol and Alfisol) of subtropical India. The SOC content under the treatments was 1.61%, 1.01% and 0.77% in Inceptisol and 0.36%, 0.25% and 0.21% in Alfisol under C1 (undepleted soil), C2 (low depletion) and C3 (medium depletion) treatments respectively. Soybean was grown under each SOC level, with four management practices, viz. (1) control, (2) recommended dose of fertilizers (RDF) + 10 Mg farmyard manure (FYM) ha⁻¹, (3) 20 Mg FYM ha⁻¹ and (4) 150% RDF, in three replicates in a factorial completely randomized design. Results indicated significant and positive effect of both SOC and management treatment on plant biomass yield, labile (KMnO₄ oxidizable) carbon, soil microbial biomass carbon (SMBC), dehydrogenase activity, soil bulk density (BD) and penetration resistance (PR). The plant biomass reduced by 45% and 29% under C3 (compared to C1) in Inceptisol and Alfisol respectively. The effect of SOC depletion was conspicuous in Inceptisol. The labile C reduced by 47% and 16% under C3 in Inceptisol and Alfisol respectively. SMBC showed a corresponding decrease of 33% and 29%. The soil physical properties, viz. BD and PR showed conspicuous effect of SOC depletion. PR increased by 324% and 75% for Inceptisol and Alfisol respectively.

Determinants of occupancy and burrow site selection by Indian crested porcupine in Keoladeo National Park, Bharatpur, Rajasthan, India Aditi Mukherjee, Honnavalli Nagaraj Kumara and Subramanian Bhupathy

Keywords: Burrows, *Hystrix indica*, occupancy modelling, site selection, spatial occupancy.

Abstract

We examined factors responsible for spatial occupancy and burrow site selection for permanent occupancy by Indian crested porcupine in Keoladeo National Park, Bharatpur, Rajasthan, India. We employed

occupancy framework to examine a priori hypotheses and to obtain detection histories of faecal droppings and burrow occurrence. The detection probability ($0.19 \pm 0.05SE$) and occupancy ($0.28 \pm 0.05SE$) of burrow sites were lower than those of faecal deposits ($0.33 \pm 0.029SE$ and $0.71 \pm 0.06SE$) respectively. The rodents avoided areas with water cover and selected those closer to the boundary of nearby agricultural fields at higher elevation as burrow sites. None of the considered covariates influenced their spatial occupancy. This study infers the strategic placement of burrows by these apex ecosystem engineers, also providing crucial ecological niche for various other co-occupants.

Morphology and miscibility of chitin– polyaniline blend

A. T. Ramaprasad and Vijayalakshmi Rao

Keywords: Biopolymer, blending, chitin, miscibility, polyaniline.

Abstract

In this article, we discuss the blending of chitin with polyaniline (PANI) and its miscibility. Miscibility of the chitin–PANI blend has been studied by solution viscometry, Fourier transform infrared (FTIR) spectrum and scanning electron microscope (SEM) techniques. From viscosity measurement Krigbaum and Wall polymer–polymer interaction parameter (Δb) is calculated; it is found to be positive for all compositions of the blend. From FTIR analysis, probable interaction is predicted. Viscosity measurement of chitin and PANI blends shows a linear relationship between intrinsic viscosity and blend composition with a positive deviation from the theoretical value and positive value of Δb refers to the miscibility of the blend system. From SEM studies, blends having 5% lithium chloride (LiCl) show a homogeneous and continuous structure. Blends having less than 5% LiCl show a homogeneous and fibrillar structure, which is further supported by atomic force microscopy studies. Fibrous structure improves as the amount of PANI increases. FTIR analysis confirms the interaction between chitin and PANI. Further, this result is supported by DSC, TGA, XRD and dissolution studies of the blend.

Geochemical tracers of buried estuary of Rushikulya River from Odisha, east coast of India

Saju Varghese, Subhasis Roychaudhuri, P. A. Mohammed Mashood and Sachin Tripathi

Keywords: Estuary, geochemical analysis, sand ridge, sedimentological studies.

Abstract

The sediments of the inner to middle shelf region of the central part of the east coast of India immediately near the growing spit of the Rushikulya River mouth, are characterized by very hard, compact, dark gray clayey silt and clay with medium to coarse sand and wood piece layers at different levels. Maximum output of the Rushikulya River during monsoon season is marked by thin layers of coarse to medium sand at different subsurface levels below the sea floor within the inner to middle shelf areas. Geochemical analysis (major and trace elements) of seabed sediments shows significant correlation with aluminium. Variation in other elements, except calcium and barium confirm their association with aluminosilicate minerals. The higher concentration of Ti-rich heavy minerals near the coast in front of the Rushikulya River is inferred due to terrigenous supply by the river. The REE analysed in the carbonaceous clays indicates enrichment of ΣREE in the sediments, which is interpreted as due to the absorption of REE into the lattices of clay from sea water. Intermittent layers of carbonaceous clay with abundant wood pieces along with the presence of H₂S and the enrichment of REE in the clay provide indirect evidences for the presence of a buried estuary in front of the Rushikulya River at different subsurface levels. The growing spit towards the northeast direction at the river mouth further acts as a favourable geomorphologic feature for the formation of an estuary in the study area. Presence of a reworked palaeosand ridge located between 54 and 57 m water depth is characterized by selective elimination of elements from the sediments. Furthermore, this sand ridge acts as the boundary for the buried estuary identified in the study area.

DNA forensics in combating food frauds: a study from China in identifying canned meat labelled as deer origin

Mukesh Thakur, Ruheena Javed, Ved Prakash Kumar, Malay Shukla, Neha Singh, Aishwarya Maheshwari, Nipun Mohan, Dong-Dong Wu and Ya-Ping Zhang

Keywords: Canned food, DNA forensics, food frauds, mitochondrial genes, species identification.

Abstract

Now-a-days processed and canned food products are consumed in increasing quantity in all developing and developed countries following changes in human lifestyle. However, customers are often fooled by products they buy and such frauds frequently go unreported since species identification requires technical inputs and considerable time and efforts. We bought two canned meat packets labelled as 'classic delicious deer meat' from Shanghai Pudong International Airport, Shanghai (People's Republic of China) to understand its origin as deer meat is legally prohibited in many parts of the world. In this study, we screened these samples with DNA barcoding approach using conserved mitochondrial genes. Homology search on NCBI and phylogenetic analysis identified these samples to have originated from a domestic pig of China. We propose that the methodology used is appropriate for identifying the processed and canned food products and further suggest to check the labelling regulations to guarantee the protection of consumers' rights.

Moisture index during the last two centuries inferred from tree growth in the western Himalaya, India Somaru Ram and H. P. Borgaonkar

Keywords: Moisture and heat indices, rainfall, temperature, tree rings.

Abstract

In the present study, a regional tree-ring chronology prepared from two species (*Picea smithiana* and *Cedrus deodara*) over the western Himalaya has been used in relation to climate fluctuations. This analysis shows that moisture index and rainfall during February to May have significant positive relationship, whereas temperature and heat index show a negative relationship with tree growth. However, moisture and heat indices show greater impact on tree growth than rainfall and temperature. The strong association of tree-ring chronology with moisture demonstrates that tree rings are much more sensitive to the availability of moisture at the root zone, which enabled us to extend our analysis back to AD 1789; in the present reconstruction, moisture deficiency for two consecutive years was noticed during 1846–1847, 1908–1909, 1921–1922, 1931–1932, 1947–1948 and 1966–1967.

Seed desiccation responses in *Saraca asoca* (Roxb.)

W.J.de Wilde T. M. Prajith and C. Anilkumar

Keywords: Critical moisture content, desiccation, germination, *Saraca asoca*.

Abstract

Saraca asoca is one among the 36 endangered medicinal plants of South India. As seeds are the main propagule with short viability, the present study has been carried out to assess the level of dehydration tolerance as a prerequisite to maintain extended viability. The viability and vigour of the seeds declined when their moisture content was reduced by different methods of desiccation. The critical moisture content (CMC) of the seeds was found to be 45–46%. Irrespective of the method of drying, dehydration of seeds resulted in the loss of viability, confirming their recalcitrant nature. Desiccation responses were investigated by exposing the seeds to five different conditions: (a) $30^{\circ} \pm 2^{\circ}\text{C}$, (b) silica gel, (c) $40^{\circ} \pm 2^{\circ}\text{C}$, (d) $20^{\circ} \pm 2^{\circ}\text{C}$ and (e) $0^{\circ} \pm 2^{\circ}\text{C}$. The duration for reaching the critical moisture level was the longest in seeds kept in an air-conditioned room ($20^{\circ} \pm 2^{\circ}\text{C}$) and minimum for those kept in a freezer ($0^{\circ} \pm 2^{\circ}\text{C}$). The lowest critical moisture level (36.3%) was

observed in silica gel and highest (49.2%) under freezer condition. Both the attainment and level of CMC showed marked variation under different desiccation treatments, which indicates the influence of storage temperature on CMC of *S. asoca* seeds.

Biomass equations and assessment of carbon stock of *Calligonum polygonoides* L., a shrub of Indian arid zone

G. Singh and Bilas Singh

Keywords: Allometric equation, arid region, biomass allocation, carbon stock.

Abstract

Biomass equations of *Calligonum polygonoides* L. were derived for the arid districts of Rajasthan, India for assessment of carbon stock. Plants varied spatially in growth and biomass (0.03–54.19 kg/plant). Contribution of stems and roots was 45.7% and 48.0% of total biomass respectively. Nonlinear models were found to be the best in predicting biomass of stems, roots, above-ground and total biomass of *C. polygonoides* using collar diameter as the predictor. Carbon concentration was highest in twigs followed by stems, roots and leaves. Carbon density due to this species ranged between 0.37 and 1.84 t/ha. Conclusively, collar diameter alone is sufficient to predict the biomass of different components of this plant. Varying climatic and human-induced stresses were found to affect the biomass and carbon sequestration by this species.

Seed desiccation responses in *Saraca asoca* (Roxb.)

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Keywords: Critical moisture content, desiccation, germination, *Saraca asoca*.

Abstract

Saraca asoca is one among the 36 endangered medicinal plants of South India. As seeds are the main propagule with short viability, the present study has been carried out to assess the level of dehydration tolerance as a prerequisite to maintain extended viability. The viability and vigour of the seeds declined when their moisture content was reduced by different methods of desiccation. The critical moisture content (CMC) of the seeds was found to be 45–46%. Irrespective of the method of drying, dehydration of seeds resulted in the loss of viability, confirming their recalcitrant nature. Desiccation responses were investigated by exposing the seeds to five different conditions: (a) $30^{\circ} \pm 2^{\circ}\text{C}$, (b) silica gel, (c) $40^{\circ} \pm 2^{\circ}\text{C}$, (d) $20^{\circ} \pm 2^{\circ}\text{C}$ and (e) $0^{\circ} \pm 2^{\circ}\text{C}$. The duration for reaching the critical moisture level was the longest in seeds kept in an air-conditioned room ($20^{\circ} \pm 2^{\circ}\text{C}$) and minimum for those kept in a freezer ($0^{\circ} \pm 2^{\circ}\text{C}$). The lowest critical moisture level (36.3%) was observed in silica gel and highest (49.2%) under freezer condition. Both the attainment and level of CMC showed marked variation under different desiccation treatments, which indicates the influence of storage temperature on CMC of *S. asoca* seeds.

Physiological responses of osmopriming and hormonal treatments in two contrasting mungbean (*Vigna radiata*) cultivars

N. Bharadwaj, S. Barthakur and N. Gogoi

Keywords: Germination, mungbean, morpho-physiological characteristics, priming treatments.

Abstract

The present study was conducted to identify the effects of some priming treatments, viz. polyethylene glycol (PEG), indole-acetic acid (IAA), abscissic acid (ABA), PEG + IAA, PEG + ABA on germination and seedling growth in two commonly grown mungbean cultivars, Pratap and IPM99-125 which differed in their response to drought. Primed seeds were further fed for evaluation of different seedling morphophysiological characteristics. The study confirms the positive effect of

priming on germination stage of mungbean, irrespective of the cultivars. Significant differences were noted for the applied treatments in both the cultivars, the best being PEG and PEG + IAA for cultivar Pratap (drought-resistant) and IPM99-125 (drought-susceptible) respectively.

Improvement in productivity and economics of major food production systems of India through balanced dose of nutrients

Raghuveer Singh, N. Ravisankar and Kamta Prasad

Keywords: Agronomic efficiency, food systems, nutrient application, partial factor productivity, productivity and economics.

Abstract

Increasing the nutrient use efficiency in major food production systems has always been a major concern because of escalating costs of production of crops, especially with regard to nutrient management. 'Researcher-designed farmer managed trials' were conducted during 2013–14 through farmer participatory research covering the major food production systems in India. A total of 144 trials in rice–rice, 156 in rice–wheat, 48 in rice–green gram and 60 in maize–wheat systems were conducted with 7 treatments. Across the various National Agricultural Research Project zones and cropping systems, farmers applied 29%, 25%, 71% and 100% lower level of N, P₂O₅, K₂O and micronutrients respectively, than the recommended dose. Application of recommended dose of NPK + deficient micronutrients in all the systems recorded higher yield over farmer package. Balanced application of recommended NPK + deficit micronutrients gave additional yield. The increase in agronomic efficiency (AE) of nitrogen (two times on an average), phosphorus (45%) and potassium (60%), partial factor productivity and relative response was also observed with the balanced application compared to N, NP and NK alone. Higher increase of AE of N and P was observed in rice–rice system while AE of K was observed in rice–wheat system. Increase in net returns was found to be 24.9%, 63.3%, 27.4% and 92.2% with the application of NPK + deficient micronutrients over farmer practice in rice–rice, rice–wheat, rice–green gram and maize–wheat systems respectively, whereas the increase in cost of cultivation due to addition of P, K and micronutrients was found to be only 4.8%, 7.3%, 13.0% and 17.9% for the respective systems.

Scanning electron microscopic study of caprine intestine with special reference to gut-associated lymphoid tissues

Chandan Kumar Gautam, Manmath Talukdar, Kabita Sarma and Nagendra Nath Barman

Keywords: Goat, gut-associated lymphoid tissue, intestine, scanning electron microscopy, villi.

Abstract

The intestine of adult indigenous goat of Assam (*Capra hircus*) was studied by scanning electron microscopy (SEM) for elucidating the morphology of intestinal mucosa as well as the morphology of gut-associated lymphoid tissue including Peyer's patches (PP) and solitary lymphoid nodule. SEM of intestines revealed the presence of villi in the small intestinal mucosa. Goblet cells were noticed as white pinheads on the villus surface between the enterocytes. The large intestinal mucosa of adult Assam local goat was devoid of villi. SEM of small intestinal mucosa revealed leaf or finger-like absorptive villi covering PP. Even the dome villi were completely covered by absorptive villi and were shorter than the absorptive villi. The absorptive villi in all segments of the small intestine had numerous microvilli. The interfollicular region had high endothelial venules. Propria nodules were lymphoid nodules predominantly in lamina propria and covered by distinct follicle-associated epithelium which lacked goblet cells and openings to deep invaginations into the mucosa.

Population implosion and the model of cavitation applied to demography

Gheorghe Săvoiu and Ion Iorga Simăn

Keywords: Cavitation phenomenon, risk of cavitation, cavitation coefficients, implosion, demography.

Abstract

Based on the hypothesis that in all states of flux (including demographic flux), as in all liquids, the phenomenon of cavitation appears when the local (or demographic) pressure decreases below the vaporization value (the demographic point of survival) respectively, under the saturation pressure (defined by the fertility rate), at the given temperature of gases (general demographic conditions), dissolved in the liquid. This paper presents and analyses cavitation phenomenon as a powerful, rather than merely a potential, demographic model. The structure of this paper could be considered as a succinct three-section solution to describe the evolution from the demographical explosion of the entire world to the demographical implosion of the whole of Europe during the next three or four decades, in a number of population trends. Some final remarks underline the importance of cavitation model and its applied version in demographic implosion, as well as evaluation of the risk of cavitation and computation of cavitation coefficients in demography.

Insights into the mechanism of lignocellulose degradation by versatile peroxidases

Aarthi Ravichandran and Manpal Sridhar

Keywords: Lignolytic enzyme, lignin degradation, ruminant nutrition, white rot fungi.

Abstract

Lignocelluloses are imperative structural components of plant cell wall and are profusely found in agricultural crop residues. The structural heterogeneity and recalcitrance of lignin limit the accessibility of cell wall carbohydrates for constructive exploitation. During the past decades, diverse lignin degrading enzymes were characterized to facilitate the utilization of lignocellulosic biomass for technological applications. Versatile peroxidases are unique among ligninolytic enzymes for their remarkably high redox potential and ability to oxidize lignin without the requisite of redox mediators. The hybrid structural architecture of this enzyme bearing functional features of lignin peroxidase and manganese peroxidase demonstrates its versatility in aromatics oxidation. This review summarizes the distinctive structural aspects of fungal versatile peroxidase in correlation to its oxidation of aromatic substrates besides emphasizing on the catalytic environment conducive for substrate oxidation. This review also focuses on the general strategies employed for production of this enzyme, its molecular framework, potential biotechnological applications of versatile peroxidase and prospects on enhancing the production of enzyme. Finally, the significance of this enzyme in improving the nutritive value of crop residues to promote ruminal productivity is highlighted.

Transgenics in ornamental crops: creating novelties in economically important cut flowers

Rishu Sharma and Yalek Messar

Keywords: Cut flowers, ornamental crops, novel traits, transgenics.

Abstract

Development of transgenics is the need of the modern era of plant breeding, as they possess the potential to incorporate those characters in crop varieties which are either difficult or impossible through conventional breeding approaches. In case of ornamental crops, the progress made in transgenic breeding is not that impressive like in cereals, pulses and vegetables, but the initiatives

taken and advancements made have implicated the bright future of this technology in ornamental crops. Improved morphology, flower colour, resistance and fragrance are some of the desired novel traits in ornamental crops where transgenic approaches need to intervene. Transgenic breeding in major cut-flower crops like rose, chrysanthemum, gladiolus and carnation has provided avenues for incorporation of novel traits in other ornamental crops as well and has made such crops an ideal target for application of other advanced technologies.

Spatio-temporal organization and biomass dynamics of plant communities in a dry tropical peri-urban region: deterministic role of alien flora in anthropo-ecosystems

Shachi Agrawal and Rup Narayan

Keywords: Aboveground and belowground biomass, alien flora, anthropo-ecosystems, exotics, peri-urban regions.

Abstract

The species nativity, growth form, habit, invasion status, aboveground biomass (AGB) and belowground biomass (BGB) distribution and soil characteristics across six diverse habitat conditions were studied in a peri-urban region in Indian dry tropics to understand their deterministic impact on vegetation structure. Eighty-seven plant species, predominantly annuals (67%), belonging to 28 angiosperm families were recorded. Among them, 89% were exotics (largest of American and Asian origins) and 48% of the exotics were invasives while 16% were naturalized. AGB of annuals was higher than perennials, but the difference in their BGB was insignificant. Compared to natives, the exotics had higher AGB and BGB. Among them, the AGB species of South America, Asia and the Indian subcontinent had higher AGB, but the order was reversed in case of BGB. Similarly, AGB of invasives was higher than natives, but they showed comparable BGB. 'Non-native annual forbs' were the most dominant functional groups in terms of both AGB and BGB. The ordination results varied with plant BGB and AGB. Canonical correspondence analysis indicated dominant role of exotic invasives (mainly of American and European origin) and significant influence of soil organic carbon (SOC) and total nitrogen on vegetation organization. At lower SOC, AGB and BGB were comparable for both native and exotics. However, with the increase in SOC, native AGB and BGB declined, whereas AGB of nonnative species increased. In conclusion, the study revealed large intrusion of alien floras into anthropoecosystems in Indian dry tropics, which significantly impacted structure and ecological processes both aboveground and belowground, as against better adaptation potential of the natives belowground.

A 'six-step-strategy' to evaluate competence of plant growth promoting microbial consortia

N. Mishra and S. Krishna Sundari

Keywords: Bioassay, consortia combinations, plant growth promoting microbes.

Abstract

In this study a stepwise, statistically verifiable scientific protocol – 'six-step-strategy' – to develop a consortium is presented. Additionally, it introduces a novel in vivo plant bioassay – 'tube-in-tube' method – that gives faster (< three weeks) and reproducible results for selecting the most desirable consortia combinations. The study employs eight plant growth promoting microbes (PGPMs) with pre-established growth supporting abilities and no mutual antagonism. Following a two-factorial design, 15 consortia combinations (CCs) were developed from these PGPMs. Applying the principles of the 'six-step-strategy', combinations CC11, CC13 and CC4 showing significant increments (>100%) in root length and dry weight were recognized as the best performing consortia. The method thus shortlists the best and manageable number of consortia for further field trials.

Metagenomic analysis of total microbial diversity and antibiotic resistance of culturable microorganisms in raw chicken meat and mung sprouts (*Phaseolus aureus*) sold in retail markets of Mumbai, India

Onkar A. Naik, Ravindranath Shashidhar, Devashish Rath, Jayant R. Bandekar and Archana Rath

Keywords: Chicken meat, food-borne pathogens, metagenomics, multiple antibiotic resistance, mung sprouts.

Abstract

Raw chicken meat and ready-to-eat sprouts are potential sources of food-borne infections. Development and spread of antibiotic resistance (AR) in microflora associated with food is a major health concern. In this study, we employed culturable and non-culturable methods to characterize microflora associated with chicken meat and mung. Pathogens belonging to Enterobacteriaceae were dominant in the culturable set. Rare species like *Citrobacter amalonaticus*, *Kluyvera georgiana*, *Kurthia gibsonii* and *Staphylococcus hominis* were isolated and metagenomic study revealed overall good species richness in both food types, Firmicutes and Gammaproteobacteria were dominant phyla in chicken meat and sprouts respectively. Common food-borne and opportunistic pathogens like *Campylobacter*, *C. perfringens*, *Streptococcus*, *Shewanella*, *Pseudomonas*, *Aeromonas hydrophila*, *Staphylococcus*, *E. coli*, *Acinetobacter*, *Enterobacter*, *Klebsiella* were detected and 18% of the genera were common to both food types. We observed high AR bacterial count (5 to 9 log CFU/g) in the microflora. Fifty AR isolates per food type were identified with high multiple AR index of 0.3–0.9.

Impact of domestic and industrial effluent discharge on the tank ecosystem in Pallipattu block, Tamil Nadu, India

J. Hemamalini, B. V. Mudgal and J. D. Sophia

Keywords: Domestic sewage, integrated effluent, irrigation tanks, water quality.

Abstract

The impact of untreated effluent from dye industries and domestic sewage that are discharged into the irrigation tank in Pandravedu village in South India was assessed through physico-chemical analysis of water samples and focus group discussion with the community. Thirty-six samples were collected from the study area across three seasons and analysed in the laboratory. The irrigation water quality indices computed indicated that the levels of sodium, salinity and hardness exceeded the permissible limits of irrigation standards. Consequently, rice yield had reduced by 40% in the region, thereby affecting the livelihood of the farmers. The colour of fishes in the tank also changed and their consumption contributed to health-related issues in the village.

Developing sustainable models of arsenic mitigation technologies in the Middle-Ganga Plain in India Sushant K. Singh, Robert W. Taylor and Haiyan Su

Keywords: Arsenic-mitigation, arsenic treatment unit, deep tube well, dug wells, piped water supply, rainwater harvesting system.

Abstract

This study seeks to understand factors that guide the decision-making process to adopt and implement the available arsenic-mitigation technologies in rural areas in the middle-Ganga Plain in India. A total of 340 households comprising 2500 people were surveyed. Socio-economic and demographic factors, water and sanitation status, time spent and distance travelled to collect water, arsenic awareness, willingness to pay (WTP) for arsenic-free water, people's trust in others and in institutions, social capital in communities, and preferences for sustainable arsenic-mitigation options were investigated. Arsenic treatment units (filters) and piped water supply systems were the most

preferred sustainable arsenic-mitigation options in the surveyed villages. Less preferred arsenic-mitigation options include deep tube wells, dug wells, and rainwater harvesting systems. Binary logistic regression models for each arsenic-mitigation option were produced. Arsenic awareness, WTP, trust in agencies, trust in institutions and social capital were found to be the most significant factors for decision-making for preferring one arsenic-mitigation technology over the others. We recommend a mixed model of two arsenic mitigation options for the studied individuals, which could be a sustainable arsenic-mitigation option for them, considering their socio-economic and demographic conditions. Existing institutions should be strengthened, agencies empowered, and communities enlightened about arsenic problems.

An updated account of mammal species and population status of ungulates in Keoladeo National Park, Bharatpur, Rajasthan

Aakriti Singh, Aditi Mukherjee, Sumit Dookia and Honnavalli Nagaraj Kumara

Keywords: Distance sampling, density, local extinction, mammal account, population dynamics, ungulates.

Abstract

This study documents the present status of mammals in Keoladeo National Park (KNP) and assesses the population structure of ungulates. It provides a comprehensive account of the mammal diversity of the park and aims to compare the change in mammalian species account ever since the park became a protected area. We employed line transect surveys for density estimation of ungulates. We report local extinction of eight species since 1966, and extant diversity of 34 mammalian species in KNP. The estimated densities of chital, feral cattle, nilgai, wild boar and sambar were 52.37, 33.66, 13.68, 3.21 and 0.32 individuals/km² respectively. Although blackbuck has become locally extinct and sambar density has significantly reduced, chital and nilgai as habitat generalists have increased in density in the last 25 years, which has contributed to an overall increase in ungulate population density in KNP. The mammalian diversity has changed substantially with local extinction of some carnivores and constant change in the habitat condition.

Fracture behaviour of fibre reinforced geopolymer concrete

S. Sundar Kumar, K. C. Pazhani and K. Ravisankar

Keywords: Alkali activators, fracture behaviour, fly ash, geopolymer concrete, iron slag, steel fibres.

Abstract

Geopolymers have several applications and concrete is one of the materials that can be produced with geopolymer as binder. Since industrial byproducts/wastes such as fly ash, iron slag, micronized biomass silica, silica fume, red mud, etc. can be used as a binder instead of Portland cement, geopolymer concrete (GPC) has generated lot of interest among the scientific and engineering community. This has also resulted in reduced carbon footprint of concrete and an effective method of disposing industrial waste. In this study GPC with a blend of class-f fly ash and ground granulated blast furnace slag as binder has been developed, and its flexural and fracture characteristics have been studied. The GPC developed has a 28-day compressive strength in the range 40–50 MPa. Incorporation of steel fibres resulted in increased flexural strength, enhanced fracture properties and ductility. The residual strength of steel fibre reinforced GPC was also determined in the study.

SWIR albedo mapping of Mars using Mars Orbiter Mission data

Ramdayal Singh, Manoj K. Mishra and Prakash Chauhan

Keywords: Albedo, Mars, methane sensor for Mars.

Abstract

Global apparent short wave infrared (SWIR) (1.64– 1.66 μm) albedo mapping results from data acquired by Methane Sensor for Mars (MSM) onboard Indian Mars Orbiter Mission from October 2014 to February 2015, are presented. Global analysis of low and high albedo patterns is discussed using MSM apparent SWIR albedo map. The occurrence frequency of MSM apparent SWIR albedo shows a clear bimodal behaviour and is in good agreement with OMEGA NIR albedo distribution. Based on MSM apparent SWIR albedo values, three classes (high, intermediate and low albedo values) are defined, which show a clear elevation dependency. Variation of weekly average apparent albedo during the study period over Syrtis Major, Daedalia Planum and Valles Marineris region, respectively, is presented.

Vulnerability of dairy-based livelihoods to climate variability and change: a study of Western Ghats region in Wayanad, Kerala

Aparna Radhakrishnan and Jancy Gupta

Keywords: Climate change, livelihoods, livelihood vulnerability, participatory rural appraisal, milk.

Abstract

The study assesses the livelihood vulnerability of dairy farmers to climate variability and change (CVC) in Wayanad district of the Western Ghats region in Kerala. For this purpose, a Livelihood Vulnerability Index (LVI) was developed underlying the definition of Intergovernmental Panel on Climate Change consisting of 28 indicators and 7 LVI components. A füssel framework was used for conceptualizing the vulnerable situation. Participatory rural appraisal and personal interviews were used to collect household data of 180 dairy farmers of three taluks complemented by thirty years of gridded weather data. The normalized data were then combined into three indices, i.e. sensitivity, exposure and adaptive capacity, which were then averaged with weights given using principal component analysis, to obtain the overall index. LVI indicated that the dairy farmers of all the taluks of Wayanad are vulnerable to CVC with Pulpally taluka being the most vulnerable with 48.33% farmers under the high level vulnerability category with wide variation in LVI components across the taluks. For the sustenance of dairy farming of small and marginal farmers of the region and for mitigating risks, policies are required for incentivizing the livelihood infrastructure and promotion of grass root level innovations.

Anatomy and functional status of haustoria in field grown sandalwood tree (*Santalum album* L.)

D. Rocha, P. K. Ashokan, A. V. Santhoshkumar, E. V. Anoop and P. Sureshkumar

Keywords: Haustoria, radio tracer, root parasitism, sandal.

Abstract

A study on the physiology of root parasitism in sandal (*Santalum album* L.) was conducted by comparing a six-year-old sandal grown alone and along with a host (*Casuarina equisetifolia*). Although maximum haustorial connections were observed when grown along with the host, sandal formed haustorial connections with plants including grass up to a distance of 3 m. Anatomical studies on haustoria indicated a vascular connectivity between the host and sandal. While the haustoria functioned as a physiological unit supporting nutritional requirements of sandal, direct lumen– lumen xylem connections between sandal and host were absent. Functional status of the haustorial connection was studied by radio-labelling the host (*Casuarina*) and nearby grass with

phosphorus (^{32}P). Presence of translocated ^{32}P in sandal was noticed after six hours of labelling the host. ^{32}P activity was noticed from eight days up to 16 days after which then it started decreasing. Study with multiple hosts revealed that the extent of translocation from hosts to sandal varied from 28.9% (coconut + Casuarina + rubber as host) to 78.5% (Casuarina + rubber as hosts). Reverse translocation of ^{32}P from sandal to host was also observed. The study concludes that it is not necessary to plant the host along with the sandal as it is practiced presently.

Estimation and validation of actual evapotranspiration for wheat crop using SEBAL model over Hisar district, Haryana,

India Anju Bala, Prakashkiran S. Pawar, Anil Kumar Misra and Kishan Singh Rawat

Keywords: Energy balance algorithm, evapotranspiration, ground truthing, remote sensing, wheat.

Abstract

Evapotranspiration (ET) is one of the complex, but essential components of the hydrologic cycle. Advances in remote sensing (RS) and geographical information systems (GIS) have enabled us to estimate ET spatially. In the present study, both, RS and GIS tools have been utilized to estimate the actual crop ET by surface energy balance algorithm for land (SEBAL) model using high spatial resolution satellite image Landsat7 ETM+ for Hisar district, Haryana in north India. Previously calibrated and validated SEBAL model with lysimeter data within the same agroclimatic zone were used in the study. Derived actual ET from lysimeter data validated SEBAL method was again validated using Penman–Montieth (PM) method for the study area located in the same agro-climatic zone. Based on the primary and secondary data analysis, it can be inferred that SEBAL ET is the best spatial ET estimation model for Hisar district or regions having similar agro-climatic conditions. Validation of SEBAL ET with ground-observed lysimeter data showed high coefficient of correlation ($R^2 = 0.91$). Validation using the PM method also showed high coefficient of correlation ($R^2 = 0.835$). Other statistical parameters (RMSE = 0.583, NRMSE = 0.236) also showed good agreement between actual SEBAL ETc and PM ETc (crop evapotranspiration). It was also found that any prior knowledge about the crops, their types and cropping seasons is not required for the estimation of actual ET by SEBAL model.

Numerical simulation of air-core vortex at intake

Behrouz Khadem Rabe, Seyyed Hossein Ghoreishi Najafabadi¹ and Hamed Sarkardeh

Keywords: Air-core vortex, flow pattern, numerical simulation, velocity components, water surface profile.

Abstract

In order to study the features of vortex at horizontal intakes, numerical investigations have been performed. The tangential, radial, and axial distributions, and water surface profile were simulated to evaluate the flow behaviour and existence of an air-core vortex. The numerical results agree with existing experimental data. The correlation of vortex characteristics between numerical and experimental results was good. Regarding formed funnel profile of flow in the basin towards horizontal intake, its limits at the existence of an air-core vortex were analysed. The spiral flow pattern from surface towards intake was identified around the air-core vortex. This numerical simulation may help to get a deeper understanding in determining the submergence required to avoid air-entraining vortices in a reservoir.

New method for discharge hydrograph measurement of the free overflow with full-width, thin-plate weir Lajos Hovany

Keywords: Run-off hydrograph, water discharge, weirs, ventilated nappe.

Abstract

The current standards recommend measuring water discharge with vented thin-plate weirs. The ventilation of full-width, thin-plate weirs during discharge hydrograph measurement still poses a problem. An experimental study regarding the design of a new type of ventilating device for hydrograph measurement was performed from 20 October through 5 December 2015 which proved that this device can be used measuring discharge at ventilated nappe according to standard recommendations. During the second part of the experiment, an opportunity was provided for measuring the discharge at non-ventilated nappe as a function of Reynolds and Weber numbers.

Modulation of midgut peritrophins' expression during Plasmodium infection in Anopheles stephensi (Diptera: Culicidae)

V. Venkat Rao, Surendra Kumar Kolli, Shruti Bargava and R. K. Chaitanya

Keywords: Anopheles stephensi, malaria, peritrophins, Plasmodium berghei, transmission

Abstract

The peritrophic matrix (PM) serves as a barrier to pathogens in many disease vectors including mosquitoes. The Plasmodium ookinete has to cross the PM barrier for its successful establishment in the mosquito midgut and subsequent transmission. It is conceived that alterations to PM may lead to a block in infection. Peritrophins which are the major constituents of PM are yet to be elucidated at molecular level. The present study demonstrates Anopheles stephensi midgut peritrophins' expression during Plasmodium berghei infection. Eight peritrophin genes (Per 10, Per 16, Per 22, Per 25, Per 26, Per 28, Per 30 & Per 43) of A. stephensi were identified from vectorbase, isolated from the adult midgut, and expression pattern monitored in real-time, in normal and infected blood meal conditions. Temporal expression of peritrophins in the midgut was monitored every 6 h till 24 h post blood meal. Results showed that the Per 10, Per 16, Per 22, Per 25 and Per 26 expression was significantly downregulated during Plasmodium infection whereas Per 30 and Per 43 expression was markedly up-regulated. The Per 28 expression was low initially but elevated later. This data clearly indicates that peritrophins are differentially modulated in infected midgut. The significance of differential expression of peritrophins' in parasite transmission is discussed further.

An assessment of crop damage and economic loss caused by elephants in Harohalli and Kodihalli ranges of Bannerghatta National Park, Karnataka, India

G. V. Venkataramana, Sreenivasa and H. G. Lingaraju

Keywords: Crop damage, elephant–human conflict, economic loss, forest ranges.

Abstract

The human–elephant conflict, which results in extensive crop damage as well as casualties (both humans and elephants) has significantly increased over the past decade. We studied the patterns of crop raiding and associated economic loss by elephants across two forest ranges of Bannerghatta National Park (BNP), Karnataka, India, namely Kodihalli and Harohalli ranges, from January 2014 to December 2014. We found that 127 villages reported crop raids by elephants during the study period. The incidence of crop raiding in villages ranged from 1 to 59 (mean = 7.17) and was highest in Kodihalli division. Maximum crop raiding incidences were recorded during the rainy season in both the ranges. Elephants with varying proportions raided all cultivated crop species in the study area. Finger millet (*Eleusine coracana*) (65 acres), banana (*Musa paradisica*) (1535 plants) and coconut (*Cocos nucifera*) (140 trees) were the most raided crop species. Crop maturity and crop

raiding incidence showed positive correlation for finger millet in the Kodihalli range. In contrast, bananas were damaged throughout the year in the Harohalli range. Other crops such as red gram, paddy, sugarcane and beans were raided less in the sampling areas. In conclusion, this study reveals rising incidence of human– elephant conflicts and significant economic loss as a result of crop damage in the adjoining regions of BNP.

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Recent advances in optimization of photoanodes and counter electrodes of dye-sensitized solar cells

Saily Bhagwat, Riddhesh Dani, Purna Goswami and M. A. K. Kerawalla

Keywords: Counter electrode, device optimization, dye-sensitized solar cells, photoanode.

Abstract

Since 1991, dye-sensitized solar cells (DSSCs) have emerged as a potential alternative to conventional silicon photovoltaics for conversion of solar energy to electric power, due to their advantages of cost-effectiveness, sustainability and ease of fabrication among others. As the functioning of DSSCs depends on the sum of the functions of individual components, effective understanding and optimization of these components is important for the optimization of the device itself. Therefore, this review focuses on the recent developments made in the fabrication of two particular components of DSSCs, viz. photoanode and counter electrode.

Teaching sustainability through traditional wisdom: a conceptual framework for business studies

Ekta Sharma and Ruchi Tewari

Keywords: Education, management application, sustainability, wisdom.

Abstract

It is imperative to strive for sustainable ways of designing and managing businesses. The managers need to develop competence to usher the path of business sustainability by understanding the concept and developing suitable strategies that build the framework for business sustainability. Students pursuing studies in Business Administration will hold managerial and leadership positions in the forthcoming years; hence their competence would be an important determinant in the successful implementation of sustainable business practices. This article proposes to explore the Indian scriptures to teach sustainability to students through examples and validations from these texts.

Deployment of underground coal gasification in India

Akshay Singan and Vivek V. Ranade

Keywords. Underground coal gasification, coal seam, pilot experiments, modelling.

Abstract

Globally, the sheen of coal-based energy production is slowly wearing, with few exceptions of developing novel technologies that aid in coal gasification and gas clean-up. Underground coal gasification (UCG) is one such tool that can be used for extracting energy contained in otherwise inaccessible reserves. UCG involves the injection of steam and oxidant directly in the seam of coal, which is ignited through different methods. Post-ignition, coal reacts with steam and oxygen to produce a combustible synthesis gas (syn-gas). This syn-gas can be used to generate electricity or utilized as feedstock to take different routes to manufacture chemicals. This paper seeks to briefly outline some aspects in the deployment of underground coal gasification in the Indian subcontinent, along with a discussion on the current status of research in the field. The different stages of

identifying and understanding key features and potential roadblocks, based on which decisions on the implementation of large scale UCG in a potential site in India are taken, are briefly outlined. We share our thoughts and experiences on the methodology, to model and understand the process and put forth our suggestions on the path forward.

Frequency-dependent electrical characterization of rock types from Ewekoro, Eastern Dahomey Basin, Nigeria

O. B. Olatinsu, D. O. Olorode, M. Josh, B. Clennell and L. Esteban

Keywords: Dielectric dispersion, frequency response, loss tangent, partial saturation, rock types.

Abstract

Dielectric measurements (40 Hz–110 MHz) conducted on samples of limestone and its associated rocks from Ewekoro, Eastern Dahomey Basin, Nigeria has yielded vital information for characterization. Cole–Cole plots manifest a distribution of relaxation times in the rock samples common for multicomponent systems. All the rock types show dielectric dispersion in dry and partially saturated conditions, but the frequency range differs for the rock types and depends on wettability. At partial water saturation there is: (i) enhanced polarization resulting in increase in real and imaginary permittivities; (ii) shortened region of dielectric dispersion; (iii) broadened electrode polarization plateau; and (iv) steeper and shorter dispersion region. Irrespective of the state of the rocks, dielectric parameters for shale and glauconite are at least an order greater than for limestone and sandstone. Geometric or textural effects are partly responsible for the observed differences coupled with the presence of charged clay/clay-like particles in shale and glauconite. Decrease in relaxation and critical frequencies in partial saturation for shale in contrast to the increase in these frequencies for the other three rock types is due the effect of pore geometry on overall dielectric relaxation. This study shows that dielectric measurement can complement geochemical analysis in laboratory evaluation and characterization of rock raw materials.

Estimation of crop coefficients and water productivity of mustard (*Brassica juncea*) under semi-arid conditions

Gupta, A. Sarangi and D. K. Singh

Keywords: *Brassica juncea*, crop coefficient, evapotranspiration, leaf area index, water productivity.

Abstract

Experiment was conducted using weighing-type field lysimeters to determine single and dual crop coefficients (K_c) and to estimate water productivity of mustard (*Brassica juncea*) cultivar, Pusa Vijay (NPJ-93) during rabi 2013–14 and 2014–15. It was observed that the single crop coefficient (K_c) during rabi 2013–14 was 0.39, 0.72, 1.02 and 0.5 for initial, development, mid and late stages respectively. While in dual K_c the value of K_{cb} (basal crop coefficient) was 0.19, 0.55, 0.91 and 0.24 for the four stages, respectively. During rabi 2014–15, the single K_c was 0.36, 0.63, 1.04 and 0.44 and for dual K_c the value of K_{cb} was 0.17, 0.46, 0.91 and 0.23 for four stages respectively. Relationship between K_{cb} and leaf area index as well as between K_{cb} and growing degree days was also established. Water productivity was estimated to be 14.9 kg/ha-mm corresponding to grain yield of 2.34 t ha⁻¹ with 157 mm of total irrigation water applied during rabi 2013–14. Whereas during rabi 2014–15, water productivity was 15.4 kg/ha-mm with grain yield of 2.89 t ha⁻¹ with 187 mm depth of applied irrigation. Nonetheless, the estimated crop coefficients of mustard can be used for judicious irrigation scheduling in order to enhance water productivity in semi-arid environment.

Environment: a futuristic view

J. S. Singh

Keywords: Biocapacity, ecological footprint, global warming, planet boundary, societal support, sustainable development.

Abstract

The earth today is experiencing environmental conditions unprecedented in the history of the planet. Biodiversity is the basis of ecosystem services for human well-being. Reports indicate that the earth has indeed entered into a phase of mass extinction, and that the ecological footprint has substantially exceeded the biocapacity of the earth. It is argued that the ecological footprint must be reduced through sustainable development which should keep nature at its core. Anthropogenic activities have led to global environmental change which is adversely affecting human well-being. Global warming may result in a temperature rise of 4–5°C; the world food production may substantially decline, and the sea level may rise by up to 195 cm by 2100, inundating vast coastal areas. Almost four billion people are facing water scarcity. Three of the nine Rockström's planetary boundaries have already been exceeded. However, the encouraging fact is that the nations have agreed to limit global warming to 1.5°C, which gives us hope.

Can cold tolerance bring in hybrids on commercial front in winter sorghum?

P. Sanjana Reddy and Sunil Gomashe

Keywords: Cold tolerance, germplasm, hybrids, winter sorghum.

Abstract

Studies on early-season and mid-season cold temperature stress on growth and yield components in diverse classes of winter sorghum are essential for targeting hybrid development that is otherwise confined only to rainy season-grown sorghum. The results showed that from among the 194 winter sorghum genotypes belonging to 5 groups – varieties, B-lines, R-lines, hybrids and germplasm lines, 81% of the genotypes were correctly placed in their respective groups based on discriminant analysis. Principal component analysis showed that most of the traits involved in the study are important and variability cannot be explained by a few traits and the traits recorded at seedling and maturity stages were explained by different principal components. Most of the traits recorded under cold stress at seedling stage did not correlate with those recorded under cold stress at anthesis. There is scope for improvement of individual groups for seedling dry fodder yield and grain yield, more so in the case of hybrids and female parental lines. Breeding for cold tolerance at seedling as well as anthesis stages has to be separately targeted. Thus, for developing new winter sorghum hybrids, female parental lines have to be diversified and improved for grain yield and percentage of seed set by crossing with promising germplasm lines identified in the study.

Integrated nutrient management and formulation of targeted yield equations for black gram (Vigna mungo L.)

Subhashis Saren, Antaryami Mishra and Pradip Dey

Keywords: Black gram, fertilizer prescription equations, Inceptisols, targeted yield.

Abstract

Three fertility gradient stripes were created in Inceptisols of Odisha by applying no fertilizer, recommended dose of fertilizer (RDF) and double the RDF and paddy was grown during kharif, 2013. These three stripes were sub-divided into 24 sub-plots and black gram was grown with different graded doses of fertilizers and manure during rabi, 2013–14. Initial and post-harvest soil nutrient status, nutrient uptake, nutrient requirement, soil efficiency, fertilizer efficiency and yield data were recorded. The highest yield (12.09 q ha⁻¹) was achieved with 30 : 50 : 50 (N : P₂O₅ : K₂O). On the basis of these data, fertilizer prescription equations were formulated for targeted yield of black gram in Inceptisols of Odisha.

Ants indicate urbanization pressure in sacred groves of southwest India: A pilot study

T. P. Rajesh, U. Prashanth Ballullaya, Parvathy Surendran and Palatty Allesh Sinu

Keywords: Biodiversity, urbanization, sacred grove, ants, *Anoplolepis gracilipes*, invasive species, Western Ghats, biotic invasion.

Abstract

Sacred groves may contain remnants of pristine and primary forests outside the state-owned protected area system. As they are small fragments and located in the neighbourhood of human settlements, towns, and cities, they are likely to be affected by urbanization. We studied the effect of urbanization on the ecosystem health of sacred groves of Kerala using litterdwelling ants as the indicator taxa. Ants were pitfalltrapped (10–12 traps/sacred grove) from three rural and two urban sacred groves, and identified to species. Overall, 1,119 ants of 32 species and 6 subfamilies (Aenictinae, Dolichoderinae, Ectatomminae, Formicinae, Myrmicinae and Ponerinae) were collected. This corresponds to 76.54% of the estimated species richness. Urbanization had little impact on the species diversity of ants. Abundance was remarkably high in urban sacred groves, mainly due to higher abundance of generalist and invasive species. The effect of urbanization was indicated by different ant assemblages. Rural sacred groves had nine species and three subfamilies exclusive to them as against the five exclusive species of urban sacred groves. Urban sacred groves were characterized by high abundance of *Anoplolepis gracilipes*, a globally important invasive species. Sacred groves were clustered based on the rural–urban gradient as hypothesized by the study.

Species diversity of white grubs (Coleoptera: Scarabaeidae) in the sub-Himalayan and northern plains of India K. Sreedevi¹, Sakshi Tyagi and Veena Sharma

Keywords: Abundance models, Melolonthinae, Rutelinae, species diversity, white grub.

Abstract

White grubs belonging to subfamilies Melolonthinae and Rutelinae of Scarabaeidae (Coleoptera) are ubiquitous pests. Studies during 2013 and 2014 document the species diversity of white grubs in the subHimalayan and northern plains of India. Surveys conducted in four states, viz. Himachal Pradesh, Uttarakhand, Uttar Pradesh and Rajasthan revealed high species diversity representing 65 species under 16 genera. The species richness, evenness and composition varied among the states. Higher species diversity was recorded in Uttarakhand and Himachal Pradesh of the sub-Himalayan region when compared to Uttar Pradesh and Rajasthan of the northern plains. The species abundance distribution followed log normal distribution in all places except Uttarakhand, where the curve skewed to the left due to overweight of species with low abundance. The species dominance and abundance patterns in different regions are presented. The new distributional records, *Anomala pictipes* Arrow and *Popillia maccllellandi* Hope from Uttarakhand, *Anomala propinqua* Arrow and *Popillia marginicollis* Hope from Himachal Pradesh and *Anomala stenodera* Arrow from Uttar Pradesh are provided.

Influence of astronomical (lunar)/meteorological factors on the onset of dawn song chorus in the Pied Bush Chat (*Saxicola caprata*)

Navjeevan Dadwal and Dinesh Bhatt

Keywords: Onset of dawn song, Pied Bush Chat, tropical songbird.

Abstract

Climatic factors which prevail during the breeding season of avian species in spring and early summer may trigger the onset of singing behaviour in songbirds. To understand the effect of climatic variables on the onset of dawn song chorus, we conducted a study in the natural habitats of

a tropical songbird, the Pied Bush Chat *Saxicola caprata* in Haridwar, Himalayan foothills, India during early spring. The results indicated that the onset time of dawn chorus depends on a number of environmental factors. The song bout length depended on daily temperature, rainfall rate, wind direction, photoperiod, lunar phase, indices of apparent temperature, dew point, sunrise timing and day length, whereas the song rate depended on daily temperature, photoperiod, indices of apparent temperatures, dew point, sunrise timing and day length. Further, stepwise multiple regression revealed that onset time of dawn chorus was dependent on photoperiod and lunar phase, while song bout length and song rate were influenced by day length and sunrise timing respectively.

Management strategy to improve input use efficiency and enhance sorghum productivity per stored rain drop in vertisols during rabi season

S. R. Kumar, Prabhakar Bhat² and P. V. Rajappa

Keywords: Management, nitrogen use efficiency, productivity, rabi sorghum, vertisols.

Abstract

Crop developmental process and in turn its growth phases (vegetative and reproductive) are influenced by environmental factors, i.e. temperature and photoperiod in field crops like sorghum. Crop growth and biomass production is a function of genotype by environment interaction, which is optimized through management strategies. Crop grain yield is determined as a product of its yield components like the grain numbers per plant and the average kernel weight at maturity. Grain numbers set at the panicle initiation phase can be enhanced by best matching the supply of nitrogen with its demand in the crop. Grain growth dynamics, a function of genotype by environment by management interaction is an important feature that enhances sorghum productivity. Rabi sorghum growing environment presents a challenge through a receding soil moisture front which decreases its response to applied external inputs like nitrogen (N) fertilizer. Deep placement of top dressed nitrogen fertilizer treatments increased rabi sorghum grain yield by about 630–930 kg ha⁻¹ over farmers, practice of no fertilizer application. A management strategy helped enhance the agronomic nitrogen use efficiency to 16 kg grain per kg applied N, and the rain water use efficiency to 15 kg ha⁻¹ mm. Thus, the hypothesis of increased rabi sorghum productivity per rain drop through improved management intervention in vertisols was validated.

Characterization of humic substances and their distribution of XAD fractions by absorption spectroscopy in the Godavari estuary, India

N. V. H. K. Chari and Sudarsana Rao Pandi

Keywords: Absorbance spectra, E2/E3 ratio, Godavari estuary, humic substances, spectral slope ratio.

Abstract

Humic substances (HS) are formed in estuarine regions by biogeochemical processes of terrestrial and in situ produced organic matters. Their structure and distribution may vary seasonally and spatially. To examine this, HS were isolated from Godavari estuarine waters using ion-exchange resins XAD-8 followed by XAD-4 during 2014–2015. The structural differences between the two fractions were characterized by E2/E3 ratio (a_{250}/a_{365}), spectral slope (S_{275–295}), and spectral slope ratio (SR, S_{275–295}/S_{350–400}), which were derived from UV-visible absorbance spectra. Lower values of E2/E3 ratio, S_{275–295} and SR for XAD-8 fractions than XAD-4, indicate higher aromaticity and higher molecular weight of dissolved organic compounds retained on the former resin. The E2/E3 ratio for XAD-8 and SR for XAD-4 fractions were found to decrease gradually from post-monsoon to monsoon, indicating that the biological process controls the production of organic matter in upstream waters. Lower molecular weight organic compounds formed by bacterial

decay and photodegradation during pre-monsoon and higher molecular weight organic compounds formed during the post-monsoon season was attributed to the freshly exudated organic matter from phytoplanktons dominated at the mouth of the estuary.

Pultruded fibre reinforced polymer planks as stay-in-place formwork for concrete structures

Reema Goyal, Shweta Goyal and Abhijit Mukherjee

Keywords: Adhesive and aggregate bonding, fibrereinforced polymer, stay-in-place formwork.

Abstract

A feasibility study in which a pultruded fibre reinforced polymer (FRP) plank was used as stay-in-place (SIP) form serving as formwork during wet stage and as reinforcement during hardened stage is presented here. First, the strength and stiffness of the FRP plank serving as formwork for concrete casting under construction stage was verified by sand-filling test. Then shear tests were carried out to develop proper bond technique between FRP and concrete, so that they can perform as composite structural member. Thirdly, static tests on beams were conducted to evaluate the load-carrying capacity and failure modes of the proposed hybrid beam. The overall investigation showed the feasibility of using the FRP plank as a SIP formwork.

Classification of remote sensed data using hybrid method based on ant colony optimization with electromagnetic metaheuristic

J. Jayanth, V. S. Shalini, T. Ashok Kumar and Shivaprakash Koliwad

Keywords: Ant colony optimization, API algorithm, electromagnetic metaheuristic, data classification, hybrid metaheuristic.

Abstract

In this study, a hybrid configuration of electromagnetic metaheuristic algorithm (EM) with Pachycondyla apicalis (API) ant algorithm (inspired by the behaviour of real ant colony Pachycondyla apicalis) belonging to ant colony optimization (ACO) called EM-API algorithm is presented for remote sensing data classification. The traditional per-pixel classification method identifies the classes using spectral variance and ignores the spatial distribution of pixels. It requires training data to be normally distributed in the pixels corresponding to land use/land cover classes and creates a lot of confusion between classes within a remote sensed (RS) data. The proposed algorithm is an integrated strategy structure to achieve advantages of global and local search ability of EM and API algorithms respectively. The objective consists of improving overall accuracy of the classified results of RS data. This method can overcome intermixing with regard to scrub land with cultivated areas and build-up land with palm groves. The proposed algorithm is tested on objective functions well used in the literature and EM-API is used for supervised land cover classification. Results of EM-API algorithm over 6 classes showed an improvement of 8% in overall classification accuracy (OCA) for EM technique and improvement of 3% in OCA for API algorithm.

Roof water harvesting in hills – innovations for farm diversification and livelihood improvement

Anup Das, R. K. Singh, G. I. Ramkrushna, Jayanta Layek, A. K. Tripathi, S. V. Ngachan, B. U. Choudhury, D. P. Patel, D. J. Rajkhowa, Debasish Chakraborty and P. K. Ghosh

Keywords: Jalkund, multiple use of water, NER hills, rain water harvesting, silpaulin.

Abstract

The north eastern region (NER) of India receives bountiful rains (>2000 mm) annually. However, there is extreme water scarcity during post- and premonsoon season (November–March). In such a situation, roof water harvesting (RWH) holds promise for multiple livelihood opportunities. RWH unit with polyfilm lined water collection tank of 37 m³ storage capacity (i.e. 5.5 × 4.5 × 1.5 m³) was demonstrated at 11 farmers

fields mostly on hill tops in the Ri-Bhoi district (Meghalaya). The average demonstration area was 500 m²/farmer in the vicinity of homesteads (kitchen gardens). Volume of water harvested in a collection tank was about 53 m³ including about 16 m³ harvested during dry season due to seasonal replenishment. The cost of water harvesting was estimated at about Rs 144 and Rs 119/m³ considering lifespan of five and ten years respectively. Farmers used harvested water for diversified activities such as raising crops [maize, broccoli, French bean, laipatta (*Brassica juncea*), tomato, etc.] and livestock (pig or poultry) in addition to domestic use. The farmers without RWH could use land only during rainy season for crop cultivation. On an average, the net income from each RWH based model (500 m² demonstration area) was Rs 14,910 for crop + piggery and Rs 11,410 for crop + poultry farming which was 261 and 176% higher, respectively than the normal farmers' practice. Similarly, employment and water use efficiency enhanced by 221 and 586%; and 168 and 218% under crop + piggery and crop + poultry based farming respectively.

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A bibliometric profile of Current Science between 1961 and 2015

Peng Wang, Fangwei Zhu, Haoyang Song and Jianhua Hou

Keywords: Bibliometrics, citation impact, Current Science, research theme, scientific journals evaluation

Abstract

A bibliometric analysis of 31,403 publications in Current Science between 1961 and 2015 revealed an unstable trend; the highest citations per publication appeared during 2003–2005. The impact factor of Current Science had an overall increasing trend and placed the journal in the quartile Q2 within 'Multidisciplinary sciences' category. The h-index of Current Science was 82 and 24 authors had more than one H-Classic articles. The most productive country was India and Current Science was dominated by contributions from Indian institutions. Analysis of author keywords showed 11 main research themes for the journal. These findings will help the readers to get a quick and intuitive overview of Current Science.

Calibration of two-dimensional variably saturated numerical model for groundwater flow in arid inland basin, China

Xiaomin Gu, Jingli Shao, Yali Cui and Qichen Hao

Keywords: Arid inland basin, groundwater flow, numerical models, multiple calibration approaches.

Abstract

Alluvial fan is an important recharge area for arid and semi-arid inland basins. In order to study groundwater circulation and quantify recharge amount of the groundwater system in arid inland basins, it is necessary to use numerical models. In this study, a 2D variably saturated numerical model of a typical profile has been developed using EOS 9 module of TOUGH2. The mesh for the fine soil plain area was refined compared with previous studies and the minimum cell size was 0.1 m in thickness. An improved approach in TOUGH2 was applied to calculate the groundwater evapotranspiration more efficiently and characterize water transport more accurately. Multiple calibration approaches were combined to calibrate the model. The results show that, the typical profile can be divided into three groundwater flow systems. The circulation depth for the local groundwater flow system is about 200 m and the shallow discharge accounts for 74.4% of the total amount with groundwater age less than 500 a (year). The circulation depth for the middle flow system can reach 800 m and the amount of discharge accounts for 18.5% of the total amount with groundwater age less than 10 ka (kiloyear). The circulation depth for the regional flow system is from 1000 to 1500 m, and the discharge accounts for 7.1% of the total amount with groundwater age

ranging from 10 to 50 ka. The improved TOUGH2 numerical model, combined with multiple calibration approaches, can better reflect regional circulation characteristics and quantify the recharge amount of different groundwater sub-systems in arid and semi-arid inland basins with limited datasets.

Drinking water sources in India: how safe is safe?

Siroop Chaudhuri and Mimi Roy

Keywords: Arsenic, groundwater, fluoride, millennium development goal, safe drinking water

Abstract

Under the loom of extreme climatic perturbations, human expansion and rising demand, world's freshwater reserves are expected to suffer severe setbacks in the coming years. A major task for the international authorities in this regard is to develop a reliable inventory of existing potable water sources and identify the challenges therein. The main objective of this study was to present a spatial summary of 'safe' water sources in India using the most 'authentic', cross-sectional, open-sourced census database for 2011 ranging from household to state level. Under the present circumstances, we urge the authorities to revisit potable water source classification scheme in India, acknowledging water quality issues and devise strategies for catchment-scale protection with special emphasis on real-time continuous monitoring and assessment of the peri-urban water resources.

Evolution and progress in the application of radiation in cancer diagnosis and therapy

Gaurav Aggarwal and Suresh Kumar Aggarwal

Keywords: Accelerators, cancer, diagnosis, oncology, radiation therapy.

Abstract

Cancer is a ubiquitous health problem globally caused by poor food quality, environmental pollution, genetic factors, etc. Despite the manifold presumptive theories put forth for its causation, there is an extreme paucity of knowledge as regards the actual etiology of cancer, as well as any preventive or prophylactic therapy. The treatment options available include surgery, chemotherapy and radiation therapy (both internal and external). There have been technical and technological advancements in the fields of 'cancer surgery' and 'cancer chemotherapy', and radiotherapy in oncology is not too far behind. X-rays (from linear accelerators LINACs) and gamma rays (e.g. in Bhabhatron) are commonly used for radiation treatment of various types of cancers. New developments include proton beam therapy (PBT) and heavy ion beam therapy (IBT) (e.g. C⁶⁺ ion). These new developments of PBT and IBT offer significant advantages to treat paediatric patients, and to radiate deep-seated and radioresistant tumours. This article gives an overview of the various radiation therapies used worldwide, cost comparison of setting up these facilities, operational and treatment costs and advantages, limitations as well as the present status of different charged particle therapy facilities available worldwide.

Revisiting groundwater depletion and its implications on farm economics in Punjab, India

S. K. Srivastava, Ramesh Chand, Jaspal Singh, Amrit Pal Kaur, Rajni Jain, I. Kingsly and S. S. Raju

Keywords: Crop profitability, energy subsidy, farm economics, groundwater depletion.

Abstract

The study identifies factors behind the groundwater depletion in Punjab (India) and examines the economics of groundwater irrigation across farm-size categories, varied groundwater levels and energy policy scenario. The farm-level evidences point out that farmers with smaller land holdings incur 2–3 times groundwater cost than those with larger land holdings. Also, small farmers are affected more adversely due to falling groundwater level. Further, financial expenses in extracting groundwater are borne equally by the society and the farmers. The withdrawal of energy subsidy is

expected to reduce net returns, but at a varying rate across different crops. However, crop cultivation would still be profitable and desubsidization will result in 29–82% savings in existing groundwater use in different crops.

Geophysical assessment of vulnerability of surficial aquifer in the oil producing localities and riverine areas in the coastal region of Akwa Ibom state, southern Nigeria

N. J. George, J. G. Atat, I. E. Udoinyang, A. E. Akpan and A. M. George

Keywords: Aquifer vulnerability, groundwater protective layer and IEC.

Abstract

1D resistivity sounding survey was combined with geological and geohydrochemical information in order to examine the aquifer vulnerability. Ten Schlumberger soundings were executed along one profile on the basis of proximity to functional boreholes. Ten samples of groundwater from nearby boreholes were checked for concentrations of significant trace element in the laboratory. The resistivity and geohydrochemical information were employed to examine the level of protection and the associated possible risk of the groundwater repository in the mapped area. The interpreted overburden parameters (resistivities and thicknesses) of water repositories were deployed to determine the integrated electrical conductivities (IEC) and susceptibility of hydrogeological units to surface contaminations. Based on results, Eket and Onna on the southern part of Nsit Ubium have IEC which reflect medium to poor protection capacity based on slightly protected and vulnerable protective layers above the underlain groundwater within the approximate depth range of 15–30 m. Nsit Ubium, the northern zone of the survey area, has a wide range of resistivity which creates windows or vulnerable pathways for percolation of waste pollutants from the surface which flow at the deeper layer. However, layers within 15–25 m depth provide good protection to their underlying aquifer based on IEC which are $>1 \Omega^{-1}$. Hydrochemical parameters also show higher values that are beyond the 2006 World Health Organization (WHO) standards. The integration of resistivity data and the hydrochemical data showed that the dominant topmost cover layers of the study areas are grossly vulnerable due to drainable pores in the formation.

Fruit peel waste: characterization and its potential uses Pranav

D. Pathak, Sachin A. Mandavgane and Bhaskar D. Kulkarni

Keywords: Characterization, fruit peel, solid waste, utilization, valorization.

Abstract

Globally, India is the leading producer of fruits. Fruits after consumption leave a peel which is a nuisance to the environment as a solid waste. In this article, commonly available large volume-fruit peels (FP) (viz. banana, orange, citrus, lemon and jackfruit) were investigated for surface, physical and chemical characteristics with a view to propose their valorization in detail. Each FP was characterized by proximate and ultimate analysis, porosity, particle density, bulk density, point of zero charge (pHpzc), surface pH, surface charges, water absorption capacity, BET surface area, scanning electron microscopy, Fourier transform infrared spectroscopy and TGA/derivative of thermogravimetric. The BET surface area of FP is very less, between 0.60 and 1.2 m²/g. The pHpzc and surface pH values of orange peel (OP), citrus peel (CP), lemon peel (LP) and jackfruit peels (JFP) are in the range of 3–4. The pHpzc value and surface pH of banana peel (BP) is closer to 7. The order of surface acidity is OP > LP > CP > JFP > BP. From TG curves it is clear that FPs are stable below 150°C. The results will be useful for rational design, when FP is used as a substrate for bioactive compounds, phenolic antioxidants, organic acids, enzymes, biofertilizer, production of energy and as adsorbents.

Exposure of *Eichhornia crassipes* (Mart.) Solms to salt water and its implications

Temjensangba Imchen, S. S. Sawant and Wasim Ezaz

Keywords: *Eichhornia crassipes*, salinity stress, superoxide dismutase, total organic carbon.

Abstract

In this article, we discuss the effect of salinity on the viability and decomposition of *Eichhornia crassipes* plant under normal photoperiod, dark condition and physiological response. Highest concentration of total organic carbon (27.43 mg C l⁻¹) was recorded in 15 psu salinity after 45 days. The TOC output was more in case of leaf (3.6 mg C l⁻¹) than petiole (2.39 mg C l⁻¹) under dark condition, after 21 days in freshwater. Salt stress was found to enhance the superoxide dismutase activity at 20 psu in both leaf and petiole. Enzyme activity declined when salt-stressed plants were transferred to nutrient enriched freshwater. This indicated that 20 psu could be a plant's salt tolerance limit. The potential transfer test conducted in this study showed that *Eichhornia* introduction through shipping activities is less likely.

Comparative end-to-end evaluation of research organizations

Gangan Prathap

Keywords: Bibliometrics, composite indicators, comparative research evaluation, size-dependent indicators, size-independent indicators.

Abstract

Comparative end-to-end research evaluations of large research entities like countries, agencies or institutions need to separate out the bibliometric part of the chain from the econometric part. Both size-dependent and size-independent terms play a crucial role to combine quantity and quality (impact) in a meaningful way. Output or outcome at the bibliometric level can be measured using zeroth, first or second-order composite indicators, and the productivity or efficiency terms follow accordingly using the input to output or outcome factors.

Geophysical assessment of vulnerability of surficial aquifer in the oil producing localities and riverine areas in the coastal region of Akwa Ibom state, southern Nigeria

N. J. George¹, J. G. Atat², I. E. Udoinyang³, A. E. Akpan⁴ and A. M. George

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1D resistivity sounding survey was combined with geological and geochemical information in order to examine the aquifer vulnerability. Ten Schlumberger soundings were executed along one profile on the basis of proximity to functional boreholes. Ten samples of groundwater from nearby boreholes were checked for concentrations of significant trace element in the laboratory. The resistivity and geochemical information were employed to examine the level of protection and the associated possible risk of the groundwater repository in the mapped area. The interpreted overburden parameters (resistivities and thicknesses) of water repositories were deployed to determine the integrated electrical conductivities (IEC) and susceptibility of hydrogeological units to surface contaminations. Based on results, Eket and Onna on the southern part of Nsit Ubium have IEC which reflect medium to poor protection capacity based on slightly protected and vulnerable protective layers above the underlain groundwater within the approximate depth range of 15–30 m. Nsit Ubium, the northern zone of the survey area, has a wide range of resistivity which creates windows or vulnerable pathways for percolation of waste pollutants from the surface which flow at the deeper layer. However, layers within 15–25 m depth provide good protection to their underlying aquifer based on IEC which are $>1 \Omega^{-1}$. Hydrochemical parameters also show higher values that are beyond the 2006 World Health Organization (WHO) standards. The integration of resistivity data and the hydrochemical data showed that the dominant topmost cover layers of the study areas are grossly vulnerable due to drainable pores in the formation.

Fluorescence spectral features of blood components of pregnant women

Sandhanasamy Devanesan, Mashael AlShebly, Rudran Kalaivani, Krishnan Sivaji, Karim Farhat, Mohamad Saleh AlSalhi, Mohamed AlAtawi, Danny Rabah and Vadivel Masilamani

Keywords: Fluorescent biomolecules, pregnancy, red blood cells, synchronous fluorescence spectra.

Abstract

During pregnancy, women experience various metabolic and hormonal changes that contribute to foetal development. These changes are investigated in the present study in terms of fluorescent biomolecules found in blood using synchronous fluorescence spectroscopy. Comparing a set of blood samples of 14 pregnant women against age-adjusted controls, it could be seen that the amino acid tryptophan is approximately twofold higher in blood plasma of pregnant women ($P < 0.1$), while the metabolite flavin adenine dinucleotide is approximately 25% lower. Further, the essential oxygen-carrying protein in the haemoglobin, porphyrin, is 80% higher in pregnant women. When these results were compared with the spectral features of blood components of patients with thalassaemia, it was found that erythrocytes had approximately 25% less haemolysis during the tenure of pregnancy.

Exposure of *Eichhornia crassipes* (Mart.) Solms to salt water and its implications

Temjensangba Imchen, S. S. Sawant and Wasim Ezaz

Keywords: *Eichhornia crassipes*, salinity stress, superoxide dismutase, total organic carbon.

Abstract

In this article, we discuss the effect of salinity on the viability and decomposition of *Eichhornia crassipes* plant under normal photoperiod, dark condition and physiological response. Highest concentration of total organic carbon (27.43 mg C l⁻¹) was recorded in 15 psu salinity after 45 days. The TOC output was more in case of leaf (3.6 mg C l⁻¹) than petiole (2.39 mg C l⁻¹) under dark condition, after 21 days in freshwater. Salt stress was found to enhance the superoxide dismutase activity at 20 psu in both leaf and petiole. Enzyme activity declined when salt-stressed plants were transferred to nutrient enriched freshwater. This indicated that 20 psu could be a plant's salt tolerance limit. The potential transfer test conducted in this study showed that *Eichhornia* introduction through shipping activities is less likely.

Fruit peel waste: characterization and its potential uses

Pranav D. Pathak, Sachin A. Mandavgane and Bhaskar D. Kulkarni

Keywords: Characterization, fruit peel, solid waste, utilization, valorization.

Abstract

Globally, India is the leading producer of fruits. Fruits after consumption leave a peel which is a nuisance to the environment as a solid waste. In this article, commonly available large volume-fruit peels (FP) (viz. banana, orange, citrus, lemon and jackfruit) were investigated for surface, physical and chemical characteristics with a view to propose their valorization in detail. Each FP was characterized by proximate and ultimate analysis, porosity, particle density, bulk density, point of zero charge (pHpzc), surface pH, surface charges, water absorption capacity, BET surface area, scanning electron microscopy, Fourier transform infrared spectroscopy and TGA/derivative of thermogravimetric. The BET surface area of FP is very less, between 0.60 and 1.2 m²/g. The pHpzc and surface pH values of orange peel (OP), citrus peel (CP), lemon peel (LP) and jackfruit peels (JFP) are in the range of 3–4. The pHpzc value and surface pH of banana peel (BP) is closer to 7. The order of surface acidity is OP > LP > CP > JFP > BP. From TG curves it is clear that FPs are stable below 150°C. The results will be useful for rational design, when FP is used as a substrate for bioactive compounds, phenolic antioxidants, organic acids, enzymes, biofertilizer, production of energy and as adsorbents.

Key technology network of BioMEMS through patent analysis

Shu-Hao Chang

Keywords: Biomicroelectromechanical system, key technology, network analysis, patent network.

Abstract

The growth of an ageing population and demand for telemedicine has rendered biomicroelectromechanical systems (BioMEMS) as one of the internationally recognized prospective research areas. Previous studies have mostly emphasized on specific BioMEMS technology or the market application of such technology. However, these studies have not actively identified the key technology of BioMEMS and have not determined the technology development trend in recent years. In the present study, BioMEMS patents were used as a basis of analysis to build a technology network and conduct network analysis. The results showed that key BioMEMS technologies mainly comprised chemical containers, measurements, printed circuits and medical diagnoses. Therefore, BioMEMS technology is applicable to not only one technical field, but multiple technical fields. However, recent technological development has mainly emphasized medical diagnostic measuring technology rather than mature technologies such as chemical containers or printed circuits. An analysis of patent holders reveals that institutions which have developed BioMEMS technology for a relatively long period of time are public or semipublic agencies, indicating that government funding and support are necessary in the early phase of BioMEMS development. This study constructed a model of a patent technology network to investigate the development trend of BioMEMS technology.

Performance of cathode catalysts for bio-electricity from paper recycling, wastewater-fed, microbial fuel cells

M. Radha and S. Kanmani

Keywords: Iron phthalocyanine, microbial fuel cell, multiwalled carbon nanotubes, oxygen reduction rate, paper recycling wastewater.

Abstract

This work deals with the performance of a microbial fuel cell, focusing on the electrocatalytic activity of selected cathodes constructed by coating nanocomposites over graphite felt under neutral pH in a doublechamber configuration using paper-recycled waste water as a typical electrolyte. Among all cathodes, iron phthalocyanine (FePc) combined multiwalled carbon nanotubes (MWCNT) shows the highest power density (9.34 W/m²) compared to other two catalysts, FePc/Ketjan black (4.68 W/m²) and MWCNT (2.9 W/m²) under similar conditions of using a reference platinum/carbon (Pt/C) loading of 0.5 mg/cm². The morphology of these catalyst coated electrodes was characterized by scanning electron microscopy. Their electrocatalytic activities were examined using cyclic voltammetry. This work provides an appropriate alternative for cathode catalysts in treatment as well as in electricity production as demonstrated by the high power density of the above catalysts compared to that using precious Pt metal catalyst in microbial fuel cells.

Phosphorus accumulation associated with intense diagenetic metal-oxide cycling in sediments along the eastern continental margin of India

C. Prakash Babu and V. Ramaswamy

Keywords: Early diagenesis, metal-oxide cycling, phosphorus accumulation, surface sediments.

Abstract

Sequential phosphorus extractions were carried out to understand phosphorus cycling and enrichment in surface sediments along the eastern continental margin of India. Phosphorus associated with authigenic (P_{aut}) and biogenic (P_{bio}) phases is high by a factor of 2–10 in the

continental shelf sediments compared to slope and deep-sea sediments. Phosphorus associated with Fe oxides (PFe) is enriched by a factor of 2–5 in the continental slope and rise sediments (500–3000 m water depth) compared to shelf sediments. Fe–Mn oxy(hydroxides) formed during early diagenesis adsorb phosphate from the water column or pore waters, thereby enriching the PFe fraction in the continental slope sediments. These results are in contrast with those from the Arabian Sea, where wide and intense mid-depth oxygen minimum zone (150–1200 m water depth) releases PFe to pore waters and enhances Paut accumulation in the continental slope sediments.

Estimation of geomorphic threshold in permanent gullies of lateritic terrain in Birbhum, West Bengal, India

Sandipan Ghosh and Sanat Kumar Guchhait

Keywords: Geomorphic threshold, gully, laterite, overland flow.

Abstract

The present geomorphic study focusses on predicting threshold conditions and vulnerable locations where gully heads might develop in the lateritic terrain, located at the eastern plateau fringe of Rajmahal Basalt Traps, Birbhum, West Bengal, India. The modern concept of geomorphic threshold is applied here on gully erosion hazard to identify the critical slope of gully head (S) and upstream drainage area (A) with a core relationship of $S = aA - b$. Based on 118 gully heads we have statistically derived significant relationships between slope and drainage area ($r = -0.55$); overland flow (Q) and slope length (L; $r = 0.694$); relative shear stress (τ) and slope ($r = 0.915$); as well as overland flow detachment rate (H) and eroding force of overland flow (F; $r = 0.980$). The established S–A critical relationship, as geomorphic threshold, is expressed as $S = 17.419A - 0.2517$, above which gully initiation occurred on the laterites. This equation can be used as a predictive model to locate the vulnerable un-trenched slopes (i.e. potential gully erosion locations) in other lateritic areas of West Bengal. The constant b value (0.2517) and Montgomery-Dietrich envelope suggest a relative dominance of overland flow (52.51% of sample gully heads) in the erosion processes. The result of erosion model predicts an annual soil loss of 2.33–19.9 kg m⁻² year⁻¹ due to overland flow above the gully heads.

Mass balance estimation using geodetic method for glaciers in Baspa basin, Western Himalaya

G. Vinay Kumar, Anil V. Kulkarni, Anil Kumar Gupta and Parmanand Sharma

Keywords: Baspa basin, geodetic method, mass balance, Western Himalaya.

Abstract

Himalayan glaciers, which contribute to water security for almost 1.3 billion people in Asia, are now under threat due to climate change. Assessment of glacier mass balance changes is crucial to determine the implications of climate change, but in situ measurements are limited due to rugged terrain and harsh climate of the Himalaya. Remote sensing-based geodetic method is therefore important for studying the evolution of Himalayan glaciers at a large scale. In this study, the mass balance of glaciers located in Baspa basin (Western Himalaya) is estimated for a period of 11 years between 2000 and 2011, using geodetic method. Out of 89 glaciers in the basin, 42 glaciers (greater than 1 km²) covering an area of ~72% (215 km²) of the total glaciated area were selected for the study. A mean thinning of $\sim 50 \pm 11$ m and mean accumulation of $\sim 35 \pm 11$ m was observed during the study period, with the cumulative mass balance varying between -36.9 ± 1.98 and 6.47 ± 1.98 m.w.e. A mean annual mass loss of -1.09 ± 0.32 m.w.e.a⁻¹ was observed for the entire basin, suggesting that the glaciers in Baspa basin are losing mass at higher rate compared to the glaciers in central and eastern Himalayas. This study demonstrates the utility of geodetic method to estimate mass balance of glaciers at basin scale, which will be useful to assess future changes in glacial extent and stream run-off.

Luminescence dating of Neolithic pottery in North East India

Sukanya Sharma and Pankaj Singh

Keywords: Cord marked, dating, hypothesis, neolithic, pottery.

Abstract

Department of Humanities and Social Sciences, Indian Institute of Technology, Guwahati 781 039, India Imprecise chronological data have long been affecting archaeological studies in Assam and Meghalaya, North East India. Relative dating methods have been used to study the antiquity of stone tools and ceramics found in the archaeological sites of these two areas. Both the areas are important as the eastern Asiatic Neolithic complex of double-shouldered celts and cord-marked pottery was first reported in India from Daojali Hading, Assam (1961), Garo Hills, Meghalaya has the highest concentration of prehistoric sites found in North East India. Optically stimulated luminescence dating offered an excellent opportunity for dating the ceramic samples recovered during the first excavations in 1961 (Daojali Hading in Dima Hasao district Assam) and 1999 (Gawak Abri, Garo Hills), as the method provided a direct age estimate of the time of last exposure of quartz or feldspar minerals to light or heat, and the purity of the etched quartz (i.e. any feldspar contaminations) can be confirmed by infrared stimulated luminescence technique. Date obtained from Daojali Hading is 2.7 ± 0.3 ka (LD1728) and that from Gawak Abri is 2.3 ± 0.2 ka (LD1727).

Antibacterial activity of protease hydrolysates isolated from *Silybum marianum*

Jing Yue, Zhicheng Zhu and Xinhua Li

Keywords: Antibacterial activity, antibacterial mechanism, proteolysis, *Silybum marianum*.

Abstract

In this study, the antibacterial activity of protease hydrolysates from *Silybum marianum* protein isolates (SMPIs) was investigated. Neutral protease, papain, pepsin and alkaline protease were used as experimental enzymes, while *Escherichia coli*, *Staphylococcus aureus*, *Sarcina lutea* and *Bacillus subtilis* were the bacterial indicators. The results showed that neutral protease, papain and pepsin hydrolysates exerted inhibitory effects on the four types of bacteria tested. However, alkaline protease hydrolysates of SMPI showed stimulatory effects on replication of the four bacteria tested. The antibacterial mechanism of SMPI hydrolysates was studied using scanning electron microscopy, and the results showed effective inhibition of *E. coli* (Gram-negative, G⁻) and *S. aureus* (Gram-positive, G⁺). It is speculated that the underlying mechanism of SMPI hydrolysates may involve injury to *E. coli* and *S. aureus* cell membranes. Currently, no similar studies have been conducted on the antibacterial activity of SMPI.

Isolation and characterization of phosphorus solubilizing bacteria from manganese mining area of Balaghat and Chhindwara

Shikha Dixit¹, K. K. Appu Kuttan and Rahul Shrivastava

Keywords: Mining area, phosphorus solubilizing bacteria, 16s rDNA.

Abstract

Plants require optimum amount of available phosphorus to support their growth and development. Phosphorus is known to have significant role in root subdivision, vitality and disease resistance of plants. Different types of bacteria involved in phosphorus solubilization can be used as biofertilizer in reclamation of mining area. The present study deals with isolation and identification of phosphorus solubilizing bacteria from the manganese mining area of Balaghat and Chhindwara districts of Madhya Pradesh, India. rDNA (16s) based molecular identification was performed assisted by MEGA phylogenetic analysis. *Pseudomonas putida*, *Bacillus licheniformis*, *Pseudomonas taiwanensis* and *Pseudomonas aeruginosa* were explored as potential phosphorus solubilizers from the selected sites.

Print mass media coverage of wildlife in the developing world

Salvador Lyngdoh, Divya Dixit and Bitapi C. Sinha

Keywords: Development, endangered, felids, indigenous people, human wildlife conflict, large mammals, print news.

Abstract

Wildlife news is assumed to be a less commonly reported item in the media. We studied wildlife related news coverage by the Indian print news agencies and quantified its patterns by reviewing 766 news items across 50 national, regional and business newspapers in the year 2011. We found a considerable size bias towards large bodied species (1 : 8 times) in portrayal of wildlife news items. The Indian print media was also more likely to report large, endangered, terrestrial mammals when they reported about wildlife. Nearly half of the wildlife reports by dailies were on tigers (>250) and other endangered large felids (>150). A tendency towards controversial portrayals with respect to species such as leopards and elephants was observed. We found similar pattern of reporting between national, regional and business newspapers with respect to species and themes covered. Business dailies rarely carried wildlife related news (5 items). It is suggested that a balanced and ecological approach to sensitize the masses by various agencies can be adopted to reduce misconceptions and increase acceptance.

Bioprospecting of medicinal plants in Nanda Devi Biosphere Reserve: Linking conservation with livelihood

R. K. Maikhuri, Vikram S. Negi, L. S. Rawat and D. S. Pharswan

Keywords: Bioprospecting, cultivation, conservation, livelihood, indigenous knowledge, medicinal plant

Abstract

Six species of medicinal and aromatic plants, viz. *Allium stracheyi*, *Allium humile*, *Allium rubellum*, *Pleurospermum angelicoides*, *Carum carvi* and *Angelica glauca* having high economic value were selected for bioprospecting and brought under cultivation from wild in the high altitude villages of Nanda Devi Biosphere Reserve, Uttarakhand. The edible parts of selected species were analysed for nutritional value to evaluate their potential for promoting large scale consumption and cultivation. Among the selected species, macronutrients were found maximum for *Allium stracheyi*, i.e. carbohydrates (98.34 mg/g), proteins (187.11 mg/g), vitamin C (156.50 mg/g), vitamin B2 (26.12 mcg/gm), vitamin E (61.10 mg/g) and phosphorus (14.13 mg/g) followed by *Allium rubellum* and *Allium humile*. The results of nutritional value, cultivation practices and technique of value addition were demonstrated to rural inhabitants through on-site training and capacity building programmes to enhance their skill and awareness about the potential of selected species for livelihood options. The cost-benefit analysis of cultivation and collection from wild, and value addition of herbal spices were done to see if the species were feasible for developing local entrepreneurs. These efforts enhance the ability and knowledge of local inhabitants for cultivation and value addition of medicinal herbal spices in the region. The overall impacts of the work were seen as an improvement in socio-economic conditions of residing community and awareness for medicinal plant conservation in their natural habitat.

Overview of the AstroSat mission

S. Seetha and S. Megala

Keywords: Astronomy mission, celestial sources, multiwavelength observations, payloads.

Abstract

AstroSat is the first dedicated astronomy mission of India aimed at simultaneous multi-wavelength observations of celestial sources in X-ray, ultraviolet and limited optical spectral bands. The satellite was launched from Satish Dhawan Space Centre, Sriharikota on 28 September 2015 by PSLV-C30 (XL) in its 30th consecutive successful flight. The satellite was placed in an orbit with an altitude of 650 km and 6° orbital inclination. Currently, all the payloads are operational and observations are underway. The mission life is expected to be 5 years.

Ultraviolet Imaging Telescope on AstroSat

S. N. Tandon, S. K. Ghosh, J. Hutchings, C. S. Stalin and A. Subramaniam

Keywords: Multi-wavelength astronomy, Ultraviolet Imaging Telescope, X-ray telescope

Abstract

The AstroSat satellite is designed for multiwavelength astronomy for observations covering a spectral range from soft and hard X-rays to the ultraviolet. The Ultraviolet Imaging Telescope (UVIT) is the only non-X-ray telescope on AstroSat and it provides the long lever arm to the multi-wavelength observations. In addition to the simultaneous multiwavelength studies in coordination with the X-ray telescopes on-board AstroSat, UVIT is used to study a large variety of objects with arcsecond-level spatial resolution. During the first year of observations, UVIT has obtained images in many filter bands in the wavelength range 130–300 nm over a field of $\sim 28'$, which are being used to study a variety of hot stars, nebulae, stellar clusters and galaxies.

Soft X-ray focusing Telescope aboard AstroSat: early results

K. P. Singh, G. C. Dewangan, S. Chandra, S. Bhattacharayya, V. Chitnis, G. C. Stewart and N. J. Westergaard

Keywords: Active galactic nuclei, stars, supernova remnants, X-ray astronomy.

Abstract

The Soft X-ray focusing Telescope (SXT) is a moderate resolution X-ray imaging spectrometer supplementing the ultraviolet and hard X-ray payloads for broadband studies of cosmic sources with AstroSat. Well suited for observing bright X-ray sources, SXT observations of nearby active galactic nuclei (AGN), binary star systems with compact companions, active stars, etc. are producing long soft X-ray light curves and high-quality spectra. The strong X-ray variability and multiple spectral components exhibited by SXT observations of nearby Seyfert 1 galaxies show excellent promise to probe accretion disks and central engines in AGN through multi-band variability and spectroscopy.

Large Area X-ray Proportional Counter instrument on AstroSat

J. S. Yadav, P. C. Agrawal, H. M. Antia, R. K. Manchanda, B. Paul and Ranjeev Misra

Keywords: Energy- and time-resolution, payloads, space observatory, X-ray sources.

Abstract

Large Area X-ray Proportional Counter (LAXPC) is one of the major AstroSat payloads. The instrument will provide high time-resolution X-ray observations in 3–80 keV energy band with moderate energy resolution. A cluster of three co-aligned identical LAXPC detectors is used in AstroSat to provide large collection area of more than 6000 sq. cm. The large detection volume (15 cm depth) filled with xenon gas at ~ 2 atm pressure, results in detection efficiency greater than 50%

above 30 keV. With its broad energy range and fine-time resolution (10 μ s), LAXPC instrument is well suited for timing and spectral studies of a wide variety of known and transient X-ray sources in the sky. We have done extensive calibration of all LAXPC detectors using radioactive sources as well as GEANT4 simulation of LAXPC detectors. We describe in brief some of the results obtained during the payload verification phase along with LAXPC capabilities.

Cadmium–Zinc–Telluride Imager on-board AstroSat: a multi-faceted hard X-ray instrument

A. R. Rao, D. Bhattacharya, V. B. Bhalerao, S. V. Vadawale and S. Sreekumar

Keywords: All-sky hard X-ray monitor, gamma-ray bursts, neutron stars, X-ray polarization.

Abstract

The AstroSat satellite is designed to make multiwaveband observations of astronomical sources and the Cadmium–Zinc–Telluride Imager (CZTI) instrument of AstroSat covers the hard X-ray band. CZTI has a large area position-sensitive hard X-ray detector equipped with a coded aperture mask, thus enabling simultaneous background measurements. Ability to record simultaneous detection of ionizing interactions in multiple detector elements is a special feature of the instrument, and this is exploited to provide polarization information in the 100–380 keV region. CZTI provides sensitive spectroscopic measurements in the 20–100 keV region, and acts as an all-sky hard X-ray monitor and polarimeter above 100 keV. During the first year of operation, CZTI has recorded several gamma-ray bursts, measured the phase-resolved hard X-ray polarization of the Crab pulsar, and the hard X-ray spectra of many bright galactic X-ray binaries. The excellent timing capability of the instrument has been demonstrated with simultaneous observation of the Crab pulsar with radio telescopes like Gaint Metrewave Radio Telescope and Ooty Radio Telescope.

Visible Emission Line Coronagraph on Aditya-L1

B. Raghavendra Prasad, Dipankar Banerjee, Jagdev Singh, S. Nagabhushana, Amit Kumar, P. U. Kamath, S. Kathiravan, Suresh Venkata1, N. Rajkumar, V. Natarajan1, Madhur Juneja, Pawan Somu, Vaibhav Pant, Nigar Shaji, K. Sankarsubramanian, Asit Patra, R. Venkateswaran, Abhijit Avinash Adoni, S. Narendra, T. R. Haridas, Shibu K. Mathew, R. Mohan Krishna, K. Amareswari and Bhavesh Jaiswal

Keywords: Coronagraph, coronal mass ejection, payload, solar corona.

Abstract

Solar coronagraph mimics total solar eclipse by blocking the solar disk and enabling the observation of extended coronal atmosphere of the Sun. Visible Emission Line Coronagraph (VELC), on-board Aditya-L1 space mission, is an internally occulted solar coronagraph capable of simultaneous imaging, spectroscopy and spectro-polarimetry close to the solar limb. This payload is designed to study the coronal plasma and heating of the solar corona. Studying development, dynamics and origin of coronal mass ejections and measurement of coronal magnetic fields over active regions are other important science goals. VELC is designed to image the solar corona at 500 nm with an angular resolution of 5" over a field of view (FOV) of 1.05–3 Ro. It also facilitates simultaneous multi-slit spectroscopy at three emission lines, viz. Fe XIV (530.3 nm), Fe XI (789.2 nm) and Fe XIII (1074.7 nm) with a spectral resolution of 28, 31 and 202 mÅ/pixel respectively, over an FOV of 1.05–1.5 Ro. The payload has a dual-beam spectro-polarimetry channel for magnetic field measurements at 1074.7 nm.

Scanning Sky Monitor on-board AstroSat

M. C. Ramadevi, S. Seetha, Dipankar Bhattacharya, B. T. Ravishankar, N. Sitaramamurthy, G. Meena, M. Ramakrishna Sharma, Ravi Kulkarni, V. Chandra Babu, Kumar, Brajpal Singh, Anand Jain, Reena Yadav, S. Vaishali, B. N. Ashoka, Anil Agarwal, K. Balaji, Manoj Kumar, Prashanth Kulshresta, Pankaj Agarwal and Mathew Sebastian

Keywords: AstroSat, crab, scanning sky monitor, Xray transient sources.

Abstract

Scanning Sky Monitor (SSM) on-board AstroSat is a wide-field imager to monitor the X-ray sky in the energy band 2.5–10 keV. The primary science objective of SSM is to detect and locate transient X-ray sources in the sky. Once detected the information is to be provided to the astronomical community for follow-up observations to do a more detailed study of the source. Long-term monitoring of known X-ray transient sources is also one of the science objectives of SSM. The instrument constitutes three units of 1D positionsensitive proportional counters with coded masks on each, all three mounted on a platform capable of rotation to scan about 50% of the sky in one full rotation. The angular resolution of each unit in SSM is $12' \times 2.5^\circ$. Sensitivity of SSM is ~ 30 milliCrab at 3 sigma in 10 min integration time. This article briefly discusses the instrument and a few early results since the launch of AstroSat.

Multi-colour hues of the Universe observed with AstroSat

K. P. Singh and D. Bhattacharya

Keywords: Active galaxies, cosmic sources, multiwavelength astronomy, multi-colour hues, supernova remnants.

Abstract

India's space astronomy observatory AstroSat was launched on 28 September 2015, carrying instruments to observe cosmic sources over a large spectral band, from optical/UV to hard X-rays. The mission, with all its payloads, has been operating successfully since its launch. After an initial period of performance verification and calibration, the satellite is now in full science operation. This article gives a brief introduction about the capabilities of the mission and presents some of the early science results.

Aditya-L1 mission

S. Seetha and S. Megala

Keywords: Corona, mission, payloads, Sun.

Abstract

Aditya-L1 is the first Indian space mission to study the Sun. The mission is aimed at studying the Sun from a halo orbit around the Sun–Earth Lagrangian point 1, which is about 1.5 million kilometres from the Earth. It carries seven payloads to observe the photosphere, chromosphere and the outermost layers of the Sun, the corona, in different wavebands. The spacecraft and payloads are under development. Aditya-L1 is expected to be launched during the 2019–20 timeframe by PSLV-XL.

The Solar Ultraviolet Imaging Telescope on-board Aditya-L1

Durgesh Tripathi, A. N. Ramaprakash, Aafaque Khan, Avyarthana Ghosh, Subhamoy Chatterjee, Dipankar Banerjee, Pravin Chordia, Achim Gandorfer, Natalie Krivova, Dibyendu Nandy, Chaitanya Rajarshi and Sami K. Solanki

Keywords: Oxygen and ozone chemistry, solar radiation, Sun–climate relationship, ultraviolet imaging telescope.

Abstract

The Solar Ultraviolet Imaging Telescope (SUIT) is an instrument on-board Aditya-L1 mission of ISRO that will measure and monitor the solar radiation emitted in the near ultraviolet wavelength range (200–400 nm). SUIT will simultaneously map the photosphere and chromosphere of the Sun

using 11 filters sensitive to different wavelengths and covering different heights in the solar atmosphere and help us understand the processes involved in the transfer from mass and energy from one layer to the other. SUIT will also allow us to measure and monitor spatially resolved solar spectral irradiance that governs the chemistry of oxygen and ozone in the stratosphere of the Earth's atmosphere. This is central to our understanding of Sun–climate relationship.

Probing the heliosphere using in situ payloads on-board Aditya-L1

P. Janardhan, Santosh Vadawale , Bhas Bapat , K. P. Subramanian, D. Chakrabarty , Prashant Kumar, Aveek Sarkar, Nandita Srivastava¹, R. Satheesh Thampi, Vipin K. Yadav , M. B. Dhanya, Govind G. Nampoothiri, J. K. Abhishek, Anil Bhardwaj and K. Subhalakshmi

Keywords: Aditya-L1, heliosphere, payload, solar wind plasma.

Abstract

Aditya-L1, the first ever Indian scientific space mission dedicated to probe the Sun, our nearest star, is slated for launch by the Indian Space Research Organisation (ISRO) most likely in 2020, the year coinciding with the expected start of the rising phase of solar cycle 25. Of the seven science payloads on-board AdityaL1, three are in situ instruments, namely the Aditya Solar wind Particle EXperiment, the Plasma Analyser Package for Aditya and a magnetometer package. These three payloads will sample heliospheric data from the L1 Lagrangian point of the Sun–Earth system, at a distance of ~1% of the distance to the Sun, along the Sun–Earth line. This is therefore a unique opportunity for the solar physics community to gain a better understanding of the inner heliosphere and predict space weather more accurately.

India's participation in the Thirty Meter Telescope International Observatory project

B. Eswar Reddy and A. N. Ramaprakash

Keywords: Actuators, coating chambers, edge sensors, International Observatory project, segment support assembly.

Abstract

The Thirty Meter Telescope International Observatory (TIO) is being built by an international consortium of institutes and universities in Canada, China, India, Japan and USA. The estimated cost is about US\$ 1.47 billion (2012 base year). At present, it is planned to be built on Mauna Kea, Hawaii, at an altitude of about 4000 m. The mountain is already home to many of the world's largest telescopes. The Union Cabinet chaired by the Prime Minister, at its meeting held on 24 September 2014, approved India's participation in the TIO project at a total cost of Rs 1299.80 crores. Only about 30% of India's contribution to the project will be made in cash to be utilized for building common facilities and infrastructure. The rest will be made through design, development and manufacturing of a number of hardware, software and optical components. India's participation in the TIO is an extramural national project jointly funded by the Department of Science and Technology (DST) and the Department of Atomic Energy (DAE). To successfully deliver India's in-kind contributions, the two funding agencies have jointly set up the India TMT Coordination Centre (ITCC) which is located at the Indian Institute of Astrophysics (IIA), Bengaluru. IIA along with the Aryabhata Research Institute of Observational Sciences, Nainital and the Inter-University Centre for Astronomy and Astrophysics, Pune are the key institutes which manage the India TMT project through ITCC. Being a major extra-mural national effort, several other institutes as well as universities participate in the technological, developmental and scientific aspects of the initiative.

X-ray spectrometers on-board Aditya-L1 for solar flare studies

K. Sankarasubramanian, Manju Sudhakar, Anuj Nandi, M. C. Ramadevi, Abhijit Avinash Adoni, Ankur Kushwaha, Anil Agarwal, Arjun Dey, Bhuwan Joshi, Brajpal Singh, V. Girish, Ishan Tomar, Kamal Kumar Majhi, Kumar, Manjunath Olekar, Monoj Bug, Manohar Pala, Mukund Kumar Thakur, Rajeev R. Badagandi, B. T. Ravishankar, Sarthak Garg, N. Sitaramamurthy, N. Sridhara, C. N. Umopathy, Vinod Kumar Gupta, Vivek Kumar Agrawal and B. Yougandar

Keywords: Coronal heating, solar flares, X-ray spectrometers.

Abstract

Aditya-L1 mission will carry two high-spectral resolution X-ray spectrometers to study solar flares. The soft X-ray spectrometer will cover the energy range from 1 to 30 keV, while the hard X-ray spectrometer will cover from 10 to 150 keV. These two instruments together will provide opportunities to study the plasma parameters during solar flares as well as acceleration mechanisms of energetic particles during the flaring time.

Development of the Thirty-Meter Telescope project

Edward Stone and Michael Bolte

Keywords: Adaptive optics system, large telescopes, segmented mirrors.

Abstract

The Thirty-Meter Telescope (TMT) project is a welladvanced effort to construct one of the first of the next generation of extremely large telescopes with primary mirror diameter larger than 25 m. When used with an adaptive optics systems capable of producing diffraction-limited images, the science reach of a 30 m telescope is extraordinary with improvements in sensitivity over existing telescopes by as much as a factor of 80 for some kinds of observations. The TMT design extends that of the twin Keck 10 m telescopes now in operation and uses the same close-packed segmented primary mirror. The partnership that will finish the design, construct and operate the telescope is described.

The Thirty Meter Telescope International Observatory facilitating transformative astrophysical science

Warren Skidmore, G. C. Anupama and Raghunathan Srianand

Keywords: Astrophysical science, black holes, dark matter, galaxies, large telescopes.

Abstract

The next major advancement in astronomy and cosmology will be driven by deep observations using very sensitive telescopes with high spatial and spectral resolution capabilities. An international consortium of astronomers, including Indian astronomers are building the Thirty Meter Telescope to achieve breakthroughs in different areas of astronomy starting from studies of the solar system to that of the early universe. This article provides a brief overview of the telescope, science objectives and details of the first light instruments.

India and the Square Kilometre Array

Philip Diamond and Yashwant Gupta

Keywords: Global collaboration, international consortium, radio telescope, science cases.

Abstract

The Square Kilometre Array (SKA), the world's nextgeneration radio telescope, is being designed by an international consortium. It will, once complete, deliver capability for a broader range of science than any other facility. Indian scientists and engineers have played a critical role in the definition of the SKA concept and its science case, in the design of the instrument and, hopefully, will do so in the construction and operation. This article describes the current status of the global project with a focus on India's role in the global collaboration.

The first direct detection of gravitational waves opens a vast new frontier in astronomy

F. J. Raab and D. H. Reitze

Keywords: Astronomy, direct detection, gravitational waves, space–time.

Abstract

We review the first direct detection of gravitational waves in the first observing run of the newly installed Advanced LIGO gravitational-wave detectors. This opens a new window on the universe, using an entirely new phenomena as the messenger to explore the cosmos. We also describe prospects for the future exploration of this new frontier.

Cosmic sirens: discovery of gravitational waves and their impact on astrophysics and fundamental physics

Sanjeev Dhurandhar and Bangalore S. Sathyaprakash

Keywords: Cosmic sirens, gravitational waves, coalescing compact binaries, general relativity.

Abstract

On 14 September 2015, the twin detectors belonging to the Laser Interferometer Gravitational Wave Observatory (LIGO) made a triple discovery: the first direct detection of gravitational waves (GWs), first observation of formation of a black hole and first observation of a binary black hole. Since then LIGO has reported two other events and a marginal candidate. These discoveries have heralded a new era in observational astronomy. They will help us in exploring extremes of astrophysics and gravity. GWs are our best chance of getting an idea of what went on a small fraction of a second after the big bang, even if that takes many more decades. With LIGO's discoveries we hope to solve many puzzles in astronomy and fundamental physics, but GWs are guaranteed to show up objects and phenomena never imagined before.

LIGO-India – a unique adventure in Indian science

Tarun Souradeep, Sendhil Raja, Ziauddin Khan, C. S. Unnikrishnan and Bala Iyer

Keywords: Astronomy and astrophysics, gravitational waves, laser interferometer, mega-science projects, observatories and detectors.

Abstract

LIGO-India is an ambitious, large scale mega-science project that will establish a state-of-the-art advanced LIGO gravitational wave (GW) observatory on Indian soil in collaboration with the LIGO Laboratory in the USA. LIGO-India is expected to commence science operations in 2024 as a key element of a global array of gravitational wave observatories. Beyond the first direct detection of gravitational waves announced in February 2016 by LIGO Science Collaboration, LIGO-India brings forth a great opportunity for Indian scientists and technologists for leadership at the frontier, a new window of gravitational-wave astronomy to probe the universe.

Scientific capabilities and advantages of the 3.6 meter optical telescope at Devasthal, Uttarakhand

Amitesh Omar, Brijesh Kumar, Maheswar Gopinathan and Ram Sagar

Keywords: Active optics technology, celestial sky, instrumentation, optical astronomy.

Abstract

India's largest 3.6 m aperture optical telescope has been successfully installed in the central Himalayan region at Devasthal, Nainital district, Uttarakhand. The primary mirror of the telescope uses the active optics technology. The back-end instruments, enabling spectroscopic and photometric imaging of the celestial sky are designed and developed by ARIES along with other Indian institutes. The Devasthal optical telescope in synergy with two other highly sensitive telescopes in the country, namely GMRT operating in the radio wavebands and AstroSat operating in the high-energy X-ray, ultraviolet and visual wavebands, will enable Indian astronomers to carry out scientific studies in several challenging areas of astronomy and astrophysics.

Multi-messenger astronomy

Varun Bhalerao

Keywords: Astrophysical source, complementary information, electromagnetic and gravitational waves, multi-messenger astronomy.

Abstract

Modern astrophysics utilizes data from a wide variety of channels extending beyond the conventional optical, radio and X-ray observations. Technological developments have augmented electromagnetic (EM) observations with data from cosmic ray detectors, neutrino detectors and recently from gravitational wave (GW) observatories – together forming the core of multi-messenger astronomy. Each ‘messenger’ carries complementary information about various physical processes occurring in an astrophysical source. Combining data from all these channels makes it possible to piece together a more detailed understanding of sources than any single channel can. In this article I discuss multi-messenger astronomy with emphasis on joint EM and GW studies.

The Multi Application Solar Telescope

P. Venkatakrishnan, Shibu K. Mathew, Nandita Srivastava, A. R. Bayanna, Brajesh Kumar, Bireddy Ramya, Naresh Jain and Mukesh Saradava

Keywords: Adaptive optics, back-end instruments, dome, solar telescope.

Abstract

Multi Application Solar Telescope (MAST), a telescope for the detailed study of solar activity, was operationalized at the Udaipur Solar Observatory (USO) of Physical Research Laboratory (PRL), on 16 June 2015. This article traces the history of the conceptualization to realization of MAST and describes its salient features. MAST is an off-axis Gregorian-Coudé telescope with a 50 cm aperture. The first light backend instruments include a narrow band polarimetric imager to map the photospheric and chromospheric magnetic fields and a multi-slit spectro-polarimeter. An adaptive optics system is also being developed for the on-line corrections of the image distortions produced by atmospheric seeing. The main objective of MAST is to obtain high spatial and temporal resolution observations of solar photospheric and chromospheric activity, with the ultimate goal of predicting space weather.

MACE gamma-ray telescope – a status update

Ramesh Koul

Abstract

A 21 m diameter imaging atmospheric Cherenkov telescope is being installed at the high-altitude astronomical site at Hanle in the Ladakh region of North India. When operational by 2018, it will have the distinction of being the largest gamma-ray telescope in the northern hemisphere and the second largest in the world. Operating at a trigger threshold energy of $<20\text{GeV}$ it will play an important role in understanding very high energy processes in the Universe.

National Large Solar Telescope

S. S. Hasan, D. Banerjee, B. Ravindra, K. Sankarasubramanian and K. E. Rangarajan

Keywords: Adaptive optics, high angular resolution, magnetic fields, solar telescope.

Abstract

Indian Institute of Astrophysics, Bengaluru 560 034, India The National Large Solar Telescope (NLST) aims primarily to carry out observations of the solar atmosphere with high spatial, spectral and temporal resolution. A comprehensive site characterization programme, that commenced in 2007, has identified an excellent site in the Ladakh region at the Pangong lake, India. With an innovative optical design, NLST is an on-axis Gregorian telescope with a low number of optical

elements to reduce the number of reflections and yield a high throughput with low polarization. In addition, it uses high-order adaptive optics to produce close to diffraction limited performance. To control atmospheric and thermal perturbations of the observations, the telescope will function with a fully open dome, to achieve its full potential atop a 25 m tower. The post-focus instruments include broadband and tuneable Fabry–Perot narrow band imaging instruments and a high-resolution spectropolarimeter.

India-based Neutrino Observatory

Vivek M. Datar and Naba K. Mondal

Keywords: Dark matter, neutrino physics, particle detectors, underground laboratory.

Abstract

India India has a rich history in neutrino physics. The first ever atmospheric neutrino interaction was observed in the deep underground laboratory at the Kolar Gold Fields (KGF) Karnataka in 1965. This laboratory later also looked for nucleon decay and placed limits on the proton lifetime. The KGF underground laboratory ceased its operation in 1992 due to the closure of the mine. The India-based Neutrino Observatory (INO) project is a recent initiative to develop a new underground laboratory to conduct experiments in the area of neutrino physics and dark matter searches under a mountain with at least 1000 m rock cover. It is expected that over the years, INO will become a full-fledged underground science laboratory hosting experiments that can exploit its special low background environment and infrastructure.

The upgraded GMRT: opening new windows on the radio Universe

Y. Gupta, B. Ajithkumar, H. S. Kale, S. Nayak, S. Sabhapathy, S. Sureshkumar, R. V. Swami, J. N. Chengalur, S. K. Ghosh, C. H. Ishwara-Chandra, B. C. Joshi, N. Kanekar, D. V. Lal and S. Roy

Keywords: Radio telescope, upgrade, scientific potential, technical challenges.

Abstract

The Giant Metrewave Radio Telescope (GMRT) is today a frontline international facility for lowfrequency radio astronomy, that has produced several exciting and important new results in the 15 years that it has been operational. To keep the GMRT competitive in the global arena in the future, a major upgrade of the observatory is nearing completion that will increase its sensitivity by up to three times and make it a more powerful and versatile facility. We describe the main goals of this upgrade, highlight the technical features and challenges, outline the science potential and update the current status of this venture.

PGPR-assisted phytoremediation of cadmium: an advancement towards clean environment

Chhaya Verma, Amar Jyoti Das and Rajesh Kumar

Keywords: Cadmium, phytoremediation, plant growth promoting rhizobacteria, toxicity.

Abstract

One of the major problems, that the world is facing today due to rapid industrialization is environmental pollution caused by several factors, including heavy metals. Among the heavy metals, cadmium is a hazardous carcinogenic element. From contaminated soil, cadmium enters the plants through the roots and is accumulated in the harvestable (edible) parts, and thus gains entry into the food cycle. Phytoremediation plays a beneficial role in the remediation of cadmium contamination from soil, but becomes less effective with increasing toxicity. Even hyperaccumulator plants fail to perform under these conditions. Plant growth promoting rhizobacteria (PGPR), inhabitants of the plant rhizosphere, play a supporting role and promote bioremediation of soil by accumulation or transformation of contaminants, thereby enhancing plant growth and development. This article focuses on cadmium contamination and PGPR-assisted phytoremediation of cadmium-contaminated soils.

Pharmaceutical patenting trends on drugs and lifestyle diseases: an analysis of Indian and global status

Vikram Singh, Kajal Chakraborty and Lavina Vincent

Keywords: Compulsory licensing, generic drug market, Indian pharma market, lifestyle diseases, pharma patenting trends.

Abstract

The Indian pharmaceutical sector is large and has the potential of a global leader for low-priced high-quality drugs. The new patent regulations had a strong impact on the drug industry in India. There is a serious decline in the number of pharma patents recently after compulsory licensing for drugs was implemented in India. While regulations are meant for reducing the prices of essential drugs, there are investment-related issues when a patent is subjected to voluntary licensing. The present study focuses on three phases in pharmaceutical patenting identified by analysing the major patent databases and the potential shift in pharma patenting sector from acute to lifestyle disease-based drugs. The recent trend identified in the pharma patenting sector in India is quite unusual and unreported so far.

Understanding relationship between melt/ freeze conditions derived from spaceborne scatterometer and field observations at Larsemann Hills, East Antarctica during austral summer 2015–16 Rajashree

V. Bothale, S. Anoop, V. V. Rao, V. K. Dadhwal and Y. V. N. Krishnamurthy

Keywords: Ground penetrating radar, ice firm, snowfork, scatterometer, snowpack characteristics.

Abstract

Snow fork and ground penetrating radar at 200 MHz were used for snow depth, wetness and density measurements towards understanding the relationship between melt/freeze conditions derived from spaceborne Advance Scatterometer (ASCAT) and Oceansat-2 Scatterometer (OSCAT), and field observations. The observations were acquired at Larsemann Hills, East Antarctica in austral summer of 2015–16 during the 35th Indian Scientific Expedition to Antarctica. The field observations of wetness correlated well with identified dry and percolation zones showcasing different behaviours of density and wetness. Ice firm was observed at 50–55 cm depth, even in dry zone. Melt onset and number of melt days based on ASCAT varied spatially and temporally over the years and correlated well with positive degree day (PDD) for automatic weather station data located at the Indian Antarctic station, Bharati. Backscatter measurements by OSCAT showed that winter backscatter reduced with accumulation for both dry and percolation zones, but increased in the later part of winter in the percolation zone. A positive but low correlation was observed between ASCAT backscatter to accumulation and the surface mass balance from regional atmospheric climate model (RACMO2.3). A high correlation of 0.78 was observed between reduction in backscatter due to liquid water content and PDD, which coincides with field observations of wetness. The observations serve as baseline to monitor melt conditions and stability of existing ice sheet.

Channel morphology and hydraulic geometry of River Kolong, Nagaon district, Assam, India: a study from the standpoint of river restoration

Minakshi Bora and Dulal C. Goswami

Keywords: Channel dimensions, embankment, flood hazard, hydraulic geometry, river restoration.

Abstract

India has been facing serious degradation since 1964 as a result of building of an embankment across the river at its take-off point from River Brahmaputra. The river Kolong, once a thriving anabranch (distributary) of the Brahmaputra marked by its active navigability, rich biodiversity and

high productivity, is presently in a moribund state. Under these circumstances, the issue of eco-hydrological restoration of the river gained added urgency among the people living in its valley. The 'natural-channel design approach' for river restoration based on the estimates of natural channel geometry and discharge is presently being applied in rivers across the globe. Adopting a similar approach in this study, based on field measurements, we determine the baseline channel dimensions (bankfull width, mean bankfull depth, bankfull cross-section, floodprone width and entrenchment ratio) across the river at four different sites, so that these parameters can be utilized in natural channel design process for restoration purpose. The study reveals that, the river is significantly entrenched with entrenchment ratio varying from 1.19 to 1.79. Moreover, bankfull discharge has also been determined and values are found to be varying from 13.85 to 918.36 cumec in the downstream direction, with an average return period of 1.7 years. The average values of 'at-a-station' hydraulic geometry exponents b , f and m are 0.22, 0.38 and 0.4 respectively, while the average values of downstream direction exponents b , f and m are found to be 0.32, 0.23 and 0.44 respectively. These values compare well with those arrived at by pioneering workers in this field and are considered useful in river restoration programmes.

Dry biomass partitioning of growth and development in wheat (*Triticum aestivum* L.) crop using CERES-wheat in different agro climatic zones of India

P. K. Singh, K. K. Singh, K. K. Gill, Ram Niwas, R. S. Singh and Sanjay Sharma

Keywords: Biomass partitioning, genetic coefficient, phenology stages, soil parameters.

Abstract

The CERES-wheat crop growth simulation model has been calibrated and evaluated for two wheat cultivars (PBW 343 and PBW 542) for three sowing dates (30 October, 15 November and 30 November) during 2008–09 and 2009–10 to study partitioning of leaf, stem and grains at Ludhiana, Punjab, India. The experimental data and simulated model data were analysed on partitioning of leaf, stem and grains, and validated. It was found that the model closely simulated the field data from phenological events and biomass. Simulated biological and grain yield was in accordance with-field experiment crop yield within the acceptable range. The correlation coefficient between field-experiment and simulated yield data and biomass data varied significantly from 0.81 and 0.96. The model showed overestimation from field-experimental yield for both cultivars. The cultivar PBW 343 gave higher yield than cultivar PBW 542 on 15 November during both years. The model performance was evaluated and it was found that CERES-wheat model could predict growth parameters like days to anthesis and maturity, biomass and yield with reasonably good accuracy (error less than 8%) and also correlation coefficient between field-experimental and simulated yield data and biomass data varied from 0.94 and 0.95. The results showed that the correlation coefficient between simulated and districts yield varied from 0.41 to 0.78 and also significantly at all six selected districts. The results may be used to improve and evaluate the current practices of crop management at different growth stages of the crop to achieve better production potential.

Screening of autochthonous intestinal microbiota as candidate probiotics isolated from four freshwater teleosts

Ankita Nandi, Goutam Banerjee, Suhas Kumar Dan, Pinki Ghosh, Koushik Ghosh and Arun Kumar Ray

Keywords: Antagonism, *Bacillus* species, fish gut bacteria, pathogen, probiotics.

Abstract

In this study altogether 109 autochthonous gut bacteria were screened from 4 fish species (*Labeo rohita*, *Labeo bata*, *Catla catla* and *Puntius javanicus*), of which 13 isolates displayed antagonism to

4 fish potent pathogens, namely *Aeromonas salmonicida*, *Aeromonas hydrophila*, *Pseudomonas fluorescens* and *Aeromonas sobria*. Eight promising isolates were further evaluated for extracellular enzyme production, non-hemolytic activity, bile tolerance and identified by 16S rRNA sequencing. Strains CCF7 (identified as *Bacillus* sp.), CCH9 and PJH1 (identified as two strains of *Bacillus amyloliquefaciens*) exhibited high score in antagonism assay and fulfilled other probiotic criteria, including safety aspects. However, application of these probiotics in aquaculture industries requires in vivo experiments and other information like immune modulating efficiency and binding ability on gut.

Offshore wind to meet increasing energy demands in India

Satya Kiran Raju Alluri, Trishanu Shit, G. Dhinesh, Devender Gujjula, S. V. S. Phani Kumar and M. V. Ramana Murthy

Keywords: Commercial viability, offshore wind energy, wind potential assessment.

Abstract

Offshore wind provides a scalable alternative to conventional energy resources. It can be a potential source to meet the increasing energy demand in developing countries like India, for which an attractive policy framework is required. The aim of this study is to provide an insight for evolving onshore wind policy in India and suggest suitable strategies for development of offshore wind sector. Various wind resource maps were reviewed and potential sites identified as Rameswaram and Kanyakumari along Tamil Nadu coast. Suitability analysis was conducted to identify the type of wind turbine recommended at potential sites to achieve high plant load factor, considering the uncertainty in wind speeds. Commercial viability studies were carried out to identify appropriate incentives for development of offshore wind sector in India. Results indicate a leveled cost of energy of Rs 10.8 and Rs 9.6/Kwh at Rameswaram and Kanyakumari for an internal rate of return of 14%.

Fusion of ginseng farnesyl diphosphate synthase and *Centella asiatica* squalene synthase involved in triterpenoid biosynthesis

Su Jin Jung, Young Chang Kim, Mei Lan Jin, Reinhard Jetter and Ok Tae Kim

Keywords: Farnesyl diphosphate synthase, fusion protein, squalene synthase, triterpenoids.

Abstract

Farnesyl diphosphate synthase (FPS) is a key enzyme in isoprenoid biosynthesis, generating farnesyl diphosphate as the central precursor for the broad classes of sesquiterpenoids and triterpenoids. On the one hand, cyclization of farnesyl diphosphate catalysed by various sesquiterpene synthases leads to structurally diverse sesquiterpenoids, while on the other, dimerization catalysed by squalene synthase (SQS) yields squalene as the first intermediate in the production of triterpenoids. To optimize triterpenoid production, the activities of an FPS generating farnesyl diphosphate and an SQS converting it should be coupled. Here, we constructed a fusion protein combining a ginseng FPS and a *Centella asiatica* SQS via a short peptide (Gly-Ser-Gly) linker. Heterologous expression in *Escherichia coli* resulted in a soluble fusion protein detected by SDS-PAGE. The fusion protein had both FPS and SQS activities, at approximately 94% and 71% of the single enzyme levels respectively. This novel fusion protein will serve as a valuable tool for genetic engineering of triterpenoid compounds, including saponins.

Quantification of carbon stocks and sequestration potential through existing agroforestry systems in the hilly Kupwara district of Kashmir valley in India

Ajit, A. K. Handa, S. K. Dhyani, G. M. Bhat, A. R. Malik, V. Dutt, T. H. Masoodi, Uma and Amit Jain

Keywords: Agroforestry systems, carbon sequestration potential, GHG mitigation, soil carbon, tree biomass.

Abstract

The dynamic carbon accounting model CO2FIX was used for evaluating carbon stocks and estimate greenhouse gas mitigation through tree-based systems, outside the forest area, in Kupwara district of Kashmir valley India. Primary survey results revealed that on an average, there were about 135 trees per hectare, existing on farmers' field. Malus (33.75%), populus (29.91%), salix (14.32%), juglans (6.68%) and robinia (4.7%) were dominant tree species. Paddy and maize are the dominant kharif crops, whereas rabi season is dominated by oilseeds and fodder crops. The carbon sequestration potential, all the three pools simultaneously (viz. tree, crop and soil), of existing agroforestry systems (AFS) has been predicted as 0.88 Mg C ha⁻¹ yr⁻¹. AFS at district level are estimated to sequester 146,996 tonnes of CO₂ equivalent annually, which may offset completely the greenhouse gas emissions from agriculture/irrigation sector on account of electricity consumption throughout the state of Jammu and Kashmir.

Optimization of key factors for enhanced fermentative biohydrogen production from water hyacinth by RSM

Veena Thakur, Mona Tandon and S. K. Jadhav

Keywords: Central composite design, Clostridium acetobutylicum NCIM 2877, hydrogen production, response surface methodology, water-hyacinth.

Abstract

This communication discusses the optimization of key factors for the enhanced bio-hydrogen production from water hyacinth. Three critical factors inoculums age (18–24 h), inoculums volume (20–80 ml/l) and concentration of sulphuric acid (0.5–2.0%) were optimized by response surface methodology (RSM) with central composite design (CCD) for better production. RSM analysis showed that all three factors significantly influenced hydrogen production. The optimum hydrogen production was 705 ml/l obtained with 21 h old bacterial culture, 50 ml/l inoculums with 1.25% sulphuric acid pre-treatment. The hydrogen concentration produced by Clostridium acetobutylicum NCIM 2877 was enhanced after using RSM. The results obtained indicate that RSM with CCD can be used as a technique to optimize culture conditions for enhancement of hydrogen production by pre-treatment of low-cost organic substrate; water hyacinth using dark fermentation methods may be one of the most promising approaches.

Ionospheric precursors observed in TEC due to earthquake of Tamenglong on 3 January 2016

Sanjay Kumar and A. K. Singh

Keywords: Earthquake, GPS TEC, ionosphere, seismoelectromagnetic.

Abstract

Atmospheric Research Laboratory, Banaras Hindu University, Varanasi 221 005, India Ground-based GPS data show the presence of earthquake precursor in the form of perturbation in TEC of the ionosphere. The analysis of data for Tamenglong Earthquake (M = 6.7, 3 January 2016) from the stations at Lhasa, China (29.65°N, 91.10°E), Hyderabad, India (17.41°N, 78.55°E), and Patumwan, Thailand (13.73°N, 100.53°E) for the duration of 5-days before and after the main shock of the earthquake show large enhancement and decrease in TEC. The results for Lhasa station which lies in

the Earthquake preparation zone showed a decrease in TEC on 29 December (−37%) and 30 December (−9%) which is followed by an enhancement in TEC (47%) on 31 December, i.e. 3 days before the main shock. After the main shock negative ionospheric perturbation has been observed on 4, 5 and 7 January 2016 with a reduction of 20%, 32% and 24% respectively. Stations lying outside preparation zone (Patumwan and Hyderabad) did not show any ionospheric precursor.

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Need for regulatory policies in India, on the use of bisphenol A in food contact plastic containers

Duraisamy Mahamuni and Nirmaladevi Dhandayudapani Shrinithiviahshini

Keywords: BPA policy, endocrine disruptor, low-dose effects, toxicity, tolerable daily intake

Abstract

The incidence of endocrine disorders and reproductive abnormalities has been increasingly reported in the recent past. There are chemicals that cause these disorders known as endocrine disrupting chemicals. Bisphenol A (BPA) is one such compound used in the polycarbonate plastics and epoxy resins. Studies are available to demonstrate the migration of BPA from such containers to food substances under various conditions. Similarly, studies conducted using animal models have revealed that BPA interacts with steroid receptors and interferes with lipid metabolism, glycogen metabolism, etc. Although studies are available to demonstrate the toxicity of BPA even at lower concentrations, formulation of strong regulatory policies against BPA usage in plastics is quite difficult for Government authorities, since the results are inconsistent. Considering the potential risks posed by this compound, there are about 40 countries that have adopted restrictive policies on BPA use in food contact plastics especially intended for young children. Despite the restrictions implemented by these countries, developing countries like India, with a large number of plastic-users, do not have any policies for regulating BPA usage. The authorities should investigate and take action based on available information, and bring regulatory policies on the use of BPA in food contact plastics, especially intended for population under developmental stage and pregnant women.

A new magnetic resonance imaging probe specifically targeting vascular endothelial growth factor receptor 2: synthesis, characterization and biological evaluation

Xiaoguang You and Yikai Xu

Keywords: Gadolinium, liver cancer xenograft, MRI, peptide, VEGF125–136

Abstract

Vascular endothelial growth factor (VEGF) is strongly expressed in most tumours and promotes both tumour growth and vascularization. The peptide, VEGF125–136, consisting of 12 amino acids is encoded by exon 6 of the VEGF gene and inhibits VEGF activity by blocking the binding of VEGF to the VEGFR2 receptor. The aim of the present study was to develop a targeting probe for magnetic resonance imaging (MRI) of tumours by conjugating VEGF125–136 to gadolinium (III) (Gd(III)) (VGd) through the formation of chelates. The targeting efficiency of VGd to human hepatocellular carcinoma (HCC) cell line, BEL-7402, was subsequently determined both in vitro and in vivo. In the in vitro studies, the MRI results of BEL-7402 cells treated with VGd showed significantly higher T1 signal-to-noise ratio than that of both the competitive group, namely, those treated with VGd and VEGF125–136 and the control group, a scramble peptide conjugated to Gd(III) (SGd). In vivo, when xenografts of BEL-7402 cells were established in mice and then VGd or SGd were injected via tail vein, MRI showed that the tumour signal from VGd initially decreased from 5 to 120 min and then it increased at 120 min post injection. The peak signal was observed at

120 min after injection. In contrast, no distinct peak was observed for SGd. These findings indicate that VGd can target VEGFR2, highly expressed by BEL7402 cells, enabling targeting MRI with high efficacy to be achieved both in vitro and in vivo.

Co-registration of LISS-4 multispectral band data using mutual information-based stochastic gradient descent optimization

S. Manthira Moorthi, D. Dhar and R. Sivakumar

Keywords: Image registration, LISS-4, mutual information, optimization.

Abstract

We propose a solution for automatic co-registration of LISS-4 MX radiometrically conditioned multispectral images issue by considering an optimization problem in which mutual information-based approach is used. Co-registration of multispectral images from the same sensor may also be a tough problem to tackle, when the payload imaging geometry is complex. The multispectral images acquired by ISRO Resourcesat-1/2 LISS-4 MX class of sensors pose such problems and demand an automatic registration solution for systemcorrected product generation to cater to user needs. Optical remote sensing image registration is assisted by image geo-referencing or navigation information along with components such as feature detection, matching, correspondence, and resampling the input image to the reference geometry. Intensity-based methods employ an iterative registration framework, where similarity metric based image matching and correspondence is refined to find out optimum transform parameters. We could successfully employ mutual information-based adaptive stochastic gradient descent optimization algorithm to do sub-pixel level satellite image registration tasks by a careful choice of parameters and models related to metric, transform, optimizer, and interpolator in a robust image registration framework which is automatic for different terrain data. The performance is also compared to a recent scale invariant feature transform (SIFT)- based registration method.

Material and energy balance calculations for commercial production of whole neem fruit powder using particle-size distribution and energy models

Sonali Tajane, Praful Dadhe, Krishna Kanth Chole, Sachin Mandavgane and Sayaji Mehetre

Keywords: Co-grinding, energy, hammer mill, particlesize distribution, whole neem fruit.

Abstract

Neem-based pesticides are well known to reduce agriculture pollution. It was earlier found that freeflowing fine powder of whole dry neem fruits (called PNF-powder neem formulation) of size range 300 μm to 390 μm , i.e. (-44 + 60 mesh) was the optimum size range. Azadirachtin which is a key ingredient of neem is quite stable in PNF. This article delineates material and energy balance to produce 1 tonne of PNF on a commercial level by using hammer mill. The particle size distribution models and classical energy consumption models were used to fit the experimental data generated by changing the hammer mill screen.

A comparative assessment of the seismic response of an earthen dam using analytical simulation and empirical methods

Srijit Bandyopadhyay, Raj Banerjee, Aniruddha Sengupta, Y. M. Parulekar and G. R. Reddy

Keywords: Earthen dam, dynamic analysis, deformations, non-linear finite element analysis.

Abstract

This article presents the permanent deformation of an earthen dam located in the vicinity of a safety related structure for $M_w = 6.5$ design basis earthquake. A nonlinear 2D dynamic analysis using a real earthquake motion compatible with the design spectrum was performed to check the

earthquake-induced deformations of the dam. Deformations of the dam were also estimated by semi-empirical and empirical methods such as Seed and Makdisi's method, Newmark's double integration method, Jansen's method and Swaisgood's method. Results from different methods are compared to obtain a range for the value of permanent deformations of the dam. It is observed that the lateral deformation obtained by Seed and Makdisi's method is the highest while Jansen's method predicts the highest crest settlement. The crest settlement of the dam is found to vary between 11.8 mm and 17.8 mm, which is within the safety limits according to IITK-GSDMA guidelines.

Physico-chemical studies on raw and processed moth caterpillar silks from the megabiodiversity hotspots of India

Pramod C. Mane, Nilam M. Qureshi, Manish D. Shinde, Sandesh R. Jadkar, Dinesh P. Amalnerkar and Ravindra D. Chaudhari

Abstract

Silkworm fibre has been identified as a suitable material for biomedical and electronics applications because of its superior optical, mechanical and biological properties. Herein, we present comparative studies pertaining to the structural and morphological features of naturally harvested moth caterpillar silk fibre samples obtained from domesticated (*Bombyx mori*) as well as wild species, viz. *Antheraea mylitta* and *Antheraea papiha*. It has been observed that silk fibres obtained from silk cocoons are several microns in thickness. Surprisingly, wild variety, i.e. tasar silk samples show better structural and morphological properties. These fibres may find broad-spectrum applications in biomedical and electronics research.

Estimation of free speed of pedestrian flow on stairways at busy suburb rail transit station in India

Shah Jiten, Joshi Gaurang, Arkatkar Shriniwas and Parida Purnima

Keywords: Free speed, pedestrian flow, rail transit station, stairway.

Abstract

Free speed, the key parameter in the modelling of pedestrian flow, is the speed that a pedestrian desires to walk at. In this study free speed of pedestrians considering characteristics such as age, gender, and with or without luggage in ascending and descending stairways located on platforms in suburban and intercity railway stations was examined. Due to difficulty in observing free speed directly, an approach for developing distributions of speeds at varying levels of pedestrian density is proposed to estimate free speed precisely. The outcome of this study may be useful for planning, design and operation of the pedestrian facility.

Wave-generated structures in the Siwalik rocks of Tista valley, eastern Himalaya: implication for regional palaeogeography

Suchana Taral, Nandini Kar and Tapan Chakraborty

Keywords: Deltaic sedimentation, Himalayan foreland basin, sedimentary facies, Siwalik group, Tista valley.

Abstract

The Siwalik foreland deposit was earlier considered as freshwater continental megafan deposit, formed by southward flowing transverse drainages, analogous to modern Kosi-like megafans. However, this analogy remained incomplete due to lack of evidence of a regionally persistent axial stream system or marginal marine depositional system, like the Ganga–Brahmaputra River and Ganga Delta, as in the present-day foreland basin. In this paper, we report the abundant wave-

generated structures and marine trace fossils from the Siwalik succession of the Tista valley and infer that they represent the deltaic part of the Neogene foreland basin. This interpretation provides the link between upland fluvial deposits of the western Himalaya and deep marine sediments of the Bengal Fan and is more consistent with available data from the Siwaliks of the eastern Himalaya. It also implies that a marine embayment existed in the eastern part of the Siwalik foreland basin.

Physico-chemical and tribological studies of Argemone biodiesel synthesized using microwave technique

Shilpi Agarwal, Vijay K. Chhibber, Ajay K. Bhatnagar, Bhawana Srivastav, Amit Kumar, Shailey Singhal and Amit K. Sharma

Keywords: Argemone, biodiesel, microwave technique, physico-chemical properties, tribological behaviour, wear scar.

Abstract

Microwave technique was applied for the synthesis of Argemone biodiesel from Argemone oil under defined experimental conditions. The method presented has the potential to synthesize quality biofuel in timeefficient manner. It also results in higher yield of biodiesel while decreasing the reaction time by almost 75% when compared with conventional heating method. The biodiesel produced was tested for various physico-chemical properties and found to maintain the quality as recommended by various specifications. Reduction in the wear scar diameter of low-sulphur diesel from 432 to 256 μm at a very low concentration of biodiesel (1.0%) was an additional advantage to produce biofuel.

Isolation and structural elucidation of an isothiocyanate compound from *Indigofera tinctoria* Linn. extract Veena Sharma and Rashmi Singh

Keywords: Column chromatography, HPLC, *Indigofera tinctoria*, isothiocyanate compounds, LC-MS.

Abstract

Indigofera tinctoria is a well-known medicinal plant that possesses several therapeutic activities. Isothiocyanate derivative from hydroethanolic extract of *Indigofera tinctoria* (HEIT) was isolated by means of chromatographic techniques, i.e. adsorption chromatography, thin layer chromatography and high-pressure liquid chromatography. Structural characterization of isolated compound was done using various spectroscopic techniques (liquid chromatograph-mass spectrometry, ^1H nuclear magnetic resonance and Fourier transform-infrared spectroscopy) and the possible structure was identified as 1-[1,2-Diisothiocyanato-2-(3-isothiocyanato-2,2-dimethyl-propylsulphanyl)-ethoxy]-3-isothiocyanato-2,2-dimethyl-propane ($\text{C}_{16}\text{H}_{22}\text{N}_4\text{O}_5$; m/z 446.70; ITC-1). Maximum yield of ITC-1 was obtained as 22 mg/5 g HEIT with 97% purity.

Callus-mediated organogenesis in *Lilium polyphyllum* D. Don ex Royle: a critically endangered *Astavarga* plant G. S. Panwar, S. K. Srivastava and P. L. Uniyal

Keywords: Callusing, *Lilium polyphyllum*, micropropagation, organogenesis.

Abstract

Lilium polyphyllum D. Don ex Royle (Liliaceae) is a critically endangered herbaceous perennial, commonly known as white lily or Ksheerkakoli. Bulbs of the plant are of immense medicinal use and have astringent and anti-inflammatory properties. Overexploitation of the species from the wild and degradation of habitats are posing threats to its existence. In the present study, a protocol was standardized for micropropagation and mass multiplication of the species from scale leaves. Callusing was induced in basal MS medium containing 2,4-D (6.78 μM) and BAP (4.4 μM), where

maximum effect (95.32%) was recorded. Maximum shooting (97.45%) was found in the calluses when shifted to MS medium fortified with BAP (4.4 μM), NAA (0.53 μM) and GA3 (20 ppm) with an average of 19.2 shoots/per culture. The welldeveloped in vitro regenerated shoots were shifted to the rooting medium and 100% rooting was achieved in half-strength MS basal medium enriched with IBA (9.8 μM). The in vitro regenerated plantlets were shifted to a glasshouse for acclimatization and finally transferred to the open environment with 85% success.

Development of lifetime milk yield equation using artificial neural network in Holstein Friesian crossbred dairy cattle and comparison with multiple linear regression model

Manisha Dinesh Bhosale and T. P. Singh

Keywords: Artificial neural network, cows, lifetime milk yield, multiple linear regression.

Abstract

Symbiosis Institute of Geo-Informatics, Symbiosis International University, Pune 411 016, India
The scope of this study was to develop lifetime milk yield (LTMY) prediction equation using different economical traits. The traits used were first lactation length, first peak yield, first lactation total milk yield, and total of three lactation milk yield of 1210 Holstein Friesian crossbred dairy cattle in India. Four variants of feed-forward back propagation algorithms were compared with the multiple linear regression model. The performance of Bayesian regularization (BR) algorithm was found to be better than the other algorithms for LTMY prediction. The BR neural network model was able to predict milk yield with 71.18% R².

Pliocene Indonesian Throughflow change and planktic foraminiferal diversity in the eastern subtropical Indian Ocean

Ajai Kumar Rai, Vishwesh K. Pathak, Lakshmi K. Sharma and Ajhar Hussain

Keywords: Diversity, Indian Ocean, Indonesian Throughflow, Pliocene, planktic foraminifera.

Abstract

The opening and closing of seaways due to plate tectonic movement strongly influenced the past oceanic circulation patterns which have their influence on the past climate and faunal record. The considerable restructuring of one such seaway, Indonesian seaway, took place during Pliocene (4–3 Ma). This would have changed the source of Indonesian Throughflow (ITF) from warm and saline south Pacific waters to the north Pacific cool and relatively fresh waters. In the present study, three indices of diversity (ShannonWiener Index; $H(S)$, equitability; E' and alpha index; α) at ODP sites 762B and 763A in the eastern subtropical Indian Ocean are calculated to better understand the role of ITF on Pliocene surface hydrography and planktic foraminiferal diversity. A major interval of early Pliocene demonstrates more diverse fauna and low abundance of fertile taxa along with increased planktic Mg/Ca ratios. Strong influence of warm ITF waters due to broad and open seaway until the end of early Pliocene, increased the sea surface temperature (SST) and depth of thermocline in the Leeuwin current area of eastern subtropical Indian Ocean. This would have been responsible for more vertical niche partitioning of surface water and thus, higher planktic foraminiferal diversity. The significant decline in faunal diversity between critical interval of ~3.5 and 3 Ma (beginning of Late Pliocene) is suggested to be the response of fall in SST and increase in surface water productivity possibly due to relatively less influence of ITF waters in the eastern Indian Ocean as a consequence of significant constriction of Indonesian Seaway.

Anthropogenic drivers shift diatom dominance–diversity relationships and transparent exopolymeric particles production in River Ganga: implication for natural cleaning of river water

Usha Pandey, Jitendra Pandey, Anand V. Singh and Abha Mishra

Keywords: Anthropogenic drivers, carbon sequestration, diatoms, transparent exopolymeric particles.

Abstract

We studied the relationships among diatom biodiversity, transparent exopolymeric particles (TEP) and water quality at the confluences of four tributaries of River Ganga (Yamuna, Assi, Varuna and Gomti) during low flow. Diatom abundance changed with concurrent shifts in water chemistry with dominance–diversity curves markedly skewed from a log-normal pattern. Canonical correspondence analysis segregated chloride-loving and calcifilous species from N- and P-favoured taxa. Despite pollution-induced reduction of diatom diversity, TEP production continued to rise plausibly due to dominance transference of TEP producers. However, with further increase in nutrient pollution, TEP declined. Since TEP enhances sedimentation removal of carbon, nutrients and heavy metals, the present study confirms one of the fundamental mechanisms that underline the self-purification capacity of River Ganga and has relevance from a biodiversity/river conservation perspective.

Sponge-associated bacterium, *Yangia pacifica*: a potential candidate for bioremediation of azo dyes

N. S. Subina, Shanta Nair and Maria-Judith Gonsalves

Keywords: Azo dyes, decolourization, sponge-associated bacteria, *Yangia pacifica*.

Abstract

The bioremediation potential of bacteria associated with the sponge *Cinachyrella cavernosa* on azo dyes, Amido black and Congo red is reported. Twenty four percent of the bacteria decolourized these dyes at 50 mg l⁻¹ concentration. The isolate, *Yangia pacifica*, which showed higher tolerance and decolourization potential, was subjected to detailed studies. The strain showed >70% decolourization on day 3 and >96% on day 7. Decolourization was dependent on growth, medium, pH, temperature and dye concentration. Although decolourization reduced the toxicity of both dyes, the mechanism leading to decolourization of the two dyes was different.

Hearing impairment of Indian agricultural tractor drivers

Abhijit Khadatkar, C. R. Mehta, L. P. Gite, B. S. Narwariya and Anup Kumar

Keywords: Audiometry, hearing impairment, noise, office workers, tractor drivers.

Abstract

Noise is an occupational hazard affecting the health and safety of the tractor drivers. The hearing impairment of Indian tractor drivers has been assessed in the present study. Sixty healthy male subjects of similar age, height and weight were selected and divided into two groups of 30 subjects each, viz. tractor drivers with more than 10 years of driving experience and office workers as control. Audiometric testing of both the ears of the selected subjects was conducted at ten frequencies, i.e. 0.125, 0.25, 0.5, 1, 1.5, 2, 3, 4, 6 and 8 kHz. It was observed that the hearing threshold levels of office workers at measured test frequencies were less than 25 dB(A) and exceeded 25 dB(A) for tractor drivers to cause hearing handicap. Statistical analysis of the data indicated significant difference in the audiometric profile of tractor drivers compared to the office workers. The estimated average excess risk of hearing impairment of the subjects was calculated from audiometric data using five standard models; it was 0.2% and 7.1% for office workers and tractor drivers respectively. Thus it can be concluded that tractor driving significantly increased the hearing threshold levels of the drivers compared to office workers.

Face recognition using a hybrid SVM–LBP approach and the Indian movie face database

Francisco A. Pujol, Antonio Jimeno-Morenilla and José Luis Sánchez-Romero

Keywords: Face recognition, hybrid methods, local binary patterns, support vector machines.

Abstract

Local binary patterns (LBP) are an effective texture descriptor for face recognition. In this work, a LBPbased hybrid system for face recognition is proposed. Thus, the dimensionality of LBP histograms is reduced by using principal component analysis and the classification is performed with support vector machines. The experiments were completed using the challenging Indian Movie Face Database and show that our method achieves high recognition rates while reducing 95% the dimensions of the original LBP histograms. Moreover, our algorithm is compared against some state-of-the-art approaches. The results indicate that our method outperforms other approaches, with accurate face recognition results.

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Astronomy of tribals of central India

M. N. Vahia and Ganesh Halkare

Keywords: Astronomical beliefs, conjunctions of Mars and Venus, tribal studies, Orion, Taurus, Ursa Major.

Abstract

A summary of the astronomical beliefs of four tribes Gond, Banjara, Kolam and Korku from Nagpur region of Maharashtra has been presented. Primary conclusions are that the tribals are mainly focused on the winter sky with Big Dipper (Saptarshi), the Orion region including Orion, Taurus, Auriga, Gemini, Canis Major and Pleiades. They are also quite conscious of the Southern Cross (Crux) and the region around it. Many tribes are aware of Scorpius but are often unable to define its location in the sky. Gonds are aware of the Great Square of Pegasus and of Leo. We discuss these beliefs in the background of the region of the sky that occupies them and the similarity and differences in their beliefs of these regions. We then summarize the results in the general framework of human intellectual development and the environment in which they live.

Early–Middle Eocene exhumation of the Trans-Himalayan Ladakh Batholith, and the India–Asia convergence

Rajeev Kumar, A. K. Jain, Nand Lal and Sandeep Singh

Keywords: Early–Middle Eocene exhumation, fission track, Ladakh Batholith, tectonics.

Abstract

Very fast Early–Middle Eocene exhumation of the Trans-Himalayan Ladakh Batholith (LB) is revealed by new Rb–Sr biotite and zircon fission-track ages along with the already published ages on these minerals. Exhumation peaked at 3.5 ± 0.9 mm/a between 50–45 Ma (40Ar/39Ar hornblende ages) and 48–45 Ma (Rb–Sr biotite ages) as a consequence of the India–Asia convergence. It was followed by deceleration at a rate of 1.2 ± 0.2 mm/a until 43–42 Ma (zircon FT ages), like the Deosai batholith in the west. Exhumation rates finally decreased during Oligocene to a minimum of ~ 0.1 mm/a before a mild late Miocene–Holocene acceleration. Lower-Middle Eocene exhumation of the LB was tectonically controlled by slab break-off of the Neo-Tethys oceanic lithosphere and underthrusting of the Himalayan Metamorphic Belt.

Pesticide use in Indian cardamom needs change in cultivation practices

M. Murugan, R. Ravi, A. Anandhi, Sajan Kurien and M. K. Dhanya

Keywords: Forest degradation, organic cardamom, soil temperature.

Abstract

Indian cardamom farming in the Cardamom Hill Reserves of Kerala has been considered one of the costliest production systems. Questionnaire survey and interviews with cardamom planters between 2008 and 2013 showed that the pesticides used in cardamom production is paradoxical. The reasons are closely associated with the unscrupulous use of pesticides which wiped out the natural enemies of pests and inefficacies of pesticides that led to dose enhancement. Climatic changes along with forest degradation and removal of shade have played a considerable role for increased pesticide consumption. The current perilous situation needs critical thinking to evolve pesticide reduction strategies.

Biofortification in cereals: progress and prospects

C. N. Neeraja, V. Ravindra Babu, Sewa Ram, Firoz Hossain, K. Hariprasanna, B. S. Rajpurohit, Prabhakar, T. Longvah, K. S. Prasad, J. S. Sandhu and Swapan K. Datta

Keywords: Biofortification, breeding, bioavailability, nutrients, varieties

Abstract

Food security of the country has been improved due to green revolution and enhancement of cereal production. However, recent surveys showed 35.8% of children suffer from malnutrition in India. The Indian Council of Agricultural Research has taken lead for the biofortification of cereal crops based on earlier national and international research efforts, targeting the enhancement of nutrients in staple food crops. In this article, the significant progress made in rice, wheat, maize and millets for identification of genotypes, development, evaluation and release of the varieties with high nutrient contents and their bioavailability studies is discussed.

Role of earthworm in improving soil structure and functioning

D. K. Sharma, S. Tomar and D. Chakraborty

Keywords: Earthworm, economic evaluation, soil ecosystem services, soil aggregation, sustainable agriculture

Abstract

Earthworms commonly occur within the soil. They alter physico-chemical and biological regimes of the soil through their activities, such as burrowing, casting, feeding and propagating, and therefore are known as 'ecosystem engineers'. Through their activities, they provide a number of ecosystem services which are ecologically and socio-economically important. This article reviews the role of earthworms in improving soil structural and functional properties, which serves as key determinants of soil ecosystem services and economic benefits for the farmers. A methodology of economic evaluation of the agro-ecosystem services provided by earthworms has been demonstrated. Further, the information gaps and future research have been discussed for ensuring sustainable agroecosystems management.

Improved criteria on robust analysis for linear system using convex combination and geometric sequence methods

Hao Chen, Huazhang Wang and Zhenzhen Zhang

Keywords: Convex combination, delay partition, geometric sequence, parameter uncertainties.

Abstract

This article addresses the robust analysis on a delayed system with uncertainties. A geometric sequence division (GSD) method is applied for delay partition. Then, a GSD-dependent Lyapunov–

Krasovskii functional (LKF) is newly proposed, in which the integral interval relevant with the state variables forms in geometric progression. In addition, by applying the convex combination method, parameter uncertainties and the delay derivative () & t can thus be flexibly overcome. As a result, unnecessary enlargement for estimating the LKF derivative is eliminated. Numerical example shows that this proposed work achieves expected results.

Molecular characterization and toxin-typing of Clostridium difficile isolates of dogs and pigs from Assam and Mizoram of North East India

B. Das, R. K. Sharma, P. Borah, S. Das, L. M. Barkalita, R. K. Mandakini Devi and B. C. Baishya

Keywords: Diarrhoea, NE India, Pseudomembranous colitis, toxin-typing, virulence.

Abstract

Clostridium difficile with its virulence factors A and B toxins cause Pseudomembranous colitis. Bacterium was isolated from 57 dog and 41 pig diarrheic faecal samples in cycloserinecefaxitin fructose agar media and molecular detection was done by amplification of gluD gene (755 bp). Variability of toxin genes in positive isolates was tested by multiplex PCR. Detection of binary toxin genes (cdtA and cdtB) was also done. Results showed 33.67% positivity with 18 and 15 from dog and pig respectively, from which 10 and 5 were toxigenic and 11 pig isolates exhibited binary toxin. PCR-RFLP demonstrated toxinotype 0 in all A+B + isolates.

Modelling of plankton and forage fish variability in the Gulf of Kachchh using 2D coupled physico-biological model

Vijay Kumar, Girija Jayaraman and Beena Kumari

Keywords: Gulf of Kachchh, physico-biological model, plankton and forage fish.

Abstract

A biophysical coupled model, which includes interaction of processes at different spatial and temporal scales, is used to assess the seasonal variability of plankton and forage fish. A five-compartment nutrient, phytoplankton, zooplankton, detritus, forage (NPZDF) ecological model is coupled with hydrodynamic model to understand the interaction of hydrographic characteristics and ecological dynamics in the study area. Operator splitting method is used to handle two different physical and biological scales for numerical simulation of the resulting partial differential equations. Gulf of Kachchh (22°20'N–23°40'N, 68°20'E– 70°40'E), in the northwest coast of India is used for the application and validation of the model's behaviour. This region demonstrates rich biodiversity and productivity in highly turbid and varying marine conditions. Co-ordinate transformation is used to convert the irregular coastal geometry of Gulf of Kachchh into a rectangular domain. Numerical experiments, together with sensitivity analysis are carried out to get the values/ranges of the model parameters. The model application is able to bring out many striking features of the Gulf of Kachchh including bimodal oscillations observed in the ecological data of the region.

Possibilistic reformed fuzzy local information clustering technique for noisy microarray image spots segmentation

V. G. Biju and P. Mythil

Keywords: Fuzzy clustering, gene expression, image processing, microarray

Abstract

The cDNA microarray image provides useful information about thousands of gene expressions simultaneously. This information is used by bioinformatics researchers for diagnosis of different diseases and drug designs. Microarray image spot segmentation using an improved fuzzy clustering algorithm is proposed in this article. The proposed Possibilistic Reformed Fuzzy Local Information C Means (PRFLICM) algorithm is a variant of Possibilistic Fuzzy Local Information C Means

(PFLICM) algorithm. The parameters used for testing the proposed algorithm include segmentation matching factor (SMF), probability of error (pe), discrepancy distance (D), normalized mean square error and sum of square distance (SSD). The performance of the algorithm is validated with a set of simulated cDNA microarray images with known gene expression values. From the results of SMF, the proposed PRFLICM shows an improvement of 0.4% and 0.1% for high noise and low noise microarray images respectively when compared to PFLICM algorithm. The proposed algorithm is applied to yeast microarray database (YMD) and is used to find the yeast cell life cycle generated genes. The results show that the proposed algorithm has identified 101 cell life cycle regulated genes out of 104 such genes published in the YMD database.

Prediction of total load transport of an Indian alluvial river to estimate unmeasured bed load through an alternative approach

Sahita I. Waikhom and S. M. Yadav

Keywords: Alluvial rivers, bed load, empirical relationship, sediment transport, suspended load.

Abstract

Predicting sediment transport in a natural stream is essential to adequately design different hydraulic structures like bridge piers, dam, causeway, etc., having a long service life. The prediction of sediment transport is a challenging task keeping in view the dynamic conditions of stream flow, which in turn depends upon a number of continuously and randomly changing flow parameters, channel parameters and fluid properties and thus no uniform mathematical or physical relationship can be adopted for prediction of sediment transport. The available empirical solutions, based mostly on regression, vary largely from one site condition to other. In India the bed load data is rarely measured and thus the availability of total load data for Indian alluvial river is virtually nonexistent and therefore a true empirical relationship cannot be developed for predicting total load in Indian streams. The present study aims to bridge this gap through a three-prong approach to predict the total load of an alluvial river (Shetrunji River). The unavailable (unmeasured) bed load data is computed using firstly, selected bed load transport equations and secondly, using Maddock's estimation. These computed total load (computed bed load plus observed suspended load) are compared with the total load transport predicted using Yang' 1973 and Yang' 1979 Unit Stream Power (USP) equations. It was found that the best prediction of total load is obtained for Yang' 1973 equation, when Shields (1936) bed load formula is used to compute bed load or when bed load is taken as 5% of observed suspended load. This methodology can be applied to predict the total load of rivers with reasonably good accuracy even in the absence of unmeasured bed load.

The attitude of undergraduate medical students towards research: a case study from two medical colleges in Maharashtra, India

Mark A. Dsouza, Tanya Balakrishnan, Manan Vora , Bryan M. Pereira, Devashish Palkar , Babar Zaman and Rajiv Khandekar

Keywords: Attitudes perceptions, barriers, medical research, undergraduate students.

Abstract

In the present study we evaluate the attitudes, perceptions and perceived barriers towards research among undergraduate medical students in India. The study enrolled 382 students from two medical colleges in Maharashtra, India. The study duration was from January 2016 to March 2016. Each student completed an anonymous on-line survey with 22 closed-ended questions. The survey was designed to assess student attitudes towards research as well as perceived barriers and participation in research. Responses were scored on a five-point Likert scale. The study sample was comprised of 241 (63%) females and 141(37%) males. Among these, 202 (53%) students were enrolled in a

government medical college and 178 (46.5%) in a private medical college; 2 students did not identify the type of college and were excluded. Fifth-year medical students comprised the highest number of participants at 105 (27.5%). Thirty-two per cent of the entire study sample indicated that they had participated in a research project, while the rest of the students had not. Over 60% of students indicated that they had access to mentors. A positive attitude towards research was reported by 94.7% students. There was no statistical difference between genders in attitude or perceived barriers to research ($P = 0.06$ and $P = 0.6$ respectively). There was a significantly greater positive attitude towards research in the senior years of medical college (years 1–3 and years 4–5; $P = 0.0006$). The perceived barriers were time constraint (45%) and inadequate training for research (50%). The majority of medical students understood the necessity for research and had a positive attitude towards the same. The perceived barriers to research such as time constraint and inadequate training need to be addressed.

Dual polarization lidar for remote sensing of aerosols and clouds in the atmosphere

Ajay Kumar Patel, Bhavani Kumar Yellapragada, R. Vishnu, M. V. R. Murthi and James Jebaseelan Samuel

Keywords: Aerosols, clouds, laser, polarization lidar, remote sensing.

Abstract

We describe an indigenously developed dual polarization lidar (DPL) system for remote sensing of the rangelresolved properties of non-spherical nature of airborne and cloud particles. The DPL system probes the atmosphere using a linearly polarized second harmonic Nd : YAG laser. The design of receiver optics is such that it separates the collected backscattered light into parallel and perpendicular polarization components. The ratio of intensity of perpendicular to parallel signals is known as the depolarization ratio (DR), which is a gauge for non-spherical particle content in the atmosphere. The DPL employs an external irradiance standard to calibrate the depolarization measurements. Comparison of simultaneous measurements between DPL and a similar instrument validates the utility of the system for cloud and aerosol studies. The altitude profiles of DR derived from lidar signals potentially indicate the type of major particle layers in the atmosphere.

Photoluminescence properties of Dy³⁺ -doped LaOF nanophosphor for white LED applications

C. Suresh, C. Ningappa, V. M. Nagaveene, K. Umeshreddy, K. M. Girisha and H. Nagabhushana

Keywords: Lanthanum oxyfluoride, nanophosphor, PXRD, SEM, synthesis.

Abstract

The present study involves the synthesis of a series of Dy³⁺ (1–11 mol%) doped LaOF nanophosphor prepared by solution combustion method using Aloe Vera gel as fuel. The samples were characterized by powder X-ray diffraction and scanning electron microscopy. The average crystallite size was estimated from Debye–Scherer’s and Williamson–Hall plots and the values were found to be in the 25–40 nm range. The effect of Dy³⁺ ions on luminescence characteristics of LaOF was studied and the results discussed. The CIE diagram clearly indicated that the entire coordinates were well coated in the white region and as a result it was quite useful for fabrication of white-light-emitting diodes.

In vitro micropropagation, total phenolic content and comparative antioxidant activity of different extracts of *Sesbania grandiflora* (L.) Pers.

Krishnamoorthy Vinothini, Masilamani Sri Devi, Veronica Shalini, Sudharshan Sekar , Ruchi Badoni Semwal , Pandian Arjun and Deepak Kumar Semwal

Keywords: Antioxidant activity, in vitro micropropagation, phenolic content, plant growth regulators, *Sesbania grandiflora*.

Abstract

Sesbania grandiflora (L.) Pers. is a common traditional medicinal plant used in bronchitis, anaemia, headache, fever, ophthalmia, nasal catarrh, leprosy, inflammation, gout and rheumatism. The present study aimed to assess plant regeneration and plantlets development in vitro using explants of *S. grandiflora* together with the estimation of total phenolic content and antioxidative activity of various extracts obtained from the plant. Murashige and Skoog (MS) basal medium added with different concentrations of plant growth regulators (PGRs) was used for plant tissue culture, whereas ferric reducing antioxidant power (FRAP) and 2,2-diphenyl-1-picrylhydrazyl (DPPH) assays were used to evaluate the antioxidant potential of different extracts of the plant. In the presence of 6- benzylaminopurine (BAP; 0.1 mg/l), the highest level (85.41%) of seed germination was achieved while the highest callus formation (96.6%) was recorded with 2,4-dichlorophenoxyacetic acid (2,4-D; 0.5 mg/l). In addition, the highest shoot induction, shoot formation and shoot elongation were observed with BAP (0.1 mg/l), indole-3-butyric acid (3 mg/l) and naphthaleacetic acid + BAP (0.4 + 0.2 mg/l) respectively. The extract of dried calluses showed highest contents of proline (110.94 mg/g), phenol (16.42 mg/g) and flavonoid (22.22 mg/g), and also highest antioxidant potential with FRAP and DPPH assays. From the present study, we may conclude that the MS basal medium supplemented with PGRs is effective for the commercial production of *S. grandiflora*.

Effect of gasifier effluent on agricultural production and soil

Lata Tripathi, Anil Kumar Dubey, A. K. Mishra, C. B. Tripathi and Prashant Baredar

Keywords: Agricultural field, gasifier effluent, growth parameter, physico-chemical analysis.

Abstract

Gasifier generates wastewater during cooling and cleaning of producer gas. This wastewater contains harmful chemicals which adversely affect the natural stream if disposed off without treatment. In the present work the effect of gasifier effluent on agricultural soil and vegetable production was studied. Experiments were conducted on seasonal vegetables like radish, spinach and tomato plant. Each plant was irrigated with gasifier wastewater and treated wastewater to study the effects of these waters and compared with control plants which were irrigated by tap water. After irrigation with gasifier wastewater and treated wastewater, different physico-chemical analyses of soil and growth parameters of plant were done. It was found that gasifier wastewater is not suitable for agricultural fields. It inhibits or delay growth of plants. But after suitable treatment, it can be useful for agricultural fields.

Effects of bedding on hydraulic fracturing in coalbed methane reservoirs

Tingting Jiang, Jianhua Zhang, Gang Huang, Shaoxian Song and Hao Wu

Keywords: Coalbed methane, coal seam, fracture toughness, hydraulic fracturing, numerical simulation, three point bending test.

Abstract

Bedding is a special structure of coal, which has notable effects on the mechanical parameters of coal and on the hydraulic fracture propagating in coalbed methane reservoirs. To study the effects of

bedding on anisotropic characteristics of coal fracture toughness, three-point bending tests have been carried out on raw coal specimens. The results indicate that fracture toughness and failure modes of the specimens both have strong anisotropy due to bedding. A geological geomechanical model of a coalbed methane (CBM) reservoir is built taking into account the effect of bedding to study the hydraulic fracture propagation and the influence of bedding on the fracture network. The hydraulic fracture initiates at the end of the perforation and tends to bifurcate and swerve at the bedding to produce induced fractures. Ultimately, these fractures form a complicated fracture network. The fracture toughness of bedding has great influence on hydraulic fracture geometry. The fracture is likely to bifurcate and swerve at the bedding to form multiple secondary fractures with larger bedding fracture toughness.

Nutrients removed from the soil decide the nutritional security of a nation: the case of iron and zinc in India

A. N. Ganeshamurthy, D. Kalaivanan and B. L. Manjunath

Keywords: Bioavailability, food sources, iron, micronutrient deficiency, vegetarian diet, zinc.

Abstract

National iron (Fe) and zinc (Zn) balance were computed using theoretical mean daily per capita dietary Fe and Zn requirement and composition of Fe and Zn in foods in agriculture, horticulture, animal husbandry and fisheries sectors. The analyses imply a satisfactory situation that the intake of Fe and Zn through food sources by the Indian population is adequate. Despite sufficient availability of Fe and Zn through food, there is widespread Zn and Fe deficiency in our population. Ours is a vegetarian-dominant society. The phytate content of our foods is relatively high as the phytate content of vegetarian diets is high. This may be the main cause of the low absorption of Zn and Fe from the foods we eat. A sector-wise contribution indicated a major share of the agriculture sector, followed by the animal husbandry sector. Surprisingly, horticulture sector contributed a small portion (9.1% Zn and 12.9% Fe). The fisheries sector contributed the least. Given the multiple sources of uncertainty in following this method, caution must be exercised in interpreting the estimated figures for prevalence. Since our food sources are supplying enough Fe and Zn, our research efforts should therefore be diverted towards bioavailability rather than bio-fortification.

Deformational characteristics of Donglingxin slope induced by reservoir fluctuation and rainfall

J. Yu, R. B. Wang, J. C. Zhang, L. Yan, Q. X. Meng, C. Zhang and X. Z. Li

Keywords: Donglingxin slope, deformational characteristics, reservoir bank slope, reservoir fluctuation, rainfall.

Abstract

Landslides induced by reservoir inundation and rainfall are very common in southwest China, adversely affecting the construction of hydropower plants in this area. In this study, a case of Donglingxin slope located at the Sanbanxi reservoir is reported, which developed into a large landslide. To understand deformation and conduct stabilization measurement, an in-depth study has been done based on monitoring the trigger events like reservoir fluctuation, rainfall and groundwater levels. It was revealed that the rainfall mainly affected deformation of the upper slope; reservoir fluctuation reduced the stability of the toes of the slope. The activity of groundwater between the bedrock and the soilrock mixture, geomaterials greatly controlled the global stability. An analysis of the comprehensive effects of these trigger events, indicated that the slope was unstable and would have slid into the reservoir. The evolution of slope deformation was simulated by particle flow code,

the result showed that the landslide started from the head of the gully. This case study provides important geo-technical references for engineering the prevention of reservoir bank slopes.

Status of zinc fractions in soils of Cooch Behar district, West Bengal, India

Sharmme Gogoi, G. C. Banik, A. Kundu, S. Mukhopadhyay and D. Mukhopadhyay

Keywords: Acid soil, cation exchange capacity, terai region, zinc fractions.

Abstract

A study was conducted on the distribution of different forms of zinc (Zn) in soils (0–20 and 20–40 cm depths) in different blocks of Cooch Behar district, West Bengal, India. The soils of the selected areas were acidic in reaction (pH) at both the depths, ranging from 4.23 to 6.96 (0–20 cm) and 3.89 to 6.45 (20–40 cm) and having sandy to sandy loam texture. The different fractions of Zn varied among the soils of all locations. The order of different zinc fractions was: exchangeable zinc (Ex-Zn) < organic matter-bound zinc (OM-Zn) < manganese oxide-bound zinc (Mn-Ox-Zn) < crystalline oxide-bound zinc (Cry-Ox-Zn) < amorphous iron oxide-bound zinc (Am-Ox-Zn). Am-Ox-Zn was relatively higher in the soils of Mekhliganj, i.e. 1.56 kg ha⁻¹ at 0–20 cm depth and 0.92 kg ha⁻¹ in the soils of Tufanganj-II at 20–40 cm depth respectively. Exch-Zn, OM-Zn, Mn-Ox-Zn and Am-Ox-Zn were positively correlated with CEC ($r = 0.088$, $r = 0.105$, $r = 0.137$, $r = 0.103$) at 0–20 cm depth, while at 20–40 cm depth, Exch-Zn, OM-Zn, Mn-Ox-Zn, Am-Ox Zn and CryOx-Zn were positively correlated with CEC ($r = 0.204$, $r = 0.168$, $r = 0.342$, $r = 0.123$, $r = 0.278$). The influence of different soil properties on the distribution of Zn fractions in the soils was apparent from this study.

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Why India needs a National Electricity Council

R. Srikanth

Keywords: Coal power plants, Electricity (Amendment) Bill, energy and environment, optimal energy mix, stressed assets.

Abstract

India is the third largest electricity generator in the world after China and USA. India has already committed to its Nationally Determined Contributions submitted to the United Nations Framework Convention on Climate Change for the period 2021–2030, which inter alia, includes a commitment, to achieve about 40% cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030 with the help of technology transfer and low-cost international finance. However, India's power sector is facing several major challenges as it makes a transition to a more environment-friendly energy mix. Since electricity is a concurrent subject as per the Constitution of India, there is an urgent need to create an empowered National Electricity Council (NEC) with pooled sovereignty to realize the goal – 'One Nation-One Grid-One Price'. The proposed NEC will facilitate the evolution of a vibrant and self-sustaining power sector in India in a timely manner.

A glimpse of doctoral training among Swarnajayanti Fellows

Inderpal Singh

Keywords: Academic training, awards and fellowships, foreign and domestic Ph Ds, SSB prize.

Abstract

The recipients of Swarnajayanti Fellowship (1997–2016) are associated with only 23 different R&D institutions across India and are mostly from the Indian Institutes of Technology (IITs); Indian Institute of Science (IISc), Bengaluru; Tata Institute of Fundamental Research (TIFR), Mumbai and

Council of Scientific & Industrial Research (CSIR) laboratories. The pattern shows that 43% of Swarnajayanti Fellows (SJFs) are also recipients of the prestigious Shanti Swarup Bhatnagar (SSB) Prize. The study reveals that 70% of SJFs with doctoral training under the supervision of Bhatnagar awardees are the recipients of the SSB Prize followed by 66% with foreign Ph Ds and 52% with Indian Ph Ds. IISc and CSIR laboratories have the distinction that all SJFs with doctoral training under the supervision of Bhatnagar awardees are recipients of the SSB Prize, while TIFR has the most with foreign Ph D.

Indian fertilizer policies: revisiting the odyssey and lessons from abroad

K. V. Praveen

Keywords: Agriculture, fertilizer policy, nutrient balance, input subsidy.

Abstract

Fertilizer campaign has played a crucial role in the journey of Indian agriculture. Well-directed policies that regulated the fertilizer sector, have contributed to improve the availability as well as consumption of fertilizers at the farm level. The scenario under which fertilizer policies need to operate changes rapidly, and this leads to new challenges. The odyssey of Indian fertilizer policy regime, stretching to more than 60 years, is complex but interesting. Here we trace this regime and the fertilizer policies of selected countries from which India can learn.

Breeding of ornamentals: tuberose (*Polianthes tuberosa* L.)

S. K. Datta

Keywords: Coloured tuberose, germplasm, genetic diversity, hybridization, pigments, tuberose.

Abstract

In the floriculture industry there is always demand and necessity for new and novel varieties. The colour, form and scent of the flower are the primary novelty markers in the global flower industry. Genetic diversity plays an important role in breeding. *P. tuberosa* is grown all over the world for cut flower production, for floriculture trade and as a source of oil. Breeding has successfully developed high yielding varieties in India, but there is no new colour. Literature survey indicates that development of coloured tuberose is possible through creation of genetic variability through conscious/selective breeding. Collection of coloured germplasm is the most important step in developing new flower colour tuberose through hybridization and induced in vitro mutagenesis.

Clinical islet cell transplantation – recent advances

Prathab Balaji Saravanan, Gopalakrishnan Loganathan, Bashoo Naziruddin and Appakalai N.

Balamurugan

Keywords: Diabetes, insulin, islet cell transplantation, immunosuppression, stem cells.

Abstract

Type-1 diabetes mellitus (T1DM) caused by autoimmune destruction of insulin-producing beta-cells essentially requires treatment with exogenous insulin therapy. Despite the education, technology and improvements in insulin formulations, patients face the ongoing life-threatening hypoglycaemia with poor quality of life as well as progressive disease leading to micro and macro-vascular complications of diabetes. Islet transplantation offers an alternative therapeutic option for these patients. In this review, we discuss the recent advancements in this field tracking from the history of pancreatic islet transplantation to the present-day challenges of clinical islet cell transplantation. We summarize the cutting-edge clinical research with special reference to the results of current trials, including Clinical Islet Transplant Consortium, improvements in immunosuppressive protocols, the need for beta-cell replacement therapies, including the application of induced pluripotent stem cells and mesenchymal stem cells.

Genetic basis of monogenic diabetes

V. Radha and V. Mohan

Keywords: Genetic screening, maturity onset diabetes of the young, monogenic diabetes, neonatal diabetes, precision medicine.

Abstract

Advances in the understanding of monogenic causes of diabetes and the discovery of single-gene mutations responsible for different phenotypes have greatly increased our knowledge of β -cell physiology. Such advances have had implications for the individual patient diagnosed with the specific monogenic cause of diabetes, especially in maturity onset diabetes of the young (MODY) and neonatal diabetes mellitus (NDM). Genetic diagnosis of MODY is also likely to have important prognostic and therapeutic implications in majority of the patients with confirmed HNF1A and HNF4A mutations. Genetic screening and analyses have helped several neonatal infants carrying mutations in the KCNJ11 and ABCC8 genes to shift from insulin treatment to oral sulphonylurea drugs. The progress in genomics of monogenic diabetic forms has helped in translating the discoveries from bench to bedside in clinical care. Therefore, there is an urgent need to incorporate genetic testing for the genes implicated in monogenic diabetes like MODY and NDM in the diabetes clinics. Discoveries in genetic research methodology and understanding of genetic etiology will have great translational implications for disease treatment and follow-up.

Built environment, physical activity and diabetes

Ranjit Mohan Anjana and Rajendra Pradeepa

Keywords: Built environment, diet, diabetes, health outcome, physical activity.

Abstract

Type-2 diabetes, which has emerged as a global epidemic in recent years, is strongly related to lifestyle and economic change. The built environment (BE) influences lifestyle factors such as physical activity and diet. Evidence shows that individuals who live in neighbourhoods with the availability of destinations for physical activity within walking/cycling distance are more likely to engage in the same and thereby improve their health. Walking can be increased in neighbourhoods by providing useable and unencroached pedestrian pathways, undertaking motor-traffic reduction strategies, improved perceived neighbourhood safety, increasing good street connectivity, parks, green space, playgrounds and recreation areas. Thus for the BE to positively influence health outcomes and be made more activity-friendly, requires combined efforts of health professionals and stakeholders in the Government as well as the private sector.

Role of inflammation in diabetic retinopathy: therapeutic targets

Samuel Hobbs, Finny Monickaraj, Paul McGuire and Arup Das

Keywords: Chemokines, cytokines, diabetic retinopathy, drug therapy, inflammation.

Abstract

Inflammation plays a key role in the pathogenesis of diabetic retinopathy (DR), leading to alterations in the blood-retinal barrier and increased vascular permeability. Many anti-VEGF medications are now available for the treatment of DR, but response to these medications is not as robust in patients with diabetic macular oedema. Newer biologic agents are currently under study to improve the treatment of DR. These have shown promising results to both decrease the treatment burden of intravitreal injections and improve visual outcomes for diabetic patients.

Diabetes and tuberculosis' – a co-epidemic of public health importance in the developing world

Satyavani Kumpatla and Vijay Viswanathan

Keywords: Diabetes, developing countries, epidemiology, tuberculosis.

Abstract

With the rising epidemic of diabetes mellitus (DM) and tuberculosis (TB) already being a major infectious disease of the world, when put together, this coepidemic constitutes a threat to global public health. The situation is critical in countries like India which are facing the dual burden of non-communicable diseases and communicable diseases. This not only affects the national productivity, but also the national exchequer. Henceforth, a crucial health strategy is required to control this co-epidemic. This article reviews the epidemiology of DM and TB, TB and its characteristics, the effect of DM on TB treatment outcomes, screening methods and diagnosis, economic impact on the health sector and guidelines which could prevent this burden.

Early life influences and type-2 diabetes – a review

Poornima Prabhakaran and Nikhil Tandon

Keywords: Birth weight, disease risk, maternal nutrition, type-2 diabetes.

Abstract

Early life factors encompassing parental, foetal and postnatal characteristics, have an important influence on individual disease risk. Of particular importance is the role of maternal lifetime nutrition and metabolic reserves, and the impact on offspring birth outcomes. Birth weight, in turn, affects disease risk in later life. Being born small and showing rapid weight gain during childhood are especially important risk determinants for impaired glucose tolerance, higher blood pressure, dyslipidaemia, overweight and obesity in later life. Postnatal growth patterns, socio-environmental factors and genetic influences thus act in concert to increase the predilection for chronic diseases, including type-2 diabetes.

Controlled hydrolytic degradation of polyglycolide–caprolactone-based bioabsorbable copolymer

Anil Kumar Singh, Rakesh Kumar Singh and Ajay Kumar Tyagi

Keywords: Biocompatibility, bioabsorbable copolymer, hydrolytic degradation, polyglycolide–caprolactone, suture

Abstract

Polyglycolide–caprolactone (PGCL)-based copolymer was synthesized from glycolide and caprolactone by ring opening polymerization in the presence of stannous octoate catalyst and diethylene glycol initiator. The effects of prepolymerization time, monomer ratio, monomer-to-catalyst and monomer-to-initiator ratios on per cent weight conversion were optimized. The end-capped copolymer was synthesized to make absorbable sutures having controlled bioabsorbability at different pH levels. It was observed that endcapped absorbable copolymer was more stable at pH 10.0 compared to uncapped absorbable material. End-capped copolymer also retained higher tensile strength compared to uncapped copolymer after 21 days. This phenomenon of controlled hydrolytic degradation of PGCL-based bioabsorbable polymer having terminal group end-capping can be attributed to less availability of hydrophilic end groups facilitating hydrolytic degradation of polymers.

Foetal programming in a diabetic pregnancy: long-term implications for the offspring

G. V. Krishnaveni and C. S. Yajnik

Keywords: Gestational diabetes, non-communicable disease, offspring, pregnancy.

Abstract

Maternal diabetes predisposes the growing foetus to non-communicable disease risk later in life. Studies show an increased risk of adiposity/obesity, type-2 diabetes and higher blood pressure in offspring of diabetic mothers. Altered metabolic and neuroendocrine functions, and epigenetic modification of genes involved in these functions are some of the mechanisms proposed for the offspring disease risk. Though optimal management of diabetes during pregnancy prevents its immediate complications, there is limited evidence on the influence of glycaemic control on longterm effects in the offspring. Future focus should be on prevention of pregnancy diabetes through appropriate maternal and child health policies in vulnerable populations.

Effectiveness of yoga for patients with diabetes mellitus

Nagendra Ramarao Hongasandra, Pooja More, Vinod Kumar, Aarti Jagannathan and Nagarathna Raghuram

Keywords: Controlled trials, diabetes mellitus, primary and secondary outcome variables, yoga.

Abstract

Diabetes mellitus is a multifactorial metabolic disorder which requires lifestyle interventions for its management. A number of controlled yoga trials in last few years have observed lifestyle interventions especially yoga to be efficacious in the management of diabetes. The aim of this study is to systematically review the research conducted in the field to understand the effectiveness of yoga on diabetes mellitus. A systematic search was done using search engines such as PubMed, Google Scholar, Cochrane Library, MEDLINE, CAMbase, PsycINFO and IndMED. A total of 212 articles were selected, of which 166 were excluded and 46 controlled trials (CTs) were included in the review. Among the 46 CTs, 31 studies were categorized based on the primary outcome variables, 10 were based on the secondary outcome variables and 5 studies were control studies. Risk of bias assessment was conducted on all the studies. The review demonstrates significant improvement due to yoga practice in the primary outcome measures such as blood glucose levels along with secondary outcome measures such as cardiac autonomic variables, lipid profile, liver enzymes, respiratory variables, quality of life, anxiety and depression. Thus yoga has not only been found to be beneficial for improved glycaemic control, but also for the wide variety of symptoms associated with the diabetes. Despite this evidence, it is worth mentioning that further gold standard randomized controlled trials are warranted with more specific sets of practice, to prescribe yoga especially as an alternative treatment for the management of diabetes.

Use of biomass ashes in agriculture with reference to farming practices in Vidarbha, Maharashtra, India

G. Kamble, Sunil K. Deokar and Sachin A. Mandavgane

Keywords: Adsorption, bagasse fly ash, biomass ash, paraquat, rice husk ash.

Abstract

As a regular farming practice in India, especially in Vidarbha, biomass ashes (BMAs) are spread on farmland. BMA forms a protective layer on the soil surface and acts as a barrier, thereby preventing direct contact between pesticides and soil. BMA acts: (i) as an adsorbent for removal of pesticides; (ii) as a soil additive and water enhancer, and (iii) as a micronutrient source for plants. In this study, paraquat, a representative chemical was selected to prove the hypothesis that BMAs are the most efficient adsorbents of herbicides used in Vidarbha. The adsorption capacity (mg/m²) of BFA for

removal of paraquat was found to be greater than that reported for natural adsorbents. Based on adsorption capacity, RHA and BFA dosages per hectare of land are recommended for different crops and fruits.

Graphene oxide reduction activity of seaweed polymer derivative: efficient bio-based alternative

Nilesh Vadodariya, Jai Prakash Chaudhary, Faisal Kholiya, Mukesh Sharma and Ramavatar Meena

Keywords: Agarose–gallate, biomaterials, green approach, graphene oxide, reduction activity.

Abstract

The present study demonstrates utilization of functionalized seaweed polysaccharide, namely agarose–gallate (Ag–GAEst) for the preparation of reduced graphene oxide (rGO) under mild reaction conditions. Ag–GAEst obtained with the lowest degree of substitution (degree of substitution (DS) = 0.45; with 1 : 0.5 w/w agarose : gallic acid) shows excellent performance compared to its high DS (1.1; with 1 : 2.0 w/w agarose : gallic acid) ester derivatives. Further, the formation of rGO was confirmed using UV–Vis, TEM, FTIR, Raman spectroscopy, elemental and XRD analysis. This study describes a new application of seaweed-derived polysaccharides.

Study on the establishment of a diversified National Ambient Noise Monitoring Network in seven major cities of India

N. Garg, A. K. Sinha, M. K. Sharma, V. Gandhi, R. M. Bhardwaj, A. B. Akolkar and R. K. Singh

Keywords: Day equivalent level, day–night average sound level, National Ambient Noise Monitoring Network, night equivalent level.

Abstract

We describe the diversified National Ambient Noise Monitoring Network (NANMN) set up across 7 major cities of India and covering 70 stations for continuous noise monitoring throughout the year. The annual average L_{day} (06–22 h) and L_{night} (22–06 h) values observed in 2015 for these 70 locations are described. Of these, 25 locations are in commercial zones, 12 in industrial, 16 in residential and 17 in silence zones. Each city has 10 noise monitoring stations installed for analysing environmental noise pollution levels round the clock (24×365 h). The long-term noise monitoring shows that ambient noise levels are very high compared to the recommended standards for some sites and thus noise abatement measures are essentially required for controlling these levels. The present study is focused on evaluation, analysis and reporting of environmental noise pollution in seven major cities of India and is instrumental in planning for the noise abatement measures for controlling noise pollution in these cities. Such a noise monitoring network established in India is unique and one of the largest noise monitoring networks of its kind across the globe.

U–Pb and Lu–Hf systematics of zircons from Sargur metasediments, Dharwar Craton, Southern India: new insights on the provenance and crustal evolution

Bidyananda Maibam, Axel Gerdes, R. Srinivasan and J. N. Goswami

Keywords: Detrital zircon, high- and low-grade metamorphism, isotope analysis, supracrustal rocks.

Abstract

A study of U–Pb and Lu–Hf–Yb isotope data in zircons from metamorphosed psammopelite and quartzite from the type area of Archaean Sargur Group, Dharwar Craton, India is carried out. Two age populations are observed: an older population with concordant U–Pb ages between 2.7 and 2.8 Ga, and a younger population with ages in the 2.4–2.6 Ga age range. The ϵ_{Hf} values of 0 to +2.0 for the older zircon population suggest that they were derived from juvenile crust formed at 2.7–2.8 Ga.

Sub-chondritic ϵ_{Hf} values for the younger population indicate metamorphism and/or crustal reworking at ~ 2.5 Ga. Metasedimentary enclaves in the Sargur type area are therefore part of the gneiss–supracrustal complex of different antiquities and may not have an independent stratigraphic status.

Effect of different spacings of poplar-based agroforestry system on soil chemical properties and nutrient status in Haryana, India

Chhavi Sirohi and K. S. Bangarwa

Keywords: Agroforestry, nutrient status, poplar, spacing, soil chemical properties.

Abstract

A field experiment was conducted during 2013–14 and 2014–15 to study the effect of different spacings, i.e. 5×4 m, 10×2 m and $18 \times 2 \times 2$ m (paired row) of 7- and 8-yr-old poplar-based agroforestry system on soil chemical properties such as soil pH, electrical conductivity (EC), soil organic carbon (SOC) and available N, P and K. Poplar-based agroforestry system had better available nutrients status in comparison to sole wheat crop. The lowest value of soil pH (7.5) was recorded under 5×4 m spacing after harvesting of wheat crop during April 2015. The decrease in EC was maximum (67%) under 5×4 m spacing followed by 10×2 m and $18 \times 2 \times 2$ m spacing with a reduction up to 63% and 61% respectively. SOC increased with the decrease in tree spacing and was maximum (0.74%) under 5×4 m spacing; it followed the order 5×4 m > 10×2 m > $18 \times 2 \times 2$ m > control after harvesting of wheat crop during April 2015. The available soil N, P and K increased significantly under different spacings of poplar-based agroforestry system in all the treatments from their initial values. The highest available soil N (366.3 kg ha⁻¹), P (21.4 kg ha⁻¹) and K (355.3 kg ha⁻¹) were recorded under 5×4 m spacing compared to 10×2 m and $18 \times 2 \times 2$ m and sole cropping after harvesting of wheat crop during April 2015.

Comparative evaluation of bus rapid transit routes using super efficiency data envelopment analysis

Ankit Kathuria, M. Parida and Ch. Ravi Sekhar

Keywords: Analytical hierarchy process, bus rapid transit, data envelopment analysis, route performance.

Abstract

Periodical evaluation of the transit system and its subunits is becoming paramount for improving its performance. This article evaluates the performance of 12 routes of the bus rapid transit system operating in Ahmedabad, India. The performance indices considered in the study were divided into five major types of efficiency, viz. route design, scheduled design, cost, service delivery, and comfort and safety efficiency. Super efficiency data envelopment analysis was used to estimate efficiency scores for each type. Further, composite efficiency of routes was estimated based on analytical hierarchy process technique.

Making scientometric and econometric sense out of NIRF 2017 data

Gangan Prathap

Keywords: Bibliometrics, comparative research evaluation, institutional ranking, size dependence and independence.

Abstract

We perform a comparative end-to-end research evaluation of leading engineering institutions in India separating out the bibliometric part of the chain from the econometric part. This combines size-dependent and size-independent terms based on quantity and quality (impact) in a meaningful

way. Output or outcome at the bibliometric level is measured using a second-order composite indicator, and the productivity or efficiency terms follow accordingly using the input to output or outcome factors. Data are taken from the recent release of the National Institutional Ranking Framework (NIRF) 2017 in the public domain. Thus, the ranking based on NIRF scores of the Indian Institute of Technology, Madras as the best engineering institution in India is too simplistic a conclusion.

Simulation and experimental validation of hill-climbing algorithm for maximum power point tracking of solar photovoltaic plant

Megha Khatri and Atul Kumar

Keywords: Hill-climbing algorithm, maximum power point tracking, photovoltaic solar system.

Abstract

Variation of solar irradiances plays an important role in changing the parameters of a photovoltaic (PV) module. This communication includes a mathematical model, system design, control algorithm and experimental set-up to obtain the maximum power point on P–V and I–V curves of an array. Discussions have been done on all the units of the system and a simulation model developed in MATLAB software using the proposed method. The resultant system is capable of tracking maximum power point without steady-state oscillations and errors in changing environmental conditions. The feasibility and improved functionality of the proposed system have been tested successfully in the laboratory.

Revisiting the *Noctiluca scintillans* paradox in northern Arabian Sea Satya Prakash, Rajdeep Roy and Aneesh Lotliker

Keywords: Hypoxia, monsoon, *Noctiluca scintillans*, oxygen, silicate/nitrate ratio.

Abstract

In 2015, a *Noctiluca scintillans* bloom and associated water column properties were studied in the northern Arabian Sea. Our observations showed photic depth limited to 30 m with uniform oxygen concentration of $\sim 223 \mu\text{M}$. In general, the dissolved oxygen ranged between 180 and 223 μM within the top 80 m indicating saturated mixed layer. Chlorophyll a varied between 0.24 and 2.4 mg m^{-3} within the core of the bloom and < 1) compared with the eastern part, resulting in a strong spatial trend. This presumably facilitates easy community transition to a *N. scintillans* bloom. This is supported by the heterotrophic nature of the species which, under detectable and belowdetectable nitrate conditions, gives it a competitive advantage over other phytoplankton communities.

Phytochemical and biochemical study of four legume plants with detergent and anti-lice properties from the Eastern Himalayan region of India

Pankaj Bharali, Yabid Gamo, Arup Kumar Das, Hui Tag, Ananta Madhab Baruah and Dwipen Kakati

Keywords: Anti-lice, *Gymnocladus assamicus*, legumes, natural soap.

Abstract

This study is aimed at the qualitative and quantitative investigation of the phytochemical content, macroand micronutrients, proximate analysis and determination of antioxidant activities of four plants belonging to the family Leguminosae namely *Acacia pennata*, *Albizia lucidior*, *Albizia chinensis* and *Gymnocladus assamicus* widely used by the Adi tribe of Arunachal Pradesh for their surfactant and insect-repellent properties. The methanol extract of the seed pod of *G. assamicus*, the most popular soap-plant among the Adi people, showed maximum 1,1-diphenyl-2-picrylhydrazyl scavenging activity with EC₅₀ of 13.50 $\mu\text{g/ml}$ and presence of hitherto reported insecticidal metabolites like 2-hydroxy- γ -butyrolactone and heptadecene-(8)-carbonic acid.

Conservation through conversation: a collaborative corridor restoration initiative in the Biligiri Rangaswamy Temple Tiger Reserve, Karnataka, India

Paramesha Mallegowda, Siddappa Setty and Ganesan Rengaiyan

Keywords: Human–wildlife conflict, restoration, stakeholder, Wildlife corridor.

Abstract

Wildlife corridors are critical in maintaining ecological processes and wildlife management, but they are fragmented and degraded due to various land-use practices. It is crucial to restore wildlife corridors through participation of communities/institutions of the landscape. Ironically, however, most of the proposed conservation plans are devoid of them in conservation and policy-making. Therefore, valuing the onus of people and their inputs to restore and manage wildlife corridors would be a practical strategy. We are addressing this ‘restoration initiative’ in the Biligiri Rangaswamy Temple Tiger Reserve, Karnataka, India by integrating knowledge from social and ecological sciences. The preliminary result indicates that, people and institutions from the landscape are willing to support the restoration efforts. This initiative would emerge as one of the successful, action-oriented and policy-driven projects in this landscape.

Characterization of marine actinomycete having antiviral activity against cucumber mosaic virus

S. B. Latake and S. G. Borkar

Keywords: Actinomycetes, antiviral activity, characterization, CMV, *Streptomyces olivaceus*.

Abstract

Metabolite of 28 marine actinomycete isolates was assessed for antiviral activities against cucumber mosaic virus (CMV). Metabolite of one isolate (no. 21) was found most effective in controlling the CMV infection under glasshouse conditions by dual inoculation, seed treatment and spray treatment, individually. Under field conditions, treatment of cucumber seeds with the metabolite of actinomycete isolate no. 21 followed by four foliar sprays of the metabolite on cucumber plants, effectively controlled CMV infection. The morphological structures of the isolate were identical to *Streptomyces* sp. It was identified as *Streptomyces olivaceus* on the basis of 16-S ribosomal RNA gene sequencing which was in conformity with morphological, physiological and biochemical characteristics of the isolate.

Petrogenesis of Ajil mafic dykes from Eastern Belt of Peninsular Malaysia: fractionated within plate lithospheric mantle magma beneath the eastern Malaya Block

Muhammad Hafifi Badrudin, Azman A. Ghani and Long Xiang Quek

Keywords: Ajil mafic dykes, clinopyroxene, peninsular Malaysia, petrogenesis, plagioclase.

Abstract

North-eastern trending mafic dykes are found intruding granitic body in Ajil area, Eastern Belt of Peninsular Malaysia. The intrusions display sharp, vertical to sub-vertical contacts to granitic host and consist mainly of plagioclase and clinopyroxene. Majority of the dykes are quartz tholeiite with some olivine tholeiite. All dykes display enrichment in light rare earth elements (LREE) relative to heavy rare earth elements (HREE) and depletion in high field strength elements (HFSE) and Pb. Low compatible elements' content such as MgO, Ni and Cr implied that crystal fractionation were controlled by olivine and clinopyroxene. The dykes were originated from shallow lithospheric mantle, the source region of which has been influenced by hydrous metasomatism. The emplacement of the dykes took place in fault-controlled within-plate tectonic setting.

Non-alcoholic fatty liver disease in Asian Indians: relationship with insulin resistance, diabetes and cardiovascular risk

Surya Prakash Bhatt, Anoop Misra and Naval K. Vikram

Keywords: Diabetes, insulin resistance, obesity, nonalcoholic fatty liver disease.

Abstract

Prevalence of non-alcoholic fatty liver disease (NAFLD) varies in India; up to one-third of the urban population is affected by the disease. In Asian Indians, presence of NAFLD is driven by multiple factors – presence of excess abdominal fat (abdominal subcutaneous and intra-abdominal fat) and lifestyle factors (imbalanced diets and physical inactivity), and it is correlated closely with insulin resistance, the metabolic syndrome and dysglycaemia in the background of genetic predisposition (investigated genes in Asian Indians: APOC3, PNPLA-3, PPAR γ , SREBP-2, adiponectin, SAMM50, PARVB and PZP). Recent studies also show that presence of NAFLD independently correlates with subclinical inflammation and surrogate markers of atherosclerosis (carotid intima-media thickness, impaired flow-mediated vasodilatation) in Asian Indians. A prediction equation (Indian Fatty Liver Index) which includes simple measures has been developed for Asian Indians. On the other hand, increased (more than 15.6 cm) liver span (surrogate marker of fatty liver), in a preliminary study, predicted diabetes in non-obese Asian Indians. Dietary factors are important for the development of NAFLD, and some evidence indicates that regular use of high monounsaturated fatty acid rich oils, and low amount of saturated fat intake are beneficial.

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Big names in innovation research: a bibliometric overview

Christian A. Cancino, José M. Merigó and Freddy C. Coronado

Keywords: Bibliometrics, innovation research, ranking, Web of Science.

Abstract

Over the last few years an increasing number of scientific studies related to innovation research has been carried out. The present study analyses innovation research developed between 1989 and 2013. It uses the Web of Science database and provides several author-level bibliometric indicators including the total number of publications and citations, and the h-index. The results indicate that the most influential professors over the last 25 years, according to their highest h-index, are David Audretsch, Michael Hitt, Shaker Zahra, Rajshree Agarwal, Eric Von Hippel, David Teece, Will Mitchell and Robert Cooper. Among these authors, it is possible to demonstrate that they are not necessarily the most productive authors, with the highest number of publications; however, they are the most influential, with the highest number of citations. The incorporation of a larger number of journals to the Web of Science has granted different authors access to publish their work on innovation research

The patent profile of green LED light bulbs: cases in the US, Japan, Taiwan and China

Ying-Chieh Lu, Shiu-Wan Hung and Her-Her Tsai

Keywords: Green light, LED bulbs, patent indicator tools, patent profile.

Abstract

There is an increasing demand for LED (light-emitting diode) bulbs, and technological development has become extremely significant, especially pertaining to patents. In this article, relevant LED bulb patents from the database of the United States Patent and Trademark Office (USPTO) from 1976 to 2014 have been examined and analysed. The applied patent indicator tools include patent analysis, technology life-cycle analysis, R&D ability analysis and patent classification analysis. The analysis

was completed at the national, company and technology levels. At the national level, the US has the best performance. At the company level, the Switch Bulb Company, Inc. has obtained the most number of patents. According to the technological field of US Patent Classification, green LED light bulb patents mainly focus on D26/2, 362/249.n and 313/46 – especially D26/2. American companies in general have maximum success in patenting green LED light bulbs, but the Hon Hai Group, Taiwan is the only company covering these three technology fields. We demonstrate the development trend and operation of green LED light bulbs from different aspects to show that the technology gap is an important reference for other relevant LED bulb companies that plan to develop new technologies and increase their competitiveness in the future.

Folic acid decorated chitosan nanoparticles and its derivatives for the delivery of drugs and genes to cancer cells Agnes

Aruna John, Saravana Kumar Jaganathan, Manikandan Ayyar, Navaneetha Pandiyaraj Krishnasamy, Rathanasamy Rajasekar and Eko Supriyanto

Keywords: Cancer, chitosan, doxorubicin, drug delivery, folic acid, 5-fluorouracil, gene delivery.

Abstract

Nanotechnology offers a number of nanoscale implements for medicine. Among these, nanoparticles are revolutionizing the field of drug and gene delivery. Chitosan is a natural polymer which provides a profitable tool to an innovative delivery system due to its inherent physicochemical and biological characteristics. Chitosan nanoparticles are promising drug and gene delivery carriers because of small size, better stability, low toxicity, inexpensiveness, simplicity, easy fabrication and versatile means of administration. Chitosan can also be easily modified chemically due to the presence of reactive functional hydroxide and amine groups. Folic acid is commonly engaged as a ligand, for targeting cancer cells, as its receptor, that transports folic acid into the cells through endocytosis and is over-expressed on the surface of several human epithelial cancer cells. Integrating folic acid into chitosan-based drug delivery inventions directs the systems with a well-organized targeting ability. The present review outlines several illustrations of this versatile system based on folate decorated chitosan, which have shown potential as auspicious delivery systems published over the past few years. In addition, it is probable to formulate chitosan nanocarriers that exhibit manifold usage beyond targeted delivery, such as nanotheranostics and cancer stem cell therapy.

Feeding biology and nutritional physiology of Psylloidea (Insecta: Hemiptera): implications in host–plant relations

Anamika Sharma and Anantanarayanan Raman

Keywords: Auchenorrhyncha, feeding behaviour, Heteroptera, nutritional requirements, primary metabolites, Sternorrhyncha.

Abstract

About 3500 species represent the Psylloidea across the world. Many Psylloidea live on a wide range of agriculturally and horticulturally important plants and some of them also act as vectors of plant pathogens. Generally they show a narrow host–plant range and feed on plant sap. Endosymbiotic bacteria are shown to be associated with some of them, enabling them to live on a nutritionally imbalanced plant diet. During feeding, the Psylloidea induce changes in plant tissues. Salivary enzymes such as pectinases enable them to mobilize primary metabolites rapidly to feeding sites from uninfested parts. Specific proteins (64 and 58 kDa) occur in the saliva of free-living Psylloidea (e.g. Aphalaridae) as well as in host–plant phloem. These insects live either freely or by constructing lerps or by inducing galls. Variations in guilds and feeding behaviour determine the

nutritional ecology and physiology of the Psylloidea. Varying nutrient levels in leaves regulate populations of the gregariously feeding Psylloidea. The lerp-constructing Psylloidea utilize more of sugar-based nutrients, while the groupfeeding Psylloidea induce more intense changes in amino-acid, fatty-acid, and mineral levels in host plants. High C and low N ratios in leaves influence psyllid growth rates negatively. For instance, the gall-inducing Psylloidea achieve only two generations a year. High levels of the sterol (440.3 molecular weight) and ergosterol and low levels of complex lipids in young leaves of *E. macrorhyncha* appear to regulate the specificity of the gall-inducing species of *Glycaspis* (*Synglycaspis*) (*Aphalaridae*). About 100 plants are indicated as hosts of Indian Psylloidea. Curiously no lerp-forming psyllid is known in India.

FTIR and ultrasonic studies on molecular interactions of ester with butanol in the temperature range 303.15–318.15

K M. Srilatha, B. Venkateswara Rao and B. Vijaya Saradhi

Keywords: Butanol, ethyl oleate, density, ultrasonic speed, viscosity.

Abstract

Ultrasonic velocity, viscosity and density of ethyl oleate in butanol have been determined at various temperatures in the range 303.15–318.15 K. These data are used to estimate adiabatic compressibility, intermolecular free length and acoustic impedance, molar volume and free volume along with their excess values. The observed variations in these parameters with different concentrations and temperatures are discussed in terms of the intermolecular interactions between the unlike molecules of the binary mixtures.

Durability characteristics of high early strength concrete

Ramesh Babu Chokkalingam and Manu Santhanam

Keywords: Chloride permeability, high early strength concrete, oxygen permeability, sorptivity, water absorption.

Abstract

High early strength concrete (HESC) is a type of high performance concrete, which attains its specified strength earlier than normal concrete. This type of concrete is normally used in precast and prestressed concrete industries. Many studies have been performed on the production of high early strength concrete, but information on performance of high early strength concrete in durability tests is limited. This article deals with evaluation of durability index characteristics of high early strength concrete mixtures made with two different cements. Durability index tests such as oxygen permeability, sorptivity, rapid chloride permeability and water absorption tests were performed on three HESC mixtures made with two different cements and compared with a reference concrete. Our results reveal that high early strength concrete using steam curing is better than concrete produced using accelerator. The microstructural studies also revealed that steam-cured concrete is better than accelerator-cured concrete supporting the durability index properties of concretes tested.

Pure oxy-fuel circulating fluidized bed combustion by controlling adiabatic flame temperature using fuel staging†

Azd Zayoud, P. Mahanta and U. K. Saha

Keywords: Adiabatic flame temperature, carbon capturing and sequestration, circulating fluidized bed, oxyfuel combustion.

Abstract

In the present study, a new method is proposed for temperature controlling by combustion staging. Two combustion stages can be used with two stages of fuel feeding. A high stoichiometric ratio

(SR) $\lambda > 1$ is used at the first stage to mitigate adiabatic flame temperature (AFT) in case of high O₂ in the oxidant. For validation, a series of experiments are conducted using mini-CFB (circulating fluidized bed), and an oxidant of 100% O₂ concentration is used with three SR ratios, i.e. $\lambda = 1.25, 2.0$ and 3.0 . The resulting average temperatures along the riser for biomass are 1031°C, 950°C and 798°C; and for coal 1129°C, 1051°C and 961°C respectively. The controlling of AFT with pure oxy-fuel combustion eliminates the recycled flue gas in oxy-fuel CFB combustion and flue gas recirculation section; this simplifies design, fabrication and installing–operating costs of the power plants. Familiarizing this concept can accelerate adapting oxy-fuel combustion in CFB power plants for carbon capturing and sequestration. This study can help commercialize the third generation of oxy-fuel CFB combustion with zero RFG. Finally, the concept of controlling AFT by SR is validated experimentally.

Metal distribution in the sediments, water and naturally occurring macrophytes in the river Gomti, Lucknow, Uttar Pradesh, India

Neha, Dhananjay Kumar, Preeti Shukla, Sanjeev Kumar, Kuldeep Baudh, Jaya Tiwari, Neetu Dwivedi, S. C. Barman, D. P. Singh and Narendra Kumar

Keywords: Bioaccumulation, Gomti River, heavy metals, macrophytes, sediments.

Abstract

River Gomti receives treated/untreated industrial as well as municipal wastes from various drains of Lucknow city, India. In order to study heavy metal pollution (Cd, As, Pb and Cu) in the river, water and sediment samples were collected from 10 sampling stations along a 9 km stretch in the city of Lucknow. Results revealed that the concentrations of heavy metals in water samples were in the range: As: 0.035–0.061, Cd: 0.016–0.068, Cu: 0.029–0.062 and Pb: 0.031–0.065 mg l⁻¹ whereas in sediments metal concentrations were found to be As: 3.72–14.98, Cd: 1.91–8.39, Cu: 8.97–95.35 and 35.82–90.92 $\mu\text{g g}^{-1}$. Bioaccumulation of these metals was assessed in four aquatic macrophytes, viz. Pistia stratiotes, Eichhornia crassipes, Polygonum coccineum and Marsilea quadrifolia. Pistia stratiotes and Polygonum coccineum accumulated maximum amount of Pb followed by Cu, Cd and As, whereas in the case of Eichhornia crassipes and Marsilea quadrifolia the relative metal accumulation pattern was found as Cu > Cd > Pb > As and Cu > Pb > Cd > As respectively. The present study suggests that though the concentrations of toxic metals were lower in water, chronic exposure could result in bioaccumulation to a degree many-fold higher than in growing medium. It was also concluded that the water and sediment of the river should be regularly monitored for heavy metal contamination and care should be taken while using river water in agriculture/ aquaculture.

Estimating capacity of hybrid bus rapid transit corridor

Harprinderjot Singh, Ankit Kathuria, Ch. Ravi Sekhar and M. Parida

Keywords: Hybrid bus rapid transit, Greenshield model, population, traffic.

Abstract

The main objective of this study is to estimate the capacity of hybrid bus rapid transit (BRT) corridor. By the term hybrid BRT corridor in context to this study, we mean a corridor in which buses have to operate in an exclusive environment as well as in a mixed traffic environment. Capacity is an important parameter to estimate corridor and system performance. Therefore to evaluate the same, Ahmedabad BRT system was chosen in the present study. On the basis of boarding alighting data, the busiest route comprising both segregated (exclusive environment) and unsegregated (mixed traffic environment) stretch was selected. For estimating the capacity, an empirical method was adopted. Bus lane capacity for segregated stretch and unsegregated stretch

was estimated as 243 buses/h and 101 buses/h respectively. The overall capacity value of hybrid BRT corridor was minimum of the two, i.e. 101 buses/h. After estimating the capacity so obtained, the effect of mixed traffic environment on overall corridor capacity was observed. Further, an attempt was made to estimate capacity using conventional Greenshield model on a mid-block section. Following this, the results of two approaches namely, empirical model capacity and capacity using Greenshield model were compared. The capacity obtained at mid-block section of the segregated stretch was overestimated by 19.34% or 290 buses/h compared to that obtained using empirical method (243 buses/h).

Temporal effect on the abundance and diversity of intertidal rocky shore macroalgae

Temjensangba Imchen and A. C. Anil

Keywords: Biomass, monsoon, microalgal abundance and diversity, nutrient run-off.

Abstract

A study of the temporal effect on the abundance and diversity of intertidal rocky shore macroalgae revealed that there are ~70 species in the intertidal rocky shore of Anjuna (60 species) and Vagator (52 species) in Goa, India. Results showed that premonsoon (May) and post-monsoon (December) seasons favoured high species richness and abundance in both the study sites. In both cases, species diversity was low during the monsoon months (July and August). The study showed that low diversity might be a monsoonal effect and it coincides with the growth of *Ulva* and *Porphyra* species. The growth of opportunistic annuals brings about an ephemeral dominance of the macroalgal community by annual macroalgae. The driver is believed to be the nutrient influx from surface run-off, change in salinity and temperature due to high precipitation. The study showed that monsoon could have a role on the macroalgal community dynamics, and there was a strong correlation between diversity and biomass.

Wood specific gravity of trees in hot semi-arid zone of India: diversity among species and relationship between stem and branches

Dipak Kumar Gupta, R. K. Bhatt, A. Keerthika, A. K. Shukla, M. B. Noor Mohamed and B. L. Jangid

Keywords: Arid region, branch, tree biomass, wood specific gravity.

Abstract

Wood specific gravity (WSG) is an important parameter in allometric equations for accurate estimation of C-sequestration and other functional properties of a tree. However, WSG of many tree species especially of arid and semi-arid regions is poorly reported. Further, identifying indirect methods for determination of stem WSG from branches may be rapid and relatively easy. The present study determined WSG of stem and branches of 21 tree species in the hot semi-arid region of Western India. Three individual trees from each species were randomly selected and sampled for determination of WSG of stem, primary and secondary branch. WSG varied significantly among the species ($F = 42.83$, $P < 0.001$) and sampling locations (stem and branches) ($F = 29.43$, $P < 0.001$). In stem (at DBH), it ranged from 0.42 ± 0.04 to 0.74 ± 0.03 among the species while within an individual tree it varied in order of stem > primary branch > secondary branch in most species. WSG of stem and branches showed linear relationship and branches were found a good predictor of stem WSG ($R^2 > 0.83$).

Dynamic push–pull strength data generation for agricultural workers to develop manual dryland weeders

D. R. Chethan and D. Anantha Krishnan

Keywords: Dynamic force, energy expenditure, field capacity, heart rate, LCP.

Abstract

Existing manual hoes are dynamic push–pull weeders, but their designs are based on static force exertions. A test rig was developed to optimize the speed and force exertions. At 1.0 km h⁻¹, an operator can exert 20 to 25 kgf. Based on optimized results V-shaped blade (V) and straight blade (S) weeders were developed and evaluated along with the existing twin wheel hoe (T). Performance of the V and S weeders was higher than T. The field capacities were 0.026, 0.033 and 0.33 ha h⁻¹ and energy expenditures were 20.35, 18.82 and 18.78 kJ min⁻¹ respectively, for T, S and V; however V was best amongst the three.

Weight–length relationship and Fulton’s condition factor of the alligator pipefish, *Syngnathoides biaculeatus* (Bloch, 1785) from the Southeast coast of India

S. V. Sanaye, C. U. Rivonker, R. A. Sreepada, Z. A. Ansari, A. Murugan and B. Ramkumar

Keywords: Allometric growth pattern, condition factor, population biology, *Syngnathoides biaculeatus*, weight– length relationship.

Abstract

The present study provides information on weight– length relationship (WLR) and Fulton’s condition factor (K) of the alligator pipefish, *Syngnathoides biaculeatus* (Bloch, 1785) sampled from Palk Bay (PB) and Gulf of Mannar (GoM) regions, southeast coast of India. The pooled estimate for the parameter b of the WLR for *S. biaculeatus* (n = 217) was determined to be 1.75, indicating the negative allometric growth pattern (b < 3). The K values ranged from 0.65 to 1.35 (pooled, 0.84) and from 0.68 to 1.27 (pooled, 0.85) for populations of *S. biaculeatus* collected from PB (n = 120) and GoM (n = 97) respectively. The results may help address the concerns of conservation of *S. biaculeatus* in the wake of habitat loss and/or incidental by-catch.

Reasonable transition form of bridge–tunnel connecting section in mountainous expressway affected by crosswind

Yunwei Meng

Keywords: Bridge–tunnel connecting section, cross wind, driving simulator, mountainous expressway, transition form.

Abstract

In order to explore a reasonable transition form of mountainous expressway in bridge–tunnel connecting section, driver’s dynamic behavioural changes affected by crosswind is analysed through driving simulator. The experimental section is composed of tunnel and bridge, with different width of left shoulder. Driver’s dynamic behaviour consists of two main parts: counter steering wheel angle and heart rate. The results show that the influence on driver’s dynamic behaviour is greater when the car encountered cross wind at the exit of the tunnel than the crosswind suddenly disappearing at entry of incoming tunnel. As design speed is 100 kmph, the recommended value of left shoulder width is 1.5 m for tunnel exit, while 1.75 m for entrance. For the facility of design and construction, the theoretical transition form of bridge– tunnel connecting section is simplified.

On shapes of ADR report accumulation data for banned drugs

Samadhan Ghubade, Krishna Asvalayan, Sharayu Paranjpe, Kushagra Gupta and Anil Gore

Keywords: Adverse drug reactions, curve fitting, side effects, withdrawn drugs.

Abstract

Adverse drug reactions (ADRs) are a matter of great concern in drug research. This study focuses on drugs which have been banned or withdrawn, due to serious problem of adverse reactions. Our attempt is to develop insights through plotting of data on cumulative counts of ADR reports. These data have been sourced from www.vigiaccess.org. Our expectation is that once a drug is banned/withdrawn, its count of ADR reports should fall precipitously and remain there. Instead a variety of shapes is encountered. These include linear, exponential and sigmoidal. We suggest that these curves can be useful in comparing safety of drugs.

Indo-French cooperation in water sciences: capturing research dynamics through co-authorship analysis Shilpa and Sujit Bhattacharya

Keywords: Co-authorship network, international collaboration, research dynamics, social network analysis, water sciences.

Abstract

Water scarcity and quality are among the key challenges of the 21st century. Compelling necessity to address this problem has led to the emergence of various types of international collaboration. India is one of the countries seriously affected by water scarcity and quality. International collaboration has emerged as an important component of India's strategy for mitigating the water-related challenges. One of the key linkages in India's international cooperation in water sciences is observed with France. This cooperation has led to the establishment of two joint laboratories: Indo-French Centre for Groundwater Research and Indo-French Cell for Water Sciences. The present study examines the structure of this research cooperation through co-authorship analysis. Analysis over a period of time showed that authors from the two laboratories played a key role in developing the network. The importance of this network is also discussed.

Proactive entrepreneurial characteristics of science and technology students: an empirical study in Indian context

Rajib Roy and Niladri Das

Keywords: Entrepreneurial intention, entrepreneurship education, science and technology graduates.

Abstract

In this article we examine the entrepreneurial tendencies among science and technology (S&T) graduates in India. The study was carried out to understand the entrepreneurial psyche among S&T students from India-based institutions of national repute, i.e. Indian Institutes of Technology and National Institutes of Technology. We found that there is a low level of interest among students to pursue an entrepreneurial career. In the psychological context, factors such as self-efficacy, locus of control, innovativeness, achievement orientation were found to positively influence students' entrepreneurial aspirations, but surprisingly not the risk taking propensity. Moreover, environmental factors such as existence of vital resources were found to motivate entrepreneurship. On policy implication per se, our finding concludes with suggestions to impart entrepreneurial knowledge through programmes especially designed for S&T graduates. Additionally, in the context of entrepreneurial ecosystem, policy makers can pave new dimensions by creating an environment that serves as a catalyst for high-tech venturing.

India's preparedness against bioterrorism: biodefence strategies and policy measures

Kewal Krishan, Baljinder Kaur and Anshula Sharma

Keywords: Bioterrorism, biodefence strategies, policy measures.

Abstract

Bioterrorism is a realistic threat to the security and well-being of all countries. Significant legal and biodefence measures must be taken to prevent the production and use of deadly biological weapons. Previous bioterror incidences, dense population and congenial climatic conditions of India, make it vulnerable to bioterrorism threats. This review provides a comprehensive picture of the potential biothreats to the country, the existing laws and policies to counteract such incidences with a strong need for their implementation, and biodefence strategies for preparedness and protection, to make India a bioterror free nation.

Automatic question generation approaches and evaluation techniques

Manisha Divate and Ambuja Salgaonkar

Keywords: Automatic question generation, evaluation techniques, quality enhancers, ranking, sentence simplification.

Abstract

The objective of this article is to review several automatic question generation systems and find why automatic question generation is still an attraction for researchers. The focus is mainly on the task of question generation, analysis of the approaches and evaluation of various methods of automatic question generation. Pointers for further research are included.

Partial factors for shear capacity assessment of in-service RC T-girder bridges

N. J. Yogalakshmi, K. Balaji Rao and M. B. Anoop

Keywords: Assessment, RC T girder bridges, partial factors, reliability index.

Abstract

As the infrastructure age, their assessment to carry the loads they are subjected to becomes increasingly important. Also, assessment is needed as part of a regular monitoring programme. Before carrying out a rigorous probabilistic analysis for assessment, it is often required to make a

preliminary assessment using simplified procedures, such as that developed using semi-probabilistic approach, in which partial factors are used. In this article an attempt has been made to evolve a framework to determine the partial factors for safety assessment of the in-service T-girder bridges in India against the limit state of shear. Limit state of shear is considered because it is one of the important ultimate limit states for bridge girder that results in brittle failure. The partial factors are derived using first order reliability method. In order to suggest a simple method for safety assessment, statistical properties of modelling error associated with the simplified equation of shear capacity estimation are estimated using test data of 185 beams reported in the literature. To demonstrate the usefulness of the framework developed, an attempt has been made to determine partial factors for assessment for a typical T-girder bridge designed according to the relevant Indian codes. The loading considered corresponds to actual traffic loads on a typical Chennai flyover. The study reported here gains importance as: (i) general guidelines to assess the reliability of in-service bridges are non-existent in the Indian context and (ii) the partial factors suggested for two consequence classes can be used for quick assessment of the safety of existing similar flyover girders against limit state of shear in a more rational way.

Drinking water contamination from peri-urban Bengaluru, India

G. Sheeba, Anjaneyulu Jalagam and Padma Venkatasubramanian

Keywords: Microbial contamination, peri-urban Bengaluru, Vrishabhavathi–Byramangala reservoir, water quality.

Abstract

The presence of diarrhoeagenic bacteria such as *Escherichia coli* in drinking water indicates faecal and sewage contamination. Testing the microbial quality of drinking water at source ($n = 29$) and households ($n = 43$) of 29 peri-urban villages of Bengaluru city, indicated that 80% and 93% of samples respectively were unfit for human consumption as per WHO standards, i.e. nil *E. coli* in 100 ml sample. This also indicated that water gets contaminated further at the point-of-use when compared to the source. Forty-one per cent of the source drinking water samples had high *E. coli* counts which in turn means that the residing population face moderate to high risk of diarrhoea. A longitudinal study of the microbial quality of drinking water at source of supply ($n = 45$) was undertaken five times over an eight-month period in a subset of eight villages. Only around 18% of the total samples were microbially safe with nil *E. coli*/100 ml. Microbial contamination was found to be lower in January and March (150 CFU/100 ml). Samples from Chikkakuntanahalli and Kodiyalakeranahalli had ≥ 1000 CFU/100 ml *E. coli*. Total dissolved solids, calcium, magnesium, alkalinity and hardness in source drinking water of eight selected villages were beyond acceptable levels. The nitrate levels were consistently high and beyond WHO permissible levels. Alarming levels of microbial and chemical contamination of drinking water from the sites press for appropriate remedial measures to reduce health threats, particularly among vulnerable population.

Nature of flow patterns of Rajahmundry lava, Gowripatnam area, West Godavari, India:

Insights from AMS studies

Supriya Mondal, Dipanjan Mazumdar, Saurodeep Chatterjee, Debesh Gain and Rana Shil

Keywords: Anisotropy of Magnetic Susceptibility, long distance lava flowage, Rajahmundry Traps, Fe–Ti oxides.

Abstract

Anisotropy of magnetic susceptibility (AMS) data for a single basaltic lava flow, herein named the Gowripatnam lava flow from the Rajahmundry Traps, are evaluated for determining precisely the mechanism of lava flow. At Rajahmundry, lava flows are found on both banks of the Godavari River and sandwich intertrappean sedimentary layers in between. The ones on the west bank of the river are studied here. This study has an implication as the mechanism of lava flow or nature of lava flow patterns of Rajahmundry Trap basalt is still a debatable issue. AMS directions is a powerful tool for investigating the source and direction of lava. Its application to single lava flow from Rajahmundry indicates maximum direction of susceptibility axes in almost all possible directions, indicating radial flowage from radial vent source(s). Two AMS directions (towards north-west – 14%, and north – 7%), however, have the maximum number of petals. This indicates that at least there were palaeoflowage patterns towards these directions. Incidentally the Godavari lineament strikes NW–SE and the flow dip is due south. However, the two dominant magnetic lineation directions are due north. Hence, the possibility of the earlier suggested river piracy model for lava flow can be ruled out. The fissure eruption near Rajahmundry is pointed out as the then prevailing lava flow mechanism. This is further supported by an overall random distribution of maximum susceptibility axes apart from two dominant flow directions.

Spatio-temporal variations in pathogenic bacteria in the surface sediments of the

Zuari estuary, Goa, India Laxman Gardade and Lidita Khandeparker

Keywords: Coliforms, sediment, estuaries, pathogenic bacteria, *Vibrio* spp.

Abstract

Estuaries are hotspots of anthropogenic activities. The deposition of pathogenic bacteria in the sediment and their re-suspension into the water column are influenced by riverine discharge and tides. The abundance of *Escherichia coli* O157:H7, *Shigella* spp., *Salmonella* spp., total coliforms (TC) and *Vibrio* spp. (*Vibrio cholerae* (VC), *Vibrio parahaemolyticus* (VP), *Vibrio alginolyticus* (VA)) was assessed along with the total bacterial count (TBC) and total viable count (TVC) in surface sediments along the banks of the Zuari estuary, Goa, India. The study was carried out fortnightly for a period of 17 months covering three seasons, i.e. pre-monsoon (PreM), monsoon (MON) and postmonsoon (POM). The spatial and temporal changes in the quality of organic matter were also assessed. The organic matter content was high and rich in carbohydrates and proteins towards upstream sites. The quality of organic matter was influenced by the seasons. *E. coli* O157:H7 was detected only during MON towards the upstream stations. A negative correlation between TC and TBC with salinity was evident indicating the influence of land run-off. The *Shigella* spp. and VA were high towards the mouth of the estuary during PreM. However, during POM, the TVC, TC and VP were abundant towards the upstream and VC were abundant at the mouth of the estuary. Among the *Vibrios*, VP and VA were the most frequently occurring bacteria whereas TC and *Shigella* spp. were dominant among allochthonous pathogens in the sediments irrespective of space and time. In addition to influence of seasons, the sampling time influenced by tidal condition also played an important role in the population dynamics of pathogenic bacteria in the sediments. Future studies should address the interaction of pathogenic bacteria with suspended particles, their transport and survival in the sediments.

Description and phylogenetic characterization of hydra from Naukuchiatal (Uttarakhand, India) and comparison with other Hydra strains

Rohini Londhe, Lakshmi Surekha Krishnapati and Surendra Ghaskadbi

Keywords: Hydra, mitochondrial genes, morphology, nematocysts, taxonomy.

Abstract

Hydra, a fresh water Cnidarian, has been used as a model system to study regeneration and pattern formation. Here we report a newly identified hydra from Naukuchiatal, India. Comparison of *Hydra vulgaris* Naukuchiatal with *Hydra magnipapillata*, *Hydra vulgaris* AEP and *Hydra vulgaris* Ind-Pune showed variations in morphology. Nema arrangement in holotrichous isorhiza nematocytes showed transverse coiling pattern, a characteristic feature of the 'vulgaris' group. Phylogenetic analysis using conserved mitochondrial genes confirmed that Naukuchiatal hydra belongs to the 'vulgaris' group though it is a different strain particular to the type locality. Its morphological peculiarities could be the result of pristine environment.

Theoretical investigation of antioxidant activity of hydroxyquinoline derivatives and their delivery via boron nitride nanocage in gas phase and solvent

Meysam Najafi

Keywords: BN nanocage, DFT and solvent, drug delivery, hydroxy-quinoline.

Abstract

The antioxidant activity of hydroxy-quinoline derivatives was studied in gas phase and solvent. Results indicate that substituents in hydroxy-quinoline decrease the bond dissociation enthalpy and ionization potential values and thus increase the antioxidant activity of hydroxy-quinoline. Results

also show that NHMe hydroxy-quinoline has the highest antioxidant activity. The ability and potential of boron nitride (B36N36) nanocage in the delivery of hydroxy-quinoline derivatives via DFT method was studied. Results show that adsorption of hydroxy-quinoline derivatives on the surface of B36N36 nanocage was exothermic. There were linear dependencies between antioxidant parameters and adsorption energy (E_{ad}) values of hydroxyquinoline derivatives. We thus propose to synthesize novel hydroxy-quinoline derivatives with higher antioxidant activity.

Production optimization of alkalithermo tolerant crude endoglucanase from *Funalia leonina* by response surface methodology

Varun Kumar, Nirmal Sudhir Kumar Harsh, Sanjay Naithani, Bipin Prakash Thapliyal and Shrikant Sharma

Keywords: Endoglucanase, *Funalia leonina*, preservation medium, response surface methodology

Abstract

A remarkable yield of an alkali-thermo-tolerant endoglucanase (2.93 IU/ml) was obtained from a white rot fungus, *Funalia leonina* through fermentation process in solid state, optimized by response surface methodology. The three test variables, viz. pH of medium, incubation temperature and incubation time were optimized as they have significant effect on enzyme production. After solving the model equation, the optimum values of medium pH, incubation temperature and incubation period were found to be 5.8, 34°C and 10 days respectively, for maximum endoglucanase production. The consequence of culture preservation medium on enzyme production capacity was also studied and wheat bran agar medium was found the most suitable medium for culture preservation.

Molecular characterization of ladybird predators (Coleoptera: Coccinellidae) of aphid pests (Homoptera: Aphididae) in North East India

Santa Ghosh, G. T. Behere and B. K. Agarwala

Keywords: Aphid pests, genetic variation, ladybird beetles, molecular characterization.

Abstract

Ladybird beetles are potential and promising biological control agents for the management of insect pests. These insects show variations in biological fitness in diverse habitats and subsequently in term of genotypes. We used cytochrome oxidase I (COI) gene sequences to study within-species genetic variation in four species of ladybird predators, viz. *Coccinella transversalis* (Fab.), *Cheilomenes sexmaculata* (Fab.), *Micraspis discolor* (Fab.) and *Anisolemnia dilatata* (Fab.) collected from different cultivated habitats of Tripura, North East India. Results of multiple sequence alignments of partial COI gene (553 bp) of mitochondrial origin showed 100% homology among different populations (within species) of three ladybird species. The molecular identity of *M. discolor* could not be established due to the absence of matching nucleotide sequence for this region of COI gene in the NCBI database. Three of the four populations of *Micraspis* species showed 100% homology in partial COI gene sequencing, but one representative population showed 52 nucleotide mutations, of which 1 mutation was found to result in the alteration of the codon from valine to isoleucine, and seemed to represent a different *Micraspis* species previously not known from NE India. This study shows that the three most common species of ladybird predators of aphid pests in NE India are fairly homogenous with respect to the COI gene, but species of *Micraspis* are genetically diverse and need further studies to address this issue.

Evaluating a survey landscape for tiger abundance in the confluence of the Western and Eastern Ghats

S. S. Lingaraja, Swayam Chowdhary, Rashmi Bhat and Sanjay Gubbi

Keywords: Biligiri Rangaswamy Temple Tiger Reserve, camera trapping, capture–recapture method, tiger.

Abstract

Due to the current depleting trends in tiger population, range countries have committed to double tiger numbers by the year 2022. However, some areas, including source sites, across the range countries lack scientifically estimated tiger numbers both at the larger landscape and at the protected area level. Here we report a population of tigers, from Biligiri Rangaswamy Temple Tiger Reserve (BRTTR), using camera trap based capture-mark recapture in a spatially explicit likelihood and Bayesian analyses that yielded an estimate of ~55 tigers with a density of about 6.8 tigers/100 km². BRTTR nestled in a larger tiger landscape, perhaps contributes dispersing individuals to the adjoining forests, calling for integrated monitoring and management efforts for the entire landscape. This data set could help in designing long-term, landscape level plans and outcomes.

Land-use/land-cover change dynamics and groundwater quality in and around shrimp farming area in coastal watershed, Cuddalore district, Tamil Nadu, India

P. Nila Rekha, R. Gangadharan, P. Ravichandran, Shirley Dharshini, Wilmart Clarke, S. M. Pillai, A. Panigrahi and A. G. Ponniah

Keywords: GIS and remote sensing, hydrogeology, groundwater, salinization, watershed, shrimp farming.

Abstract

The present study was envisaged mainly to ascertain the influence of aquaculture on salinization of coastal groundwater resources in the Cuddalore district of Tamil Nadu located between 11°30'N–11°20'N and 79°38'E–79°48'E. Watershed-based multidisciplinary approach combining GIS and Remote Sensing, and hydro-geochemistry has been applied. The land-use study revealed that though aquaculture was initiated after 1991, the groundwater quality in some locations showed elevated total dissolved solids and electrical conductivity content during that time itself, supporting the fact that aquaculture has been initiated in in situ saline area. Land-use change dynamics showed no defined relationship between area of culture and the groundwater quality, indicating that there was no salinity build-up due to shrimp farming. Besides major chemical compositions, the hydro-geochemical analysis using Chadha's plot suggests that reverse ion exchange is dominant in the study area due to the natural geological condition and it controls the groundwater quality rather than sea water incursion to a large extent. Thus these analyses clearly bring out the fact that shrimp farming is not the main reason for the source of salinity in the study area.

Effect of developmental stage and medium on embryo culture of low chill peach hybrids

Indira Devi, Harminder Singh and Anirudh Thakur

Keywords: Embryo germination, growth stages, low chill peach hybrids, media.

Abstract

The main objective of the present programme was to widen the varietal range of early ripening peach cultivars. Crosses were made between Shan-i-Punjab × Florda Prince, Shan-i-Punjab × Flordaglo and Shan-i-Punjab × Prabhat. The embryos of these crosses were rescued after 65, 75 and 85 days of crossing and cultured in MS basal medium supplemented with varying concentration of BAP (0 to 2 mg/l) and IBA (0 to 1 mg/l). After stratification at 4°C, the embryo cultured tubes were transferred to a growth chamber at 24 ± 2°C for germination. Seeds harvested at 85 days after

crossing showed maximum embryo germination (75.26%). Among these crosses, hybrid-3 (Shan-iPunjab × Prabhat) showed maximum germination (81.66%) in M2 medium (MS medium + BAP 0.25 mg/l + IBA 0.05 mg/l) when rescued after 85 days of pollination. Embryos harvested at fully matured stage (85 days after pollination) took minimum days to germinate.

Association between epidemiology and haematophagous behaviour of *Haemonchus contortus* and *Ostertagia ostertagi* infecting sheep of Kashmir Valley, India

Irfan-ur-Rauf Tak, Jehangir Shafi Dar, B. A. Ganai and M. Z. Chishti

Keywords: Epidemiology, *Haemonchus contortus*, haematophagous behaviour, *Ostertagia ostertagi*, sheep.

Abstract

Haemonchus contortus and *Ostertagia ostertagi* are predominantly sheep parasites and majority of the pathological effects they cause are due to their bloodfeeding behaviour. This study was carried out to ascertain the prevalence of these two parasites in sheep of Kashmir Valley, India and to determine effect on haematological parameters of sheep. *H. contortus* was more prevalent than *O. ostertagi*; the infection was found to be higher in summer, lower age groups and males. As far as the effect on haematology is concerned, haemoglobin concentration, packed cell volume and red blood cell count showed significant decrease and white blood cell count showed significant increase in case of infected sheep.

Isolation of *Listeria monocytogenes* from peridomestic birds and captive wild animals

U. V. Jagtap, R. P. Kolhe, P. D. Deshpande, N. V. Kurkure, C. V. Dhandore, D. M. Muglikar, S. N. Jadhav, N. K. Nighot and S. B. Barbuddhe

Keywords: Antibiotic sensitivity, birds, *Listeria monocytogenes*, serotyping, wild animals

Abstract

Listeria monocytogenes is an important foodborne pathogen responsible for septicaemia, meningitis and abortions. There are several animal reservoirs; however, the role of wild animals and peridomestic birds remains underestimated. We have screened 270 faecal samples of wild animals in captivity (18 species) and peridomestic birds (12 species). *Listeria* species were isolated from seven (6.66%) mammals and two (1.21%) birds. *L. monocytogenes* was isolated from barking deer, porcupine, pigeon and crow. Isolated *L. monocytogenes* were virulent strains of 4b serogroup. There is a need to explore the role of such nonconventional sources in the spread of *L. monocytogenes* in nature.

Visions for India: public participation, debate and the S&T community

Pankaj Sekhsaria and Naveen Thayyil

Keywords: Technology visions, technology assessment, visioning exercise.

Abstract

This article is an exploration into the nature, width and scope of science and technology visioning exercises in India, particularly in the context of how these narratives are presented and discussed in Current Science, one of India's premier science journals. We categorize these visions into two broad categories – one is a vision that is more individual and/or domain-specific; the other is the institutionalized vision that has a larger mandate and canvas and that creates imaginaries of the future and/or provides horizons for society and S&T to move towards. Prominent examples of the latter are India's Technology Vision 2020 and the most recent, Technology Vision 2035. We observe that visioning exercises in the country have been and continue to be taken up quite prominently, but narratives and debates around them are present only marginally in Current Science. We discuss possible reasons for this and conclude with the hope that more attention will be paid to such exercises and documents on the accounts of investments that are made in them, on the implications these visions have and the importance of imaginaries of the future they create for society, country and for S&T.

Bio-business in brief: the case for ambitious action in the public sector†

K. VijayRaghavan and Gayatri Saberwal

Keywords: Basic research, biotech industry, liberalization, pharma industry, public sector.

Abstract

At the time of independence, India was a poor country. Nevertheless, the Government saw fit to invest in industry and research. In recent decades the public sector has received a bad press, with pressure to reduce it while increasing the role of the private sector. The public sector is not intrinsically bad, but has often been misused. The 'market' and the 'state' each have a role in economic development. To ensure steady growth of the economy, the country must ensure universal healthcare, for which it needs an innovative homegrown industry and universal good education. This requires large public investment.

Rational use of antimicrobials in animal production: a prerequisite to stem the tide of antimicrobial resistance Sidharath

Dev Thakur and A. K. Panda

Keywords: Antibiotics, food animals, growth promoters, surveillance, veterinary governance

Abstract

Antimicrobial resistance (AMR) is a worldwide 'One Health' problem. The spread of AMR has limited the treatment options against infectious diseases. Inappropriate use of antimicrobials, is a major contributor for the development of AMR and its spread. In animal husbandry, antimicrobials are used for treating infectious diseases and in sub-therapeutic concentrations for growth promotion and disease prophylaxis. The use of antimicrobials in sub-therapeutic concentrations exerts selective pressure on bacteria and results in the emergence of bacterial strains resistant to one or more antimicrobials. The food animals raised on sub-optimal doses of antibiotics become reservoirs of resistant bacterial strains, transmitted subsequently to man and the environment. Various human, animal and environmental health agencies have decided to jointly address this problem.

Establishment of integrated and harmonized AMR surveillance programmes, reduced use of antimicrobials in animal production, good governance of veterinary services, and development of new antimicrobials and their alternatives are some of the AMR management strategies in animals. Antibiotics are indispensable for human health; however, they should be totally banned in the food animals to preserve effectiveness of these drugs. In India, use of antimicrobials in food animals is limited for disease prophylaxis and growth promotion. However, absence of uniform regulations on the use of antimicrobials in animal production threatens the rationale use of these drugs in livestock.

Use of geospatial techniques in maritime archaeology with reference to the Tamil Nadu coast

Sundaresh, R. Mani Murali, A. S. Gaur and M. Dhivya Sri

Keywords: Archaeological sites, coastal habitation, geospatial analysis, satellite imageries, shoreline changes.

Abstract

CSIR-National Institute of Oceanography, Dona Paula, Goa 403 004, India Geospatial analysis of shoreline changes at a particular place includes topographic sheets, satellite imageries and field data. The remains of maritime activities along the Indian coast have been traced dating back to the 4th millennium BCE. Subsequently, due to shoreline changes, many past habitations have been submerged in the sea or located far in the hinterland. Archaeological sites play a major role in determining palaeo-shoreline. The present article discusses the use of geospatial techniques in determining ancient coastal habitations along the Tamil Nadu region of the Indian coast.

Ground survey to aerial survey: methods and best practices in systematic archaeological explorations and excavations

V. N. Prabhakar and Ravi Korisettar

Keywords: Field walking, geophysical techniques, geospatial archaeology, ground and aerial surveys.

Abstract

Geospatial archaeology is gradually gaining a place of priority in the field archaeology of a variety of archaeological sites during the last decade and a half in India. In accordance with the changing emphasis in the aims and methods of archaeological investigations within and outside the Indian subcontinent and with the availability of scientific and technical expertise in India, application of non-destructive and efficient field techniques has become inevitable. Collaborative research programmes between archaeologists (both Indian and foreign) and experts in geospatial techniques have demonstrated the vast scope of geospatial archaeology in India. Results of such investigations summarized in this article show the efficacy of geospatial archaeology and its potential for ushering a new era of field archaeology in India.

The science behind archaeological signatures from space

Ranganath Navalgund and M. B. Rajani

Keywords: Archaeology, image interpretation, remote sensing, signatures.

Abstract

Archaeology has traditionally focused on studying historic or prehistoric people and their cultures by analysis of their artefacts, inscriptions, monuments and other such material remains, especially those that have been documented from excavations. This focus is somewhat narrow, because it excludes many new methods that have emerged in the last few decades (described in detail by Prabhakar and Korisettar in this special section (page 1873)). One such novel method is to study large imprints on the landscape caused by human activity. These tell-tale features include soil

marks, crop marks, drainage patterns, field boundaries and a host of man-made structures, whose study can provide additional cultural insights. In some cases, these features are difficult to detect by the naked eye at ground level, but are detectable by remote sensing techniques from aerial/space-based platforms in a non-destructive manner. For these reasons, it is now well recognized that examining archaeological landscapes using remote sensing can complement traditional investigations. An analysis of remote sensing data can play an important role in (1) understanding spatial relationships between cultural materials and activities, (2) formulating archaeological sampling schemes, (3) measuring distances and spatial distributions of structures and monuments, and (4) evolving schemes for their conservation.

Potential of RISAT-1 SAR data in detecting palaeochannels in parts of the Thar Desert, India

Hrishikesh Kumar and A. S. Rajawat

Keywords: Desert, geoarchaeological exploration, palaeochannels, synthetic aperture radar data.

Abstract

In the present study, we have demonstrated the potential of RISAT-1 Synthetic Aperture Radar (SAR) data to detect palaeochannels in parts of Thar Desert, India, which may be utilized as one of the guides of geoarchaeological exploration, besides forming groundwater prospective zones. Palaeochannels have been detected using RISAT-1 SAR MRS datasets in the southern parts of Jaisalmer and northeastern parts of Barmer districts, Rajasthan. These palaeochannels of length varying between 14 and 36 km and width varying between 20 and 65 m are present within parabolic sand dune complexes. Palaeochannels have been detected as distinct dark tone on RISAT-1 SAR data compared to feeble expression on corresponding LANDSAT-OLI FCC datasets. This is due to sand-filled valleys, acting as radar smooth surface and absorbing the radar energy with negligible backscatter and enhanced topography due to side-looking capability of RISAT-1 SAR. High-resolution Cartosat DEM has been utilized to prepare topographical profiles, supporting the geomorphological interpretation. Merging of RISAT-1 SAR and LANDSAT ETM datasets using PCA techniques led to enhancements of palaeochannels on merged FCC data products. Like polarization of RISAT-1, SAR data could further enhance and aid in detecting palaeochannels. The entire region was flooded in August 2006 and water had flown through these palaeochannels, which subsequently dried up and facilitated their easy detection; they are otherwise difficult to interpret using pre-flood images. Analysis of sequential post-flood images has been taken up for detailed study of the area, as there is scope to detect additional hitherto unknown palaeochannels.

Unravelling the hidden truth from Vigukot in the Great Rann of Kachchh, western India by surface and sub-surface mapping Javed

N. Malik, Mahendrasinh S. Gadhavi, Sravanthi Satuluri, Saurav Kumar, Santiswarup Sahoo and Bhuvan Vikrama

Keywords: Ground Penetrating Radar survey, regression of settlements, surface and subsurface mapping.

Abstract

The Vigukot Fort is in ruins lying along the northern fringe of the Great Rann of Kachchh, Gujarat, India. This settlement is located on the left bank of the palaeochannel of the Nara river – a tributary of River Indus. We conducted Real Time Kinematics and Ground Penetrating Radar (GPR) surveys for surface and subsurface. The digital elevation model (DEM) reveals an average elevation ranging from 2 to 4 m from mean sea-level. Two elevated areas: EA1 (site 1) and EA2 (site 2) represent residential areas in the township. EA1 located on higher ground (3–4 m amsl) in the eastern portion comprised of a housing complex of larger dimensions. Two rooms with an area of 650 and 250 sq. ft

respectively, possibly indicative of living rooms attached with a courtyard suggest that highranked authorities occupied this portion of the township. EA2 with low-elevation (3 m amsl) marked by a smaller residential complex may be indicative of a trade complex along the western flank of the township. On the basis of 3D GPR survey we infer two levels of settlement at EA1 and one level of settlement at EA2. EA1 remained as a residential complex as reflected from both the levels, whereas EA2 was a trading complex close to the main gateway G1. Probably two scenarios prevailed: (1) Both areas flourished likewise at the first level and might have got disturbed by an earthquake; later EA1 may have been reoccupied while EA2 was left to be an open trading complex at the second level (recent). (2) During the first level of occupancy, EA1 was probably a residential complex (having enclosed walls), and EA2 might be the trading complex (with partially enclosed walls lying opposite to G1). Both the areas were affected during the disaster, and the second level of occupancy EA1 was rebuilt and occupied, whereas EA2 was used without renovation. Moreover, the 1819 earthquake probably destroyed both the areas completely and led to their abandonment.

A ‘reflexive’ multi-stage survey methodology for historical landscape research in central India: field-walking, local knowledge, and satellite imagery as archaeological site prospection and mapping tools in the Sanchi Survey Project

Julia Shaw

Keywords: Archaeological mapping, local knowledge, landscape archaeology, reflexive survey methods, satellite remote sensing.

Abstract

The present article evaluates the relative usefulness of systematic versus unsystematic field-walking, local knowledge frameworks and satellite imagery as archaeological prospection and mapping tools for the Sanchi Survey Project (SSP) in central India. While the satellite imagery proved helpful as a supplementary site prospection and mapping tool during later phases of the project, initial site identification was more effectively facilitated through ground-based explorations, and a ‘reflexive’ approach that included a sensitivity to local memory and the continued currency of archaeological sites in today’s socio-ritual landscape. Set within discussions of the role of local traditions in ‘reflexive’ field methodologies, as well as broader public archaeology discourse, the article stresses the importance of local perceptions of place and history in the development of a regionally specific research design.

National-scale inventory and management of heritage sites and monuments: advantages and challenges of using geospatial technology

Uday Raj, N. K. Sinha and Rakesh Tewari

Keywords: Cultural resources management, geospatial techniques, heritage sites and monuments, predictive locational modelling.

Abstract

India is a vibrant and culturally diverse country with more than 3600 heritage sites and monuments of national importance, of which only 36 are recognized as World Heritage Sites by UNESCO. These heritage sites and monuments are precious and non-renewable resources which need to be conserved, protected and monitored. Conventional along with emerging geospatial techniques are required to prepare databases and action plans to manage them effectively and efficiently. This article discusses ISRO’s efforts in the last decade in the field of archaeology using highresolution remote sensing data in conjunction with GIS, GPS and other geospatial techniques in various applications like inventory and site management plans for a monument/site, cultural resources management plans for World Heritage Sites as well as in exploration archaeology and research for

predictive location modelling in the identification of areas with high archaeological potential. Most of the projects have been executed in collaboration with major stakeholders involved in archaeology and in the process have institutionalized the use of geospatial technology to a large extent in operational and research activities.

Applications of geospatial technology in the management of cultural heritage sites – potentials and challenges for the Indian region

Krupa Rajangam and M. B. Rajani

Keywords: Cultural heritage management, geospatial technology, heritage practice, potentials and challenges.

Abstract

Cultural heritage management can be defined as all the processes in understanding (through knowing and identifying), conserving and managing various expressions of cultural heritage. These expressions could be intangible like traditional skills, crafts, folklore, rituals, etc. or tangible like objects or places. Objects including artefacts, murals and sculptures are defined as movable cultural property, while structures, monuments, precincts, water bodies and canals are called sites and also termed as immovable cultural property. Emerging technologies and scientific developments are increasingly being used in the management of these different expressions of cultural heritage. For example, heritage object databases that link source, provenance and current location are proving useful in museum contexts, predictive technologies are being used to fill in partially missing sections of murals/inscriptions or aid virtual reconstruction of object remains or even something as basic as mapping indigenous processional routes. However, the expression of cultural heritage as immovable cultural property or heritage sites appears to render itself most to analysis through various techniques available under the large umbrella of geospatial technology. This is because of the nature of such heritage – structures are necessarily built in particular geographical and cultural settings, presumably based on appropriate site selection in order to suitably locate them and their components, and the initially planned layout and subsequent additions would have a spatial spread – these factors combined with the locational permanence of the structures relative to movable property make built heritage well-disposed for geospatial analysis. This review article therefore explores the use and applicability of geospatial technology for the management of built cultural heritage, including its context and environment.

The need for a National Archaeological database

Ekta Gupta, Sonia Das, Kuili Suganya Chittirai Balan, Viraj Kumar and M. B. Rajani

Keywords: Archaeological database, economic development, geospatial solutions, protection of heritage sites

Abstract

India's economic development is evident in its industrial growth, extensive transportation network, and rapidly expanding cities, towns and villages. While this growth has numerous positive aspects, it also has the potential to cause irrevocable damage (directly or indirectly) to rich archaeological heritage of the country. The present study makes three contributions. First, it examines several archaeological sites where economic developmental activities have caused significant damage. Second, it demonstrates how the risk of further damage can be minimized using geospatial solutions to protect and manage such sites. Third, it conceptualizes a framework for incorporating spatial and non-spatial knowledge of archaeological sites into a National Archaeological Database. We propose that this national archive should be made publicly accessible under the Digital India programme, where it can assist decision makers (development authorities, state departments, etc.) and help citizens plan for future economic growth while preserving the fragile remnants of our past.

Investigation of dynamical heterogeneities in polymer melts

Rupam Borah, Nabi Ahamad and Pallavi Debnath

Keywords: Dynamics, heterogeneities, microscopic analysis, polymer melts.

Abstract

Department of Chemistry, Indian Institute of Technology Roorkee, Roorkee 247 667, India In this paper, dynamical heterogeneities are characterized both at the monomer and centre-of-mass level, in polymer melts well above their glass transition temperature, responsible for anomalous dynamics in these systems. Microscopic analysis of united atom molecular dynamics simulations of unentangled polyethylene melts suggests a molecular mechanism for the observed heterogeneous dynamics based on local density fluctuations about a tagged polymer. These local density fluctuations are related to variations in entropy in a small volume about a polymer in the melt, which result in initial connections of the dynamical heterogeneities to entropy.

Phytoecdysteroid profiling of *Silene vulgaris* by UPLC-ESI-MS

Jasmeen Sidana, Renuka Devi, Pawan Kumar, Bikram Singh and Om P. Sharma

Keywords: Chemical profiling, chromatographic analysis, phytoecdysteroids, *Silene vulgaris*.

Abstract

Silene vulgaris is a wild edible plant consumed in both raw as well as cooked forms in several parts of Europe. The phytoconstituents of *Silene* species include phytoecdysteroids, triterpenoidal saponins, terpenoids, flavonoids and phenolics. *Silene vulgaris* is a relatively unexplored species and the chemical profiling of this plant has not been attempted so far. Hence the UPLC-ESI-MS approach was applied to the extracts of flowers, leaves and roots of *S. vulgaris* for the profiling of phytoecdysteroids. The relative distribution of these compounds varied between flowers and leaves; however, the qualitative composition was similar. Only traces of phytoecdysteroids were present in the roots. The aglycones, sugars and other moieties were determined on the basis of ESI-MS. A total of eight previously known phytoecdysteroids were identified. Partial characterization of eight other phytoecdysteroids was also attempted.

Effects of root architecture characteristics on soil reinforcement in undisturbed soil

Yunpeng Li, Yunqi Wang, Yujie Wang and Shuangshuang Song

Keywords: Direct shear test, plant roots, soil shear strength, theory model.

Abstract

The effects of plant roots on the increase in soil shear strength involve a complex interaction of mechanical and hydrological processes operating over a scale of very diverse root architecture. Understanding the effects of mechanical mechanisms on soil shear strength is challenged by this inherent complexity. A high level of inaccuracy in field measurements of soil reinforcement makes field measurements much more challenging than that of indoor observations. This paper presents a simple experimental study where the shear strength of undisturbed soil is measured at different soil depths and at different distances from the main stems of 7 tree species, a bamboo, a herbaceous perennial, perennial grass and a fern by measuring their root area ratio, diameter class, and tensile strength. The result confirms that root distribution varies widely within root diameter classes and root area ratio between species and soil layers. Root architecture characteristics were the dominant factors influencing shear strength in the 0.2–0.4 m soil layer. In the process of vegetation restoration, *O. compositus* and *H. fulva* were used as colonizing vegetation. Later, *S. lucida* and *L. kwangtungensis* were recommended to stabilize the shallow soil in the Three Gorges reservoir region.

Can developmental interventions reduce households' vulnerability? Empirical evidence from rural India

Unmesh Patnaik, Prasun Kumar Das, Chandra Sekhar Bahinipati and Onkar Nath Tripathi

Keywords: Covariate, developmental interventions, idiosyncratic risk, rural setting, vulnerability.

Abstract

Vulnerability is a multidimensional concept incorporating notions of risk and poverty. While it has been established that higher incidence of poverty in developing countries exacerbates vulnerability, the role of risk requires closer inspection. Developmental interventions in these countries target poverty reduction, which in turn, could reduce vulnerability. However, a key question is whether developmental interventions reduce the vulnerability and risks faced by households. To answer this, the present study empirically examines the impact of developmental interventions on the vulnerability of households in a rural Indian setting. The major advantage hence is that it not only looks into the impact on aggregate vulnerability but also its different components such as poverty, covariate, idiosyncratic and unexplained risks. Empirical analysis is based on a survey of 800 households in the drought-prone villages of western Odisha, India, where a key developmental intervention, Western Orissa Rural Livelihood Project was implemented during the last decade. Adopting 'vulnerability as expected utility' approach, this study reveals three major findings. First, both aggregate risk and poverty are the dominant sources of vulnerability, with the former accounting for a sizable share. Second, the households that benefited from livelihood interventions are found less vulnerable. Third, the other major determinants of vulnerability are education, access to social network, family size and crop-diversification. From a policy perspective, results support continuation of these programmes, but realigning these also target risk reduction.

Insights into the great Mw 7.9 Nepal earthquake of 25 April 2015

Prosanta Kumar Khan, Md. Afroz Ansari and Dhananjay Singh

Keywords: 2015 Nepal earthquake, frictional sliding, gravity modelling, Indian upper crust.

Abstract

The 2015 Mw 7.9 earthquake occurred in the Nepal Himalaya between the Indian and Asian plates. The gravity modelling has been carried out along a 2D trench-orthogonal profile passing through the epicentre of this earthquake. The projections of mainshocks and aftershocks show their major confinement around the bending segment of the Indian upper crust (IUC). The operative shallowly plunging maximum compressive stress led to the accumulation of strain energy around the bending zone of the IUC, and triggered thrust-dominated southward movement of the Indian crustal block along a shallowly, dipping shear plane in the anisotropic layer. This can be broadly explained by three-stage rupture processes: the first one was associated with slow nucleation and rupture growth for early ~15 sec, the second one migrated upward, rupturing the uppermost part of the IUC for the next ~10 sec, and the third one propagated very fast during deformation for the remaining ~25 sec till the fracture-tip reached the overlying brittle Asian crust.

Coping with hailstorm in vulnerable Deccan Plateau region of India: technological interventions for crop recovery

S. K. Bal, P. S. Minhas, Yogeshwar Singh, Mahesh Kumar, D. P. Patel, J. Rane, P. Suresh Kumar, P. Ratnakumar, B. U. Choudhury and N. P. Singh

Keywords: Bio-regulators, canopy management, crop recovery, hail-damaged crops, nutritional supplements.

Abstract

Vulnerability of agriculture to climate change is becoming increasingly apparent in recent years. During 2014 and 2015, India experienced trails of unusually widespread and untimely hailstorm events. The increased frequency of hailstorm events, especially in vulnerable ecosystem of Deccan

Plateau region of India demanded appropriate measures to minimize adverse impact on agricultural crops. Therefore some of the post-hail measures including nutritional supplement, plant bio-regulators and canopy management were evaluated in field trials conducted at Maharashtra, India during 2014 and 2015. Amongst these, pruning of the hardy and indeterminate eggplant crop induced effective branches, which produced more flowers and fruits. Nitrogen supplemented with urea drenching and stress alleviating effects of salicylic acid promoted recovery in maize while drenching with humic acid along with spraying of potassium nitrate improved productivity of onion. These studies indicate the potential of technological interventions to cope with extreme events such as hailstorms.

IHHNV infection from the wild shrimps of Andaman and Nicobar Islands, India

K. Saravanan, P. Puneeth Kumar, Arunjyoti Baruah, J. Praveenraj, T. Sathish Kumar, S. Pramod Kumar, T. Sivaramakrishnan, A. Anuraj, J. Raymond Jani Angel, R. Kiruba Sankar and S. Dam Roy

Keywords: Andaman and Nicobar Islands, disease surveillance, IHHNV, *Penaeus monodon*, wild shrimp.

Abstract

The present study was intended to screen the wild shrimps of Andaman and Nicobar Islands (ANI) against infectious diseases. A total of 175 shrimp samples (35 pools) consisting of *Fenneropenaeus indicus*, *Penaeus monodon*, *Penaeus merguensis* and *Metapenaeus monoceros* were collected from different landing centres across ANI. Out of 35 pools of samples analysed by polymerase chain reaction (PCR), a total of 10 pools of *Penaeus monodon* collected from Betapur (1 pool), Lohabarrack (4 pools) and Campbell Bay (5 pools) were found positive for Infectious Hypodermal and Hematopoietic Necrosis Virus (IHHNV). Nucleotide sequence of IHHNV isolated from ANI showed 100% identity to the sequences of IHHNV reported from Vietnam, Taiwan, Australia, China, Egypt, USA, Ecuador, 99% identity to IHHNV reported from Brazil, Venezuela, Korea, 96% identity to IHHNV reported from Thailand and 95% identity to IHHNV reported from India. Based on phylogenetic tree analysis, IHHNV of ANI is closely related to IHHNV of Vietnam. Histopathological analysis revealed typical eosinophilic intranuclear Cowdry type A inclusion bodies in gill lamellae which further confirmed the IHHNV infection. The present study provides a definitive evidence for the first report of infectious IHHNV in wild *P. monodon* from ANI.

How NaCl, Na₂SO₄, MgCl₂ and CaCl₂ salts affect the germinability of *Pinus halepensis* Mill.

Bouزيد Nedjimi

Keywords: Aleppo pine, rate of germination, reforestation, saline soils.

Abstract

In the Mediterranean forests, *Pinus halepensis* Mill. (Aleppo pine) plays an important role against desertification, reforestation of degraded lands and soil rehabilitation. Therefore, knowledge of its seed germinability requirements is necessary for its propagation in field conditions to colonize new territories habitually not conventional for other species. The study was carried out to assess the effects of different soluble salts (NaCl, Na₂SO₄, MgCl₂ and CaCl₂) on seed germination characteristics [germination percentage (GP) and rate of germination (RG)] of this conifer. Data show that all soluble salts decreased both parameters GP and RG. The highest GP was obtained in conditions without salinity. The maximum values of germination were obtained by low concentrations of MgCl₂. Comparatively, NaCl was generally the most toxic salt followed by CaCl₂ and Na₂SO₄. The present findings could be useful in the design of future projects for reforestation of degraded arid lands.

Detection of dust around Mars and its implications

J. P. Pabari

Keywords: Dust devils, Mars, natural satellites, torus

Abstract

Recent observations of MAVEN find dust to be present at altitudes from ~150 to 1000 km from the Mars surface. It is expected that it could be interplanetary in nature, based on assumption of particle velocity. Existence of dust at orbital altitudes on Mars could be mainly due to two plausible sources, viz. interplanetary dust and Phobos/Deimos-originated dust. Dust devils prevailing near the surface can lift the dust to a few tens of kilometres and at present, no physical process can explain dust transport to high altitudes (>50 km) from the dust devils. Another possible source of dust around Mars could be interstellar in nature; however, its possibility is rare. Dust originating from Phobos/Deimos could be either due to secondary ejecta created by continuous bombardment of micrometeorites or due to grain levitation. Though dust levitation on the Moon is yet to be confirmed by in-situ measurements, it is expected that it should occur on the airless bodies. The velocity of secondary ejecta and that of levitated dust can exceed the escape velocity of Phobos/Deimos and cause the dust to escape into outer space. Such escaping particles can form dust ring/torus around Phobos/Deimos and therefore also around Mars. The dust ring/torus is yet to be studied and fully understood. Observations of dust, whether originating from Phobos/Demos or interplanetary dust particles, are necessary for finding its origin, abundance and distribution around Mars. This article discusses the existence of high-altitude (>100 km) dust around Mars, and techniques for the detection of these dust particles using an impact ionization detector in a future Mars orbiter mission.

Classifying medicinal plant collectors: their approach and attitude

Sanjay Kr. Uniyal

Keywords: Conservation, extraction, Himalaya, medicinal plants, plant collectors.

Abstract

Medicinal plant collection from the Himalayas is a key conservation issue that involves extraction of plants from the wild by collectors. While the word collectors is generalized, not all collectors are the same. In this paper, three types of collectors namely, professional, opportunist, and user have been identified. They have been compared with respect to how they perceive medicinal plants and what their approach is. Of the three categories, only the users consume the plants at source, while the other two are involved in trade. This is clearly reflected in the difference in their value chain. It has also been realized that while professionals and opportunists are buyer-driven, the user is producer-driven. Subtle differences between the three with respect to twelve parameters have been presented in the paper. Thus, a conservation and management policy that not only focuses on plants but also, diversity of people, is the need of the hour.

Predicting learning styles based on students' learning behaviour using correlation analysis

Li Ling Xiao and Siti Soraya Binti Abdul Rahman

Keywords: Automatic learning style assessment, learning behaviour pattern, student modelling.

Abstract

Past research has proposed various approaches to automatically detect students' learning styles to address problems associated with traditional research methods (i.e. questionnaire). However, results obtained through traditional research methods have issues in terms of accuracy and precision which need to be addressed. In general, the existing automatic detection approaches are only able to provide satisfactory results for specific learning style models and/or dimensions, or even only work

for certain learning management systems. The aim of this study is to propose an automatic detection of learning styles from the analysis of students' learning behaviour by constructing a mathematical model. This study specifically explores the relationship between students' learning behaviour and their learning styles. To investigate this relationship, a pilot experiment was conducted with 33 students. The students used Moodle platform, a learning management system, as supplementary online learning material for Java programming. The students' learning behaviour was tracked and recorded. Thirty students' data (i.e. their learning behaviour and learning styles; measured using the Index of Learning Styles (ILS) instrument) were analysed using the proposed correlation analysis to identify the relationship. The remaining three students' learning behaviour data were used to predict their learning styles. The findings are discussed with regard to accuracy of automatic detection of learning styles using the ILS instrument.

Study on sensitivity analysis method of slope stability based on Sweden arc method

Jing Yu Zhang, Liang Peng Wan and Guo Yong Duan

Keywords: Non-dimensional, partial derivative, sensitivity ratio, sensitivity analysis.

Abstract

In this study, an attempt has been made to analyse the impact of different parameters (such as bulk density, cohesive force, internal angle of friction, angle of slip surface and pore water pressure) on the safety factor of a given slope. The analysis was done using the Swedish Arc method. Meanwhile, the sensitivity ratios between different parameters were determined by taking the partial derivatives of non-dimensional parameters. A typical case study with a uniform slope was considered to verify the efficiency of the provided method. The results showed that the change in failure path had a significant impact on the sensitivity ratio of parameters. In the meantime, unstable slopes will have higher value of sensitivity ratio in the shear strength parameters ($\tan \phi$ and c). The sensitivity analysis method introduced in this article eliminated the crude assumptions made on the conventional approach. The advantage of this analytical method is that both the safety factor and the sensitivity ratio can be computed simultaneously, for slopes with any given slip surface. It is believed that the results will have an indispensable role in understanding and capturing the nature of geotechnical problems.

Formulation for critical shear stress of cohesive sediment mixture Umesh

K. Singh, Z. Ahmad and Ashish Kumar

Keywords. Clay content, cohesive sediment mixture, critical shear stress, incipient motion, sediment transport.

Abstract

This article describes results of an experimental study on incipient motion of gravel particles present in the cohesive mixtures, i.e. clay-silt-gravel and clay-silt-sand-gravel, in which the percentage of clay varied from 10% to 50% on weight basis. Incipient motion condition is visually and quantitatively identified which responds to sheet and line erosion type appearance on the top surface of the channel bed for clay up to 30% and mass erosion pattern for 40% and 50% of clay. The clay percentage, weighted geometric standard deviation and bulk density of the cohesive sediment mixture are found to be the main parameters that affect the incipient motion of gravel particles. A functional relationship is proposed to determine critical shear stress of gravel particles present in cohesive sediment mixtures. The regression analyses as well as goodness of fit test were conducted for the proposed relationships which were found to be in good agreement with the present data.

Removal of colour and chemical oxygen demand from textile effluent by Fenton oxidation method

K. Ramesh, M. Balakrishnan, B. Vigneshkumar, A. Manju, S. Dhanakumar, M. Palanivel and K. Kalaiselvi

Keywords: Chemical oxygen demand, colour, Fenton, textile effluent, ZLD.

Abstract

The main objective of this study is to focus on the removal of colour and chemical oxygen demand (COD) from the secondary treated effluent (SE) and reverse osmosis (RO) concentrate, using Fenton oxidation as an advanced oxidation process. In order to identify the feasibility and economics, the experiments were conducted in these two streams of the textilebased effluent treatment plant. In this study, COD and colour removal efficiencies were observed as 75% and 94% in the SE and 85% and 99% in the RO concentrate respectively. After comparing the operating cost between these two streams, treating of SE with Fenton oxidation was found to be an economical, sustainable option for removing the colour and COD from the SE. This option will improve the performance of membrane filtration systems in effluent treatment plants that are based on zero liquid discharge.

Breeding phenology of *Psammophilus dorsalis*: patterns in time, space and morphology

Shreekant Deodhar and Kavita Isvaran

Keywords: Agamids, breeding phenology, India, lizards, reptiles, tropical.

Abstract

Since reproduction is costly, animals are expected to invest in reproduction when abiotic and biotic conditions are optimal. Although tropical ecosystems are not as starkly seasonal as temperate ecosystems, some tropical ecosystems may experience high seasonality in conditions that affect reproduction. Systematic studies of breeding phenology from tropical ecosystems are scarce. We describe the breeding phenology of *Psammophilus dorsalis*, a sexually dimorphic, diurnal, rupicolous lizard found in the tropical scrub forests of peninsular India. Regular census was conducted covering multiple habitat patches for three years, recording age and breeding status of lizards. Lizards were systematically caught, tagged, measured and released. We report clear breeding seasonality, with most males showing breeding colouration from May to September and juveniles emerging from September until April. Timing of breeding coincides with the annual peak in daily maximum temperatures, while juvenile emergence might be affected by the timing of the annual precipitation peak. We report that this is a predominantly annual species with a female-biased sex ratio and strong male-biased dimorphism in multiple morphological traits. In the face of climate change, detailed studies of breeding phenology of tropical animals are important, particularly for ectotherms, since these taxa are easily affected by changes in temperature and precipitation patterns.

Purification and characterization of chondroitinase ABC from *Proteus vulgaris*, an Iraqi clinically isolate Murtadha

Nabeel Abdul-Gani and Bahaa Abdullah Laftaah

Keywords: Chondroitinase ABC, chondroitinase extraction, *Proteus vulgaris*, purification of chondroitinase

Abstract

Forty-eight isolates were found belonging to *Proteus* sp. with isolation percentage of 38 out of 125 urine samples which were collected from urinary tract infected patients. *Proteus vulgaris* and *Proteus mirabilis* represent 18.7% (9 isolates), and 81.25% (39 isolates) respectively. The

production of chondroitinase enzyme was studied in a medium which contained chondroitin sulphate as substrate. One hundred per cent of *P. vulgaris* showed the ability to produce chondroitinase. P.v 8 isolate produced the highest enzymatic activity which reached about 150 units/ml. Chondroitinase was extracted and purified by precipitation with 60% saturation of ammonium sulphate, dialysis, and followed by column chromatography on Sephadex 6B. The specific activity increased to 5000 (units/mg), with 35.2% yield and 17.4 fold purification. Optimum pH for activity and stability was 8.0; the optimal temperature for activity was 37°C, but the stability of chondroitinase was maintained 100% at 20–40°C for 30 min. Chondroitinase activity increased to 120% and 113% when the enzyme was incubated with Mg²⁺ and Ca²⁺ respectively, while NH₄Cl and KCl reduced the activity to 95% and 86% respectively. The human cartilage was degradable by the purified enzyme after incubation for 14 days at 37°C. Direct injection of chondroitinase at 0.1 mg/ml in knee cartilage of mice, showed changes in tissues. It may be concluded that chondroitinase enzyme may work as a virulence factor by catalysing the hydrolysis of chondroitin sulphate of cartilage and increasing the tissue permeability to invade the cartilage tissue by *P. vulgaris* which causes destruction of cartilage and inflammation in humans.

A new species of *Kirkegaardia* (Annelida: Polychaeta, Cirratulidae) from the southeast coast of India

P. Atchuthan and Dattesh V. Desai

Keywords: *Kirkegaardia serracroochaeta*, port, sediment, serrated capillary setae.

Abstract

A new polychaete species, *Kirkegaardia serracroochaeta* sp. nov. belonging to family Cirratulidae collected from the Chennai port, southeast coast of India is described here. This species possesses distinctly serrated capillary setae. The unique morphological characters of this species are presence of four serrated chaetae, which are referred as special chaetae 1–4. They possess important species-level characteristics such as serrated capillaries, less-spaced teeth and barbs downwards; in addition chaeta 2 is crooked in the middle. This species is named after the special characteristics it possesses when compared to the already existing species of genus *Kirkegaardia*.

Assessment of heavy metal toxicity in four species of freshwater ciliates (Spirotrichea: Ciliophora) from Delhi, India

Jeeva Susan Abraham, S. Sripoorna, Ashish Choudhary, Ravi Toteja, Renu Gupta, Seema Makhija and Alan Warren

Keywords: Ciliates, freshwater, heavy metals, toxicity

Abstract

In vitro laboratory experiments were conducted to determine the toxicity (per cent survival and LC₅₀) of essential and non-essential heavy metals (cadmium, copper, nickel, lead and zinc) in four spirotrich ciliates: *Euplotes* sp., *Notohymena* sp., *Pseudourostyla* sp. and *Tetmemena* sp. isolated from three different freshwater ecosystems in the Delhi region, India. The toxicity of the heavy metals was found to vary among the different ciliates. Copper was most toxic (24 hLC₅₀ value ranged between 0.125 and 0.74 mg/l) and zinc was least toxic (24 h LC₅₀ value ranged between 46.98 and 144.32 mg/l) to each of the ciliates. Of the four ciliates, *Notohymena* sp. had the highest tolerance limit to three heavy metals (Cu, Cd and Pb) out of the five tested. This study shows the high potentiality of using freshwater ciliates for monitoring the intensity and potency of ecological damage caused by heavy metals in aquatic ecosystems.

Observed variability of surface layer in the Central Bay of Bengal: results of measurements using glider

Shijo Zacharia, R. Seshasayanan, Tata Sudhakar, M. A. Atmanand and R. R. Rao

Keywords: Bay of Bengal, density, eddy, glider, salinity, SLD, MLD, ocean observation, temperature.

Abstract

Underwater gliders measure high-resolution spatiotemporal oceanographic data. In April 2014, the National Institute of Ocean Technology, Chennai operated an underwater glider 'Barathi', for 127 days for observation of Bay of Bengal (BoB). In this article we present the effectiveness of the glider Barathi for high resolution temporal sampling of the surface layer in the central BoB for studying variation of temperature, salinity and density structures and acoustic characteristics on 26–27 May 2014. The results showed 'afternoon effect' on acoustic characteristics and formation of secondary sound channel. Our data set is strongly correlated (coefficient of determination $r^2 > 0.96$) with data from a nearby Array for real-time geostrophic Oceanography (Argo) float.

The importance of metaphorical thinking in the teaching of mathematics

Heris Hendriana and Euis Eti Rohaeti

Keywords: Mathematical concepts, metaphors, thinking, teaching

Abstract

This communication assesses the relevance of metaphorical thinking in helping to develop students' comprehension of mathematical concepts. It is of utmost importance to examine the role of metaphors in the understanding of mathematical concepts as well as how different types of metaphors can provoke interpretations of mathematical problems for students before looking at the relevance of metaphorical thinking in the teaching of mathematics. This acts as a basis for grasping the importance of metaphorical thinking in fostering the transition of mathematical perceptions to theory and its applicability to day-to-day life.

Mega private universities in India: prospects and promise for world-class performance

Gangan Prathap and P. Sriram

Keywords: Bibliometrics, comparative research evaluation, mega universities, National Institutional Ranking Framework.

Abstract

Several higher educational institutions are now emerging in the private sector, which are much larger than the traditional high performing Government funded institutions like the Indian Institute of Science (IISc) and the IITs. We identify seven such mega institutions and use the bibliometric and financial data from NIRF 2017 to see how they compare with IISc when both research excellence and socio-economic performance are taken into account. Apart from other legacy and perception factors that attract the best faculty to premier institutions, the capital expenditure per faculty per year must be increased by 5 to 50 times as the case may be, before these universities can become attractive destinations for the best and brightest of aspiring faculty.

Aberration in NF κ B–I κ B binding may cause two states of NF κ B activity

Raghvendra Singh

Keywords: Basal activity, cancer, cell survival, constitutive activation, protein complex

Abstract

NF κ B activation is involved in cell survival and aberration of NF κ B signalling is found in cancer. I κ B is an inhibitor that sequesters NF κ B in the cytoplasm. By mathematical modelling, we predict

that under an aberrant condition in which I κ B does not bind to NF κ B, there exist two states of NF κ B activity: a constitutive activity state for any positive value of the stimulus and a zero activity state for no stimulus. Further, under the assumption that NIK can be activated by TAB1– pTAK1, we predict that TAB1 has a role in the basal activity of NF κ B. Thus, we predict the importance of TAB1 and I κ B in NF κ B activation. Our prediction may have implication for cell survival and cancer.

Experimental analysis of the ratio of similar materials by similarity model test on raw coal

Fan Zhang, Geng Ma, Xiao Liu, Yunqi Tao, Rui Li and Dan Feng

Keywords: Experimental investigation, hydraulic fracturing, raw coal, similar materials, mechanical parameters.

Abstract

Similarity model test is an effective approach to study the mechanism of hydraulic fracture propagation in coalbed methane reservoirs as well as theoretical analysis and numerical simulation. The efficiency of the similarity model test result is closely related to the selection and ratio of similar materials. Similar material ratio test was conducted to simulate the mechanical parameters of raw coal using orthogonal method and an appropriate similarity model for hydraulic fracturing experiment was developed in this study. Results show that it is suitable to select cement, gypsum as binder and apply pulverized coal as aggregate through the analysis of experimental data. The mechanical parameters of similar materials, including uniaxial compressive strength, elastic modulus, Poisson ratio and firmness coefficient are tested using laboratory tests. The impact of diverse ratios of similar materials on the mechanical parameters is analysed. A proper ratio is selected to make the mechanical parameters of raw coal close to the ones of similar material, in order to meet the demand of the similarity model test based on raw coal. The results can provide theoretical basis and technical support for the selection of similar materials to carry out hydraulic fracturing experiments.

Space-borne sun-induced fluorescence: an advanced probe to monitor seasonality of dry and moist tropical forest sites

Sanjiv K. Sinha, Hitendra Padalia and A. Senthil Kumar

Keywords: Fluorescence, remote sensing, seasonal variations, tropical forests, vegetation index.

Abstract

Space-borne sun-induced fluorescence (SIF) is the latest breakthrough in remote sensing of physiological response of plants. We studied the seasonality of sal (*Shorea robusta*) forest canopies analysing spaceborne SIF and reflectance data collected over moist and dry sites in central India. Results indicate that the monthly response of OCO-2 SIF, MODIS NDVI and GPP differs significantly across the wet and dry forest sites. SIF explained higher seasonal variations and was also better correlated to rainfall across sites compared to NDVI.

Sustainable livelihood options for women in the coastal ecosystem: a participatory assessment

J. Charles Jeeva

Abstract

The present study aimed at identifying the need-based and sustainable livelihood options suitable for members of the coastal women self-help groups (SHGs). The study was conducted on a sample of 240 women representing 24 SHGs in Kerala, India. Out of the 30 potential and sustainable livelihood options assessed through participatory tools, aqua tourism (index: 83.33) was found to be the most potential option for women in the coastal ecosystem, especially as a group activity for the

women SHGs. Fish drying units (80.42), preparation of value-added fish products (77.08), catering units (77.08), fish/prawn feed manufacture (69.17), fish/prawn seed collection (64.17) and collection of bivalves such as oyster, clam, etc. (61.67) were also found to have high potential as sustainable livelihood options. Lack of access to institutional finance was reported as a major constraint, which traps women microentrepreneurs in the clutches of private moneylenders. Policy development to support women in the coastal ecosystem requires appropriate institutional arrangements and effective organizations and structures, which extend assistance in the areas of training, credit, technology and marketing through SHGs.

Ecological flow requirement for fishes of Godavari river: flow estimation using the PHABSIM method

J. A. Johnson, K. Sivakumar and Jordan Rosenfeld

Keywords: Environmental flow, habitat suitability curves, instream flow incremental methodology, river fishes.

Abstract

Fish habitat requirements are an essential aspect of the estimation of environmental flows. In India, a few studies have proposed environmental flows for the major rivers on the basis of qualitative observation or expert opinion. As part of a study regarding the effect of altered flow across the Godavari river on fishes, we estimated flow requirement of the fishes using a physical habitat simulation model (PHABSIM). This model uses habitat requirement of selected fish species in the form of habitat suitability curves (HSCs) against river habitat availability. We developed HSCs for five economically important fishes (*Bangana dero*, *Cirrhinus cirrhosus*, *Labeo calbasu*, *Labeo fimbriatus* and *Wallago attu*). These HSCs indicate that *B. dero* prefers high velocities (0.9–1.2 m/s) compared with the other species and that *L. fimbriatus* prefers deeper areas (1.2–1.5 m). *C. cirrhosus* uses low flows with moderate depth (0.3–0.6 m/s; 0.6–1.5 m). The HSCs were used in PHABSIM along with instream habitat data recorded from four cross-sections to predict the weighted usable areas (WUAs) of the fishes. The relationship between habitat area and discharge was used to predict the minimum acceptable flow for maintaining fish habitats. On the basis of the WUA–discharge relationship curve, 26% of the mean flow was recommended as the minimum ecological flow required below the Polavaram dam of Godavari river.

Prevalence and co-occurrence of gastrointestinal parasites in Nilgiri Langur (*Trachypithecus johnii*) of fragmented landscape in Anamalai Hills, Western Ghats, India

Sunil Tiwari, D. Mahender Reddy, Muthulingam Pradheeps, Gubbi Shamanna Sreenivasamurthy and Govindhaswamy Umapathy

Keywords: Coccidia, forest fragmentation, gut parasites, Nilgiri langur, positive/negative association, strongyloides, Trichuris.

Abstract

Habitat fragmentation is known to alter species composition, influence infection risk and disease emergence in the native species of fragmented landscapes. This study aimed at understanding the prevalence of gastrointestinal parasite in Nilgiri langur, an endemic primate species of the Western Ghats, India. We collected 283 faecal samples from 8 rainforest fragments of Anamalai Hills, Western Ghats and examined gastrointestinal parasites using faecal flotation and sedimentation techniques. A total of 13 gastrointestinal parasite taxa were recovered, which are known to infect humans and livestock. Parasite species richness was higher in disturbed forest fragments than undisturbed ones. We found *Trichuris trichiura* to be the most prevalent parasite taxa followed by *Strongyloides* sp. A negative association between *Schistosoma* sp. and *Trichuris trichiura* was also

observed. Fragment size, proximity to human settlements and other habitat variables such as tree density, canopy cover and tree height did not show any significant relationship with parasitism in Nilgiri langur, which might be attributed to their ability to survive in a disturbed landscape.

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Revisiting the Kothari Commission (1964–66) Report from the perspective of strengthening our science education and research enterprise

Dipankar Mukhopadhyay

Keywords: Higher education, nation-building, research enterprise, science, technology and innovation enterprise.

Abstract

Last year (2016) was the fiftieth year since the submission of the Report of the Education Commission (1964–66), popularly known as the Kothari Commission Report. This report, in four volumes, was the most comprehensive among other such reports and laid the foundation for the national education pattern. In the sphere of higher education and scientific research, the report strongly urged the necessity of rooting our science on indigenous ethos and priorities, maintaining highest autonomy in academic matters in our institutions of higher education, making our universities the arena of high-quality teaching and research, maintaining high efficiency in the utilization of scarce resources including that of our scientific manpower, selectively encouraging certain centres of excellence so as to bring them at par with international institutions of repute and, above all, nurturing a value system in our scientific temperament, so that we draw nourishment from our rich cultural and spiritual heritage. In this article, we dwell upon these aspects of the report, some of which are rather unconventional. A review like this is still relevant, particularly in the context of making our science, technology and innovation system more productive and socially relevant.

Science communication as an academic discipline: an Indian perspective

Abhay S. D. Rajput

Keywords: Academic discipline, science communication, science–society interactions, training and capacitybuilding.

Abstract

Scientific ignorance can be a potential obstacle in the journey of India becoming a developed nation and a knowledge economy. Such ignorance can also be the cause of various myths, superstitions and blind faiths which can further hinder the development agenda of any nation. Science communication can potentially dissipate scientific ignorance in the society. Science communication is a rapidly growing area of expertise both academically and professionally around the globe. It is getting established as an academic discipline with several universities/institutions around the world starting academic and research programmes. Science communication is an effort to better understand how science and society interact, and to popularize and commonize scientific knowledge, scientific temper, scientific method of enquiry and scientific culture among the masses. However, the trends in India are not encouraging. This article discusses the emergence of science communication as an academic discipline, its global and Indian trends, and the need of science communication initiatives, training and capacity-building in India.

Combinatorial optimization in science and engineering

Julius Beneoluchi Odili

Keywords: Combinatorial optimization models, discrete optimization, mathematical models, science and engineering applications.

Abstract

This article is a review of combinatorial optimization in science and engineering applications. Combinatorial optimization has found wide applicability in most of our day-to-day affairs, ranging from industrial, academic, logistic to manufacturing applications, etc. This study introduces the concepts of optimization identifying the different types of optimization in the literature, before focusing on discrete optimization methods. Moreover, much emphasis is placed on the application areas, examples and the development of mathematical models in combinatorial optimization. The study concludes by highlighting the merits and demerits of combinatorial optimization models and recommends further studies on the development of more efficient and user-friendly combinatorial optimization methods.

Mobile phone radiation induces sedation in *Periplaneta americana*

P. R. Syalima, Rameesa Raseek and D. A. Evans

Keywords: Electromagnetic radiation, mobile phone, *Periplaneta americana*, sedation.

Abstract

Exposure of adult male *Periplaneta americana* to electromagnetic radiation (EMR) emitted by mobile phones has resulted in sharp changes in the various enzymes systems of fat body and haematological profile. Sharp decline in the protein content of fat body together with increase of total free amino acids was observed. While the activity of glutamate oxaloacetate transaminase showed a significant decrease, that of glutamate pyruvate transaminase showed a sharp increase. The content of glucose and uric acid of fat body showed a sharp increase as well. A proteolytic enzyme, leucine amino peptidase showed significant decrease at the third hour of treatment, but a sharp increase at the sixth hour. Another proteolytic enzyme, cathepsin-D showed significant increase in activity both at third and sixth hour. Content of acetylcholine in the central nervous system showed a sharp increase, and organisms were found to be inert and lethargic after the third hour of EMR treatment. Total haemocyte count showed a sharp decline at the third hour, but a sharp increase at the sixth hour, together with imbalance and fluctuations on differential count. Cytopathological changes evidenced by lack of membrane integrity on plasma membrane and nuclear membrane, particularly on granulocyte were also observed. The present study revealed that continuous exposure to EMR of cell phones can result in widespread effects on the brain, neurons, developing cells and enzyme systems.

Ion imprinted polymer monoliths as adsorbent materials for the removal of Hg(II) from real-time aqueous samples

Siti Khadijah Ab. Rahman, Nor Azah Yusof, Faruq Mohammad, Abdul Halim Abdullah and Azni Idris

Keywords: Adsorbent material, ion imprinted polymer monoliths, mercury ions selectivity, wastewater treatment.

Abstract

Ion imprinted polymer monoliths (IIMs) for the adsorption of Hg(II) ions in tablet form were prepared by forming a mercury ion (template ion) complex with 2-(methacryloyloxy)ethyl trimethylammonium cysteine (ligand) and thermally copolymerized with a monomer (methacrylic acid), cross-linker (ethylene glycol dimethacrylate), initiator (benzoyl peroxide) and porogen

(acetonitrile) in the polyethylene tube (drinking straw) as a mould. The formed composite was thoroughly characterized by means of FTIR, TGA, FESEM and BET, and further tested by applying the changes in solution pH, concentration, contact time, recycle test and selectivity. The analysis revealed that the activity of the materials was maximum at pH 4.7 and adsorption capacity of Hg(II) by IIMs followed the Langmuir isotherm model. The adsorption equilibrium was achieved after 120 min and followed the second-order reversible kinetics. In addition, we found that the IIMs were reusable up to 15 cycles and exhibited good selectivity towards the Hg(II) ions even in the presence of other interference ions such as Pb(II), Cd(II), As(II) and Cr(III). On further testing for the recovery of Hg(II) ions in real-time aqueous samples (contaminated petrochemical and mining industries), the IIM tablets showed higher selectivity and excellent reusability. In summary, we indicate that the IIMs are easy to prepare, possess high levels of permeability, porosity and selectivity, and offer excellent reusability, thereby making them one of the promising candidates for the successful removal of mercury ions from industrial samples.

Genome-wide analysis of a potent functional dairy starter bacterium *Streptococcus thermophilus* MTCC 5460: a comprehensive study of its dairy Niche adaptive features

Jashbhai

B. Prajapati, Hemaxi P. Zala, Neelam M. Nathani, Manisha Sajani and Chaitanya G. Joshi

Keywords: Dairy starter, genome, MTCC 5460, probiotics.

Abstract

Genomic analysis of *Streptococcus thermophilus* strain MTCC 5460, an isolate from market dahi (curd), revealed particular gene features that contributed towards its adaptation to a dairy-specific niche. The genome comprising 1.6 Mb, encoding 1809 genes, revealed the presence of genes involved in lactose/ galactose utilization; well-developed proteolytic system including cell envelope proteinases and several transporters; and bacteriocin synthesis and competence proteins involved in defence mechanism, which help prevent food spoilage. The genome comprised genes for stress resistance property of the strain, contributing to its gut endurance and gene encoding formation of aroma compounds. Unlike pathogenic streptococci, genes for virulence property were absent in the genome. Overall, the study revealed features within the genome that enabled the organism to survive in a gastric environment and assisted in its interaction with the host microbiota and mucosa, thus, validating the strain as a potent functional dairy starter and a promising candidate for potential probiotic applications.

Field testing of indigenously synthesized sex pheromone for the management of *Phyllocnistis citrella* Stainton under central Indian conditions

C. N. Rao, Anjitha George, A. R. Prasad, Hafeez Ur Rehman, Rathod Aravind Kumar, A. Suman Kumar, Sonali Ghike and V. N. Dhengre

Abstract

The objective of this study was to determine the optimum height and dose of the indigenously synthesized sex pheromone of citrus leaf miner, *Phyllocnistis citrella* Stainton for the management of citrus groves under central Indian conditions. The influence of pheromone dose (5 and 8 mg) and trap height (canopy and mid-canopy height) on the capture of *P. citrella* males was evaluated. The dose of 5 mg of synthetic sex pheromone placed at mid-canopy (1.55 m) height attracted the highest number of *P. citrella* males (667.15 ± 9.84 adults/trap/week) in year-old *Citrus aurantifolia* (Christm) Swingle (acid lime) groves of ICAR-CCRI, Nagpur experimental farm. Further evaluation of the pheromone baited traps @ 10, 15 and 20 mg/lure in year-old orchards of acid lime recorded significant maximum trap catch in orchards with 20 mg lure (4 traps/0.3 ha) with mean trap catch/

month from 4, 3 and 2 traps/0.3 ha of 1659.76 ± 36.67 , 950.19 ± 17.91 and 668.44 ± 8.78 adults in 2014–15 and 1400.17 ± 36.67 , 873.64 ± 17.91 , 446.91 ± 8.78 adults in 2015–16 respectively.

Interactive effect of elevated carbon dioxide and elevated temperature on growth and yield of soybean

Narendra K. Lenka, Sangeeta Lenka, J. K. Thakur, R. Elanchezhian, S. B. Aher, Vidya Simaiya, D. S. Yashona, A. K. Biswas, P. K. Agrawal and A. K. Patra

Keywords: Carbon dioxide fertilization, climate change, elevated temperature, seed index, soybean biomass.

Abstract

A field experiment was undertaken in the kharif season of 2016 in open-top chambers to study the individual and combined effects of elevated carbon dioxide and temperature on growth and yield parameters in soybean crop. The soybean (var. JS 20–29) crop was grown under two levels of CO₂ (ambient, 550 ppmv) in combination with two levels of air temperature (ambient, +2.0°C). The five different climate treatments were: open field (OF), ambient chamber (AC), elevated temperature (eT), elevated CO₂ (eC) and elevation of both temperature and CO₂ (eCeT). At the time of sowing, vermicompost @ 2.0 tonnes ha⁻¹ was applied along with 30 kg N ha⁻¹ (in the form of urea), 60 kg P₂O₅ ha⁻¹ (through single super phosphate) and 40 kg K₂O ha⁻¹ (through muriate of potash) to the soybean crop. Impact of the climate variables was studied in terms of selected plant attributes, viz. plant height, leaf area, biomass, number of pods, number of grains per pod, grain yield and seed index (100 seed weight). Results indicated significant positive effect of elevated CO₂ and temperature on plant growth parameters, pod attributes and grain yield. Compared to AC, leaf area at 50 days after sowing was higher by 143%, 281% and 259% and aboveground biomass at harvest was higher by 47%, 31% and 47% under eC, eT and eCeT treatments respectively. The difference in biomass under OF and AC was not significant. The increase in grain yield over ambient varied from 30% under eT to 51% and 65% under eC and eCeT treatments respectively. The seed index as measured through weight of 100 numbers of seeds, was significantly higher under elevated CO₂ and/or elevated temperature treatments than the ambient chamber and open field treatments.

Dendrogeomorphic potential of the Himalaya – case studies of process dating of natural hazards in Kullu valley, Himachal Pradesh

Amalava Bhattacharyya, Markus Stoffe, Mayank Shekhar, Juan Antonio Ballesteros Cánovas and Daniel Trappmann

Keywords: Dendrogeomorphology, flash flood, Himachal Pradesh, snow avalanche, tree-ring.

Abstract

Trees impacted by the forces of natural processes such as flash floods, snow avalanches, landslides, rockfalls or earthquakes, record these events and exhibit growth disturbances in their growth-ring series. As a consequence, these disturbances provide an excellent signal for the spatio-temporal reconstruction of past natural hazard activity and a means to date and document past disasters. In the context of the Indian Himalayas Climate Change Adaptation Programme (IHCAP; <http://www.ihcap.in/>), a field trip was carried out in May 2014 to define suitable sites for dendrogeomorphic research in Kullu valley, Himachal Pradesh. Several tree species and sites where recent and past process activity can be reconstructed were inventoried, namely flash floods in the Beas and Sainj rivers as well as snow avalanches in Solang valley. Through this exploratory analysis, we ascertain that tree-ring techniques have wide applicability in the analysis of natural hazards, not only in the Kullu region but also in other geographical contexts of the Himalayas.

Antagonistic interactions of sponge-associated Actinobacteria against heterotrophic bacteria from sponge and ambient water

N. S. Subina, C. S. Sonam, Shanta Nair and Maria-Judith Gonsalves

Keywords: Actinobacteria, antagonistic activity, heterotrophic bacteria, sponge.

Abstract

In the present study, 11 sponge-associated Actinobacteria showed 316 inhibitory interactions against 75 heterotrophic bacteria as each Actinobacteria inhibited the growth of >1 bacterial isolates from the sponge and ambient water. The antagonistic activity depended on the source of isolation and the taxonomic group of heterotrophic bacteria. The order of inhibition of bacteria by Actinobacteria was ambient water > cortex > mesohyl tissues of sponge. The absence of certain genera in the sponge might be because of the inhibition by sponge-associated Actinobacteria. Hence, the antagonistic property of Actinobacteria in the sponges may influence the selection of resident sponge-associated bacteria.

Transition probability approach for direct calculation of coefficients of configuration interaction wave function

Arijit Bag

Keywords: Configuration interaction, potential energy curve, transition probability approximation, wave function.

Abstract

To reduce the computation cost of configuration interaction (CI) method, a novel technique is used to calculate the coefficients of doubly excited determinants directly from orbital energies, orbital overlap matrix and electron population obtained from Hartree–Fock level run. This approach to approximate the coefficients of CI wave function is termed as transition probability approximated CI (TPA-CI). In principle, calculated dynamical electron correlation energies of TPA-CI and full CI (FCI) are equivalent. It is observed that computed TPA-CI correlation energies of hydrogen, water, ammonia and ozone are close to the FCI values, within 5% error. The potential energy curve of hydrogen molecule is also studied, and it is found that the energy is minimum at its equilibrium bond length.

Negative allometry for egg size in ladybeetles (Coleoptera: Coccinellidae): Trade-off between egg hatch time and size

B. K. Agarwala and A. F. G. Dixon

Keywords: Egg size, inter-specific negative allometry, ladybeetles.

Abstract

Similar to a wide range of other organisms, large species of predatory ladybeetles lay proportionally small eggs when compared to smaller species. This study determines whether egg size in aphidophagous lady beetles is constrained by the time it takes for the eggs to hatch. The eggs of the large species, *Anisolemnia dilatata* (168 mg), and small species of ladybeetle, *Coccinella septempunctata* (27 mg), were collected immediately after they were laid, separated from one another and weighed. The time for the egg to hatch was determined at 22°C. As predicted, the eggs of the large species were a smaller proportion (0.0048) of their mother's weight when compared to the eggs of the small species (0.0061). On an average, the eggs of the large species were about 4.9 times heavier and took 1.31 times longer to hatch than those of small species. These results indicate that in insects and aphidophagous ladybeetles, in particular, egg hatch time is not directly proportional to the egg size and reproduction may involve more than a trade-off between the number of eggs and size. It is likely that egg hatch time is a constraining factor and an important determinant of the inter-specific negative allometry for egg size in this group of insects.

Application of indigenously developed remotely operated vehicle for the study of driving parameters of coral reef habitat of South Andaman Islands, India

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Keywords: Coral reef, driving parameters, remotely operated vehicle, spectral irradiance.

Abstract

Coral reef biodiversity in South Andaman Islands, India was studied using indigenously developed remotely operated underwater vehicle, PROVe. The vehicle was manoeuvred in coral reef habitats using underwater navigational aids to record faunal assemblages along with underwater spatio-temporal spectral irradiance characteristics coupled with surface radiance, water temperature, salinity and underwater visuals by high-definition camera devices. PROVe-based observations and the outcome from scientific payloads indicated that it will be a new additional tool for the Indian scientific community to map coral reef habitats, correlate and validate the satellite-derived parameters to understand coral reef health.

Foraging rhythm of bees in relation to flowering of sweet basil, *Ocimum basilicum*

L. D. P. Abrol, Uma Shankar and Debjyoti Chatterjee

Keywords: Agricultural crops, foraging rhythm, nonApis bees, *Ocimum basilicum*.

Abstract

Sixteen species of insects belonging to four families of Hymenoptera visited flowers of *Ocimum basilicum*. Among them, non-Apis bees represented 85% of all flower visitors. Nectar was the main attractant for floral visitors. Besides *Ocimum*, agricultural crops such as cucumber, bitter melon, brinjal, etc. in adjacent fields were visited by the same species of flower visitors. Hence, if planted near the agricultural fields, *Ocimum* sp. could attract pollinating insects for enhancing crop productivity.

Satellite-based mapping and monitoring of heavy snowfall in North Western Himalaya and its hydrologic consequences

Bhaskar R. Nikam, Vaibhav Garg, Prasun K. Gupta, Praveen K. Thakur, A. Senthil Kumar, Arpit Chouksey, S. P. Aggarwal, Pankaj Dhote and Saurabh Purohit

Keywords: AWiFS, MOD10A2, North Western Himalaya, snow cover area, SCATSAT-1.

Abstract

Snow cover is one of the most important land surface parameters in global water and energy cycle. Large area of North West Himalaya (NWH) receives precipitation mostly in the form of snow. The major share of discharge in rivers of NWH comes from snow and glacier melt. The hydrological models, used to quantify this runoff contribution, use snow-covered area (SCA) along with hydro-meteorological data as essential inputs. In this context, information about SCA is essential for water resource management in NWH region. Regular mapping and monitoring of snow cover by traditional means is difficult due to scarce snow gauges and inaccessible terrain. Remote sensing has proven its capability of mapping and monitoring snow cover and glacier extents in these area, with high spatial and temporal resolution. In this study, 8-day snow cover products from MODIS, and 15-daily snow cover fraction product from AWiFS were used to generate long-term SCA maps (2000–2017) for entire NWH region. Further, the long term variability of 8-daily SCA and its current status has been analysed. The SCA mapped has been validated using AWiFS derived SCA. The analysis of current status (2016–17) of SCA has indicated that the maximum extent of snow cover in NWH region in last 17 years. In 2nd week of February 2017, around 67% of NWH region was snow covered. The comparison of SCA during the 1st week of March and April in 2016–17

against 2015–16 indicates 7.3% and 6.5%, increased SCA in current year. The difference in SCA during 1st week of March 2017 and 1st week of April 2017 was observed to be 14%, which indicates that the 14% SCA has contributed to the snow melt during this period. The change in snow water equivalent retrieved using SCATSAT-1 data also validates this change in snow volume.

New approaches towards measuring cupule volume for empirical analysis: an experimental study from Brahmagiri, Southern India R. Arjun

Keywords: Brahmagiri, cupule volume, late Prehistory, rock art, South India.

Abstract

Cupules (cup marks) are found across the world ranging in age from Palaeolithic to recent in different archaeological contexts. Cupules sites at Brahmagiri, Southern India are rock shelter, mortuary and settlement in context of Iron Age (1200–300 BCE) and Early History (300 BCE–500 CE) evidences. The emphasis of this research is on developing an advanced approach for measuring cupule volume from one of the sites at Brahmagiri through $V = \pi \times d \times (R^2 + r^2 + R \times r)/3$. In order to test the accuracy of the volume values obtained from this formula, a simple experiment was conducted by filling premeasured water into cupules through 5 and 60 ml volume matrix glass and this showed close results validating the above formula with a minimal error margin.

M 6.7, 4 January 2016 Imphal earthquake: dismal performance of publicly-funded buildings

Durgesh

C. Rai, Hemant B. Kaushik and Vaibhav Singhal

Keywords: Earthquake effects, reinforced concrete frame, seismic vulnerability.

Abstract

The M 6.7 Imphal Earthquake of 4 January 2016 caused devastation in Manipur state and adjoining areas. This event presented another opportunity to understand the earthquake risk of the affected region as well as of the North-Eastern Himalayan region, which have similar patterns of seismicity, built environment and construction practices. Many dramatic collapses and damages, especially to Publicly-funded buildings were disproportionate to the observed intensity of shaking. This was primarily due to poor compliance with seismic codes, inferior quality of raw materials and shoddy workmanship. Consequently, the seismic risk in the region is growing at an alarming pace with increasing inventory of vulnerable construction. This article discusses seismic performance of three publicly-funded buildings in the recent earthquake and highlights the vulnerability of such inventories along with the below par preparedness of the government agencies in dealing with such calamities. This event should be regarded as a preview of what is likely to happen in the event of a greater shaking expected for the region and should hasten the community to take necessary steps to identify seismic vulnerabilities and improve construction practices through effective intervention.

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