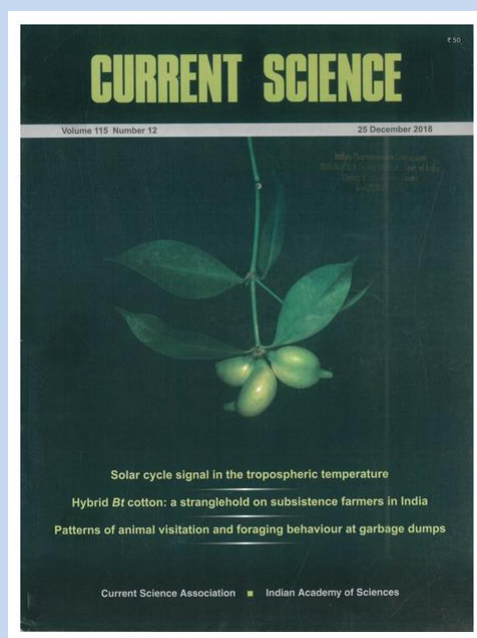


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Science-based mandatory standards and the implementation gap: the case of bottled water regulations in India

Aviram Sharma

1

An overview of Reusable Launch Vehicle Technology Demonstrator

K. Sivan and S. Pandian

1

Aerodynamic design, characterization and flight performance of RLV-TD

G. Vidya, K. Manokaran, V. R. Ganesan, M. Prasath, Sundeepekumar Epuri, P. Balasubramanian, C. Babu, B. Venkatasubrahmanyam and Priyankar Bandyopadhyay

1

Aerothermal design, qualification and flight performance

T. Sivamurugan, P. Anoop and S. L. N. Desikan

2

Comparison of the estimated structure temperatures with measured temperatures in flight shows the robustness of the design methodologies adopted.

Flush air data sensing system

N. Shyam Mohan, M. Jayakumar, T. Sivamurugan, K. C. Finitha, S. B. Vidya, Jayanta Dhoaya, N. Remesh, M. Prasath, Shashi Krishna and Aisha Sidhique

2

Development of slow-burning solid rocket booster for RLV-TD hypersonic experiment

Achutananda Parhi, V. Mahesh, Khadarvoli Kalluru, S. Reshmi, R. Harikrishnan, V. M. Lakshmi, J. Paul Murugan and Renjith Kumar Reddy

2

Integrated electrohydraulic control actuation system with centralized power plant for the Reusable Launch Vehicle Technology Demonstrator

V. Masilamani, Manoj Kumar, S. Sankar Narayan, N. Raghu, M. N. Namboodiripad and T. Mookiah

3

Mission design and performance of RLV-TD

Jyothish R. Pillai, M. Mutyala Rao, P. Bhanumathy, Vijith Mukundan, Jaison Joseph, A. K. Anil Kumar, C. Ravikumar and Abhay Kumar

3

Integrated navigation, guidance and control system and validation

Arindam Barua, M. P. Premchand, R. Vishnu, Prabhat Kumar Dubey, Jayachitra, Ambili K. Gopinath, S. Anitha, Renjith Keezhoth, Anil P. Madeckal, D. Karthikeyan, Sheethal Antony, J. Suresh Babu, R. Manohara Rao, I. Sudar and E. S. Padmakumar

4

An end-to-end airframe structural system design

B. P. Deepak, T. Manojkumar, A. Prashanthan, R. Suresh, Philip K. Mathew, M. I. Junaidh, S. Rajendran, B. S. Raju and C. K. Krishnadasan

4

Development of large-sized Titanium alloy Ti6Al4V and nickel-based superalloy Inconel-718 forgings for Reusable Launch Vehicle-Technology Demonstrator flight	
R. K. Gupta, V. Anil Kumar, P. Ramkumar and U. V. Gururaja	4
Ceramic coating on flexible external insulation blankets for reusable missions	
Deepa Devapal, M. P. Gopakumar, P. V. Prabhakaran and S. Packirisamy	5
Quality assurance challenges in testing and evaluation of reusable launch vehicle systems	
P. K. Abraham and B. Valsa	5
Innovative technologies for quality seed production and vegetative multiplication in forage grasses	
D. Vijay, C. K. Gupta and D. R. Malaviya	5
Greywater treatment using horizontal, vertical and hybrid flow constructed wetlands	
C. Ramprasad and Ligy Philip	6
Assessment of contamination of soil and groundwater due to e-waste handling	
Rashmi Makkar Panwar and Sirajuddin Ahmed	6
Subsurface geological structure and tectonics as evidenced from integrated interpretation of aeromagnetic and remote sensing data over Kutch sedimentary basin, western India	
P. Chandrasekhar, K. Chandra Mouli, D. P. Rao and V. K. Dadhwal	7
Food preferences and foraging strategies of wood-feeding termites in a West African savanna	
A. B. N'Dri, J. Gignoux and S. Konaté	7
Multi-functional system for persons with disabilities using electroencephalography signals of eye blink	
Subhra Sankha Sarma, Piyush Kant and Rajkumar	7
Detection of IHHN virus in a Specific Pathogen Free bonafide Penaeus vannamei (Boone, 1931) broodstock consignment imported to India	
M. C. Remany, R. Kirubakaran, Daly Cyriac, O. C. Sruthi Prem, P. Krishnakanth Varadaraju, A. K. Panda, Jaideep Kumar and Y. C. Thampi Samraj	8
Automatic estimation of tree stem attributes using terrestrial laser scanning in central Indian dry deciduous forests	
R. Suraj Reddy, Rakesh, C. S. Jha and K. S. Rajan	8
Recognizing the rapid expansion of rubber plantation – a threat to native forest in parts of northeast	
India Kasturi Chakraborty, S. Sudhakar, K. K. Sarma, P. L. N. Raju and Ashesh Kr. Das	9
Characterization of Mukundpura carbonaceous chondrite	
R. P. Tripathi, Ambesh Dixit and N. Bhandari	9

Introducing a third culture: Carl Djerassi and Roald Hoffmann in theatre Harshal Sanjay Pawar and Adrene Freeda D'cruz	10
Changes in capacity of China's agriculture to feed its population Yan Zhang, Hong Zhang and Xiaohui Yang	10
The history of liquid metal pump development in India R. D. Kale, B. K. Sreedhar and K. V. Sreedharan	10
An integrated linearization technique for GaAs bipolar WCDMA power amplifier Jagadheswaran Rajendran, Sofiyah Sal Hamid, Shukri Korakkottil Kunhi Mohd, Mohd Zaid Abdullah, Harikrishnan Ramiah and Narendra Kumar	11
Towards generation of effective 3D surface models from UAV imagery using open source tools P. S. Singh, Mayuri Sharma , Victor Saikhom, Dibyajyoti Chutia, Chirag Gupta, Avinash Chouhan and P. L. N. Raju	11
Assessment of spatial variations in temperature and precipitation extremes in west-flowing river basin of Kutch, Saurashtra and Marwar, India Ila Agnihotri, M. P. Punia and J. R. Sharma	11
Genome-wide consistent molecular markers associated with phenology, plant production and root traits in diverse rice (<i>Oryza sativa</i> L.) accessions under drought in rainfed target populations of the environment Vivek Deshmukh, Sumeet Prabakar Mankar, C. Muthukumar, P. Divahar, A. Bharathi, Helen Baby Thomas, Ashish Rajurkar, Reena Sellamuthu, R. Poornima, S. Senthivel and R. Chandra Babu	12
An observer-based fault-tolerant controller for flexible buildings-based on linear matrix inequality approach Chaojun Chen, Zuohua Li, Jun Teng and Ying Wang	12
Quantification of regional and global sustainability based on combined resource criticality of land and water Prashant Goswami and Shivnarayan Nishad	13
First lasing in an infrared free electron laser at RRCAT, Indore K. K. Pant, Vinit Kumar, Bhaskar Biswas, Arvind Kumar, Shankar Lal, Sona Chandran, Saket Kumar Gupta, Md. Khursheed, Pravin Nerpagar, A. K. Sarkar, Ravi Kumar Pandit	13
Imaging of stratified media using high-speed swept source optical coherence tomography Maddipatla Reddikumar and Raju Poddar	13
The adsorption capacity of the base layer of pervious concrete pavement prepared with additives for typical runoff pollutants Wang Junling, Wei Jiangtao, Wang Xueming, Feng Cuimin, Chen Tao, Sun Lihua1 and Li Junqi	14

Climate change-induced coral bleaching in Malvan Marine Sanctuary, Maharashtra, India
K. Diraviya Raj, G. Mathews, M. Selva Bharath, Rohit D. Sawant, Vishal Bhawe, Deepak Apte, N. Vasudevan and J. K. Patterson Edward 14

Dichogamy and style curvature avoid self-pollination in *Eremurus altaicus*
Wei Gu, Miao Ma and Jun-Feng Fan 14

Antiproliferative and antibacterial activity of some para-substituted benzylideneacetophenones and establishing their structure activity relationship
Deepak Chowrasia, Nisha Sharma, Ajay Kumar, Vinod Dohrey, Md. Arshad, Asif Jafri, Juhi Rais, Madhu Gupta and Sahabjada 15

Volume 114 - Issue 03, February 2018

Learning to think like a scientist and a mathematician
K. P. Mohanan and Tara Mohanan 15

A new solution for city water: quality drinking water from the river floodplains
Vikram Soni, Shashank Shekhar, S. V. N. Rao, Suman Kumar and Diwan Singh 16

Advances in understanding of structure, function and plasticity of HCN channels
Sukant Khurana 16

Geographic distribution pattern of threatened plants of India and steps taken for their conservation
S. K. Barik, O. N. Tiwari, D. Adhikari, P. P. Singh, R. Tiwary and S. Barua 16

Recovery of critically endangered plant species in India: need for a comprehensive approach
G. Ravikanth, M. R. Jagadish, R. Vasudeva, R. Uma Shaanker and N. A. Aravind 17

Contributions of plant taxonomy, herbarium and field germplasm bank to conservation of threatened plants: case studies from the Himalayas and Eastern and Western Ghats
K. Haridasan, A. A. Mao, M. K. Janarthanam, A. K. Pandey, S. K. Barik, S. K. Srivastava, P. C. Panda, Geetha Suresh, S. K. Borthakur, B. K. Datta and B. Ravi Prasad Rao 17

Inventory and characterization of new populations through ecological niche modelling improve threat assessment
D. Adhikari, Z. Reshi, B. K. Datta, S. S. Samant, A. Chettri, K. Upadhaya, M. A. Shah, P. P. Singh, R. Tiwary, K. Majumdar, A. Pradhan, M. L. Thakur, N. Salam, Z. Zahoor, S. H. Mir, Z. A. Kaloo and S. K. Barik 18

Metapopulation modelling of threatened plants to assess conservation status and determine minimum viable population size
Mark K. Lyngdoh, Arun Chettri, D. Adhikari and S. K. Barik 18

Bioactive metabolite profiling for identification of elite germplasms: a conservation strategy for threatened medicinal plants

Padma Venkatasubramanian, S. P. Balasubramani, S. K. Nandi and Mohd Tariq 19

Establishing taxonomic identity and selecting genetically diverse populations for conservation of threatened plants using molecular markers

N. K. Chrungoo, G. R. Rout, S. P. Balasubramani, P. E. Rajasekharan, K. Haridasan, B. R. P. Rao, R. Manjunath, G. Nagduwar 19

In vitro propagation of some threatened plant species of India

C. R. Deb, G. R. Rout, A. A. Mao, S. K. Nandi, R. K. Nilasana Singha, D. Vijayan, T. Langhu, Z. P. Kikon, S. Pradhan, Mohd Tariq 20

Floral biology and embryological studies are important for conservation of threatened plants having reproductive bottlenecks: a case study of *Illicium griffithii*

Hook. f. & Thomson E. J. Marbaniang, N. Venugopal, Susheel Verma, Ravinder Raina, Ankush Khajuria and Kamini Gautam 20

Classifying threatened species of India using IUCN criteria

S. K. Barik, B. R. P. Rao, K. Haridasan, D. Adhikari, P. P. Singh and R. Tiwary 21

Morphology of slope streaks within Nicholson crater, Mars: records of recent wind activity

Ami J. Desai and S. V. S. Murty 21

Modelling vadose zone processes for assessing groundwater recharge in semi-arid region

A. T. Dandekar, D. K. Singh, A. Sarangi and A. K. Singh 22

Seasonal variation in wildlife roadkills in plantations and tropical rainforest in the Anamalai Hills, Western Ghats, India

P. Jeganathan, Divya Mudappa, M. Ananda Kumar and T. R. Shankar Raman 22

Coherence of the light of firefly *Luciola praeusta*

Upamanyu Sharma, Angana Goswami and Anurup Gohain Barua 23

Stability-indicating method of entacapone-related substances using UPLC in finished dosage form

Naresh Konduru, Rambabu Gundla, Naresh Kumar Katari and G. V. Madhuri 23

Differential bleaching patterns in corals of Palk Bay and the Gulf of Mannar

P. Krishnan, R. Purvaja, C. R. Sreeraj, R. Raghuraman, R. S. Robin, K. R. Abhilash, R. S. Mahendra, A. Anand, M. Gopi, P. C. Mohanty, K. Venkataraman and R. Ramesh 23

An assessment of groundwater quality in Kottukal microwatershed in Thiruvananthapuram district, South Kerala

Lal Thompson, Shalu George, A. Bushra1 and S. R. Santy 24

Alaskan-type mafic–ultramafic complex at Padhar, Betul Belt, Central India
R. R. Meshram, N. K. Rao, S. Chore, M. L. Dora, S. Shome, M. Shareef and M. Korakoppa 24

African buffalo optimization for global optimization
Julius Beneoluchi Odili and A. Noraziah 24

Volume 114 - Issue 04, February 2018

Role of electric mobility in a sustainable, and energy-secure future for India
R. Srikanth 25

Research output of Indian institutions during 2011–2016: quality and quantity perspective
K. S. Rajan, S. Swaminathan and S. Vaidhyasubramaniam 25

A bibliometric analysis of research on multiple criteria decision making
Dejian Yu, Wanru Wang, Wenyu Zhang and Shuai Zhang 25

Recent wintertime climatic variability over the North West Himalayan cryosphere
H. S. Negi, Neha Kanda, M. S. Shekhar and A. Ganju 26

Remote sensing analysis of changes in Chorabari glacier, Central Himalaya, India
Debmitta Bandyopadhyay, Gulab Singh and Farjana Birajdar 26

Temporal change and flow velocity estimation of Patseo glacier, Western Himalaya, India
K. K. Singh, D. K. Singh, H. S. Negi, A. V. Kulkarni, H. S. Gusain, A. Ganju and Babu Govindha Raj K. 26

Decadal change in supraglacial debris cover in Baspa basin, Western Himalaya
S. Pratibha and Anil V. Kulkarni 27

Investigating the performance of snowmelt runoff model using temporally varying near-surface lapse rate in Western Himalayas
Smarika Kulshrestha, RAAJ Ramsankaran, Ajay Kumar, Manohar Arora and A. R. Senthil Kumar 27

Developing extension model for uptake of precision conservation agricultural practices in developing nations: learning from rice–wheat system of Africa and India
G. A. Shitu, M. S. Nain and Rashmi Singh 28

Response of bacterial biosorbents to chemical treatment as influenced by cell membrane structure and impact on the adsorption behaviour of dyes
Lwandle P. Simelane, Elvis Fosso-Kankeu, Patrick Njobeh and Sadanand Pandey 28

Production, purification and partial characterization for an oxalate decarboxylase (OxDcase) from the probiote *Lactobacillus plantarum*
KSK-II Essam Kotb 28

Phosphate solubilization mechanisms in alkaliphilic bacterium <i>Bacillus marisflavi</i> FA7	29
Prabhu, Sunita Borkar and Sandeep Garg	
Analysis of regional competitiveness in the high-tech industry	29
Weida He ^{1,2} , Zhifeng Lin ¹ and Rong Hao	
Quantitative inventories of ants from India: gaps, prospects and recommendations	30
Aniruddha Marathe and Priyadarsanan Dharma Rajan	
Seasonal surface chlorophyll a variability in the Seychelles–Chagos Thermocline Ridge	30
Jenson V. George, M. Nuncio, N. Anilkumar, Racheal Chacko and D. Rajashekhar	
Archaeological studies at Dholavira using GPR	30
Silky Agrawal, Mantu Majumder, Ravindra Singh Bisht and Amit Prashant	
Strong electron–phonon interaction establishes correlation between superconducting and charge density wave states in NbSe₂	31
I. Naik and S. Sethy	
Nanocellulose as functional filler in starch/polyvinyl alcohol film for preparation of urea biosensor	31
Prasad Satyamurthy and Vigneshwaran Nandanathangam	
Selecting clinical and laboratory methods of manufacture of orthopaedic titanium alloy structures using a biopotentiometer	31
Alexei V. Yumashev, Anatolij S. Utyuzh, Maria V. Mikhailova, Vadim O. Samusenkov and Ilona R. Volchkova	
Identification of unique characteristics of deception from facial expression	32
Ananya Mondal, Pritha Mukhopadhyay, Nabanita Basu, Samir Kumar Bandyopadhyay and Tanima Chatterjee	
Soybean MAGIC population: a novel resource for genetics and plant breeding	32
M. Shivakumar, Giriraj Kumawat, C. Gireesh, S. V. Ramesh and S. M.	
Moisture-dependent physical and physiological properties of accelerated aged pea (<i>Pisum sativum</i> L.) seeds	32
Manoj Kumar Mahawar, D. V. K. Samuel, J. P. Sinha and Kirti Jalgaonkar	
Proline-rich proteins may regulate free cellular proline levels during drought stress in tomato Ranjit	33
Singh Gujjar, Suhas G. Karkute, Ashutosh Rai, Major Singh and Bijendra Singh	

Understanding the Aryan debate: population genetic concepts and frameworks Partha P. Majumder	34
Mangrove forests of India K. Kathiresan	34
Understanding the linkages between climate change and forest Rinku Moni Devi, Maneesh Kumar Patasaraiya, Bhaskar Sinha , Sameer Saran, A. P. Dimri ⁴ and Rajeev Jaiswal	34
Speciality rice biodiversity of Kerala: need for incentivising conservation in the era of changing climate Girigan Gopi and M. Manjula	35
Quantitative analysis of marker-based watershed image segmentation S. Madhumitha and M. Manikandan	35
A target imaging method of multiple-input-multiple-output ground penetrating radar-based on direction of arrival estimation Xi Jianjun and Huang Ling	35
Regional scale analysis of climate extremes in an SRM geoengineering simulation, Part 1: precipitation extremes Rohi Muthyala, Govindasamy Bala and Aditya Nalam	36
Scaling of hydraulic functions in heterogeneous soil using nonlinear least squares minimization method Akram Ahmed	36
Changes and vertical distribution characteristics of soil organic carbon in different land cover types in Honghe wetland of Sanjiang Plain, China Yukai Liang, Weihong Dong, Xiancang Wu and Wei Xie	37
Calcite precipitation by Rhodococcus sp. isolated from Kotumsar cave, Chhattisgarh, India Sushmitha Baskar, Swati Chalia and Ramanathan Baskar	37
Multivariate analysis of deboning data for classifying Hanwoo (Korean native cattle) by gender Joon-Yong Shim, Ha-Yeong Kim, Byoung-Kwan Cho, Seung Hwan Yang, Changyeun Mo , Kyung Do Kwon, Jin-Hyoung Kim and Wang-Hee Lee	37
Quality and impact of GPSRO observations from Megha-Tropique satellite on NGFS model C. J. Johny and V. S. Prasad	38

Comparative analysis of grain quality and nutraceutical properties of selected rice varieties from Kerala	
K. S. Shylaraj, Soumya G. Nadh and Shimi K. Chandra	38
Dynamics of shifting cultivation in relation to slope and elevation in parts of Nagaland, India	
Jenita Mary Nongkynrih, Chwadaka Pohshna and Kamani Kanta Sarma	38
Role of antagonistic yeast <i>Candida tropicalis</i> YZ27 on postharvest life and quality of litchi cv. Bombai	
V. Yeka Zhimo, Jayanta Saha, Balveer Singh and Ivi Chakraborty	39
Coral-killing sponge <i>Terpios hoshinota</i> invades the corals of Gulf of Mannar, Southeast India	
K. Diraviya Raj, M. Selva Bharath, G. Mathews, Greta S. Aeby and J. K. Patterson Edward	39
Surface water quality in sacred groves of Garhwal Himalayan region, India	
Purna Jana, Kaboli Wotsa, Sabyasachi Dasgupta and Nagendra P. Todaria	40
Kinematics and timing of brittle–ductile shearing of Mylonites along the Bok Bak fault, Peninsular Malaysia	
Ahmad Faiz Salmanfarsi, Mustaffa Kamal Shuib, Ng Tham Fatt and Mohamad Tarmizi Mohamad Zulkifley	40

Volume 114 - Issue 06, March 2018

Assessing the quality of higher education institutions in India: an alternative framework	
Pranab Mukhopadhyay, Murari P. Tapaswi, P. K. Sudarsan and Kavya Sudarsan	40
Collaboration patterns of Indian scientists in organic chemistry	
K. C. Garg, S. Kumar and Bebi	41
Policy as a driver of economic growth: historical evidence from the Indian pharmaceutical industry	
Nisha Chandran and Samir K. Brahmachari	41
Breeding of new ornamental varieties: Rose	
S. K. Datta	41
In vitro and in silico validation of anti-cobra venom activity and identification of lead molecules in <i>Aegle marmelos</i> (L.) Correa	
N. C. Nisha, S. Sreekumar, D. A. Evans and C. K. Biju	42
A comparative study to elucidate the inhibitory mechanism of a 6-mer fragment of amyloid-beta 42 peptide as a potential therapeutic in Alzheimer's disease: insights from molecular dynamics simulations	
Mary Dutta and Venkata Satish Kumar Mattaparthi	42

Antioxidant and nutritional potential of some underutilized leafy vegetables consumed by tribals of Jharkhand, India	42
Srivastava, R. S. Pan1 and B. P. Bhatt	
Enhanced oil accumulation in tobacco (<i>Nicotiana tabacum</i> L.) leaves by ectopic overexpression of VgDGAT1a for renewable production of biofuels	43
Chang-Yong Gao, Xue Mao, Hong-Qin Shang, Fang Li and Run-Zhi Li	
A simplified soil nutrient information system: study from the North East Region of India Shelton	43
Padua, T. Chattopadhyay, S. Bandyopadhyay , S. Ramchandran, R. K. Jena, P. Ray, P. Deb Roy, U. Baruah, K. D. Sah, S. K. Singh and S. K. Ray	
Effects of root properties and branching characteristics on soil reinforcement in the Jinyun Mountain, China	43
Shuangshuang Song, Yunqi Wang, Baoping Sun and Yunpeng Li	
Isolation and selection of cellulose-degrading microorganisms for utilization along with earthworms in efficient conversion of municipality waste mix to compost Sanasam	44
Shantibala Devi, Nongthombam Grihalakshmi Devi, Mohan Chandra Kalita and Narayan Chandra Talukdar	
Socio-economic costing of road traffic accidents: evidence from Nagpur city, Maharashtra, India	44
Bhaswati Bora, Vishrut Landge and Bahuguna Dalai	
Impact of tropical volcanic eruptions on Hadley circulation using a high-resolution AGCM	45
Muhammad Mubashar Dogar	
Electron density, interaction energy and hydrogen-bond radius of C–H...O interaction	45
R. Parajuli	
A critical analysis of the ‘UGC-approved list of journals’	46
Bhushan Patwardhan, Shubhada Nagarkar, Shridhar R. Gadre, Subhash C. Lakhotia, Vishwa Mohan Katoch and David Moher	
Projection of climate change scenarios in the Kabul River Basin, Afghanistan	46
Massouda Sidiqi, Sangam Shrestha and Sarawut Ninsawat	
Influence of open and polyhouse conditions on soil carbon dioxide emission from Amaranthus plots with different nutrient management practices under changing climate scenario	46
U. Surendran, Aswathy K. Vijayan, V. Bujair and E. J. Joseph	

Odd–even traffic rule implementation during winter 2016 in Delhi did not reduce traffic emissions of VOCs, carbon dioxide, methane and carbon monoxide

B. P. Chandra, V. Sinha, H. Hakkim, A. Kumar, H. Pawar, A. K. Mishra, G. Sharma, Pallavi, S. Garg, Sachin D. Ghude, D. M. Chate, Prakash Pithani, Rachana Kulkarni, R. K. Jenamani and M. Rajeevan

47

Effective weed control strategy in tomato kitchen gardens – herbicides, mulching or manual weeding

Daud Ahmad Awan, Faheem Ahmad and Sharmin Ashraf

47

Divergence studies of white willow (*Salix alba* L.) germplasm

P. A. Paray and S. A. Gangoo

48

Detection of coastal landforms in a deltaic area using a multi-scale object-based classification method

Tapas R. Martha, A. Mohan Vamsee, Vikas Tripathi and K. Vinod Kumar

48

Estimating net primary productivity of croplands in Indo-Gangetic Plains using GOME-2 sun-induced fluorescence and MODIS NDVI

N. R. Patel, Hitendra Padalia, R. Devadas, A. Huete, A. Senthil Kumar and Y. V. N. Krishna Murthy

49

Occupancy time-based passenger car equivalents at unsignalized intersections in India

Mithun Mohan and Satish Chandra

49

Volume 114 - Issue 07, April 2018

Observed warming of sea surface temperature in response to tropical cyclone Thane in the Bay of Bengal

Simi Mathew, Usha Natesan, G. Latha, R. Venkatesan, Rokkam R. Rao and M. Ravichandran

49

Movement of water flux through unsaturated zones: a transient impact on in situ potential field

Rolland Andrade, D. Muralidharan and R. Rangarajan

50

Citation characteristics of non-citable documents and contributions to journal impact factor

Liu Xue-Li, Wei Ya-Hui and Gai Shuang-Shuang

50

Links between energy usage and climate: implications on increasing CO₂ emissions and carbon capture and storage

S. K. Tandon and Jyotirmoy Mallik

50

Sperm sexing of dairy cattle: economics, animal welfare and technological challenges

Jagdish Rai

51

Influence of fabrication processes on transport properties of superconducting niobium nitride nanowires

Manju Singh, Rishu Chaujar, Sudhir Husale, S. Grover, Amit P. Shah, Mandar M. Deshmukh, Anurag Gupta, V. N. Singh, V. N. Ojha, D. K. Aswal and R. K. Rakshit

51

Evaluation and management system design for airfield clearance condition	52
Wantong Cai, Hao Geng, Liangcai Cai and Xiaolei Chong	
Modelling U-turning behaviour of vehicles at mid-block median openings in multilane urban roads	52
Ankit Gupta, Satyajit Mondal and Vinay Kumar Sharma	
Isolation, characterization and practical significance of cellulose degrading bacteria from the gut wall of two ecologically distinct earthworms	52
Kishore K. Dey, Narayan C. Talukdar, Fenella M. W. Nongkhlaw and Dwipendra Thakuria	
On-the-go position sensing and controller predicated contact-type weed eradicator	53
Abhilash Kumar Chandel, V. K. Tewari, Satya Prakash Kumar, Brajesh Nare and Aditya Agarwal	
Projections of extreme precipitation events under climate change scenarios in Mahaweli River Basin of Sri Lanka	53
Naditha Imbulana, Shakthi Gunawardana, Sangam Shrestha and Avishek Datta	
Petrography and mineralogy of calcium-, aluminum-rich inclusions in an unequilibrated carbonaceous chondrite Y 81020 (CO3.05)	54
Ritesh Kumar Mishra	
Diversity in a widely distributed dioecious medicinal plant, <i>Tinospora cordifolia</i> (Willd.) Miers. ex. Hook F. and Thomas	54
Suchita Lade, Pooja Singh Sikarwar, Md. Akram Ansari, Sayyada Khatoon, Nikhil Kumar, Hemant Kumar Yadav and Shirish A. Ranade	
Risk assessment and stability analysis of a recent landslide at Vishnuprayag on the Rishikesh–Badrinath highway, Uttarakhand, India	54
S. Sarkar, Koushik Pandit, Mahesh Sharma and Ashish Pippal	
The 12 May 2015 Kodari earthquake (Mw 7.3) in Central Nepal: delayed triggering by the 25 April 2015 Gorkha earthquake (Mw 7.8)	55
Rajeev Kumar Yadav, Bhaskar Kundu, Kalpna Gahalaut and V. K. Gahalaut	
Record of charcoal from early Maastrichtian intertrappean lake sediments of Bagh valley of Madhya Pradesh: palaeofire proxy Dhananjay	55
M. Mohabey, Bandana Samant, Deepesh Kumar, Anup Dhobale, Arka Rudra and Suryendu Dutta	
The wood-boring trace fossil <i>Asthenopodichnium</i> from Palaeocene sediments of the Barmer Hill Formation, western Rajasthan, India	55
S. C. Mathur, N. S. Shekhawat, S. L. Nama, C. P. Khichi, A. Soni, Saurabh Mathur and V. S. Parihar	
Risk factors for seropositivity to feline retroviruses among owned domestic cats in Valdivia, southern	56
Chile L. Azócar-Aedo and G. Monti	

Measuring scientific value of Indian journals beyond impact factor: a case with physics–chemistry–biology journals Bhaskar Mukherjee	56
Bibliometric analysis of greenhouse gas research on a global scale from 2000 to 2014 Wei Yang, Haijin Zhou, Fuqi Si, Cheng Liu, Wei Wang, Youwen Sun, Wenqing Liu and Changgong Shan	56
Vitamin B12 as a regulator of bone health Vijay K. Yadav	57
Intellectual property evolution and innovation ecosystem as effective tools in strengthening Indian healthcare sector Tripta Dixit, Sadhana Srivastava, Smita Sahu and W. Selvamurthy	57
Is mercury really toxic? The way forward for its judicious medicinal applications based on the therapeutic doctrines of Ayurveda Kapil Deo Yadav and Anand K. Chaudhary	58
Luminescent solar concentrators – the solar waveguides Brindha V. G. Mohan, V. Vasu, A. Robson Benjamin and M. Kottaisamy	58
The GIVE ionospheric delay correction approach to improve positional accuracy of NavIC/IRNSS single-frequency receiver Mehul V. Desai and Shweta N. Shah	58
Spliceosomal proteins encoded by fungal genomes Sandeep J. Sarde, Frank Kempken and Abhishek Kumar	59
Phytosociological analysis of Myristica swamp forests of Kulathupuzha, Kerala, India T. J. Roby, Joyce Jose and P. Vijayakumaran Nair	59
Ground motion simulation for earthquakes in Sumatran region J. Dhanya and S. T. G. Raghukanth	60
Spectral response of few important textural variants of chromitite and its potential in estimating relative grades of chromitite – a case study for chromitite of Nuggihalli Schist Belt, India Arindam Guha, Biswajit Ghosh, Sukanya Chaudhury, Komal Rani and K. Vinod Kumar	60
Demography and birth seasonality in the Nicobar long-tailed macaque (<i>Macaca fascicularis umbrosus</i>) Arijit Pal, Honnavalli N. Kumara, Avadhoot D. Velankar, Partha Sarathi Mishra and Mewa Singh	61

- Comparison of culture and PCR methods for diagnosis of group B Streptococcus in women**
Mohtaram Nasrollahi, Masoud Moghadaszadeh, Maryam Abdollahi, Zeynab Marzhoseyni, Maryam Salehian, Eisa Nazar, Shukufe Sharif and Behnam Hashemi 61
- Development and validation of marker-free constructs based on nucleocapsid protein gene of watermelon bud necrosis orthotospovirus in watermelon**
S. K. Holkar, Bikash Mandal and R. K. Jain 61
- Dual transmitter–receiver electromagnetic system for lateral boundary detection of subsurface formations**
R. Rajesh and V. S. Sarma 62
- Overestimated groundwater 14C ages triggered an inexpediency of water policy in China**
Tao Wang and Jiansheng Chen 62
- Inbound tourism in Uttarakhand, India, before and after the 2013 Kedarnath disaster – evidence derived from social networking sites using GIS**
Stutee Gupta, Shikha Anand and Srishti Gwal 63
- Supplementation of an immunomodulator, Ergosan in early larvae rearing of Indian white prawn, Fenneropenaeus indicus**
Sambhu Chithambaran and Nasser K. Ayaril 63
- Spectral modelling of estuarine coloured dissolved organic matter**
Nittala S. Sarma, Sudarsana Rao Pandi, N. V. H. K. Chari, Gundala Chiranjeevulu, Rayaprolu Kiran, K. Shiva Krishna, D. Bhaskara Rao, P. Venkatesh, B. Charan Kumar and A. V. Raman 63
- Impact of elevated CO₂ on Oryza sativa phenology and brown planthopper, Nilaparvata lugens (Hemiptera: Delphacidae) population**
G. Guru-Pirasanna-Pandi, Subhash Chander, Madan Pal and P. S. Soumia 63

Volume 114 - Issue 09, May 2018

- SERB merit review process: adapting to emerging challenges**
Premila Mohan and Ramasamy Brakaspathy 64
- Engineering curriculum development based on education theories**
Jitendra Prasad, Avijit Goswami, Brijesh Kumbhani, Chittaranjan Mishra, Himanshu Tyagi, Jung Hyun Jun, Kamal Kumar Choudhary, Mukesh Kumar, Naveen James, V. Ravi Shankar Reddy, Satwinder Jit Singh, Deepak Kashyap, Milind Sohoni, Nandita DasGupta, Prabhu Krishna Raina, Samir Kumar Saha, Sanjay Mittal, Suman Chakraborty and Sarit Kumar Das 64
- Aspects of science education in India: a synoptic review and possible directions for the future**
Ramjit Kumar and Smriti Singh 65
- Social media and communication by scientists: M. S. Swaminathan on Twitter**
B. Jayashree 65

Water soluble nanocarbon materials: a panacea for all?	65
S. V. Eswaran	
Fluoride distribution in drinking groundwater in Rajasthan, India	66
Shanti Lal Choubisa	
Cellular and molecular basis of heavy metal-induced stress in ciliates	66
Sripoorna Somasundaram, Jeeva Susan Abraham, Swati Maurya, Seema Makhija, Renu Gupta and Ravi Toteja	
Knowledge, attitude and practice of antibiotic use and antimicrobial resistance: a study post the ‘Red Line’ initiative	66
Deepanwita Banerjee and Anu Raghunathan	
Layered Pt.ZSM-5-C by greener chemical reduction for catalysing fuel cell reactions	67
Basu M. Daas and Susanta Ghosh	
Magneto-mineralogical characterization and manifestations of magnetic fabrics from the gneissic rocks and associated intrusive bodies in and around Bankura and Purulia districts, West Bengal, India	67
Saurodeep Chatterjee, Supriya Mondal, Pratik Roy, Debesh Gain and Amitava Bhattacharya	
Assessing unrealized yield potential of maize producing districts in India	68
B. M. K. Raju, C. A. Rama Rao, K. V. Rao, Ch. Srinivasarao, Josily Samuel1 , A. V. M. Subba Rao, M. Osman, M. Srinivasa Rao, N. Ravi Kumar, R. Nagarjuna Kumar, V. V. Sumanth Kumar, K. A. Gopinath and N. Swapna	
Migmatization, granite generation and melt accumulation in the Himalayan Orogenic Channel, Central and Eastern Bhutan	68
A. K. Jain, Sushmita, Sandeep Singh and P. K. Mukherjee	
Travel time reliability as a level of service measure for urban and inter-urban corridors in India	68
Anish Kumar Bharti, Ch. Ravi Sekhar and Satish Chandra	
Extreme space-weather effect on D-region ionosphere in Indian low latitude region	69
K. Venkatesham and Rajesh Singh	
Morphometric and internally transcribed spacer gene sequence-based characterization of Alternaria burnsii	69
Nirbhay K. Singh, Dasharathbhai B. Patel, Smitkumar R. Chaudhari, Bindiyaben G. Morad, Sonalben M. Rabari, Anirudh Chattopadhyay and Mohan L. Tatarwal	
Women empowerment through agricultural mechanization in India	70
C. R. Mehta, L. P. Gite and A. Khadatkar	

Last 42 ky sediment chemistry of oxygen deficient coastal region of the Bay of Bengal: implications for terrigenous input and monsoon variability	70
T. Sarathchandraprasad and V. K. Banakar	
Multiple regression analysis of geoelectric imaging and geotechnical site investigation test results	70
Rambhatla G. Sastry, Sumedha Chahar and Mahendra Singh	
Mixing dynamics in double-diffusive convective stratified fluid layers	71
Rishabh More and Sridhar Balasubramanian	
Mechanical properties and differentiation assessments of neural stem cells with pneumatic micropipette aspiration	71
Ming Wu, Qili Zhao, Cui Yang, Wen Shen, Xin Zhao, Yun Lu and Xi Zeng Feng	
Coral mortality in the Gulf of Mannar, southeastern India, due to bleaching caused by elevated sea temperature in 2016	71
J. K. Patterson Edward, G. Mathews, K. Diraviya Raj, R. L. Laju, M. Selva Bharath, A. Arasamuthu, P. Dinesh Kumar, Deepak S. Bilgi and H. Malleshappa	

Volume 114 - Issue 10, May 2018

Localization–affordability–saturation for speedy distribution of solar study lamps to millions	72
Chetan Singh Solanki, N. C. Narayanan and Jayendran Venkateswaran	
Diagnosis and epidemiology of amoebiasis in India	72
Joyobrato Nath, Baby Singha, Jaishree Paul and Sankar Kumar Ghosh	
Identification and analysis of classic articles and sleeping beauties in neurosciences	73
Andy Wai Kan Yeung and Yuh-Shan Ho	
Environmental pollutants and aggressive climatic conditions: combination scaffolds of brain stroke	73
Jeetendra Kumar Gupta, Kamal Shah and Pradeep Mishra	
Quantitative structure–activity relationship and combinatorial design of 1,3,4-oxadiazolebased thymidine phosphorylase inhibitors as potential anti-cancer agents	73
Shalini Bajaj, Piyush Ghode, Jagadish Singh, Partha Pratim Roy and Sanmati Kumar Jain	
Comparison of stochastic gradient-based optimization techniques for nonlinear satellite image coregistration problem	74
S. Manthira Moorthi and R. Sivakumar	
Urban growth dynamics and modelling using remote sensing data and multivariate statistical techniques	74
Manish Kumar, R. B. Singh, Ram Pravesh, Pankaj Kumar, Dinesh Kumar Tripathi and Netrananda Sahu	

Exploring effective factors on energy data of some benzofuran derivatives Pouya Karimi, Somayeh Makarem and Hamid Ahmar	75
Identification of bioactive compound from Citrus maxima fruit against carbohydrate-hydrolysing enzymes S. K. Reshmi, H. K. Manonmani, J. R. Manjunatha and M. N. Shashirekha	75
Paddy cultivation during early Holocene: evidence from diatoms in Lahuradewa lake sediments, Ganga Plain B. Thakur, A. Saxena and I. B. Singh	75
Chitosan nanoparticles as a carrier for Mentha longifolia extract: synthesis, characterization and antifungal activity Abeer Ramadan Mohamed Abd El-Aziz, Monira Rashed Al-Othman, Mohamed Abobakr Mahmoud, Shereen Mohamed Shehata and Nahla Shazli Abdelazim	76
‘Prosopis for prosperity’: using an invasive non-native shrub to benefit rural livelihoods in India Debbie Bartlett, Sarah Milliken and Dayesh Parmar	76
Conservation prospects of the Kashmir Red Deer (Cervus hanglu hanglu) beyond Dachigam National Park, in Jammu and Kashmir, India Rahul Kaul, Mayukh Chatterjee, Tapajit Bhattacharya, Smita Bodhankar, Riyaz Ahmad, Mansoor Nabi Sofi and Samina Amin Charoo	76
Public accounting reporting, under an achievable metamorphosis? Cristina Silvia Nistor and Cristina Alexandrina Stefanescu	77
Effect of primary tillage implements on physical properties of harvested Spunta potato tubers Saad A. Al-Hamed, Mohamed F. Wahby, Abdulwahed M. Aboukarima, Khaled A. Ahmed and Mohamed S. El Marazky	77
Tracking the disparities in Gujarat dairy development – an application of biplot analysis Darshnaben P. Mahida, R. Sendhil, Smita Sirohi, B. S. Chande, K. Ponnusamy and Gopal Sankhala	77
Does Pestalotiopsis royenae cause leaf streak of large cardamom? R. Gopi, H. Kalita, R. K. Avasthe, Ashish Yadav, M. Singh and D. Thapa	78
Processes controlling enrichment of transition elements in the surficial sediments of the western Bay of Bengal C. Prakash Babu and V. Ramaswamy	78
Estimation of rock load in development workings of underground coal mines – a modified RMR approach Avinash Paul, Vemavarapu Mallika Sita Ramachandra Murthy, Amar Prakash and Ajoy Kumar Singh	79

Electrical conductance map for Saurashtra region, Gujarat, India P. V. Vijaya Kumar, P. B. V. Subba Rao, A. K. Singh and C. K. Rao	79
Response of fish communities to abiotic factors in Western Ramganga, Kumaun Lesser Himalaya, India Shahnawaz Ali, N. N. Pandey, Prem Kumar, Ravindar Posti and A. K. Singh	79
Can a common and abundant plant-visiting ant species serve as a model for nine sympatric ant-mimicking arthropod species? Sudha Kumari and Neelkamal Rastogi	80

Volume 114 - Issue 11, June 2018

Bibliometrics of social science and humanities research in India Manorama Tripathi, Sunil Kumar and Parveen Babbar	80
Trends in metabolomics research: a scientometric analysis (1992–2017) Shanshan Guo, Jingchen Tian, Bin Zhu, Shu Yang, Kefu Yu and Zhigang Zhao	80
Thermosensitive hydrogels: from bench to market Nida Nadeem, Muhammad Sohail, Muhammad Hassham Hassan Bin Asad, Muhammad Usman Minhas, Mudassir and Syed Ahmed Shah	81
Impact of Wi-Fi interference on NavIC signal Darshna D. Jagiwala and Shweta N. Shah	81
Data mining techniques for predicting dengue outbreak in geospatial domain using weather parameters for New Delhi, India Nikita Agarwal, Shiva Reddy Koti, Sameer Saran and A. Senthil Kumar	81
Influence of absorptive reservoir bottom on the performance of dam–reservoir–foundation coupled system Kalyan Kumar Mandal and Damodar Maity	81
A survey-based structural equation model analysis on influencing factors of non-citation Zewen Hu, Yishan Wu and Jianjun Sun	82
Flowering and fruiting phenology of woody trees in the tropical-seasonal rainforest, Southwestern China D. Mohandass, Mason J. Campbe, Xin-Sheng Chen and Qing-Jun Li	82
Patterns in distribution, population density and uses of medicinal plants along the altitudinal gradient in Dhauladhar mountain range of Indian Himalayas Natasha Sharma and Chandra Prakash Kala	82

Crystallization evolution of accessory minerals in palaeoproterozoic granites of Bastar Craton, India	
Dinesh Pandit	84
Comparing the imitating capabilities of parrots and crows with human beings using COMSOL Multiphysics	
Randhir Singh, Ajay Kumar and Parveen Kumar Lehana	84
Accounting for secondary inner filter effect in fluorescence spectra from solid samples	
Tuhin Khan, Kalyani Bhagabani, Preeti Kumari and Anindya Datta	85
Asp72 of pro-peptide is an important pH sensor in the zymogen activation process of papain: a structural and mechanistic insight	
Sumana Roy and Sampa Biswas	85
Capabilities of satellite-derived datasets to detect consecutive Indian monsoon droughts of 2014 and 2015	
Satya Prakash	85
Use of molecular-based approach in resolving subspecies ambiguity of the rescued tiger cubs from Arunachal Pradesh, India and their relationship with other population	
Puneet Pandey, Deepa Goel, Randeep Singh, Sujeet Kumar Singh and Surendra Prakash Goyal	86
Analysing the black polished pottery of proto-historic-early historic India	
Vibha Tripathi and Parul Singh	86
Impact of transport sustainability on air quality in Lahore, Pakistan Rizwan Haider, Abdullah Yasar and Amtul Bari Tabinda	
	86
Volume holographic gratings in acrylamidebased photopolymer to provide selective light as an added input for improving the performance of dye-sensitized solar cells	
A. B. Sreebha, S. Suresh, C. O. Sreekala and V. P. Mahadevan Pillai	87

Volume 114 - Issue 12, June 2018

Bibliometric and visual analysis of planthopper research between 1980 and 2017	
Chaoxing Hu and Lingzhen Cao	87
Lithium-ion battery supply chain: enabling national electric vehicle and renewables targets	
Epica	
Mandal Sarkar, Tanmay Sarkar and Mridula D. Bharadwaj	87
A versatile 205 MHz stratosphere–troposphere radar at Cochin – scientific applications	
K. Mohanakumar, K. R. Santosh, P. Mohanan, K. Vasudevan, M. G. Manoj, Titu K. Samson, Ajil Kottayil, V. Rakesh, Rejoy Rebello and S. Abhilash	88

Groundwater dynamics in North Bihar plains	88
Rajiv Sinha, Surya Gupta and Santosh Nepal	
Impact of local factors on decision making – a multi criteria modelling framework in wind energy investment	89
Rahi Jain, Riddhi Panse and Satanand Mishra	
Navigational safety and traffic pattern analysis using AIS data on the western coast of India	89
Saurav Mandal, Vishwanath Nagarajan and Om Prakash Sha	
Effects of homegarden size on floristic composition and diversity along an altitudinal gradient in Central Himalaya, India	89
Vibhuti, Kiran Bargali and S. S. Bargali	
Studies of forest fire induced changes in atmosphere over Uttarakhand, India, using space based observations and model simulations	90
M. K. Madhav Haridas, P. V. N. Rao, K. Sreenivas Rao and Prijith Sudhakar	
Quality assurance of rituximab (anti-CD 20) antibodies by potency testing: determining the system suitability criteria and sample acceptance criteria	90
Subhash Chand, Birendra Kumar, Vivek Morris Prathap, Surinder Singh and Richi V. Mahajan	
Improved square-Z-shaped DNG meta-atom for C- and X-band application	90
Md. Mehedi Hasan, Mohammad Rashed Iqbal Faruque and Mohammad Tariqul Islam	
Analytical estimation of water contents, specific heat capacity and thermal profiles associated with enzymatic model compound β-cyclodextrin	91
Gaurav R. Gupta, Pankaj D. Patil, Vasim R. Shaikh, Rahul R. Kolhapurkar, Dilip H. Dagade and Kesharsingh J. Patil	
Biochemical characteristics, fatty acid profiles and antioxidant activities of tea seed oil	91
Kritideepan Sarmah and Priyanka Das	
Risk assessment of rail haulage accidents in inclined tunnels with Bayesian network and bow-tie model	91
Qingwei Xu and Kaili Xu	
Exclusion of putative CATSPER2 and STRC gene deletion and FOXI1 gene mutations in a unique cohort with sensorineural deafness and male infertility from south India	92
Justin Margret Jeffrey, Jayasankaran Chandru, Amritkumar Pavithra, Murugesan Kalaimathi, Nagarathinam Indhumathi, Pangadan Ashraf and C. R. Srikumari Srisailapathy	
Molecular characterization of potassium solubilizing bacteria from crop rhizosphere of the North Eastern Region of India	92
Smrita Buragohain, Dhruva Jyoti Nath, Yumnam Bijilaxmi Devi, Badal Bhattacharyya and Samiron Dutta	

Incessant erosion of high tidal mudflats in the northern Gulf of Khambhat	93
Hiren Bhatti, Ratheesh Ramakrishnan, A. K. Sharma and A. S. Rajawat	
Effect of synthetic astaxanthin, Lucantin on colour and physical quality of Indian white prawn, Fenneropenaeus indicus	93
Sambhu Chithambaran and Nasser K. Ayaril	
Science and mega science: a perspective	93
Rashmi Raniwala and Sudhir Raniwala	

Volume 115 - Issue 1, July 2018

Low-cost solar water purifier for rural households	94
Anil K. Rajvanshi and Noorie Rajvanshi	
Digital Accessible Knowledge of the birds of India: characterizing gaps in time and space	94
A. Townsend Peterson, R. Suresh Kumar, Manoj V. Nair and Gautam Talukdar	
Modelling of climate-induced groundwater recharge for assessing carbon emission from groundwater irrigation	94
G. T. Patle ¹ , D. K. Singh and A. Sarangi	
Impact of macroeconomic and healthcare provision factors on patient satisfaction	95
Ana Iolanda Vodă, Ionel Bostan and Claudiu Gabriel Țigănaș	
Surface plasmon resonance: physics and technology	95
S. Nivedha, P. Ramesh Babu and K. Senthilnathan	
Expression profiles of key genes involved in rice gall midge interactions reveal diversity in resistance pathways	95
D. Divya, Suresh Nair and J. S. Bentur	
Frequency-dependent response of Chromobacterium violaceum to sonic stimulation and altered gene expression associated with enhanced violacein production at 300 Hz	96
Chinmayi Joshi, Pooja Patel, Abhishek Singh, Jinal Sukhadiya, Vidhi Shah and Vijay Kothar	
In vitro plant development of Eleusine coracana via indirect organogenesis and somatic embryogenesis using mature seeds as explants	96
Anamika Kashyap, Santosh Madanrao Penak, Arnab Saha and B. R. Singh	
Seasonal behaviour of upper ocean freshwater content in the Bay of Bengal: synergistic approach using model and satellite data	96
Smitha Ratheesh, Neeraj Agarwal, Rashmi Sharma, K. V. S. R. Prasad and Sujit Basu	
Assessment of soil erosion in the fragile Himalayan ecosystem of Uttarakhand, India using USLE and GIS for sustainable productivity	97
S. K. Mahapatra, G. P. Obi Reddy, Ritu Nagdev, R. P. Yadav, S. K. Singh and V. N. Sharda	

Optimization for blasting scheme of crown-sill pillar based on CW-GT and GC-WTOPSIS Qiucui Zhang, Lei Zuo, Qing Yu, Yulong Liu, Yushan Yang and Dexing Ding	97
Responses of selected C3 and C4 halophytes to elevated CO2 concentration under salinity Saranya Jothiramshekar, Jenifer Joseph Benjamin, Rani Krishnasamy, Anand Kumar Pal, Suja George, Rajalakshmi Swaminathan and Ajay K. Parida	97
Land-use dynamics in Corbett National Park, Uttarakhand, India using CA-Markov and agent-based LULC-SaarS model Arijit Roy and Pooja Rathore	98
Fragilariopsis sp. bloom causes yellowish-brown waters off Alappuzha, south-central Kerala coast, India, during the mud bank-upwelling phase R. Jyothibabu, N. Arunpandi, C. Karnan, L. Jagadeesan, T. M. Manojkumar, K. K. Balachandran and S. W. A. Naqvi	98
Inter-specific relationship of size and walking speed in predaceous ladybirds (Insecta: Coleoptera: Coccinellidae) S. Ghosh and B. K. Agarwala	99
Population structure and reproductive biology of selected sciaenid species along the fishing grounds of Goa, west coast of India Dinesh T. Velip and Chandrashekher U. Rivonker	99
AdaBoost-based long short-term memory ensemble learning approach for financial time series forecasting Yungao Wu, and Jianwei Gao	99

Volume 115 - Issue 2, July 2018

Re-envisioning engineering education in India: IIT Gandhinagar's Foundation Programme Srinivas Reddy and Sudhir K. Jain	100
Concentrated solar power in India: current status, challenges and future outlook Suhas Bannur	100
The bio-incubation boom in India Satya Prakash Dash and Gayatri Saberwal	101
Impulsive and switching load balancing model and stability analysis Tinglei Zhao, Jianzhong Qiao, Shukuan Lin and Yanhua Wang	101
Prospects of customized fertilizers in Indian agriculture Sabyasachi Majumdar and Nagabovanalli B. Prakash	102
Exopolysaccharides from cyanobacteria and microalgae and their commercial application Dhanesh Kumar, Petr Kaštánek and Siba P. Adhikary	102

Classification of SDSS photometric data using machine learning on a cloud Vishwanath Acharya, Piyush Singh Bora, Karri Navin, Anisha Nazareth, P. S. Anusha and Shrisha Rao	102
Multidisciplinary approach to teaching inorganic chemistry in high school: an example of the topic of metals D. A. Kostić, R. S. Nikolić, N. S. Krstić, M. G. Nikolić, V. D. Dimitrijević and S. Simić	103
Variation in carbon storage among tree species in the planted forest of Kathmandu, Central Nepal S. P. Bhatta, K. P. Sharma and S. Balami	103
Multiresidue determination of pesticides in market honey from northern India using QuEChERS approach and assessment of potential risks to consumers Atul Kumar, Jatinder Paul Singh Gill and Jasbir Singh Bedi	103
Analysis of agricultural substrates for nutritive values and biomethane potential Shehbaz Ali, Tawaf Ali Shah, Asifa Afzal and Romana Tabassum	104
Palaeo-channel bisecting Puri town, Odisha: vestige of the lost river ‘Saradha’? Subhamoy Jana, William Kumar Mohanty, Saibal Gupta, Chirashree Srabani Rath and Priyadarshi Patnaik	104
Synthesis, heterocyclization and anti-tumour activity evaluation of some benzimidazole derivatives M. F. El-Ahwany and Mohamed H. M. Abd El-Azim	105
Effect of reduced traffic density on characteristics of particulate matter over Delhi Vikas Goel, Sumit Kumar Mishra, Ajit Ahlawat, Chhemendra Sharma, N. Vijayan, S. R. Radhakrishnan, A. P. Dimri and R. K. Kotnala	105
Enhanced fire severity in modern Indian dwellings Nasar Ahmad Khan and Gaurav Srivastava	105
Advances in sea surface layer temperature measurements with fast responding thermistor arrays on drifting buoys R. Srinivasan, V. Rajendran, Shijo Zacharia and Tata Sudhakar	106
Status of desertification in South India – assessment, mapping and change detection analysis Dharumarajan, M. Lalitha, Rajendra Hegde, N. Janani, A. S. Rajawat, K. L. N. Sastry and S. K. Singh	106
Integrated assessment of drought vulnerability using indicators for Dhasan basin in Bundelkhand region, Madhya Pradesh, India Saswat Kumar Kar, T. Thomas, R. M. Singh and Lokesh Patel	107

- Response of fast ice to ground penetrating radar and backscattering coefficient from scatterometer in Larsemann Hills, East Antarctica Rajashree**
Vinod Bothale, S. Anoop, Manne Gopaiah and Mehanaz Sherief 107
- A damage constitutive model for the intermittent cracked rock mass under the planar complicated stress condition**
Hongyan Liu and Fengjin Zhu 108
- Science and engineering research in India (1985–2016): insights from two scientometric databases**
A. Jaya Kumar and Rahul Pandit 108
- Collaborative characteristics and networks of national, institutional and individual contributors using highly cited articles in environmental engineering in Science Citation Index Expanded**
Hui-Zhen Fu and Yuh-Shan Ho 108
- Updating India's National Biodiversity Action Plan: the process and way forward**
Malvika Onial, Biba Jasmine, Yashaswi Singh, Anant Pande, Chinnasamy Ramesh, Kuppusamy Sivakumar and Vinod. B. Mathur 109
- Electrode materials for supercapacitors synthesized by sol–gel process**
Sunetra Dhere 109
- Plant diversity in cities: call for assessment and conservation**
Ashutosh Kumar Singh, Hema Singh and J. S. Singh 109
- Comparison of bioinspired computation and optimization techniques**
Muhammad Kashif Hanif, Ramzan Talib, Muhammad Awais, Muhammad Yahya Saeed and Umer Sarwar 110
- An optimal algorithm based on kinetic-molecular theory with artificial memory to solving economic dispatch problem**
Chaodong Fan, Jie Li, Lingzhi Yi, Leyi Xiao, Biaoming Zhu and Ke Ren 110
- Experimental study on the hydraulic fracture propagation in shale**
Shuai Heng, Chunhe Yang, Lei Wang and J. J. K. Daemen 111
- Microwave-assisted synthesis and characterization of oxime derivative of substituted chalcone and its nickel(II) complex**
Kusum Lata Dangwal and A. R. Semwal 111
- Soil quality and fibrous mineral in black soils of Maharashtra**
T. Bhattacharyya, S. K. Ray, P. Chandran, K. Karthikeyan and D. K. Pal 111

Portfolio mean-variance approach modifications: modulus function, principles of compromise, and ‘min–max’ approach

Alexey Karpovich¹ and Alexander Rymanov 112

Molecular interaction studies of phosphatidylcholine as drug delivery substrate for asenapine maleate

A. Harani¹, J. VijayaRatnam, B. Dipankar, D. Sathis Kumar, M. Bhagya Lalitha and S. P. N. Kumar 112

Optimization of factors affecting decolourization of sulphonated azo dye Red HE7B in vitro by Bacillus sp. Azo

Jyoti Kumar Thakur, Sangeeta Paul, Nishant K. Sinha and Maheshwar Singh Rathi 112

Forest cover monitoring and prediction in a Lesser Himalayan elephant landscape

S. P. S. Kushwaha, S. Nandy, M. A. Shah, R. Agarwal and S. Mukhopadhyay 113

Bt-cotton–vegetable-based intercropping systems as influenced by crop establishment method and planting geometry of Bt-cotton in Indo-Gangetic plains region

Sudhir K. Rajpoot, D. S. Rana and Anil K. Choudhary 113

Changes in water stability of soil aggregates in a solar greenhouse in different planted years and their relationship to iron oxide

Yin Yan, Pei Zhong-Jian, Xi Feng-Ming, Liang Cheng-Hua, Wang Jiao-Yue and Bing Long-Fei 114

Toxic aqueous discharge of iron and sulphur from spoiled coal mined lands and its control by phytostabilization process

A. K. Singh 114

Diversity and conservation status of mangrove communities in two areas of Mesocaribea biogeographic region

Ana Cano Ortiz¹, Carmelo M. Musarella, José C. Piñar Fuentes¹, Carlos J. Pinto Gomes³, Sara Del Río González⁴ and Eusebio Cano 115

Development of a model for detection of saline blanks amongst mangrove species on hyperspectral image data

Somdatta Chakravorty and Dipanwita Ghosh 115

Contrasting observation in culturable aerobic and micro-aerophilic heterotrophic fish gut-bacteria: intestine-breathing Lepidocephalichthys guntea (Hamilton Buchannan) versus gill-breathing Labeo rohita

Rudra Prasad Roy, Tilak Saha and Ranadhir Chakraborty 115

Bringing a women's perspective to family planning Sunita Sangar	116
Research productivity and international collaboration of top Indonesian universities Ahmad Darmadji, Lantip Diat Prasajo, Fitri Ayu Kusumaningrum and Yuli Andriansyah	116
Geological and geotechnical approach for excavation of large unlined rock cavern D. Singh, A. Mandal, A. Usmani and A. Nanda	117
Site-specific land resource inventory for scientific planning of Sujala watersheds in Karnataka Rajendra Hegde, K. V. Niranjana, S. Srinivas, B. A. Danorkar and S. K. Singh	117
Quantum dots for solar energy harvesting Karen Das and Sunandan Baruah	117
ESAT-6 Independent survival and virulence: need for paradigm shift? Raj Kumar Gour, Shikha Nag and Krishnasastry Musti	118
Modelling finite and infinite behaviour of cancer stages using Büchi and finite automata Natasha Singh and Ajay Kumar	118
Low-high temperature flue gas direct injection in south African bituminous and anthracite coals: sorption capacity assessment Major Mabuza, Kasturie Premlall, Maurice Onyango and Michael O. Daramola	118
Fluorosis is linked to anaemia Andezhath K. Susheela, Nisith Kumar Mondal, Rashmi Gupta, Mohini Sethi and Ravindra Mohan Pandey	119
Genomic variation mapping and detection of novel genes based on genome-wide survey of an elite upland cotton hybrid (<i>Gossypium hirsutum</i> L.) Zhenyu Wang, Wei Li, Guanghui Xiao, Xiaojian Zhou, Xiaoyu Pei, Yangai Liu, Kehai Zhou, Kunlun He, Junfang Liu, Ying Li, Wensheng Zhang, Zhongying Ren, Qingqin Meng, Haifeng Wang, Xiongfeng Ma and Daigang Yang	119
Estimation of elastic parameters, mineralogy and pore characteristics of Gondwana shale in Eastern India for evaluation of shale gas potential Piyush Sarkar, Kumar Hemant Singh, Ranjana Ghosh and Trilok Nath Singh	119
Assessing water footprints and virtual water flows in Gomti river basin of India Santosh S. Mali, D. K. Singh, A. Sarangi and S. S. Parihar	120
Large-scale shoreline undulations and role of self-organization processes Xiaoqing Zhong, Ping Dong and Shenliang Chen	120

Workforce challenges in Indian banking scenario – Journey from identification till mitigation	
Neha Chhabra Roy and T. Vishwanathan	121
Optic disc and cup segmentation in fundus retinal images using feature detection and morphological techniques	
R. Priyadharsini, A. Beulah and T. Sree Sharmila	121
A comparative study on biodegradation of chlorpyrifos by wild E. coli and Pseudomonas fluorescens bacterial isolates inhabiting different ecosystems of Kashmir valley	
Imtiyaz Murtaza, Bushra, Sageera Showkat, Shah Ubaid-Ullah , Omi Laila, Sumyra Majid, Neyiaz A. Dar, Mukhtar Ahmad and Girish Sharma	121
An improved microscopic method for the rapid diagnosis of emerging microsporidian parasite, Enterocytozoon hepatopenaei in shrimp farms	
P. Ezhil Praveena, T. Bhuvaneswari, A. Navaneeth Krishnan, V. Jagadeesan, J. Joseph Sahaya Rajan and K. P. Jithendran	122
Haematobiochemical parametrs of fishes of preferential nutritional habits	
Gayatri Acharya, Prafulla K. Mohanty, Sujata Puspamitra, Aryadhara Das and Sarbeswar Nayak	122
Crop productivity and suitability analysis for land-use planning in Himalayan ecosystem of Uttarakhand, India	
Vishwambhar Prasad Sati and Deng Wei	122
Mudbanks and fisheries along the Kerala coast – myth and reality	
S. Prasanna Kumar, P. K. Dinesh Kumar, K. R. Muraleedharan, Grinson George, Dayana Mathew, V. Kripa, R. Jeyabaskaran, N. Ramaiah, A. Gopalakrishnan and S. W. A. Naqvi	123
Antimicrobial coating of cotton twill tape with neem oil, eucalyptus oil and tulsi oil for medicinal application	
G. K. Balamurugan ¹ and S. Babuskin	123
Volume 115 - Issue 5, September 2018	
Electronic national agricultural markets: the way forward	
A. Amarender Reddy	124
Sustainable exploitation of building stone in India – emerging issues	
Abhishek Sharma, A. K. Mishra and B. S. Choudhary	124
Collaboration pattern in male breast cancer research	
Sandhya Dwivedi and K. C. Garg	124
Attrition of agents in Indian life insurance companies	
Neha Chhabra Roy and Samik Shome	125

Fluorosis and iodine deficiency disorders in India	125
Andezhath K. Susheela	
Rehabilitation device supporting active and passive upper limb exercises	125
Roman Trochimczuk, Tomasz Hućcio, Szymon Grymek and Dominika Szalewska	
Delineation of subtle and obscure structures in West Bengal Shelf: a remote sensing and GIS-based parallel approach	126
Subhobroto Mazumder, Kalyan Adhikari, Durga Shanker Mitra, Samiran Mahapatra and Krishan Kumar Singh Pangtey	
Marker to authenticate <i>Eurycoma longifolia</i> (Tongkat Ali) containing aphrodisiac herbal products	126
Jaya Vejjayan, Aini Norhidayah Mohamed, Amira Alia Zulkifli, Yasmin Amira Che Yahya, Norliana Munir and Mashitah M. Yusoff	
A simple method for the separation and detection of trace levels of buprofezin, flubendiamide and imidacloprid by NP-HPTLC and RP-HPTLC	126
B. Nareshkumar, Praveen U. Sangnalmath, S. Gayatridevi and K. Sreeramulu	
Ranking Mediterranean-type shrubs and trees by their allelopathic activity is not independent of how extract concentration is expressed	127
I. P. Pereira, L. S. Dias and A. S. Dias	
Capturing richness-independent phylogenetic diversity and testing surrogates in woody plant communities	127
B. Divya and K. Praveen Karanth	
Understanding sea ice melting via functional data analysis	127
Purba Das, Ananya Lahiri and Sourish Das	
Evaluation of school backpack prototype-based on gait parameters, energy expenditure and posture of students	128
Ishant Gupta, Parveen Kalra ¹ and Rauf Iqbal	
Obtaining 3D and 3D revert cultures of BMG-1 cell line for the analysis of cytokine expression differences	128
Maddaly Ravi and Aishwarya Subramaniyan	
Occurrence of <i>Fusarium</i> species in asymptomatic barley plants grown in field conditions under differential phosphate regimes	128
Mariela Echeverria, Maria Virginia Moreno and Carla Caputo	
Agronomic biofortification of zinc in wheat (<i>Triticum aestivum</i> L.)	129
Arvind Kumar, Manas Denre and Ruplal Prasad	

Cotton crop in changing climate	
A. Shikha, P. Maharana, K. K. Singh, A. P. Dimri and R. Niwas	129
Identification of potential areas for crops	
V. Ramamurthy, S. Chattaraj, S. K. Singh and R. P. Yadav	129
Applications of two-dimensional seismic tomography for subsurface cavity and dissolution features detection under Doon valley, NW Himalaya	
A. K. Mahajan	130
Study of a snow avalanche accident along Chowkibal–Tangdhar road in Kupwara district, Jammu and Kashmir, India	
H. S. Gusain, V. D. Mishra and D. K. Singh	130
Application of ICP-MS technique for analysis of heavy metals in LD slag fines	
Shrenivas Ashrit, Ravikrishna V. Chatti, S. Sarkar, R. Venugopal and G. Udayabhanu Nair	130
Preparation of nanosized bioapatite by cryogenic grinding from sintered scales of silver carp <i>Hypophthalmichthys molitrix</i> (Cuvier and Valenciennes)	
Ravneet, Gaurav Verma, Bandu Matiyal and Neha Thakur	131
Effect of temperature on minor invertebrate predator reduviid <i>Isyndus heros</i> (Fab.) (Hemiptera: Reduviidae)	
Rakshitha Mouly, T. N. Shivananda and Abraham Verghese	131

Volume 115 - Issue 6, September 2018

Uranium constraints in Pakistan: how many nuclear weapons does Pakistan have?	
Lalitha Sundaresan and Kaveri Ashok	132
Reducing resource disparity in healthcare resource allocation of laboratories in countries with limited resources by empowering policy-making and implementation	
Rahi Jain, Himank Ajmera and Bakul Rao	132
Floristic diversity, community composition and structure in Nanda Devi National Park after prohibition of human activities, Western Himalaya, India	
Vikram S. Negi, Lalit Giri and K. Chandra Sekar	133
An overview of cleaning and prevention processes for enhancing efficiency of solar photovoltaic panels	
Surajit Mondal, Amit Kumar Mondal, Abhishek Sharma, Vindhya Devalla, Sravendra Rana, Suresh Kumar and Jitendra Kumar Pandey	133
Entomophagy for nutritional security in India: potential and promotion	
Ruparao T. Gahukar	133

- Cryogenic measurement set-up for characterization of superconducting nano structures for single-photon detection applications**
Manju Singh, Rishu Chaujar and R. K. Rakshit 134
- Domestication and conservation efforts in *Haematocarpus validus* (Miers.) Bakh. f. ex Forman (Menispermaceae): an underutilized fruit species and natural colourant**
Pooja Bohra, Ajit Arun Waman, Debabrata Basantia, Hidangmayum Lembisana Devi and Ezekiel Reang 134
- MRI segmentation using Fuzzy C-means and radial basis function neural networks**
A. H. Rasooli, M. Ashtiyani, P. M. Birgani, S. Amiri, P. Mirmohammadi and M. R. Deevband 135
- Design and evaluation of a pneumatic metering mechanism for power tiller operated precision planter**
Sandip Mandal, G. V. Prasanna Kumar, Hetal Tanna and Arvind Kumar 135
- Sonar sensing predicated automatic spraying technology for orchards**
V. K. Tewari, Abhilash Kumar Chandel, Brajesh Nare and Satyaprakash Kumar 135
- Assessment of the viability of *Saccharomyces cerevisiae* in response to synergetic inhibition during bioethanol production**
Corli de Klerk, Elvis Fosso-Kankeu, L. Du Plessis and S. Marx 136
- Occurrence, severity and association of fungal pathogen, *Botrydiplodia theobromae* with sudden death or decline of tree bean (*Parkia timoriana*, (DC.) Merr) in North Eastern India**
A Ratankumar Singh, S. K. Dutta, S. B. Singh, T. Boopathi, S. Lungmuana, S. Saha, Vishambhar Dayal, Romila Akoijam, S. K. Sharma and N. Hemanta Singh 136
- Impact of cloud parameterization schemes on the simulation of cyclone Vardah using the WRF model**
C. P. R. Sandeep, C. Krishnamoorthy and C. Balaji 137
- Role of east–west shear zone and wind confluence on the occurrence of intense heavy rainfall over North Konkan during southwest monsoon season**
S. D. Sanap, S. Bhute and K. S. Hosalikar 137
- Mechanical properties and brittleness of shale with different degrees of fracturing-fluid saturation**
Zhenkun Hou, Marte Gutierrez, Anming Wang, Abdulhadi Almrabat and Chunhe Yang 138
- A novel approach to calculate braiding of a large alluvial river**
Lalit Saikia, Chandan Mahanta and Suranjana Bhaswati Borah 138
- Characterization of Hg-based ayurvedic drug *Kajjali*: classical and contemporary approaches**
Vinamra Sharma, Amiya K. Samal, Shruti Pandey, Anand K. Chaudhary and Rajesh K. Srivastava 138

Screening and enhancement of anaerobic germination of rice genotypes by pre-sowing seed treatments	
Dhonada Doley, Meghali Barua, Debojit Sarma and Purna K. Barua	139
Quality evaluation of pearl millet based pasta as affected by depigmentation	
Kirti Jalgaonkar, S. K. Jha and Manoj Kumar Mahawar	139
Adopt and adapt nature's design principles to create sustainable aquaculture systems	
Saleem Mustafa and Abentin Estim	140
Impact of growing medium composition on morphological development of chrysanthemum (Chrysanthemum morifolium Ramat cv. Snowball)	
Tanya Thakur, H. S. Grewal and S. S. Kukal	140

Volume 115 - Issue 7, October 2018

Necessity of 'two time zones: IST-I (UTC + 5 : 30 h) and IST-II (UTC + 6 : 30 h)' in India and its implementation	
Lakhi Sharma, S. De, P. Kandpal, M. P. Olaniya, S. Yadav, T. Bhardwaj, P. Thorat, S. Panja, P. Arora, N. Sharma, A. Agarwal, T. D. Senguttuvan, V. N. Ojha and D. K. Aswal	141
Tactical water management in field crops: the key to resource conservation	
C. S. Praharaj, Ummed Singh, S. S. Singh and N. Kumar	141
The necessity to develop a comprehensive feed library for livestock production in south Asia	
A B. V. Ramana, Abu Sadeque Md. Selim and Luis O. Tedeschi	142
Oxidized lipoproteins as the diagnostic target for cardiovascular diseases	
S. Sreeja, Anand Manoharan and Krishnan Venkataraman	142
Lumen anatomy and localization of Wolbachia sp. in the thrips, Plicothrips apicalis (Bagnall)	
Singh Ambika and Raman Rajagopal	142
Preparation and characterization of PLGA-based biocompatible nanoparticles for sustained delivery of growth factor for wound healing applications	
E. Santhini, V. M. Pramila, M. Shalini, R. Vignesh Balaji and K. P. Chellamani	143
Expression of alpha-synuclein during eye development of Bufo arabicus	
Amin A. Seleem and Fakhr El-Din M. Lashein	143
Intratumoural and peritumoural lymphangiogenesis in canine mammary tumour linked to tumour spread and poor survival	
Parmeet Pal Singh, Naresh Kumar Sood, Kuldip Gupta and Deepti Narang	143
Photo-thermal effects on time to flowering in dolichos bean (Lablab purpureus (L). sweet) var. lignosus	
C. M. Keerthi, S. Ramesh, M. Byregowda, A. Mohan Rao and G. A. Mary Reena	143

- Redox structure of Vindhyan hydrosphere: clues from total organic carbon, transition metal (Mo, Cr) concentrations and stable isotope ($\delta^{13}\text{C}$) chemistry**
Arvind K. Singh, Partha Pratim Chakraborty and Subir Sarkar 144
- Eschewing poisons: an ingenious wisdom of foraging macrofungi by Karbi ethnic group in North East India**
Prila Hansepi and Robindra Teron 145
- Automatic crater classification framework based on shape parameters**
Suchit Purohit, Savita Gandhi and Prakash Chauhan 145
- Climate resilient agriculture in Manipur: status and strategies for sustainable development** S. S. Roy, M. A. Ansari, S. K. Sharma, B. Sailo, Ch. Basudha Devi, I. M. Singh, Anup Das, D. Chakraborty, A. Arunachalam, N. Prakash and S. V. Ngachan 145
- Identification of weather events from INSAT-3D RGB scheme using RAPID tool**
A. K. Mitra, Shailesh Parihar, R. Bhatla and K. J. Ramesh 146
- Analysis of WorldView-2 band importance in tree species classification based on recursive feature elimination**
Huaipeng Liu, Huijun An and Yongxin Zhang 146
- Effect of humic acid application rates on physicochemical and fertility properties of sandy loam soil grown with mung bean under different irrigation water regimes**
Abdulmohsin R. Al-Shareef, Saleh M. Ismail and Fathy S. El-Nakhlawy 147
- Morphological, cytological, palynological and molecular characterization of certain *Mangifera* species**
M. Sankaran, M. R. Dinesh, N. Chaitra and K. V. Ravishankar 147
- The height of fractured zones caused by strip Wongawilli mining in a shallow buried coal seam underlying a hard roof**
Yi Tan, Wenbing Guo, Erhu Bai and Daming Yang 148
- Milk proteins, health issues and its implications on National Livestock Breeding Policy of India**
Ashish Kumar, Bakul Rao and Arun Kumar De 148

Volume 115 - Issue 8, October 2018

- Exploitation of heterobeltiosis and economic heterosis for horticultural yield, and its attributes and biochemical traits in pumpkin (*Cucurbita moschata* Duch. ex. Poir) under salt affected soil**
Vimlesh Kumar, D. P. Mishra, G. C. Yadav and Satish Yadav 149
- Estimates of losses caused in paddy due to rice hispa, *Dicladispa armigera* (Oliver) (Coleoptera: Chrysomelidae)**
Urvi Sharma and Ajai Srivastava 149

Effect of light interception and penetration at different levels of fruit tree canopy on quality of peach	
Yamini Sharma, Harminder Singh and Sompal Singh	149
Ground surface warming in peninsular India: evidence from geothermal records	
Vyasulu V. Akkiraju, Sukanta Roy and Shalivahan	150
Bank material characteristics and its impact on river bank erosion, West Tripura district, Tripura, North-East India	
Moujuri Bhowmik, Nibedita Das (Pan) , Champakali Das, Istak Ahmed and Jatan Debnath	150
Garnetiferous metamorphic rocks in Jaspa granite, Himachal Pradesh, India: implication of Tethyan Himalayan metamorphism and tectonics	
S. S. Thakur, A. K. Singh, D. Rameshwar Rao, Rajesh Sharma, Subhajit Pandey and Aliba	150
Fish short-term reproductive assay for evaluating the estrogenic property of a commonly used antioxidant, butylated hydroxyanisole	
George Paul, R. N. Binitha and Francis Sunny	151
Biological suppression of coconut black headed caterpillar <i>Opisina arenosella</i> outbreak in East Godavari district of Andhra Pradesh – eco friendly technology	
N. B. V. Chalapathi Rao, A. Nischala, G. Ramanandam and H. P. Maheswarappa	151
Forest laws, for whom, by whom? A concept mapping study of the Ecologically Fragile Lands Act, 2003 in Wayanad, Kerala, India	
Jiss K. Varkey, S. Gopakumar, K. Vidyasagar, Joy Mathew and A. V. Santhosh Kumar	151
Scientific contribution of Professor Mahalanobis: a bio-bibliometric study	
Dhiman Mondal, Nitai Raychoudhury and Juran Krishna Sarkhe	152
Research preferences of the G20 countries: a bibliometrics and visualization analysis	
Gege Lin, Zhigang Hu and Haiyan Hou	152
A brief history of solitons and the KdV equation	
Alex Kasman	152
Fourth-generation refrigerant: HFO 1234yf	
Pinklesh Arora, Geetha Seshadri and Ajay Kumar Tyagi	153
First-principles study of the electronic, magnetic and structural properties of ZnO and Zn_{1-x}Cr_xO (x = 0.125, 0.25, 0.375, 0.5) in the room temperature wurtzite structure	
Sarajit Biswas	153
Automatic recognition of acute lymphoblastic leukemia using multi-SVM classifier	
Pouria Mirmohammadi, Amirhossien Rasooli, Meghdad Ashtiyani, Morteza Moradi Amin and Mohammad Reza Deevband	153

Bacillus amyloliquefaciens (VB7) with diverse antimicrobial peptide genes: A potential antagonist for the management of fairy ring spot in carnations	154
S. Vinodkumar and S. Nakkeeran	
Pollution and environmental stressors modulate the microbiome in estuarine mangroves: a metagenome analysis	154
Mandar S. Paingankar and Deepti D. Deobagkar	
Udaria – a new liverwort genus of Lophocoleaceae from Eastern Himalaya, India	155
D. K. Singh, Shuvadeep Majumdar and Devendra Singh	
Statistical analysis of performance in SMEs	155
Gaban Lucian, Masca Ema, Morar Dan Ioan, Fatacean Gheorghe and Moscviciov Andrei	

Volume 115 - Issue 9, November 2018

Periodic table of elements revisited for accommodating elements of future years	155
M. C. Rath	
Biobusiness in brief: what ails clinical trials?	156
Gayatri Saberwal	
Bibliometric and social network analysis in scientific research on precision agriculture	156
José Luis Aleixandre-Tudó, Lourdes Castelló-Cogollos, José Luis Aleixandre and Rafael Aleixandre-Benavent	
Occurrence of ice-bonded sediments in the Mackenzie Trough, Beaufort Sea	156
Young-Gyun Kim, Young Keun Jin, Sookwan Kim, Seung-Goo Kang and Jong Kuk Hong	
Ground-based observations for the upper atmosphere at Jang Bogo Station, Antarctica: preliminary results	157
Ji Eun Kim, Jeong-Han Kim, Geonhwa Jee, Changsup Lee, Hyuck-Jin Kwon, Young-Bae Ham, Terence Bullett, Qian Wu, Justin Mabie and Nikolay Zaboltn	
Palaeolimnological records of regime shifts from marine-to-lacustrine system in a coastal Antarctic lake in response to post-glacial isostatic uplift	157
Badanal Siddaiah Mahesh ¹ , Abhilash Nair, Anish Kumar Warriar, Anirudha Avadhani, Rahul Mohan and Manish Tiwari	
Effects of vertically propagating mountain waves during a strong wind event over the Ross Ice Shelf, Antarctica	158
Sheeba Nettukandy Chenoli, John Turner ⁴ and Azizan Abu Samah	
Population dynamics of bacterioplanktonic component associated with the phytoplankton biomass in Kongsfjorden, an Arctic fjord	158
Rupesh Kumar Sinha, K. P. Krishnan ¹ and Savita Kerkar	

- Draft genome sequence of a novel actinobacterium from the family Intrasporangiaceae isolated from Signy Island, Antarctica**
S. M. Thomas, P. Convey, H. M. Gan, D. A. Pearce and G. Y. A. Tan 158
- Effects of field warming on a High Arctic soil bacterial community: a metagenomic analysis** P. J. Lim, K. K. Newsham, P. Convey, H. M. Gan, W. C. Yew and G. Y. A. Tan 159
- Analysis of bacterial communities of King George and Deception Islands, Antarctica using high-throughput sequencing**
C. Y. Chua, S. T. Yong, M. A. González, P. Lavin, Y. K. Cheah, G. Y. A. Tan and C. M. V. L. Wong 159
- Genome sequences of two cold-adapted *Cryobacterium* spp. SO1 and SO2 from Fildes Peninsula, Antarctica**
C. P. Teoh, C. M. V. L. Wong, D. J. H. Lee, M. A. González, N. Najimudin, P. C. Lee and Y. K. Cheah 159
- Microbial eukaryotic diversity with emphasis on picoprasinophytes under the sea ice of the central Arctic Ocean in summer**
Wei Luo, Huirong Li, Xiaoyan Gao, Ling Lin, Yong Yu and Yinxi Zeng 160
- The malaise of under-representation of women in science: the Indian story**
Charu Malhotra 160
- Tree-based classification of tabla strokes**
Subodh Deolekar and Siby Abraham 160
- Photocatalytic degradation of aqueous phenanthrene in a slurry photocatalytic reactor: optimization and modelling**
C. Nirmala Rani and S. Karthikeyan 161
- Microbial biomass carbon and nitrogen in relation to cropping systems in Central Himalaya, India**
Kirtika Padalia, S. S. Bargali, Kiran Bargali and Kapil Khulbe 161
- Population dynamics of *Betula ermanii* in response to climate change at the Changbai Mountain treeline, China**
Xiaodong Wang, Weihua Dong, Huiqing Liu, Zhengfang Wu, Weihong Fan and Junhu Dai 161
- Semi-empirical model for predicting pot-hole depth in underground coal mining**
Lokhande D. Ritesh, V. M. S. R. Murthy and Singh Kalendra 162
- Development of a unique full-scale real-fire façade testing facility at IIT Gandhinagar**
Gaurav Srivastava, Chinmay Ghoroi, Pravinray Gandhi, V. Jagdish, G. Karthikeyan, Aravind Chakravarthy and Dharmit Nakrani 162

10Be/9 Be ratios of Cauvery river delta sediments, southern India: implications for palaeo-denudation rates in the catchment and variation in summer monsoon rainfall during Late Quaternary

Soumya Prakash Dhal, S. Balakrishnan, Pankaj Kumar, Pramod Singh, Alok Sharan and Sundeep Chopra

162

Monitoring of total volatile organic compounds and particulate matter in an indoor environment

Manisha Gaur, Kirti Bhandari and Anuradha Shukla

163

Developing a management plan for Loktak Lake considering Keibul Lamjao National Park and hydropower demand using a data driven modeling approach

Kh. Eliza, R. Khosa, A. K. Gosain and A. K. Nema

163

Rift assessment and potential calving zone of Amery Ice Shelf, East Antarctica

Simone Darji, Sandip R. Oza, R. D. Shah, B. P. Rathore and I. M. Bahuguna

164

Phenology of a temperate fern *Dryopteris wallichiana* (Spreng.) Hyl. (Dryopteridaceae) in Uttarakhand, India

N. Punetha, J. N. Pant, R. Punetha and K. Bhakuni

164

Volume 115 - Issue 10, November 2018

A decade of OSDD for TB: role and outcomes

Nisha Chandran and Samir K. Brahmachari

164

Expansion of boro rice in Meghalaya using space technology

Pratibha T. Das, B. K. Handique and P. L. N. Raju

165

Pivotal 20th century contributions to the development of the Anthropocene concept: overview and implications

Ricardo A. Correia, Zeynep C. H. Correia, Ana C. M. Malhado and Richard J. Ladle

165

Modern technologies for sustainable food and nutrition security

P. C. Kesavan and M. S. Swaminathan

165

Automation in transplanting: a smart way of vegetable cultivation

Abhijit Khadatkar, S. M. Mathur and B. B. Gaikwad

166

Synthesis and biological activities of some condensed oxazine and pyrimidine derivatives: cyclization, ring transformation and functionalization of oxazine

Reda A. Haggam, Essam Abdelghani Soylem, Mohammed Gomaa Assy and Mariam Fikery Arastiedy

166

Bubble size prediction in gas–solid fluidized beds using genetic programming

R. R. Sonoliker, M. P. Patil, R. B. Mankar, S. S. Tambe and B. D. Kulkarni

167

- Application of the ecological footprint method for measuring sustainability of agricultural land use at a micro level in Bardhaman district, West Bengal, India**
Biswajit Ghosh and Namita Chakma 167
- Biological control of potato tuber soft rot using N-acyl-L-homoserine lactone-degrading endophytic bacteria**
Nguyen Thanh Ha, Tran Quang Minh, Pham Xuan Hoi, Nguyen Thi Thanh Thuy, Naruto Furuya and Hoang Hoa Long 167
- Analysis of in vitro and in silico anti-hyperglycaemic action of bioflavonoids isolated from different citrus peels**
A Sanmuga Priya, P. Senthamil Selvan and A. Syed Arshad 168
- Fusion of multispectral and panchromatic data using regionally weighted principal component analysis and wavelet**
J. Jayanth, T. Ashok Kumar and Shivaprakash Koliwad 168
- Data visualization by alluvial diagrams for bibliometric reports, systematic reviews and meta-analyses**
Andy Wai Kan Yeung 169
- Prevalence and risk factors of hypertension among Mizo population: a population-based epidemiological study from North East India**
Prasanta K. Borah, Suman K. Paine, Hem Ch Kalita, Dipankar Biswas, Dilip Hazarika, Chandra K. Bhattacharjee and Jagadish Mahanta 169
- Comparative expression analysis of defence-related genes in Bacillus-treated Glycine max upon challenge inoculation with selective fungal phytopathogens**
Shekhar Jain, Anukool Vaishnav, Ajit Varma and Devendra Kumar Choudhary 169
- Soil microbial characteristics in sub-tropical agro-ecosystems of North Western Himalaya**
Rahul Singh, D. R. Bhardwaj, Nazir A. Pala, Rajesh Kaushal and Bhalendra Singh Rajput 170
- Distribution pattern and population characteristics of *Impatiens johnii* E. Barnes, a stenotopic endemic and endangered Balsam in the mountain landscape of Munnar, Kerala, India**
G. Prasad, P. Rajan, V. T. Antony and P. K. Shaji 170
- The host range of multi-host endophytic fungi**
T. S. Suryanarayanan, P. T. Devarajan, K. P. Girivasan, M. B. Govindarajulu, V. Kumaresan, T. S. Murali, T. Rajamani, N. Thirunavukkarasu and G. Venkatesan 170
- Monitoring and analysis of ground subsidence and backfill stress distribution in Jinchuan Mine, China**
Rong Lu, Fengshan Ma, Jie Guo and Haijun Zhao 171

- Role of biotechnology in conservation and utilization of agricultural biodiversity**
Kanupriya and V. Radhika 171
- Research performance of the National Institutes of Technology in India**
Sumit Kumar Banshal, Tanu Solanki and Vivek Kumar Singh 172
- An analysis of biographical information on National Bioscience awardees from 1999 to 2016**
Inderpal Singh 172
- Omega automata and its classes**
Natasha Singh and Ajay Kumar 172
- Alternative sources of soil organic amendments for sustaining soil health and crop productivity in India – impacts, potential availability, constraints and future strategies**
A. K. Indoria, K. L. Sharma, K. Sammi Reddy, Ch. Srinivasarao, K. Srinivas, S. S. Balloli, M. Osman, G. Pratibha and N. S. Raju 173
- Multilayer perceptron and evolutionary radial basis function neural network models for discrimination of HIV-1 genomes**
Ashok Kumar Dwivedi and Usha Chouhan 173
- Density functional theory-based quantum rationalization of flavones from *Oroxylum indicum*, their correlation with redox effect, molecular interaction studies and osmotic hemolysis**
Nusrat Masood, Akhilesh Kumar Yadav, Naresh Kumar, Madan Mohan Gupta and Suaib Luqman 173
- Prevalence of extended spectrum beta-lactamases among Enterobacteriaceae isolated from intrahospital patients in Serbia**
Slavica S. Ćirić, Dragana I. Stanišić, Božidar N. Milošević, Zoran Ž. Ilić and Zvonko Lj. Spasić 174
- Health-related analysis of uranium in Fazilka district, Punjab, India**
Saurabh Narang, Deepak Kumar and Ajay Kumar, 174
- Comparison of traditional grow-out test and DNA-based PCR assay to estimate F1 hybrid purity in cauliflower**
Arpita Pattanaik, D. C. Lakshmana Reddy, S. Ramesh and Aswath Chennareddy 175
- Artificial seed for short-term storage: using nodal buds in *Aquilaria malaccensis* Lam. Seram**
Devika Devi, Bateimon Kharsahnoh, Suman Kumaria and Meera C. Das 175
- Bacterial diversity at a shallow-water hydrothermal vent (Espalamaca) in Azores Island**
Rajasabapathy, Chellandi Mohandass, Raul Bettencourt, Ana Colaço, Joana Goulart and Ram Murti Meena 175

Public acceptance study of environmentally suitable landfill sites Debishree Khan, Atul Kumar and Sukha Ranjan Samadder	176
Thiamine an unexplored, ecologically hormonizable, nontoxic catalyst for benzoylation Deepak Chowrasia and Nisha Sharma	176
Degraded products of stem bromelain destabilize aggregates of β-amyloid peptides involved in Alzheimer's disease Debratna Mukherjee, Payel Bhattacharjee, Reema Bhattacharya, Alok K. Dutta and Debasish Bhattacharyya	176
Responses of short-nosed fruit bat, <i>Cynopterus sphinx</i> (Vahl 1797) towards distress calls of their conspecifics from related and unrelated sites: implications for building a social relationship A. F. P. Allwin Mabes Raj, K. Emmanuvel Rajan and H. Raghuram	177
Performance analysis of South-Indian mushroom units: imperative policy implications for their preparedness for global competitiveness Mahantesh Shirur, N. S. Shivalingegowda, M. J. Chandregowda and Rajesh K. Rana	177
Enumeration of total virioplankton and isolation of specific cyanophages from selected aquatic ecosystems in Goa, India Judith Miriam Noronha, Amara Begum Mulla, Manguesh U. Gauns and Sanjeev C. Ghadi	178
Response of methane diffusion in varying degrees of deformed coals to different solvent treatments Pengpeng Li, Xiaodong Zhang and Shuo Zhang	178

Volume 115 - Issue 12, December 2018

Kallar elephant corridor in the Western Ghats, India: trend of human interface vis-à-vis feasibility of wildlife-friendly flyover and land acquisition Neha Midha, N. Krishna Kumar, D. Boominathan, Samuel Thomas and Chhavi Jain	178
Host-Plasmodium interaction: role of RNAi Rohit Shrivastava and S. Rajasubramaniam	179
Detection of solar cycle signal in the tropospheric temperature using COSMIC data V. Kumar, S. K. Dhaka, V. Panwar, Narendra Singh, A. S. Rao, Shristy Malik and S. Yoden	179
Hybrid Bt cotton: a stranglehold on subsistence farmers in India Andrew Paul Gutierrez	179
DOMIS: a decision support system for design and cost estimation of micro-irrigation systems Neelam Patel, T. B. S. Rajput, Deepak Kumar Dinkar, Sita Ram and Sushil Kumar Singla	180

Evapotranspiration and crop coefficient of okra under subsurface drip with and without plastic mulch	<i>180</i>
Ashish Patil and K. N. Tiwari	
Impact of open burning of crop residues on air pollution and climate change in Indonesia	<i>180</i>
Ade Andini, Sébastien Bonnet, Patrick Rousset and Udin Hasanudin	
Assessment of co-contamination in soil samples from agricultural areas in and around Lucknow city, Uttar Pradesh, India	<i>181</i>
Arpna Ratnakar and Shikha	
Growth profile of <i>Chaetoceros</i> sp. and its steady state behaviour with change in initial inoculum size: a modelling approach	<i>181</i>
Sayani Kundu, Joyita Mukherjee, Farhana Yeasmin, Samarpita Basu, Joydev Chattopadhyay, Santanu Ray and Sabyasachi Bhattacharya	
Synthetic modulation including structure establishment, antiproliferative activity of some p-aryl substituted (Z)-2-cyanoethylideneacetohydrazides, and their structure activity relationship	<i>182</i>
Deepak Chowrasia, Nisha Sharma, Ajay Kumar, Md Arshad, Sahabjada Siddiqui, Asif Jafri and Juhi Rahis	
Absolute age evidence of Early to Middle Ordovician volcanism in Peninsular Malaysia	<i>182</i>
Long Xiang Quek, Azman A. Ghani , Yu-Ming Lai, Hao-Yang Lee, Mokhtar Saidin, Muhammad Hatta Roselee, Muhammad Hafifi Badrudin, Meor H. Amir Hassan, Jasmi Hafiz Abdul Aziz, Tham Fatt Ng , Muhammad Afiq Muhammad Ali and Mohamad Tarmizi Mohamad Zulkifley	
Late Pleistocene relative sea-level changes from Saurashtra, west coast of India	<i>182</i>
S. P. Prizomwala, Gunjan Yadav, Nilesh Bhatt and Komal Sharma	
Mesoscale model compatible IRS-P6 AWiFS-derived land use/land cover of Indian region	<i>183</i>
Biswadip Gharai, P. V. N. Rao and C. B. S. Dutt	
Development of a bird habitat resource classification scheme based on vegetation structure analysis	<i>183</i>
Peter S. Lee and Brendan G. Mackey	
Fruit predation and adaptive strategies of <i>Garcinia imberti</i>, an endangered species of southern Western Ghats	<i>183</i>
M. Anto, P. S. Jothish, M. Angala and C. Anilkumar	
Trash on the menu: patterns of animal visitation and foraging behaviour at garbage dumps	<i>184</i>
Gitanjali Katlam, Soumya Prasad, Mohit Aggarwal and Raman Kumar	

Science-based mandatory standards and the implementation gap: the case of bottled water regulations in India

Aviram Sharma

Keywords: Bottled water, implementation gap, regulation-making, science-based standards

Abstract

Science-based standards and regulation-making is not a new phenomenon in India. In fact, Indian regulatory institutions have been developing standards and evolving in multiple areas over many decades. However, even mandatory standards are not easily enforceable in several cases, and often an 'implementation gap' has been reported. The present article explores this critical aspect of regulation-making exercise in India by considering the case of bottled water. The article analyses the regulatory governance of bottled water quality standards promulgated by the Bureau of Indian Standards. The findings could be useful for Indian industry, regulators, science administrators and the government

An overview of Reusable Launch Vehicle Technology Demonstrator

K. Sivan and S. Pandian

Keywords: Flush air data system, hypersonic flight test, Reusable Launch Vehicle Technology, winged-body configuration.

Abstract

After the successful operationalization of Polar Satellite Launch Vehicle and Geo Synchronous Launch Vehicle, the Indian Space Research Organisation is in the process of developing Reusable Launch Vehicle technologies to achieve low-cost access to space. Towards this programme, a winged body configuration was conceived, which can fly at subsonic, supersonic and hypersonic Mach number regime, re-enter into the earth's atmosphere and simulate the landing manoeuvre. The aerodynamic design, analysis and wind-tunnel testing, aerothermal and structural design, analysis and testing were carried out. Suitable solid motor with slow burn rate propellant was developed. Mission design, guidance and control schemes were implemented. In order to meet the above objectives, certain technologies and infrastructure were developed. The entire subsystems were integrated and a large number of flight measurements were made in the maiden successful flight of Reusable Launch Vehicle Technology Demonstrator in May 2016. The flight measurements and flight performance indicated that the design philosophy, testing schemes and approaches followed are in order, thus providing confidence to proceed to the next logical step in the development of Reusable Launch Vehicle Technologies.

Aerodynamic design, characterization and flight performance of RLV-TD

G. Vidya, K. Manokaran, V. R. Ganesan, M. Prasath, Sundeepkumar Epuri, P. Balasubramanian, C. Babu, B. Venkatasubrahmanyam and Priyankar Bandyopadhyay

Keywords: Aerodynamic design and characterization, ascent and descent phases, flight performance, Reusable Launch Vehicle, wing body.

Abstract

Complete aerodynamic design and characterization of ascent as well as descent phases of Reusable Launch Vehicle-Technology Demonstrator (RLV-TD) have been obtained through thousands of wind tunnel tests, flow simulations using various computational fluid dynamic codes and tailor-made engineering codes. The evolution of the ascent and descent designs, aerodynamic characterization and flight performance is presented in this article. The flight data comparison of aerodynamic

coefficients, control surface loads, pressure distribution and external acoustic levels with preflight data is good and therefore, providing confidence in using the ground-based data generation techniques along with defined dispersion bands. Some of the minor deviations in the performance observed in flight were resolved/understood in the post-flight analysis, whereas few effects observed in flight need further understanding.

Aerothermal design, qualification and flight performance

T. Sivamurugan, P. Anoop and S. L. N. Desikan

Keywords: Heat flux, reusable launch vehicle, temperature, thermal protection system.

Abstract

Reusable Launch Vehicle-Technology Demonstrator (RLV-TD) experiences severe thermal environment during its ascent as well as re-entry into the atmospheric regime. Structures should be designed to withstand this thermal load. Thermal environments were estimated for RLV-TD and depending on the peak heat flux and heat load, hot structure design for nose cap, wing, vertical tail and control surfaces was developed. Thermal protection system (TPS) using silica tile and flexible insulation was designed to protect the windward and leeward regions respectively. It is essential to verify and establish the design and also physically corroborate the actual thermal performance. Besides the design, the hot structures and TPS functionality as a system has to be qualified and thereby yield full confidence on the total performance during flight. To qualify the hot structures and TPS, various qualification tests were undertaken. The demonstration of their fly-ability and qualification under the combined effect of structural and thermal load was carried out successfully for all structures. This article provides details of aerothermal design of RLVTD and various qualification tests carried out.

Comparison of the estimated structure temperatures with measured temperatures in flight shows the robustness of the design methodologies adopted.

Flush air data sensing system

N. Shyam Mohan, M. Jayakumar, T. Sivamurugan , K. C. Finitha1 , S. B. Vidya , Jayanta Dhoaya , N. Remesh , M. Prasath, Shashi Krishna and Aisha Sidhique

Keywords: Angle of attack, flushed air data system, hypersonic flight vehicles, subsonic, wind tunnel.

Abstract

Flush air data sensing system (FADS) forms a mission-critical subsystem in re-entry vehicles. It makes use of surface pressure measurements from the nose cap of the vehicle for deriving air data parameters such as angle of attack, angle of sideslip, Mach number, etc. of the vehicle. These parameters are used by the flight control and guidance systems, and also assist in the overall mission management. The overall system engineering of FADS, including selection of pressure transducers, tubing size, port geometry, FADS algorithm and associated processing electronics along with the integration scheme is addressed in this article. Details of the qualification tests carried out in wind tunnel for end-to-end verification of the entire FADS system are covered in brief. Majority of the tests were carried out in a low-speed wind tunnel at a wind speed of 65 m/s (Mach number 0.2). The flight performance of FADS is also discussed in this article.

Development of slow-burning solid rocket booster for RLV-TD hypersonic experiment

Achutananda Parhi, V. Mahesh, Khadarvoli Kalluru, S. Reshmi, R. Harikrishnan, V. M. Lakshmi, J. Paul Murugan and Renjith Kumar Reddy

Keywords: Burning rate, igniter, motor case, performance prediction, solid rocket booster.

Abstract

This article discusses the developmental challenges of the low-thrust, long-duration solid rocket motor for the launch of the experimental Reusable Launch Vehicle-Technological Demonstrator (RLV-TD). The main challenges were: (1) developing a motor case and subsystems with low inert mass; (2) design of an optimum nozzle such that the motor can have maximum specific impulse at atmospheric conditions, but with no flow separation at low operation pressures; (3) developing a slow-burning propellant (3 mm/s) to meet the mission requirements; (4) design of propellant grain for the motor so that it has long burning time, the vehicle experiences low dynamic pressure at the transonic regime, and the motor is without combustion instability; (5) developing necessary thermal protection system to take care of long-duration operations, and (6) developing the igniter to ensure the ignition of the motor, especially when easy ignition is difficult with slow-burning propellants and that there should be sufficient overlap of igniter functioning with motor initiation. Performance of the motor in flight indicated that the design met all the required criteria within the expected tolerance.

Integrated electrohydraulic control actuation system with centralized power plant for the Reusable Launch Vehicle Technology Demonstrator

V. Masilamani, Manoj Kumar, S. Sankar Narayan, N. Raghu, M. N. Namboodiripad and T. Mookiah

Keywords: Aerodynamic control surfaces, control electronics, electrohydraulic actuation system, hydraulic power unit, servo design.

Abstract

An electrohydraulic control actuation system for actuating eight aerodynamic control surfaces of the two-stage technology demonstrator of the Indian reusable launch vehicle (RLV-TD) was developed, validated by extensive testing in various test beds, simulation runs and flight proven in the RLV-TD HEX-01 mission flight on 23 May 2016. A centralized hydraulic power generating unit (HPU) was used for powering the eight actuators located in two stages. The network of plumbings and control components of this actuation system were required to be laid out over the entire length and breadth of the vehicle measuring 17 m in length, to distribute the hydraulic power to all the actuators. The hydraulic actuation system had to work for the longest ever duration of 833 s for an Indian launch vehicle. Many challenges arose due to a single HPU for two stages, long complex network of plumbings, longest ever operating duration, thermal issues, second-stage structure resembling an aircraft, limited occupancy for operations at the launch pad, limited power source, etc. Necessary provisions were incorporated in the design to successfully overcome them. This article describes the development of the control actuation system.

Mission design and performance of RLV-TD

Jyothish R. Pillai, M. Mutyala Rao, P. Bhanumathy, Vijith Mukundan, Jaison Joseph, A. K. Anil Kumar, C. Ravikumar and Abhay Kumar

Keywords: Flight performance, reusable launch vehicles, mission design, pre-flight predictions.

Abstract

Renewed interest in re-usable launch vehicles has led to the evolution of technology demonstration concepts, where the prime objective is to demonstrate new technologies at reduced cost and shorter turnaround time. This article presents details of both ascent and descent mission design of a low-cost Reusable Launch Vehicle Technology Demonstration (RLV-TD) programme. The technology demonstrator vehicle is boosted to hypersonic Mach number using a solid booster. During ascent phase, the vehicle was flown in a gravity turn trajectory to minimize structural loads on it. In the descent phase, an optimum angle of attack profile as a function of Mach number was computed to limit dynamic pressure, load factor and achieve vehicle trim with minimum control surface

deflection. The mission design parameters were evaluated using Monte Carlo analysis utilizing six degrees of freedom simulations. Comparison of actual flight performance with pre-flight prediction is also made in this article. Flight performance exhibits close match with the pre-flight predictions.

Integrated navigation, guidance and control system and validation

Arindam Barua, M. P. Premchand, R. Vishnu, Prabhat Kumar Dubey, Jayachitra, Ambili K. Gopinath, S. Anitha, Renjith Keezhoth, Anil P. Madeckal, D. Karthikeyan, Sheethal Antony, J. Suresh Babu, R. Manohara Rao, I. Sudar and E. S. Padmakumar

Keywords: Control, guidance, integrated simulation, navigation, Reusable Launch Vehicles, validation.

Abstract

The navigation, guidance and control (NGC) system of Reusable Launch Vehicle – Technology Demonstrator (RLV-TD) is the most complex system ever flown in ISRO's launches. It includes a navigation system employing traditional inertial navigation system along with global positioning system aiding and radar altimeter, ceramic servo accelerometer package, angle of attack-based control, different control systems, including secondary injection thrust vector control, reaction control system and aero control surfaces. Closed loop simulations of integrated NGC system of RLV-TD are of utmost importance to ensure mission success by assessment of system performance in nominal and off-nominal flight conditions. Validation is achieved through progressive evaluations in different levels of integrated simulation, namely autonomous simulations, software in loop simulation, on-board processor in loop simulation, hardware in loop simulation and actuator in loop simulation using Iron Bird test facility. This article discusses the overall NGC system, challenges faced during the realization of the simulation test bed, including system design to validate the new on-board elements, commissioning of Iron Bird facility and validation through various phases of simulation. The outcome of these simulations played a crucial role in bringing about improvements and helping in the evolution of the on-board system to the final configuration, ensuring the success of the mission.

An end-to-end airframe structural system design

B. P. Deepak, T. Manojkumar, A. Prashanthan, R. Suresh, Philip K. Mathew, M. I. Junaidh, S. Rajendran, B. S. Raju and C. K. Krishnadasan

Keywords: Airframe structure, integrated design cycle, reusable launch vehicle, thermal protection system.

Abstract

Design of aerospace reusable launch vehicle (RLV) structures offers diverse challenges due to stringent specifications in geometry, structural mass, integrity for thermal protection system and interfaces with propulsion, avionics and power systems. Airframe structures for RLVs should cater to the specified strength, stiffness and stability, and meet the functional and integration requirements of aerospace vehicles. To address these challenges, an integrated design cycle comprising load estimation, layout design, torsion box analysis and sizing of structural components is devised and presented. Verification of structural design is done by structural and thermo-structural analyses of the integrated airframe. Qualification of the airframe by integrated airframe test, thermostructural test and acoustic test is also discussed.

Development of large-sized Titanium alloy Ti6Al4V and nickel-based superalloy Inconel-718 forgings for Reusable Launch Vehicle-Technology Demonstrator flight

R. K. Gupta, V. Anil Kumar, P. Ramkumar and U. V. Gururaja

Keywords: Aerospace alloys, forging, microstructure, ultrasonic quality.

Abstract

Ti6Al4V owing to its high specific strength and Inconel-718 due to its high strength and oxidation resistance at elevated temperatures, have been used in Reusable Launch Vehicle-Technology Demonstrator (RLV-TD). Achieving required properties in large cross-section aerospace quality forgings of these alloys is challenging and has not been reported earlier. Hence, thermo-mechanical processing cycles have been devised to realize forgings of ~1400 mm length in these alloys and successfully used in RLV-TD. Forgings of these alloys having desired microstructures and ultrasonic quality of Class-A1 as per AMS 2630 B standard have been realized. This article discusses the processing challenges and solutions thereof.

Ceramic coating on flexible external insulation blankets for reusable missions

Deepa Devapal, M. P. Gopakumar, P. V. Prabhakaran and S. Packirisamy

Keywords: Emissivity, flexible external insulation, protective ceramic coating, reusable missions.

Abstract

Flexible thermal protection material (flexible external insulation; FEI) is used in the Reusable Launch Vehicle-Technology Demonstrator (RLV-TD) leeward region where multiple curvatures are present. FEI configuration has silica cloth layers on either side with Cerablanket felt sandwiched and stitched together using quartz thread. FEI should ensure an airframe skin temperature in the leeward region within the temperature constraint limits (100°C) of aluminum alloy during the RLV-TD ascent (4.8 W/cm²) and descent (3.7 W/cm²) phases. A ceramic room-temperature coating with low surface solar absorptivity (α) and high thermal emissivity (ϵ) to generate the required thermal gradient at the backwall was developed. The salient features of the ceramic coating are roomtemperature curability, ease of application, minimum weight, durability, erosion resistance, stable optical characteristics, easily repairable, non-contaminating, high purity and high temperature compatibility with silica fabric. The properties of the ceramic coating are weight/area: 0.025–0.030 g/cm², solar absorptivity the UV–VIS region: 0.12–0.18, IR emittance: >0.86, backwall temperature

Quality assurance challenges in testing and evaluation of reusable launch vehicle systems

P. K. Abraham and B. Valsa

Keywords: Reusable Launch Vehicle, quality assurance challenges, testing and evaluation, mission design.

Abstract

Quality assurance of the various reusable launch vehicle subsystems and the certification for flight involve many major and unique challenges compared to the conventional launch vehicle. This article highlights the major challenges faced by quality assurance teams during various phases of realization of the Reusable Launch Vehicle-Technology Demonstrator.

Innovative technologies for quality seed production and vegetative multiplication in forage grasses

D. Vijay, C. K. Gupta¹ and D. R. Malaviya

Keywords: BN hybrid, defluffing, Deenanath grass, Guinea grass, high density nursery, in vitro maturation.

Abstract

India is facing a shortage of green fodder, dry crop residues and concentrates. The increase in area under fodder crops seems difficult owing to competition from food crops. Hence, utilization of non-cultivable areas for pastures and introducing high biomass producing forages in cultivable lands appear as the viable option. However, the major constraint in revitalizing 85 m ha of denuded

grasslands/forest wastelands is the availability of good quality seed and/or planting material. The present article describes the development of technologies for multiplication of seed and planting material in Bajra-Napier hybrid, Deenanath grass and Guinea grass. The in vitro rooting of stem cuttings and rapid multiplication of Bajra-Napier hybrid rooted slips using high-density stem cutting nursery were developed to reduce the time and space constraints for multiplication and transport of rooted slips. The innovative defluffing technique helps in extracting the caryopsis from the fluffy seed material of Deenanath grass and significantly reduces the volume. The naked seed so produced is good for pelleting and precise sowing. The in vitro maturation of panicles and application of indoleacetic acid during pre-anthesis stage in Guinea grass have resulted in increased seed set and germination respectively. All these innovative technologies are cost-effective, simple and can boost the grass seed and planting material production which otherwise is miniscule compared to the demand. These techniques are in way to solve the myriad problems of grass seed production and multiplication of planting material.

Greywater treatment using horizontal, vertical and hybrid flow constructed wetlands

C. Ramprasad and Ligy Philip

Keywords: Constructed wetlands, hybrid flow, horizontal flow, organics and nutrients, *Phragmites australis*, vertical flow.

Abstract

The performance evaluation of three pilot scale subsurface flow constructed wetlands (CW), i.e. horizontal flow (HFCW), vertical flow (VFCW) and a baffle type-hybrid (HYCW) was studied. The units were continuously fed with greywater and were planted with *Phragmites australis*. The inflow concentrations of BOD, COD, TSS, NO₃, TP and FC were in the range of 72–120 mg/l, 216–320 mg/l, 224–320 mg/l, 10.3–14.6 mg/l, 2.9–3.8 mg/l and 50–120 CFU/100 ml respectively. The average removal efficiencies of BOD, COD, TSS, TP, TN and FC in HYCW were 95 ± 2%, 96 ± 3%, 98 ± 2%, 92 ± 2%, 98 ± 2% and 98 ± 2% respectively and comparatively more than the other two constructed wetlands.

Assessment of contamination of soil and groundwater due to e-waste handling Rashmi Makkar

Panwar and Sirajuddin Ahmed

Keywords: Contamination, e-waste, groundwater, heavy metals, soil.

Abstract

This paper reveals the magnitude of heavy metal contamination of soil and groundwater in and around an unauthorized e-waste recycling site in Delhi. Though unsafe and unorganized and with the e-waste handling now legally banned in Delhi, the informal sector is still actively involved in dismantling, extracting and disposing of e-waste in certain places on a considerably large scale. The leachate produced by these recycling units contains a large amount of heavy metals which are likely to pollute the groundwater and soil adjoining the recycling sites. This study evaluates the e-waste contamination at such sites by monitoring the potential contaminants at a number of specific monitoring points in Krishna Vihar near Mandoli. The soil and underground water samples are tested for the presence of heavy metals around e-waste recycling and dumping sites using atomic absorption spectrometry. The standard values according to Central Ground Water Board are taken as reference values for water, and standards for agricultural soil in Britain as reference values for soil. The results show that the groundwater and soil in and around these sites have been contaminated by lead, copper, chromium and cadmium to a large extent.

Subsurface geological structure and tectonics as evidenced from integrated interpretation of aeromagnetic and remote sensing data over Kutch sedimentary basin, western India

P. Chandrasekhar, K. Chandra Mouli, D. P. Rao and V. K. Dadhwal

Keywords: Aeromagnetic and satellite data, basement depth, hydrocarbons, earthquakes.

Abstract

A number of magnetic zones, faults, lineaments and domal structures were interpreted based on the analysis of aeromagnetic data. Magnetic basement depth and thickness of the sediments were computed by means of quantitative interpretation techniques. A number of alternate basement ridges/highs/uplifted blocks and depressions/lows/downthrown blocks were also delineated. The lithological variations, major folding and faulting patterns, circular spectral anomalies and other geological structures were interpreted from IRS-1C satellite data. The tectonic framework and deformational history of the basin were deduced. The results obtained from the interpretation of aeromagnetic and satellite data were then integrated and the potential zones of hydrocarbon deposits and vulnerable areas for earthquake occurrence were derived.

Food preferences and foraging strategies of wood-feeding termites in a West African savanna

A. B. N'Dri, J. Gignoux and S. Konaté

Keywords: Food preference, foraging strategies, tree species, wood-feeding termites.

Abstract

The feeding preferences of termites in a Guinean savanna (Lamto, Côte d'Ivoire) were studied in the field to better understand the incidence of termite damages observed on adult trees, which, on interaction with fire, affect the dynamics of the tree community. Two separate multiple-choice test experiments were conducted on the six dominant tree species, aiming at determining preferences for the species and for wood conditions naturally encountered and likely to affect termite consumption behaviour. The preferences of termites were determined by their occurrence on standard-sized wood pieces and their behaviour during the first attack. Two fungus-growing termites, *Ancistrotermes* and *Microtermes* were frequently encountered on wood pieces, whereas wood feeders were absent. The two genera have different preferences, and they do not compete for the same food. Wood density and water content did not explain termite preference. Holes in the bark seem to facilitate termite entry into pieces of wood, whereas the action of fire on wood apparently makes it less attractive to termites. In the field, the decision by termites to forage on a given tree species seems to be more driven by habitat and accessibility differences than real food quality differences.

Multi-functional system for persons with disabilities using electroencephalography signals of eye blink

Subhra Sankha Sarma, Piyush Kant and Rajkumar

Keywords: Human-machine interface, electroencephalography signals, eye blinks, persons with disabilities.

Abstract

Here we report a system which can be operated using electroencephalography (EEG) signals generated during eye blink and thus may be useful for persons with locomotive and other disabilities for performing their day-to-day activities. EEG signals are processed by a microcontroller and based on programming, the microcontroller takes a decision to perform the desired task by actuating a corresponding device from several devices connected to the system. An important feature of the system is that it can be adapted to particular needs of the user and can be attached/detached for actuation of different appliances according to the user's condition and requirements.

Detection of IHHN virus in a Specific Pathogen Free bonafide *Penaeus vannamei* (Boone, 1931) broodstock consignment imported to India

M. C. Remany, R. Kirubakaran, Daly Cyriac, O. C. Sruthi Prem, P. Krishnakanth Varadaraju, A. K. Panda, Jaideep Kumar and Y. C. Thampi Samraj

Keywords: Bonafide, shrimp aquaculture, broodstock, infectious hypodermal haematopoietic necrosis virus, specific pathogen free.

Abstract

The World Organization for Animal Health (formerly Office International des Epizooties OIE) listed pathogenic shrimp virus, infectious hypodermal haematopoietic necrosis virus (IHHNV), has been detected in a specific pathogen free (SPF) declared consignment imported from an approved SPF vannamei broodstock supplier to India. The Aquatic Quarantine Facility (AQF), Chennai the only Government-approved quarantine premise for ensuring the SPF status of imported *Penaeus vannamei* broodstock detected this pathogen during its routine screening process. The AQF, which has so far screened about 1068 SPF batches of vannamei consignment, recorded that one particular batch imported to India was not SPF, though the exporting country declared the stock as SPF. The presence of the viral pathogen was confirmed by both nested PCR and quantitative PCR (qPCR). Sequencing data of the target viral genome revealed 100% similarity with the already published decapod penstyldensovirus-1 isolate IHHNV partial genome (GenBank accession no. KJ862253). The test results declared by AQF were further validated by the Central Institute of Brackishwater Aquaculture, Chennai, which is the referral laboratory of AQF. As the import of non-SPF stock into the country is a source of biosecurity threat, the entire batch was incinerated according to the standard operating procedure of AQF. Thus the stringent biosecurity measures and disease diagnostic strategies followed at AQF served to safeguard the industry from this virus, which would have otherwise gained entry into the country through the falsely claimed SPF stock. This communication highlights the importance of SPF stock and detection of IHHNV.

Automatic estimation of tree stem attributes using terrestrial laser scanning in central Indian dry deciduous forests

R. Suraj Reddy, Rakesh, C. S. Jha and K. S. Rajan

Keywords: DBH, forest inventory parameters, multiscan, single-scan, terrestrial laser scanner.

Abstract

Forest inventories are critical for effective management of forest resources. Recently, the use of terrestrial laser scanning (TLS) to automatically extract forest inventory parameters at tree level (e.g. tree location, diameter at breast height (DBH) and height) has gained significant importance. TLS using both single-scan and multi-scan techniques, not only helps in detailed and accurate measurements of tree objects but also helps increase the measurement frequency. In the current study, we develop an automated solution to extract forest inventory parameters at individual tree level from TLS data by using random sample consensus (RANSAC)-based circle fitting algorithm. The method was evaluated on both single- and multiscan data by characterizing four circular plots of radius 20 m in dry deciduous forests of Betul, Madhya Pradesh (India). Over all the plots, tree detection rates of 75% and 97% were obtained using single- and multi-scan TLS data respectively. Tree detection rates were significantly affected by increase in distance from the scanner, in single-scan approach when compared to multi-scan approach. Field based DBH measurements correlated well using both single ($R^2 = 0.96$) and multiple scans ($R^2 = 0.99$). The DBH estimates from multi-scan TLS data resulted in low root-mean-square error (RMSE) of 2.2 cm compared to that of 4.1 cm using single-scan. Further, tree heights were extracted from TLS data and validated with selectively measured trees on field ($R^2 = 0.98$; $N = 65$). The RMSE of tree height was estimated to be 1.65 m.

The current results show the potential use of TLS in automatically deriving forest inventory parameters with reliable accuracy at individual tree level.

Recognizing the rapid expansion of rubber plantation – a threat to native forest in parts of northeast

India Kasturi Chakraborty, S. Sudhakar, K. K. Sarma, P. L. N. Raju¹ and Ashesh Kr. Das

Keywords: Northeast India, Remote sensing and GIS, rubber plantation.

Abstract

With the current trend of land use/land cover (LULC) change taking place globally, several parts of northeast India are also showing signs of change in LULC pattern leading to forest loss. This study focusses on the expansion of monoculture rubber plantation (*Hevea brasiliensis*) in selected sub-watersheds in northeast India, and distributed in parts of north Tripura, Mizoram and a major portion in the Karimganj district of Assam. Remote sensing and GIS technique has been used to map and analyse the extent of rubber plantation using temporal IRS LISS III satellite data from 1997 to 2013. It has been observed that rubber plantation increased from 4.47 sq. km to 28.42 sq. km in various parts of the study area. The expansion was more rapid during recent times, i.e. during 2010 to 2013. The plantation took place in dense forest, open forest and degraded forest areas. The spread of the plantation was also observed in one reserved forest located within the study area. There are several instances of negative impacts of rubber plantation expansion in Southeast Asia. Similar expansion of rubber plantation has been observed in northeast India as well. Further spread of rubber plantations in the region needs to be regulated to avoid conversion of dense and reserved forest areas by fostering use of mixed cropping methods instead of rubber monocultures, and by adopting more sustainable land use and management practices.

Characterization of Mukundpura carbonaceous chondrite

R. P. Tripathi, Ambesh Dixit² and N. Bhandari³

Keywords: Carbonaceous chondrite, chemical composition, meteorite fragments, spectral analysis.

Abstract

Two meteorite fragments collected from the Mukundpura impact site, Rajasthan, India have been analysed using scanning electron microscopy, energy dispersive X-ray spectroscopy, Mössbauer spectroscopy, thermogravimetric analysis (TGA) and Raman spectroscopy. High Fe (22.65 wt%), Ni (1.53%) and S (3.69%) and concentrations of other elements obtained by X-ray analysis indicate that it is a carbonaceous chondrite. Mössbauer spectra show similarity with those obtained from Cold Bokkeveld and Murchison carbonaceous chondrites, and this analogy allows us to classify it as belonging to CM group of carbonaceous chondrites. TGA shows large weight loss, implying presence of significant amount of volatiles in this meteorite and Raman spectroscopy shows the presence of abundant organic matter consisting of disordered and aromatic (graphitic or polyaromatic) carbon. These results indicate that Mukundpura meteorite is a rare type of extraterrestrial object deserving further in-depth studies.

Introducing a third culture: Carl Djerassi and Roald Hoffmann in theatre

Harshal Sanjay Pawar and Adrene Freeda D'cruz

Keywords: Discovery of Oxygen, gender, science-in-theatre, third culture.

Abstract

More than a century-old gap of mutual incomprehension between social scientists and humanities scholars, famously pointed out by C. P. Snow in 1961, has resulted in the formation of two cultures – the sciences and the arts – which have ceased to communicate over a period of time. In the late 1980s, however, Carl Djerassi's invention of a new literary genre called science-in-theatre paved the way for the development of a 'third culture'. In focusing on this interface between scientific knowledge and humanistic enquiry, the present article outlines several conversations that take place among the areas of history, gender, theatre, and science, all of which find their place in the thematic landscape of Carl Djerassi and Roald Hoffmann's play Oxygen (2001).

Changes in capacity of China's agriculture to feed its population

Yan Zhang, Hong Zhang and Xiaohui Yang

Keywords: Demand, energy, food security, nutrients, supply.

Abstract

In order to better understand whether China's agriculture can feed its population, and how much Chinese demand for food depends on the world, the changes in capacity of China's agriculture to feed the nation were explored. Moreover, the main food sources of energy and nutrients for the Chinese and the contribution of imported agricultural products were studied. The results show that for energy, self-sufficiency in cereals was achieved in 1970. Energy, protein, fat and superior protein provided by self-produced agricultural products could also meet the nation's demand since 1983, 1994, 1998 and 2002 respectively. Due to opening up, the supply of energy and nutrients increased and met the nation's demand ahead of time. Cereals have been the main source of energy and nutrients for the Chinese, but their importance has decreased. Energy and nutrients from vegetable products are substantial; however, the share of energy and nutrients from animal products has increased. The contribution rate of energy from imported products was low, but that of fat and superior protein increased rapidly and has been over the warning level of food security since 2000. Cereals, meats, eggs and vegetables, with a strong self-support capacity, are the most important food sources for the Chinese. It indicates that China has been depending on domestic production to meet its demand up to now. However, with growth in the population, optimization of nutritional structure and imbalance of the agriculture structure, the nation will have a great demand for the world's agricultural products.

The history of liquid metal pump development in India

R. D. Kale, B. K. Sreedhar and K. V. Sreedharan

Keywords: Cavitation, liquid metal, model testing, manufacture, sodium centrifugal pump.

Abstract

In a fast breeder reactor, the liquid sodium coolant is circulated through the core using vertical centrifugal pumps. These pumps are critical equipment for reactor operation and they have many unique design features. Indigenous development of pumps is vital for the demonstration and expansion of fast reactor technology which constitutes the critical second stage of our three-stage programme. Indigenous design and development of vertical centrifugal sodium pumps was taken up more than two decades ago in close collaboration with Indian industry. This article provides an

account of the work done in the areas of pump hydraulics, mechanical design and testing, and manufacture.

An integrated linearization technique for GaAs bipolar WCDMA power amplifier
Jagadheswaran Rajendran, Sofiyah Sal Hamid, Shukri Korakkottil Kunhi Mohd, Mohd Zaid
Abdullah, Harikrishnan Ramiah and Narendra Kumar

Keywords: Heterojunction bipolar transistor, linearization, power amplifier, strap ballasting technique.

Abstract

Here we report a novel linearization and efficiency improvement technique for heterojunction bipolar transistor (HBT)-based Wireless Code Division Multiple Access (WCDMA) power amplifier. A process solution is proposed where a tantalum nitride (TaN) layer is strapped to the HBT base metal layer that resolves the current hogging issue. This is known as the strap ballasting technique. The resistance introduced by TaN improves the linear output power without trading-off its power added efficiency. At supply voltage of 4 V, the strap ballasting methodology improves the adjacent channel leakage ratio by 4.5 dB compared to the conventional base ballasting technique at output power of 28 dBm. The corresponding improvement in power added efficiency is 4%. The maximum output power delivered by power amplifier is 36 dBm. The proposed technique can be employed in the WCDMA power amplifier to minimize the fundamental trade-off issue between linear output power and efficiency.

Towards generation of effective 3D surface models from UAV imagery using open source tools

P. S. Singh, Mayuri Sharma , Victor Saikhom, Dibyajyoti Chutia, Chirag Gupta, Avinash Chouhan
and P. L. N. Raju

Keywords: 3D reconstruction, open source, point clouds, remote sensing, structure from motion, unmanned aerial vehicle.

Abstract

There has been increasing popularity in large scale mapping for deriving 3D surface and elevation models of earth and building structures. The techniques of computer vision comprising feature detections and matching and photogrammetry play an important role in deriving near accurate 3D reconstruction of scenes from 2D images. Since the images captured by the unmanned aerial vehicle (UAVs) are of high resolution, there is need for more sophisticated processing and analysis of the imagery to generate 3D models and other useful imagery products. The open source softwares are excellent tools for research and can be modified or changed to suit our model, as specific or combinations of algorithms behave differently based on the nature of UAV image scene to be processed. Though many algorithms are available for performing feature extractions from images, few studies have been carried out to identify suitable detector algorithms to be used based on the nature of image or scene that the UAV captures. An attempt has been made to understand and analyse the suitability of feature detection and descriptor algorithms for different scene types. This article also describes the popular technique called structure from motion process pipeline for sequential processing of UAV images with high overlapping, which involves the estimation of 3D point clouds from the keypoint correspondences. The relative accuracy of the 3D point cloud derived from our approach is comparable with similar output from other state-of-the-art UAV processing systems and is found to match with high precision.

Assessment of spatial variations in temperature and precipitation extremes in west-flowing river basin of Kutch, Saurashtra and Marwar, India

Ila Agnihotri, M. P. Punia and J. R. Sharma

Keywords: Climate, precipitation, river basin, spatial variations, temperature.

Abstract

Climate extreme event indicates the manifestation of higher or lower values (with respect to a threshold value) by a climatic variable. The goal of this study is to analyse the spatial variation in 27 indices of temperature and precipitation extremes in the westflowing river basin of Kutch, Saurashtra and Marwar (WFR-KSM basin). Climate extreme indices were calculated using RClimDex software on 50 years of daily precipitation gridded data and 36 years of daily maximum and minimum temperature data. Theil–Sen slope was calculated as the estimator of trend in 16 extreme indices of temperature and 11 extreme indices of precipitation throughout the basin. The results indicate increase towards wetter climate extremes and a shift towards hotter climate extremes.

Genome-wide consistent molecular markers associated with phenology, plant production and root traits in diverse rice (*Oryza sativa* L.) accessions under drought in rainfed target populations of the environment

Vivek Deshmukh¹ , Sumeet Prabakar Mankar¹ , C. Muthukumar¹ , P. Divahar¹ , A. Bharathi¹ , Helen Baby Thomas¹ , Ashish Rajurkar¹ , Reena Sellamuthu¹ , R. Poornima¹ , S. Senthivel² and R. Chandra Babu

Keywords: Association mapping, drought resistance, molecular markers, rice.

Abstract

Drought is the most predominant constraint to rainfed rice production. Identifying molecular markers associated with drought resistance traits and deploying them in marker-assisted breeding will hasten the development of drought-resilient cultivars. A total of 49 diverse rice accessions, including traditional landraces, were evaluated for plant production and root traits under natural drought stress in rainfed target populations of environment (TPE) in six successive field trials from 2010 to 2015. Significant variation for phenology, plant production and root traits under drought was noticed among the accessions. Genotyping of the rice accessions using 599 polymorphic simple sequence repeat (SSR) markers showed considerable variation among them. STRUCTURE analysis grouped the 49 accessions into three subpopulations. Similarly, three clusters were observed in Neighbor joining tree created using Nei's genetic distance. The subpopulation POP1 consisted mostly of landraces, while subpopulation POP3 consisted of advanced breeding lines and POP2 accessions from all groups. Genome-wide association mapping detected 61 markers consistently associated in two or more trials with phenology, plant production and root traits under drought in TPE. The markers PSM52 (Chr 3), RM6909 (Chr 4), RM242 (Chr9) and RM444 (Chr 9) were consistently associated with grain yield and root traits under drought. The markers PSM127 (Chr 3) and PSM133 (Chr 4) were consistently associated with yield, plant height and spikelet fertility. These markers with pleiotropic and consistent associations with yield and secondary traits under drought in TPE may be robust candidates for marker-assisted breeding for drought resistance in rice.

An observer-based fault-tolerant controller for flexible buildings-based on linear matrix inequality approach

Chaojun Chen, Zuohua Li , Jun Teng and Ying Wang

Keywords: AMD control system, fault-tolerant control, flexible buildings, fault detection and isolation, state observer

Abstract

Since failures in sensors degrade the performance of active mass damper (AMD) control systems, a dynamic filter design method, a state observer design method and a robust control strategy are developed and presented in this paper to overcome this deficiency. The filter design method is transformed into a H_2/H_∞ control problem that is solved by linear matrix inequality approach. Thus, it is used to perform fault detection and isolation (FDI) for the control systems. The state observer design method uses the acceleration responses as the feedback signal. The detected and isolated fault signals in accelerometers are used to estimate the whole states, that are used to calculate the control force through a robust control strategy based on regional pole-assignment algorithm. Then, the active fault-tolerant control (FTC) is accomplished. To verify its effectiveness, the proposed methodology is applied to a numerical example of a tenstorey frame and an experiment of a single span fourstorey steel frame. Both numerical and experimental results demonstrate that the performances of FTC controller and the control system are improved by the designed dynamic FDI filter to effectively detect and isolate fault signal.

Quantification of regional and global sustainability based on combined resource criticality of land and water

Prashant Goswami and Shivnarayan Nishad

Keywords: Agricultural sustainability, carrying capacity, criticality index, food sustainability, water sustainability.

Abstract

The overall global food sustainability is limited by the simultaneous availability of primary resources at regional scales, although the international trade network can redistribute available (surplus) food. Assessments based on isolated resource (like water) or demand (like food) cannot provide correct estimates of sustainability. We define a novel criticality index on the basis of simultaneous regional availability of arable land and water to quantify sustainability. Analyses at regional and global scale show that while a relatively small fraction of world population is subcritical in terms of food availability, much larger fractions are becoming subcritical in terms of food production. The combined resource criticality implies stronger constraints for sustainability.

First lasing in an infrared free electron laser at RRCAT, Indore

K. K. Pant, Vinit Kumar, Bhaskar Biswas, Arvind Kumar, Shankar Lal, Sona Chandran, Saket Kumar Gupta, Md. Khursheed, Pravin Nerpagar, A. K. Sarkar, Ravi Kumar Pandit

Keywords: Beam parameters, free electron laser, infrared power, undulator.

Abstract

An Infrared Free Electron Laser (IR-FEL) designed to operate in the 12.5–50 μm wavelength band is presently in an advanced stage of commissioning at the Raja Ramanna Centre for Advanced Technology (RRCAT), Indore. Here we report results from first experiments on the IR-FEL after installation of its optical cavity, which has resulted in a power output that is ~ 105 times the expected spontaneous emission power for the beam parameters used in the experiment. The estimated out-coupled peak micro-pulse power during these experiments is ~ 2 kW. This is the first observed signature of lasing in the IR-FEL, and the first reported lasing in a FEL in India. This communication discusses the development of the IR-FEL, the recent experimental results, and the ongoing efforts to further increase the IR power to the design peak outcoupled power of 2 MW.

Imaging of stratified media using high-speed swept source optical coherence tomography

Maddipatla Reddikumar and Raju Poddar

Keywords: Biomedical imaging, optical coherence tomography, medical optics instrumentation, stratified media, swept-source laser.

Abstract

We demonstrate a noninvasive, three-dimensional, depth-resolved imaging of stratified media with a swept source optical coherence tomography (SS-OCT) system at 1064 nm centre wavelength. A swept source laser is used to enable imaging rate of 100 kHz (100,000 A-scans/s). A comparison between SS-OCT and other imaging modalities is also presented. Brief theory, detail instrumentation of the system and signal processing method are described. The system has axial and transverse resolution of 5 and 14 μm in air respectively. The potential and performance of the system was tested, and two- and three-dimensional imaging of different objects like human skin, infrared detection card, leaf, etc. has been presented.

The adsorption capacity of the base layer of pervious concrete pavement prepared with additives for typical runoff pollutants

Wang Junling, Wei Jiangtao, Wang Xueming , Feng Cuimin , Chen Tao , Sun Lihua¹ and Li Junqi

Keywords: Adsorption, base layer, optimization, pervious concrete pavement.

Abstract

Additives were added to pervious concrete pavement to improve the removal capacity for runoff contaminants. In this study, static isothermal adsorption experiments were conducted for concrete prepared with fly ash or bentonite. The results showed that the material containing bentonite showed better adsorption capacity for runoff contaminants. The saturated adsorption values of bentonite for major runoff pollutants, including chemical oxygen demand (COD), total phosphorus (TP) and copper (Cu) were 8.61, 6.93, 19.31 mg/g respectively. However, the two additives showed only weak adsorption capacity for total nitrogen (TN). Compared to hardened cement, the adsorption capacity for COD, TP and Cu of the cement with bentonite was increased by 54%, 30% and 42% respectively, and the capacity of cement with fly ash increased by 42%, 11% and 33% respectively. Therefore, additives can improve the decontamination capacity of the base layer of the pervious concrete pavement. This study provides technical support for the construction of a sponge city.

Climate change-induced coral bleaching in Malvan Marine Sanctuary, Maharashtra, India

K. Diraviya Raj, G. Mathews, M. Selva Bharath, Rohit D. Sawant, Vishal Bhawe, Deepak Apte, N.

Vasudevan and J. K. Patterson Edward

Keywords: Climate change, coral bleaching, mortality, marine sanctuary, sea surface temperature.

Abstract

Malvan Marine Sanctuary (MMS), Maharashtra, India is rich in coral reefs and the associated resources, which provide livelihood for the people involved in fishing and tourism. The elevated seasurface temperature triggered by climate change had caused the coral reefs around the world to undergo severe bleaching during 2014–2016. Scientists have declared this as the third global coral bleaching event. Two underwater surveys during December 2015 and May 2016 were conducted in MMS to assess the intensity and trend of coral bleaching. A high prevalence of coral bleaching, i.e. 70.93% (SD = 4.53) was recorded inside MMS during December 2015, with a mortality of about 8.38% (SD = 0.91). After a lapse of six months, corals were found to recover. This is borne out by the reduction in the bleaching prevalence to $6.77 \pm 0.12\%$ during May 2016. Climate change being a global issue, reduction in the local stressors such as fishing and tourism is highly recommended in order to allow the corals to recover and enable sustainable utilization of coral reef resources around MMS.

Dichogamy and style curvature avoid self-pollination in *Eremurus altaicus*

Wei Gu, Miao Ma and Jun-Feng Fan

Keywords: Foxtail lily, mating system, protandry, pollination, style movement.

Abstract

This paper gives a systematic study of *Eremurus altaicus* in terms of flowering characteristics, pollinating features, style movement pattern, stigma receptivity and mating system. The result showed that it was protandrous and that the stigma had no receptivity until the end of pollen dispersal. Its style showed a regular movement pattern during the flowering phase. The style was upright, very close to anthers at first; then it quickly curved down 90° from the base just before the dehiscing of anthers, but went back to the former upright state after pollen dispersal of all 6 anthers. From the blossoming to the end of pollen dispersal, the stigma was smooth and dry, and had no receptivity to pollens until the style went back to the upright state with papillae, and mucus appeared. The curving down movement of the style significantly widened the relative distance between the stigma and the dehiscing anthers. Therefore, protandry and style movement are double safeguard mechanisms for avoiding selfing and promoting outcrossing in *Eremurus altaicus*, which has important significance in its reproduction and evolution potential.

Antiproliferative and antibacterial activity of some para-substituted benzylideneacetophenones and establishing their structure activity relationship

Deepak Chowrasia, Nisha Sharma, Ajay Kumar, Vinod Dohrey, Md. Arshad, Asif Jafri, Juhi Rais, Madhu Gupta and Sahabjada

Keywords: Antiproliferative, antibacterial assay, benzylideneacetophenone, MTT assay

Abstract

We report here in-vitro antiproliferative and antibacterial activity of para-substituted benzylideneacetophenones and established their structure activity relationship to optimize para position as a biologically oriented-synthetic target for design of small molecule based future anticancer/antibacterial agents. Among synthesized compounds, 1c exhibits excellent antiproliferative activity against human osteosarcoma cell line (MG-63) compared to 1b and 1a suggesting dimethylamino ($-N(CH_3)_2$) functionality as a better para-substituted analogue for in-future anticancer agents. Similarly antibacterial screening of the aforesaid compounds against different strains of Gram-negative and Gram-positive bacteria reveals methoxy ($-OCH_3$) rather than dimethylamino ($-N(CH_3)_2$) as a better para-substituted functionality on ring B comparatively. From our results, we justify our theory 'lipophilicity affects antibacterial activity'.

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Learning to think like a scientist and a mathematician

K. P. Mohanan and Tara Mohanan

Keywords: Inquiry-oriented education, knowledge construction, trans-disciplinary thinking.

Abstract

This article proposes that the goals of math and science education ought to go beyond understanding and applying a body of established knowledge, to aim at developing the capacity to construct knowledge. This would empower students to think like mathematicians, experimental scientists and theoretical scientists. These mental capacities and the concepts that underlie them serve as the trans-

disciplinary foundations for research, allow individuals to function well in their professional, public and personal lives, and integrate knowledge across domains. It also functions as an effective means for the popularization of mathematics and the sciences.

A new solution for city water: quality drinking water from the river floodplains

Vikram Soni, Shashank Shekhar, S. V. N. Rao, Suman Kumar and Diwan Singh

Keywords: River floodplains, quality drinking water.

Abstract

Cities world over are facing drinking water problem. The planners are often over emphasizing on sourcing surface water from far off places. This will involve exorbitant cost and many a times diversion of river flow beyond the permissible limit. Obviously such river flow diversions will have adverse ecological consequences. In this context, the article reinvents traditional knowledge with sound scientific rigour. It argues for ecologically sustainable local solutions for meeting drinking water need of cities from flood plain of rivers. A case of river Yamuna in Delhi has been discussed to highlight the potential of flood plain aquifer as a drinking water source.

Advances in understanding of structure, function and plasticity of HCN channels

Sukant Khurana

Keywords: Developmental plasticity, HCN channels, interacting proteins.

Abstract

Hyperpolarization-activated, cyclic nucleotide-sensitive, cation non-selective (HCN) channels are gaining attention in recent years. These ion-channels are gated by two factors: voltage, specifically hyperpolarization and some subunits, more than others, by cyclic nucleotides. They conduct both sodium and potassium ions, and regulate many functions in both neuronal and non-neuronal cells. In neurons, HCN channel functions range from setting resting potential, synaptic normalization, gain control, after-hyperpolarization, setting responses in dendrites, mediating cannabinoid role in neuronal plasticity to the gating of plasticity. Emerging properties of circuits expressing HCN channels manifest in the form of various kinds of functions like brain rhythms, perception, spatial learning, executive memory, epilepsy, ataxia, depression, sound localization, anxiety, etc. We are beginning to understand the roles of these channels in nonneuronal cells and we would discover more such roles in the future. Following ischaemia, there is HCN overexpression in the reactive astrocytes. There is an altered expression of HCN channels in few tissues in diabetic animal models. Recent evidence suggests that HCN channels are also involved in uterine contractions and renal functioning. This review focuses on the function, structure, interacting proteins and developmental plasticity that enable the versatility of HCN channels

Geographic distribution pattern of threatened plants of India and steps taken for their conservation

S. K. Barik, O. N. Tiwari, D. Adhikari, P. P. Singh, R. Tiwary and S. Barua

Keywords: Conservation strategy, geographic distribution pattern, threatened plants.

Abstract

In spite of its importance in nation-wide conservation planning, comprehensive information on geographic distribution of threatened plants in India is lacking. Even the threat status of these plants is ambiguous and the country's effort to conserve them is not widely known. A critical analysis of these aspects is essential for identifying gaps in threatened plant conservation. Keeping these in view, we present a review of the existing knowledge on geographic distribution pattern of threatened plants of India, their threat status, and conservation action undertaken to recover these species. Using the

available data, we unravel patterns of distribution of these threatened plants in different states of India. When ranking of the families was done based on the total number of species under different threat categories, Orchidaceae (644), Fabaceae (185), Poaceae (164), Rubiaceae (103), Asteraceae (88), Euphorbiaceae (72), Asclepiadaceae (62) and Acanthaceae (60) constituted more than half of the total threatened plant species of India. A review on conservation efforts so far undertaken in different parts of the country revealed that the biodiversity-rich phytogeographic regions such as the Himalayas, North East India, and Andaman and Nicobar Islands had lesser conservation efforts in comparison to the Western Ghats, Vindhyas and Peninsular regions of India. The skewed distribution of threatened plants in different states did not truly reflect their absolute presence or absence; rather it is the result of incomplete survey because of the difficult geomorphological and associated geo-climatic conditions, tough terrain and remote locations. In addition, the current data on threatened plants suffer from methodological shortcomings such as classification without using the population data that are so crucial in modern day threat classification, and lack of long-term observational data. The review emphasizes the use of modern tools such as ecological niche modelling for population inventory, area of occupancy and extent of occurrence, and trends in population size and regeneration for precise threat classification conforming to globally accepted methods (e.g. IUCN version 3.1). The works undertaken through the support of Department of Biotechnology, GoI for conservation of 156 threatened plant species under different disciplines of conservation biology during the past three decades have also been compiled and reviewed. A successfully tested protocol following an integrated approach for threatened species conservation is recommended for future conservation action.

Recovery of critically endangered plant species in India: need for a comprehensive approach G.

Ravikanth, M. R. Jagadish, R. Vasudeva, R. Uma Shaanker and N. A. Aravind

Keywords: Endangered plants, ecological interactions, genetic enrichment, niche modelling, species recovery.

Abstract

There has been a growing concern about the increasing number of species that are globally threatened. Developmental projects, and increased dependence on forests both for sustenance and livelihood have rendered many species threatened. In the Indian context, more than 150 species are critically endangered and require immediate intervention to sustain their populations. A number of plant species are destructively extracted solely from the forests. Apart from anthropogenic threats, several species are threatened due to invasive species and climate change. In the light of increasing and continued threats, species recovery is the only viable option for restoring many of them from extinction. Here, we review the existing recovery programmes in the country and suggest a comprehensive approach in the conservation and recovery of many of the critically endangered species. We highlight issues that need to be addressed and discuss strategies for recovering the critically endangered species in the country.

Contributions of plant taxonomy, herbarium and field germplasm bank to conservation of threatened plants: case studies from the Himalayas and Eastern and Western Ghats

K. Haridasan, A. A. Mao, M. K. Janarthanam, A. K. Pandey, S. K. Barik, S. K. Srivastava, P. C. Panda, Geetha Suresh, S. K. Borthakur, B. K. Datta and B. Ravi Prasad Rao

Keywords: Biodiversity, conservation, germplasm bank, herbarium, taxonomy.

Abstract

Conservation of biodiversity, a growing concern today, faces multiple challenges. Although ecosystem approach has been recommended as a solution, conservation of threatened species is

difficult as they are spread across the ecosystems and are often restricted to microhabitats. In this article, the importance of taxonomy, herbarium and field germplasm bank in conservation of threatened species is discussed. It is concluded that individually each of these measures has important role to play in conservation. They also complement each other in reversing the threat perspective of the species

Inventory and characterization of new populations through ecological niche modelling improve threat assessment

D. Adhikari, Z. Reshi, B. K. Datta, S. S. Samant, A. Chettri, K. Upadhaya, M. A. Shah, P. P. Singh, R. Tiwary, K. Majumdar, A. Pradhan, M. L. Thakur, N. Salam, Z. Zahoor, S. H. Mir, Z. A. Kaloo and S. K. Barik

Keywords: Niche modelling, population characterization, threatened plants, threat assessment.

Abstract

Categorization of species under different threat classes is a pre-requisite for planning, management and monitoring of any species conservation programme. However, data availability, particularly at the population level, has been a major bottleneck in the correct categorization of threatened species. Till date, threat assessments have been mostly based on expert opinion and/or herbarium records. The availability of primary data on distribution of species and their population attributes is limited in India because of inadequate field survey, which has been ascribed to resource constraints and inaccessibility. In this study, we demonstrate that ecological niche modelling (ENM) can be an economical and effective tool to guide surveys overcoming the above two constraints leading to the discovery of new populations of threatened species. Such data lead to improved threat assessment and more accurate categorization. We selected 14 threatened plants comprising 5 trees (*Acer hookeri* Miq., *Bhesa robusta* (Roxb.) Ding Hou, *Gynocardia odorata* Roxb., *Ilex venulosa* Hook. f. and *Lagerstroemia minuticarpa* Debb. ex P.C. Kanjilal), 8 herbs (*Angelica glauca* Edgew., *Aquilegia nivalis* Falc. ex Jackson, *Artemisia amygdalina* DC., *Begonia satrapis* C.B. Clarke, *Corydalis cashmeriana* Royle, *Dactylorhiza hatagirea* (D. Don) Soo, *Podophyllum hexandrum* Royle, and *Rheum australe* D. Don), and 1 pteridophyte (*Angiopteris evecta* (Forst.) Hoffm.) having distribution range in North East India, Eastern and Western Himalaya, and Jammu and Kashmir. The study was carried out between 2012 and 2016. ENM-based survey led to the discovery and characterization of 348 new populations. The data so obtained helped in assigning conservation status to 10 species, which earlier were never classified due to data deficiency. Using the new population and distribution data of the remaining four species, only one was confirmed regarding its existing status and two species were classified as 'Critically endangered' instead of the present classification as 'Endangered'. The fourth species was classified as 'Critically endangered' against the earlier category of 'Least concerned'.

Metapopulation modelling of threatened plants to assess conservation status and determine minimum viable population size

Mark K. Lyngdoh, Arun Chettri, D. Adhikari and S. K. Barik

Keywords: Demography, extinction risk, metapopulation, minimum viable population.

Abstract

Use of metapopulation modelling in conservation of threatened plants has been demonstrated in this article taking *Paris polyphylla* Smith as an example. The metapopulation data collected from Sikkim Himalaya over a period of four years were analysed using RAMAS Metapop 5.0 software. Demographic projection, assessment of extinction probability, population viability analysis, and

analysis of impact of disturbance on the metapopulation were undertaken. The metapopulation had 11 populations of which seven were in continuous forest (CF) and four were in forest fragments (FF). All the analyses were done in two model scenarios, viz. base-model (M1) representing the disturbed condition, and alternate model (M2) representing the undisturbed condition for three distinct layers of *P. polyphylla* populations, i.e. CF, FF in isolation, and collectively as metapopulation. The outputs of the deterministic population models in respect of CF and FF populations revealed that both the populations had contribution of growth and survival of plants to such decline was greater than the fecundity in both the models. Stochastic simulations revealed an extinction risk of >10% in 100 years in M1 scenario, which put the species under vulnerable category. The extinction risk of metapopulation significantly varied between the two models (M1 = 0.85; M2 = 0.42), conforming the hypothesis that disturbance and forest fragmentation have detrimental effect on the persistence of *P. polyphylla*. Recovery of species was most promising when reproductive individuals were introduced to the M2 model. Thus, both introduction of individuals in the field and protection of the populations with emphasis on the reproductive subset would result in achieving minimum viable population size or low threat status of the species.

Bioactive metabolite profiling for identification of elite germplasms: a conservation strategy for threatened medicinal plants

Padma Venkatasubramanian, S. P. Balasubramani, S. K. Nandi and Mohd Tariq

Keywords: Bioactive metabolites, conservation strategy, medicinal plants, elite germplasm.

Abstract

Medicinal plants are used as a source of raw drugs, chemical compounds or bioactive metabolites. Many of the medicinal plant species are facing threat of extinction due to indiscriminate harvesting by humans. Conservation of such species is no longer an altruistic choice but a necessity to ensure sustainable supply of bioactive compounds to the drug industry. This article demonstrates that conservation of threatened species is possible through large-scale cultivation of elite germplasm identified using biochemical markers. Six species, viz. *Aconitum balfourii* Stapf, *Aconitum heterophyllum* Wall. ex Royle, *Podophyllum hexandrum* Royle (syn = *Sinopodophyllum hexandrum* (Royle) T. S. Ying), *Picrorhiza kurroa* Royle ex Berth., *Berberis aristata* DC. and *Embelia ribes* Burm. f. were selected for the study under the all-India coordinated project on threatened species. The approach proved to be effective for bringing back the species from the verge of extinction.

Establishing taxonomic identity and selecting genetically diverse populations for conservation of threatened plants using molecular markers

N. K. Chrungoo, G. R. Rout, S. P. Balasubramani, P. E. Rajasekharan, K. Haridasan, B. R. P. Rao, R. Manjunath, G. Nagduwar

Keywords: Conservation, genetic variability, molecular markers, phylogeny, threatened plants.

Abstract

The extent of genetic diversity within a species is an important determinant of successful adaptation to adverse environmental conditions. Assessment of extent of genetic diversity/variability is also important to monitor genetic erosion within a species. In threatened plant species, genetic diversity assessment helps in selection of genetically diverse populations to enrich the genetically impoverished populations, thus minimizing the probability of genetic drift. Confirming taxonomic identity of threatened species, particularly those belonging to species complexes with dispute identity, is another essential task in the conservation of threatened species, which is best resolved through molecular approaches. The present study estimated the genetic variability within and among the populations of four threatened species, viz. *Justicia beddomei* (C.B. Clarke) Bennet (Acanthaceae),

Embelia ribes Burm. f. (Myrsinaceae), *Madhuca insignis* (Radlk.) H.J. Lam (Sapotaceae) and *Cycas beddomei* Dyer (Cycadaceae) using Inter Simple Sequence Repeat (ISSR) and Simple Sequence Repeat (SSR) markers for selecting the genetically diverse populations. The phylogeny was analysed through ITS (nrDNA) and matK (cpDNA) sequences to confirm the species identity. The phylogenetic analyses confirmed four distinct species of *Justicia*, which also revealed that *J. beddomei* and *J. adhatoda* were sister groups with a common ancestor showing rapid parallel speciation with *J. gendarussa* in one clade and *J. betonica* in another. *Madhuca insignis* with extremely small population in the Western Ghats (Karnataka to Kerala) might have undergone either extensive hybridization or incipient speciation. In case of *Embelia* species, a greater evolutionary closeness between *E. subcoraceae* and *E. floribunda* was revealed, while *E. ribes* had a distinct clad. Both ISSR and SSR markers distinguished various genotypes of *Cycas beddomei*.

In vitro propagation of some threatened plant species of India

C. R. Deb, G. R. Rout, A. A. Mao, S. K. Nandi, R. K. Nilasana Singha, D. Vijayan, T. Langhu, Z. P. Kikon, S. Pradhan, Mohd Tariq

Keywords: Conservation, in vitro regeneration, microshoots, threatened species.

Abstract

To prevent extinction of threatened species, in vitro regeneration protocols for the propagation of six threatened species were standardized. The regenerated micro-shoots were rooted in nutrient medium supplemented with low concentrations of auxin. The well-developed plantlets were successfully established in field conditions, thus improving the probability of self-sustenance of the introduced populations. The success story of these six threatened species reaffirms the role of in vitro propagation in conserving plants facing the threat of extinction.

Floral biology and embryological studies are important for conservation of threatened plants having reproductive bottlenecks: a case study of *Illicium griffithii*

Hook. f. & Thomson E. J. Marbaniang, N. Venugopal, Susheel Verma, Ravinder Raina, Ankush Khajuria and Kamini Gautam

Keywords: Embryological studies, floral biology, *Illicium griffithii*, reproductive bottlenecks, threatened species conservation.

Abstract

Information on reproductive biology of threatened plant species could be useful for conservation, particularly when the species fails to perpetuate in nature due to regeneration failure. In flowering plants, the domain of reproductive biology includes structural details of reproductive units such as flower or inflorescence, formation of viable gametes, pollination dynamics, role of pollinators, pollen–pistil interactions as determined through compatibility, breeding system and mating strategies, fertilization and embryogeny, seed development, dispersal and germination. The importance of reproductive biology in species conservation has been demonstrated through a case study of *Illicium griffithii* Hook f. & Thomson, a threatened plant species from Arunachal Pradesh. *I. griffithii* (Illiciaceae) is a member of the ANITA clade and a representative taxon of the three most basal angiosperms. The flowers of *I. griffithii* are obligate xenogamous, and hence compatible pollen grains only germinate on the stigmatic papillae. Esterase and phosphatase enzymatic activities are absent in most stigmatic surfaces. Therefore, stigmatic receptivity is absent in many carpels. The ovules are anatropous and bitegmic with a four-celled/four-nucleate structure of embryo sac at maturity. Antipodals and filiform apparatus are absent. Presence of mucilage cells in the embryo sac facilitates the entry of pollen tubes into it. Embryolike organization of the endosperm is present, with one pole globular having smaller cells and the other pole roughly filamentous with larger cells resembling that

of a suspensor. Extragynoecial compitum is not observed in *I. griffithii*. The flowers are brooding sites for the midges and the young ovules are eaten by larvae of the midges. Only 10% of the flowers mature into 13-seeded fruits and the carpels of the remaining 90% of the flowers have seeds ranging from 1 to 5. The seedling survival rate is only 7%. In addition to the above-mentioned reproductive bottlenecks, the species is also being over-harvested. It is now categorized as endangered. The findings of the present study on reproductive biology of *I. griffithii* should help in improving its conservation status.

Classifying threatened species of India using IUCN criteria

S. K. Barik, B. R. P. Rao, K. Haridasan, D. Adhikari, P. P. Singh and R. Tiwary

Keywords: Area of occupancy, extent of occurrence, IUCN classification, population size, threatened plants.

Abstract

Assigning threat status to a species is essential for prioritization of species under any conservation programme, and therefore, a pre-requisite for species conservation. In India, due to inadequate data, threat status has not been assigned to several plant species, although their population sizes are quite small and they are considered important from conservation point of view. Besides, there is a need for reassessment of threat status assigned by various agencies using updated data on population size, number of mature individuals, area of occupancy, and geographic extent of occurrence. This is crucial as the natural habitats as well as populations of such species are being affected by anthropogenic activities, exotic species invasion, and climate change. In the present study, we assessed the threat status of 59 selected plant species following the IUCN criteria (ver. 3.1). The species were selected after consultation with various experts throughout the country. Field surveys were carried out in various ecoregions of India to locate the species. Population size and number of mature individuals were enumerated following quadrat/plot-based sampling. The exogenous and endogenous factors leading to decline in population and rarity were identified based on field observations as well as laboratory-based seed viability and germination tests. Based on these studies, 20 species were classified under critically endangered category, 21 under endangered, 11 under vulnerable, five under near threatened, and one species each under data deficient and least concern category. Threat assessment for 41 species was done based on number of locations and geographical range of occurrence, while for 18 species it was done based on restricted population and number of mature individuals. Over-exploitation and habitat degradation or loss were the dominant exogenous factors leading to decline in natural populations of the selected species. The major endogenous factors that lead to population decline and species rarity were low seed viability and germination, long dormancy period, less seedling recruitment, low population size, habitat specificity and narrow niche leading to restricted distribution.

Morphology of slope streaks within Nicholson crater, Mars: records of recent wind activity

Ami J. Desai and S. V. S. Murty

Keywords: Aeolian activities, craters, morphology, slope streaks

Abstract

Wind is currently the dominant active geological agent bringing about constant changes over the Martian surface. One of the most conspicuous resultant morphology derived is the formation of slope streaks, highly transient features that tend to develop and may completely disappear within a few ten of years. In this article a detailed analysis on the pattern, morphology and appearance of slope streaks within the central mound of the Nicholson crater on Mars, has been made and plausible reasons for their formation as well as darkening and fading mechanisms are discussed. We focus on some

observations which indicate the role of wind in carving specific streak patterns. The morphological observations discussed, strongly support active aeolian processes and provide evidences in favour of the dust avalanche theory for the formation and current morphology of slope streaks in the Nicholson crater.

Modelling vadose zone processes for assessing groundwater recharge in semi-arid region

A. T. Dandekar, D. K. Singh, A. Sarangi and A. K. Singh

Keywords: Groundwater recharge modelling, HYDRUS and MODFLOW, semi-arid region, vadose zone processes.

Abstract

Normally groundwater recharge is estimated using methods based on water balance, water table fluctuations, fixed factor of annual rainfall and tracer movement. In many of these methods water stored in the vadose zone and evapotranspiration are not accounted properly. These factors control groundwater recharge to a large extent, particularly in arid and semi-arid regions which are normally characterized by a deep water table, thick vadose zone and high evapotranspiration. In this study, HYDRUS-1D and MODFLOW models were used to assess the recharge flux and groundwater recharge in an area under a semi-arid region giving due consideration to important vadose zone processes. Cumulative recharge flux at water table in various sub-areas varied from 20.01 cm to 23.43 cm (29.26% to 34.26% of the monsoon rainfall). The average groundwater recharge was 22.2%. Total surface runoff in various sub-areas varied from 3.39 cm to 14.36 cm (5% to 21% of the monsoon rainfall). Evapotranspiration was found to be a major recharge controlling factor. Reference evapotranspiration varied from 37.19 cm to 45 cm (54% to 66% of the monsoon rainfall). Natural recharge under the prevailing pumping rate and pumping schedule was 23.3% of the monsoon rainfall. Simulation results revealed that if all the surface runoff is retained in the area, water table will rise by 1.46 m.

Seasonal variation in wildlife roadkills in plantations and tropical rainforest in the Anamalai Hills, Western Ghats, India

P. Jeganathan, Divya Mudappa, M. Ananda Kumar and T. R. Shankar Raman

Keywords: Linear infrastructure intrusions, roadkill, road ecology, Western Ghats, wildlife-vehicle collisions.

Abstract

Wildlife-vehicle collisions on the roads lead to mortality of a range of animal taxa both within and around wildlife reserves. Quantifying and understanding impacts of roads on wildlife mortality are essential for identifying vulnerable taxa and suitable mitigation measures. We studied animal mortality on roads in relation to habitat and season in the Anamalai Tiger Reserve and adjoining Valparai plateau in the Western Ghats, India. Habitats were broadly classified as forest, monoculture plantations (tea, coffee, eucalyptus) and mixed. Eleven road transects of 3–12 km length were surveyed between 9 and 12 times each during monsoon (2011) and summer (2012). We recorded 2969 roadkills (mean = 2.01/km) during the 1473.4 km of road surveys carried out. The overall roadkill rate was 21.2 (\pm 3.87 SE) individual kills/10 km. Amphibians were most frequent in roadkills (overall roadkill rate of 9.3 \pm 2.17 SE kills/10 km, n = 1307), followed by invertebrates and unidentified taxa (7.6 \pm 1.81 SE kills/10 km, n = 1066). Roadkill rate was 2.4 times higher in monsoon than summer, with amphibians particularly averaging higher kill rate during monsoon. Frequency of roadkills of various animal groups differed between seasons in different habitats. In both the seasons, most roadkills were recorded mainly in tea, forest, and forest-tea habitats. Relative to length of roads through forest, a disproportionately large number of roadkills of herpetofauna and

mammals were recorded in forest habitat. Higher vehicular movements, including tourist traffic, road widening, removal of native plants along roads and construction of sidewalls without breaks obstruct animal movements and may be responsible for roadkills. Designing roads to be more permeable for safe animal movement, particularly where roads pass through forest, and sensitizing highways authorities are essential to reduce animal mortality and make roads more wildlife-friendly in this region.

Coherence of the light of firefly *Luciola praeusta*

Upamanyu Sharma, Angana Goswami and Anurup Gohain Barua

Keywords: Bioluminescence, firefly, interference patterns, temporal and spatial coherence.

Abstract

Firefly bioluminescence has given rise to several curiosity-driven as well as application-oriented studies. The emission spectrum of the Indian species of firefly *Luciola praeusta* Kiesenwetter 1874 (Coleoptera : Lampyridae : Luciolinae) has been shown to consist of two broad green- and red-coloured sectors, with a narrow yellow one in between. Here we present interference patterns of light of this firefly species using a Michelson interferometer for different positions of the two reflecting mirrors, up to a path difference of 11.5 cm. Next we employ Young's double-slit method with the lantern of the firefly as the source at pinhole separations of 160, 170 and 180 μm . From the fringes obtained in these two sets of experiments, we conclude that the light of the firefly exhibits excellent temporal as well as good spatial coherence properties.

Stability-indicating method of entacapone-related substances using UPLC in finished dosage form

Naresh Konduru, Rambabu Gundla, Naresh Kumar Katari and G. V. Madhuri

Keywords: Entacapone-related substances, dosage form, force degradation study, liquid chromatography.

Abstract

A rapid, specific, sensitive and robust method for entacapone-related substances in carbidopa, entacapone and levodopa film-coated tablet was developed using ACQUITY UPLC with BEH C18 column. Mobile phase (A), i.e. 0.1% orthophosphoric acid and mobile phase (B), i.e. acetonitrile with water in the ratio 75 : 25 (v/v) with gradient method were employed. The method was evaluated for identification of process impurities and unknown impurities. It has been validated according to ICH (Q2) R1 guidelines. The values of LOD and LOQ for impurity and entacapone were found to be 0.01% and 0.03% respectively. Degradation studies were carried out in peroxide, acid, alkali conditions and contribution to mass balance was established. It was stable under heat, light-exposed and humid conditions.

Differential bleaching patterns in corals of Palk Bay and the Gulf of Mannar

P. Krishnan, R. Purvaja, C. R. Sreeraj, R. Raghuraman, R. S. Robin, K. R. Abhilash, R. S. Mahendra, A. Anand, M. Gopi, P. C. Mohanty, K. Venkataraman and R. Ramesh

Keywords: Adaptive coral bleaching, Gulf of Mannar, Palk Bay.

Abstract

The status of reefs in Palk Bay and the Gulf of Mannar was studied during April–May 2016 following a bleach alert, as the sea surface temperature recorded a sudden increase from 30.5°C to 34.0°C in Gulf of Mannar. About 71.48% \pm 8.9% of the corals in Palk Bay and 46.04% \pm 3.78% in Thoothukkudi group of Islands in Gulf of Mannar were found bleached, showing a clearly decreasing trend from north to south, which could be attributed to the corresponding pattern in intensity of SST

recorded in the study sites. Observations of bleaching patterns among different life-forms showed 68% of the bleached corals were massive forms. It was observed that 22 out of the 26 massive forms were bleached, while the *Acropora corymbose* (ACC), digitate (ACD) and encrusting coral (CE) forms were not bleached in any of the study sites in Palk Bay and Gulf of Mannar. The study suggests that the ACC, ACD and CE forms have adapted to thermal stress, subsequent to the earlier mass bleaching events. The study highlights the need for understanding the molecular mechanism of the association between corals and the symbiotic algae, for further understanding on coral bleaching in Indian waters.

An assessment of groundwater quality in Kottukal microwatershed in Thiruvananthapuram district, South Kerala

Lal Thompson, Shalu George, A. Bushral and S. R. Santy

Keywords: Groundwater recharge, groundwater quality, Kottukal stream, micro-watershed.

Abstract

The Kottukal microwatershed is an uplifted sedimentary watershed of recent origin formed due to large scale neo-tectonic activity. The groundwater from this watershed is largely abstracted for both irrigation and local public drinking water supply schemes. The present communication is an attempt to assess the detailed groundwater quality of the unconfined aquifers and the stream water system within the microwatershed. The Hill–Piper diagram indicates majority of groundwater samples are found to be Na–Cl followed by a mixed and Ca–HCO₃ type. The Na–Cl characterization of groundwater in this elevated terrain is not due to primary salinity, but could be attributed to combined effects of irrigation salinity and improper sanitation facilities. The values of total dissolved solids and electrical conductivity in groundwater samples are low as compared to stream water samples, suggesting distinct imprints of hydro-geochemical behaviour. The Wilcox diagram indicates, 90% of water samples falls in the C1–S1 sector depicts its suitability for irrigation. The total coliform and faecal coliform count of >1600 MPN is noted in 88% of water samples. The alkaline trend and high bacteriological contamination points to the prevalence of a non-sterile environment resulted from agronomic practices and poor environmental sanitation facilities within the watershed.

Alaskan-type mafic–ultramafic complex at Padhar, Betul Belt, Central India

R. R. Meshram, N. K. Rao, S. Chore, M. L. Dora, S. Shome, M. Shareef and M. Korakoppa

Keywords: CITZ, mafic–ultramafic complex, hydrous magmas, intrusive bodies, lithological zoning.

Abstract

We report here an Alaskan-type mafic–ultramafic complex at Padhar from the Precambrian Betul Belt of Central India. The Padhar intrusive bodies show lithological zoning defined by olivine-bearing ultramafic rocks in the core and gabbroic rocks at the margins, and are commonly accompanied by Cr–Cu–Ni sulphide mineralization. Mineral chemistry and whole-rock geochemistry of these rocks indicate that they are derived from the crystallization of hydrous magmas. The Padhar complex is characterized by high Mg and low abundance of incompatible trace elements. Flat REE pattern with negative Nb anomaly suggests arc-magmatism typical of Ural–Alaskan type. Presence of Mg-rich clinopyroxene and hornblende-rich rock types in the Padhar mafic–ultramafic intrusives along with paucity of orthopyroxenes in them further distinguish its from different types of complexes, i.e. ophiolite, Alpine and stratiform layered-type. These features are akin to Alaskan-type rocks as seen in Alaska, Canada and Urals of Russia. This finding of Alaskan-type ultramafic complex in the Padhar area of Betul Belt, Madhya Pradesh, is significant and has important implications in the tectonics and geodynamics of the Central Indian Tectonic Zone in general, and in the search of platinum group of minerals in particular.

African buffalo optimization for global optimization

Julius Beneoluchi Odili and A. Noraziah

Keywords: African buffalo optimization, global optimization, search landscapes, swarm intelligence techniques.

Abstract

In this study we apply the African buffalo optimization (ABO) to solve benchmark global optimization problems. Such problems which are artificial representation of different search landscapes ranging from unimodal to multimodal, separable to non-separable, constrained to unconstrained search landscapes have become a veritable instrument to test the search capacities of optimization algorithms. After a number of experimental procedures involving 28 benchmark problems, results from ABO prove to be rather competitive leading to the conclusion that it is a worthy addition to the body of swarm intelligence techniques.

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Role of electric mobility in a sustainable, and energy-secure future for India

R. Srikanth

Keywords: Battery storage, electric vehicles, energy security, low-carbon economy.

Abstract

Within the next decade, a set of four low-carbon technologies – LEDs, solar energy, wind energy, and electric vehicles are set to reconfigure the dynamics of several industries. While India is making significant progress in the first three, we hardly see any electric vehicles on our roads, though the National Electric Mobility Mission Plan (NEMMP-2020) was launched by the Government of India on 9 January 2013 with the aspiration of selling 6–7 million new electric vehicles in 2020 to achieve liquid fuel savings of 2.2–2.5 million tonnes, along with substantial lowering of vehicular emissions and a decrease in CO₂ emissions. In addition to these vital benefits, acceleration of electric mobility in India will also lead to higher job creation in manufacturing. In this article, key recommendations are proposed to accelerate the progress of electric vehicles as a much-needed move towards a more sustainable and energy-secure future for India and a healthier life for Indians.

Research output of Indian institutions during 2011–2016: quality and quantity perspective

K. S. Rajan, S. Swaminathan and S. Vaidhyasubramaniam

Keywords: Public and private institutions, performance assessment, quality and quantity perspective, research output.

Abstract

The publication output from Indian institutions has been steadily increasing during the last few years. This may be attributed to the higher investment in research and also linking the number of publications with career advancement. There is a need to analyse the publication output of Indian institutions in terms of quality of publications. In this study, output in the top 10 percentile, as computed by SciVal (a product of Elsevier), has been used as an indicator of the quality of research output, since it reflects the percentage of an institution's publication in the top 10 percentile of the most cited articles. Out of the 15 subject areas listed in SciVal, 7 contribute to more than 65% of publications from Indian institutions. Accordingly, Indian institutions with output in the top 10 percentile greater than the national average in these 7 major subject areas have been identified to compare their research output in terms of quality.

A bibliometric analysis of research on multiple criteria decision making

Dejian Yu, Wanru Wang*, Wenyu Zhang and Shuai Zhang

Keywords: Bibliometrics, multiple criteria decision making, multiple attribute decision making, social network analysis, VOSviewer.

Abstract

In this study, publications in the multiple criteria decision making (MCDM) field during 1977–2016 were analysed using bibliometric analysis. The statistical analysis of influential publications, journals, countries/territories and authors was first conducted. The developing trends of authors' collaborative structure and research topics were then analysed based on four different periods. The results indicated that more number of publications and authors contributed to MCDM research in the last ten years, and that the collaboration among authors has increased. The comprehensive and scientific analysis of MCDM should help researchers conduct studies in related fields.

Recent wintertime climatic variability over the North West Himalayan cryosphere

H. S. Negi, Neha Kanda, M. S. Shekhar and A. Ganju

Keywords: Climate change, cryosphere, rainfall, winter warming and precipitation.

Abstract

This study discusses the observed long-term (1991–2015) and short-term (1991–2000 and 2001–2015) trends in winter temperature and precipitation over Northwestern Himalaya (NWH) along with its constituents, i.e. Lower Himalaya (LH), Greater Himalaya (GH) and Karakoram Himalaya (KH). An overall warming signature was observed over NWH since maximum, minimum and mean temperatures followed rising trends with a total increase of 0.9°C, 0.19°C and 0.65°C respectively, in 25 years, the increase being statistically significant for maximum and mean temperatures. However, warming was not consistent over all zones of NWH with minimum temperature at LH showing anomalous cooling by 0.83°C (statistically significant at $\alpha = 0.05$) during 25 years. The rise in mean temperature was observed highest at GH, i.e. 0.87°C (1991–2015) followed by KH, i.e. 0.56°C, which is in agreement with observations of comparatively higher rate of glacier retreat over GH than KH as reported in several studies. Total precipitation (rainfall + snowfall) was found to increase whereas snowfall was found to decrease with concurrent significant increase in rainfall at all zones of NWH. The spatiotemporal winter climatic variations over NWH support the impact on recently reported findings on the Himalayan snow cover and glacier variations at different durations.

Remote sensing analysis of changes in Chorabari glacier, Central Himalaya, India

Bandyopadhyay, Gulab Singh and Farjana Birajdar

Keywords: Chorabari, elevation change, mass balance, remote sensing analysis.

Abstract

In this study, mass balance for Chorabari glacier of the Central Himalaya, India has been estimated. This glacier has been considered for the case study as it feeds the Mandakini River and was one of the reasons for flash floods in Rudraprayag district, Uttarakhand in 2013. The observations are based on glacier area/length change and rate of melting in the multidecade (1976–2016) using Landsat data. The study estimates an overall decrease in area at 0.8% per year. Elevation change has been studied using geodetic method utilizing shuttle radar topography mission and TanDEM-X datasets, which have shown a decrease in elevation in 16 years (2000–16). From these remotely observed parameters, a negative mass balance for the decade 2000–11 indicates glacier retreat. This study highlights the applicability of optical and radar remote sensing for the Himalayan glaciers, for better disaster management and understanding glacier dynamics in response to climate change.

Temporal change and flow velocity estimation of Patseo glacier, Western Himalaya, India

K. K. Singh, D. K. Singh, H. S. Negi, A. V. Kulkarni, H. S. Gusain, A. Ganju and Babu Govindha Raj K.

Keywords: Glaciers, ground penetrating radar surveys, velocity and thickness estimation, winter precipitation.

Abstract

In the present study we estimate the velocity and thickness of the Patseo glacier, Himachal Pradesh, India. The average velocity of the glacier was estimated as ~ 5.47 m/year using co-registration of optically sensed images and correlation (COSI-Corr) method. The glacier thickness was found to vary between 12 and 278 m, with an average value 59 m. The total glacier ice volume was estimated as $\sim 15.8 \times 10^7$ m³, with equivalent water reservoir of $\sim 14.5 \times 10^7$ m³. Ground penetrating radar (GPR) surveys were conducted during 2004 and 2013 for validation of the estimated glacier thickness. The glacier thickness estimated using COSI-Corr method was found to be in agreement with GPR-retrieved glacier thickness (RMSE = 4.75 m; MAE = 3.74 m). The GPR profiles collected along the same geographic locations on the glacier during 2004 and 2013 showed a reduction in ice thickness of ~ 1.89 m, and thus resulting in an annual ice thickness decrease of ~ 0.21 m. The glacier area was estimated for 2004 and 2013 using LISS IV satellite data and found to be ~ 2.52 and ~ 2.30 sq. km respectively. This shows an annual reduction of ~ 0.024 sq. km in glacier area. The total annual loss in glacier ice volume was estimated as $\sim 4.55 \times 10^5$ m³. This loss in the glacier ice volume of the Patseo glacier is supported by the snow and meteorological observations collected at a nearby field observatory of Snow and Avalanche Study Establishment (SASE). The climate data collected at SASE meteorological observatory at Patseo (3800 m), between 1993–94 and 2014–15 showed an increasing trend in the mean annual temperature and a decreasing trend in winter precipitation.

Decadal change in supraglacial debris cover in Baspa basin, Western Himalaya

S. Pratibha and Anil V. Kulkarni

Keywords: Climate change, glaciers, remote sensing, supraglacial debris cover, western Himalaya.

Abstract

Supraglacial debris cover (SDC) influences surface energy balance and glacier dynamics. However, very few studies have been carried out to understand its distribution and evolution. Previous glacier investigations carried out in Baspa basin, Western Himalaya, focus on retreat and mass balance. Therefore, the present study monitored change in SDC area from 1997 to 2014 using Landsat data. SDC area change was estimated within a ‘minimum snow-free glacier area’ using normalized difference snow index (NDSI) and band ratio of near infrared and shortwave infrared. Threshold values for NDSI and band ratio map were derived manually. The study was carried out for a ‘minimum snow-free glacier area’ of 60.5 ± 2.4 sq. km out of 174 ± 7 sq. km of total glaciated area. SDC area of 31.5 ± 1.4 , 33.2 ± 1.2 , 34.6 ± 1.9 and 36.3 ± 0.7 sq. km for 1997, 2000, 2011 and 2014 respectively, was estimated. Analyses show a linear increase in SDC area from 1997 to 2014 by $2.8 \pm 0.4\%$. Naradu, a benchmark glacier in the basin, show one of the highest increase in SDC area ($5.6 \pm 0.4\%$). The findings from the present study are in line with other published results that suggest retreat, glacier fragmentation and mass loss, which could be due to climate change. The present study can be extended further using the SDC map and the results, in glacier hydrology and mass balance modelling to predict future loss.

Investigating the performance of snowmelt runoff model using temporally varying near-surface lapse rate in Western Himalayas

Smarika Kulshrestha, RAAJ Ramsankaran, Ajay Kumar, Manohar Arora and A. R. Senthil Kumar

Keywords: Himalayas, lapse rate, snowmelt runoff model, temporal variation.

Abstract

The present study assesses the effect of accounting the temporal variation of near-surface lapse rate in the conceptual, degree-day snowmelt runoff model simulations in a cold-desert region of Himalayas. The nearsurface lapse rate over Spiti basin shows seasonal variation during a year. The results obtained show that the inclusion of monthly variation of lapse rate in the hydrological modelling is able to capture the observed hydrograph more efficiently than when an annually constant value of lapse rate is employed. Based on our results and considering the available data, a monthly representation of near-surface lapse rates in the temperature index based models is recommended for Himalayan basins.

Developing extension model for uptake of precision conservation agricultural practices in developing nations: learning from rice–wheat system of Africa and India

G. A. Shitu, M. S. Nain and Rashmi Singh

Keywords: Developing nations, extension strategies, rice–wheat system, smallholder farmers, sustainable agriculture.

Abstract

We have learnt time and again that food supply shocks have resulted in food price spikes, instability, violence and even regime collapse. When the supply chain at the primary producers (farmers) level is functioning well, the success will ripple down the whole chain. In this review, we present our approach for the development of an extension model for the promotion of precision conservation agricultural practices (PCAPs) uptake among rice–wheat smallholder farming households, considering the demand as well as the prospect for developing and up-scaling rice–wheat production system in Africa. PCAPs are technologies and practices that are capable of helping farmers to apply right resources at the right place and, at the right time, using the right method. The combination of these technologies and practices can help in achieving optimum resource stewardship and resource conservation in the farmers' field. However, extension strategies and supports are needed to facilitate the adoption of these best practices at the farmers' level.

Response of bacterial biosorbents to chemical treatment as influenced by cell membrane structure and impact on the adsorption behaviour of dyes

Lwandle P. Simelane, Elvis Fosso-Kankeu, Patrick Njobeh and Sadanand Pandey

Keywords: Adsorption affinity, bacteria, bioremediation, chemical treatment, dyes, water pollution.

Abstract

The impact of cell membrane structure and adsorption capacity of dyes due to chemical treatment on Gram-positive and Gram-negative bacteria was studied. The adsorption was found to occur through a chemisorption mechanism. The adsorption capacity of treated bacteria was higher (68.49–161.29 mg/g) than untreated bacteria (9.37–29.11 mg/g) during the removal of methylene blue. Furthermore, the treatment allowed bacteria to adsorb methyl orange, which was not removed by untreated bacteria. The applied chemical treatment is therefore influenced by the cell membrane structure and could be considered to improve the adsorption capacity of bacteria for the removal of dyes from polluted water

Production, purification and partial characterization for an oxalate decarboxylase (OxDcase) from the probiote *Lactobacillus plantarum*

KSK-II Essam Kotb

Keywords: Calcium oxalate, *Lactobacillus plantarum*, oxalate decarboxylase, purification, urolithiasis.

Abstract

Lactobacillus plantarum KSK-II was the most potent oxalate decomposer among various isolated lactic acid bacteria. There was no detectable extracellular or even intracellular oxalate decarboxylase (OxDcase) productivity in the absence of oxalate. The highest enzyme productivity was obtained at 72 h in a medium containing 0.1 M oxalate, 0.1% (w/v) D-glucose, 0.05% (w/v) soybean flour and 0.1% (w/v) of the prebiotics fructo-oligosaccharides and arabinogalactan. Enzyme purification increased its specific activity to 19.6-fold with 14.8% recovery and molecular weight of 63 kDa. The optimal reaction temperature, pH and pI values for OxDcase were 35°C, 5.0 and 3.5 respectively, and it was stable till 70°C and at pH 4.0–7.0 for 1 h. The apparent K_m value of the enzyme was 12.70 mM, the turnover number (K_{cat}) was 64.10 s⁻¹ and the catalytic efficiency (K_{cat}/K_m) was 5.05 mM⁻¹ s⁻¹. Treatment of oxaluric rats with *L. plantarum* KSK-II and a prebiotic mixture significantly decreased oxalate levels inside their bodies suggesting a successful synbiotic system in the prevention of oxalate stones. KSK-II OxDcase may also be clinically significant from the perspective of its thermo-tolerance and activation by triton X-100 and the reducing agents (sodium-L-ascorbate, potassium ferrocyanide and o-PDA). The non-inhibitory activity of chloride and the oxalate specificity are also significant for clinical applications of the enzyme in measuring of oxalate levels in body fluids.

Phosphate solubilization mechanisms in alkaliphilic bacterium *Bacillus marisflavi* FA7 Neha

Prabhu, Sunita Borkar and Sandeep Garg

Keywords: Alkaliphilic bacterium, *Bacillus*, mechanism, phosphate solubilization, phosphatase.

Abstract

This study reports the mechanisms of phosphate solubilization present in alkaliphilic *Bacillus marisflavi* FA7. The strain obtained from sediment samples of mangrove ecosystem exhibited different mechanisms to solubilize inorganic phosphate and mineralize organic phosphate under alkaline conditions. It reduced the pH of the medium that showed near perfect correlation with tri-calcium phosphate solubilization. Organic acids produced by the strain were detected in broth. Maximum decrease in pH of the medium was observed with NH₄Cl as an inorganic nitrogen source. This indicated involvement of proton extrusion mechanism toward phosphate solubilization during ammonium uptake. It produced exopolysaccharide, but failed to produce siderophore. *Bacillus marisflavi* FA7 produced extracellular alkaline phosphatase having molecular weight of 175–200 kDa. The pH optimum for maximum enzyme activity was 10.1 and K_m of 1.13 μM p-nitrophenolphosphate. This is the first study to report the highest tri-calcium phosphate solubilization by an alkaliphilic bacterium.

Analysis of regional competitiveness in the high-tech industry

Weida He^{1,2}, Zhifeng Lin¹ and Rong Hao¹

Keywords: Factor analysis, high-tech industry, regional competitiveness.

Abstract

The high-tech industry has resulted in economic development and international competition among countries. High output and large exports cannot conceal development imbalances of the high-tech industry. This study is an empirical research to analyse regional competitiveness differences using China as a case study. Based on factor analysis, it compared the competitiveness of the high-tech

industry in 31 provinces, autonomous regions and municipalities, analysed the competitiveness differences among four economic regions, and discussed spatial distribution features of the high tech industry. The results showed that large differences existed in regional competitiveness of the high-tech industry. Guangdong had the strongest high-tech industry competitiveness, while Shanxi ranked at the bottom. Among the four economic regions, the eastern region had the strongest competitiveness, followed by middle, western and north-eastern regions. In addition, differences and imbalances of development of the high-tech industry also existed within the same economic region.

Quantitative inventories of ants from India: gaps, prospects and recommendations

Aniruddha Marathe and Priyadarsanan Dharma Rajan

Keywords: Ant sampling, ALL-protocol, Arunachal Pradesh, inventory of ants.

Abstract

India is regarded as one of the highly diverse but data-deficient regions in terms of ant diversity. Despite a number of studies, patterns in diversity of ants in India are still unclear. Through a review of recent Indian studies based on samples of ground dwelling ants, we highlight reasons that may underestimate diversity and hinder comparisons. This study shows that recent developments in sampling ant assemblages and analysis of the data have not sufficiently rooted in India. In addition, several geographic areas are still under-explored and need further attention. Therefore, it is important that future inventories adapt methods that facilitate comparison of data. In this regard, we provide results that reiterate some of the important developments in designing effective inventories for ants. The appraisal of data through such methods is expected to improve the knowledge about Indian ant fauna and its distribution.

Seasonal surface chlorophyll a variability in the Seychelles–Chagos Thermocline Ridge

Jenson V. George, M. Nuncio, N. Anilkumar, Racheal Chacko and D. Rajashekhar

Keywords: Buoyancy flux, chlorophyll a, climatology, wind mixing.

Abstract

Seychelles–Chagos Thermocline Ridge (SCTR, 5°– 10°S, 50°–75°E) in the southwestern tropical Indian Ocean is a unique area that experiences year-round upwelling. This is a response to the upward Ekman pumping prevalent in the region. Satellite data, model data and objectively analysed Argo temperature/ salinity data have been used to study the seasonal surface chlorophyll a (chl a) variability in SCTR. Variability of surface chl a concentration in SCTR showed a weak semiannual signature. The western part of SCTR (WSCTR, 50°–62°E) is characterized by higher chl a concentration than the eastern part (ESCTR, 63°–75°E). Average chl a concentration in WSCTR/ESCTR showed a primary peak in July– August (~0.26/~0.16 mg/m³) and a secondary peak in January (~0.14/~0.12 mg/m³). Minimum chl a concentration (~0.12/~0.1 mg/m³) was observed during March– April and December–January. The high amplitude of chl a variability observed during July–August is associated with weak stratification and deep mixed layer depth (MLD). Deep MLD reaching to nutrient-rich thermocline entrains nutrients to the surface and thereby increases the surface chl a concentration. However, the low surface chl a concentration is a result of shallow MLD in the region. The deep MLD (30–40 m) observed during June–October is dominated by wind mixing and supported by buoyancy mixing. Shallow MLD observed during rest of the year is due to weak wind mixing and high surface buoyancy. The high surface buoyancy is a manifestation of ocean surface warming and presence of low saline surface waters in the SCTR region.

Archaeological studies at Dholavira using GPR

Silky Agrawal, Mantu Majumder, Ravindra Singh Bisht and Amit Prashant

Keywords: Archaeology, electromagnetic waves, ground penetrating radar, water reservoirs.

Abstract

A new area at an existing archaeological site of Harappan civilization at Dholavira, Gujarat, India has been studied using ground penetrating radar (GPR). An area of 12,276 m² was surveyed using 200 MHz antenna at grid spacing of 2–3 m. The soil strata was found to extend mainly up to 3.5–4 m. The survey was conducted during the dry season to collect good signals. Post-processing was carried out to map the bedrock as well as archaeological features. A number of linear features were observed from the 3D image of the subsurface created from the acquired GPR profiles. Unlike residential structures, the large dimensions of these features indicate the likely existence of a series of water structures that may have partly collapsed due to floods at some point. There were some areas full of rubble next to the damaged walls that appeared to be orthogonal to the direction of possible flood from Manhar River.

Strong electron–phonon interaction establishes correlation between superconducting and charge density wave states in NbSe₂

I. Naik and S. Sethy

Keywords: Charge density wave, phonon energy, superconductivity, transition-metal compound.

Abstract

Here an analytical expression is proposed for the correlation between superconducting (SC) transition temperature (T_{sc}) derived by Louie and Cohen and charge density wave (CDW) transition temperature derived by Peierls at strong electron–phonon interaction. This expression was verified by the pressure effect T_{sc} and T_{cdw} of 2H-NbSe₂ with $m \approx 64.86$ and $c \approx 2.24$ as best-fitting parameters. From these parameters, phonon energies $\langle \omega \rangle_{sc} \approx 3.8$ meV and $\langle \omega \rangle_{cdw} \approx 1.4$ meV were calculated for SC and CDW states respectively. It also provides T_{cdw} very close to the experimental values of 2H- and 4H-NbSe₂, regardless of their stacking order and coordination difference.

Nanocellulose as functional filler in starch/polyvinyl alcohol film for preparation of urea biosensor

Prasad Satyamurthy and Vigneshwaran Nandanathangam

Keywords: Functional filler, nanocellulose, starch film, urea biosensor, urease immobilization.

Abstract

Urea analysis is of considerable interest in clinical, agricultural and environmental chemistry. Urea biosensor helps in on-site monitoring of urea. The aim of this study was to evaluate the potential use of nanocellulose reinforced composite film as substrate for urea biosensor. Nanocellulose was prepared from non-spinnable short staple cotton fibres by controlled microbial hydrolysis process. This was used as a substrate to immobilize urease enzyme and, subsequently used to reinforce the starch/polyvinyl alcohol biocomposite film. Nanocellulose acted as both carrier for the enzyme and reinforcing agent in the film. Use of 1.5% nanocellulose increased the tensile strength of the resultant film to the tune of 2.5-fold. About 68% immobilization efficiency of urease onto nanocellulose was observed in the reported process. The biosensor could detect the presence of urea linearly in the range of 10 to 1000 ppm concentration in water with a response time between 30 sec and 1 min. The storage lifetime was 2 months when stored in 4°C with the activity more than 90%. The study revealed that the nanocomposite film could significantly improve the performance and storability of urea biosensor.

Selecting clinical and laboratory methods of manufacture of orthopaedic titanium alloy structures using a biopotentiometer

Alexei V. Yumashev, Anatolij S. Utyuzh, Maria V. Mikhailova, Vadim O. Samusenkov and Ilona R. Volchkova

Keywords: Biopotentiometry, dentistry, dentures, galvanosis, galvanic currents, titanium alloys.

Abstract

The present communication aims at determining an optimum method of manufacture of orthopaedic arch titanium alloy dentures that would not cause galvanosis in patients using such dentures. A clinical randomized controlled retrospective study was conducted. Sixty patients who used arch titanium alloy dentures were examined. Three measurements of electrochemical potentials in various areas of the oral cavity were done in all patients, using a biopotentiometer. Linear prediction of differences in potentials in measurement areas 1–3 for the control group (CG) of patients exhibited minor growth dynamics, which can be indicative of the risk of galvanosis in CG patients in the future.

Identification of unique characteristics of deception from facial expression

Ananya Mondal, Pritha Mukhopadhyay, Nabanita Basu, Samir Kumar Bandyopadhyay and Tanima Chatterjee

Keywords: Deception, facial asymmetry, facial expression.

Abstract

Facial asymmetry provides important information for detecting deception. The present study aims at deciphering deception in facial expression unique to Indian culture and to detect differences between parameters of expression of ‘felt’ emotion and ‘deceived’ expression. Facial expressions are analysed based on Facial Action Coding System. Results reveal that participants deamplify happiness whereas they neutralize and mask negative emotions.

Soybean MAGIC population: a novel resource for genetics and plant breeding

M. Shivakumar, Giriraj Kumawat, C. Gireesh, S. V. Ramesh and S. M.

Keywords: High-throughput genotyping, quantitative trait, multiparent, 8-way hybrids.

Abstract

The acronym MAGIC that stands for ‘multiparent advanced generation intercross’ is a powerful next generation mapping population to precisely map the agronomically important quantitative trait loci. An eight parent based soybean MAGIC population was developed by employing 2-way, 4-way and 8-way intercross hybridization. The aim was to obtain MAGIC-derived breeding lines with higher yield, broader genetic base, increased diversity and variability. The 8-way and 4-way intercross hybrids so developed in the present study will be evaluated for their yield potential in the subsequent generation under changing climatic conditions (F2–F8 generation).

Moisture-dependent physical and physiological properties of accelerated aged pea (*Pisum sativum* L.) seeds

Manoj Kumar Mahawar, D. V. K. Samuel, J. P. Sinha and Kirti Jalgaonkar

Keywords: Moisture, physical properties, germination properties, accelerated aging.

Abstract

The present study was carried out to determine the physical as well as physiological properties of three fresh pea seed lots (cv. Arkel) with moisture content and germination percentage varying from 14.94% to 28.04% dry basis and 80% to 60% respectively. This variation in moisture content and physiological parameters was obtained using accelerated aging (40°C and 100% RH). The geometric

(spatial dimensions, sphericity and surface area), gravimetric (terminal velocity, true density, test weight, bulk density and porosity), frictional (angle of repose, coefficient of static friction), mechanical (compressive strength) and physiological parameters (seedling dry weight, seedling length, vigour indices, electrical conductivity and root growth parameters) were determined for the selected seed lots. The effect of moisture content on seed lots was significant ($R^2 \geq 0.947$) on physical and physiological properties of seed lots. This study may help in designing seed priming prototype suitable for pea seeds.

Proline-rich proteins may regulate free cellular proline levels during drought stress in tomato
Ranjit

Singh Gujjar, Suhas G. Karkute, Ashutosh Rai, Major Singh and Bijendra Singh

Keywords: Drought stress, gene expression, prolinerich proteins, tomato.

Abstract

Proline (Pro)-rich proteins (PRPs), initially identified as structural proteins of cell wall, have emerged as multifunctional plant proteins in recent past. Their vibrant role in plant development and environmental stress promoted us to study a SIPRP gene of tomato, which was significantly downregulated under drought stress in a microarray experiment performed in our laboratory. Promoter analysis of SIPRP revealed a number of stress-responsive protein-binding sites, confirming its expression in response to stress. Expression of SIPRP gene in different tissues of tomato, viz. root, stem, leaf and flower was studied to analyse the gene expression pattern in response to drought stress. Further, we have correlated the expression of SIPRP gene with Pro levels of the respective plant tissues under drought stress. In anticipation, it has been observed that downregulation of SIPRP gene is coupled with simultaneous increase in cellular Pro concentration in all the tissues under drought stress, except the roots. This could help preserve the available cellular proline to function as osmoprotectant during stress. The present results propose a hypothesis where PRPs may regulate free cellular proline levels during drought stress by regulating their own gene expression. Thus, it may be concluded that transcription of PRPs in plants is synchronized with the cellular Pro concentration under environmental stress in order to provide drought tolerance to plants.

Understanding the Aryan debate: population genetic concepts and frameworks

Partha P. Majumder

Keywords: Ancestry, admixture, central Asia, haplogroup, lineage

Abstract

A long-standing debate on whether 'Aryans' (central Asians) had entered India has recently gained momentum. The debate is polarized. In the recent set of articles, some authors have strongly criticized inferences drawn using genomic data and population genetic methods. Some criticisms are flawed. These criticisms stem from lack of clear understanding of population genetic concepts and frameworks. Such inappropriate criticisms have led to unnecessary confusion and further polarization among readers. This article attempts to place the ongoing 'Aryan debate' in the perspective of population genetic frameworks.

Mangrove forests of India

K. Kathiresan

Keywords: Bhitarkanika, mangrove forest ecosystems, management, Sundarbans.

Abstract

Mangrove forests of India are globally unique with the highest record of biodiversity, gifted with the mangrove genetic paradise at Bhitarkanika, and the globally threatened wildlife species in the Sundarbans. The Sundarbans of India and Bangladesh is the only largest mangrove forest in the world colonized by the Royal Bengal Tigers. Mangroves are dense and floristically diverse along the east coast of India and the Andaman and Nicobar Islands. They are largely distributed in the high energy tidal coast of two extreme conditions: (i) humid and wet in Sundarbans with rich biodiversity, and (ii) arid and dry in Gujarat with low biodiversity. Despite increasing pressures, the mangrove cover in India increases annually at the rate of 1.9%, as against the global mangrove cover that disappears at 0.66%. However, India has a large track of sparse mangrove stand. This article discusses the present status of mangrove forests, conservation and management strategies being followed successfully in India, and recommends the future directions for mangrove restoration, improvisation of sparse stands, participatory management, and quality publications on mangrove research.

Understanding the linkages between climate change and forest

Rinku Moni Devi, Maneesh Kumar Patasaraiya, Bhaskar Sinha, Sameer Saran, A. P. Dimri⁴ and
Rajeev Jaiswal

Keywords: Climate change, forest, regional climate models, remote sensing.

Abstract

The present study reviews the application of various regional climate models and remote sensing techniques to understand and define impacts of climate change on the forest resources with specific reference to India. It illustrates the potentials and limitations of regional climate models, vegetation models and remote sensing techniques like normalized difference vegetation index time-series analysis, change detection method and phenological attributes in assessing and monitoring the impacts of climate change on vegetation. The study recommends that regional climate models and remote sensing techniques need to be integrated in tandem for understanding the present and future impacts of climate change on forest ecosystems. This could help to improve the accuracy and prediction, which can contribute to planning effective adaptation strategies in the forestry sector.

Speciality rice biodiversity of Kerala: need for incentivising conservation in the era of changing climate

Girigan Gopi and M. Manjula

Keywords: Climate change, conservation incentive, genetic diversity, in situ conservation, rice landraces.

Abstract

Genetic diversity is integral to food security and sustainable agriculture. The erosion in genetic diversity across the globe raises serious threats to food security and our capacity to adapt to climate change. This article discusses the status of genetic diversities of rice varieties in Kerala, and the contributing factors for the genetic diversity. The rich genetic diversity of rice in Kerala offers scope to adapt to multiple agroecologies, provides resistance to biotic and abiotic stresses, carries special culinary traits and has cultural significance. Thus, these rice landraces are important in creating an enabling environment for farming in the context of climate change. However, shift from landraces to modern varieties and large scale conversion of rice fields for alternate uses poses challenge to in situ conservation of rice landraces. The existing policy environment, research and development strategies and markets are skewed in favour of modern varieties. It is argued that the need for 'conservation incentive' is a key strategy for promoting in situ conservation of rice landraces of Kerala.

Quantitative analysis of marker-based watershed image segmentation

S. Madhumitha and M. Manikandan

Keywords: Gradient magnitude, image segmentation, markers, morphology, watershed.

Abstract

A methodology is proposed by combining the application of markers along with watershed transformation and thresholding for image segmentation. Use of the traditional watershed algorithm is widespread because of its advantage of being able to produce a complete division of the image. However, its drawbacks include over-segmentation and noise sensitivity. Therefore, the marker-based watershed segmentation is proposed here to overcome these effects. First, the original image is preprocessed by filtering techniques in order to smoothen it. Secondly, the foreground objects are marked. Then, the background markers are computed. Finally, the marked image is transformed through watershed transformation. The area is computed for the segmented objects in the image. It has been proved that this method reduces the error percentage.

A target imaging method of multiple-input-multiple-output ground penetrating radar-based on direction of arrival estimation

Xi Jianjun and Huang Ling

Keywords: Beam-forming algorithms, direction of arrival estimation, ground penetrating radar, target imaging.

Abstract

In this study we consider imaging of the multipleinput-multiple-output ground penetrating radar (MIMO-GPR) system, and analyse the effect and accuracy of the estimation for target echo arrival upon direction of arrival (DOA) in the three beam-forming algorithms, i.e. least square, Capon algorithm and amplitude phase estimation. We propose a method of multi-antenna GPR target imaging based on the DOA estimation. This method, to perform the target imaging, makes combined use of DOA estimation of target echo signal in MIMO array and array spatial observation information. By spatial scanning for the imaging points, the target is localized and the reflection intensity is estimated from the weighted integral of each estimated DOA amplitude value at the imaging point. This method, with simpler practice, less data observation frequency and more efficient

calculation, can speed up the target detection measurement and improve the data interpretation efficiency.

Regional scale analysis of climate extremes in an SRM geoengineering simulation, Part 1: precipitation extremes

Rohi Muthyala, Govindasamy Bala and Aditya Nalam

Keywords: Geoengineering, solar radiation management, extreme events, regional analysis

Abstract

In this study, we examine the statistics of precipitation extreme events in a model simulation of solar radiation management (SRM) geoengineering. We consider both intensity and frequency-based extreme indices for precipitation. The analysis is performed over both large-scale domains as well as regional scales (22 Giorgi land regions). We find that precipitation extremes are substantially reduced in geoengineering simulation: the magnitude of change is much smaller than those that occur in a simulation with elevated atmospheric CO₂ alone. In the geoengineered climate, though the global mean of the intensity of extreme precipitation events is slightly less than in control climate, substantial changes remain on regional scales. We do not find significant changes in the frequency of precipitation extremes in geoengineering simulation compared to control simulation on global and regional scales. We infer that SRM schemes are likely to reduce precipitation extremes and the associated impacts on a global scale. However, we note that a comprehensive assessment of moral, social, ethical, legal, technological, economic, political and governance issues is required for using SRM methods to counter the impacts of climate change.

Scaling of hydraulic functions in heterogeneous soil using nonlinear least squares minimization method

Akram Ahmed

Keywords: Effective saturation, lognormal distribution, scaling, soil matric potential, unsaturated hydraulic conductivity

Abstract

Presenting soil heterogeneity precisely in various spatial scales is the main key to simulate water and solute transport through it. The method described by Richards is mostly used to study water flow through vadose zone. It requires spatial representation of hydraulic functions and water retention relationship in the soil. To represent the spatial relationship of soil hydraulic functions, scaling approach is being used since the last few decades. In this study, a simple scaling method using nonlinear least squares minimization technique has been used to scale soil matric potential, hydraulic conductivity as well as simultaneous scaling of soil matric potential and hydraulic conductivity data. Simultaneous scaling is necessary as it reduces the volume of data by producing a single set of scale factors for hydraulic functions in a heterogeneous soil. Van Genuchten's semi-empirical expressions were used in this study to parameterize soil hydraulic functions. Results showed that correlation coefficient from raw and descaled data was superior when soil matric potential and hydraulic conductivity data were scaled separately than simultaneously. Improvement of correlation coefficient in simultaneous scaling can be obtained by adding more weight to the soil matric potential data than unsaturated hydraulic conductivity data, which enhances the overall correlation coefficient in simultaneously scaling. Statistical analysis of the scale factors showed that they are lognormally distributed. Scale factors calculated by solving simple equations obtained using the method described in this study can be used to simulate water movement through heterogeneous soil conditions using HYDRUS model.

Changes and vertical distribution characteristics of soil organic carbon in different land cover types in Honghe wetland of Sanjiang Plain, China

Yukai Liang, Weihong Dong, Xiancang Wu and Wei Xie

Keywords: Honghe wetland, land cover types, soil organic carbon, vertical distribution characteristics.

Abstract

Soil organic carbon (SOC) responds rapidly to changes in land cover types, and changes in SOC provide essential guidance for sustainable utilization of land resources and protection of wetlands. The vertical distribution of SOC under different land cover types in Honghe wetland was analysed through soil samples and remote sensing interpretation. Changes in SOC under different land cover types were assessed in 2002 and 2014. The results showed that wetland and meadow were the primary land cover types in Honghe wetland. The reduction in normalized difference vegetation index from 2002 to 2014 was mainly due to wetland and meadow area changes. The SOC contents under different land cover types followed the order: wetland > meadow > forest land > dry field > paddy field in the 0–15 cm soil layer. With increase in soil depth from 0 to 60 cm, SOC contents tended to decrease. According to preliminary estimations, the SOC stocks of wetland, meadow, forest land, paddy field and dry field in the soil profile from 0 to 60 cm were 4.39×10^4 , 2.62×10^4 , 2.66×10^4 , 2.11×10^4 and 1.98×10^4 t/sq. km respectively. The total amount of SOC declined by about 364.8 Gg C in the 0–30 cm soil layer from 2002 to 2014, which resulted in the emission of 1338.82 Gg CO₂ to the atmosphere

Calcite precipitation by *Rhodococcus* sp. isolated from Kotumsar cave, Chhattisgarh, India

Sushmitha Baskar, Swati Chalia and Ramanathan Baskar

Keywords: Biocalcification, cave geomicrobiology, precipitation, *Rhodococcus* sp.

Abstract

The precipitation of carbonate minerals by *Rhodococcus* sp. strain S14 isolated from Kotumsar cave, Chhattisgarh, India is reported. The speleothems at Kotumsar showed high microbial cell enumeration on B4 agar; iron agar (3.4×10^5 CFU/g) and sulphite agar (7.2×10^2 CFU/g). National Centre for Biotechnology Information database was used for the BLASTn sequence search of 16S rRNA sequences. The S14 strain gave similarity scores of $\geq 99\%$ with the respective organisms on the database. The strain was identified as *Rhodococcus* sp. Culture experiments performed using the isolated strains suggested that the rate of precipitation was dependent on pH, temperature and bacterial growth. *Rhodococcus* sp. S14 strain induced the formation of calcite in vitro and the biominerals produced were calcified spherulites with pores (as imaged with SEM). The precipitate, at the end of the experimental period of 35 days, had the appearance of coccoliths. This is the initial report on the possible involvement of *Rhodococcus* sp. in the precipitation of carbonates at Kotumsar cave.

Multivariate analysis of deboning data for classifying Hanwoo (Korean native cattle) by gender

Joon-Yong Shim, Ha-Yeong Kim, Byoung-Kwan Cho, Seung Hwan Yang, Changyeun Mo, Kyung Do Kwon, Jin-Hyoung Kim and Wang-Hee Lee

Keywords: Beef gender, discriminant function analysis, gender classification, Hanwoo, deboning data.

Abstract

Gender is an important factor in determining the market price of Hanwoo, but its discrimination is impossible after deboning. This study aims at identifying the variables in Hanwoo deboning data that could be used for gender identification and classification. Deboning data of Hanwoo were analysed by

discriminant function analysis. Seven pre-deboning and 24 post-deboning variables were identified and showed 91.3% and 98.9% accuracy in gender identification respectively. Discriminant power was 98.9% on using all 31 deboning variables. This result suggests that physical characteristics of meat parts are suitable factors for classification of beef by gender.

Quality and impact of GPSRO observations from Megha-Tropique satellite on NGFS model C.

J. Johny and V. S. Prasad

Keywords: Assimilation, bending angle, GPSRO, Megha-Tropiques, NGFS.

Abstract

Megha-Tropique satellite mission launched in 2011 was aimed at providing more observations in the tropical region. In the initial phase of the mission, it was found that the quality of global positioning system radio occultation (GPSRO) observations was not satisfactory. The Indian Space Research Organisation (ISRO) took remedial measures in this regard by modifying the data processing algorithm and releasing the new version of data. In 2012, an observing system simulation experiment (OSSE) was done at National Centre for Medium Range Weather Forecasting (NCMRWF) using simulated data at MeghaTropiques ROSA observation location with Global Forecast System (GFS) based model. As an extension of the previous study, the quality of new version of GPSRO bending angle observations and impact of assimilation of these observations in NCMRWF GFS (NGFS) model were studied. It was found that with the use of a new data processing algorithm, quality of bending angle observations improved and comparable with other GPSRO missions in the pressure range between 500 hpa and 200 hpa. Impact study shows that the new observations improved forecasts in the middle and upper levels in the tropics.

Comparative analysis of grain quality and nutraceutical properties of selected rice varieties from Kerala

K. S. Shylaraj, Soumya G. Nadh and Shimi K. Chandra

Keywords: Antioxidants, grain quality, nutraceutical property, rice varieties.

Abstract

Kerala, the land of rich biodiversity, is a treasure of land races of many crops. The speciality rice varieties of Kerala include Pokkali (organic rice), Jeerakasala and Gandhakasala (scented rice varieties), Black Njavara and Golden Njavara (medicinal rice varieties). A study on the nutraceutical properties of these speciality rice varieties was made to understand their health benefits. Oil content in the rice bran and antioxidants like oryzanol, tocopherol and tocotrienol in the rice bran oil (RBO) of these rice varieties were estimated and compared apart from the quality and nutritional analysis of both rice and bran. The study revealed that the bran is rich in RBO and antioxidants like oryzanol, tocopherol and tocotrienol which may contribute to its high therapeutic value. The study recommends minimum polishing of these rice varieties during milling for consumption purpose. As the bran is rich in fibre and micronutrients like Fe, Cu, B and S, it should be utilized for the preparation of valueadded products like biscuits, baby foods, breads, etc. for healthy human consumption. The study envisages an urgent need for the utilization of the huge quantity of rice bran oil and as component of other food products.

Dynamics of shifting cultivation in relation to slope and elevation in parts of Nagaland, India

Jenita Mary Nongkynrih, Chwadaka Pohshna and Kamani Kanta Sarma

Keywords: Remote sensing, slope, shifting cultivation

Abstract

Shifting cultivation in North Eastern Region of India is practised along the hill slopes by tribes of the region for subsistence living. The present study was carried out to examine the dynamics of shifting cultivation in relation to slope and elevation in Mokokchung, Teunsang and Wokha districts of Nagaland. Temporal Advanced Widefield Sensor data of Resources I were used to derive information on the changes and spatial extent of shifting cultivation areas in these districts. Slope and elevation parameters were derived from Shuttle Radar Thematic Mapper data. The study found a change in current shifting cultivation lands to regenerating shifting cultivation. All three districts showed an increasing trend in regenerating shifting cultivation and decrease in current shifting cultivation lands. A shift of cultivation plots towards higher elevations was noted. Southern slopes are mostly occupied for shifting cultivation by tribal communities in these areas.

Role of antagonistic yeast *Candida tropicalis* YZ27 on postharvest life and quality of litchi cv. Bombai

V. Yeka Zhimo, Jayanta Saha, Balveer Singh and Ivi Chakraborty

Keywords: Biocontrol agent, *Candida tropicalis*, fruit quality, litchi, postharvest life. LITCHI (*Litchi chinensis* Sonn)

Abstract

The efficacy of the antagonistic yeast (*Candida tropicalis* YZ27) as a biological control agent against postharvest natural decay and quality retention of litchi (cv. Bombai) was studied. Application of the yeast antagonist led to rapid colonization on the surface of the fruit and significantly reduced the natural decay incidence and severity following storage at ambient condition ($28 \pm 2^\circ\text{C}$, $78 \pm 1\%$ RH) for six days compared to control fruit. Application of *C. tropicalis* YZ27 prevented weight loss of fresh fruit (8.2%), pericarp browning (8%) and reduction of anthocyanin pigments (11%) of the pericarp over control (12.4%, 96.0% and 38.5% respectively in untreated fruit). Quality attributes like total soluble solids, titratable acidity and ascorbic acid content of litchi fruit were 17.18%, 0.53% and 7.78 mg/100 g in *C. tropicalis* YZ27 applied fruits compared to 11.95%, 0.30% and 6.16 mg/100 g respectively. The results indicate that *C. tropicalis* YZ27 has great potential for development of commercial biocontrol formulations as an alternative of SO₂ fumigation to control postharvest decay and quality retention of litchi fruit.

Coral-killing sponge *Terpios hoshinota* invades the corals of Gulf of Mannar, Southeast India

K. Diraviya Raj, M. Selva Bharath, G. Mathews, Greta S. Aeby and J. K. Patterson Edward

Keywords: Coral reefs, invasion, *Montipora divaricata*, sponge, *Terpios hoshinota*.

Abstract

Terpios hoshinota is an encrusting cyanobacteriosponge which grows aggressively over live coral colonies and has been reported to undergo outbreaks which kill corals. In an underwater survey conducted on the reefs of Gulf of Mannar, an outbreak of this coral-invading sponge was witnessed for the first time. It was found invading approximately 5% of the *Montipora divaricata* colonies ($n = 383$) at 1 m depth in Vaan Island. The affected site had a high coral cover (85.13%) dominated by montiporids (79.97%). *T. hoshinota* was confirmed via underwater morphology and microscopic observation of distinctive lobed tylostylespicules. This sponge is reported to have caused significant damage to many reefs around the world and hence immediate steps are needed to protect the reefs of Gulf of Mannar. Further studies are needed to assess the extent of *T. hoshinota* invasion in Gulf of Mannar and progression rate over live coral colonies.

Surface water quality in sacred groves of Garhwal Himalayan region, India

Purna Jana, Kaboli Wotsa, Sabyasachi Dasgupta and Nagendra P. Todaria

Keywords: Deodar and oak forest types, sacred grove, water quality.

Abstract

We have studied the quality of surface water in three sacred groves of Garhwal (Uttarakhand, India). The water samples were collected in March–April 2013. Results showed that all water samples conformed to WHO standards for potability. Water of Hariyali Devi recorded the lowest dissolved oxygen and water of Tarkeshwar had the highest hardness. The quality water of Ravigaon was found to be the best among the waters of the three groves. Water from deodardominant forests recorded higher dissolved oxygen, total hardness, calcium and magnesium hardness. The overall drinking water quality of oak-dominated forests was found to be better.

Kinematics and timing of brittle–ductile shearing of Mylonites along the Bok Bak fault, Peninsular Malaysia

Ahmad Faiz Salmanfarsi, Mustaffa Kamal Shuib, Ng Tham Fatt and Mohamad Tarmizi Mohamad Zulkifley

Keywords: 40Ar– 39Ar dating, Bok Bak fault, Peninsular Malaysia, Sundaland, strike slip.

Abstract

Study on the Bok Bak fault in Peninsular Malaysia reveals it to be a predominantly dextral brittle–ductile strike slip fault zone. This fault zone is characterized by gentle to sub-horizontal NE stretching lineation. The deformation occurred in a brittle–ductile domain. 40Ar/39Ar radiometric dating of biotite from the mylonite assigns an age of 136.1 ± 1.4 Ma. This age is the first reported radiometric dating of the Bok Bak fault, suggesting that the fault affected Sundaland prior to the collision between India and Asia, and therefore indicates an early faulting in the Malay Peninsula.

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Assessing the quality of higher education institutions in India: an alternative framework

Pranab Mukhopadhyay, Murari P. Tapaswi, P. K. Sudarsan and Kavya Sudarsan

Keywords: National Institutional Ranking Framework, publication rate, ranking HEIs, Scopus.

Abstract

Various stakeholders use the ranking of Higher Education Institutions (HEIs) as a measure of quality. This is evident from numerous ranking efforts – both of the government (National Institutional Ranking Framework (NIRF) of the Ministry of Human Resources Development (MHRD), the National Academic Accreditation Council (NAAC) and the National Board of Accreditation (NBA)) and the private sector. Developing countries like India should assess the academic quality by working with parameters that are globally acceptable, transparent to all stakeholders and not amenable to the control of lobby groups. One such parameter is publications in reputed international journals indexed by databases like Scopus and Web of Science is also considered by the NIRF. However, in contrary to the NIRF method, we propose that instead of considering the total publications the computations should be based on the publication rate (number of publications per teacher) to control the faculty size bias. Besides using the NIRF 2017 data, we observed that higher density of Ph D students increases both the number and the quality of publications and HEIs that invest more, tends to have a higher publication rate. Therefore, we conclude that the Indian HEIs should increase the number of Ph D students and access better funding in order to improve their global presence.

Collaboration patterns of Indian scientists in organic chemistry

K. C. Garg, S. Kumar and Bebi

Keywords: Academic institutions, collaboration pattern, collaborative index, organic chemistry

Abstract

An analysis of 17,344 papers published by Indian scientists and indexed by Web of Science in the discipline of organic chemistry during 2004–2013 indicates that collaborative coefficient has increased during the later years (2011–2013). Of the total published papers, 6312 (36.4%) were due to domestic and international collaboration. The share of papers in domestic collaboration was 77.3% (4882) and international collaboration was 22.7% (1430). Among the international collaborating countries, India had published highest number of papers with the USA followed by Germany. Academic institutions followed by Council of Scientific and Industrial Research (CSIR) contributed the highest number of papers in domestic as well as in international collaboration. However, the value of domestic collaborative index and international collaborative index was less than 100 for both the sectors. The labs funded by CSIR also topped the list of institutions having domestic and international collaborative papers. The compound annual growth rate in domestic and international collaborative papers was 4.7 and 5.3 respectively. The value of domestic collaborative index was highest for CSIR-CDRI, Lucknow and international collaborative index for Madurai Kamaraj University, Madurai.

Policy as a driver of economic growth: historical evidence from the Indian pharmaceutical industry

Nisha Chandran and Samir K. Brahmachari

Keywords: Health policy, Indian pharmaceutical industry history, open source, science policy history, science and technology policy.

Abstract

Sound implementation of a well-crafted policy decision allows for technological innovation and sectoral economic proliferation. The rise of the Indian pharmaceutical sector is a classic example in this context. This article aims to trace the evolution of the Indian pharmaceutical industry, highlighting the robust policy decisions favouring the proliferation of the pharmaceutical industry. The national linkages in the form of institutional capacity building and technological improvements have also been focused upon.

Breeding of new ornamental varieties: Rose

S. K. Datta

Keywords: Floriculture, genetic diversity, hybridization, mutation, pigments, rose breeding.

Abstract

Floriculture has become an important industry in many countries as a result of advanced scientific techniques and stable supply of improved varieties. Development of new varieties and their fast marketing are major challenges in floriculture trade. Rose is grown mainly for cut flowers for floriculture industry. All the present-day colourful varieties and their novelties are the result of extensive random hybridization, spontaneous and induced mutations and selections. Voluminous literature is now available on rose breeding using different technology. Here we highlight how present knowledge can be exploited to regulate various desirable characters of rose for selective hybridization, target-oriented induced mutation and in vitro mutagenesis. Molecular breeding offers new and exciting challenges for future improvement of rose.

In vitro and in silico validation of anti-cobra venom activity and identification of lead molecules in *Aegle marmelos* (L.) Correa

N. C. Nisha, S. Sreekumar, D. A. Evans and C. K. Biju

Keywords: *Aegle marmelos*, cobra venom, docking, phytochemicals, snakebite.

Abstract

Venomous snakebite is a global serious health issue and in India high rate of mortality is caused by *Naja naja* (Indian cobra). To evaluate anti-cobra venom activity and identify lead molecules in *Aegle marmelos*, in vitro and in silico screening was carried out. Leaves, stem and root bark of *A. marmelos* were extracted in ethanol, methanol and hexane and maximum yield was obtained in methanol. All extracts were used for testing in vitro anti-haemolytic, inhibition of antiacetylcholinesterase and anti-proteolytic activities. The results revealed that ethanol extract of root bark has high anti-haemolytic activity, methanol extracts of leaves have the highest inhibitory effect on venom induced anti-acetylcholinesterase activity and ethanol extracts of leaves have maximum anti-proteolytic activity. Docking between 81 phytochemicals from *A. marmelos* and each of the 14 cobra venom toxic proteins revealed that the plant contains potential molecules for detoxification of all the cobra venom proteins.

A comparative study to elucidate the inhibitory mechanism of a 6-mer fragment of amyloid-beta 42 peptide as a potential therapeutic in Alzheimer's disease: insights from molecular dynamics simulations

Mary Dutta and Venkata Satish Kumar Mattaparthi

Keywords: Alzheimer's disease, aggregation, docking, hydrophobic interaction, inhibitor peptide

Abstract

Alzheimer's disease is a neurodegenerative and incurable disease that is associated with the amyloid beta ($A\beta$) aggregation. We have carried out comparative molecular dynamics simulations of a 6-mer peptide and its analogues to elucidate the inhibitory mechanism on $A\beta$ aggregation. The top analogue screened after refinement via docking exhibited significant inhibitory activities on both $A\beta_{17-42}$ fibril as well as $A\beta_{1-42}$ monomer, leading to disassembly of β -strands of $A\beta_{1-42}$ peptide and fibril by interacting with C-terminal residues via hydrogen bonds and hydrophobic contacts. Binding of the analogue to the C-terminal region proves to be significant.

Antioxidant and nutritional potential of some underutilized leafy vegetables consumed by tribals of Jharkhand, India

Srivastava, R. S. Pan1 and B. P. Bhatt

Keywords: Antioxidants, leafy vegetables, nutritional potential, underutilized

Abstract

In the present study, 20 species of local underutilized leafy vegetables commonly consumed by tribals of Jharkhand, India have been identified through market survey of seven districts of the state. Among the leafy vegetables sold in fresh form, *Amaranthus gangeticus* was found highest in quantity followed by *Amaranthus viridis*, *Ipomoea aquatica*, *Chenopodium album* and *Basella alba*. Amongst those sold in dried form, *Cassia tora* was found highest in quantity followed by *Vangueria spinosa* and *Ipomoea batatas*. The leafy vegetables were found to be rich in antioxidant activity, vitamin C and various minerals.

Enhanced oil accumulation in tobacco (*Nicotiana tabacum* L.) leaves by ectopic overexpression of VgDGAT1a for renewable production of biofuels

Chang-Yong Gao, Xue Mao, Hong-Qin Shang, Fang Li and Run-Zhi Li

Keywords: Biofuels, metabolic engineering, plant oil, tobacco leaves, VgDGAT1a gene.

Abstract

To increase oil accumulation in the high-biomass vegetative organs of tobacco (*Nicotiana tabacum* L.) plants for renewable production of biofuels, VgDGAT1a isolated from developing seeds of *Vernonia galamensis* L. was ectopically overexpressed in tobacco leaves using a constitutive promoter. The transgenic tobacco leaves showed a 3.5–5.0-fold increase in oil content compared to the control, with a maximum increase of 9.2% (DW). The transgenic leaves also showed a substantial change in fatty acid composition, with significant enhancement of linoleic acid (18 : 2) and notable reduction of α -linolenic acid (18 : 3). The overexpression of VgDGAT1a exhibited no deleterious effect on other phenotypes in the tobacco plant. These results will facilitate development of a novel system for lipid metabolic engineering in vegetative organs of plants, as well as provide a platform for the production of biofuels using the vegetative organs of commercial non-food crops.

A simplified soil nutrient information system: study from the North East Region of India Shelton

Padua, T. Chattopadhyay, S. Bandyopadhyay, S. Ramchandran, R. K. Jena, P. Ray, P. Deb Roy, U. Baruah, K. D. Sah, S. K. Singh and S. K. Ray

Keywords: Decision rules, multinutrient deficiency, soil fertility, spatial v

Abstract

Soil fertility has direct implications on the agricultural production scenarios of a region. Surface soil samples at 1 km grid were collected to assess the fertility status of Lakhimpur district (Assam) in North East India. Fertility parameters like soil organic carbon, available nitrogen, phosphorus, potassium, iron, manganese, zinc and copper were determined using standard analytical procedure. Spatial distribution maps of the soil parameters were generated using regularized spline method in ArcGIS 10.0. The average soil organic carbon content was 1.05% and the maximum area was under high availability status (78%). In the case of nitrogen, 57% of the area was under low availability status. In the case of available potassium and phosphorus, the areas under low availability status were 48% and 49% respectively. But for micronutrients, in general, the availability status was high except for zinc, which indicated that 40% of the area was under low availability. A methodology was developed to integrate the individual nutrient layers using a set of decision rules to identify the multinutrient deficient zones. The integrated map showed that 24% of the area had multiple nutrient deficiencies and fell under high priority zone that warrant immediate nutrient management interventions to mitigate the situation.

Effects of root properties and branching characteristics on soil reinforcement in the Jinyun Mountain, China

Shuangshuang Song, Yunqi Wang, Baoping Sun and Yunpeng Li

Keywords: Root architecture, root properties, shear test

Abstract

Plant roots can substantially improve slope stability and prevent soil slippage. Many researchers have quantified effects of root properties on soil reinforcement. However, the mechanism of root architecture on shear strength increments needed to be studied and analysed. This paper presents a man-made direct shear test to compare the effects of six tree species roots on soil reinforcement. Thus, root tensile strength, diameter, root area ratio (RAR), inclination and distribution were

measured to study the differences between root architecture. Meanwhile, stress propagation simulations were conducted to analyse the mechanisms of root architecture on soil reinforcement. Results showed that shear strength increment value corresponded to *P. massoniana* (42.4 kPa), followed by *C. camphora* (37.6 kPa), *N. aurata* (36.0 kPa), *L. kwangtungensis* (28.8 kPa), *G. acuminata* (27.4 kPa) and *S. laurina* (23.0 kPa). Root architecture that contained taproots (VH-type) and widely distributed roots (H-type) showed larger shear strength increments than that contained oblique roots (R-type) when the initial friction between soil and root was ignored. When there are thick, widely distributed roots in the root system, the resistance of root architecture on shear failure would become larger. Root diameter class and RAR cannot be used to reflect the effects of root architecture on soil shear strength increment. While estimating the different tree species roots on soil reinforcement in field, initial friction between soil and root should be considered as important as root architecture.

Isolation and selection of cellulose-degrading microorganisms for utilization along with earthworms in efficient conversion of municipality waste mix to compost Sanasam

Shantibala Devi, Nongthombam Grihalakshmi Devi, Mohan Chandra Kalita and Narayan Chandra Talukdar

Keywords: Cellulose degrading microorganism, municipality biowaste, nitrogen loss, pathogenic and beneficial bacteria.

Abstract

Municipality biowaste (MBW) was decomposed alone or in mixture with rice straw (RS) and cow dung (CD) using cultures of *Streptomyces xanthochromogens* (CDM9) and *Eisenia fetida*. Cellulose degrading microorganisms (CDMs) were isolated from six source materials which contained CDM population in the range 5.4–8.5 log cfu/gdb and their cellulolytic activity ranged from 0.0 to 0.431 IU/min. CDM9 showed consistently high cellulase activity in cellulose and MBW substrate, and its co-inoculation with earthworm enhanced decomposition of the MBW mix. A positive correlation between pH of the composting feed mix and N loss suggested N loss in form of NH₃. Overall, mixing of municipality biowaste with rice straw and cow dung and inoculation with the two decomposer agents resulted in better quality compost in all respects.

Socio-economic costing of road traffic accidents: evidence from Nagpur city, Maharashtra, India

Bhaswati Bora, Vishrut Landge and Bahuguna Dalai

Keywords: Road traffic accidents, safety measures, socio-economic costing, system dynamics approach.

Abstract

Road traffic accidents (RTAs) have become a serious problem worldwide as they incur losses of around 2% of a country's gross domestic product (GDP). RTAs are one of the major causes of death and injury in developing countries like India. To enable governments to take policy decisions on road safety, it is necessary that good research is undertaken to estimate the cost of accidents. This kind of study will help governments make important decisions on investment in traffic safety, improvement of roads and other facilities. On the other hand, evaluation and estimation of the costs of RTAs will help governments ascertain economic feasibility of policy decisions given limited economic resources. Apart from humanitarian losses, the contribution to economic losses from RTAs is alarmingly high, as most people involved in accidents are from the most economically active and productive agegroups of a society. The main objective of this study is to establish the cost components of road accidents in Nagpur city, Maharashtra, India. The methodologies for such studies

generally vary according to traffic pattern, modal share, accident pattern, etc. This study makes use of a system dynamics approach, which provides a comprehensive understanding of the problem for Indian cities. Data were collected and collated with major inputs from the Traffic Department of the city for all road accidents from 2010 to 2015. The study found that the costs recorded for RTAs amounted to INR 935.5 million in 2015, which was 0.09% of the city's GDP. In addition, major cost components were evaluated by varying the severity level.

Impact of tropical volcanic eruptions on Hadley circulation using a high-resolution AGCM

Muhammad Mubashar Dogar

Keywords: Atmospheric models, jet streams, monsoon circulation and ITCZ, tropical volcanic eruptions

Abstract

The direct radiative effects of volcanic eruptions resulting in solar dimming, stratospheric warming, global surface cooling and reduction in rainfall are well documented. However, eruptions also cause indirect climatic impacts that are not well understood. For example, solar dimming induced by volcanic aerosols could cause changes in tropical Hadley circulation that in turn largely affect evaporation and precipitation patterns. Therefore, understanding the sensitivity of HC to volcanism is essential, as this circulation is directly related to precipitation changes in the tropics and with other large-scale circulations. Hence, to better understand the post-eruption sensitivity of HC and associated changes in the hydrologic cycle, simulations for the El Chichón and Pinatubo tropical eruptions were conducted using a high-resolution atmospheric model (HIRAM), effectively at 25 and 50 km grid spacing. The model simulated results are then compared with observational and reanalysis products. Both the model and observational analysis show posteruption weakening, shrinking and equatorward displacement of the updraft branch of HC caused by the equatorward shift of midlatitude jets and hemispheric land–sea thermal gradient. The Intertropical Convergence Zone (ITCZ) is tightly coupled to the rising branch of HC, hence, post-eruption weakening and equatorward displacement of HC cause weakening of ITCZ that adversely affects rainfall distribution in the monsoon-fed regions, especially the South Asian and African tropical rain-belt regions. The model-produced post-eruption distribution of cloud contents suggests a southward shift of ITCZ. The HIRAM results are largely in agreement with the reanalysis, observations and previous studies indicating that this model performs reasonably well in reproducing the global and regional-scale dynamic changes caused by volcanic radiative forcing.

Electron density, interaction energy and hydrogen-bond radius of C–H...O interaction

R. Parajuli

Keywords: Electron density, hydrogen-bond radius, interaction energy, linear parameters.

Abstract

Atoms in theoretical analysis of molecules was used to study C–H...O interaction taking five different molecules with the same acceptor, O of water. The relation between electron density at hydrogen-bond critical point and interaction energy has been studied and hydrogen-bond radii were derived. Although a linear relationship was obtained like other intermolecular interactions, the value of linear parameters was found to be different when a similar type of interaction was compared suggesting that the parameters depend on the type of acceptor and donor and not the type of interaction. The H-bond radii for this type of interaction were found to have significant variance.

A critical analysis of the ‘UGC-approved list of journals’

Bhushan Patwardhan, Shubhada Nagarkar, Shridhar R. Gadre, Subhash C. Lakhotia, Vishwa Mohan Katoch and David Moher

Keywords: Predatory and dubious journals, publication ethics, university source component, unethical practices.

Abstract

Scholarly journals play an important role in maintaining the quality and integrity of research by what they publish. Unethical practices in publishing are leading to an increased number of predatory, dubious and low-quality journals worldwide. It has been reported that the percentage of research articles published in predatory journals is high in India. The University Grants Commission (UGC), New Delhi has published an ‘approved list of journals’, which has been criticized due to inclusion of many substandard journals. We have developed a protocol with objective criteria for identifying journals that do not follow good publication practices. We studied 1336 journals randomly selected from 5699 in the university source component of the ‘UGC-approved list’. We analysed 1009 journals after excluding 327 indexed in Scopus/Web of Science. About 34.5% of the 1009 journals were disqualified under the basic criteria because of incorrect or non-availability of essential information such as address, website details and names of editors; another 52.3% of them provided false information such as incorrect ISSN, false claims about impact factor, claimed indexing in dubious indexing databases or had poor credentials of editors. Our results suggest that over 88% of the non-indexed journals in the university source component of the UGC-approved list, included on the basis of suggestions from different universities, could be of low quality. In view of these results, the current UGC-approved list of journals needs serious re-consideration. New regulations to curtail unethical practices in scientific publishing along with organization of awareness programmes about publication ethics at Indian universities and research institutes are urgently needed.

Projection of climate change scenarios in the Kabul River Basin, Afghanistan

Massouda Sidiqi, Sangam Shrestha and Sarawut Ninsawat

Keywords: Climate change, Kabul River Basin, RCPs, temperature, precipitation.

Abstract

This study was conducted to examine the changes in future temperature and precipitation of the Kabul River Basin in Afghanistan by using the outputs of three general circulation models (GCMs) under two representative concentration pathway (RCP 4.5 and RCP 8.5) scenarios. Future climate data for temperature and precipitation obtained from climate models were bias corrected using the delta change approach. Maximum and minimum temperatures and precipitation were projected for three future periods: 2020s, 2050s and 2080s against the baseline period of 1961–1980. The mean annual temperature in the basin is projected to increase by 1.8°C, 3.5°C and 4.8°C by the 2020s, 2050s and 2080s respectively. The mean annual precipitation is projected to increase whereas monthly precipitation is expected to increase and decrease according to the months for the whole river basin, under both scenarios, by 2100.

Influence of open and polyhouse conditions on soil carbon dioxide emission from Amaranthus plots with different nutrient management practices under changing climate scenario

U. Surendran, Aswathy K. Vijayan, V. Bujair and E. J. Joseph

Keywords: Amaranthus, carbon dioxide emission, crop productivity, soil temperature.

Abstract

A field study was conducted using Amaranthus to assess the impact of increased temperature in polyhouse with three different treatments, viz. 100% organic, 100% inorganic and 50% organic +

50% inorganic nutrition on growth, yield and carbon dioxide (CO₂) evolution compared to that of open natural condition. Among the different treatments applied, 100% application of organic manure resulted in maximum CO₂ emission in both open (538 mg) and polyhouse conditions (551 mg). The lowest value of CO₂ evolution (266 mg) was observed with 100% application of inorganic fertilizers under polyhouse conditions. In all the three treatments, CO₂ evolution almost reached a plateau and stabilized during the last two observations. At the last interval, CO₂ evolution ranged from 4.00 to 6.80 mg in all the treatments. However, cumulative CO₂ evolution showed that the emission was higher under open natural conditions (434 mg) compared to the polyhouse conditions (398 mg) at elevated temperature. This indicated that the microbial respiration was higher under natural conditions. Ambient air temperature and soil temperature were higher under polyhouse condition than open natural condition. However, soil moisture was higher under open condition than polyhouse condition for most observations. It could be observed from the experiment that Amaranthus production declined with increase in temperature, and maximum yield was obtained with 100% application of organic manure under open condition. Under elevated temperature condition in polyhouse, 50% application of inorganic fertilizer + 50% application of organic manure (T3) registered the maximum crop production. This suggests that sufficient mitigation strategies need to be adopted for sustaining crop production under changing climate scenario.

Odd–even traffic rule implementation during winter 2016 in Delhi did not reduce traffic emissions of VOCs, carbon dioxide, methane and carbon monoxide

B. P. Chandra, V. Sinha, H. Hakkim, A. Kumar, H. Pawar, A. K. Mishra, G. Sharma, Pallavi, S. Garg, Sachin D. Ghude, D. M. Chate, Prakash Pithani, Rachana Kulkarni, R. K. Jenamani and M. Rajeevan

Keywords: Odd–even rule, pollution, PTR-MS, traffic, VOCs.

Abstract

We studied the impact of the odd–even traffic rule (implemented in Delhi during 1–15 January 2016) on primary traffic emissions using measurements of 13 volatile organic compounds, carbon monoxide, carbon dioxide and methane at a strategic arterial road in Delhi (28.57°N, 77.11°E, 220 m amsl). Whole air samples (n = 27) were collected during the odd–even rule active (OA) and inactive (OI) days, and analysed at the IISER Mohali Atmospheric Chemistry Facility. The average mass concentration ranking and toluene/benzene ratio were characteristic of primary traffic emissions in both OA and OI samples, with the largest fraction comprising aromatic compounds (55– 70% of total). Statistical tests showed likely increase ($p \leq 0.16$; OA > OI) in median concentration of 13 out of 16 measured gases during morning and afternoon periods (sampling hours: 07 : 00–08 : 00 and 13 : 30– 14 : 30 IST), whereas no significant difference was observed for evening samples (sampling hour: 19 : 00– 20 : 00 IST). This suggests that many four-wheeler users chose to commute earlier, to beat the 8 : 00 AM– 8 : 00 PM restrictions, and/or there was an increase in the number of exempted public transport vehicles. Thus, the odd–even rule did not result in anticipated traffic emission reductions in January 2016, likely due to the changed temporal and fleet emission behaviour triggered in response to the regulation.

Effective weed control strategy in tomato kitchen gardens – herbicides, mulching or manual weeding

Daud Ahmad Awan, Faheem Ahmad and Sharmin Ashraf

Keywords: Herbicide, kitchen gardens, tomato, mulching, weed control.

Abstract

Effect of weed control on tomato (*Solanum lycopersicum* L.) crop has been rarely explored in kitchen gardens for improving fruit yield and quality. Therefore, we studied the impact of manual weeding,

herbicide application and mulching (using polyethylene sheet) on tomato crop improvement in kitchen gardens. The data show significant differences among different treatments in terms of weed density/m², weed fresh biomass and dry biomass and quality of tomato plants in terms of plant height, fruit-bearing (fruits/plant) and yield (tonne/ha). Highest weed density/m² (3.5 ± 0.84) was observed in plots with herbicide treatment and it was similar to that in control. Weed fresh biomass was significantly reduced in all treatments. Manual weeding resulted in the highest number of fruits/plant (33.75 ± 1.67), plant height (60 ± 1.01 cm) and yield of tomato (4.45 ± 0.18 tonne/ha). Therefore, manual control proved to be the most effective treatment in terms of weed suppression and yield enhancement of tomato crop. It was also observed that in crop production mulching must be encouraged in the future weed management strategies.

Divergence studies of white willow (*Salix alba* L.) germplasm

P. A. Paray and S. A. Gangoo

Keywords: Clustering, divergence, germplasm, plus trees, *Salix alba*.

Abstract

The present study was carried out with the aim to determine genetic diversity in *Salix alba* germplasm/ plus trees by employing the various catkin, seed and seedling characteristics. Divergence studies revealed grouping of 20 plus trees of *S. alba* into five clusters, with maximum plus trees in clusters I and II. There was maximum (748.77) cluster distance between clusters V and IV among all the clusters. This was followed by clusters I and IV (598.23). It indicates that there exists wide diversity between these groups. Cluster V had maximum for majority of the catkin, seed and seedling characteristics under study. The plus trees/genotypes in the clusters which are more divergent can be used for future breeding/tree improvement programmes of the species.

Detection of coastal landforms in a deltaic area using a multi-scale object-based classification method

Tapas R. Martha, A. Mohan Vamsee, Vikas Tripathi and K. Vinod Kumar

Keywords: Beach, cyclone, DEM, image segmentation, mangrove, OBIA, Resourcesat-2.

Abstract

Coastal landforms play an important role in protecting deltaic areas from erosion due to the action of waves. However, landforms in the deltas are dynamic and vulnerable to changes due to the effect of natural disasters like floods and cyclones. Automatic detection of dynamic landforms from satellite data can provide important inputs for effective coastal zone management. In this study, we developed an Object-Based Image Analysis (OBIA) technique to identify and map landforms in the Krishna delta, east coast of India using Resourcesat-2 LISS-IV multispectral image (5.8 m) and digital elevation model (DEM) (4 m). Since landforms are represented at multiple scales, the plateau objective function method was used to select appropriate scales during multiresolution segmentation. Knowledge-based rules in OBIA, using the parameters tone, texture, shape and context derived from satellite images and height from DEM were developed for classification of landforms. A total of 11 landforms (beach, beach ridge, swale, tidal creek, marsh, spit, barrier bar, mangrove, natural levee, channel island and channel bar) were mapped using this approach. High detection accuracy of these landforms indicates that the method developed has the potential for geomorphological mapping of dynamic landforms in low lying deltaic areas.

Estimating net primary productivity of croplands in Indo-Gangetic Plains using GOME-2 sun-induced fluorescence and MODIS NDVI

N. R. Patel, Hitendra Padalia, R. Devadas, A. Huete, A. Senthil Kumar and Y. V. N. Krishna Murthy

Keywords: Crop lands, net primary productivity, photosynthetic activity, sun-induced fluorescence.

Abstract

Recently evolved satellite-based sun-induced fluorescence (SIF) spectroscopy is considered as a direct measure of photosynthetic activity of vegetation. We have used monthly averages of satellite-based SIF retrievals for three agricultural year cycles, i.e. May to April for each of the three years, viz. 2007–08, 2008–09 and 2009–10 to assess comparative performance of SIF and normalized difference vegetation index (NDVI) for predicting net primary productivity (NPP) over the Indo-Gangetic Plains, India. Results show that SIF values for C4 crop-dominated districts were higher than C3 crop-dominated districts during summer and low during winter for all three years. SIF explained more or less above 70% of variance in NPP. The variance explained by integrated NDVI ranged from 60% to 67%. Thus the present study has shown the potential of SIF data for improved modelling of agricultural productivity at a regional scale.

Occupancy time-based passenger car equivalents at unsignalized intersections in India

Mithun Mohan and Satish Chandra

Keywords: Heterogeneous traffic conditions, occupancy time, passenger car equivalents, unsignalized intersections.

Abstract

In developing countries, one of the vital steps involved in analysing the capacity of any transportation facility is the estimation of passenger car equivalents (PCEs) for different types of vehicles to convert the heterogeneous traffic stream into an equivalent stream of passenger cars. This study proposes occupancy time method for the estimation of PCEs for different types of vehicles generally observed at unsignalized intersections in India. PCEs for vehicles executing different movements at unsignalized intersections have been estimated in this study and the dynamic nature of PCEs has also been explored. However, PCEs were found to be statistically similar across different movements and across intersections of different geometry.

Volume 114 - Issue 07, April 2018

Observed warming of sea surface temperature in response to tropical cyclone Thane in the Bay of Bengal

Simi Mathew, Usha Natesan, G. Latha, R. Venkatesan, Rokkam R. Rao and M. Ravichandran

Keywords: Bay of Bengal, cyclone, OMNI buoy, SST.

Abstract

An unusual near-surface warming was seen in observations from a moored buoy BD11 at 14°N/83°E, and a nearby Argo profiling float in the Bay of Bengal, during the passage of tropical cyclone Thane, during 25–31 December 2011. The cyclone induced a warming of sea surface temperature (SST) by 0.6°C to the right of the track. Heat budget analysis based on moored observations and satellite data rules out the role of horizontal advection and net heat flux in warming the surface layer. We find that vertical mixing/entrainment in response to the cyclone, in conjunction with a pre-storm temperature inversion (subsurface ocean warmer than SST) led to the observed warming. Pre-storm and post-storm salinity and temperature profiles from an Argo float close to the mooring BD11 have higher vertical resolution than the moored data; they suggest vertical mixing of the upper 70 m of the water

column. The moored observations show that the thermal inversion, erased by storm-induced mixing, reappears in a few days.

Movement of water flux through unsaturated zones: a transient impact on in situ potential field

Rolland Andrade, D. Muralidharan and R. Rangarajan

Keywords: Infiltration test, soil moisture movement, water flux.

Abstract

Attempts were made to understand moisture movement in soil and unsaturated zones under a transient saturation phase created through an infiltration test using conventional self-potential (SP) survey and supportive studies of resistivity profiling and tracer, over a granite terrain having coarse sandy soil cover. The SP behaviour at various time intervals of infiltration stages qualitatively indicated a preferential soil moisture movement after an initial vertical downward movement at deeper depths. As inferred from the SP survey, tracer and conventional resistivity profiling studies substantiate the flow direction by means of highest concentration of tritium content in deep soil cores and significant reduction in apparent resistivity along the direction. The results demonstrate that the SP method could be a useful tool to understand the rainfall recharge process and in surface-induced contamination studies.

Citation characteristics of non-citable documents and contributions to journal impact factor

Liu Xue-Li, Wei Ya-Hui and Gai Shuang-Shuang

Keywords: Citation characteristics, impact factor, journals, non-citable documents.

Abstract

Journal impact factor (JIF) is defined as the number of citations within a given year to items published by a journal in the preceding two years, divided by the number of citable items published by the journal during those two years. However, the 'citable documents' include only articles and reviews, and the 'non-citable documents' (NCDs) actually can be and are often cited, and some may have higher citations. Here we explore the cited characteristics of NCDs and their contributions to JIF. All data were taken from the Web of Science database. The results showed that 315,017 NCDs (including editorials, letters, reprints, news items, corrections, biographical items, and book reviews) could be retrieved from 2012 to 2013. There were 160,580 editorials and 81,652 letters with the respective citations of 98,434 and 40,692 in 2014; the citations per item were 0.613 and 0.498 respectively. The contributions of these two types of NCDs to JIF are obvious. Of the 64 journals with NCDs ≥ 500 or NCDs ≥ 10 while the citations ≥ 20 , 19 showed contributions of NCDs to more than 20%. Although some journals publish more NCDs, their contributions to JIF are not obvious; only for a few journals are the NCDs contributions to JIF higher. These are mainly medical journals.

Links between energy usage and climate: implications on increasing CO₂ emissions and carbon capture and storage

S. K. Tandon and Jyotirmoy Mallik

Keywords: Climate, CO₂, carbon capture and storage, energy, fossil fuel.

Abstract

Global climate change due to increase in greenhouse gases in the atmosphere resulting from persistent use of fossil fuels over the past century is one of the major challenges of the contemporary industrial world. The exploitation of natural resources including fossil fuels has not always been done in a sustainable way. One of its adverse effects, faced by our generation, is climate change. We must not only be alert to these changes, but also make necessary efforts to adopt scientific measures to combat their ill effects. The combustion of fossil fuels together with added emissions from cement

production, and land use change result in net annual increase in CO₂ in the atmosphere by 4 GtC. Scientists have clearly demonstrated the role of CO₂ emission in global warming. Carbon capture and storage (CCS) is an advanced technology to capture CO₂ from its source, isolate it from the atmosphere and store it typically in underground geological formations. We highlight the need to invest in obtaining cleaner energy from fossil fuels by implementing technologies like CCS along with technological advancements in renewables. We present here a review on the general debate around implementing CCS technology and dwell on some developments in India to understand if CCS will be effective in the future towards reducing the carbon footprint in our growing economy.

Sperm sexing of dairy cattle: economics, animal welfare and technological challenges

Jagdish Rai

Keywords: Animal welfare, chromosomes, sexed semen of cattle

Abstract

There is a growing need for sexed semen of cattle in India. Farmers prefer female calves of cows or buffalos than male calves as they can produce milk in the future which is economically more beneficial. Very few bulls are required for breeding in herds and they are no more required in agricultural fields due to mechanization of cultivation and transportation. Therefore these extra bulls/oxen are often sold at low prices to the meat industry. This is an animal welfare concern and can also cause communal tensions due to differences in belief systems of religious sects. At present there is no indigenous technology for producing sexed semen although artificial insemination with nonsexed semen is a well-established method of breeding among cattle farmers. The imported sexed semen is not easily available and also not affordable for most Indian farmers. There is a need for the development of cost effective indigenous sperm sexing techniques as an alternative to fluorescence-activated cell sorting. Recent developments in microfluidics and BEMS (bio electromechanical systems) may hold the key to the development of a portable device for semen sexing with minimal tampering of the sperm structure.

Influence of fabrication processes on transport properties of superconducting niobium nitride nanowires

Manju Singh, Rishu Chaujar , Sudhir Husale, S. Grover , Amit P. Shah , Mandar M. Deshmukh, Anurag Gupta, V. N. Singh, V. N. Ojha , D. K. Aswal and R. K. Rakshit

Keywords: DC magnetron sputtering, EBL, FIB, niobium nitride, superconducting nanostructure, thin films.

Abstract

Fabrication of niobium nitride (NbN) superconducting nanowires based on focused ion beam (FIB) milling and electron beam lithography (EBL) is presented. The NbN films were deposited using reactive magnetron sputtering. Argon-to-nitrogen ratio turned out to be a crucial factor in synthesizing high quality superconducting NbN. Critical temperatures (T_c) of around 15.5 K were measured for films with a thickness of around 10 nm. Zero-field-cooled magnetization was measured to optimize the superconducting properties of ultra thin NbN films. The transport behaviour was studied using conventional resistance vs temperature and current-voltage characteristics down to 2 K. Effect of gallium contamination on superconducting properties has been discussed. Whereas the various processing steps of standard EBL route do not have any significant impact on the superconducting transition temperature as well as on the transition width of nanowires, there is significant degradation of superconducting properties of nanowires prepared using FIB. This has been attributed to gallium ion implantation across the superconducting channel. Although the effect of gallium implantation may

have technological limitations in designing fascinating single photon detector architectures, it provides some interesting low-dimensional superconducting properties.

Evaluation and management system design for airfield clearance condition

Wantong Cai, Hao Geng, Liangcai Cai and Xiaolei Chong

Keywords: Airfield, clearance condition, evaluation and management, three-dimensional modelling.

Abstract

Composite obstacle limitation surfaces are defined by overlaying the obstacle limitation requirements for departure and approach. Based on the assumption that airfield clearance zone consists of 3D lumps, adaptive algorithm for resolving 3D lumps is proposed, which can be used to design an airfield clearance condition evaluation procedure that can evaluate superelevation of topographical data. A programming method for airfield topography information collection based on Google Earth is proposed. By overlaying the three layers that include topographical information, obstruction information and image of airfield clearance zone, a stereoscopic display of airfield clearance condition management platform is established under ArcGIS. Thereby, an airfield clearance condition evaluation and management system is formed, which contains topographical information collection, evaluation and management of airfield clearance zone.

Modelling U-turning behaviour of vehicles at mid-block median openings in multilane urban roads

Ankit Gupta, Satyajit Mondal and Vinay Kumar Sharma

Keywords: Critical position, critical gap, gap acceptance, median opening, U-turning vehicles.

Abstract

Gap acceptance and lateral placing of vehicles are considered as prime parameters for analysing the behaviour of U-turning in vehicles at un-signalized median opening in urban areas. Critical gap is the sole parameter in gap acceptance phenomenon where critical position gives the vehicle's location during U-turn operation. Data for this study were collected using video photography at six median openings on a sixlane road and three median openings on a four-lane road from two different cities of India. Data as extracted by categorizing the traffic stream into five different classes such as two-wheelers, three-wheelers, car/SUVs, LCVs (light commercial vehicles) and HCVs (heavy commercial vehicles). Three different methodologies (namely the traditional method, INAFOGA and modified Raff's method) were utilized to estimate the critical gap. Critical position of vehicles is estimated using the markings on the pavement surface. Regression technique was used for modelling critical gap and position using different variables for each motorized mode. All the proposed models have a high coefficient of determination value which indicates its high significance level. Modelling of critical position for 3-wheelers was not framed as the P-value for each variable was higher than 0.05. The reason could be the randomness in data because of the undisciplined lateral movement of three-wheelers. A design recommendation for right turn pocket lanes near the median opening area is proposed especially for U-turning traffic based on the percentage of the U-turning traffic and maximum critical position of vehicles from the median edge.

Isolation, characterization and practical significance of cellulose degrading bacteria from the gut wall of two ecologically distinct earthworms

Kishore K. Dey, Narayan C. Talukdar, Fenella M. W. Nongkhlaw and Dwipendra Thakuria

Keywords: Cellulase activity, easterase isozyme, earthworm–microorganism interactions, *Glyphidrilus spelaeotes*, intestinal microbiology, soil fauna.

Abstract

This study has determined the relationship of culturable community of cellulose degrading bacteria (CDB) within the gut walls of two habitat-specific earthworm species, epigeic (compost heap inhabitant) earthworm, *Perionyx excavatus* (PE) and an endogeic (submerged rice field inhabitant), *Glyphidrilus spelaeotes* (GS) and their functional significance. The 16Sr RNA analysis for the isolated CDB from two ecologically distinct earthworms clearly showed the presence of distinct communities of CDB in their gut ecosystem. Enzymatic assay of cellulase for the isolated CDB showed significantly higher cellulase activity compared to the reference strain M-23, *Cellulomonas cellulans* ($P < 0.01$, one-way ANOVA). The functional significance of such high cellulase activity was also demonstrated by the enhancement of decomposition of rice straw and fresh vegetation biomass in the presence of native microbiota community. The growth rate of CDB of epigeic PE was approximately twice slower than that of CDBs of endogeic GS. The CDB of PE exhibited 12 polymorphs of esterase isozyme as against 4 polymorphs for CDB of GS. The present study emphasizes the functionally significant relationship of gut wall CDB and host earthworm for sustaining efficient C-cycling in agroecosystems.

On-the-go position sensing and controller predicated contact-type weed eradicator

Abhilash Kumar Chandel, V. K. Tewari, Satya Prakash Kumar, Brajesh Nare and Aditya Agarwal

Keywords: Contact application, graphic user interface, image analyser, locomotion sensing, microcontroller, weed density.

Abstract

This article presents a robust contact-type weed eradicator based on position sensing, digital image processing and microcontroller for weed control in row crops. The imaging system determines the weed density between the crop rows using an image analyser developed in Visual Studio Open computer vision platform for use under varying illumination levels. Graphic user interface was developed for parametric adjustments of the image analyser. The image analyser conducts image analysis after image acquisition and the data is sent via computer serial to microcontroller for pulse width modulation controlled chemical release. Solenoid valves are employed for liquid release on sponge rollers. The contact-type technique overcomes losses due to chemical drift and percolation resulting in an efficient application. The machine locomotion sensing is done through an inductive type proximity switch. The developed system was calibrated in laboratory, followed by extensive field tests. The average weeding efficiency reported was 90.30% with lowest plant damage of 5.74% and 7.91% and high yield coefficients of 26.15 g/plant and 581.74 g/plant in two selected crops of groundnut and maize plantation. The technology saved about 79.50% of herbicide marking it as a robust and eco-friendly technology.

Projections of extreme precipitation events under climate change scenarios in Mahaweli River Basin of Sri Lanka

Naditha Imbulana, Shakthi Gunawardana, Sangam Shrestha and Avishek Datta

Keywords: Bias correction, climate change, extreme precipitation, GCMs, rainfall, RCPs.

Abstract

The future changes in rainfall pattern in the Mahaweli River Basin of Sri Lanka using three general circulation models under two representative concentration pathways were assessed. The projections showed that consecutive dry days will decrease, consecutive wet days and annual total precipitation in wet days will increase, the monthly maximum consecutive five-day precipitation will generally decrease, and annual rainfall will increase except for the first inter-monsoon. The projections of the heavy rainfall varied according to the time periods and climate zones. The present results can help policy makers to optimize the use of water resources considering future climate change.

Petrography and mineralogy of calcium-, aluminum-rich inclusions in an unequilibrated carbonaceous chondrite Y 81020 (CO3.05)

Ritesh Kumar Mishra

Keywords: Antarctic meteorites, calcium, aluminum-rich inclusions, petrography, quantitative analyses, unequilibrated carbonaceous chondrites.

Abstract

Petrographic and quantitative analyses of more than 70 refractory inclusions found in the studied thin section of Yamato 81020 (CO3.05) showed diverse objects that can be grouped into five distinct types based on morphology and mineralogy. Mineralogical, textural similarities to the pristine carbonaceous Vigarano (3.1–3.4) types of Efremovka, Vigarano were observed despite their smaller size (~100 micron diameter). Wark-Lovering rims were found predominantly in melilite-rich calcium, aluminum-rich inclusions. Comparison of mineralogy, morphology at macro and micro scale of Y 81020 with ALH A77307 and other carbonaceous chondrites is suggestive of the unaltered characteristics of the refractory inclusions in agreement with previous studies.

Diversity in a widely distributed dioecious medicinal plant, *Tinospora cordifolia* (Willd.) Miers. ex.

Hook F. and Thomas Suchita Lade¹, Pooja Singh Sikarwar¹, Md. Akram Ansari¹, Sayyada Khatoon², Nikhil Kumar³, Hemant Kumar Yadav and Shirish A. Ranade

Keywords: AMOVA, berberine, ISSR, NJ tree, RAPD, *Tinospora*, tinosporaside.

Abstract

The nature and extent of diversity in *Tinospora cordifolia*, a dioecious climber, widely distributed in India, and one of the most important medicinal plants has remained underexplored. The present study reveals wide range of tinosporaside content (0.016–4.523 mg/g), berberine content (0.27–76.9 mg/g) and jaccard distances (0.0341–0.559). The neighbour joining tree, structure simulation and principal coordinate analysis resolved all the accessions into six sub-clusters, four of which were congruent in the analyses. Sub-cluster I uniquely included all male accessions, with above average leaf areas and below average tinosporaside contents with hairy and fibrous leaves. Further, analysis of molecular variance considering three populations showed that maximum variance (87%) was within the population. The result of this preliminary study revealed genetic diversity, population structure in *T. cordifolia*.

Risk assessment and stability analysis of a recent landslide at Vishnuprayag on the Rishikesh–Badrinath highway, Uttarakhand, India

S. Sarkar, Koushik Pandit, Mahesh Sharma and Ashish Pippal

Keywords: Control measures, landslides, risk assessment, slope stability.

Abstract

A massive landslide was triggered on 19 May 2017 at Vishnuprayag near Joshimath, Uttarakhand, India. The landslide blocked the Rishikesh–Badrinath highway and halted traffic for about 24 h till the debris was removed and the road reopened. The Hathi Pahar hill in Vishnuprayag has been a landslide-prone zone because of the presence of loose boulders and large rock blocks on very steep slopes. The site was visited immediately after the landslide and a rapid field assessment of slope stability was carried out. The stability analysis was performed with limited geological and geotechnical data collected from field and laboratory. Based on the two-dimensional finite element analysis, it was inferred that the slope is marginally stable under static load, but fails under seismic loading. The slope could fail in future due to triggering factors such as heavy rainfall, earthquake and anthropogenic activities. This communication presents field observations and the subsequent stability analysis along with possible suggestive control measures.

The 12 May 2015 Kodari earthquake (Mw 7.3) in Central Nepal: delayed triggering by the 25 April 2015 Gorkha earthquake (Mw 7.8)

Rajeev Kumar Yadav, Bhaskar Kundu, Kalpna Gahalaut and V. K. Gahalaut

Keywords: Coseismic rupture, delayed triggering, earthquakes, failure stress, thrust faulting.

Abstract

The 12 May 2015 earthquake of Mw 7.3 occurred in the Kodari region, Central Nepal, 17 days after the 25 April 2015 Gorkha earthquake (Mw 7.8) along the Himalayan plate boundary. Both the earthquakes were associated with predominantly thrust faulting on the Main Himalayan Thrust (MHT). This is the largest aftershock of the 2015 Gorkha earthquake which occurred approximately 150 km east of it. Our analysis suggests that the 2015 Gorkha earthquake significantly increased the Coulomb stress on the shallow unruptured and updip part of the MHT, further west of the 2015 rupture and also in the hypocentre region of 12 May 2015 Mw 7.3 aftershock. In the following 17 days period, Coulomb failure stress increased further by the relaxation of coseismic pore pressure on the eastern side of its coseismic rupture, where the 12 May 2015 aftershock had occurred.

Record of charcoal from early Maastrichtian intertrappean lake sediments of Bagh valley of Madhya Pradesh: palaeofire proxy Dhananjay

M. Mohabey, Bandana Samant, Deepesh Kumar, Anup Dhobale, Arka Rudra and Suryendu Dutta

Keywords: Deccan volcanism, fossil charcoal, Maastrichtian, Malwa group, palaeofire.

Abstract

Presence of charcoal in intertrappean lake sediments associated with the Malwa Group of the Deccan trap, India is recorded. The finding provides the first evidence of palaeofire in the Indian late Cretaceous. Though previous studies have shown the presence of carbonaceous clays and coal bands in the Deccan volcanic associated sediments, the presence of fossil charcoal in the sediments is rarely reported. The fossil charcoal was identified based on optical microscope, Scanning Electron Microscope and Pyrolysis-Gas Chromatography Mass Spectrometer (Py-GC-MS). This study indicates that charcoal is derived from burning of plants caused by forest fire during the Maastrichtian (Chron 30N).

The wood-boring trace fossil *Asthenopodichnium* from Palaeocene sediments of the Barmer Hill Formation, western Rajasthan, India

S. C. Mathur, N. S. Shekhawat, S. L. Nama, C. P. Khichi, A. Soni, Saurabh Mathur and V. S. Parihar

Keywords: *Asthenopodichnium*, freshwater environment, trace-fossils, wood-rotting fungi.

Abstract

The present study documents the wood-boring trace fossil *Asthenopodichnium* from the Palaeocene sediments of the Barmer Hill Formation (BHF) in the Barmer Basin, Western Rajasthan, India. The *Asthenopodichnium* trace fossils are loosely to tightly packed, pouch-like burrows or almond-shaped structures identified as *Asthenopodichnium lignorum*, whereas lozenge and J-shaped structures are designated as *Asthenopodichnium lithuanicum*. The *A. lignorum* trace markers are considered to be the feeding and dwelling burrows produced by wood-rotting fungi, whereas *A. lithuanicum* are interpreted as feeding and dwelling burrows produced by Mayfly nymphs and larvae. The sedimentological and palaeontological studies of trace fossil-bearing horizons of BHF suggest freshwater fluvial sedimentary environment with humid to sub-humid climate.

Risk factors for seropositivity to feline retroviruses among owned domestic cats in Valdivia, southern

Chile L. Azócar-Aedo and G. Monti

Keywords: Feline leukaemia virus, feline immunodeficiency virus, immunochromatography, risk factors, seropositivity.

Abstract

We identified risk factors associated with seropositivity to feline leukaemia virus (FeLV) or feline immunodeficiency virus (FIV) and the association between seropositivity to these retroviruses and the presence of clinical signs. Cats under veterinary care had lower risk of FeLV seropositivity and male cats had higher risk of FIV seropositivity. FeLV seropositive animals had higher odds of non-specific clinical signs and reproductive disorders. FIV seropositive cats had higher odds of buccal alterations. These findings are useful to obtain a first approach to identifying felines that need the application of diagnostic tests for retroviral infections.

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Measuring scientific value of Indian journals beyond impact factor: a case with physics–chemistry–biology journals

Bhaskar Mukherjee

Keywords: Scientific value – Indian journals, scholarly journal publishing – India, status of PCB journal – India.

Abstract

Qualitative scientific journals play a vital role in scholarly communication processes. However, during the last few years, there is a mushroom growth of journals in every discipline in India. There has been no single source of systematic advice on how to measure the scientific value of Indian journals. The present study is an attempt to minimize the gap by developing a mechanism for measuring scientific value of Indian journals. Consulting various international databases and their journal inclusion policy, a viable mechanism has been devised and tested with 100+ Indian journals in the fields of physics, chemistry and biology. The results indicate that although the quantity of yearly additions of new journals in each of the three disciplines is quite impressive, the yearly discontinuation is also alarming. Almost 29% of physics journals, 11% of chemistry journals and 21% of biology journals were stopped within a year. Although irregularity in publication, improper execution of review process, non-disclosure of article processing charges, lower percentage of foreign contributors and low citation rate were identified as some drawbacks with Indian physics, chemistry and biology journals. The percentage of predatory journals in these three disciplines is quite less till date. In order to choose a better platform of scholarly publishing, this study suggests some recommendations for prospective authors.

Bibliometric analysis of greenhouse gas research on a global scale from 2000 to 2014

Wei Yang, Haijin Zhou, Fuqi Si, Cheng Liu, Wei Wang, Youwen Sun, Wenqing Liu and Changgong Shan

Keywords: Bibliometric analysis, climate change, global trends, greenhouse gas research, SCI.

Abstract

A bibliometric approach is used in this study for the assessment of greenhouse gas (GHG) research trends on a global scale. The relevant literature published from 2000 to 2014 in journals of all subject categories of the Science Citation Index Expanded from the Web of Science Core Collection databases has been used. The strings ‘greenhouse gas’ or ‘green house gas’ are used for retrieving

data. The information of GHG research-related literature is analysed, including the types and languages of literature, characteristics of articles published, source countries/territories of articles, distribution of articles in different subject categories and journals, frequency/number of words in the title of articles and the frequency/number of keywords used. Over the past 15 years, an obvious growth trend is seen in the number of published articles, and countries/territories involved in the study of GHG. The number of the world articles published by the seven most developed industrialized countries (G7) is maximum in the field of GHG research. The G7 countries have played a predominant role in GHG research in the last 15 years. Analysis of the title words, author keywords and keywords plus showed that ‘greenhouse gas emission’ and ‘climate change’ were the keywords with highest frequency during the whole research period. Carbon sequestration and biotechnology have been widely used in reducing the environmental pressure of the greenhouse effect and the dependence on fossil energy.

Vitamin B12 as a regulator of bone health

Vijay K. Yadav

Keywords: Bone formation, endocrinology, osteoblasts, vitamin B12.

Abstract

In the early 1920s, the anti-anaemic effect of liver-rich diet had been recognized. The anti-anaemic substance from the liver was isolated by 1950 and called ‘vitamin B12’ (hereafter B12). It took another 20 years to structurally define and chemically synthesize B12 in its pure form. Since then, it has been recognized that B12 modulates a variety of biological systems, from immune system to bone homeostasis. Recent clinical studies have shown that B12 deficiency is likely to be an important etiological factor in the pathogenesis of bone degeneration. In this regard, either observational studies that aimed to verify an association between low B12 level and bone mass, or clinical trials on the effect of B12 as a supplementary treatment in low bone mass patients have been presented in the emerging clinical literature. Recently, we created a mouse genetic model of B12 deficiency to elucidate its mode of action by genetic deletion of gastric intrinsic factor, a protein essential for the absorption of B12 from the gut. This has led to the identification of a novel gut– liver-bone axis that has the potential to be pharmacologically targeted for treating low bone mass diseases in humans. In this review, we revisit the history of B12 from its discovery in the early 20th century to the elucidation of its mode of action in the bone till date.

Intellectual property evolution and innovation ecosystem as effective tools in strengthening Indian healthcare sector

Tripta Dixit, Sadhana Srivastava, Smita Sahu and W. Selvamurthy

Keywords: Healthcare, innovation ecosystem, intellectual property, public–private partnership.

Abstract

Despite India’s enormous technological potential, indigenous medicinal knowledge and various initiatives by the government and industry at translational cycle, the country carries a global disease burden of 21%, majorly contributed by dual disease burden. Public health faces the major anomalies of 3A (accessibility, affordability, availability) of the healthcare sector, possibly due to restrictive coordination among stakeholders, transiting disease profile, undeveloped delivery system and regulatory mechanisms. This article emphasizes the significance of integrative approach of using our research and development strength and establishing a strong intellectual property system for conducive healthcare environment, accentuating the significance of 3P (public–private partnership) in addressing the major anomalies of 3A.

Is mercury really toxic? The way forward for its judicious medicinal applications based on the therapeutic doctrines of Ayurveda

Kapil Deo Yadav and Anand K. Chaudhary

Keywords: Ayurveda, mercury, neurotoxic effects, pharmacokinetic profile, stabilization.

Abstract

Mercury-based formulations have been extensively used in Indian and Chinese systems of medicine with high therapeutic index. However, at present mercury is considered as a global pollutant having potent neurotoxic effects. Also, it has been proposed to ban the export, import and manufacture of a range of products containing mercury from 2021. This situation compels one to ponder how mercury-based formulations were safe during ancient times, but are now considered to be toxic. Naturally mercury occurs in three forms, viz. elemental (Hg), inorganic (HgS, HgCl₂) and organic (MeHg). Organic mercury is completely absorbed by gastrointestinal tract, and elemental mercury is 75–80% absorbed by the lungs only in vapour state, while 10% of inorganic mercury is absorbed by the gastrointestinal tract. Additionally, organic mercury crosses the blood brain barrier and placenta, producing neurotoxic symptoms and foetal toxicity. In Ayurvedic science, mercury is converted only into inorganic form with special stabilization technology and this stabilized mercury is converted to mercuric polysulphides under gastrointestinal conditions, whereas elemental mercury is converted to organic form by specific bacteria. Thus mercury available in the atmosphere is converted into organic form that is highly toxic, while using Ayurvedic methods it is converted to inorganic form having potent therapeutic activity. Judicious and injudicious application of mercury has advantageous and disadvantageous effect respectively.

Luminescent solar concentrators – the solar waveguides Brindhya

V. G. Mohan, V. Vasu, A. Robson Benjamin and M. Kottaisamy

Keywords: Fluorescence, luminescent solar concentrator, poly (methyl methacrylate), total internal reflection.

Abstract

This study aims at giving a prologue to the nontracking, concentrating solar waveguides called luminescent solar concentrators. It deliberates the major factors of loss in such systems that limit photon collection and conversion efficiency. Identifying fluorescent molecules possessing a larger Stokes shift value with a broad degree of absorption in the UV-Vis continuum, with sharper and narrower near infra-red emission spectra at a higher quantum yield that achieves a perpetual total internal reflection, remains a challenge now. Geometrical and material properties also play a strategic role in accomplishing waveguides, with minimal loss, through total internal reflection of trapped photons for photovoltaic conversion.

The GIVE ionospheric delay correction approach to improve positional accuracy of NavIC/IRNSS single-frequency receiver

Mehul V. Desai and Shweta N. Shah

Keywords: Ionosphere, navigation systems tropospheric delay, positional accuracy.

Abstract

The Navigation with Indian Constellation (NavIC)/ Indian Regional Navigation Satellite System (IRNSS) is an independent navigation system developed for the Indian subcontinent by the Indian Space Research Organisation (ISRO). The positional accuracy of this system is mainly affected by the ionosphere of the lowlatitude equatorial Indian subcontinent, as large ionospheric gradients and intense irregularities are present in it. The objective of this study is to improve the positional accuracy of NavIC/IRNSS systems by applying ionospheric correction using the most suitable single-frequency

model. The data to be analysed were collected from the NavIC/IRNSS receiver provided by the Space Applications Centre, ISRO. A comparative analysis between the dual-frequency model and single-frequency model (e.g. GIVE model, coefficient-based model) was performed on the data from the NavIC/IRNSS receiver. Different ionospheric models were applied to compute ionospheric delay (ionodelay) on a quiet day ($3 < KP < 5$). Our result shows that both the single-frequency Grid Ionosphere Vertical Error (GIVE) model and dual frequency model outperform remarkably compared to the traditional coefficient-based model. The GIVE model was also analysed on FAR categorized satellites for different stormy days of different months. It was observed that during stormy days also, the 3D position computed by applying the GIVE model was nearly the same as the dual-frequency model.

Spliceosomal proteins encoded by fungal genomes

Sandeep J. Sarde, Frank Kempken and Abhishek Kumar

Keywords: Fungal genomes, pre-mRNA, snRNPs, spliceosomal proteins.

Abstract

A large number of spliceosomal proteins are required for proper RNA splicing. While spliceosomal proteins from several model organisms have been analysed, only limited studies are available for fungal species. Hence, we have performed a comparative genomic analysis using eight fungal species belonging to three taxa (Ascomycetes, Basidiomycetes and Glomeromycota). We identified variable number of spliceosomal proteins in fungal species. From the small nuclear ribonucleoproteins (snRNPs), all the snRNPs were identified. In non-snRNPs, only some sub-groups were found extensively conserved in all fungal species, including PRP19 complex proteins, catalytic step II and late-acting proteins. In heterogeneous nuclear ribonucleoproteins (hnRNPs), variable number of proteins was identified. The number of spliceosomal proteins identified in filamentous fungi was higher than that in yeast. The collection of these spliceosomal proteins provides further insight into pre-mRNA splicing in fungi.

Phytosociological analysis of Myristica swamp forests of Kulathupuzha, Kerala, India

T. J. Roby, Joyce Jose and P. Vijayakumaran Nair

Keywords: Floristic composition, phytosociological analysis, Myristica forests, structure and diversity

Abstract

The vegetation of Myristica swamp forests in Kulathupuzha, southern Kerala, India, was examined with reference to floristic composition, structure and diversity. Quadrates of 100×10 m were laid inside (17) and outside the swamps (14), and trees >10 cm girth at breast height were enumerated. A total of 2246 individual trees belonging to 58 species were recorded inside the swamps as against 1203 trees belonging to 89 species from outside the swamps. A total of 1775 shrubs belonging to 46 species and 26 species of herbs with 1082 individuals were recorded from inside the swamps. A total of 3535 shrubs belonging to 83 species and 491 herbs belonging to 30 species were recorded from outside the swamps. The Myristica swamp forests showed less diversity when compared to other forest types and was dominated by two Myristicaceae species, *Myristica fatua* var. *magnifica* and *Gymnacranthera farquhariana*. Comparison with Myristica swamps in other regions indicates that the Kulathupuzha region has the largest populations of the endangered *M. fatua* var. *magnifica*. Immediate steps for conservation are suggested.

Ground motion simulation for earthquakes in Sumatran region

J. Dhanya and S. T. G. Raghukanth

Keywords: Ground motion time history, ground residual displacement, peak ground displacement, Sunda arc.

Abstract

The present study aims at developing a model for simulating ground motion for earthquakes in the Sumatran region where one of the most devastating earthquakes took place in 2004 with a moment magnitude (M_w) of 9.1. With advancements in instrumentation, the three-dimensional material properties, topography and bathymetry of the region are available in the global database. These parameters are used as inputs in Spectral Finite Element Method to simulate ground motions. The model is first validated with the IGCAR broadband velocity data for 2012 M_w 8.6 Sumatra Earthquake. Due to favourable comparison, our model is also used to generate ground displacement characteristics of M_w 9.1 event. The source uncertainties are accounted by using three finite fault slip models available in the global database. The simulated time histories showed that the ground motion is sensitive to input slip models. The peak ground displacement (PGD) and ground residual displacement (GRD) in both horizontal and vertical directions are presented as contour plots. PGD obtained from various slip models in the epicentral region is of the order of 14–22 m in horizontal direction and 7–16 m in vertical direction. GRD in the epicentral region is of the order of 6–17 m in East–West (E–W) 4–17 m in the North–South (N–S) directions. The vertical uplift obtained from various slip models is around 2–8 m. The developed model can be used to simulate ground motion time histories, which can be further used in hazard analysis, tsunami simulations, etc.

Spectral response of few important textural variants of chromitite and its potential in estimating relative grades of chromitite – a case study for chromitite of Nuggihalli Schist Belt, India

Arindam Guha, Biswajit Ghosh, Sukanya Chaudhury, Komal Rani and K. Vinod Kumar

Keywords: Chromitite, electronic processes, modal analysis, spectral feature, texture, vibrational processes.

Abstract

We have collected, processed and analysed the reflectance spectra of representative chromitite samples of spot type, clot type and disseminated type textural variants to understand the diagnostic spectral features of each of these samples. We have found that the reflectance spectrum of each textural variant is distinct from the spectra of other variants despite having few common absorption features. Spectral features of chromitite samples are governed by the spectra of two dominant minerals, chromite and chlorite. Spectral features of chromitite at 550 nm and 1100 nm are governed by electronic transition process in Fe^{3+} and crystal field effect in Fe^{2+} ions present in chromite structure respectively. On the other hand, spectral features at 1400 nm, 1900 nm and 2300 nm are related to the vibration of O–H, H–OH and metal hydroxide bonds in chlorite. Amongst these features, the spectral feature at 1100 nm (due to Fe^{2+} in chromite grains) is common to all three major textural varieties of chromitite samples studied here. Electron probe micro analysis (EPMA) data of chromite and chlorite grains of each texture are used to relate the presence and abundance of Fe^{2+} (in chromite grains) with absorption feature. Width of the 1100 nm feature has a correlation value 0.95, while depth of the same feature has a correlation value 0.94 with the abundance of chromite mineral estimated using modal analysis of chromite samples. Therefore, spectrometric parameter of 1100 nm spectral feature of chromitite can be used as proxy for estimating modal abundance of chromite in chromitite samples after estimating deposit specific correlation coefficient.

Demography and birth seasonality in the Nicobar long-tailed macaque (*Macaca fascicularis umbrosus*)

Arijit Pal, Honnavalli N. Kumara, Avadhoot D. Velankar, Partha Sarathi Mishra and Mewa Singh

Keywords: Birth rate, demography, group size, population dynamics

Abstract

The Nicobar long-tailed macaque (*Macaca fascicularis umbrosus*) is confined to the southern and central Nicobar archipelago. We have collected demographic and birth data for five groups of *M. f. umbrosus* to understand their group structure, demography and breeding seasonality. Group size, individuals in age–sex classes and age–sex ratio did not vary between the groups and years. The birth rate was neither associated with the number of adult females in the group nor with group size. The number of births in a month was positively correlated with rainfall, and about 71% of the births occurred during the rainy season, though, the number of births did not vary systematically among the months. Perhaps, higher availability of food resources in the wet season than the rest of the year may support lactation in females and provide food for the weaned infants. The similarity in some demographic traits between the Nicobar long-tailed macaque and other subspecies indicates that these traits may be conserved over evolutionary time, while for other traits, differences among subspecies may reflect the effect of local conditions and recent histories. This is the first report on demography and birth seasonality of this unique subspecies of the long-tailed macaque.

Comparison of culture and PCR methods for diagnosis of group B *Streptococcus* in women

Mohtaram Nasrollahi, Masoud Moghadaszadeh, Maryam Abdollahi, Zeynab Marzhooseyni, Maryam Salehian, Eisa Nazar, Shukufe Sharif and Behnam Hashemi

Keywords: Culture, detection, group B *Streptococcus*, polymerase chain reaction, women, pregnancy.

Abstract

Group B *Streptococcus* (GBS), as a risk factor for newborns, is one of the most important causes of meningitis and septicaemia in newborns, intrauterine infections in women and colonization in the vaginal region in late gestation. We evaluate GBS prevalence and infection among pregnant women through culture and PCR methods, and then compare these methods. To this end, vaginal and urine swabs were separately collected from 246 women at the Women's Hospital of Sari, Iran. Next, the samples were enriched in selective culture media Todd–Hewitt broth for 24 h at 37°C, recognized using blood agar media, and finally were amplified STREP gene by PCR technique. The indicated that the frequency of GBS in samples collected from urine and vaginal cultures and PCR method was positive. In addition, no significant relationship was found among the positive results of culture, maternal age, gestational age, a history of abortion and infection. With regard to the cultivation method as a standard technique, the sensitivity of PCR test was 100% and specificity was 96%. Moreover, it was found that the colonization rate of GBS in women was significant in Sari. Therefore, PCR is recommended as a reliable and rapid method for detection of GBS.

Development and validation of marker-free constructs based on nucleocapsid protein gene of watermelon bud necrosis orthospovirus in watermelon

S. K. Holkar, Bikash Mandal and R. K. Jain

Keywords: Agroinfiltration, bud necrosis disease, orthospovirus, watermelon.

Abstract

Marker-free (MF) constructs were developed using 825 bp and 426 bp N genes of watermelon bud necrosis orthospovirus (WBNV). N genes were amplified and cloned in pDrive (825 bp) and/or pGEMT (426 bp) vectors and recombinants were confirmed. pCAMBIA 2300 was restricted with

XhoI to release nptII gene and re-circularized; it is called MF-pCAMBIA 2300. GUS cassette with promoter and terminator from pBI 121 was cloned into the MCS region of MF-pCAMBIA 2300 with EcoRI and HindIII. Eluted PCR products of 825 and 426 bp were cloned in already developed MFpCAMBIA 2300. These N gene constructs were then mobilized in *Agrobacterium tumefaciens* strain EHA 105. Agroinfiltration of *A. tumefaciens* harbouring MFpCAMBIA 2300 N gene constructs was practised by syringe method in 20-day-old watermelon seedlings. PCR amplification showed 825 and 426 bp amplicons which confirmed their presence in agroinfiltrated seedlings. Further, three days of post agroinfiltration seedlings were challenge-inoculated with WBNV and kept under artificial light for 3–6 days. Agroinfiltrated and inoculated seedlings were tested by ELISA and resulted positive with OD ranging from 0.31 to 0.46 and 0.35 to 0.43 in full and partial N genes respectively. Six days post-inoculation, necrosis and complete drying of the leaves were observed. The systemic upper young leaves were subjected to DAC-ELISA and results revealed negative reaction with OD ranging from 0.11 to 0.19. The N gene constructs conferred resistance against WBNV in watermelon.

Dual transmitter–receiver electromagnetic system for lateral boundary detection of subsurface formations

R. Rajesh and V. S. Sarma

Keywords: Conducting bodies, electromagnetic system, magnetic permeability, physical model studies, susceptibility.

Abstract

A new frequency domain electromagnetic system, based on different working principle has been designed and its efficacy tested over the existing systems through laboratory-scale-model studies. In this system, two transmitter coils have been employed to generate a magnetic null plane at their geometric centre. The receiver coil is placed in the null plane to record the induced secondary field. The interaction of the primary field is almost negligible on the secondary field recorded by the receiver. We present the theory and physical model results describing the system parameters and efficacy. The testing through physical model studies suggests an increased depth of detection in this new configuration compared to the existing systems. In terms of secondary field, the strength of the anomaly reflects the magnetic permeability/susceptibility difference of the subsurface medium on either side of the receiver. The study concludes that there is significant increase in depth of investigation and secondary field strength in this system over the existing conventional frequency domain systems and also more robust for boundary detection.

Overestimated groundwater 14C ages triggered an inexpediency of water policy in China

Tao Wang and Jiansheng Chen

Keywords: Groundwater, 14C dating method, northern China, South–North Water Transfer Project.

Abstract

Northern China has been facing a serious problem of groundwater scarcity. The government developed restrictive policies on groundwater extraction, and designed the South–North Water Transfer Project (SNWTP) to transfer water from the Yangtze River in southern China to the arid region in the north. However, contrary to expectation, groundwater levels in northern China have been rising significantly before completion of the project. Due to misapplication of the 14C dating method, the age of deep confined groundwater in arid northern China has been overestimated. This classifies the groundwater as palaeo-groundwater with little recharge, which results in the prohibition of groundwater extraction and SNWTP. Significant tritium concentrations recently reported in the so-called palaeo-groundwater, along with rising groundwater levels, imply recent groundwater recharge in arid northern China.

Inbound tourism in Uttarakhand, India, before and after the 2013 Kedarnath disaster – evidence derived from social networking sites using GIS

Stutee Gupta, Shikha Anand and Srishti Gwal

Keywords: Big data, natural disasters, social networking sites, tourism, visitation rates.

Abstract

Tourism is an important industry for the developing nations. The Indian Himalayan region attracts a multitude of tourists, but is highly prone to natural disasters that affect tourism. The 2013 Kedarnath disaster in Uttarakhand caused by the torrential downpour and subsequent flooding is one such example. In the present study, visitation rates were assessed with regard to the Kedarnath disaster using geo-tagged photographs posted on Flickr as proxy. Continued decrease in photo-user days from 2012 to 2014 was witnessed and the effectiveness of GIS in the spatio temporal analysis of inbound tourism using big data available on social networking sites has been demonstrated.

Supplementation of an immunomodulator, Ergosan in early larvae rearing of Indian white prawn, Fenneropenaeus indicus

Sambhu Chithambaran and Nasser K. Ayaril

Keywords: Bacterial colonies, immunomodulator, larval rearing, supplementation, white shrimp.

Abstract

Efficacy of an algine-based immunomodulator, Ergosan was tested on growth and survival of early larval stages (nauplii – PL3) of Indian white shrimp, Fenneropenaeus indicus in fibreglass tanks (10,000 l) for two larval rearing cycles. Larvae fed on a diet with Ergosan were considered as treatment and those fed on a diet without Ergosan as control. Both control and treatments were replicated in five tanks and arranged in a completely randomized design. Significant difference ($P < 0.01$) in survival was observed between control and treatment. However, growth of larvae was not influenced by the supplementation of Ergosan. Total colony forming units, yellow, green Vibrio and luminescent bacterial colonies were found to be significantly decreased in treatment tanks. Thus Ergosan was found to be a safe immunomodulator for improving larval survival and reducing bacterial load in rearing water.

Spectral modelling of estuarine coloured dissolved organic matter

Nittala S. Sarma, Sudarsana Rao Pandi, N. V. H. K. Chari, Gundala Chiranjeevulu, Rayaprolu Kiran, K. Shiva Krishna, D. Bhaskara Rao, P. Venkatesh, B. Charan Kumar and A. V. Raman

Keywords: CDOM, Chilika lagoon, Godavari estuary, spectral slope, S330–440, UV-visible absorbance.

Abstract

Measuring coloured dissolved organic matter (CDOM) holds advantage over dissolved organic carbon (DOC) determination, as it can be remotely estimated unlike the latter, for which it can potentially act as a proxy. The CDOM absorbance, by definition, falls exponentially with wavelength of light (λ) in the ultraviolet-visible region. Investigating over 800 absorption spectra of water samples from the tropical monsoonal Godavari estuary and the Chilika brackish water lagoon, we found that the spectral slope (S) of the 330–440 nm region (S330–440) is best suited to retrieve CDOM and its exponential character.

Impact of elevated CO₂ on Oryza sativa phenology and brown planthopper, Nilaparvata lugens (Hemiptera: Delphacidae) population

G. Guru-Pirasanna-Pandi, Subhash Chander, Madan Pal and P. S. Soumia

Keywords: Brown planthopper, climate change, elevated CO₂, hopper burn, Poaceae, yield loss

Abstract

The impact of elevated CO₂ (570 ± 25 ppm) on brown planthopper, *Nilaparvata lugens* (Stål) and Pusa Basmati 1401 rice in comparison to ambient CO₂ was studied in open top chambers (OTCs) during the rainy seasons of 2013 and 2014. Crop canopy circumference was higher (13.1–16.8 cm) under elevated CO₂ when compared to ambient CO₂ (10.3–13.1 cm) during different rice phenological stages indicating the positive influence of elevated CO₂. In addition, elevated CO₂ exhibited a positive effect on rice plants through increase in tiller number (17.6%), reproductive tiller number (16.2%), number of seeds/panicle (15.1%) and thousand grains weight (10.8%) that resulted in higher grain yield (15%) when compared to ambient CO₂. Elevated CO₂ also exhibited a positive effect on brown planthopper population through increase in fecundity (29% and 31.6%) which resulted in a significant increase in its population to 150.3 ± 16.4 and 97.7 ± 8.7 hoppers/hill at peak incidence during 2013 and 2014 respectively, when compared to the corresponding 49.1 ± 9.3 and 43.7 ± 7.0 hoppers/hill under ambient CO₂. Moreover, brown planthopper females excreted more honeydew (68.2% and 72.3%) under elevated CO₂ over ambient CO₂ during both years. However, elevated CO₂ caused reduction in the longevity of females (23.9–27.4%) during both years and male longevity (24.1%) during 2013. Despite the positive effect, rice crops suffered higher yield loss under elevated CO₂ (29.9–34.9%) due to increased brown planthopper infestation coupled with higher sucking rate due to reduced nitrogen level under elevated CO₂ compared to ambient CO₂ (17–23.1%) during 2013 and 2014.

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SERB merit review process: adapting to emerging challenges

Premila Mohan and Ramasamy Brakaspathy

Keywords: Funding agencies, merit review, research proposals, science and engineering.

Abstract

Merit review is the most trusted process adopted by funding agencies worldwide for selecting highquality research proposals. Recently, owing to intense competition, the merit review process has come under pressure necessitating the funding agencies to deliberate on issues associated with it. This article describes the merit review process of the Science and Engineering Research Board, Department of Science and Technology, Government of India, which funds competitive research grants of about 8 billion rupees a year for supporting research in science and engineering. The issues associated with the merit review process and possible suggestions are discussed.

Engineering curriculum development based on education theories

Jitendra Prasad, Avijit Goswami, Brijesh Kumbhani, Chittaranjan Mishra, Himanshu Tyagi, Jung Hyun Jun, Kamal Kumar Choudhary, Mukesh Kumar, Naveen James, V. Ravi Shankar Reddy Satwinder Jit Singh, Deepak Kashyap, Milind Sohoni, Nandita DasGupta, Prabhu Krishna Raina, Samir Kumar Saha, Sanjay Mittal, Suman Chakraborty and Sarit Kumar Das

Keywords: Curriculum development, engineering education, entrepreneurship, innovation, societal needs.

Abstract

Education theories stress not only societal context of education, but also educational philosophy, anthropology and psychology of learning. A formal curriculum theory, viz. Taba–Tyler rationale, has been proposed to incorporate philosophical, sociological, anthropological and psychological contexts of engineering education in the curriculum. The newly developed undergraduate curriculum at the

Indian Institute of Technology Ropar is based on such education theories and has been presented as a case study. It has been demonstrated that the resulting curriculum can lead to unique courses that collectively bring out unique features such as core competency, strong connection to society, hands-on learning, creativity and innovation.

Aspects of science education in India: a synoptic review and possible directions for the future

Ramjit Kumar and Smriti Singh

Keywords: Post-independent India, science education, society.

Abstract

Science is the constitutive feature of modern society. It has not only changed the world but has also changed the way we understand the social and natural world. Apart from alleviating us from the traps of ignorance, illiteracy and penury, it has challenged the centrality and dominance of metaphysical beliefs in society. The attributes of science like rationality, and open-mindedness, and scientific worldviews are universal values, essential for the growth of an individual as well as the society. In post-independent India, our Constitution adopted the goals of establishing a society based on scientific temperament, humanism and spirit of inquiry. The same is also enshrined in Article 51 A(h) of the Constitution that states that it is the fundamental duty of every citizen of the country to inculcate, propagate and further disseminate scientific temper in society. This underlines that science education is central to our modernity project and the idea of society predicated on scientific rationality, democratic values and open-mindedness. Introducing the idea of science as a process at curriculum level, exposing students to the nature of science are some of the important components of pedagogical content knowledge that can be leveraged in today's science education programme to make science education enjoyable, productive and intrinsic to the learning process. It will also bring the issue of educational praxis at the centre of learning.

Social media and communication by scientists: M. S. Swaminathan on Twitter

B. Jayashree

Keywords: Agriculture, policy, scientists, science communication, social media, Twitter.

Abstract

Scientists use popular media to share views or facilitate greater understanding of their work. Social media also offers scientists the opportunity to build public opinion. Hailed as one of three most influential Indians of the 20th century by Time Magazine¹, renowned agriculture scientist M. S. Swaminathan has written prolifically in scientific and mainstream media. From March 2015, for a period of one year, his use of social media platform Twitter is being taken up as a case study of social media communication by scientists. This article analyses themes articulated by a scientist on social media and finds that this provides an entry for discussions on science and development. Through this study, it is suggested that scientists, especially in India, can intervene more actively, for greater authenticity, accuracy and understanding among social media users on scientific subjects.

Water soluble nanocarbon materials: a panacea for all?

S. V. Eswaran

Keywords: Nanobiotechnology, nanomaterials, theranostics, targeted drug delivery.

Abstract

The low solubility of nanocarbon materials (fullerenes, CNTs and graphene) has restricted their widespread commercial use. Functionalization, however, helps overcome this major limitation. Much work has been documented recently on water soluble fullerenes (FWS) in treating cancer (e.g. breast cancer), tumours, arthritis, Parkinson's, influenzas and HIV/AIDS. Even an aqueous nasal spray to

combat Alzheimer's has been advocated. A recent US patent shows that FWS, based on its anti-oxidant activity, is a powerful Radical Oxygen Scavenger. FWS have been used in X-ray imaging, as MRI Contrast Agents (MRI-CA), to make solar cells and could help produce nanodevices and biosensors. This review examines this emerging field.

Fluoride distribution in drinking groundwater in Rajasthan, India

Shanti Lal Choubisa

Keywords: Groundwater, guinea-worm disease, fluoride distribution, hydrofluorosis, mitigation and prevention.

Abstract

Hydrofluorosis caused by fluoride-rich water was predominantly restricted in Rajasthan, India before the commencement of guinea-worm (*Dracunculus medinensis*) eradication programme in 1986. During implementation of the programme, numerous bore- and tube-wells fitted with hand pumps were dug in villages even in the remote areas of the state, simultaneously closing down the traditional step/open-wells which were used as drinking water sources. Groundwater from tube- and bore-wells drawn from deeper sources in all the 33 districts of Rajasthan is found contaminated with varying amounts of fluoride (F), with most containing F above the maximum acceptable limits of 1.0–1.5 ppm. As a result, hydrofluorosis has become more rampant in rural Rajasthan. Extreme large amounts of F in potable water sources were detected in desert districts located in western Rajasthan (Thar Desert region). The findings of this article show how a well-intentioned medical health programme has led to the spread of another disease (hydrofluorosis) in Rajasthan. These findings can play an important role in the formulation and implementation of a health policy at the state level for mitigation and prevention of endemic hydrofluorosis.

Cellular and molecular basis of heavy metal-induced stress in ciliates

Sripoorna Somasundaram, Jeeva Susan Abraham, Swati Maurya, Seema Makhija, Renu Gupta and Ravi Toteja

Keywords: Ciliates, heat shock protein, heavy metal stress, metallothionein, superoxide dismutase.

Abstract

Globally, heavy metals are the major pollutants present in both terrestrial and aquatic ecosystems. Increase in their concentration due to various anthropogenic activities is a matter of concern. Higher concentration of these metals is known to be toxic due to their non-biodegradable nature. Eukaryotic microorganisms, ciliates can be used as cellular tools to assess and study the various mechanisms to overcome heavy metal toxicity. Here we discuss, at cellular level, the effect of heavy metal toxicity on growth rate, behavioural and morphological changes of ciliates. At the molecular level, changes in stress genes like hsp70, metallothionein and expression of various antioxidant enzymes (superoxide dismutase, glutathione peroxidase) adopted by ciliates have also been deliberated. It is also being argued that ciliates can be used as biosensor/cellular tools for detecting heavy metal pollution.

Knowledge, attitude and practice of antibiotic use and antimicrobial resistance: a study post the 'Red Line' initiative

Deepanwita Banerjee and Anu Raghunathan

Keywords: Antibiotic resistance, attitude, community, knowledge, practice.

Abstract

Antimicrobial resistance (AMR) is propagated by irrational use of antibiotics by healthcare practitioners and the uninformed public. This study assessed a select cohort of 504 urban Indians for their knowledge, awareness and practice of antibiotic use and AMR. Forty seven per cent were

unaware of the differences between over-the-counter drugs and antibiotics. One in four believes that dose-skipping does not contribute to AMR. One in ten tends to self-medicate. One in five bought medicines without prescription or started an antibiotic course by calling a doctor. Our results mandate educational campaigns, stewardship and surveillance at the national level for prudent antimicrobial use in the Indian community.

Layered Pt.ZSM-5-C by greener chemical reduction for catalysing fuel cell reactions

Basu M. Daas and Susanta Ghosh

Keywords: Chemical reduction, electro-oxidation, platinum nanoparticles, zeolite modified electrode, ZSM-5.

Abstract

Metal ion exchanged catalysts are known now and are successfully used for many catalytic processes. But supported metal nanoparticles on the zeolite bed, and their use as catalysts is still under experimental probe. ZSM-5 supported platinum nanoparticles are synthesized from in-situ chemical reduction of platinum chloride solution in the presence of zeolite, by zinc dust chemical reduction method which is comparatively 'greener'. This platinum nanoparticle loaded ZSM-5 is studied in the role of catalyst in electrooxidation of methanol and ethanol using Nafion-117 to bind the catalyst on carbon felt. The platinum nanoparticle loaded ZSM-5 is found to be a better catalyst compared to pure ZSM-5 and pure platinum. This greener chemical reduction method can be used as the results show that zeolite modified catalysts are as good as those prepared by other less environment friendly methods, if not better.

Magneto-mineralogical characterization and manifestations of magnetic fabrics from the gneissic rocks and associated intrusive bodies in and around Bankura and Purulia districts, West Bengal, India

Saurodeep Chatterjee, Supriya Mondal, Pratik Roy, Debesh Gain and Amitava Bhattacharya

Keywords: Atomic Absorption Spectrophotometry, Anisotropy of Magnetic Susceptibility, Fe–Ti-oxide, gneiss, pegmatites

Abstract

The present study aims to unravel the mineralogical, chemical and anisotropy of magnetic susceptibility (AMS) from gneissic rocks and associated pegmatitic bodies from Bankura–Purulia region, West Bengal (India). Petrographic studies were done to detect the textural relationship of minerals that contribute susceptibility with that of the silicates. The study of polished thin-sections under reflected light microscope showed the presence of titanomagnetite and magnetite as dominant magnetic minerals. More than one generation of magnetic minerals were found which are linked to different conditions of temperature and tectonics that prevailed during their oxidation. AMS studies depicted the overall nature of magnetic fabrics (and other related parameters like mean susceptibility, magnetic foliation, magnetic lineation, corrected degree of anisotropy, shape parameter) in the region. The susceptibility ellipsoids were dominantly oblate in the region as evident from the P_j – T_j plots. The absence of linear relationship between mean susceptibility and degrees of anisotropy proves that the fabrics are independent of bulk ferromagnetic susceptibility and controlled by deformational features. The equal area plots of the principal susceptibility axes and representation of maximum susceptibility axes in the rose diagram revealed parity between the field and magnetic fabrics thus pointing to a tectonic control of fabrics. Moreover, the pegmatitic bodies based on AMS parameters are found to have emplace syn-tectonic to basement deformation which impinged a linear feature (both in mesoscopic fabric and magnetic fabric) to the otherwise undeformed intrusive bodies.

Assessing unrealized yield potential of maize producing districts in India

B. M. K. Raju, C. A. Rama Rao, K. V. Rao, Ch. Srinivasarao, Josily Samuel1 , A. V. M. Subba Rao, M. Osman, M. Srinivasa Rao, N. Ravi Kumar, R. Nagarjuna Kumar, V. V. Sumanth Kumar, K. A. Gopinath and N. Swapna

Keywords: Agro-climatic zone, climate, cluster, irrigation, potential yield, yield gap.

Abstract

The projected demand of maize production in India in 2050 is 4–5 times of current production. With the scope for area expansion being limited, there is need for enhancement of yield. This calls for identifying areas where huge unrealized yield potential exists. With a view to address the issue, the present study delineates homogeneous agro-climatic zones for maize production system in India taking district as a unit and using the factors production, viz. climate, soil, season and irrigated area under the crop. There are 146 districts in India that grow maize as a major crop. They were divided into 26 zones using multivariate cluster analysis. Study of variation in yield between districts within a zone vis-à-vis crop management practices adopted in those districts was found useful in targeting the yield gaps. These findings can have direct relevance to the maize farmers and district level administrators.

Migmatization, granite generation and melt accumulation in the Himalayan Orogenic Channel, Central and Eastern Bhutan

A. K. Jain, Sushmita, Sandeep Singh and P. K. Mukherjee

Keywords: Bhutan, Channel, Himalayan Orogenic migmatite, leucogranite.

Abstract

In Central and Eastern Bhutan Himalaya, the Great Himalayan Sequence (GHS) reveals mesoscopic structures within the migmatite–leucogranite association due to crustal anataxis above the Main Central Thrust (MCT). The first phase of dominant melting generates stromatitic migmatite along the main foliation during high grade of metamorphism, possibly by dehydration melting. Subsequent ductile strike–slip shearing caused in situ melting in dilatational sites to produce structureless, non-foliated patchy leucogranite leucosome as well as in boudin necks and post-tectonic patches. In addition, melt-enhanced deformation caused doming of accumulated melt and subsidiary ductile shear zones on either margins of these domes. Surrounded by biotite-rich melanosome, leucosomes destroy the pre-existing foliation during new anatexis phase, which post-dates earlier stromatitic migmatite. These migmatites are the snapshot of mutual relations between newly-developed migmatite and leucogranite melt, and signify the transportation of Himalayan Orogenic Channel to the extreme south in Central and Eastern Bhutan over the Lesser Himalayan sedimentary belt along the MCT.

Travel time reliability as a level of service measure for urban and inter-urban corridors in India

Anish Kumar Bharti, Ch. Ravi Sekhar and Satish Chandra

Keywords: Automatic license plate method, buffer time index, capacity, travel time index, travel time reliability, urban arterial.

Abstract

The present study demonstrates the application and usefulness of travel time reliability as a level of service (LOS) measure for urban arterial and inter-urban highway corridors on Indian roads. For travel time estimation, automatic vehicle license plate number data were collected through TrafficMon system. This system is a fully video-based enforcement system designed to measure the speed of vehicles passing in view of the camera, and read the vehicular license plate number. This system was implemented at the entry and exit side of the identified three study corridors and data

were collected during morning and evening peak periods. The data were analysed and various travel time reliability measures were evaluated. The study also attempts to correlate reliability measures such as planning time (PT), buffer time (BT), planning time index (PTI) and buffer time index (BTI) with volume-to-capacity ratio which is the most widely used LOS measure for Indian roads. Analysis of results indicated that at LOS B the travel time of intercity highway was 40–46 sec/km, whereas it was 64–80 sec/km and 75–135 sec/km for urban uninterrupted and interrupted corridors respectively. The planning time for LOS B was more on urban arterial corridors when compared to inter-urban corridor for the same width of the carriageway. The upper limits of LOS B for PT were 132 sec/km and 63 sec/km for uninterrupted urban corridor and intercity highway corridor respectively. Other parameters of reliability like PTI and BTI were also evaluated and their values for different ranges of volume-capacity ratio were presented for identified corridors.

Extreme space-weather effect on D-region ionosphere in Indian low latitude region

K. Venkatesham and Rajesh Singh

Keywords: Low latitude, D-region ionosphere, solar flare, solar cycle 24, very low frequency waves.

Abstract

The present study delineates on the observations and modelling of low latitude D-region ionosphere perturbations caused by strongest solar flare (X6.9) of solar cycle 24. An extreme space weather event occurred on 9 August 2011. To understand the severity of X-class flare on ionosphere, a comparative study was made with a low intensity C-class flare of 6 August 2011. Both flares originated from the same sunspot AR#1263. Very low frequency (VLF) waves propagating in the Earth's ionosphere wave guide (EIWG) measured from VLF transmitter NWC (19.8 kHz) located in Australia, and recorded at Allahabad (India) were used. The recorded VLF amplitude and phase were modelled with long wavelength propagation capability code to understand solar flare-induced ionospheric variation. Modelling results revealed that the lower boundary of D-region ionosphere is lowered by 10 km during X-class and 1.0 km for C-class flare. This implies change in the properties of EIWG, and hence becomes important to observe our ionosphere on continuous basis for space weather events since ionosphere is the key medium of propagation for radio waves.

Morphometric and internally transcribed spacer gene sequence-based characterization of *Alternaria burnsii*

Nirbhay K. Singh, Dasharathbhai B. Patel, Smitkumar R. Chaudhari, Bindiyaben G. Morad, Sonalben M. Rabari, Anirudh Chattopadhyay and Mohan L. Tatarwal

Keywords: *Alternaria burnsii*, blight, conidia, ITS, MEGA

Abstract

Alternaria burnsii, the pathogen responsible for cumin blight, was collected from diseased plant samples from North Gujarat. AB-01 showed maximum growth at $28 \pm 1^\circ\text{C}$. Conidia ranged from 44.92 to 63.28 μm in length and 10.84 to 24.36 μm in width whereas beak length of conidia ranged from 20.34 to 47.85 μm . The isolate AB-01 showed the highest sporulation frequency (1.24×10^5 /ml), but the highest percentage of disease intensity was observed in AB-08 (31.4). Internally transcribed spacer gene sequence based phylogenetic grouping using MEGA5.6 and the factorial analysis using DARwin5 reflect the presence of two distinct groups. The fast growing isolates that show high pathogenicity are present in group-I of the dendrogram whereas the members of group-II show grey black colony colour, light brown colony margin, plain irregular growth pattern, and comparatively larger beak length of conidia.

Women empowerment through agricultural mechanization in India

C. R. Mehta, L. P. Gite and A. Khadatkar

Keywords: Agricultural mechanization, empowerment, farm equipment, hand tools, women workers

Abstract

Based on the 2011 census, 37% of the total number of agricultural workers in the country are women and by 2020, this figure is expected to be about 45%. The increased participation of women in agriculture will demand more emphasis on the development of genderfriendly tools, equipment as well as work places. Women have different ergonomical characteristics. It is necessary to give due consideration to their ergonomical characteristics while designing various farm tools and equipment. An effort has been made in this study to analyse various issues related to women and suggest ways to empower women workers through use of modern farm tools and machines. This study also highlights the need to organize demonstrations and trainings for farm women on proper operation of various modern tools/equipment. It is also necessary to find a way to ensure supply of these improved tools and equipment at the village level.

Last 42 ky sediment chemistry of oxygen deficient coastal region of the Bay of Bengal: implications for terrigenous input and monsoon variability

T. Sarathchandraprasad and V. K. Banakar

Keywords: Bay of Bengal sediment, geochemistry, Holocene-LGM, OMZ, monsoon.

Abstract

The discharge of terrigenous clastics by seasonal peninsular rivers is known to reach the upper slope of the eastern margin of India, which is presently impinged by the monsoon-sensitive intense oxygen minimum zone (OMZ); however, their mutual behaviour in response to changes in the intensity of past Indian summer monsoons (ISM) is not clear. The $\delta^{18}\text{O}_{\text{org}}$ time-series of a sediment core from the upper slope off Chennai exhibits distinct enrichment ($\sim 0.4\%$) during the last glacial period (30–18 kiloyears BP: ka), and depletion ($\sim -2.2\%$) during the Holocene, suggesting a significant shift in ISM intensity. The monotonously increased terrigenous elements (Al, Ti and Mg) content and depleted $\delta^{18}\text{O}_{\text{org}}$ during the Holocene suggest tight-coupling between ISM and terrigenous sediment input. Highly depleted redoxsensitive Mn (less than the source sediment content of 0.07%) throughout the last 42 kyr suggests well-sustained intense OMZ irrespective of ISM variation.

Multiple regression analysis of geoelectric imaging and geotechnical site investigation test results

Rambhatla G. Sastry, Sumedha Chahar and Mahendra Singh

Keywords: Geoelectronic imaging, geotechnical site characterization, multi-regression analysis, grain size, water content.

Abstract

Geotechnical site characterization through non-invasive and cost-effective electrical resistivity imaging (ERI) and induced polarization imaging (IPI) offers promise compared to conventional point-geotechnical site investigations (standard penetration test, SPT), for which a basic understanding of factors (grain size (sand, fines) and water content) influencing them is needed. Here we perform a multiple regression analysis of ERI, IPI and SPT results in a site investigation at Lucknow, India. The results show that grain size and water content influence both chargeability and SPT values in a similar manner, while resistivity values are affected differently with a low RMS prediction error for chargeability.

Mixing dynamics in double-diffusive convective stratified fluid layers

Rishabh More¹ and Sridhar Balasubramanian

Keywords: Double-diffusive convection, entrainment velocity, linear stratification, radiative cooling, mixing layer depth.

Abstract

Double-diffusive convection in a linearly stratified fluid in the presence of radiative cooling at the surface has been investigated experimentally and theoretically. The stratification strength, which was varied in the experiments, is characterized by the buoyancy frequency of a stable environment defined as $N^2 = (g/\rho_0) / (d\rho/dz)$. The surface radiative cooling mimics buoyancy forcing incumbent at the surface of the ocean during the boreal winter months. The significant parameters governing the mixing dynamics for such a system were identified to be the Richardson number (Ri) and flux Rayleigh number (Raf). Controlled experiments were performed for $Ri = 0-6$, while maintaining a constant $Raf = 2.58 \times 10^7$. This indicates that the stratification strength N was changed while the cooling flux Q was fixed. The mixing and barrier layers were visualized using a commercial dye solution. The thickness of the mixing layer was quantified from the flow evolution images. It was found that the mixing layer decays exponentially with increase in the stratification strength owing to suppression of downward convective motion due to the buoyancy force. A similar trend was observed for the entrainment velocity. A scaling law was proposed as follows: $\Delta = CRi^{-3/4}$, where Δ is the mixing layer depth and C is a constant. The experimental results were compared with theoretical analysis and reasonable agreement was found. The results would be useful in parameterizing the mixing and barrier layers in strongly stratified environments such as the Bay of Bengal.

Mechanical properties and differentiation assessments of neural stem cells with pneumatic micropipette aspiration

Ming Wu, Qili Zhao, Cui Yang, Wen Shen, Xin Zhao, Yun Lu and Xi Zeng Feng

Keywords: Mechanical properties, robotic micromanipulation system, differentiation assessment, neural stem cells.

Abstract

The change in chemical and biological properties of neural stem cells (NSCs) before and after differentiating into neurons and glial cells has been well studied. However, there is lack of knowledge on the relationship between cell differentiation and alteration of cell mechanical features. Mechanical properties can reflect specific changes that occur with biochemical and cytological changes. Here, we present a robotic micromanipulation system for measuring the mechanical properties of single cells. This system consists of a suction micropipette, a robotic micromanipulator and an inverted microscope. A pneumatic micropipette aspiration method is utilized to measure the elastic properties of the cells. We found that the mechanical properties of NSCs belong to the solid state, however, neurons and glial cells are close to the liquid state. Further, NSCs are harder than neurons and glial cells.

Coral mortality in the Gulf of Mannar, southeastern India, due to bleaching caused by elevated sea temperature in 2016

J. K. Patterson Edward, G. Mathews, K. Diraviya Raj, R. L. Laju, M. Selva Bharath, A. Arasamuthu, P. Dinesh Kumar, Deepak S. Bilgi and H. Malleshappa

Keywords: Bleaching, climate change, coral reefs, mortality, sea surface temperature.

Abstract

Intensive underwater surveys have been conducted to assess the extent of coral bleaching and subsequent mortality in the Gulf of Mannar between March and October 2016. The extent of

bleaching was $23.92\% \pm 10.55\%$ during the period between March and June 2016, and the live coral cover was drastically reduced to $22.69 \pm 9.07\%$ during October 2016 with a mortality of $16.17 \pm 8.46\%$. Fast-growing coral forms, including the genera *Acropora*, *Montipora* and *Pocillopora* were most affected, not only by bleaching but also by severe mortality. Boulders, including the genera *Porites*, *Favia* and *Favites* were found to be resistant to bleaching. During the bleaching period, water temperature was between 31.2°C and 32.6°C . The current bleaching is in alignment with the third global coral bleaching event which occurred between 2014 and 2017. Management interventions, including protection and rehabilitation using the native resistant coral species will not only help in the recovery process, but also increase the live coral cover.

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Localization–affordability–saturation for speedy distribution of solar study lamps to millions

Chetan Singh Solanki, N. C. Narayanan and Jayendran Venkateswaran

Keywords: Affordability, kerosene, localization, rural, saturation.

Abstract

Millions of rural households in India lack access to clean basic lighting which hampers the ability of children to study during dark hours. Over 81 million students are likely to be dependent on kerosene lamps for basic lighting. Despite programmes focusing on disseminating solar lanterns since the last three decades, penetration is limited owing to three main barriers: affordability, absence of after-sales services and unavailability in rural markets. This paper presents the localization– affordability–saturation (LAS) model that addresses these main barriers by bringing together three institutional spheres – government, corporate and NGOs for speedy upscaling. This paper illustrates experiences and challenges that have emerged from field testing of the model through Million Solar Urja Lamp Programme while disseminating 1,000,000 solar study lamps to rural school children residing in more than 10,000 villages in India. Though implemented successfully, applicability of LAS model can be hindered due to dependence on subsidies, bottlenecks in local manufacturing infrastructure, absence of market mechanism and its relevance in providing complete lighting solutions.

Diagnosis and epidemiology of amoebiasis in India

Joyobrato Nath, Baby Singha, Jaishree Paul and Sankar Kumar Ghosh

Keywords: *Entamoeba* complex, microscopy, DNA-based diagnosis and molecular epidemiology, risk factor, strain typing.

Abstract

It is now well established that *Entamoeba histolytica* was indeed a species complex comprising of pathogenic *E. histolytica* and morphologically indistinguishable non-pathogenic *E. dispar* and *E. moshkovskii*. A greater hindrance is the different and inconsistent use of diagnostic methods in different areas of the world. Though microscopy has poor sensitivity, it seems that till today, many epidemiological studies are either based on microscopy alone or PCR assay carried out on microscopy screened samples or PCR assay performed on a very small sample size and thus fails to figure out the true magnitude of amoebiasis. The present review recommends DNA-based systematic approach like rDNA-based DNA dot blot screening followed by PCR assay to determine the true prevalence rate, suggesting its implication in the large-scale epidemiological study. DNA-based studies from across the world showed that the prevalence rate varies from 0.55% to 69.6% among human populations. The studies indicate that various unhygienic practices like unhygienic toilet facilities, poor living conditions, hand washing habits, etc. HIV infection and mutation in LEPR are among common factors

that increase the likelihood of amoebiasis. On the other hand, till today it remains unclear if the *E. histolytica* causing intestinal and extra-intestinal amoebiasis is a similar or different strain.

Identification and analysis of classic articles and sleeping beauties in neurosciences

Andy Wai Kan Yeung and Yuh-Shan Ho

Keywords: Bibliometrics, classic articles, literature survey, neurosciences, sleeping beauties.

Abstract

This study aims to evaluate the properties of neuroscience articles highly cited at present, based on the overall neuroscience literature. Results reveal 387 classic articles that have been cited at least 1000 times from the Web of Science since their publication to the end of 2016. Data showed that the 1990s was the most prolific decade in terms of classic articles published, and that USA, UK and Canada were the major contributors. Harvard University and Stanford University, USA, were the most dominant institutes. Moreover, there was one classic sleeping beauty, a paper published with scarce citations for a long period before being cited frequently.

Environmental pollutants and aggressive climatic conditions: combination scaffolds of brain stroke

Jeetendra Kumar Gupta, Kamal Shah and Pradeep Mishra

Keywords: Brain stroke, environmental pollution, disease mortality, global warming.

Abstract

In the present scenario, health-related complications are worsening because of escalating environmental factors. Pollution of the earth has reached alarming levels. High motorization rate and unchecked industrial wastes produce massive environmental pollutants, which are the most profound factors for aggressive climatic conditions. Heat-trapping pollutants like carbon monoxide and chlorofluorocarbons are increasingly being emitted in the atmosphere. Many toxic pollutants, viz. sulphur dioxide, nitrogen dioxide, mercury and lead have crossed their threshold levels in urban and industrial regions. These pollutants have serious consequences on human health, affecting many organs and systems. They affect our respiratory system, circulatory system and nervous system by entering the blood stream. The blood–brain barrier of the central nervous system is also being disrupted due to sustained exposure. Ischaemia and haemorrhage are the most hazardous incidences of environmental pollutants in brain. It has now become a serious cause of morbidity and mortality. Pollutants like sulphur dioxide and carbon monoxide have a tendency to produce ischaemia and clump through inflammation and arterial blockage. Almost 40% of mortality is caused due to pollution-induced brain stroke. Hence, environmental pollutants are the leading cause of cerebral stroke and somatic disabilities.

Quantitative structure–activity relationship and combinatorial design of 1,3,4-oxadiazolebased thymidine phosphorylase inhibitors as potential anti-cancer agents

Shalini Bajaj, Piyush Ghode, Jagadish Singh, Partha Pratim Roy and Sanmati Kumar Jain

Keywords: Anti-cancer therapy, docking, combinatorial library, 1,3,4-oxadiazole, 3D-QSAR.

Abstract

The 3D quantitative structure–activity relationship model representing $r^2 = 0.8605$, $q^2 = 0.8193$ and $\text{pred}_r^2 = 0.6847$ respectively, was generated for thymidine phosphorylase (TP) inhibitory activity of some 1,3,4-oxadiazole derivatives. Electronegative substituents at R 1 and less steric bulk with electropositive substituents at R 2 were found to be favourable for TP inhibition. The activity prediction of a combinatorial library of 1629 compounds resulted in 50 molecules whose predicted activity was comparable to the most active compound in the dataset and within the model's

applicability domain. Among them six molecules showed favourable interactions with the active site of TP proposing potential anticancer activity of the title compounds.

Comparison of stochastic gradient-based optimization techniques for nonlinear satellite image coregistration problem

S. Manthira Moorthi and R. Sivakumar

Keywords: Coregistration problem, remote sensing, satellite image, simultaneous perturbation, stochastic optimization.

Abstract

Information-oriented intensity-based cost functions are generally used for optimization frameworks in automatic satellite image registration. Optimization mechanics which updates the transform parameters in the iterative loop requires estimation of derivatives of the cost function to set-up update rules that retrieve the deformation model between the image pairs. Application of stochastic approximation of cost function and its derivatives for solving optimization problems while the objective function is non-differentiable or non-smooth or computed with noise is encountered in real-world problems. The known methods of approximation for solving these problems use the idea of stochastic gradient and certain rules of changing the step length for ensuring convergence. In this article, satellite image coregistration problem is chosen for comparing the performance of two important stochastic optimizers like adaptive stochastic gradient descent and simultaneous perturbation stochastic approximation. Coregistration datasets from Resourcesat-2 LISS-4 MX sensor are chosen for different terrains and features to study subpixel accuracies of order better than 1/20th of a pixel achieved in the comparison of two different optimization techniques employed in intensity-based automatic image registration framework.

Urban growth dynamics and modelling using remote sensing data and multivariate statistical techniques

Manish Kumar, R. B. Singh, Ram Pravesh, Pankaj Kumar, Dinesh Kumar Tripathi and Netrananda Sahu

Keywords: Remote sensing, statistical techniques, spatial and temporal variability, urban sprawl.

Abstract

In this article, sprawl area of impervious surfaces and their spatial and temporal variability have been studied for Pune city over a period of 19 years, i.e. 1992– 2011. Statistical techniques and image classification approach have been adopted to quantify the urban sprawl and its spatial and temporal characteristics. For this purpose, satellite images were obtained from various sensors, viz. Landsat Thematic Mapper and Landsat Enhanced Thematic Mapper Plus. To establish the relationship between urban sprawl and its causative factors, multivariate statistical technique has been used. The determinants of causal factors of urban sprawl such as population, α -population density, β -population density, workforce engaged in secondary and tertiary sectors, road density, and gender gap in literacy collectively explain the 93.09% variation in urban growth. The result also depicts that incessant growth in the built-up area in Pune city has surpassed the rate of population growth. From 1992 to 2011, population in the region grew by 75.40% while the amount of built-up land grew by 227.3%, i.e. more than three times the rate of population growth. To understand the future urban growth of Pune city, a foresight approach is being developed that allows long-term projections. This depicts that by the year 2051, the built-up area in the municipal limits would rise to 212.27 sq. km, which may be nearly 50.0% more than that in 2011 (141.50 sq. km). The vegetative areas, open spaces and areas around the highways are expected to become major targets for urban sprawl due to further increase in the pressure on land.

Exploring effective factors on energy data of some benzofuran derivatives

Pouya Karimi, Somayeh Makarem and Hamid Ahmar

Keywords: Benzofuran, computational quantum chemistry, energy data, molecular properties.

Abstract

Benzofuran derivatives have many useful applications. Computational quantum chemistry method was used to study the relationship between energy data and molecular properties of the 5,6-dihydroxy-2-methyl-1-benzofuran-3-carboxylate derivatives (molecules 3a–3f). Results indicate that there is a good relationship between intramolecular hydrogen bond lengths and energy data of these molecules. Also, X-ray of molecule 3e was used to compare experimental and computational geometrical parameters. Chemical hardness, chemical potential and electronegativity values were calculated to recognize relation between energy data and reactivity of these molecules. Atomic net charges and molecular electrostatic potential values were employed for better insight regarding energy data of the molecules. Electronic charge densities were calculated using atoms in molecules method. The correlation coefficients between experimental and computational ¹³C NMR chemical shifts were examined. Total spin–spin coupling constant and its components were evaluated to understand the contribution of these properties in energy data of the molecules. The relation between energy data of the molecules and aromaticity of the rings was also determined.

Identification of bioactive compound from Citrus maxima fruit against carbohydrate-hydrolysing enzymes

S. K. Reshmi, H. K. Manonmani, J. R. Manjunatha and M. N. Shashirekha

Keywords: Bioactive compound, Citrus maxima, carbohydrate-hydrolysing enzymes, hyperglycaemia.

Abstract

The aim of this study was to identify the bioactive compound of Citrus maxima fruit that targets the enzymes responsible for hyperglycaemia. Preliminary in vitro screening of extracts of fruit parts revealed that juicy segments (ethanol, methanol and aqueous) showed the highest inhibition towards the carbohydrate-hydrolysing enzymes. Further, juicy segment extracts were subjected to preparative HPLC for separation and isolation of compounds. After a series of separations, in vitro analysis and characterization, naringin was identified to be the bioactive compound that is responsible for inhibiting carbohydrate-hydrolysing enzyme activities. Further application, such as developing food formulations from C. maxima will benefit diabetic populations.

Paddy cultivation during early Holocene: evidence from diatoms in Lahuradewa lake sediments, Ganga Plain

B. Thakur, A. Saxena and I. B. Singh

Keywords: Agriculture, diatoms, Holocene, Lahuradewa lake, paddy field.

Abstract

Lahuradewa lake deposits, adjacent to the Lahuradewa archaeological site were rich in diatoms, going back to about 10 kyrs. The diatoms are grouped into four categories, namely, planktic, benthic, paddy field and anthropogenic-influenced. The variation in planktic and benthic forms reflects changes in the water budget of the lake in response to the change in rainfall, viz. more planktic in humid phases and less planktic in dry phases. These changes correspond to the changes identified by other proxies, namely phytolith. Paddy field diatoms are present in good numbers since about 8 ka along with anthropogenic diatoms; their numbers increase during dry phases and decrease in humid phases. This supports the contention that humans were living in this area since early Holocene and agriculture activity started around 8 ka. Presence of paddy field diatoms in lake sediments is rather unique. It is

argued that the lake margin was used for paddy cultivation. Intermittently, sediment and organic remains namely paddy field diatoms, rice phytoliths and grass microcharcoal were washed from lake margin agricultural fields into deeper parts of the lake to be preserved in lake sediments.

Chitosan nanoparticles as a carrier for *Mentha longifolia* extract: synthesis, characterization and antifungal activity

Abeer Ramadan Mohamed Abd El-Aziz, Monira Rashed Al-Othman, Mohamed Abobakr Mahmoud, Shereen Mohamed Shehata and Nahla Shazli Abdelazim

Keywords: Antifungal activity, characterization, chitosan nanoparticles, *Mentha longifolia*, synthesis.

Abstract

A recent study was aimed at determining the antifungal activity of chitosan in both its natural and nanoparticle forms. The present study reports on the preparation and characterization of chitosan nanoparticles and chitosan nanoparticle-incorporated *Mentha longifolia*. The size of the chitosan nanoparticles was 157 nm, and the mint extraction nanoparticles at concentrations of 5%, 10% and 20% were 142, 105 and 63 nm respectively. The surfaces of the chitosan nanoparticles had a positive charge of approximately 33.2 mV, and the mint extract chitosan nanoparticles at 5%, 10% and 20% had charges of approximately 37.5, 36.9 and 36.1 mV respectively. The chitosan nanoparticles had a maximum encapsulation efficiency of 92% at a mint extract concentration of 20%. Mint extract incorporation into chitosan nanoparticles resulted in increased antifungal effects against mycelium growth of *A. niger*.

‘Prosopis for prosperity’: using an invasive non-native shrub to benefit rural livelihoods in India

Debbie Bartlett, Sarah Milliken and Dayesh Parmar

Keywords: Biochar, living fence, *Prosopis juliflora*, rural livelihoods.

Abstract

Prosopis juliflora is an invasive non-native shrub species which has an adverse impact on natural habitats in many parts of India, with detrimental effects on both wildlife and traditional livestock-based economies. Attempts to eradicate this very adaptable and resilient species tend to be unsuccessful and expensive. Here we report on two management techniques that could be used not only to minimize its ecological impact, but also to acknowledge its value as a resource to support rural livelihoods: biochar production and the creation of stock-proof living fences.

Conservation prospects of the Kashmir Red Deer (*Cervus hanglu hanglu*) beyond Dachigam National Park, in Jammu and Kashmir, India

Rahul Kaul, Mayukh Chatterjee, Tapajit Bhattacharya, Smita Bodhankar, Riyaz Ahmad, Mansoor Nabi Sofi and Samina Amin Charoo

Keywords: Corridor, habitat suitability, Hangul, Kashmir stag, red deer.

Abstract

India's only extant red deer species, the Kashmir red deer, or hangul (*Cervus hanglu hanglu*) is restricted today to the confines of the 141 sq. km Dachigam National Park (NP) in Jammu and Kashmir, with about 200 surviving individuals. A continual population decline of hangul has necessitated the identification of relict populations and suitable habitats outside Dachigam NP, so that a meta-population approach to its conservation may be employed. Extensive surveys in 2008–2012 across the Kashmir valley, helped identify three distinct areas, where the presence of the red deer was confirmed year-round. Ecological Niche Factor Analysis results indicated that hangul exhibits high global marginality (1.24) and low global tolerance (0.28). Habitat suitability modelling predicted

610.75 sq. km area of conifer and temperate broadleaved forests as highly (61–100%) suitable and 980.25 sq. km as moderately (31–60%) suitable, primarily in two distinct areas of Wanghat Naranag and Chandaji, which also showed presence of the hangul year-round. This suggests that apart from Dachigam NP, suitable habitats bearing hangul populations still exist in Kashmir valley (935.46 sq. km), emphasizing the need to urgently direct protection and conservation focus to these areas to conserve hangul successfully in this landscape.

Public accounting reporting, under an achievable metamorphosis?

Cristina Silvia Nistor and Cristina Alexandrina Stefanescu

Keywords: European Public Sector Accounting Standards, European System of National Accounts, European Union, International Public Sector Accounting Standards

Abstract

This study aims to provide a holistic approach of the European Union (EU) fiscal and financial reporting systems by assessing them through European System of National Accounts (ESA 2010) and International Public Sector Accounting Standards (IPSAS) reference, both having the accrual basis as benchmark of governmental accounting. The empirical research performed by combining the cluster analysis with the multidimensional scaling technique enables us to map all EU member states and emphasize potential connections between their fiscal and financial systems, thus providing a visual image of the two facets of public accounting. The results reveal a wide and strong interest in sound reporting able to improve transparency through performance management systems. These support European Public Sector Accounting Standards project aimed to adjust inaccuracies between IPSAS and ESA 2010 and finally to enhance good governance and create a positive environment by facilitating transparency and comparability.

Effect of primary tillage implements on physical properties of harvested Spunta potato tubers

Saad A. Al-Hamed, Mohamed F. Wahby, Abdulwahed M. Aboukarima, Khaled A. Ahmed and Mohamed S. El Marazky

Keywords: Physical properties, potatoes, tillage.

Abstract

We study the effect of implements on the physical properties of the produced potato tubers. These potatoes were classified as grade A. There was a significant difference in tuber shape index among the tillage implements. The results showed that the tuber weight of fresh potatoes was 179.28–201.64 g, and the bulk density was 1.066–1.068 g/cm³. There were no significant differences among the physical properties. Thus, it is appropriate for a farm to select any of the studied tillage implements that are available.

Tracking the disparities in Gujarat dairy development – an application of biplot analysis

Darshnaben P. Mahida, R. Sendhil, Smita Sirohi, B. S. Chande, K. Ponnusamy and Gopal Sankhala

Keywords: Biplot, Eigen value, Gujarat dairy development, PCA, regional disparity.

Abstract

Gujarat, despite being a highly progressive state of India in terms of dairying, has great potential to enhance its milk production and make dairying a more lucrative enterprise. It is home to many high quality dairy animal breeds and has a very active milk cooperative structure which can accelerate the possibilities of uplifting the level of milk production further, if proper and balanced micro level development policies are promoted. The present study depicts the causes for disparities besides analysing the strengths and weaknesses in dairying across 26 districts in Gujarat. To identify and capture the variation in resource use which causes disparities in dairy development, the principal

component analysis-based biplot technique was employed. Data on different variables like resource availability, infrastructure and veterinary facilities, and, milking animals and their yields have been sourced from 26 districts of Gujarat for tracing the disparity. The conclusions drawn from the biplot imply that promoting the quality of animal breeds and increasing the population of high yielding cattle breeds in low-developed districts can lead to high milk production. In the setting of increased milk production, the cooperative milk marketing structure will become more dynamic and result in enhanced income for dairy producers.

Does *Pestalotiopsis royenae* cause leaf streak of large cardamom?

R. Gopi, H. Kalita, R. K. Avasthe, Ashish Yadav, M. Singh and D. Thapa

Keywords: *Helopeltis theivora*, large cardamom, leaf streak, *Pestalotiopsis royenae*.

Abstract

Leaf streak caused by *Pestalotiopsis royenae* (Guba) Steyaert has been reported as a new disease of large cardamom (*Amomum subulatum*). It is characterized by rectangular spots running parallel to the veins. *P. royenae* was isolated onto potato dextrose agar from the infected portion of the plant. In the pathogenicity test, disease symptoms were not present on inoculated plant and on detached leaf in vitro after 20 days. During 2014–2016, a survey in various large cardamom plantations of Sikkim revealed the presence of tea mosquito bugs on the infected parts of *A. subulatum*. The spots did not show any growth. Different sized spots have been noticed on the infected leaf produced by different instars. At the initial stage, these symptoms appear on the young and tender leaves of large cardamom. Tea mosquito bugs were collected from the infested leaves and allowed to feed under controlled conditions, which produced similar type of leaf streak symptoms in large cardamom and also in other non-host crops like maize and turmeric. The results reveal that the cause of leaf streak is due to feeding injury of tea mosquito bugs and rule out *P. royenae* as a pathogen causing leaf streak disease symptoms. *Pestalotiopsis* sp. was also isolated as endophyte from large cardamom.

Processes controlling enrichment of transition elements in the surficial sediments of the western Bay of Bengal

C. Prakash Babu and V. Ramaswamy

Keywords: Diagenesis, Fe–Mn micronodules, oxygen minimum zone, sedimentation, transition elements.

Abstract

The processes leading to surficial enrichment of transition elements have been studied in continental slope and deep-sea sediments from the western Bay of Bengal (~500–4500 m water depth). The lower continental slope and rise (1800–3000 m) sediments are characterized by enrichment of Mn/Al ratios by 2–3 orders of magnitude and transition elements (Fe, Ni, Co, Cr and V) by a factor of 2–3 compared to the upper continental slope (500–1100 m) sediments. The occurrence of micronodules rich in Fe and Mn and elements associated with Mn-oxides, confirmed by scanning electron microscope and electron probe micro analysis, are responsible for the accumulation of transition elements in the lower continental slope sediments. The freshwater stratification, low carbonate productivity, fine grain size, low porosity, thin oxidized surficial layer and high sedimentation are conducive for diagenetic enrichment of Fe, Mn and elements associated with Mn-oxides in the lower slope sediments. The middepth oxygen minimum zone, resuspension and absence of oxidized surface layer enhance metal release to water column in the upper slope sediments. The oceanographic settings and high sedimentation rates control metal cycling in the Bay of Bengal sediments.

Estimation of rock load in development workings of underground coal mines – a modified RMR approach

Avinash Paul, Vemavarapu Mallika Sita Ramachandra Murthy, Amar Prakash and Ajoy Kumar Singh

Keywords: CMRI-ISM RMR, RMRdyn, P-wave velocity, rock load, support design.

Abstract

Underground coal mining in India contributes to a share of 55 Mt production with more than 500 mines in operation. In spite of using the well-established CMRI-ISM Rock Mass Rating (RMRdyn) classification system for roof support design successfully in Indian geo-mining conditions, accidents due to roof fall constitute the major challenge. These failures are generally due to the presence of weak beddings and laminations. Seismic refraction technique (for shallow depth) can be useful in detecting the rock mass conditions. Based on the study a modified rock mass classification system (RMRdyn) was setup by incorporating field P-wave velocity with a view to arrive at a real ground condition of the in situ rock. Rock loads were also determined in the field to develop a relation with RMRdyn. A comparison of rock load estimation by CMRI-ISM RMR, numerical simulation and RMRdyn clearly depicts that the latter approach is more reliable as the results are close to the actual scenario.

Electrical conductance map for Saurashtra region, Gujarat, India

P. V. Vijaya Kumar, P. B. V. Subba Rao, A. K. Singh and C. K. Rao

Keywords: Carbon films, induction arrows, thermal activity, thin sheet modelling.

Abstract

In the present study, we have deployed 35 fluxgate magnetometers and 20 long-period magnetotelluric sites to derive the electrical conductivity distribution of Saurashtra region, Gujarat, India. Geomagnetic field variations (X-north–south, Y-east–west and Zvertically downward components) recorded at the above sites are investigated to obtain single-station vertical field transfer functions. Maps of induction arrows suggest that the offshore basins are more conducting than inland basins of the region. Thin sheet modelling of the induction features suggests that the anomalous behaviour is strongly influenced by the offshore and shelf edge sedimentary basins that contain thick depo centres of Mesozoic sediments. Jamnagar, Ulva and Mesozoic sedimentary basins on land are also reflected as high conductivity anomalies that could be related to the presence of carbonate/shale sediments. Release of carbon (in the form of thin films) due to thermal activity of Reunion hotspot on carbonate rich sediments may give rise to high conductivity anomalies.

Response of fish communities to abiotic factors in Western Ramganga, Kumaun Lesser Himalaya, India

Shahnawaz Ali, N. N. Pandey, Prem Kumar, Ravindar Posti and A. K. Singh

Keywords: Abiotic factors, assemblage structure, fish communities, multivariate analysis, riverine ecosystem.

Abstract

Abiotic factors in the riverine ecosystem are important in structuring fish communities along the longitudinal gradients. Quantitative data on species abundance were collected during October 2015–September 2016 in the mountain stretch of the River Western Ramganga from Kumaun Lesser Himalayas, India. Multivariate analyses were done to study the relationship between fish assemblages and abiotic parameters. Cluster analysis and non-metric multidimensional scaling indicated two distinct groups in the upstream and downstream zones. The composition of fish assemblages in different zones was found to be strongly associated with habitat characteristics. Canonical correspondence analysis revealed species abundance association with temperature, conductivity, stream width and altitude. Further analysis showed conductivity–altitude combination as the primary

factor determining the longitudinal distribution of species composition in the studied stretch of this river. The present study aids in understanding the factors that determine the spatial segregation of species for the restoration, conservation and management of aquatic resources.

Can a common and abundant plant-visiting ant species serve as a model for nine sympatric ant-mimicking arthropod species?

Sudha Kumari and Neelkamal Rastogi

Keywords: Batesian mimicry, *Camponotus compressus*, herbivorous myrmecomorphs, *Myrmarachne* spp.

Abstract

Many arthropods mimic ants to avoid predation risk from visual predators. Our study of ant-mimicking arthropod diversity revealed 10 sympatric myrmecomorphs including spiders, mantids, bugs and grasshoppers. All, except one, were found predominantly on extrafloral nectary-bearing and homopteran harbouring plants. Of the five plant-visiting ant species, *Camponotus compressus*, *Camponotus paria*, *Camponotus sericeus*, *Crematogaster subnuda* and *Tapinoma melanocephalum*, only *C. compressus* showed significantly high occurrence and abundance on these plants. Except for a small spider morph, the remaining nine myrmecomorphic species resembled *C. compressus* and apparently use this common and abundant ant species as their model.

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Bibliometrics of social science and humanities research in India

Manorama Tripathi, Sunil Kumar and Parveen Babbar

Keywords: Authorship, bibliometrics, citations, social sciences and humanities

Abstract

The present study is an attempt to highlight the research output generated in India in the field of social sciences and humanities (SSH) during the period 2005–2014. This study is based on secondary data, extracted from the Social Science Citation Index (SSCI) and Arts & Humanities Citation Index (A&HCI), which are integral components of the Web of Science. Descriptive and inferential statistical techniques were applied in the study. There were 9525 articles by Indian scholars in SSH during 2005–2014; they preferred to publish in Indian journals. The research contributions were in the form of research articles and book reviews with a consistent drop in the number of book reviews with time. Co-authorship was the norm in SSH disciplines with a steady increase in the number of multi-author papers in recent years. The study shows that multi-authored research papers received more citations than single-authored papers.

Trends in metabolomics research: a scientometric analysis (1992–2017)

Shanshan Guo, Jingchen Tian, Bin Zhu, Shu Yang, Kefu Yu and Zhigang Zhao

Keywords: CiteSpace, metabolomics, scientometrics, visualization analysis.

Abstract

The aim of this study is to identify thematic trends, landmark articles, influential scientists and journals of metabolomics by exploring the scientific outputs in this field. This work was based on 66,721 bibliographic records retrieved from the Web of Science Core Collection database during 1992–2017. The results show that the USA was the leading country, and the Chinese Academy of Sciences had the largest number of publications. The Proceedings of the National Academy of Sciences of the United States of America was the most influential journal, meanwhile PLOS ONE had the most number of publications. Nicholson was identified as the most prominent scientist with the

most number of articles and the highest co-citation counts. Metabolic syndromes and related diseases, disease biomarkers, novel pathways, as well as system biology association studies in metabolomics research, might be closely observed in the coming years.

Thermosensitive hydrogels: from bench to market

Nida Nadeem, Muhammad Sohail, Muhammad Hassham Hassan Bin Asad, Muhammad Usman Minhas, Mudassir and Syed Ahmed Shah

Keywords: Biomedical science, biocompatibility and biodegradability, synthetic polymers, thermosensitive hydrogels.

Abstract

Temperature-sensitive hydrogels belong to the class of ‘smart hydrogels’. These hydrogels when introduced to an environment of desired temperature have the property to release the drug incorporated in them in a controlled and predictable manner. Hence, they can be used not only as a dosage form but also as a drug delivery system. Thermosensitive hydrogels due to their unique properties have wide applications in the field of biomedical science. This review summarizes various thermosensitive hydrogels that are being used, including natural as well as synthetic polymers-based hydrogels. It is important that the hydrogels have good biocompatibility and biodegradability, as well as their degradation products must be non-toxic and easily excreted out from the body. The technology of nanogels is under development that will help the hydrogels reach areas of the body otherwise difficult to reach. In essence, development of safe and efficient thermosensitive hydrogels that can be marketed and used for various ailments is the key area of research nowadays.

Impact of Wi-Fi interference on NavIC signal

Darshna D. Jagiwala and Shweta N. Shah

Keywords: Power spectral density, radio frequency interference, satellite navigation system, Wi-Fi signals.

Abstract

The Navigation with Indian Constellation (NavIC) designed by the Indian Space Research Organisation (ISRO) is an autonomous regional satellite navigation system for providing accurate real-time positioning and timing services to India up to 1500 km from its boundary. The NavIC system exploits L5- and S-band for its navigation. The performance of these bands may be interfered by other bands or out-of-band communication systems, which can be the main threat to the performance of the NavIC receiver. This article focuses on real-time out-of-band interference of Wi-Fi signals in the S-band of the NavIC receiver. The performance analysis is carried out with respect to power spectral density, histograms, execution of acquisition stage and parameters of hypothesis testing method like P-value, confidence interval to identify the presence of interference on the NavIC receiver. All these results show that the Wi-Fi signal transmission represents a potential source of interference for NavIC applications and causes severe degradation on NavIC satellite signals.

Data mining techniques for predicting dengue outbreak in geospatial domain using weather parameters for New Delhi, India Nikita Agarwal, Shiva Reddy Koti, Sameer Saran and A. Senthil Kumar

Keywords: Dengue, multi-regression, Naïve Bayes, spherical k-means, weather parameters.

Abstract

Dengue is a hazardous disease which poses a critical threat to the population of Delhi, India. These cases are steadily reported during and post-monsoon season indicating its correlation with weather parameters. Establishing this relation will help understand the spread of dengue and will allow

decision makers take precautionary steps beforehand. Our study explains the adopted multi-regression and Naïve Bayes approach to model the relation between dengue cases and weather parameters, i.e. maximum temperature, rainfall and relative humidity. Both these models have served a great deal in modelling this relationship which has enabled us to forecast a probable dengue outbreak. Our results have shown that sudden and high rainfall accompanied with 30–35°C temperature and high relative humidity contributes to a highly vulnerable weather for the spread of dengue. Also, we have proposed a new application of spherical k-means clustering algorithm to identify zones with similar transmission pattern which gives insight into the distribution of dengue incidences in Delhi. Results show that Central, Civil Lines, Rohini, South and West zones have the highest odds of dengue occurrences.

Influence of absorptive reservoir bottom on the performance of dam–reservoir–foundation coupled system

Kalyan Kumar Mandal and Damodar Maity

Keywords: Absorptive reservoir bottom, added response, coupled systems, free field response, reflection coefficient.

Abstract

In this article we present the performance of concrete gravity with absorptive reservoir bottom and soil– structure–fluid interaction. A two-dimensional direct coupling methodology is presented to evaluate the performances of dam–reservoir–foundation coupled system. A reflection coefficient is introduced to simulate the reservoir bottom absorption. The fundamental frequency of reservoir has a decreasing trend with increase of reflection coefficient and the responses of individual sub-systems with different reservoir bottom depend on exciting frequency. However, this effect decreases continuously with fluid–structure and soil– structure–fluid interaction.

A survey-based structural equation model analysis on influencing factors of non-citation Zewen Hu, Yishan Wu and Jianjun Sun

Keywords: Determinants, impact factor, influencing factors, non-citation, questionnaire, structural equation model, uncitedness.

Abstract

Although bibliometric approach has been frequently utilized to analyse reasons behind non-citation and show relations between uncitedness and impact factors, the survey-based structural equation model approach is not usually used. Therefore, a Likert scale questionnaire was designed to collect data on noncitation and its various types of determinants. The survey-based structural equation model was used to analyse mutual relations and correlation degrees between non-citation rate and its various determinants. As a result, the categories ‘academic status of journal’ and ‘personal features of papers’ were found to be two extremely significant determinants of non-citation rate. Their path coefficients reached 0.83 and 0.43 respectively. Accordingly, the category ‘contents and topics of papers’ was shown to have extremely significant indirect influence on non-citation rate through ‘academic status of journal’. The three observed variables of ‘academic status of journal’ including ‘public praise of journal’, ‘impact factor of journal’, and ‘member of SCI, EI and Scopus Journals’, showed the highest values of indirect effect on the non-citation rate. Furthermore, there were weaker correlations among ‘academic status of journal’, ‘personal features of papers’, ‘contents and topics of papers’ and ‘publicity and recommendation’ except between ‘contents and topics of papers’ and ‘academic status of journal’. Meanwhile, the six observed variables of ‘publicity and recommendation’ and ‘contents and topics of papers’ show the smaller values at ≤ 0.12 of indirect effect on non-citation rate. Our empirical results suggest some significant determinants of non-citation rate that might enlighten

researchers on how to improve the chance of having their works cited, and assist them in expanding their research impact. These findings can also help journal editors to identify contributions with high-citation potential.

Flowering and fruiting phenology of woody trees in the tropical-seasonal rainforest, Southwestern China

D. Mohandass, Mason J. Campbe, Xin-Sheng Chen and Qing-Jun Li

Keywords: Biotic factors, climatic variables, plant phenology, seasonal patterns, south China.

Abstract

The reproductive phenology of tropical plants is potentially driven by a number of abiotic and biotic factors. However, it is still unclear as to which climatic factors and biotic interactions drive the reproductive phenology of woody trees in the tropical seasonal rainforest of Xishuangbanna region in Southwest China. We conducted observations on woody plants (including trees and shrubs) phenology between November 2004 and October 2007 at biweekly intervals in the one hectare permanent plot of tropical seasonal rainforest in Southwest China. A total of 357 individuals of 76 species (70 genera, 37 families), comprising of 59 (78%) woody trees and 17 (22%) shrub species were observed. Our results demonstrate that flowering and fruiting frequencies show slight temporal variation between years. Flowering was significantly correlated with day-length, temperature and rainfall and fruiting was significantly correlated with rainfall and temperature. This finding indicates that woody tree reproductive phenology was primarily associated with temperature and rainfall and to a lesser extent with day-length. Reproductive phenology is also linked to seasonal patterns with flowering peaking in the late dry season and fruiting peaking in the late wet season. Moreover, reproductive phenology is also significantly associated with reproductive ecological guilds such as pollination types and dispersal modes. Community reproductive phenology is associated with climatic seasonality and biotic interactions. It also suggests that seasonal phenology patterns may play a fundamental role in community reproductive success in the tropical seasonal rainforest of Xishuangbanna region of Southwest China.

Patterns in distribution, population density and uses of medicinal plants along the altitudinal gradient in Dhauladhar mountain range of Indian Himalayas

Natasha Sharma and Chandra Prakash Kala

Keywords: Altitude, Dhauladhar mountain, Indian Himalayas, medicinal plants, population density, regeneration.

Abstract

We studied the patterns in distribution, population density and uses of medicinal plant species in Dhauladhar mountain range of Himachal Pradesh in Indian Himalayas. The study area was stratified into three zones on the basis of forest types and altitudes. In each zone, quadrats were laid down for sampling of plant species, and the local people were interviewed for gathering information on medicinal uses of plants. A total of 184 plant species were encountered in the sampling plots, of which 86% had medicinal uses. Among woody plant species, the use of bark was highest, whereas in herbaceous species the use of leaf and root was highest for treatment of over 32 groups of diseases. In terms of density, *Pinus roxburghii* was the most dominant tree species in subtropical forests, which declined in temperate regions and was absent in subalpine forests. *Rhododendron arboreum* was the most dominant tree species in temperate region whereas in subalpine forests it was replaced by *Abies pindrow*, in terms of density. *Berberis asiatica* and *Vitex negundo* were the most dominant shrubs in subtropical forests besides *Lantana camera*, whereas *Berberis lycium* dominated the temperate and *Juniperus indica* dominated the subalpine forests. The heavy infestation of *Lantana camera* in sub-

tropical forests has degraded the habitats of native medicinal plant species. Spearman's correlation indicates positive correlation between local uses and density of respective medicinal plant species ($P < 0.05$). The results are further discussed in light of medicinal plants conservation in this part of the Indian Himalayas.

Crystallization evolution of accessory minerals in palaeoproterozoic granites of Bastar Craton, India

Dinesh Pandit

Keywords: Accessory minerals, Bastar Craton, Dongargarh, granite, Malanjkhand.

Abstract

The Malanjkhand and Dongargarh granitoids are compared to study the role of accessory minerals (apatite, zircon, titanite and titanomagnetite) to understand crystallization evolution of Palaeoproterozoic granitic magmatism in the Bastar Craton, central India. Two varieties of titanite (magmatic and hydrothermal types) are observed in the Palaeoproterozoic granitoids. Occurrence of zircon, apatite, titanite and titanomagnetite as accessory phases in the Palaeoproterozoic granitoids indicates that the early stage of crystallization of granitic magma was saturated with Zr, P and Ti. Petrography and mineral equilibria reaction suggest that magmatic titanite in the Palaeoproterozoic granitoids was formed due to hydration of amphiboles and biotites which favours high f_{O_2} and f_{H_2O} conditions. Apatite composition suggests that it was formed in the granitic magma at nearliquidus to near-solidus temperature (900–1000°C) which increased fugacity ratio $\log(f_{H_2O}/f_{HF})$ and also controlled the halogen budget during magma crystallization. Relatively high halogen content in the apatites from the Malanjkhand Granitoid (MG) indicates that the parental magma was enriched in F and Cl compared to Dongargarh Granitoids (DG), implying a dominant role of halogens in metal transportation and hydrothermal mineralization. In MG, apatite was the earliest phase to be crystallized in granitic magma followed by zircon and titanite whereas, in DG, crystallization of zircon was followed by apatite and titanite. Two contemporaneous plutons, DG and MG, represent a unique Palaeoproterozoic granitic magmatism wherein early progressive crystallization is dominated by accessory mineral saturation in a relatively static environment with constant magma composition

Comparing the imitating capabilities of parrots and crows with human beings using COMSOL Multiphysics

Randhir Singh, Ajay Kumar and Parveen Kumar Lehana

Keywords: Birds calls, cardinal vowels, imitation, speech production.

Abstract

Speech signal is a natural means of communication. It uses small units of sound to convey feelings and messages. Birds also use sound signals to express their emotions. Some birds, like parrots and crows, are capable of imitating the speech of other animals. The aim of this study is to compare the imitating capabilities of these birds with those of human beings. The software COMSOL Multiphysics has been used for investigating the effect of dimensional modifications of the vocal tract on the system output. The analysis of the results shows that the acoustic spaces used by human beings, parrots and crows are not overlapping, but similar in shape. Further, maximum formant scattering is observed in human beings and minimum for parrots. The results may be important for understanding the vocal tract modulation, for example, to generate artificial food calls to assemble the birds for feeding medicines to avoid spread of diseases, specifically by parrots and crows as they try to settle down near human civilizations.

Accounting for secondary inner filter effect in fluorescence spectra from solid samples

Tuhin Khan, Kalyani Bhagabani, Preeti Kumari and Anindya Datta

Keywords: Aggregation-induced emission, inner filter effect, fluorescence spectroscopy, solid-state emitters.

Abstract

Fluorescence experiments at high fluorophore concentrations or in solid state have biological relevance and application potential in devices. Inner filter effect, arising from reabsorption of emitted photons, is the simplest of several factors that complicate the emission in these systems. This effect is prominent, especially for systems with small Stokes shift between absorption and emission. Solid state 'dilution' of a fluorophore with an optically transparent, noninterfering substance can significantly minimize this effect. This has been shown in the present study, using salophen as a fluorophore and NaCl as the dilutant. The general applicability of this method is tested with three more fluorophores.

Asp72 of pro-peptide is an important pH sensor in the zymogen activation process of papain: a structural and mechanistic insight

Sumana Roy and Sampa Biswas

Keywords: Cysteine protease, pH regulation, protein engineering, pro-peptide, X-ray crystallography.

Abstract

The zymogen of papain contains a pro-peptide at the N-terminus of the catalytic domain. Pro-peptide contains residues which act as pH-sensors in zymogen activation cascade. To understand the influence of pro-peptide in the pH-induced zymogen activation process of the protease, we performed structural studies of the zymogen of papain at activation pH of 4.0. The X-ray structure of zymogen at acidic pH reveals that Asp72 of the pro-peptide, a highly conserved residue of the GXNFXD motif, plays an important role in pH-induced conformational changes in the prodomain leading to the zymogen activation process. Far-UV circular dichroism spectrum of zymogen at pH 4.0 demonstrates loss of helical structure compared to that at pH 8.0. The structural observation is further corroborated by mutational studies, where D72A mutant is shown to undergo auto-activation at pH 5.0 compared to pH 4.0 for wild-type, though the general proteolytic activity of the D72A mutant remains similar to that of wild-type. Our findings indicate that the conserved Asp72 residue is an important pH sensor in the zymogen activation process and that the pro-peptide part can also be a useful target of protein engineering for altering the activation pH of a protease.

Capabilities of satellite-derived datasets to detect consecutive Indian monsoon droughts of 2014 and 2015

Satya Prakash

Keywords: Drought, multi-satellite product, non-parametric multivariate drought index, Southwest monsoon

Abstract

India received anomalously deficit southwest monsoon rainfall during 2014 and 2015, which resulted in consecutive droughts across the country. Reliable detection and monitoring of droughts are crucial for the reduction in drought vulnerability and associated socio-economic impacts. In this study, the potential of multiple high-resolution satellite datasets is examined using distinct drought indices over India for these two successive monsoon seasons. The satellite-derived precipitation, soil moisture and land surface temperature estimates are capable of depicting the anomalous drought conditions with some exceptions. A nonparametric multivariate standardized drought index, based on precipitation and soil moisture estimates is proven to be better in the detection of droughts when compared to

conventional standardized drought indices. Overall, remote sensing satellite datasets provide immense opportunity to detect and monitor different kinds of droughts using a composite of indices. However, limited temporal records of these high-resolution satellite datasets restrain their applicability from the climatological perspective.

Use of molecular-based approach in resolving subspecies ambiguity of the rescued tiger cubs from Arunachal Pradesh, India and their relationship with other population

Puneet Pandey, Deepa Goel, Randeep Singh, Sujeet Kumar Singh and Surendra Prakash Goyal

Keywords: Bengal tiger, DNA sequencing, single nucleotide polymorphism, subspecies.

Abstract

Genetic approach is often suggested for resolving taxonomic ambiguities in areas where there have been overlaps in distribution of a species or subspecies. The Northeast part of India is one of the identified biodiversity hotspots, having the junction of Palearctic and Indomalayan realms with dense canopy forests and rugged terrains. The distribution range of two tiger subspecies, i.e. Bengal tiger and northern IndoChinese tiger, overlaps with each other in this region. The government authorities rescued three tiger cubs from Angrim Valley Village, Arunachal Pradesh, Northeast India in November 2012. We carried out a comprehensive genetic study on the rescued cubs to elucidate their subspecies status and determine their relationship with the remnant tiger populations. Our findings based on 3661 base pair of mitochondrial DNA sequence spanning across six mitochondrial genes (ND1, ND2, ND5, ND6, 12S rRNA and CytB) and non-coding control region (CR) suggest the Bengal tiger ancestry of the rescued tiger cubs. Further, comparison of mitochondrial haplotype with other Bengal tiger populations reveals that the haplotype reported for the rescued cub is novel and has close affinity to the northeast tiger populations of India. However, detailed population assignment to infer the source of origin was not possible due to lack of genetic data for all Bengal tiger populations. The present study attempts an assessment of tiger status that has resulted in identification of another tiger occupied landscape in India (Dibang Tiger Reserve).

Analysing the black polished pottery of proto-historic-early historic India

Vibha Tripathi and Parul Singh

Keywords: Black slipped ware, energy-dispersive X-ray spectroscopy, firing technique, proto-historic, scanning electron microscopic study.

Abstract

The development of ceramic technology in India can be traced back to a hoary past. Highly sophisticated potteries like black slipped ware (BSW), black-andred ware (BRW), painted grey ware, grey ware and northern black polished ware (NBPW) were present in proto-historic and early historic times (circa 2000–300 BCE). The present communication aims to throw light on the technology of one of the important wares, viz. BSW especially from sites located in the Vindhya– Ganga region. Through analytical examination of the ware, the authors propose to fill in a lacuna in the field of ancient ceramics.

Impact of transport sustainability on air quality in Lahore, Pakistan Rizwan Haider, Abdullah

Yasar and Amtul Bari Tabinda

Keywords: Air quality, emission factor, fuel quality, public transport, transport sustainability.

Abstract

Transport sustainability has direct association with improvement of urban emissions levels. Different sustainable steps like promotion of public transport, walking or the use of bicycles, reduction in the number of personal cars and improvement in speed (up to 50 km/h), fuel and model of vehicles can

decrease emissions levels in the cities. In this study, emission factors of seven different vehicles have been calculated using the OSPM software. An estimated decrease of 7% in NO_x emission, 33% in CO emission and 25.8% in benzene emission has been observed with 10% reduction in the number of cars and 10 km/h gain in speed (from 40 to 50 km/h). It has also been observed that 2005 model buses using 1999 level fuel emit 1.3 times less benzene, NO_x and CO emissions compared to 2000 model buses using the quality of fuel, which was available in 1990 in Europe.

Volume holographic gratings in acrylamidebased photopolymer to provide selective light as an added input for improving the performance of dye-sensitized solar cells

A. B. Sreebha, S. Suresh, C. O. Sreekala and V. P. Mahadevan Pillai

Keywords: Diffraction efficiency, dye sensitized solar cells, photopolymer, transmission holographic grating.

Abstract

A transmission holographic grating with good storage life and diffraction efficiency is fabricated in an indigenously prepared red-sensitive photopolymer. Stability retained by the photopolymer transmission holographic grating in its diffraction efficiency upon long-term exposure to temperature indicates the suitability of the fabricated photopolymer holograms in solar applications. Holographic elements diffract different wavelengths to different regions and dye sensitized solar cells (DSSCs) can absorb the desired range of wavelengths from the diffracted light. Hence, we exploit this property of the holographic grating to enrich the performance of DSSCs by enhancing its input and output power, particularly under low photometric conditions. Improvement in maximum power output of DSSCs is observed in all cases, with a maximum enhancement of about 100% for the lowest level of input intensity.

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Bibliometric and visual analysis of planthopper research between 1980 and 2017

Chaoxing Hu and Lingzhen Cao

Keywords: Bibliometric and visual analysis, planthoppers, rice viruses.

Abstract

Planthoppers are highly destructive pests of rice. We carried out a bibliometric analysis of planthopper research from 1980 to 2017, to retrospect planthopper research progress in recent decades. We found that China leads planthopper research, and that the possible research frontiers are rice resistance or defence to planthoppers, mechanisms controlling planthopper winged morphs, resistance mechanism of planthopper to insecticide imidacloprid, Southern rice black-streaked dwarf virus vectored by planthopper, and molecular and genetic methods in planthopper research (dsRNA, RNAi and genomics).

Lithium-ion battery supply chain: enabling national electric vehicle and renewables targets

Epica

Mandal Sarkar, Tanmay Sarkar and Mridula D. Bharadwaj

Keywords: Electric vehicle, grid, lithium-ion battery, supply chain

Abstract

Energy storage will play an important role in the Government of India's efforts to meet the ambitious targets with regards to electric mobility and renewable energy. Among the different types of storage technologies, lithium-ion battery (LIB) is considered to be the best suited for electric vehicles (EVs). LIBs can also address intermittency problems in renewable energy integration with the grid. It is

estimated that 13.8 GWh of battery capacity is required by 2020 for the EV sector and 15 GWh battery capacity is needed for grid storage requirements. Indigenization of LIB manufacturing can help to meet this large-scale demand. Moreover, indigenization has the potential to bring down the cost of a battery. One of the key components in manufacturing LIBs is lithium (as raw material), which needs to be imported as India does not have sufficient reserves. Therefore it is important to estimate the total amount of lithium required for fulfilling the domestic demand. To set-up indigenous manufacturing facilities, it is important to identify the key players in the global supply chain of the LIB industry and formulate policies that enable the success of this industry in India. This study presents a review of a complete supply chain related to manufacturing LIBs, along with policy instruments to support the domestic battery demand and supply ecosystem.

A versatile 205 MHz stratosphere–troposphere radar at Cochin – scientific applications

K. Mohanakumar, K. R. Santosh, P. Mohanan, K. Vasudevan, M. G. Manoj, Titu K. Samson, Ajil Kottayil, V. Rakesh, Rejoy Rebello and S. Abhilash

Keywords: Atmospheric waves, monsoon, ST radar, turbulence, VHF radar.

Abstract

A state-of-the-art, indigenously developed, and the world's first 205 MHz stratosphere–troposphere (ST) wind profiler radar installed at the Cochin University of Science and Technology, Kerala, with the support of Science Engineering Research Board, Department of Science and Technology, Government of India, is introduced in this article. This radar provides a cost-effective and high precision technology capable of monitoring in all weather conditions round the clock. Its primary goal is to understand the characteristics of the Indian summer monsoon at its gateway at Cochin. Brief technical details and the validation of radar data with the colocated GPS radiosonde observations are mentioned. Applications of the ST radar data for various studies of atmospheric, ionospheric and radio astronomical features are discussed. Cochin ST Radar is open to all researchers from national institutes, universities and other academic institutions for conducting regular as well as special experimental campaigns, based on their scientific proposals.

Groundwater dynamics in North Bihar plains

Rajiv Sinha, Surya Gupta and Santosh Nepal

Keywords: Groundwater level, groundwater storage, GIS, ordinary kriging, water table fluctuation method.

Abstract

The plains of north Bihar, drained by numerous rivers originating in the Himalayas also experience a reasonably high rainfall of ~1200 mm per year. Still, more than 80% of the irrigation demand in this region is met by groundwater resources. Also, the increasing population and industrialization are likely to lead to overexploitation of groundwater as in several other states of northwest India over the last 4–5 decades. This article aims to assess the groundwater dynamics in the plains of north Bihar using 30 years (1983– 2013) of groundwater level data to understand the spatial and temporal, pre- and post-monsoon characteristics using Geographical Information System (GIS) and ordinary kriging (interpolation technique) method. Groundwater storage change was estimated using the water table fluctuation method. Our analysis shows 2–3 m decline in groundwater level in several districts such as Begusarai, Bhagalpur, Samastipur, Katihar and Purnea in both pre- and post-monsoon periods in the last decade (2004–2013). Similar trends were observed in groundwater storage for Samastipur and Purnea districts; the maximum reductions in groundwater storage for the pre-monsoon period are computed as 636 MCM and 631 MCM respectively, and the values for the post-monsoon period are 289 MCM and 216 MCM respectively. Such large scale depletion in groundwater storage in such a

short time span is alarming. If this trend continues unabated, it may lead to serious scarcity of water resources in this region, negatively impacting agricultural productivity and food security.

Impact of local factors on decision making – a multi criteria modelling framework in wind energy investment

Rahi Jain¹, Riddhi Panse and Satanand Mishra

Keywords: Agricultural hierarchy process, renewable energy, wind portal, wind power plant.

Abstract

Wind power is an important renewable energy generation technology, but the location of wind potential and wind power plant installation are not in complete sync with each other. Many national, state and local variables other than wind potential play a role in site selection. The weights given to different local variables during wind power investment decisions are not known and are difficult to estimate in data paucity settings in India. Accordingly, this study proposes a framework to estimate the weights given to different local parameters in wind power investment decisions. We use the case study of select districts in Maharashtra, India to test the framework. The investment predictions based on priority of local factors estimated by the proposed approach are in agreement with the actual investment in the wind energy sector.

Navigational safety and traffic pattern analysis using AIS data on the western coast of India

Saurav Mandal, Vishwanath Nagarajan and Om Prakash Sha

Keywords: Automatic identification system, collision risk value, DCPA and TCPA, probit regression model.

Abstract

Ship-borne automatic identification system (AIS) is required to be installed onboard ships as per the regulations of International Maritime Organization. The AIS data for Indian coast for three months was analysed to determine marine traffic safety, navigation pattern, etc. The entire western Indian coast was divided into 22 legs. The analysis utilized probit regression model to calculate quantitative collision risk values for identifying the risky zones in Indian coast. The methodology uses an estimate of the distance of closest point of approach and time for closest point of approach between any set of vessels in a zone to find the collision risk index.

Effects of homegarden size on floristic composition and diversity along an altitudinal gradient in Central Himalaya, India

Vibhuti, Kiran Bargali and S. S. Bargali

Keywords: Altitudinal gradient, floristic composition, homegarden size, species diversity.

Abstract

In the present study, data were collected from 36 homegardens at four altitudes, viz. very low (up to 350 m), low (350–700 m), mid (700–1500 m) and high (above 2000 m). Homegardens were categorized into three sizes: large (>0.007 ha), medium (0.004– 0.006 ha) and small. A total of 111 plant species belonging to 55 families were recorded. Asteraceae, Fabaceae and Cucurbitaceae (seven species each) formed the most diverse family, and 34 families were mono-specific. Species richness was maximum (22) in medium homegarden at mid altitude and minimum (11) in small homegardens at high altitude. Herb density was maximum (84 individuals m²) at very low altitude and diversity was maximum (2.38) at mid altitude in large homegardens. Tree density was maximum (1200 individuals ha⁻¹) at mid altitude and diversity was maximum (2.42) at very low altitude in large homegardens. Total tree basal area was maximum (66.61 m² ha⁻¹) in small homegardens at very low altitude. Principal component analysis showed that the first component accounted for 54.53%

most reliable and high loadings of tree (0.959) and herb density (0.922) with positive effect. The second component (74.93%) showed high factor loading of concentration of dominance for herbs (0.729) with positive effect.

Studies of forest fire induced changes in atmosphere over Uttarakhand, India, using space based observations and model simulations

M. K. Madhav Haridas, P. V. N. Rao, K. Sreenivas Rao and Prijith Sudhakar

Keywords: Aerosol optical depth, forest fire, trace gas.

Abstract

The northern Indian state of Uttarakhand had witnessed an episode of intense forest fire during April–May 2016. The present study analyses the changes in trace gas and other atmospheric constituents induced by the forest fire using satellite data. The study reveals elevated levels of CO, NO₂, ozone and aerosol optical depth (AOD) over the affected region. Higher levels of CO are observed at altitudes of 2–3 km. The column amount of CO has almost doubled from mean background values, whereas NO₂ has increased by almost three times to values normally seen over highly polluted cities. Increase in ozone is only moderate and AOD has risen towards the end of the main phase of the fire episode. Weather research and forecasting simulations of wind and planetary boundary layer height are also performed and the results discussed. The study shows the potential of Earth-Observation Satellites to track and monitor such environmental impacts effectively.

Quality assurance of rituximab (anti-CD 20) antibodies by potency testing: determining the system suitability criteria and sample acceptance criteria

Subhash Chand, Birendra Kumar, Vivek Morris Prathap, Surinder Singh and Richi V. Mahajan

Keywords: Complement-dependent cytotoxicity, geometric coefficient of variation, quality assurance, rituximab.

Abstract

A validated and robust bioassay is of paramount importance in the various stages of biosimilar development to ensure efficacy, quality and potency. The complement-dependent cytotoxicity assay was validated over six simulated potencies and found specific for rituximab-like antibodies. The bioassay was found robust with linearity parameter $R^2 = 0.99$, %GCV for precision and accuracy was less than 20% for >40 individual performances. Detailed set of system suitability and sample acceptance criteria was determined. The study may play a key part in the development of written and physical potency reference standards for incorporation in different pharmacopeia for effective biosimilar development and regulation.

Improved square-Z-shaped DNG meta-atom for C- and X-band application

Md. Mehedi Hasan, Mohammad Rashed Iqbal Faruque and Mohammad Tariqul Islam

Keywords: Double negative meta-atoms, dual-band, effective medium ratio.

Abstract

An improved dual-band square-Z-shaped meta-atom is presented. It shows a bandwidth of 3.61 GHz, where the operating frequency ranges from 2.0 to 14.0 GHz. The meta-atom is split in such a way that it appears as a square-Z-shaped structure and is printed on an epoxy resin fibre substrate material. The dimensions of the single unit cell and array structure are respectively, $10 \times 10 \text{ mm}^2$ and $200 \times 150 \text{ mm}^2$. Also the unit cell and 1×2 , 2×2 and 4×4 arrays are studied for double negative characteristics. CST Microwave Studio 3D-electromagnetic simulator is used to design and perform investigation. The performance of a meta-atom unit cell is measured by wave guide ports. The measured and simulated results matched well and are applicable for C- and X-band applications.

Analytical estimation of water contents, specific heat capacity and thermal profiles associated with enzymatic model compound β -cyclodextrin

Gaurav R. Gupta, Pankaj D. Patil, Vasim R. Shaikh, Rahul R. Kolhapurkar, Dilip H. Dagade and Kesharsingh J. Patil

Keywords: Cyclodextrins, differential scanning calorimetry, specific heat capacity, thermo-gravimetric analysis.

Abstract

Studies of water contents of solid β -cyclodextrin (β -CD) in crystallized and vacuum dried conditions are reported. Water contents were estimated using Karl–Fischer (KF) titration and thermo-gravimetric analysis (TGA) techniques. It was found that the water contents for crystallized and vacuum-dried samples were 6.93 and 0.86 moles of water per β -CD molecule respectively. TGA studies gave values of 6.83 and 0.52 moles of water per β -CD molecule respectively. The results agree with those reported from X-ray diffraction studies. Also, the molecular weight of the vacuum dried sample was determined using vapour pressure osmometry, which agrees well with the actual molecular weight of β -CD. The thermal profiles of α -cyclodextrin (α -CD) and β -CD are presented. The differential scanning calorimetry data was used to calculate specific heat at constant pressure (C_p) at different temperatures (338.15–468.15 K). These results are compared with similar data for α -CD and discussed in terms of motional contribution to C_p values and related conformational effects.

Biochemical characteristics, fatty acid profiles and antioxidant activities of tea seed oil

Kritideepan Sarmah and Priyanka Das

Keywords: Bi-clonal seed, DPPH scavenging activity, saponification, tea, unsaturated fatty acids.

Abstract

India, the highest producer of the beverage tea (*Camellia* spp), is not yet self-sufficient on edible oil production. A large portion of oils from secondary sources remains unexploited, which also includes the potentiality of oil production originating from trees. The present study was undertaken to evaluate the possibility of tree-borne oilseeds like tea. The crude fat (oil) was extracted from the dried cotyledons of matured tea seeds of eight different bi-clonal tea seed stocks of Assam, which were commercially maintained for propagation purposes. The oil content ranged from 10.75% to 26.84%. Acid values, iodine values, saponification values and specific gravity of oil were found to be in the range 1.01–1.22 (mg KOH/g), 72.94–94.91 (gI₂/100g), 177.56–200.45 (mg KOH/g) and 0.82–0.88 g/cm³ respectively. The saturated and unsaturated fatty acids range in tea seed oil as determined by GC-MS was 2.21–20.3% and 79.97–97.79% respectively. The 50% 2,2-diphenyl-1-picrylhydrazyl (DPPH) scavenging activity (IC₅₀ values) of oils of different bi-clonal seed stocks ranged from 60.3 to 81.52 mg/ml. Identification of high level of oleic acid and linoleic acid in most of the tea seed stocks revealed better nutritional quality of tea seed oil. The present study indicates the future scope of tea seed oils as a commercial product in India.

Risk assessment of rail haulage accidents in inclined tunnels with Bayesian network and bow-tie model

Qingwei Xu and Kaili Xu

Keywords: Bayesian network, bow-tie model, rail haulage accidents, risk assessment.

Abstract

Rail haulage system is an important part in mine production as people and materials are mainly transported through rail haulage equipment. The purpose of this communication is to establish a composite risk analysis model of rail haulage accidents in inclined tunnels based on Bayesian network and bow-tie model, which can be used to predict the risk of rail haulage accidents in mines and adopt

relevant safety measures towards critical basic events. First, a simple case study of mapping fault tree into Bayesian network was introduced. Second, the risk level and critical basic events could be achieved according to forward analysis and backward analysis of Bayesian network with the help of GeNIe software. The obstacles on rails, unqualified rails and acceleration or deceleration were identified as the first category critical basic events of rail haulage accidents based on the above analysis. Third, acceleration or deceleration was chosen as the risk Bayesian node and a detailed analysis was made using bow-tie model. Twelve preventive safety measures were set on the left to prevent basic events and 10 mitigative safety measures were set on the right to mitigate accident consequences, the risk of rail haulage accidents in inclined tunnels can further be reduced by bow-tie analysis. Composite risk analysis model can be applied for similar risk analysis of rail haulage accidents.

Exclusion of putative CATSPER2 and STRC gene deletion and FOXI1 gene mutations in a unique cohort with sensorineural deafness and male infertility from south India

Justin Margret Jeffrey, Jayasankaran Chandru, Amritkumar Pavithra, Murugesan Kalaimathi, Nagarathinam Indhumathi, Pangadan Ashraf and C. R. Srikumari Srisailapathy

Keywords: Assortative mating, contiguous gene deletion, CATSPER2, STRC, p.I35S.

Abstract

Prelingual genetic deafness and male infertility can appear as isolated findings or as part of a syndrome. Deafness-Infertility Syndrome (DIS) was previously reported to be caused due to a rare contiguous gene deletion of CATSPER2 and STRC genes on chromosome 15q15.3. We tested this contiguous gene deletion in a unique cohort of 15 probands with deafness and male infertility, who were partners in assortative mating from south India. Screening for this alleged contiguous gene deletion did not test positive. Given high parental consanguinity, it is possible that infertility and deafness may not be part of a contiguous gene deletion, but two independent events. As a next option we screened another candidate gene FOXI1 (5q35.1), known to independently influence sperm maturation and also encode transcriptional factor of a deafness gene SLC26A4, to implicate for this DIS phenotype. However none of the probands had any pathogenic mutations in FOXI1 gene. Having excluded (i) DIS contiguous gene deletion and (ii) FOXI1 gene mutations' role in this phenotype, we conclude that this unique cohort's genetic etiology can be resolved using high-throughput NGS and CNV assessment. This approach may also identify potential linkage to any novel genes.

Molecular characterization of potassium solubilizing bacteria from crop rhizosphere of the North Eastern Region of India

Smrita Buragohain, Dhruva Jyoti Nath, Yumnam Bijilaxmi Devi, Badal Bhattacharyya and Samiron Dutta

Keywords: Crop rhizosphere, molecular characterization, mica, potassium solubilizing bacteria.

Abstract

In this study, isolation and characterization of potassium solubilizing bacteria (KSB) have been carried out which could solubilize a substantial amount of potassium (K) following incubation with mica. Five KSB, isolated from banana and chilli rhizosphere were identified by 16S rDNA sequence analysis. The identified bacteria were Klebsiella sp. and Bacillus cereus. The isolates had K solubilization potential within the range of 76.3–78.42% compared to control along with significant drop in pH (4.62–4.86). The study reveals the exploitation of Klebsiella sp. and B. cereus as potential K solubilizing biofertilizers.

Incessant erosion of high tidal mudflats in the northern Gulf of Khambhat

Hiren Bhatti, Ratheesh Ramakrishnan, A. K. Sharma and A. S. Rajawat

Keywords: DSAS, erosion, high tidal mudflat, satellite data, tidal channel.

Abstract

Extensive erosion of high tidal mudflat along the northern parts of Gulf of Khambhat (GoK) was observed from the analysis of time series satellite images during the time period from March 2014 to September 2017. Around 28.66 sq. km area of high tidal mudflat eroded within this time period. Maximum erosion rates estimated have even peaked to about 4 km/year showing the severity of erosion. The mudflats under erosion are along the outer boundary of a meandering tidal channel connecting the Gulf with Mahi river. A possible cause of the incessant erosion of mudflats is the strong tidal currents along the outer boundary of the meandering tidal channel, that have carved the mudflats and pushed the tidal channel further landward. A subtle seasonal pattern of erosion was observed with decrease in erosion rates during the summer monsoon period when the high tidal currents are weak due to the river influx. Rapid erosion of the tidal mudflats has not only destroyed the vital habitat, but has also eventually exposed the inhabited land area to tidal flooding, making it vulnerable to erosion. The study shows the importance of assessing the stability of mudflats along the GoK, where large development activities are proposed.

Effect of synthetic astaxanthin, Lucantin on colour and physical quality of Indian white prawn, Fenneropenaeus indicus

Sambhu Chithambaran and Nasser K. Ayaril

Keywords: Fenneropenaeus indicus, Lucantin, shrimp quality, supplementary feed.

Abstract

The effect of a synthetic source of astaxanthin, Lucantin on colour, loose shell/soft shell quality, taste and black spot formation of Indian white shrimp, Fenneropenaeus indicus, was studied. Supplementary feed incorporated with Lucantin red and pink at 250 ppm was fed for a period of 45 days prior to harvest. Shrimp fed with the normal feed were considered as control. Shrimp colour and quality were assessed after 15, 30 and 45 days of Lucantin feeding. Significant difference in colour was noticed between control and treatment, whereas no significant difference was observed in loose shell/soft shell and black spot formation. Lucantin is found to be a safe feed additive to improve colour in *F. indicus*.

Science and mega science: a perspective

Rashmi Raniwala and Sudhir Raniwala

Keywords: Collaborative research, extreme scales, international projects, mega-science

Abstract

The need for pursuit of science arises from the innate curiosity of human beings, making them wonder, deliberate and learn. Natural sciences observe nature across different scales and the knowledge acquired is often used for the benefit of mankind through technological applications. Study of nature at extreme scales always pushes the existing limits of technology, and has made it necessary that governments across the world pool in their human and other resources through international collaborations. The wide participation of India in large international projects, megascience projects, is highlighted in this article. The sociological and scientific need and implications for the participation of our country are also discussed.

Low-cost solar water purifier for rural households

Anil K. Rajvanshi and Noorie Rajvanshi

Keywords: Coliforms, solar water purifier, tubular collectors, thermal degradation.

Abstract

A simple, low-cost solar water purifier (SWP) for rural households, which does not require electricity or waste precious water has been developed. The SWP consists of four tubular solar water heaters attached to a manifold. Non-potable water is filled in the SWP after filtering with four-layered cotton cloth and heated in the stagnation mode by solar energy to make it potable. The cost of the SWP is around Rs 2500–3000 (~US\$ 40–50) and is so simple that any small rural workshop can fabricate it. In large-scale production it is envisaged that the cost can come down to Rs 1500. Details of the technology are provided in this article.

Digital Accessible Knowledge of the birds of India: characterizing gaps in time and space

A. Townsend Peterson, R. Suresh Kumar, Manoj V. Nair and Gautam Talukdar

Keywords: Birds, digital accessible knowledge, global change, India, primary biodiversity data.

Abstract

This paper evaluates Digital Accessible Knowledge on occurrence of Indian bird species. More than 2 million primary occurrence records from across India were obtained from the Global Biodiversity Information Facility and eBird. These were processed into maps of inventory completeness across the country both prior to 1980 and after 2000, in an attempt to develop evaluations of faunal change resulting from global climate change. We found good coverage of the country by wellinventoried areas after 2000, but almost no coverage prior to 1980. As such, in before-and-after comparisons documenting effects of global change on Indian birds, the ‘after’ is well documented, but the ‘before’ is lacking. This significant information gap points to the need for digital capture and open sharing of historical information regarding Indian bird species’ occurrences; this information will derive in large part from natural history museum specimens, particularly in India and Great Britain, and potentially from older observational data sources and the literature.

Modelling of climate-induced groundwater recharge for assessing carbon emission from groundwater irrigation

G. T. Patle¹, D. K. Singh and A. Sarangi

Keywords: Climate change, carbon emission, groundwater modelling, groundwater recharge, hydrus, modflow.

Abstract

In this study impact of climate change on groundwater recharge is investigated and the carbon emission from groundwater irrigation is assessed under projected climate change scenarios for Karnal district of Haryana state in India. HYDRUS-1D and MODFLOW models were used to simulate the climate change impacts on groundwater recharge for different projected climate change scenarios. Simulation results showed that groundwater recharge would increase marginally by 2030 over the baseline year of 2008 under the scenario based on ARIMA predictions, which considered the effect of all climate parameters. However, under the scenarios, which considered only rise in temperature, groundwater recharge would decrease by 0.07–0.22 m. Rise in temperature by 3.5°C and 4.3°C along with 9% and 16% increase in rainfall over the base year would increase the recharge by 0.09 m and 0.14 m respectively. The study also revealed that the effect of climate change on cumulative recharge would be more in sugarcane fields than in rice fields. Carbon emission of groundwater irrigation

under the scenarios based on rise in temperature only would increase by a minimum of 12 kg CO₂/ha in pearl millet crop by the year 2030 to a maximum of 3250 kg CO₂/ha for sugarcane crop by the end of this century. Estimated total carbon emission in 2030 would be 345,857 metric tonne from groundwater irrigation in Karnal district which is 87,474 metric tonne more than the baseline emission.

Impact of macroeconomic and healthcare provision factors on patient satisfaction

Ana Iolanda Vodă, Ionel Bostan and Claudiu Gabriel Țigănaș

Keywords: GDP, healthcare provision and expenditure, macroeconomic factors, patient satisfaction.

Abstract

This article examines how macroeconomic and healthcare provision factors affect patient satisfaction. In line with the specialized literature, we have formulated two hypothesis statements that were tested on a sample of 31 countries, using 2012, 2013 and 2014 data. OLS regression models were used for testing different explanatory variables and their impact on patient satisfaction. The main findings of the study clearly illustrate a positive and strong relationship between patient satisfaction and healthcare provision, namely practising physicians and the number of nurses, and macroeconomic factors such as public healthcare expenditure and GDP per capita. Furthermore, we notice a negative but strong correlation with healthcare infrastructure (available hospital beds) and private healthcare expenditure.

Surface plasmon resonance: physics and technology

S. Nivedha, P. Ramesh Babu and K. Senthilnathan

Keywords: Biosensor, optical fibre, surface plasmon resonance.

Abstract

Over the last few decades, surface plasmon resonance (SPR) technique has been very promising for sensing applications. It involves light-matter interaction at the interface of the metal and dielectric. This technology is employed in physical, chemical and biological sensing applications. In this review, we present the principle of SPR, different configurations used for excitation of SPR, performance characteristics of a sensor and commercialization of the biosensors technology. A few applications of SPR as biosensors have also been reviewed in this article.

Expression profiles of key genes involved in rice gall midge interactions reveal diversity in resistance pathways

D. Divya, Suresh Nair and J. S. Bentur

Keywords: HR⁺ type resistance, HR⁻ type resistance, HR, ROS, SAR.

Abstract

Resistance against the Asian rice gall midge, *Orseolia oryzae* (Wood-Mason), is conferred by any one of the 11 major genes identified so far. Resistance conferred by these genes may or may not involve a hypersensitive reaction (HR). Three of these gall midge resistance genes have been already cloned. In this study, expression of 20 key genes, identified based on our earlier studies, in 12 rice genotypes was profiled through quantitative real time (RT)-PCR at two time points. Results highlighted diversity in resistance pathways either involving reactive oxygen species (ROS)- hypersensitive reaction (HR) salicylic acid-mediated systemic acquired resistance or strong suppression of ROS-HR at initial stage itself. Some of the susceptible test genotypes derived from crosses between gall midge resistant and susceptible parents expressed trace activity of these genes even during compatible interaction.

Frequency-dependent response of *Chromobacterium violaceum* to sonic stimulation and altered gene expression associated with enhanced violacein production at 300 Hz

Chinmayi Joshi, Pooja Patel, Abhishek Singh, Jinal Sukhadiya, Vidhi Shah and Vijay Kothar

Keywords: Altered gene expression, *Chromobacterium violaceum*, sonic stimulation, violacein.

Abstract

In this study, *Chromobacterium violaceum* was subjected to sonic (100–2000 Hz) stimulation. Sound waves of 300 Hz frequency promoted bulk production of the quorum-regulated pigment, violacein. Whole transcriptome analysis indicated that a total of 342 genes (i.e. 4.63% of the whole genome) were significantly upregulated in the sonic stimulated culture. Enhanced violacein production in the soundstimulated culture seems to have stemmed from enhanced expression of the genes involved in pentose phosphate pathway, resulting in an increased availability of erythrose-4-phosphate to be used in the synthesis of tryptophan – the precursor of violacein synthesis. This study is a good demonstration of the ability of sound waves to alter bacterial metabolism.

In vitro plant development of *Eleusine coracana* via indirect organogenesis and somatic embryogenesis using mature seeds as explants

Anamika Kashyap, Santosh Madanrao Penak, Arnab Saha and B. R. Singh

Keywords: Embryogenesis, finger millet, indirect organogenesis, mature seeds, somatic millets.

Abstract

A complete plant regeneration system has been developed using mature seeds as explants. Mature embryos were used for induction of callus and regeneration of finger millet GE-3885 genotype. Highest callus induction and proliferation was found with MS + 1.5 mg/l NAA and MS+0.5 mg/l NAA respectively. Somatic embryos were obtained in MS + 0.5 mg/l 2,4-D. Histological analysis of somatic embryos revealed globularshaped structure. Plantlets attained good length of shoots and roots on MS + 1.5 mg/l BA and MS + 1.5 mg/l IBA respectively, and were acclimatized under glasshouse conditions after proliferation of roots in hydroponics system.

Seasonal behaviour of upper ocean freshwater content in the Bay of Bengal: synergistic approach using model and satellite data

Smitha Ratheesh, Neeraj Agarwal, Rashmi Sharma, K. V. S. R. Prasad and Sujit Basu

Keywords: Freshwater content, sea surface salinity, seasonal variability, upper ocean region. THE Bay of Bengal (BoB) is an important

Abstract

Any change in precipitation, evaporation and river discharge, by virtue of its impact on the distribution of ocean salinity, leaves its inevitable signature on the freshwater content (FWC) in the oceans. In this study, synergistic use of satellite data and numerical ocean circulation model is explored to examine the seasonality of FWC of the upper 30 m water column of the Bay of Bengal (BoB). For this purpose, first the sea surface salinity (SSS) from Aquarius is assimilated into a model of the Indian Ocean. Strength of assimilation is judged by comparing simulated SSS with satellite and Argo datasets. An overall improvement of 39% is observed in SSS over free run of the model without data assimilation. Next, the focus is shifted to the spatial and temporal variability of FWC of the upper 30 m of BoB in relation to the different components of freshwater forcing. A delay of three months in the peak of FWC is observed with respect to the peak of net freshwater influx for BoB as a whole. However, the nature of the response of FWC to the total freshwater input forcing in the major river-dominated regions of BoB is different from that for the whole BoB. The relative role of river influx in controlling FWC in these regions is well brought out in the study. For the Ganga–Brahmaputra region, river run-off is observed to be a crucial parameter in regulating FWC, whereas

for both Irrawaddy river region and central BoB, precipitation dominates the response. The response of salinity in the uppermost part of the northern BoB to the total freshwater input is much more rapid than in the other regions.

Assessment of soil erosion in the fragile Himalayan ecosystem of Uttarakhand, India using USLE and GIS for sustainable productivity

S. K. Mahapatra, G. P. Obi Reddy, Ritu Nagdev, R. P. Yadav, S. K. Singh and V. N. Sharda

Keywords: Conservation measures, erodibility, fragile ecosystems, geographic information system, universal soil loss equation.

Abstract

In this study, we assess quantitative soil loss in the Himalayan ecosystem of Uttarakhand, India using universal soil loss equation and geographic information system. The analysis shows that about 359,000 (6.71%), 473,000 (8.84%) and 1,750,000 ha (32.72%) area is under moderately severe (15–20 tonne ha⁻¹ year⁻¹), severe (20–40 tonne ha⁻¹ year⁻¹) and very severe (40–80 tonne ha⁻¹ year⁻¹) soil loss respectively. It clearly indicates that about 48.3% area of the state is above the tolerance limit of 11.2 tonne ha⁻¹ year⁻¹ of soil loss. This explains the need to undertake appropriate soil and water conservation measures to mitigate the topsoil loss in this fragile Himalayan ecosystem. Based on the degree of severity of soil loss, appropriate soil and water conservation measures need to be adopted on priority basis. The agriculture practices should be diversified with farm-forestry, agro-horticulture and/or agro-forestry to minimize soil loss in cultivated areas of the state. Such conservation programmes help mitigate accelerated soil erosion, restore the fragile ecosystems and generate employment opportunities for the needy.

Optimization for blasting scheme of crown-sill pillar based on CW-GT and GC-WTOPSIS

Qiucan Zhang, Lei Zuo, Qing Yu, Yulong Liu, Yushan Yang and Dexing Ding

Keywords: Blasting scheme, combination weight based on game theory, CW-GT, GC-WTOPSIS.

Abstract

Blasting scheme for crown-sill pillar of a lead–zinc mine was optimized by a new combination optimization model on the basis of CW-GT and GC-WTOPSIS. Nine main evaluation indices influencing blasting were chosen from economy, technology and safety aspects to establish the synthetic evaluation index system of four blasting schemes. Then the synthetic superiority degrees of the four schemes were determined with the basic theory of CW-GT and GC-WTOPSIS. Scheme III (burn cut, inclined hole and side collapse with an angle of 80°) had the highest superiority degree and hence was confirmed as the best. The result was consistent with AHP-TOPSIS, BP neural network and catastrophe progressing model. The practice showed that the selected blasting scheme achieved the desired blasting effect, and the new method was suitable for optimization of blasting scheme, which provided a new way for scientific and reliable optimization of similar programmes.

Responses of selected C3 and C4 halophytes to elevated CO₂ concentration under salinity

Saranya Jothiramshekar, Jenifer Joseph Benjamin, Rani Krishnasamy, Anand Kumar Pal, Suja George, Rajalakshmi Swaminathan and Ajay K. Parida

Keywords: Elevated carbon dioxide, halophytes, salinity, photosynthetic pathway, *Sesuvium portulacastrum*, *Suaeda nudiflora*.

Abstract

Halophytes have superior capacity to withstand soil salinity and are appropriate resources to study the mechanism of salt tolerance which can be harnessed to develop crops to withstand salinity. In this communication, we report the effect of salinity (200 mM NaCl) and elevated carbon dioxide (CO₂)

treatments in tandem, on select halophytes that have different photosynthetic pathways: C3 and C4. The plants were raised in ambient (380 ppm) and enriched (500 ppm) concentrations of CO₂ using a mini-FACE facility. Total chlorophyll content, total soluble sugar concentration, lipid peroxidation level and electrolyte leakage were measured from fresh leaf samples collected at different time points. The results show a positive effect for elevated CO₂ concentration on salt tolerance in both C3 and C4 plants, and indicate that halophytes may benefit from rising atmospheric CO₂ concentration. The results also suggest that C4 halophytes may benefit from the rising atmospheric CO₂ concentration than C3 halophytes.

Land-use dynamics in Corbett National Park, Uttarakhand, India using CA-Markov and agent-based LULC-SaarS model

Arijit Roy and Pooja Rathore

Keywords: Agent-based modelling, buffer zone, landuse dynamics, National Park.

Abstract

Corbett National Park (CNP), Uttarakhand, India is currently facing pressure of encroachments from human settlements around the buffer zone leading to increasing human and animal conflicts. In the present study, we have analysed the extent of land-use/landcover (LULC) changes between 1976 and 2011 using medium-spatial-resolution satellite data in and around CNP. Future projections have also been generated using CA-Markov and agent-based SaarS model. The study highlights that unlike in the past decades, the projected LULC may undergo restricted growth in built-up area agriculture.

Fragilariopsis sp. bloom causes yellowish-brown waters off Alappuzha, south-central Kerala coast, India, during the mud bank-upwelling phase

R. Jyothibabu, N. Arunpandi, C. Karnan, L. Jagadeesan, T. M. Manojkumar, K. K. Balachandran and S. W. A. Naqvi

Keywords: Bloom, coastal upwelling, *Fragilariopsis* sp., mud bank, fisheries.

Abstract

Mud banks (Chakara) of Kerala are calm coastal waters that form in several isolated stretches along the coast usually during the southwest monsoon (SWM) period (June–September). They are characterized by the damping of incident waves, generating localized calm sea environment conducive for fishing activities, while the high monsoon waves create hostile environment in the rest of the region. Here, we present the scientific basis of the yellowish-brown discoloration of water column that occurs off Alappuzha, Kerala annually during the peak and late SWM associated with coastal upwelling-mud bank event. The discoloured waters that occur off Alappuzha associated with these events are locally known as ‘pola vellam’, which is nothing but diatom blooms. In 2014, pola vellam was actually caused by the bloom of *Fragilariopsis* (= *Fragilaria*) sp.; hereafter *Fragilariopsis*, which widespread in the study region, even beyond the mud bank domain. This bloom feature is attributable to the nutrient enrichment associated with intense coastal upwelling that was dominant over a larger spatial extent in the study domain, including the mud bank. FlowCAM-based plankton data strongly support the above view, as the abundance, biovolume and biomass of *Fragilariopsis* had similar temporal trend both in the mud bank and non-mud bank regions. The general ecology and importance of *Fragilariopsis* bloom in the study domain, from the point of view of commercial fisheries, is also elaborated in this communication.

Inter-specific relationship of size and walking speed in predaceous ladybirds (Insecta: Coleoptera: Coccinellidae)

S. Ghosh and B. K. Agarwala

Keywords: Evolutionary allometry, predaceous ladybirds, size and speed.

Abstract

Inter-specific relationships of size and walking speed were examined in five species of predaceous ladybird beetles of aphid prey from different habitats. Lengths of legs, weight and volume of body, and walking speed varied significantly among the five species of different sizes that were reared on their preferred prey food in uniform growth conditions. The species are *Menochilus sexmaculata*, *Coccinella transversalis*, *Anisolemnia dilatata*, *Micraspis discolor* and *Scymnus* sp. Lengths of legs and body sizes showed similar growth rates across the five species (isometry), but the giant ladybird species showed significantly higher positive allometry in body volume (allometric coefficient, $\alpha = 6.66$) and significantly lower negative allometry in walking speed relative to body weight ($\alpha = 0.95$) when compared to other species ($\alpha = 3.54$). The unique response by the giant ladybird species in body form and speed may be attributed to its foraging habitat of perennial bamboo forests with large aggregations of non-winged aphid food which seem to favour the evolution of higher body volume and slower speed for giant size when compared to species of smaller sizes which usually forage for short-lived aphid colonies in seasonal and annual habitats of crop plants and weeds. Evidently, size (weight and volume) and speed matter in the evolution of life history attributes of predaceous ladybird beetles.

Population structure and reproductive biology of selected sciaenid species along the fishing grounds of Goa, west coast of India

Dinesh T. Velip and Chandrashekher U. Rivonker

Keywords: Fecundity, population, spawning, Sciaenidae.

Abstract

The present hypothesis on reproductive migration pattern between two species of sciaenids is based on the data collected with the help of the single-day commercial trawl with a fishing effort of 181 h along the fishing grounds of Goa, west coast of India. The observations on abundance revealed that between the two species (*Johnius borneensis* and *Otolithes ruber*) that formed bulk of the catch, a significant inverse trend in catch was observed. The pattern of migration based on the examination of female gonadal status suggested *J. borneensis* to be a continuous spawner and was evidenced by continuous occurrence of gravid and spent females and their juveniles. On the other hand, the rare occurrences of gravid females of *O. ruber* from the study area suggest that the species spawns away from the coast or might migrate to some potential spawning grounds. Further, an assessment of fecundity and the ova distribution pattern propounded higher fecundity in *O. ruber* compared to *J. borneensis* with multiple spawning in both the species.

AdaBoost-based long short-term memory ensemble learning approach for financial time series forecasting

Yungao Wu, and Jianwei Gao

Keywords: AdaBoost algorithm, ensemble learning, financial time series forecasting, long short-term memory network.

Abstract

A hybrid ensemble learning approach is proposed for financial time series forecasting combining AdaBoost algorithm and long short-term memory (LSTM) network. First, LSTM predictor is trained

using the training samples obtained by AdaBoost algorithm. Then, AdaBoost algorithm is applied to obtain the ensemble weights of each LSTM predictor. The forecasting results of all the LSTM predictors are combined using ensemble weights to generate our final results. Four major daily exchange rate datasets and two stock market index datasets are selected for model evaluation and model comparison. The empirical study demonstrates that the proposed AdaBoostLSTM ensemble learning approach outperform other single forecasting models and other ensemble learning approach in terms of both level forecasting accuracy and directional forecasting accuracy. This suggests that the AdaBoost-LSTM ensemble learning approach is a highly promising for financial time rates forecasting.

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Re-envisioning engineering education in India: IIT Gandhinagar's Foundation Programme

Srinivas Reddy and Sudhir K. Jain

Keywords: Engineering education, induction programme, orientation programme, reenvision, student feedback

Abstract

The Foundation Programme (FP) of the Indian Institute of Technology, Gandhinagar (IITGN) is a dynamic five-week event that strives to nurture every new batch of undergraduate B Tech students in a holistic and engaging manner. During the first five weeks after joining the institute, students participate in an engaging series of activities designed to address five major themes: (1) values and ethics, (2) creativity, (3) teamwork, (4) social awareness and (5) physical fitness. The intensive programme is thus designed to inspire students to build their sense of self-confidence, explore their creative passions, and develop their minds and bodies as well-rounded global citizens. There are no formal classes during this time and students are expected to immerse themselves in this transformative programme. The IITGN FP began at IITGN in 2011 and has been successfully conducted every year since then. Over the years, student feedback regarding the programme has been tremendous, and many have expressed that it is a powerfully engaging and transformative experience. In addition, FP functions as an active and participatory introduction to the institute's core belief that students must strive to know themselves and the world around them.

Concentrated solar power in India: current status, challenges and future outlook

Suhas Bannur

Keywords: Concentrated solar power, levelized cost of electricity and poly-generation, photovoltaic cells

Abstract

India is blessed with good solar resources and many regions of the country receive above-average sunshine compared to other regions of the world. The primary technology used for harnessing and converting solar energy into electrical energy in India is based on photovoltaic (PV) cells. Concentrated solar power (CSP) has hardly contributed to the overall installed solar power capacity in the country. In this article, some of the challenges that have inhibited the growth of CSP are identified and possible solutions suggested. The critical challenges for CSP are related to the lack of reliable direct normal irradiance database, indigenous manufacturing and competition from PV. The results of a case study carried out to assess the impact of indigenous manufacturing and economies of scale on capital costs and levelized cost of electricity are presented. This study shows that even with indigenous manufacturing and considering economies of scale, the capital cost per MW (Megawatt) of installed capacity is higher than the Central Electricity Regulatory Commission benchmark costs.

To initiate larger adoption of CSP in India, we may have to consider alternative configurations, such as coupling desalination or thermal cooling systems to a CSP power plant. The merits of such configurations, called poly-generation plants, are presented for the Indian scen India is blessed with good solar resources and many regions of the country receive above-average sunshine compared to other regions of the world. The primary technology used for harnessing and converting solar energy into electrical energy in India is based on photovoltaic (PV) cells. Concentrated solar power (CSP) has hardly contributed to the overall installed solar power capacity in the country. In this article, some of the challenges that have inhibited the growth of CSP are identified and possible solutions suggested. The critical challenges for CSP are related to the lack of reliable direct normal irradiance database, indigenous manufacturing and competition from PV. The results of a case study carried out to assess the impact of indigenous manufacturing and economies of scale on capital costs and levelized cost of electricity are presented. This study shows that even with indigenous manufacturing and considering economies of scale, the capital cost per MW (Megawatt) of installed capacity is higher than the Central Electricity Regulatory Commission benchmark costs. To initiate larger adoption of CSP in India, we may have to consider alternative configurations, such as coupling desalination or thermal cooling systems to a CSP power plant. The merits of such configurations, called poly-generation plants, are presented for the Indian scenario.

The bio-incubation boom in India

Satya Prakash Dash and Gayatri Saberwal

Keywords: BIRAC, entrepreneurship, incubation, start-ups, tech-transfer.

Abstract

There are already 30 biotech or medtech incubators that have incubated 397 companies (listed). Another 50 are planned. Most are under 10 years old, located in three southern cities and funded by the Government of India. Some have outstanding instrument facilities, others access to a large number of students. Over half can host foreign companies. Rentals and grants are their largest sources of funds; sustainable funding is their biggest challenge. At least one start-up per incubator has achieved Rs 1 crore in annual turnover. We outline an assessment framework for the incubators which form a crucial part of the rapidly evolving entrepreneurship landscape.

Impulsive and switching load balancing model and stability analysis

Tinglei Zhao, Jianzhong Qiao, Shukuan Lin and Yanhua Wang

Keywords: Asymptotic stability, dynamic load balancing, distributed system, impulsive and switching system, time delay.

Abstract

Load imbalance in a distributed system causes low efficiency. Aiming at the dynamics of resource and load running status, we propose an impulsive and switching load balancing model with time delay based on control theory. In order to describe various current states of a node, we construct corresponding subsystems according to the dynamics of a node's resources. The sub-system switching is triggered by an impulsive signal which can decrease the communication overhead among nodes. The model reallocates loads in light of their real-time running statuses, which improves the efficiency of dynamic load balancing. We deduce the sufficient condition for asymptotic stability of the model by using the Lyapunov–Krasovskii function, and simulation by Linear Matrix Inequality (LMI) to verify effectiveness of the model. Experimental results produced by a shared platform based on block chain demonstrate that the proposed model can make the balanced system speedy, which verifies its feasibility.

Prospects of customized fertilizers in Indian agriculture

Sabyasachi Majumdar and Nagabovanalli B. Prakash

Keywords: Customized fertilizer, fertilizer policy, fertilizer grades, fertilizer subsidy, micronutrient deficiency

Abstract

In many countries, blanket fertilizer recommendations for different crops have caused poor nutrient supply, low nutrient use efficiency and limited crop response. In contrast, soil and area specific, customized fertilizers may help to sustain soil health by ensuring appropriate fertilization. Hence, specific customized fertilizers should be promoted to counteract the problem of expanding multi-nutrient deficiencies in Indian soils. This article discusses the manufacturing methodologies, eligibility criteria, success in Indian fertilizer industry, adoption of fertilizer recommendations and problems in marketing of customized fertilizer.

Exopolysaccharides from cyanobacteria and microalgae and their commercial application

Dhanesh Kumar, Petr Kaštánek and Siba P. Adhikary

Keywords: Cyanobacteria, carbohydrate, exopolysaccharides, green algae.

Abstract

Cyanobacteria and green algae are phototrophic microorganisms showing high diversity in their cellular structure in response to the environmental conditions of the niche where they occur. Production of exopolysaccharides (EPS) in response to adverse conditions is one of the important features of these organisms. EPS are present mainly around their cells/ filaments as an enveloped layer and released outside. EPS play protective functions and are important for their survival in stressed habitats exposed to radiation, desiccation and elevated temperatures. This review discusses the production, extraction and possible commercial applications of EPS produced by cyanobacteria and green algae.

Classification of SDSS photometric data using machine learning on a cloud

Vishwanath Acharya, Piyush Singh Bora, Karri Navin, Anisha Nazareth, P. S. Anusha and Shrisha Rao

Keywords: Astronomical data, classification, cloud computing, distributed algorithms, machine learning.

Abstract

Astronomical datasets are typically very large, and manually classifying the data in them is effectively impossible. We use machine learning algorithms to provide classifications (as stars, quasars and galaxies) for more than one billion objects given photometrically in the Third Data Release of the Sloan Digital Sky Survey (SDSS-III). We have used kNN, SVM and random forest algorithms in a distributed environment over the cloud to classify 1,183,850,913 unclassified photometric objects present in the SDSSIII catalog. This catalog contains photometric data for all objects viewed through a telescope and spectroscopic data for a small part of these. Although it is possible to classify all the objects using spectroscopic data, it is impractical to obtain such data for each one of them. To classify such a big dataset on a single machine would be impractically slow, so we have used the Spark cluster computing framework to implement a distributed computing environment over the cloud. We found that writing results (dozens of gigabytes) to the cloud storage is very slow while using kNN. Though writing the results with SVM is faster as it is done in parallel, its accuracy is only around 87%, due to lack of a kernel implementation of it in Spark. We then used the random forest algorithm to classify the entire set of 1,183,850,913 objects with an accuracy of 94% in about 17 hours of processing time.

The result set is significant as even collecting spectroscopic data for these many objects would take decades, and our classifications can help astronomers and astrophysicists carry out further studies.

Multidisciplinary approach to teaching inorganic chemistry in high school: an example of the topic of metals

D. A. Kostić, R. S. Nikolić, N. S. Krstić, M. G. Nikolić, V. D. Dimitrijević and S. Simić

Keywords: Inorganic chemistry, high school, multidisciplinary approach, teaching, metals.

Abstract

We present in this article a multidisciplinary approach to teaching high-school chemistry in Serbia, illustrated by an example of the course topic of metals. The aim is to increase the level of interest in studying chemistry and acquiring knowledge that is applicable in daily life. The experiment was carried out in four classes of second-year gymnasium students. The redesigned materials can serve as a model for the preparation of similar materials for other course topics. Multidisciplinary approach in processing of the lesson on metals and the redesigned curriculum content significantly increased the interest of the students and improved their knowledge.

Variation in carbon storage among tree species in the planted forest of Kathmandu, Central Nepal

S. P. Bhatta, K. P. Sharma and S. Balami

Keywords: Allometric equation, carbon sequestration rate, Coronation garden, importance value index, species-specific.

Abstract

Carbon stock variation among trees of planted forest, was estimated in a 41-year old Coronation garden of Kathmandu, Central Nepal. Forty-one square quadrates of 20 m × 20 m were selected by applying stratified systematic sampling method in three horizontal strata of the forest. The biomass of trees was estimated using an allometric equation which was later converted to the carbon stock by using carbon fraction. The study site stored 196.4 Mg C ha⁻¹ (carbon sequestration rate: 4.78 Mg ha⁻¹ yr⁻¹) equivalent to 720.7 Mg CO₂ ha⁻¹ (CO₂ assimilation rate: 17.58 Mg ha⁻¹ yr⁻¹). *Eucalyptus citriodora* had the highest carbon storage (54.6 Mg ha⁻¹, 27.8%) and sequestration rate (1.33 Mg ha⁻¹ yr⁻¹). *Cinnamomum camphora* and *Salix babylonica* were the dominant tree species, while Salicaceae and Lauraceae were the dominant families growing in the forest. Myrtaceae was the dominant family in terms of carbon storage and carbon sequestration rate. The study suggests that *E. citriodora*, *C. camphora*, *S. babylonica* and *P. roxburghii* would be the best species to select for forest plantation which would yield large impacts on landscape-level carbon stocks and could also mitigate climate change.

Multiresidue determination of pesticides in market honey from northern India using QuEChERS approach and assessment of potential risks to consumers

Atul Kumar, Jatinder Paul Singh Gill and Jasbir Singh Bedi

Keywords: Honey, northern India, pesticides, risk assessment, QuEChERS.

Abstract

Honey has multiple beneficial properties but polluted environments have led to its contamination. Contaminated honey not only serves as a sentinel of environmental pollution, but can also pose potential risks to consumers' health. In the present study, QuEChERS (quick, easy, cheap, effective, rugged and safe) method along with gas chromatography coupled to selective detectors (ECD/FTD/MS) was used for determining 24 pesticide residues and/or their metabolites in 150 honey samples collected from markets in Northern India. The method was optimized and validated

according to the European Commission's guidelines. Residues of pesticides were detected in 12% of samples, of which a majority contained organophosphate residues. Assessment of human health risks suggests that contaminated honey at current levels has minimal contribution to toxicological risks. However, precautionary measures should always be taken considering the customary honey feeding in infants and cumulative effect of these chemicals in the foreseeable future. This study highlights the importance of continuous monitoring of pesticide residues, and consumer awareness towards certified products to safeguard public health.

Analysis of agricultural substrates for nutritive values and biomethane potential

Shehbaz Ali, Tawaf Ali Shah, Asifa Afzal and Romana Tabassum

Keywords: Acid detergent fibre, acid detergent lignin, anaerobic digestion, neutral detergent fibre, volatile fatty acids.

Abstract

Bio-methane from agricultural waste has enough potential to compete with other sources of energy. This study aims to examine the bio-methane potential of numerous agricultural wastes, including cotton waste, wheat bran, lentil straw, barley straw, rice bran and peanut peels straw with the aim to produce renewable energy and solve waste disposal issues. The proximate, ultimate and chemical composition analyses were performed to predict the theoretical biomethane potentials *in silico*. However, the potential was experimentally assayed at mesophilic conditions. Moreover, elemental and lignin based biodegradability of substrates have also been determined. The methane contents in biogas are in the range 57–64% and the yield varied from 216.3 (barley straw) to 317.6 (cotton waste) ml/g volatile solids. These results indicate that higher biodegradability of substrates resulted in higher methane production. The prediction of bio-methane potential from chemical composition, elemental composition and organic fraction were not as fit accurately as being assessed for methane potential. It merely provided the extent of biodegradability. During digestion, volatile fatty acids were produced, viz. acetic acid (58–63%), butyric acid (28–32%), propionic acid (6–13%) and converted into methane but limited concentrations of intermediate acids indicated similar microbial consortium in all digestions. Hence, it was also concluded that the lignin and hemicellulose content played a limiting role in digestion and posed negative impact on biogas production.

Palaeo-channel bisecting Puri town, Odisha: vestige of the lost river 'Saradha'?

Subhamoy Jana, William Kumar Mohanty, Saibal Gupta, Chirashree Srabani Rath and Priyadarshi Patnaik

Keywords: Ancient texts, lost river, Puri, satellite imagery.

Abstract

Puri, an ancient town located on the Odisha (Orissa) coast in eastern India, is associated with the 12th century CE Jagannath Temple. Many ancient and historical texts mention a mythical river named Saradha that flowed across the present Grand Road (Badadanda) between the Jagannath and Gundicha temples in Puri, dividing the town into two parts. This study traces the trail of a palaeo-channel beyond and within the heart of Puri town through an integrated study of geology, satellite imagery and ground-penetrating radar (GPR) survey. Various satellite imagery manipulation techniques – band combination, NDVI, MNDWI, linear spectral unmixing algorithm, density slice and spatial profiling – indicate the existence of water components along with vegetation bands, and the presence of a sinusoidal palaeo-channel trace with a V-shaped topographic outline. This is interpreted to represent the remnants of an extinct river valley. GPR survey also suggests that a subsurface river valley, about 128 m wide, existed across parts of the Grand Road. A large, sinusoidal water body near the sea beach at Puri, may represent the last remains of the dried-up channel. Integration of all these

features suggests that a river once existed between Jagannath and Gundicha temples in Puri town. The constructed palaeo-channel trail may be that of the lost Saradha river described in ancient texts. The study develops a sequential methodology for identifying palaeo-channels even in urbanized localities like Puri.

Synthesis, heterocyclization and anti-tumour activity evaluation of some benzimidazole derivatives

M. F. El-Ahwany and Mohamed H. M. Abd El-Azim

Keywords: Active methylene, benzimidazoles, cytotoxicity activity, hydrazines, lactambenzimidazole.

Abstract

Methylbenzimidazole 1 is converted to imidazole acrylic acid 3 via cyclo condensation with chloral followed by hydrolysis. Compound 3 also obtained from the reaction of o-phenylenediamine with maleic anhydride. Treatment of 1 with SeO₂ yielded the oxidized product 4 (Aldehyde 4) which undergoes Wittig reaction using ester and Ph₃P to furnish the acrylates 5. Compound 5 is also obtained by cyclocondensation of o-phenylenediamine and the corresponding maleate. Cyclization of 3 using Ac₂O provides pyrroloimidazole 6. Imidazole 6 undergoes several transformations using HCl, ammonium hydroxide in neutral medium, o-phenylene diamine/HCl to provide acrylic acid 3, amide 7 and/or bicomponent 8 respectively. Anilide 9 is obtained as a result of condensation of 3 with amines. Ester 5 undergoes 1,4-addition to benzimidazole ring to give the corresponding anilino derivative 10. Pyridazine cyclization is achieved by treatment of 5 with NH₂OH in acidic medium. In vitro cytotoxicity is evaluated using SRB (sulphorhodamine-B) assay against two human cell lines, breast and liver carcinoma cell lines. The results show that compound 11 has strong activity against all cell lines tested.

Effect of reduced traffic density on characteristics of particulate matter over Delhi

Vikas Goel, Sumit Kumar Mishra, Ajit Ahlawat, Chhemendra Sharma, N. Vijayan, S. R. Radhakrishnan, A. P. Dimri and R. K. Kotnala

Keywords: Black carbon, elemental composition, PM_{2.5}.

Abstract

Road rationing policy, implemented in Delhi from 1 to 15 January 2016, reduced the traffic density. This particular event serves an opportunity to study the effect of reduced traffic density over particulate matter (PM) characteristics. The mean PM_{2.5} and black carbon (BC) mass concentration before, during and after the event were observed as 163.51 µg/m³ and 14.01 µg/m³, 186.98 µg/m³ and 19.87 µg/m³, 197.45 µg/m³ and 17.79 µg/m³ respectively. During the first week (1–7 January 2016), high PM_{2.5} mass concentration was observed while in the second week (8–15 January 2016), the concentration was relatively low. The concentration of elements like P, Cu, As and Pb was observed to be minimum during the event.

Enhanced fire severity in modern Indian dwellings

Nasar Ahmad Khan and Gaurav Srivastava

Keywords: Design fire, enhanced fire risk, fire load energy density, fire load survey.

Abstract

The present study focuses on assessment and probabilistic characterization of fire load, a key input to performance-based fire design, in office and dormitory buildings in India. A survey using combined inventory-weighting method was conducted and the results analysed with respect to several parameters such as room use, type of combustibles, etc. Probabilistic models based on the generalized extreme

value and gamma probability density functions have been proposed for fire load energy density. It has been found that, on an average, the fire load present in modern buildings is about three times greater than what is reported by earlier studies and prescribed by building codes. Thus, the severity of potential fires that can occur in a compartment has increased considerably. Parametric fire curves have been developed and compared with standard fire curves to assess the increase in severity. The developed fire curves possess a greater growth rate and predict a greater temperature within the first one hour, when compared to the standard curves, showing that there is a greater fire risk.

Advances in sea surface layer temperature measurements with fast responding thermistor arrays on drifting buoys

R. Srinivasan, V. Rajendran, Shijo Zacharia and Tata Sudhakar

Keywords: Drifting buoy, NTC thermistor sensor, sensor array, Steinhart–Hart coefficients.

Abstract

A precise and accurate ocean temperature measurement system is essential for better understanding and knowledge of the spatial and temporal variability of thermal stratification of the upper-ocean layers is fundamental. The National Institute of Ocean Technology, Chennai has indigenously developed a novel negative temperature coefficient (NTC) thermistor based sensor array with RS232 digital output for drifting buoy (Pradyu) (DB) wherein, it is mainly used in ocean observation applications. The DB is built with Indian satellite (INSAT) for real time data telemetry. The NTC sensing element is used in developing the temperature sensor for the measurement of sea surface layer temperature. The Steinhart–Hart equation and coefficients are applied on each sampling to zero down the error components involved in temperature measurements which corresponds to the nonlinear functionality of the NTC element. In-house developed SST sensor and sensor array are calibrated and extensively tested in laboratory conditions. The results of the SST and sensor array laboratory calibrations and field validations are briefly presented here with significant data sets collected in the Bay of Bengal warm pool regions.

Status of desertification in South India – assessment, mapping and change detection analysis S. Dharumarajan, M. Lalitha, Rajendra Hegde, N. Janani, A. S. Rajawat, K. L. N. Sastry and S. K. Singh

Keywords: Change detection analysis, desertification, salinization, vegetal degradation, waterlogging.

Abstract

Desertification is the transformation of productive land into a non-productive one due to poor resource management, and unfavourable biophysical and economical factors. Periodical assessment of desertification status is imperative for a suitable comprehensive and combating plan. In the present study, desertification status maps of Andhra Pradesh (AP), Karnataka and Telangana in South India have been prepared using remote sensing data for two time-frames (2003– 2005 and 2011–2013) and change detection analysis has been carried out. The results reveal that 14.35%, 36.24% and 31.40% of the total geographical area in Andhra Pradesh, Karnataka and Telangana were affected by desertification processes respectively, in 2011–2013. Among the desertification processes, vegetal degradation contributes 7.27% of total area in AP, followed by water erosion (4.93%) and waterlogging (0.83%), whereas in Karnataka water erosion (26.29%) is dominant followed by vegetal degradation (8.93%) and salinization (0.45%). Change detection analysis shows that desertification processes of AP and Karnataka have increased by 0.19% and 0.05% respectively, whereas in Telangana it has decreased by about 0.52% from 2003 to 2005 data. The present database will help the scientists, planners and stakeholders to prepare appropriate land reclamation measures to control the increasing trend of desertification.

Integrated assessment of drought vulnerability using indicators for Dhasan basin in Bundelkhand region, Madhya Pradesh, India

Saswat Kumar Kar, T. Thomas, R. M. Singh and Lokesh Patel

Keywords: Drought characteristics, drought indicators, drought vulnerability.

Abstract

Department of Farm Engineering, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi 221 005, India 2 Ganga Plains South Regional Centre, National Institute of Hydrology, Bhopal 462 016, India The present study has integrated both spatially and temporally varying drought vulnerability factors to develop an integrated drought vulnerability map for Dhasan basin. A drought vulnerability index is used to classify the study area into different vulnerability zones. From the drought vulnerability assessment for the study area during July 2002, it was observed that the northeast, northwest and extreme southern part of the basin (20% area) was under critical vulnerability condition whereas the southwest and central part of the basin (79.9% area) was under high vulnerability condition. The critical drought vulnerability condition existed in Dhamoni, Pidarua, Sagar, Patharia Hat, Chhapri, Baroda Sagar and Singtoni region, whereas high vulnerability condition existed in the remaining parts of the study area. The integrated drought vulnerability approach gives superior result for drought assessment as compared to vulnerability assessment by considering the individual factors for the study area.

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Response of fast ice to ground penetrating radar and backscattering coefficient from scatterometer in Larsemann Hills, East Antarctica Rajashree

Vinod Bothale, S. Anoop, Manne Gopaiiah and Mehanaz Sherief

Keywords: Antarctica, ASCAT, fast ice, GPR, Larsemann Hills.

Abstract

The study presents inter-annual variations in the backscatter response of fast ice (sea ice attached to the coast) to C band Advanced Scatterometer (ASCAT) (2012–2016). It also analyses the Ground Penetrating Radar (GPR) observations collected during the 35th Indian Scientific Expedition to Antarctica (ISEA, 2015–16) for identification of different fast ice features and to measure fast ice depth in the Larsemann Hills area, East Antarctica. Apart from clear demarcation of features like melt water channels, frozen icebergs within fast ice and underlying topography near island, GPR provided fast ice depth information, which was used to understand backscatter response. The seasonal variations of C band backscatter were caused due to changes in snow thickness, time of freezing and sporadic melt/freeze events apart from summer melt. The backscatter response to NOAA high resolution blended daily sea surface temperature (SST) variations indicate that sudden rise/fall in backscatter during winter is probably due to sporadic melt/freeze events caused by rise/fall in SST. The results show volumetric contribution from sheet ice and domination of snow metamorphism towards increase in backscatter over fast ice. This study highlights the importance of monitoring backscatter response of fast ice to determine its state and condition. Depending on the characteristics of backscatter inter-annual curve, information about time of freeze up, melt season, ice build-up, and sporadic freeze/ thaw events can be inferred which play an important role in the energy budget of Antarctica.

A damage constitutive model for the intermittent cracked rock mass under the planar complicated stress condition

Hongyan Liu and Fengjin Zhu

Keywords: Damage, intermittent cracked rock mass, planar complicated stress condition, stress intensity factor, strain energy density criterion.

Abstract

The calculation of rock mass damage induced by the intermittent crack is the premise for establishment of the rock mass damage constitutive model (DCM). However, there are two shortcomings in the previous calculation methods of the rock mass damage: (a) it only considers the crack geometry or strength parameters, and does not consider its deformation parameter such as normal and shear stiffness; and (b) the influence of loading condition of the rock mass is not considered. This study focuses on intermittent cracked rock mass under the planar complicated stress condition and calculates its damage tensor. The proposed calculation method of rock mass damage considers the crack parameter such as length, dip angle, internal friction angle, normal and shear stiffness (internal factor) as well as the loading condition (external factor). The corresponding DCM for the intermittent cracked rock mass is then set up. The calculation examples validate that the proposed model can reflect the influence of crack parameter and loading condition on the rock mass mechanical behaviour.

Science and engineering research in India (1985–2016): insights from two scientometric databases

B. Jaya Kumar and Rahul Pandit

Keywords: Data structure, h-index, India, research performance, scientometry.

Abstract

We furnish scientometric data, for science and engineering, of research organizations in India, extracted principally from the Web of Science™ (WoS) database via their InCites™ tool. We classify the data into different granularity levels and address problems in their reliable extraction from publication metadata. We accumulate scientometric measures such as the numbers of publications, citations, and the h-index for the period 1985–2016. We use them to compare research performance in science and engineering, (a) across countries, very briefly, and (b) among Indian research organizations, for which we refine the data to carry out subject-level comparisons. A brief comparison with data from Scopus® and SciVal© is also included.

Collaborative characteristics and networks of national, institutional and individual contributors using highly cited articles in environmental engineering in Science Citation Index Expanded

Hui-Zhen Fu and Yuh-Shan Ho

Keywords: Collaboration, co-authorship, environmental engineering, highly cited articles, Y-index.

Abstract

Collaboration has strongly intensified recently and its characteristics are attractive and multidimensional. This study explored the trends, characteristics and citation impact of collaboration as well as collaboration networks for the macrolevel of country, the mesolevel of institution and the microlevel of author, using highly cited articles in environmental engineering (EE) category of the Science Citation Index Expanded. A data visualization and manipulation software, Gephi 0.9.1 was used to visualize the relationships of collaboration among authors, institutions and countries. Although collaboration in general is known to be beneficial in many research areas, collaboration is not beneficial for highly cited research in the EE field. Single author, single country and single institution articles were more visible than articles involving international collaboration,

interinstitutional collaboration and individual collaboration. There were certain group collaborations, which played an important role in publishing highly cited articles in the EE field.

Updating India's National Biodiversity Action Plan: the process and way forward

Malvika Onial, Biba Jasmine, Yashaswi Singh, Anant Pande, Chinnasamy Ramesh, Kuppusamy Sivakumar and Vinod. B. Mathur

Keywords: Aichi Biodiversity Targets, biodiversity conservation, convention on biological diversity, National Biodiversity Strategy and Action Plan, National Biodiversity Targets.

Abstract

The National Biodiversity Strategy and Action Plan is the primary tool for implementation of the Convention on Biological Diversity (CBD) at the country level. A National Biodiversity Action Plan (NBAP) was prepared for India in 2008, through an inter-ministerial consultative process. Five years later, it was considered necessary to align the existing NBAP in accordance with the Strategic Plan for Biodiversity 2011–2020 and the Aichi Biodiversity Targets (ABTs). This was achieved by formulating India's National Biodiversity Targets (NBTs) and developing a monitoring framework using indicators, and through an evaluation of funding support for biodiversity conservation in India. The draft document was prepared and reviewed through a series of national stakeholder consultations and technical review meetings, based on which the 'National Biodiversity Action Plan: Addendum 2014 to NBAP 2008' was finalized. As part of its commitments to the CBD to accomplish the global ABTs, India must ensure effective implementation of the NBAP and meet the NBTs. This requires cooperation amongst all stakeholders including the relevant federal ministries and state level agencies along with a rigorous and time-bound application of the monitoring framework.

Electrode materials for supercapacitors synthesized by sol–gel process

Sunetra Dhere

Keywords: Specific capacitance, sol–gel process, supercapacitor materials.

Abstract

This review article on synthesis of various carbonaceous and transition metal oxide based supercapacitor electrode materials and their electrochemical performance shows that though a potential method, the sol–gel process needs to be extensively explored and practiced on a large extent. The carbonaceous materials possess high electrochemical stabilities but they demonstrate lower capacitance compared to the ruthenium-based materials. Overall excellence in electrochemical behaviour was exhibited by a binary metal oxide NiCoO₄ in thin film form with a value of 2157 F/g.

Plant diversity in cities: call for assessment and conservation

Ashutosh Kumar Singh, Hema Singh and J. S. Singh

Keywords: Benefits and cost of city trees, non-native species, plant diversity, urbanization.

Abstract

Urbanization destroys natural habitats, displaces native ecosystems and results in regional extinction of native species. Urbanization is also argued to cause homogenization during which native species are replaced with non-native species. Negative impact of urbanization on ecosystems and biodiversity is usually focused upon while the fact that high levels of biodiversity may flourish inside cities are frequently ignored. Cities comprise a mixture of remnants of the pre-existing urban habitats and new urban habitats. The remaining fragments of natural landscapes, and other vegetation areas constitute the green infrastructure supporting the biological diversity of cities. Several biotopes such as lawns, hedges, parklands and street trees occur in the cities. In the cities ambient temperatures are higher than those of the surrounding rural areas, exhibiting the phenomenon of urban heat island. Urban

vegetation experiences longer growing seasons and exhibits earlier greening than vegetation in the surrounding rural areas. Trees comprise the natural capital assets for cities as they provide immense benefits and ecosystem services for the wellbeing of city dwellers, although there are some disservices also. Studies on urban vegetation are very few in the tropics and particularly in India. In this article we review several aspects of plant diversity in cities in order to sensitize scientists, city managers and lay public to the need for more research on socioeconomic benefits and costs of city vegetation and to augment the vegetation within cities through conservation.

Comparison of bioinspired computation and optimization techniques

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

Keywords: Bioinspired computing, combinatorial optimization, computational complexity, evolutionary algorithms.

Abstract

In this article we focus on the bioinspired algorithms and their computational classification. The basic ideas and various techniques developed recently are described. The research outcomes in the computational area of solution optimization are presented for different problems, i.e. mathematical, combinatorial, exact approximation and multiple objective optimization. Moreover, evolutionary, stochastic and swarm optimization algorithms are discussed. All these areas have principles of extracting natural concepts in the form of mathematics and algorithms. Nature-inspired algorithms can help explore new dimensions to solve many problems with optimal cost and time. This review shows that bioinspired computing can provide innovative optimal computational algorithms.

An optimal algorithm based on kinetic-molecular theory with artificial memory to solving economic dispatch problem

Chaodong Fan, Jie Li, Lingzhi Yi, Leyi Xiao, Biaoming Zhu and Ke Ren

Keywords: Artificial memory, benchmark function, economic dispatch, KMTOA.

Abstract

Economic dispatch (ED) problem exhibits highly nonlinear characteristics, such as prohibited operating zone, ramp rate limits and non-smooth property. Due to its nonlinear characteristics, it is hard to achieve the expected solution by classical methods. To overcome the challenging difficulty, an improved optimization algorithm based on kinetic-molecular theory (KMTOA) was proposed to solve the ED problem in this article. Memory principle is employed into the improved algorithm. By accepting strengthened or weakened stimulus strength, the memory is divided into four states; instant-term, short-term, long-term and forgotten states to update the memory value iteratively. In this way, more and more elites appear in the long-term memory library. Simultaneously, the improved KMTOA, according to the elite population-based guide on the other population, enhances the search ability and avoids the premature convergence which usually suffered in traditional KMTOA. The designs are able to enhance the performance of KMTOA, which has been demonstrated on 12 benchmark functions. To validate the proposed algorithm, we also use three different systems to demonstrate its efficiency and feasibility in solving the ED problem. The experimental results show that the improved KMTOA can achieve higher quality solutions in ED problems.

Experimental study on the hydraulic fracture propagation in shale

Shuai Heng, Chunhe Yang, Lei Wang and J. J. K. Daemen

Keywords: Fracture propagation, fracture network, hydraulic fracturing, shale, stimulated reservoir volume.

Abstract

To realize the control on geometry of fracture network and improve the individual well production of shale gas reservoirs, hydraulic fracturing simulation tests of shale outcrops for horizontal well were carried out. This was based on an established true triaxial hydraulic fracturing simulation test system, to analyse the propagation and formation of a complex fracture network. The results show that the typical severe fluctuation of pump pressure during extension, is an obvious feature of hydraulic fracturing by Stimulated Reservoir Volume (SRV). Due to the large size and abundant natural fractures in shale specimens, the acoustic emission (AE) energy is weak during propagation of hydraulic fractures. However, fracture propagation can still be effectively determined to some extent, although relatively few AE events are detected. Hydraulic fractures from horizontal well initiate approximately along the maximal in situ stress. But the fractures gradually deviate from the orientation when extending. Branching, re-orientation or penetrating bedding planes and then interconnecting with natural fractures or weak beddings are the main mechanisms of the formation of complicated fracture networks.

Microwave-assisted synthesis and characterization of oxime derivative of substituted chalcone and its nickel(II) complex

Kusum Lata Dangwal and A. R. Semwal

Keywords: Antibacterial activity, chalcone oxime, metal complex, mole ratio.

Abstract

In this study, microwave-assisted green synthesis of a complex of Ni (II)-2',4'-dihydroxy 4-fluoro chalcone oxime has been carried out. The structure of the complex was characterized by elemental analysis, molar conductance, magnetic moment, IR, ¹H-NMR, ¹³CNMR spectroscopic data and thermal studies. IR data showed that Ni(II) is coordinated to the ligand through the phenolic-O and azomethine-N of the latter. TGA studies confirmed the presence of coordinated water molecules. The 1 : 2 metal to ligands stoichiometry was indicated by mole ratio method, which was further confirmed by Job's method of continuous variation modified by Turner and Anderson. Stability constant (K_s) of the complex determined by mole ratio method was 8.5245. Standard free energy change (ΔG^0) for metal–ligand complex formation was found to be -11.7026 K cal/mol at $27 \pm 2^\circ\text{C}$. On the basis of analytical data, octahedral structure has been proposed for the complex. All compounds were tested for antibacterial activity and showed moderate to good activity against *Escherichia coli* and *Staphylococcus aureus* at different concentrations. In this study, we report synthesis of oxime derivative of chalcone and its Ni(II) complex in the hope of developing new compounds which might be used as analytical reagents or intermediates in the synthesis of various classes of bioactive compounds.

Soil quality and fibrous mineral in black soils of Maharashtra

T. Bhattacharyya, S. K. Ray, P. Chandran, K. Karthikeyan and D. K. Pal

Keywords: Fibrous minerals, palygorskite, black soils, soil quality.

Abstract

There are many reports on soil parameters that have both yield-reducing and yield-favouring potential. However, only a few are available on the index soil properties of fibrous minerals containing soils on crop yields in the semi-arid tropical (SAT) regions. These minerals in soils are

mostly palygorskite and sepiolite. In the present study, only the palygorskite mineral in black soils (cracking clay soils), its formation and probable influence on soil quality is addressed. The present study was also undertaken to indicate a possible genesis of palygorskite in Indian black soils with and without soil modifiers (Ca-zeolites and gypsum) supporting both rainfed and irrigated agriculture in SAT environments. Palygorskite is absent in aridic/gypsic/sodic intergrades of black soils (Haplusterts), which might indicate non-interference of soil modifiers in its formation. Palygorskite is present only in sodic black soils (Calciusterts) in Maharashtra and parts of central and western India that contain no soil modifiers, and are under both rainfed and irrigated agricultural systems. The severe impairment of hydraulic properties of palygorskite containing naturally degraded black soils warrants a new research initiative for soils containing fibrous minerals.

Portfolio mean-variance approach modifications: modulus function, principles of compromise, and 'min-max' approach

Alexey Karpovich¹ and Alexander Rymanov

Keywords: Mean-variance, 'min-max' approach, modern portfolio theory, portfolio selection.

Abstract

We offer a variant for the problem of portfolio selection, based on the modification of quadratic function. It reduces overestimation of expected returns that arise from large deviations of the market condition. Further, we examine the modified 'min-max' approach to portfolio structure. We obtain analytical expressions to solve the portfolio selection model for a few cases. Finally, we offer certain compromise principles between criterial values of the expected return/risk.

Molecular interaction studies of phosphatidylcholine as drug delivery substrate for asenapine maleate

A. Harani¹, J. VijayaRatnam, B. Dipankar, D. Sathis Kumar, M. Bhagya Lalitha and S. P. N. Kumar

Keywords: Asenapine, binding docking energy, maleate, phosphatidylcholine.

Abstract

Phospholipid complexes have become promising delivery systems for delivery of drugs with poor bioavailability like asenapine maleate. To improve the bioavailability of asenapine maleate, phospholipid complex was chosen for the drug with Phospholipon 90 G (phosphatidylcholine). The automated molecular docking calculation for asenapine and maleate individually with phospholipid was performed by AutoGrid 4.2.6, a docking program. The van der Waals hydrogen bond, electrostatic potential energy and desolvation free energy grid maps were calculated by AutoDock parameter set- and distance-dependent dielectric functions respectively. The change in free energy was specifically seen for the complex between asenapine and phospholipid which exhibited least binding docking energy of -3.86 kcal/mol among the summary of 25 poses. Finally, molecular docking studies confirmed that the asenapine is able to make a complex with phosphatidylcholine, plausibly on account of its structural similarity with phospholipid in its physiochemical properties.

Optimization of factors affecting decolourization of sulphonated azo dye Red HE7B in vitro by Bacillus sp. Azo

Jyoti Kumar Thakur, Sangeeta Paul, Nishant K. Sinha and Maheshwar Singh Rathi

Keywords: Azo dye, Bacillus sp., co-substrate, decolourization.

Abstract

Azo dyes are widely used organic molecules that are generally recalcitrant to biodegradation, thus causing environmental pollution. In this study, the effect of various growth conditions like temperature, pH, dye concentration, aeration and presence/absence of co-substrate on decolourization

of azo dye Red HE7B by *Bacillus* sp. Azo1 has been determined. Decolourization of the dye was achieved under static condition. Optimum decolourization of Red HE7B was observed at 30°C and 50 mg/l dye concentration, where more than 90% decolourization was achieved within three days of inoculation. *Bacillus* sp. Azo1 could decolourize the dye through a range of pH values from 6 to 9. Presence of co-substrate limited the decolourization with glucose being the most potential inhibitor. Identification of factors influencing decolourization will help in rapid removal of these pollutants from contaminated habitat.

Forest cover monitoring and prediction in a Lesser Himalayan elephant landscape

S. P. S. Kushwaha, S. Nandy, M. A. Shah, R. Agarwal and S. Mukhopadhyay

Keywords: Change detection, deforestation, elephant landscape, North East India, satellite images.

Abstract

We have monitored the forest cover depletion in parts of Assam and Arunachal Pradesh over an area of 42,375 km² in an elephant landscape falling in the Lesser Himalaya, North East India and report the results here. The US Army topographic maps (1924) and multi-date satellite images (1975, 1990, 2000 and 2009) were visually interpreted on-screen for post-classification comparison and forest cover change detection. The exercise showed continuous high loss of forest cover during the study period. A land area having 17,846.27 km² forest in 1924 was depleted to 12,514.56 km² by 1975, 11,861.75 km² by 1990, 10,808.92 km² by 2000 and 10,256.58 km² by 2009, thereby indicating a constant decrease in forest cover by 12.59%, 1.54%, 2.48% and 1.31% respectively. The total loss in forest cover was estimated to be about 7590 km² from 1924 to 2009. The Cellular Automata Markov Model has predicted a further likely decrease of 9007.14 km² by 2028. In general, more districts of Assam than Arunachal Pradesh and more plains than hills faced deforestation. We have identified increasing human population and subsequent demand on the land for cultivation as major reasons for forest cover depletion.

Bt-cotton–vegetable-based intercropping systems as influenced by crop establishment method and planting geometry of Bt-cotton in Indo-Gangetic plains region

Sudhir K. Rajpoot, D. S. Rana and Anil K. Choudhary

Keywords: Bt-cotton, crop establishment methods, intercropping systems, planting geometry, vegetable cowpea.

Abstract

The present study was conducted at ICAR-Indian Agricultural Research Institute, New Delhi in a splitplot design replicated thrice with four main-plot treatments, i.e. four combinations of two cotton establishment methods (CEMs) and two planting geometries (PGMs) [M1 – transplanted cotton (90 × 60 cm PGM); M2 – transplanted cotton (120 × 45 cm PGM); M3 – direct seeded cotton (DSC; 90 × 60 cm PGM); M4 – DSC (120 × 45 cm PGM)]; while sub-plot treatments comprised three intercropping systems [S-Ct – sole cotton; Ct + Ok – cotton + okra (1 : 2 row ratio); Ct + Cp – cotton + cowpea (vegetable purpose; 1 : 2 row ratio)]. It can be inferred from the study that transplanted cotton (TPC) with 90 × 60 cm planting geometry in Bt-cotton + vegetable cowpea intercropping system exhibited maximum seed-cotton equivalent yield (SCEY) as well as gross and net returns and other economic indices, followed by Ct + Ok and sole cotton. DSC with 90 × 60 cm PGM in Ct + Ok intercropping system proved superior in terms of SCEY, and gross and net returns besides other economic indices. Based upon yield advantage indices, TPC in 90 × 60 cm PGM under Ct+Cp intercropping system and DSC in 90 × 60 cm PGM under both intercrops were found to be the best options. Crop competition indices also revealed that the inclusion of these intercrops is advantageous because of spatial and temporal complementarity, different rooting pattern and plant architecture to

utilize natural resources more efficiently in Bt-cotton-based intercropping systems in the semiarid Indo-Gangetic plains region.

Changes in water stability of soil aggregates in a solar greenhouse in different planted years and their relationship to iron oxide

Yin Yan, Pei Zhong-Jian, Xi Feng-Ming, Liang Cheng-Hua, Wang Jiao-Yue and Bing Long-Fei

Keywords: Iron oxide, soil aggregate, soil cementation process, solar greenhouse, water stability.

Abstract

The distribution and stability of soil aggregates and its relation to iron oxide during different plantation years are studied in a solar greenhouse. Soil samples were obtained from a vegetable bed within a greenhouse in Xinmin (Liaoning, China). The composition, water stability and percentage of aggregate destruction, as well as variations in different forms of iron oxides were evaluated at 5 time points (0, 2, 5, 8 and 16 years). Soil from a dry land in an open field was also collected for comparison. The quantity and water stability of >0.25 mm soil aggregates from 2 and 5 years were lower than those in the soil from the open field. These parameters significantly increased after five years. The contents of non-free iron oxides decreased under greenhouse cultivation, resulting in reduced aggregate stability. Free iron oxides were positively associated with >2 mm aggregates. Complex iron oxides were positively correlated with 2–0.25 mm and 0.25–0.053 mm aggregates but negatively correlated.

Toxic aqueous discharge of iron and sulphur from spoiled coal mined lands and its control by phytostabilization process

A. K. Singh

Keywords: Acid mine drainage, coal mining, northeastern India, phytostabilization.

Abstract

Toxic aqueous discharge of iron and sulphur due to acid mine drainage causes soil and water pollution. Many countries with unoperating as well as functional mining industries face this problem. In north-eastern India, coal mining has severely degraded much of the agricultural land by impairing soil, plant diversity and water quality. A study was conducted in coal mined out area of Jaintia hills, Meghalaya (northeastern India) to eliminate toxic aqueous discharge (iron and sulphur) and restore the soil fertility of affected land for sustainable crop production. The treatment of acid mine drainage through phytostabilization and soil amendment with agricultural lime and organic manures reduced sulphate from 22 to 5 mg kg⁻¹ and soluble iron from 476 to 109 mg kg⁻¹ of surface soil. The soil pH increased by 1.4 unit from its initial value and concentration of plant nutrients like N, P, K and microbial biomass content reached optimum fertility levels. Soluble iron and sulphate in drainage water reduced considerably by 26% and 49% respectively, with concurrent increases in water pH (3.2 to 7.2). Rice grain yield in the mined out area reached about 1320 kg ha⁻¹ after reclamation as compared 1920 kg ha⁻¹ in non-mined area. The adaptation of native plant species (*Citrus reticulata*, *Prunus napolensis* and *Pyrus communis*) was about 70%. Afforestation with native fruit plant species and ferns/ grasses, soil amendment using lime and organic manure, and channelling of seepage water for checking acid mine drainage contamination of water bodies and crop fields were some of the measures that were effective in mitigating toxicity. Phytostabilization helped in reversing the trend and restoring soil fertility and plant growth due to a rise in soil organic matter, nutrient availability as well as biological activities.

Diversity and conservation status of mangrove communities in two areas of Mesocaribia biogeographic region

Ana Cano Ortiz¹ , Carmelo M. Musarella, José C. Piñar Fuentes¹ , Carlos J. Pinto Gomes³ , Sara Del Río González⁴ and Eusebio Cano

Keywords: Biogeographic region, diversity and conservation, mangroves, phytosociology.

Abstract

The study of mangrove communities (*Avicennia germinans*, *Conocarpus erectus*, *Laguncularia racemosa* and *Rhizophora mangle*) in Central America reveals a total diversity of 121 species included in 7 plant communities, of which 15 are characteristic of mangroves and 31 of flooded areas with less pronounced salinity, while 75 are invasive species belonging to neighbouring communities. Frequent fires in the dry forest have caused intense erosion, leading to the silting of the lake basin. As a result, the first belt of *Rhizophora* vegetation is extremely rare. In contrast, there is a predominance of *Laguncularia* and *Conocarpus* mangrove plants, in addition to a belt of *Phragmites australis* with a high incidence of *Phragmites australis*, which acts as an indicator of sediment silting due to its shallowness.

Development of a model for detection of saline blanks amongst mangrove species on hyperspectral image data

Somdatta Chakravorty and Dipanwita Ghosh

Keywords: Saline blanks, hyperspectral data, mangroves, derivative analysis.

Abstract

In this study we apply hyperspectral imagery to identify saline blank patterns within the mixed mangrove forest of Sunderban Bio-geographic Province, West Bengal, India. We use derivative analysis to identify hyperspectral wavelengths that are sensitive to the presence of minerals comprising saline blanks. These wavelengths have been considered for development of a novel saline blank identification model. The wavelength showing derivative value with maximum absorption in the SWIR region at 1780 nm and maximum reflection in the red region at 690 nm has been extracted for development of saline blank index. This index has been compared with the existing salinity indices and a detailed analysis has been carried out. It is found that the index outperforms existing salinity indices – normalized differential salinity index and salinity index, and accurately detects the saline blank areas of Henry Island of the Sunderbans Delta. The accuracy of pixels identified as saline blank pixels has been assessed by comparing the overall accuracy with other existing indices. Physical sampling has also been carried out and the salinity results have been compared with the image-derived results.

Contrasting observation in culturable aerobic and micro-aerophilic heterotrophic fish gut-bacteria: intestine-breathing *Lepidocephalichthys guntea* (Hamilton Buchannan) versus gill-breathing *Labeo rohita*

Rudra Prasad Roy, Tilak Saha and Ranadhir Chakraborty

Keywords: Dissolved oxygen, gut bacteria, *Labeo rohita*, *Lepidocephalichthys guntea*.

Abstract

Lepidocephalichthys guntea exhibits exceptional adaptive characters and can survive in flowing or stagnant waters as well as muddy hypercarbic condition resembling a desiccating habitat. This study was conducted to relate aerophilic (both aerobic and microaerophilic) bacterial density in the gut of *L. guntea* with dissolved oxygen (DO₂) content. Aerophilic bacterial density in the gut of *L. guntea* was found independent of DO₂ content, as the air pocket(s) present in the gut balances the deficit of oxygen obtained through gill respiration. This phenomenon was found to be reversed in gill-breathing

fish like *Labeo rohita* because the additional mechanism to breathe air via gut is absent. The density of both the categories of culturable aerophilic bacteria was found to be significantly reduced in the gut of *L. rohita* gut in low DO₂ condition of its habitat.

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Bringing a women's perspective to family planning

Sunita Sangar

Keywords: Family planning, maternal and child health, male involvement, women's perspective.

Abstract

The National Family Planning Programme (FPP) was promoted to restrict the increasing population by reducing the high birth rates in India. It was also encouraged for its potential to reduce poverty, hunger and avert maternal and childhood deaths. Several studies have found a positive association between women empowerment and lower fertility, longer birth intervals and lower rates of unintended pregnancy. Family planning (FP) services gave a sense of autonomy to women to decide when to have children and how many. However, the available services were so womencentric that it puts the burden of FP almost entirely on them, whether it was in the use of contraceptive methods, sterilization or abortions. Despite half a century of efforts to reduce population growth, India still faces challenges in delivering a FPP to help couples delay and space out their children that goes beyond female sterilization. Sharing of FP responsibilities by men during these years has been dismal. The burden of FP also seems to have a negative impact on the economic empowerment of women. This article examines the FPP in India through a women's perspective. It uses empirical evidence to show how burden of FP is mainly borne by women. It recommends shifting the focus on men and making FP a shared responsibility between men and women, if gender equality has to be achieved in FPPs.

Research productivity and international collaboration of top Indonesian universities

Ahmad Darmadji, Lantip Diat Prasojo, Fitri Ayu Kusumaningrum and Yuli Andriansyah

Keywords: Bibliometric assessment, international collaboration, research productivity, top universities.

Abstract

This article analyses research productivity and international collaboration of top Indonesian universities. The data were collected from Scopus with regard to number of documents, authors, affiliation and country partners in research. The top ten Indonesian universities were then chosen for analysis. The results suggest that top universities in Indonesia published articles in peerreviewed journals earlier too, but showed slow progress before 2000. After 2010 the number of documents increased significantly, especially among the three largest Indonesian universities, i.e. Bandung Institute of Technology, University of Indonesia and Gadjah Mada University. These universities also showed higher productivity of their authors. The top Indonesian universities collaborated with universities in developed countries such as Japan, the United States, The Netherlands, Australia and Germany. There was collaboration with neighbouring countries in Southeast Asia, mainly with Malaysia, Thailand and Singapore. Based on these findings, this article suggests some insights to improve the quantity and quality of publications from Indonesian universities.

Geological and geotechnical approach for excavation of large unlined rock cavern

D. Singh, A. Mandal, A. Usmani and A. Nanda

Keywords: Geotechnical and geological investigations, cavern, tunnelling, underground excavations, rock.

Abstract

The degree of uncertainty involved in an underground storage project is relatively higher compared to other underground projects. In order to allow for a safe and economical construction of underground rock caverns, continuous updating of the geological and geotechnical model along with adjustment in construction approach is required. Investigations planned during different stages of excavation of the project assist in the identification of various geological features and ground characteristics to ensure robust design of underground structures. Investigation in each stage of the project is planned in line with the time and money available at that stage, along with level of detailing required for different design stages. In order to develop an efficient investigation scheme, it is necessary to assimilate the existing information from one stage before planning for the next stage of investigations. This article highlights the significance of various investigations carried out for one of the strategic storage site in the southern part of India.

Site-specific land resource inventory for scientific planning of Sujala watersheds in Karnataka

Rajendra Hegde, K. V. Niranjana, S. Srinivas, B. A. Danorkar and S. K. Singh

Keywords: Digital library, land resource inventory, land resources portal, land resource database analysis and interpretation, Sujala-III project.

Abstract

Land resource inventory for site-specific planning and development of watersheds on scientific basis under Sujala-III project sponsored by the Watershed Development Department of Karnataka and funded by the World Bank is being implemented in 11 districts covering 9.66 lakh ha across 2531 microwatersheds benefiting 7.02 lakh households in the state. The analysis and interpretation of the spatial and non-spatial database generated so far in 1600 microwatersheds covering 5 lakh ha has revealed that most of the watersheds suffer from major problems. In many watersheds, soil erosion and alkalinity affected even up to 75% of the watershed area, thus reducing the production potential and crop choices. The soils are either moderately or highly suited for growing most of the agricultural and horticultural crops. By interfacing land resource data with RS, GIS and GPS, different management scenarios were analysed to arrive at the best management alternatives (optimum land use plans) that would be most suitable. This data handling system will be useful for making land use decisions and providing proactive advice to farmers on a real time basis protecting the health of natural resources.

Quantum dots for solar energy harvesting

Karen Das and Sunandan Baruah

Keywords: Light harvesting, multiple exciton generation, quantum dots, solar cells, tunable band gap.

Abstract

Owing to their versatile optical and electrical properties, semiconductor quantum dots are attracting attention as a material of choice for solar energy conversion. The quantum dot sensitized solar cells are considered as one of the most promising next generation solar cells as they have the advantage of tunable band-gap energy and multiple exciton generation. We present here a study on quantum dot sensitized solar cells considering their construction and working, impact of incorporation of nanomaterials in solar cells and various structures for improving the performance of solar cells.

ESAT-6 Independent survival and virulence: need for paradigm shift? Raj Kumar Gour,

Shikha Nag and Krishnasastry Musti

Keywords: ESAT-6 secretion, Mycobacterium tuberculosis, virulence, survivability.

Abstract

Tuberculosis is a major health concern that has received lot of attention from researchers across the world. The virulent form of tuberculosis is caused by Mycobacterium tuberculosis (M. tb), a highly evolved, slow-growing, facultative pathogen. In the literature, the major suspected pathway responsible for its virulence is the Esx-1 secretion system owing to the properties attributed by ESAT-6 secretion. By arguing through literature instances that support ESAT-6 secretion independent virulence, this review not only questions ESAT-6 secretion as a sole readout to virulence, but also, suggests survivability as a likely separable property from virulence in mycobacterium, ultimately trying to create a tiny breach to the existing paradigm of thinking in mycobacterial pathogenesis in relation to ESAT-6 secretion.

Modelling finite and infinite behaviour of cancer stages using Büchi and finite automata

Natasha Singh and Ajay Kumar

Keywords: Büchi automaton, cancer progression, cell division, doubling, replication.

Abstract

Cancer is an incurable disease in which abnormal cells multiply uncontrollably and infect the surrounding tissues and organs of the body. A Büchi automaton is a finite automaton that operates on infinite input words. This article presents normal cell division and cancer progression using the finite automata and Büchi automaton respectively. It will help in understanding the intricacies of cancer, and can ultimately benefit in designing an effective treatment that can slow down the progression of cancer.

Low-high temperature flue gas direct injection in south African bituminous and anthracite coals: sorption capacity assessment

Major Mabuza, Kasturie Premlall, Maurice Onyango and Michael O. Daramola

Keywords: Carbon dioxide, coal, flue gas, preferential sorption, sorption capacity.

Abstract

Numerous studies have been carried out recently on the sequestration of carbon dioxide (CO₂), a greenhouse gas, produced due to human activities. Consequently, storage of CO₂ in storage sites, such as unmineable coal seams, has been identified as one of the promising options with the advantage of recovering coal-bed methane (CH₄). However, CO₂ injected into coal seams contains additional gases that may reduce storage capacity, cause changes in sorption behaviour and physicochemical properties of coal. This research was aimed at investigating the sorption behaviour of three South African coals (sorbents) upon pure CO₂ and flue gas (sorbates) sorption. Measurements were conducted on 10 g samples with a grain size <2 mm. A synthetic industrial flue gas containing 12% CO₂, 5.5% O₂, 82% N₂, 0.38% SO₂ and 0.12% NO₂ was used in the study. Sorption isotherms were measured at a temperature ranging from 30 to 60°C and pressures up to 9 MPa using a high-pressure CO₂ volumetric adsorption system (HPCVAS). Sorption of CO₂ by coal was highly reduced in the presence of additional gases due to competition for sorption sites. The reduction in CO₂ (in flue gas) sorption capacity of coal was up to 63% compared to sorption of pure CO₂.

Fluorosis is linked to anaemia

Andezhath K. Susheela, Nisith Kumar Mondal, Rashmi Gupta, Mohini Sethi and Ravindra Mohan Pandey

Keywords: Anaemia, fluoride toxicity, school children, treatment procedure.

Abstract

We report here a simple, easy-to-practice treatment procedure for anaemia, by focusing on withdrawal of fluoride consumption and promotion of nutrients through diet. The approach to improve nutrient intake as supplementation of iron and folic acid or iron tonic does not yield beneficial results. The reason being highly destructive F⁻ enters the body through food, water, habit forming substances and dental products destroys the lining of the intestine and prevents absorption of nutrients. Testing of Hb, F⁻ in urine, drinking water and body mass index are necessary to assess the problem. The study was made on 2420 adolescent students from 6 schools in Delhi. F⁻ removal through diet editing and improved nutrients through counselling without prescription of drugs led to correction of anaemia. This treatment procedure is beneficial to pregnant and lactating mothers and patients in hospital OPDs due to ill health issues aggravated due to low Hb/anaemia.

Genomic variation mapping and detection of novel genes based on genome-wide survey of an elite upland cotton hybrid (*Gossypium hirsutum* L.)

Zhenyu Wang, Wei Li, Guanghui Xiao, Xiaojian Zhou, Xiaoyu Pei, Yangai Liu, Kehai Zhou, Kunlun He, Junfang Liu, Ying Li, Wensheng Zhang, Zhongying Ren, Qingqin Meng, Haifeng Wang, Xiongfeng Ma and Daigang Yang

Keywords: Cotton hybrid, genomic variation map, mutational hotspots, novel genes.

Abstract

CCRI63, with the largest cultivated area among hybrids in China, is a successful promotion of elite upland cotton (*Gossypium hirsutum* L.) hybrid cultivar. We have constructed a detailed genomic variation map of CCRI63 by aligning whole-genome shotgun sequencing reads from CCRI63 to the TM-1 reference genome. Genomic single nucleotide polymorphism (SNP) and insertion-deletion (Indel) mutational hotspots were identified, most of which were located on chromosome D02, and associated with disease resistance and lipid glycosylation and modification. The density of heterozygous SNP sites showed 73 quantitative trait loci overlapped with peak intervals of high-density heterozygous SNPs, suggesting that the heterozygous sites in the peak are important for improvement of CCRI63 yield and fibre quality. To avoid loss of genetic components, unmapped reads were used for de novo assembly of the missing regions in the reference genome, and 153 novel functional genes were obtained. The large-scale genetic variation and novel functional genes identified in the CCRI63 genome can facilitate future gene-phenotype studies and provide an additional resource for the improvement of cotton.

Estimation of elastic parameters, mineralogy and pore characteristics of Gondwana shale in Eastern India for evaluation of shale gas potential

Piyush Sarkar, Kumar Hemant Singh, Ranjana Ghosh and Trilok Nath Singh

Keywords: Gondwana shale, SEM, shale gas, ultrasonic, XRD.

Abstract

Studies on resource potential of unconventional reservoirs are drawing the attention of scientific community since the last couple of decades. Because of low permeability of shale, the production demands hydraulic fracturing in shale layers. Brittleness index gives an idea on the toughness of shale layers and helps in setting the parameters for hydraulic fracturing. Elastic properties such as Young's modulus are important parameters for building geo-mechanical models for rock strata which are

essential for several applications related to mechanical rock failure during well drilling, completion and stimulation. The physical and geochemical properties of Gondwana shale samples from Eastern India were analysed for mineralogy, pore types and dynamic elastic properties using powder X-ray diffraction (XRD), scan electron microscopy (SEM) and ultrasonic velocity measurements respectively. The measured P- and S-wave velocities and the estimated elastic parameters of Gondwana shale samples show an increase in magnitude with depth indicating the effect of hardness and compaction. The effect of hardness on velocity and elastic parameter is also supported by the increase in quartz percentage in shale with depth. An empirical relationship between P- and S-wave velocity is proposed for Gondwana shale. The XRD experiments reveal the dominance of clay minerals over non-clay minerals in the samples lower the shear strength of SouthKaranpura field, at shallow depth, supported by measured elastic properties. The presence of flaky clay texture/topography and abundant micro ($>0.75 \mu\text{m}$) and nano pores of various shapes in the samples with organic matter in the SEM images suggests that formations are of high shale gas prospecting zones.

Assessing water footprints and virtual water flows in Gomti river basin of India

Santosh S. Mali, D. K. Singh, A. Sarangi and S. S. Parihar

Keywords: Economic water productivity, river basin, virtual water flow, water footprint.

Abstract

This article analyses the blue, green and grey water footprints and virtual water flows within the Gomti river basin (GRB) in India. Assessments were made at spatial resolution of agricultural production units (APUs). An APU is a homogeneous spatial unit delineated on the basis of soil type, agro-ecological region and district boundaries. Water footprints of crop production and consumption were compared to arrive at virtual water balance within the GRB. Results show that water footprint of GRB was 12,773 million $\text{m}^3 \text{ year}^{-1}$. Crop production was the largest water consumer accounting for 95.5% of water footprint within the basin. The higher proportion of blue water footprint (47.3%) indicates the dependence of GRB on irrigated agriculture. Contribution of rainfed agriculture to total water footprint was about 11.2%. Considerable portion of blue water is used in the production of low value water-intensive crops. The GRB was assessed as a net virtual water importer, indicating its dependence on the water resources of other river basins; it imports 2945 million m^3 virtual water annually. This scenario can be changed if the area allocated to different water-intensive crops is optimized and limited to the extent that meets the consumption needs within the basin, leading to reduction in production surplus of these crops.

Large-scale shoreline undulations and role of self-organization processes

Xiaojing Zhong, Ping Dong and Shenliang Chen

Keywords: Beach, forcing, power-law, seasonal, selfaffinity.

Abstract

This study investigates the large scale spatial variation behaviour of shoreline changes using the beach profile data along approximately 600 km shoreline around Hainan Island, China. It was found that there exists a power-law relationship between the mean shoreline change variance and the corresponding alongshore scale which holds up to 30 km for the annual shoreline change and reduces to 15 km for the seasonal shoreline change. The spatial and seasonal variations of shoreline azimuth, beach sediment size and wave conditions, and their connection with the shoreline change on different scales were studied. The results suggest that the internal feedback mechanisms between various processes with different spatial scales may be responsible for the observed shoreline change patterns, i.e. the annual shoreline behaviour on spatial scale 5–30 km is likely to be the result of

selforganization, while the seasonal waves including tropical cyclones and storms exert dominant control of the morphological patterns at spatial scale of 10–25 km.

Workforce challenges in Indian banking scenario – Journey from identification till mitigation

Neha Chhabra Roy and T. Vishwanathan

Keywords: Factor analysis, Indian banking system, risk mitigation framework, workforce challenges, workforce challenges assessment.

Abstract

The banking industry has been going through rapid transformation due to progressive economic reforms, changing demographics and fast-paced technological developments. Banks in India have been facing multitudinous challenges such as regulatory risks, upgradation of technology, intense competition, workforce challenges and operational risk. Workforce challenge plays a vital role among other challenges. The extant literature review shows that several studies have identified various workforce challenges of banks. However, their impact has not been quantified for effective risk mitigation. Such studies are more observatory than investigational. The present study aims to identify the major workforce challenges of banks through a structured approach that includes literature review, focus group discussion, assimilation of consultancy reports and conducting risk perception survey. The scope of the current study is limited to Indian public and private sector banks. As per literature review, the major workforce challenges identified are lack of required skills, performance management, inadequate recruitment and career planning and increasing staff cost. The workforce challenges are identified using factor analysis and a conceptual model is proposed for mitigation of key challenges.

Optic disc and cup segmentation in fundus retinal images using feature detection and morphological techniques

R. Priyadharsini, A. Beulah and T. Sree Sharmila

Keywords: Feature detection, fundus retinal image, morphological closing, optic disc and cup, segmentation.

Abstract

Segmentation of optic disc and cup from the fundus retinal image helps in the detection of glaucoma which is one of the important causes for vision loss. In this study, we propose a method for optic disc followed by optical cup segmentation. The retinal input image is first preprocessed by applying histogram equalization and the connected components in the image are obtained. On applying the circle detection Hough transform, the circular-shaped optic disc is segmented from the other connected components. The morphological closing operation is applied on the segmented optic disc area to identify the optic cup location. The optic cup is then segmented by applying Otsu's thresholding only on the extracted green channel of the retinal image. The proposed method was evaluated using DRISHTI-GS dataset containing 50 test images. The performance metrics such as dice coefficient, average boundary localization error and cup–disc ratio error were obtained by comparing the proposed method with the ground truth values of 51 training images in the DRISHTI-GS dataset.

A comparative study on biodegradation of chlorpyrifos by wild E. coli and Pseudomonas fluorescens bacterial isolates inhabiting different ecosystems of Kashmir valley

Imtiyaz Murtaza, Bushra, Sageera Showkat, Shah Ubaid-Ullah, Omi Laila, Sumyra Majid, Neyiaz A. Dar, Mukhtar Ahmad and Girish Sharma

Keywords: Bioremediation, chlorpyrifos, E. coli, HPLC, Pseudomonas fluorescens, resistance.

Abstract

Among 1081 naturally occurring wild isolates examined for *E. coli* and *Pseudomonas fluorescens*, EC1 (*E. coli*) from Dal Lake (Srinagar district) and PF1 (*P. fluorescens*) from soil samples of Ganderbal district showed maximum tolerance (11 mg/ml) towards chlorpyrifos. The high performance liquid chromatography (HPLC) based chlorpyrifos (CP) degradation analysis demonstrated that each isolate degraded chlorpyrifos much more efficiently than the reference strain *E. coli* MTCC-533 used in the current study. The present study suggests that EC1 and PF1 bacterial isolates inhabiting different ecosystems, degrade chlorpyrifos efficiently via genetic determinants and OPP enzymatic system and provide strong basis for development of bioremediation strategies in the area.

An improved microscopic method for the rapid diagnosis of emerging microsporidian parasite, *Enterocytozoon hepatopenaei* in shrimp farms

P. Ezhil Praveena, T. Bhuvaneshwari, A. Navaneeth Krishnan, V. Jagadeesan, J. Joseph Sahaya Rajan and K. P. Jithendran

Keywords: *Enterocytozoon hepatopenaei*, microsporidia, trichrome staining, shrimp aquaculture.

Abstract

Penaeus (*Litopenaeus*) *vannamei* shrimp samples (hepatopancreas and faeces) collected from grow-out farms were evaluated for the presence of newly emerged microsporidian parasite *Enterocytozoon hepatopenaei* by concentration techniques using either water–ether sedimentation or Sheather's sugar solution for spore recovery and subsequent microscopic detection by modified trichrome stain (Ryan-blue method). This improved selective staining protocol can easily resolve the identification of microsporidian spores in hepatopancreatic tubules compared to conventional stains. This method enables differential diagnosis of microsporidian spores by a characteristic staining pattern of pinkish-red, often with a belt-like diagonal stripe seen in the middle of the spore and a halo of unstained area at one end which could be easily distinguished from similarly staining particles or debris.

Haematobiochemical parameters of fishes of preferential nutritional habits

Gayatri Acharya, Prafulla K. Mohanty, Sujata Puspamitra, Aryadhara Das and Sarbeswar Nayak

Keywords: Freshwater fish, haematobiochemical parameters, nutritional habit, statistical analysis.

Abstract

This study compares the haematobiochemical parameters of fishes of different food habits, viz. *Labeo rohita* (herbivore), *Channa striatus* (carnivore), *Clarias batrachus* (omnivore) and *Cirrhinus reba* (detritivore). Statistical analyses reveal the significant differences in haematobiochemical parameters like haemoglobin, red blood cell, packed cell volume, mean corpuscular haemoglobin and white blood cells with respect to nutritional habits. The monocytes have been observed to vary significantly at $P < 0.001$ level, mean corpuscular volume deviates at $P < 0.05$, whereas both eosinophils and albumin show significant variation at $P < 0.01$ level. Haematobiochemical parameters have been regarded as a valuable tool for monitoring the health of fish.

Crop productivity and suitability analysis for land-use planning in Himalayan ecosystem of Uttarakhand, India

Vishwambhar Prasad Sati and Deng Wei

Keywords: Arable land, productivity, suitability analysis, Uttarakhand Himalaya.

Abstract

Crop productivity and suitability evaluation form a prerequisite for land use planning. Soil properties and agro-climatic conditions further influence crop performance. This communication examines crop

productivity and suitability in view of agro-ecological conditions and soil properties. Time series data of major crops were gathered from secondary sources and their mean value was obtained. Further, district-wise crop productivity of major crops was analysed and suitability criteria evaluated. We observed that crop productivity is low in the mountainous mainland compared to plain districts. However productivity also varies from crop to crop. Our study further revealed that the highlands are suitable for growing potato, small millets, pulses and temperate fruits whereas the valley regions are suitable for growing citrus fruits, paddy, wheat and spices. Tarai and Doon plains are suitable for growing sugarcane, paddy and wheat.

Mudbanks and fisheries along the Kerala coast – myth and reality

S. Prasanna Kumar, P. K. Dinesh Kumar, K. R. Muraleedharan, Grinson George, Dayana Mathew, V. Kripa, R. Jeyabaskaran, N. Ramaiah, A. Gopalakrishnan and S. W. A. Naqvi

Keywords: Mudbank, monsoon, suspended sediments, pelagic and demersal fishery, upwelling.

Abstract

Mudbanks, a unique coastal oceanographic phenomenon occurring along the southwest (SW) coast of India during the SW monsoon season, are synonymous with the fishery of this region. Here we examine the validity of the popular notion that mudbanks directly support rich fisheries, using a high temporal resolution water column data collected from the Alappuzha mudbank region in Kerala during April to September 2014, in conjunction with fisheries data. Our study reveals that the upwelling which occurs during the SW monsoon season along this coast brings oxygen deficient subsurface water to the upper water column. Escaping the oxygen-depleted waters, the fish aggregate within a thin upper layer allowing easy visual identification and capture of fish shoals. This process occurs throughout the coast and is not confined just to the mudbanks. Mudbank being a calm region, traditional fishermen using non-motorized country craft were able to carry out fishing within this region only during the SW monsoon. With the induction of motorized and mechanized fishing, the link between mudbanks and fisheries is becoming less prominent, although the former still continue to be important fish landing centres.

Antimicrobial coating of cotton twill tape with neem oil, eucalyptus oil and tulsi oil for medicinal application

G. K. Balamurugan¹ and S. Babuskin

Keywords: Antimicrobial finishing, cotton twill tape, essential oil, washing fastness.

Abstract

This paper reports the development of antimicrobial finishing for cotton twill tape with essential oil extracted from eucalyptus leaves, tulsi leaves and neem seed. The inhibition was analysed against four bacterial and one yeast isolate. The washing fastness shows that fabrics treated with neem seed oil show antimicrobial effect against *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Candida albicans*, till the end of the third wash, followed by tulsi oil, but lower inhibition against others. But for eucalyptus oil, inhibition was observed well only after the first wash. The results show the antibacterial holding capacity of cotton twill tape after repeated washes.

Electronic national agricultural markets: the way forward

A. Amarender Reddy

Keywords: Agricultural commodities, commission agents, electronic markets, farmers, traders.

Abstract

The Model Agricultural Produce Marketing Act (APMC Act), 2003, and recent improvements to it through Model Agricultural Produce and Livestock Marketing (Promotion and Facilitating) Act (APLM), 2017, provide some hope in increasing efficiency in agricultural markets in India. The Model APLM Act advocates increased competition in the marketplace by allowing private markets, farmers' markets, and electronic-National Agricultural Markets (eNAM). Under eNAM, the Central Government introduced electronic trading in about 400 APMC markets in 2016 and connected them through uniform market platform in line with the e-markets of Karnataka introduced in 2012. This article examines experience of e-markets in Karnataka since 2012, with the intention to suggest improvements to eNAM. Results show that e-markets help increase competition, eliminate collusion among traders resulting in increased farmers' price and market arrivals. They facilitate competitive bidding and same day payments to farmers. However, there was some resistance from traders and commission agents as they felt that there were no benefits in e-auction compared to physical transactions. In addition, there was fear of taxation of on-line transactions. Aligning interests of all stakeholders, including farmers, traders and commission agents is the biggest hurdle in the implementation of eNAM.

Sustainable exploitation of building stone in India – emerging issues

Abhishek Sharma, A. K. Mishra and B. S. Choudhary

Keywords: Construction aggregates, health, safety, stone quarry, sustainability.

Abstract

Stone aggregates are one of the most important construction materials obtained through conventional mining and crushing of building stones. The construction mining sector is highly unorganized, despite alarm calls raised by individuals and corporates regarding high accident rates and rapidly declining stone deposits. We may soon run out of quality stone deposits to support our aspiring infrastructure development plans. This article aims to create awareness on the importance of stone quarrying in supporting our infrastructure development plans, challenges faced by this sector, and eliciting appropriate and concrete action plans for the future.

Collaboration pattern in male breast cancer research

Sandhya Dwivedi and K. C. Garg

Keywords: International collaboration, male breast cancer, research publications.

Abstract

An analysis of 4168 research papers on male breast cancer (MBC) published by different countries and indexed by Science Citation Index Expanded during 2005–2014 indicates that only 15% of the papers were non-collaborative and the rest were published either in domestic or international collaboration. The sub-field of MBC had a high proportion of domestic collaboration. The number of papers written with domestic collaboration was almost three times the number of papers written with international collaboration. The value of co-authorship index (CAI) decreased in single-, two and multi-authored papers in the second block 2010–2014 as compared to the first block (2005–2009). Higher value of CAI for mega-authored papers reflects higher collaborative coefficient (CC) in 2010–2014. The highest value of CC is for the sub-field S9 (genetics and heredity). This is also indicated by

the highest value of CAI for mega-authored papers in this subfield. Among 17 highly productive institutions, CC value is more or equal to the global value of CC for 10 prolific institutions.

Attrition of agents in Indian life insurance companies

Neha Chhabra Roy and Samik Shome

Keywords: Agents, attrition index, fuzzy logic approach, innovative conceptual framework, life insurance companies.

Abstract

The insurance industry in India is primarily human-intensive, and the business is managed by a large number of agents or advisors. This article identifies the factors responsible for attrition of individual agents of life insurance companies in India and explores its implications for these companies. The study draws and builds on findings from the primary survey of individual agents and senior officials of public and private life insurance companies in the country. The article posits fuzzy logic theory to estimate the attrition index. Some of the mitigation measures of agent attrition are proposed, which provide an initial assessment of the extent to which these can be applied in the Indian context.

Fluorosis and iodine deficiency disorders in India

Andezhath K. Susheela

Keywords: Amendments, fluoride excess, health issues, iodine deficiency, protocol.

Abstract

This review focuses on fluorosis and iodine deficiency disorders, two serious, highly prevalent metabolic disorders that are under-reported. These are caused by the two elements of the halogen family, fluorine and iodine. The former in excess and the latter in deficiency are the cause for concern. Excess fluoride (F^-) consumption through untreated groundwater was the main reason for fluorosis and defluoridation of water was the focus to provide safe water with $F^- < 1.0$ mg/l. On the other hand, iodine deficiency in diet was due to agricultural crops grown in iodine-deficient soil, and iodization of cooking salt was identified as the way forward to attain iodine sufficiency (i.e. 15 ppm in iodized salt). The two diseases are addressed through structured national programmes, but the implementation unfortunately is in a compartmentalized manner. The major issue is that both F^- -excess and iodine deficiency caused goitre. Besides, other disorders identical in clinical manifestations, also occur. This review discusses the issues to address the diseases with better understanding that has emerged from the scientific information available for correct diagnosis and management of patients in an integrated manner.

Rehabilitation device supporting active and passive upper limb exercises

Roman Trochimczuk, Tomasz Hućcio, Szymon Grymek and Dominika Szalewska

Keywords: Mechatronics, positioner, rehabilitation, upper limb.

Abstract

This article presents a mechatronic solution for rehabilitation devices supporting active and passive exercises in persons with motor dysfunctions of the upper limbs in the area of the elbow and shoulder joints. A planar positioner integrated with original software and a control system, served as the basis for creating the present solution. Bellman's programming method was applied to optimize the motion trajectory of the planar positioner along with the upper limb undergoing rehabilitation. The design of the planar coordinate positioner and the components of the system for supporting a therapy conducted by a rehabilitation specialist are presented.

Delineation of subtle and obscure structures in West Bengal Shelf: a remote sensing and GIS-based parallel approach

Subhobroto Mazumder, Kalyan Adhikari, Durga Shanker Mitra, Samiran Mahapatra and Krishan Kumar Singh Pangtey

Keywords: Geological domain, hydrocarbon, seismic exploration, subsurface structures.

Abstract

In the West Bengal part of the Bengal Basin, even after five decades of seismic-based hydrocarbon exploration no commercial finds have been identified. Deep drilling revealed the presence of hydrocarbon within the thick sedimentary sequence ranging from Gondwana to Recent. However, well-defined structures suitable for hydrocarbon pool in shallower sediments are apparently not visible in seismic data. In this article, a parallel approach to seismic exploration has been attempted to delineate shallow and subtle structures in the shelf area based on analysis of surface geomorphic data. The study identifies subtle structures in shallow sediments that entrap the remigrated hydrocarbons as well as envisages a multistoried, stacked model of hydrocarbon accumulations in the area. These areas are considered as promising targets and recommended for high-resolution seismic and close grid micro-gravity exploration survey for further detailing.

Marker to authenticate *Eurycoma longifolia* (Tongkat Ali) containing aphrodisiac herbal products

Jaya Vejayan, Aini Norhidayah Mohamed, Amira Alia Zulkifli, Yasmin Amira Che Yahya, Norliana Munir and Mashitah M. Yusoff

Keywords: Authentication, electrophoresis, *Eurycoma longifolia*, herbal products, markers.

Abstract

The benefits of *Eurycoma longifolia* (Tongkat Ali, TA) for its aphrodisiac capabilities are well known and many products are marketed worldwide. Due to its popularity, the plant is being abused for promoting fake products. Therefore, there is a need for better testing of the markers required by authorities and responsible manufacturers. A low-molecular-weight protein has been studied for developing it as a testing marker. Two dimensional electrophoresis (2DE) (four spots were observed) was used for positive detection of proteins in an aqueous extract of TA root and the pronounced separation of a Coomassie-stained spot, subsequently referred to as Marker A. Consecutive chromatographic separations of the aqueous extract of TA led to the isolation of pure protein from Marker A. When this marker was used to test 46 TA-based products randomly selected from markets worldwide, in 20 of them, the results were found to be comparable to those obtained using the organic eurycomanone marker. The ranking of products from the highest quantity to the lowest observed to be ordered differently if compared for both markers. This is an expected outcome because Marker A was measured for its protein content and eurycomanone for its organic molecule. Marker A detection using 2DE is shown to be a useful tool to test products supplemented with *E. longifolia* root.

A simple method for the separation and detection of trace levels of buprofezin, flubendiamide and imidacloprid by NP-HPTLC and RP-HPTLC

B. Nareshkumar, Praveen U. Sangnalmath, S. Gayatri Devi and K. Sreeramulu

Keywords: Detection and separation, human toxicity, insecticides, thin-layer chromatography.

Abstract

A study was undertaken to evaluate the retention (RF and RM) and separation (Δ RF, R_{α} F, α and RS) of buprofezin (B), flubendiamide (F) and imidacloprid (I) using n-hexane-acetone (6.5 : 3.5 v/v) in the case of NP-HPTLC and methanol-water (8 : 2 v/v) for RP-HPTLC as mobile phase. The study revealed that increasing the acetone content in NP-HPTLC and decreasing the water content in RP-

HPTLC resulted in high resolution with increase in RF values for B, F and I. $\Delta RF > 0.04$ and $RS > 1.5$ were achieved for all pairs of compounds ($\Delta RF(B-F) = 0.35$, $\Delta RF(F-I) = 0.19$, $\Delta RF(B-I) = 0.54$, $RS(B-F) = 4.12$, $RS(F-I) = 7.34$, $RS(B-I) = 2.02$ using NP-HPTLC; $\Delta RF(F-B) = 0.23$, $\Delta RF(I-F) = 0.26$, $\Delta RF(I-B) = 0.49$, $RS(F-B) = 2.63$, $RS(I-F) = 2.97$, $RS(I-B) = 5.92$ using RP-HPTLC). Imidacloprid was adsorbed strongly on NP-HPTLC layer and buprofezin on RP-HPTLC layer, as indicated by their high RM values. The maximum absorption of UV for B, F and I was found to be 252, 242 and 276 nm respectively. Stability analysis indicated that these compounds were stable up to 6 h in methanol and on the plates (NP-HPTLC and RPHPTLC layers). This protocol is useful for toxicologists to detect a mixture of these insecticides in forensic as well as environmental samples.

Ranking Mediterranean-type shrubs and trees by their allelopathic activity is not independent of how extract concentration is expressed

I. P. Pereira, L. S. Dias and A. S. Dias

Keywords: Allelopathy, extract concentration, germination, osmotic pressure.

Abstract

Water extracts from 19 Mediterranean-type shrubs and trees were screened for phytoactivity on germination of lettuce. The existing model for the effects of pH and osmotic pressure on germination requires refitting. Extract concentrations were expressed as plant fresh weight, plant dry weight and extract dry weight, and final ranking of the six phytoactive species was found to strongly depend on the way the concentrations are expressed. This methodological issue requires consideration when designing allelopathic bioassays. Extract dry weight is conceptually the most adequate way to express concentration and should be used, despite the increase in time and labour it requires.

Capturing richness-independent phylogenetic diversity and testing surrogates in woody plant communities

B. Divya and K. Praveen Karanth

Keywords: Biodiversity, community phylogenetics, conservation, deciduous forest.

Abstract

Phylogenetic diversity (PD) indices quantify the evolutionary history of a community. Studies have shown how decoupling between taxon richness (TR) and PD provides useful insights into biodiversity. The present study on three dry deciduous forest patches (Nandi, Savandurga and Devarayandurga) shows such decoupling patterns. Our analysis of unique (endemic) taxa revealed that whereas the high PD in Nandi was contributed largely by its unique taxa which were composed of different evolutionary lineages, unique taxa in Savandurga contributed negatively due to highly shared lineages. Also, the use of higher-level TR did not provide an adequate surrogate for PD. We, therefore, propose the use of an integrative approach (both TR and PD) to quantify biodiversity for gaining better insights into the composition and evolutionary history of a community.

Understanding sea ice melting via functional data analysis

Purba Das, Ananya Lahiri and Sourish Das

Keywords: Arctic ocean, bootstrap and confidence band, mean function, sea ice extent, southern ocean.

Abstract

We have addressed the problem of sea ice extent (SIE) melting for Arctic and Southern Ocean. The 'satellite passive microwave remote sensing data' for daily SIE over a year has been considered as a smooth continuous function, called functional data. The analysis of the mean function of SIE over the different year-blocks and 95% bootstrap confidence bands for Arctic Ocean shows a statistically

significant drop in SIE. Additional evidence of SIE melting in the Arctic Ocean is provided through phase plane analysis. During the summer, the SIE is observed about 30% less in the current year-block than that of the first year-block.

Evaluation of school backpack prototype-based on gait parameters, energy expenditure and posture of students

Ishant Gupta, Parveen Kalra¹ and Rauf Iqbal

Keywords: Backpack design, trunk angle, natural spine, school children, back pain.

Abstract

Carrying of backpacks by school going children leads to postural and gait adaptations, leading to falls, imbalances, low back pain and musculoskeletal disorders. This study examined gait parameters, posture and energy expenditure differences between the modified backpack (MBP) and the existing backpacks (EBPs) in school students. Using portable gait system, 26 healthy participants performed the trials with three loading conditions of 10%, 20% and 30% of their body weight (BW) with the two different categories of backpacks. There was significant difference in cadence, double support time, ground impact, energy expenditure and anterior lean angle between no-load condition and the backpacks. Relative to the no-load condition, energy expenditure (EE) increased by 4.26 cal/min, and anterior lean angle (ALA) increased by 6.90° for the EBPs at 30% load condition whereas EE increased by 2.83 calories/min and ALA by 4.43° in case of MBP at 30% condition. The results indicate that parameters recorded while carrying MBP resembled the those recorded during no-load condition. The erect posture, natural gait patterns and reduction in energy consumption supported by the MBP may thus reduce the causes of back pain and fatigue among school children.

Obtaining 3D and 3D revert cultures of BMG-1 cell line for the analysis of cytokine expression differences

Maddaly Ravi and Aishwarya Subramaniyan

Keywords: Agarose hydrogels, BMG-1, 3D aggregates, 3D reverts, cytokines; differential expression.

Abstract

Methods to utilize cell lines as research material are evolving continuously as with the parallel advancement in instrumentation and analysis technologies. One such advancement in culture methodology of particular significance is the 3-dimensional (3D) way of culturing cells. It is now clear that 3D cultured cells behave differently from their monolayer (2D) counterparts and provide meaningful insights into complex cellular mechanisms that are rather difficult to study using 2D cultured cells. We take a step further and describe 3D-reverts, an extension of the '2D to 3D' culture methodology. We demonstrate that 2D, 3D and 3DRs express cytokines differently and also that such differences extend to the culture stages of 3D and 3DRs, in a time-dependent manner. This approach of analysing differences between 3D and 3DRs as a time-dependent or culture stage-dependent manner will surely enhance the utility of cells that will augment the 3D culture systems.

Occurrence of Fusarium species in asymptomatic barley plants grown in field conditions under differential phosphate regimes

Mariela Echeverria, Maria Virginia Moreno and Carla Caputo

Keywords: Barley (*Hordeum vulgare* L.), endophytic fungi, *Fusarium* species, latent pathogens, nutritional regime.

Abstract

Occurrence of genus *Fusarium* as endophytes in roots of healthy barley plants cultivated in fields under two levels of phosphorous (P) was examined. *F. avenaceum*, *F. graminearum*, *F. konzum*, *F. oxysporum*, *F. sacchari*, *F. scirpi*, *F. solani* were isolated from asymptomatic surface sterilized root tissues. *F. konzum* and *F. solani* were only present in the roots of fertilized plants, whereas *F. sacchari* was present in unfertilized plants. *F. scirpi* was isolated in highest frequency and relative density, and was higher under P deficiency suggesting that P availability would determinate the occurrence of this species, suggesting the possibility of their association with stressed plants. This is the first report on the occurrence of *Fusarium* spp. as endophytes in healthy barley plants. However, it remains to be determined whether *Fusarium* spp. isolated are nonpathogenic forms and beneficial to barley plants or latent pathogens that could produce disease symptoms in other conditions.

Agronomic biofortification of zinc in wheat (*Triticum aestivum* L.)

Arvind Kumar, Manas Denre and Ruplal Prasad

Keywords: Agronomic, biofortification, *Triticum aestivum* L., red and lateritic soil, zinc deficiency.

Abstract

India Zinc malnutrition poses a major health issue for human beings globally. Agronomic biofortification explores the feasibility to control the zinc deficiency related disorders of the human population. Field experiment was conducted in a red and lateritic soil of Ranchi on 23 wheat cultivars with soil and foliar applications of $ZnSO_4 \cdot 7H_2O$. Zinc content of wheat grain increased from 38.86 to 77.17 mg/kg with soil application and to 76.49 mg/kg with soil + foliar application of Zn. Total Zn uptake by wheat (grain + straw) cultivars with soil + foliar application of Zn was significantly higher in short (933 g/ha) and long (960 g/ha) duration cultivars compared to that with soil application. Apparent Zn recovery in wheat also improved with soil + foliar application of Zn fertilizer, suggested that agronomic bio-fortification of zinc is possible in wheat and can prevent Zn malnutrition in human beings to a considerable extent.

Cotton crop in changing climate

A. Shikha, P. Maharana, K. K. Singh, A. P. Dimri and R. Niwas

Keywords: Cotton, irrigation, temperature, water.

Abstract

Cotton is a major cash crop of global significance. It has a peculiar and inherent growth pattern with coinciding physiological growth stages. This study is based upon modelling and simulation for Hisar region. Stage-wise water stress has been quantified for three Bt-cotton cultivars with three sowing dates under both irrigated and non-irrigated (rainfed) conditions to assess the most sensitive stage. As per model output, it was observed that, at some stages stress value during excess years remains below 0.3 which is characterized as mild stress, in contrast with drought years where it is above 0.3, impacting potential crop productivity. Thus, rainfall impacts the productivity of cotton even in irrigated semi-arid region. Irrigation measures practiced, could partially alleviate influence of stress. Also, early sowing is found beneficial. The most water-sensitive period is ball formation and maturity stage followed by flowering stage.

Identification of potential areas for crops

V. Ramamurthy, S. Chattaraj, S. K. Singh and R. P. Yadav

Keywords: Potential areas, commodity specific zones/ areas, relative spread index, relative yield index, land use policy.

Abstract

Identification and delineation of potential areas for different crops, both at country and state level by using available legacy data assumes importance, in order to preserve and conserve these areas to feed

the increasing population and future generations. In this direction, a new integrated approach has been developed to identify potential areas for different crops and the same has been validated. Identifying and delineating commodity specific areas/zones, would help in enhancing the productivity and profitability and framing of land use policies.

Applications of two-dimensional seismic tomography for subsurface cavity and dissolution features detection under Doon valley, NW Himalaya

A. K. Mahajan

Keywords: Caverns and palaeo-channels, Dehradun Fan, dissolution features, multichannel analysis of surface waves, sub-surface investigations.

Abstract

The presence of natural voids, cavities and palaeochannels under the surface hinders the extension of urbanization particularly in the new upcoming cities in the frontal part of the Himalaya. The Doon valley is characterized by such features. In this context, multichannel analysis of surface waves technique is used as a cost-effective solutions for investigating subsurface cavities, voids, shallow weathered zones and dissolution features in the Doon valley, NW Himalaya. Given the sensitivity of the deduced shear wave velocity to lithology, clast composition, degree of saturation, velocity distribution to a target depth of 40–50 m is a useful guide to demarcate different erosional/ dissolution features, cavities and palaeo-channels. 2D shear wave velocity data sets have been acquired along several profiles in the upcoming region of the Doon valley. Data processing has been carried out at 50 sites and shear wave velocity and profiles were validated taking into account field observations and bore hole data. The subsurface karst features or palaeo-channels are always a matter of concern to engineers before any development starts, because these features could cause subsidence in the region. Anomalies, that include caverns, dissolution features, and erosional channels etched into the Dehradun Fan sediments at shallow depth, have effectively been identified in the 2D shear wave velocity (V_s) field from >50 sites. The subsurface architecture further suggests variation in tectono-climatic condition and shifting of provenance during the fan building processes.

Study of a snow avalanche accident along Chowkibal–Tangdhar road in Kupwara district, Jammu and Kashmir, India

H. S. Gusain, V. D. Mishra and D. K. Singh

Keywords: Avalanche accident, mountainous terrain, snow storm.

Abstract

An avalanche accident was occurred on 5 January 2018 on Chowkibal–Tangdhar road in Kupwara district, Jammu and Kashmir about 6 km from Chowkibal village. One light passenger vehicle was swept away in the avalanche and 10 persons lost their lives. In this communication, we study the cause of avalanche accident and simulate the snow avalanche flow using Rapid Mass MovementS model. Total snow depth recorded at the nearest observation location from the accident site was 31 cm and fresh snow of the storm was 24 cm. Avalanche condition on slope was building up and the Snow and Avalanche Study Establishment issued an avalanche warning of ‘Low Danger’ for the Chokibal–Tangdhar road axis. Maximum thickness of avalanche debris on road was observed to be 3.0 m. Flow simulation showed maximum velocity of avalanche to be $\sim 25 \text{ ms}^{-1}$, maximum impact pressure $\sim 9.39 \times 10^4 \text{ kg m}^{-1} \text{ s}^{-2}$ and maximum height of avalanche flow $\sim 3.0 \text{ m}$.

Application of ICP-MS technique for analysis of heavy metals in LD slag fines

Shrenivas Ashrit, Ravikrishna V. Chatti, S. Sarkar, R. Venugopal and G. Udayabhanu Nair

Keywords: Heavy metals, LD slag, mass spectrometry, fires, steel making.

Abstract

Inductively coupled plasma-mass spectrometry (ICPMS) is a powerful tool for analysing trace metals in environmental samples, industrial wastes and samples of biogenic nature. In the present study, this technique has been used to analyse the content of heavy metals in trace levels which specifically include elements like lead, cadmium, selenium and arsenic in LD slag fines. LD slag is the waste generated during the Linz–Donawitz steel making process or the basic oxygen furnace process. LD slag fines in the size range 0–6 mm are obtained after the recovery of metallic iron by means of physical separation in waste recycling plants, and are mostly recycled in sinter-making process. The non-metallic portion of LD slag fines is generally used as an aggregate in road construction, in acid mine drainage treatment and as an acidic soil conditioner. All these applications require a thorough analysis of trace and heavy metals as they can leach and penetrate into the soil and potentially contaminate it. The present study addresses this issue by analysing heavy metals in traces levels using ICP-MS. The analysis reveals that most of the heavy and hazardous elements are present in very low concentrations in the slag itself when compared with the EPA maximum allowed concentration in the leachate samples. However, the concentration of mercury in LD slag is more than the limit set by EPA in the leachate, and leachability of mercury needs to be studied further. The study also reveals that there are traces of platinum and palladium in the slag, indicating the requirement of future studies to understand their economic recovery.

Preparation of nanosized bioapatite by cryogenic grinding from sintered scales of silver carp

Hypophthalmichthys molitrix (Cuvier and Valenciennes)

Ravneet, Gaurav Verma, Bandu Matiyal and Neha Thakur

Keywords: Bioapatite, biogenic source, cryogenic grinding, fish scales, sintering.

Abstract

The present study is based on the processing of bioapatite (BAP) of sintered fish scales, i.e. heat treated fish scales at 900°C, by the cryogenic grinding technique. It shows that BAP formed by cryogenic grinding of sintered fish scales became purer and nanosized. Earlier studies had reported that nanosized bioapatite increases the resorbability and bioactivity for tissue replacement and regeneration like bones and dental tissues of human beings. Energy dispersive X-ray spectroscopy of sintered fish scale BAP confirmed the presence of tetracalcium phosphate with Ca/P ratio of 1.97. Field emission scanning electron microscopy and dynamic light scattering (DLS) showed microsized particles. The sintered fish scales when cryoground showed the formation of nanosized particles as revealed by transmission electron microscopy and DLS. The Fourier transform infrared spectroscopy results of sintered and cryoground BAP had similar functional groups, but cryoground BAP showed greater purity.

Effect of temperature on minor invertebrate predator reduviid *Isyndus heros* (Fab.)

(Hemiptera: Reduviidae)

Rakshitha Mouly, T. N. Shivananda and Abraham Verghese

Keywords: Abiotic factors, biocontrol agents, mango orchard, reduviid predator.

Abstract

Reduviid predators are the largest terrestrial bugs considered to be potential biocontrol agents and an integral part of integrated pest management (IPM). Despite the rich fauna of reduviids and their prey records, potential studies on reduviid are relatively meagre. Understanding the biotic and abiotic

factors influencing the reduviid population is essential to exploit them as biocontrol agents in agriculture. Hence the present study was aimed at determining the abundance of reduviid, *Isyndus heros* in an organic mango orchard and to determine the impact of abiotic factors on its occurrence. The peak population of reduviids was found during the initial flowering phase (January) and vegetative phase (September–December). Correlation matrix showed that there was a significant positive correlation of between the population of *I. heros* and relative humidity, and significant negative correlation between maximum and minimum temperatures. Further, the significant variables were regressed and the highest coefficient of determination was found in maximum temperature ($R^2 = 0.62$) with a single weather factor. However, multiple regression analysis revealed that the maximum and minimum temperatures could explain the variability up to 49%. This forms a baseline for the conservation and augmentation of reduviids that can be utilized as potential biocontrol agents in IPM programmes.

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Uranium constraints in Pakistan: how many nuclear weapons does Pakistan have?

Lalitha Sundaresan and Kaveri Ashok

Keywords: Fissile materials, highly enriched uranium, nuclear weapons, Pakistan, weapons grade plutonium.

Abstract

It is generally accepted that Pakistan's nuclear weapons programme relies on domestic supplies of uranium. Although constraints on uranium supply in Pakistan are recognized, this is often not taken into account when estimating the amount of fissile material that Pakistan may have produced. In simple words, most assessments of Pakistan's fissile materials and arsenal size fail to look at the supply and demand situations in Pakistan in an integrated way. This paper attempts to rectify this lacuna by taking a combined look at the supply and demand situations for uranium in Pakistan. It specifically addresses issues of how shortages in supply or increases in demand will affect the allocation of available uranium resources for meeting various military and civilian needs.

Reducing resource disparity in healthcare resource allocation of laboratories in countries with limited resources by empowering policy-making and implementation

Rahi Jain, Himank Ajmera and Bakul Rao

Keywords: Developing nations, healthcare, optimization, policy, resource disparity, resource allocation.

Abstract

In resource constraint settings of developing countries like India, inadequate importance and consideration to resource (re)allocation approach causes resource disparity issues. The Indian public health care system has focused on developing rural primary health centres (PHCs) to reduce rural–urban resource disparity and pressure on urban health care facilities. However, all the resources as recommended in national standards for PHCs' functioning are not completely available in PHCs. Local-level decision-makers are not provided with a policy framework to (re)allocate resources. This study states that empowering local-level decision makers with the ability to (re)allocate resources to reduce resource disparity is critical. The study proposes a new framework for minimizing resource disparity with resource allocation optimization. The study suggests a strategy to improve implementation of policies like the National Rural Health Mission and the National Health Policy. The 42 PHCs in rural areas of Osmanabad District (India) with 23 laboratory technicians (LTs) as resources are considered as a case study to assess the proposed method. The study optimization model showed that reallocating 6 of 23 LTs to different PHCs would reduce disparity in LT workload (from

57.62% to 30.54%) and LT access (from 116.4% to 49.3%). The disparity reduction highlights the impact of resource reallocation according to the proposed framework.

Floristic diversity, community composition and structure in Nanda Devi National Park after prohibition of human activities, Western Himalaya, India

Vikram S. Negi, Lalit Giri and K. Chandra Sekar

Keywords: Conservation, Nanda Devi National Park, tree regeneration, species diversity, western Himalaya.

Abstract

The present study was carried out to assess floristic diversity, community composition and regeneration status of different forests in Nanda Devi National Park after prohibition of human activities in 1983 with a view to understand the impact of ban, and provide a basis for assessing subsequent changes on plant diversity and composition. The comparison of the present study with the earlier studies conducted in 1993 and 2003, indicated positive changes on plant diversity, forest composition and ecological conditions of the National Park. A total of 409 taxa belonging to 203 genera and 71 families (377 Angiosperms, 7 Gymnosperms and 25 Pteridophytes) were documented from the National Park. Two types of forest communities, i.e. *Betula utilis* along timberline, and mixed forest of *Abies spectabilis* with *B. utilis* form the dominant forests inside the National Park. Proportionate distribution of individuals in seedling, sapling and tree layers showed considerable variation in the population structure of different communities. Maximum species richness was observed in Dibruggheta (128) followed by Dharansi (43) and Sarsopatal (34) among the studied alpine meadows of this National Park. The present results could be a pilot to strengthen conservation measures across the Protected Area Network by understanding the impact of the ban on anthropogenic activities, and is also useful for future assessment of floristic diversity and forest composition in the National Park.

An overview of cleaning and prevention processes for enhancing efficiency of solar photovoltaic panels

Surajit Mondal, Amit Kumar Mondal, Abhishek Sharma, Vindhya Devalla, Sravendra Rana, Suresh Kumar and Jitendra Kumar Pandey

Keywords: Automated cleaning process, dust, electrodynamic screening, particle removal, solar photovoltaics.

Abstract

The energy produced by solar photovoltaic (SPV) modules is directly connected with the solar accessible irradiance, spectral content, different variables like environmental and climatic components. Dust and bird droppings are considered as the real challenges for SPV performance. This article covers dust-related challenges and advanced improvements made on the automated cleaning system, by providing a brief framework on strategies such as mechanical, electrical, chemical and electrostatic. The environmental impact of cleaning processes has also been evaluated, which is directly related to the ultimate performance of overall conversion.

Entomophagy for nutritional security in India: potential and promotion

Ruparao T. Gahukar

Keywords: Constraints, edible insects, food products, human safety, nutritional security, tribal communities.

Abstract

Entomophagy is practised on a large scale by the tribal communities in North East India compared to eastern and southern states. Termites, honey bees, grasshoppers, stink bugs, aquatic insects and

silkworms are common and preferred insect species because they contain high amount of protein, fat, minerals and vitamins. Silkworms are successfully mass-reared on host plants or laboratory diets for commercial production. Generally, insects meant for food recipes are processed before consumption to improve taste, flavour, palatability and nutritional value which make them comparable with animal products. Thus, entomophagy supports nutritional security and family livelihood of tribal communities during difficult periods of the year. This review discusses risks for human health due to consumption of insects and emphasizes conservation of at least major insect species collected from nature. Regular bioprospecting revealed a few new species but needs validation of their consumption through regulatory framework. This initiative would boost not only the sale in local markets but also may open new vista for export. Holistic approach and intensive efforts are needed to promote entomophagy in regions other than the North East.

Cryogenic measurement set-up for characterization of superconducting nano structures for single-photon detection applications

Manju Singh, Rishu Chaujar and R. K. Rakshit

Keywords: Device packaging, optical alignment, liquid helium cryostat, low temperature measurement probe.

Abstract

We discuss the design and development of a cryogenic set-up down to ~1.8 K for carrying out measurements on superconducting nanowire single-photon detectors. The set-up consists of two separate low-temperature inserts, one for electrical characterization and the other for optical measurements and characterization of single-photon detectors. A sample holder with necessary arrangements for precise alignment of laser light with the active area of the device to enhance optical coupling efficiency has been designed for the optical probe. The invar alloy has been used for the sample holder to ensure that the alignment is not disturbed at low temperature. Single-mode fibres due to their high transmission rate, minimum attenuation and least distortion have been used to shine light on the samples. The sample holder with 20-pin LCC socket and matching chip carrier provides convenient and fast sample mounting in the electrical insert. Mumetal has been employed to cover the sample space in both the inserts in order to attenuate any electromagnetic interference. Temperature stability with the passage of time has been monitored. It has been found that variation in temperature is less than 10 mK at the lowest operating temperature. Another important advantage of the system is its low enough liquid helium loss rate (~100 ml/h) with all inserts, which allows uninterrupted measurements for several days without any refilling of liquid helium.

Domestication and conservation efforts in *Haematocarpus validus* (Miers.) Bakh. f. ex Forman (Menispermaceae): an underutilized fruit species and natural colourant

Pooja Bohra, Ajit Arun Waman, Debabrata Basantia, Hidangmayum Lembisana Devi and Ezekiel Reang

Keywords: Chlorophyll, germination, home garden, liana, Menispermaceae, regeneration, tropical islands.

Abstract

Blood fruit is a promising anti-oxidant rich underutilized fruit species with potential as a natural colourant for food, beverage and handicraft industries. The species has been used for fresh consumption, treating ailments and as a dyeing agent by local people including regional tribes in tropical Asian countries. However, at present, fruits are harvested from the wild and there is considerable scope for promoting their cultivation in homestead gardens. Owing to limited population of the species, seed germination studies were conducted. Treatment of seeds with thiourea (0.1%) or

GA3 (1000 mg/l) for 24 h was most congenial for obtaining healthy seedlings in large numbers. To extract chlorophylls and total carotenoids, dimethylsulphoxide was found to be a superior solvent over acetone (80%). Differences in fruit sizes were noticed in fruits grown in two states of India. These findings form the basis for conservation as well as domestication of this multipurpose fruit species in the tropical Asian countries.

MRI segmentation using Fuzzy C-means and radial basis function neural networks

A. H. Rasooli, M. Ashtiyani, P. M. Birgani, S. Amiri, P. Mirmohammadi and M. R. Deevband

Keywords: Fuzzy C-means, magnetic resonance imaging, neural networks, segmentation, radial basis function.

Abstract

Image segmentation is one of the major preprocessing steps of magnetic resonance imaging (MRI) analysis in many medical and research applications. Accurate differentiation between three major soft tissues of the brain – grey matter, white matter and cerebrospinal fluid – is a key step in structural and functional brain analysis, visualization of the brain's anatomical structures and measurement, diagnosis of neurodegenerative disorders and image-guided interventions as well as surgical planning. We propose a new methodological approach in segmentation of MRI images of the brain structure. Although various methods for MRI segmentation have been proposed, improvement of soft, automatic and precise MRI segmentation methods are worth a try. The proposed method has almost the same results as those from recent efforts in this field. However, it performs better in the presence of noise and RF-filed inhomogeneity.

Design and evaluation of a pneumatic metering mechanism for power tiller operated precision planter

Sandip Mandal, G. V. Prasanna Kumar, Hetal Tanna and Arvind Kumar

Keywords: Pareto dominance, pneumatic seed metering, power tiller, precision planter.

Abstract

Power tiller is the most common prime mover in medium and marginal farms due to its light weight, compact design and low cost. Many attachments for power tiller have been developed except for precision pneumatic planter which is necessary to plant irregular, small and expensive seeds. In the present work, a pneumatic seed metering mechanism was designed for the power tiller operated 3-row precision planter. It was tested for planting soybean, pigeon pea and corn seeds at 20 cm spacing. The best design and operating parameters of the modular seed metering device were identified by conducting experiments on the sticky belt test stand considering various performance indices on the basis of pareto dominance criterion. The seed metering disc having 8 holes of 3.5 mm diameter on pitch circle diameter of 116 mm and operated at 0.11 ms⁻¹ peripheral speed and 6 kPa suction were found to be the best combination of design and operating parameters for the precise metering of seeds. More than 67% of the seeds got distributed in the range of 15–20 cm spacing.

Sonar sensing predicated automatic spraying technology for orchards

V. K. Tewari, Abhilash Kumar Chandel, Brajesh Nare and Satyaprakash Kumar

Keywords: Agricultural engenderment, efficient spraying, environment pollution, fruit infection, ultrasonic sensing technology.

Abstract

Wastage of chemical inputs and environmental degradation have been a serious issues with conventional methods of pesticide application in agricultural and horticultural engenderment, resulting in fruit poisoning. A tractor-operated low-cost, ultrasonic sensor predicated selective pesticide sprayer was developed and tested for efficient spraying on the plant canopy and to abstain

from spraying in canopy absentia. Sensing technology was interfaced with programmed Atmega328P for automatic spray control through pump, solenoid valves and nozzles. The sensing signals instigated the microcontroller system for desired spraying. The sprayer was evaluated with two different types of nozzles for optimal input resulting in best spray coverage and impact fruit infection. Water sensitive papers were used for estimation of spray characteristics. The turbo nozzle sprayer resulted in 47.41% of spray coverage, 171 drops/cm² with 26% of pesticide savings and considerably prevented fruit infection up to 95.64%. This proved to be much better than hollow cone nozzle spraying. The technology was provisioned for boom height and nozzle angle adjustment as per canopy geometry. The ultrasonic sensor sprayer was designed for low cost and precise pesticide spraying especially for marginal farmers, thereby reducing both costs and environmental pollution by plant protection products.

Assessment of the viability of *Saccharomyces cerevisiae* in response to synergetic inhibition during bioethanol production

Corli de Klerk, Elvis Fosso-Kankeu, L. Du Plessis and S. Marx

Keywords: Bioethanol production, cell viability, flow cytometry, *Saccharomyces cerevisiae*, synergetic inhibition.

Abstract

Second-generation biofuels, fuels produced from lignocellulosic materials, including wood, agricultural residues and biomass waste include bioethanol, biodiesel and biogas. These fuel sources have great potential as useful substitutes to conventional fossil fuels. Biomass sources are also non-toxic and biodegradable energy sources that can be produced from a wide range of organic materials resulting in economic and renewable energy source. Pretreatment of lignocellulosic biomass is required to reduce physicochemical restrictions that hinder the accessibility of sugars necessary for hydrolysis and fermentation. Various pretreatment processes exist, but all of them produce inhibitory compounds that ultimately reduce ethanol production and cell viability of the fermenting microorganism, *Saccharomyces cerevisiae*. In this study different combinations of inhibitors (acetic acid, formic acid and vanillin) were considered to mimic realistic fermentation conditions during bioethanol production; ethanol yield and cell viability were then concurrently measured over a period of 48 h. The combination of acetic acid and formic acid exhibited ethanol reduction up to $11 \pm 3.74\%$, while cell viability decreased by $23 \pm 6.61\%$. Acetic acid and vanillin reduced ethanol production by $25 \pm 1.77\%$ and cell viability by $4 \pm 4.38\%$. Formic acid and vanillin inhibited ethanol production by $31 \pm 3.14\%$ and cell viability $16 \pm 7.54\%$. Finally, the synergistic effect of all three inhibitors reduced the final ethanol production by $58 \pm 5.09\%$ and cell viability by $27 \pm 5.44\%$, indicating the toxic effect of the synergistic combination.

Occurrence, severity and association of fungal pathogen, *Botrydiplodia theobromae* with sudden death or decline of tree bean (*Parkia timoriana*, (DC.) Merr) in North Eastern India

A Ratankumar Singh, S. K. Dutta, S. B. Singh, T. Boopathi, S. Lungmuana, S. Saha, Vishambhar Dayal, Romila Akoijam, S. K. Sharma and N. Hemanta Singh

Keywords: *Botrydiplodia theobromae*, north eastern India, *Parkia timoriana*, sudden death or decline disease, tree bean. TREE bean

Abstract

Tree bean, *Parkia timoriana* is one of the most important perennial tree legume vegetable crops in north eastern region (NER) of India. Recently, sudden death or decline is emerging as a major constraint in the production of tree bean. The prevalence, intensity and etiology of this disease have not been extensively studied. The present work was aimed at studying the symptomology, severity

and etiology of sudden death or decline of tree bean in the north eastern region of India. Typical symptoms of tree bean decline were initiated with wilting of half portion of the tree, excessive shedding of leaves, gradual drying up leading to death, and secondary infestation by insects on dead trees. The highest disease severity of 68.5% was observed in warmer regions like Kolasib, Mizoram. During survey, small bark borer was recorded in all districts and levels of infestation rate (holes/ft² of log) reached maximum up to 25.49 in Hnanthial of Lunglei district. Young trees in the range 1–10 years with 57.32% (917 trees) of total trees (1600) infected were most susceptible to the disease compared to 12.58% (201 trees) infection in old trees in the range 21–30 years. The frequently associated pathogen with sudden death or decline of tree bean was identified as *Botrydiplodia theobromae* at the Indian Type Culture Collection, ICAR-IARI, New Delhi. It was the most aggressive species and proven to be pathogenic to tree bean following artificial inoculation.

Impact of cloud parameterization schemes on the simulation of cyclone Vardah using the WRF model

C. P. R. Sandeep, C. Krishnamoorthy and C. Balaji

Keywords: Cyclone Vardah, cumulus parameterization, microphysics parameterization, WRF model.

Abstract

The objective of this study is to examine the sensitivity of cumulus and microphysics schemes when simulating the track, intensity and inner core structure of the very severe cyclonic storm (VSCS) Vardah using the Weather Research and Forecasting (WRF) model. Four cumulus parameterization schemes (CPS) and six microphysics schemes (MPS) were used. Both the track and intensity of cyclone Vardah are seen to be sensitive to the CPS and MPS. New simplified Arakawa–Schubert scheme (NSAS) as CPS and Kessler scheme (KS) as MPS combination has better predicted the track and intensity of the cyclone with respect to the Indian Meteorological Department (IMD) data when compared to other schemes. To verify the robustness of the best set of schemes for cyclone Vardah, two random sets of schemes as well as the best set of schemes were run for cyclones Hudhud and Thane.

Role of east–west shear zone and wind confluence on the occurrence of intense heavy rainfall over North Konkan during southwest monsoon season

S. D. Sanap, S. Bhute and K. S. Hosalikar

Keywords: Heavy rainfall events, monsoon season, shear zone, wind confluence.

Abstract

An attempt has been made to understand the mechanism in occurrence of intense heavy rainfall events over North Konkan and adjoining areas using observed, satellite and reanalysis datasets. Synoptic conditions associated with Dahanu heavy rainfall event, 2016, Mumbai floods, 2005 and historical heavy rainfall events over North Konkan region are considered in the present study. In presence of East–West shear zone with upper air cyclonic circulations extending up to mid-tropospheric levels located at west central Bay of Bengal, west Arabian Sea and anti-cyclonic circulation over east-central Arabian Sea were the major synoptic features observed during these events. Results suggest that the confluence of moisture-laden winds from these circulations over North Konkan lead to the occurrence of intense heavy rainfall events.

Mechanical properties and brittleness of shale with different degrees of fracturing-fluid saturation

Zhenkun Hou, Marte Gutierrez, Anming Wang, Abdulhadi Almrabat and Chunhe Yang

Keywords: Brittleness evaluation index, hydration swelling, immersion time, Longmaxi Formation shale, triaxial compression, weakening mechanism.

Abstract

The mechanical characteristics of Longmaxi Formation shale with different degrees of fracturing-fluid saturation were characterized by applying triaxial compression tests at a confining pressure of 50 MPa. The test samples were collected from fresh outcrop shale in Dayou, Chongqing, China and the shale brittleness was evaluated based on brittleness-drop coefficient, stress decrease coefficient and softening modulus. The weakening of related rock parameters of shale specimens being immersed in fracturing-fluid for different time periods was studied and discussed. The degree of deterioration of the peak strengths, elastic and softening moduli and brittleness were significant and varied exponentially when the samples were soaked in fracturing-fluid. The samples were found to fail by shear on the whole accompanied by varying degrees of bedding plane cracking. With increase of sample immersion time, the number of shear failure surfaces changes from one to two and finally to more than three. The length and number of cracks parallel to bedding planes increased gradually, however, no cracks were formed perpendicular to the bedding plane even when the shale was soaked for a long time. The weakening of the brittleness and mechanical parameters with sample fracturing-fluid saturation are mainly related to change of stress state at the crack tips caused by hydration swelling, the dissolution caused by alkaline fracturing-fluid and the formation of liquid film on the surface of shale particles, all of which are the results of mechanical–physical–chemical coupling.

A novel approach to calculate braiding of a large alluvial river

Lalit Saikia, Chandan Mahanta and Suranjana Bhaswati Borah

Keywords: Alluvial river, braiding, sandbars, Brahmaputra.

Abstract

Braiding pattern in sixteen reaches of the Brahmaputra river in Assam, India is discussed. A new braiding index has been introduced incorporating a fraction of area covered by sandbars, number of midchannel bars and maximum width of alluvial reach. Braiding parameters calculated using different formulae showed similar trend but higher values in 2014 compared to 1973. Increase of braiding in different reaches in 2014 was due to development of more sandbars and distributaries. The new index has shown comparable result with other approaches and better correlation with sinuosity.

Characterization of Hg-based ayurvedic drug Kajjali: classical and contemporary approaches

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

Keywords: Kajjali, metacinnabar, sulphur, XRD.

Abstract

This communication presents characterization of Kajjali, a mercury (Hg) based Indian traditional ayurvedic drug, by both ancient and contemporary methodology. For preparation of Kajjali, 225 g each of Shuddha Parada (purified mercury) and Shuddha Gandhak (purified sulphur), initially purified through traditional methods of purification as described in ayurvedic literature, were manually triturated using stone mortar and pestle until it became a very fine black coloured powder.

This preparation process took up to ~78 h. Thereafter, Kajjali was characterized by classical and contemporary methods. Kajjali passed the classical tests like Rekhapurnatwa, Slakshanatwa, Nishchandratwa and Varitara. XRD study confirmed that Kajjali contains mercury sulphide (HgS), identified as metacinnabar (cubic form of HgS), in addition to free sulphur. Composition of Kajjali has been determined by EDXA method, which validated the presence of 88.84% mercury and 11.16% sulphur. SEM studies substantiated particle size distribution of Kajjali, which varied from 60 nm to 2 µm range. Such integration of classical and contemporary studies is important, because such vital medicines should be characterized properly for safety and efficacy before their appropriate use for diseases.

Screening and enhancement of anaerobic germination of rice genotypes by pre-sowing seed treatments

Dhonada Doley, Meghali Barua, Debojit Sarma and Purna K. Barua

Keywords: Anaerobic germination, pre-sowing seed treatment, priming, submergence tolerant.

Abstract

In the present study, 243 lowland rice genotypes were screened for anaerobic germination (AG) under 10 cm of flooding in plastic trays. Forty three genotypes showed anaerobic germination. Pre-sowing seed treatments of the genotypes by soaking, priming with water, 1% KCl and 5% PEG each for 24 h revealed enhanced AG and other seed germination parameters under flooding compared to control. Priming could induce AG in the genotypes that failed to germinate under submerged condition. Hydro-priming and 1% KCl priming found to be the best treatments showing the usefulness of pre-sowing seed treatments. Jalashree, Jalkuwari and Ranjit Sub1-C-376, having submergence tolerance, were identified as potential genotypes for AG and hence can be used in breeding programmes.

Quality evaluation of pearl millet based pasta as affected by depigmentation

Kirti Jalgaonkar, S. K. Jha and Manoj Kumar Mahawar

Keywords: Anti-nutritional properties, cooking, depigmentation, pearl millet.

Abstract

The effect of depigmentation on colour, nutritional, anti-nutritional, cooking and textural qualities of pasta prepared from pearl millet was studied. Depigmentation was achieved by soaking pearl millet grains in hydrochloric acid of 0.2 N for 18 h at 28–32°C followed by washing, blanching (98°C for 30 sec) and tray drying (50°C). Pasta prepared from 100% wheat semolina (WS), 100% native pearl millet flour (PMF) and blend (50 : 50) of wheat semolina and native pearl millet flour (WS : PMF) were compared with pasta prepared from blend (50 : 50) of wheat semolina and depigmented pearl millet flour (WS : DPMF). It was observed that depigmentation significantly improved the colour of pasta and was very close to 100% wheat semolina pasta. Results also demonstrated that the contents of fat, protein and ash of pasta made from PMF (100%), WS : PMF (50 : 50) and WS : DPMF (50 : 50) were higher than that of pasta prepared using WS (100%). Reduction in phytic acid (5.56%) and trypsin inhibitor activity (5.27%) was observed with depigmentation in the WS : DPMF (50 : 50) pasta compared to WS : PMF (50 : 50) pasta. However, cooking and textural properties of pasta were not affected by depigmentation. Overall results of the study suggested that depigmentation technique was effective for formulation of acceptable pearl millet products.

Adopt and adapt nature's design principles to create sustainable aquaculture systems

Saleem Mustafa and Abentin Estim

Keywords: Aquaculture, nature's design, systems approach, sustainability.

Abstract

Sustainable development of aquaculture faces many constraints. An approach that offers solutions to these challenges is emulating nature's patterns and strategies. There are many elements of sustainability employed by nature that can be adopted for aquaculture systems through necessary adjustments (or adaptations). Analysis of empirical data generated by a series of experiments on different aquaculture systems generated new knowledge of practical importance. An outcome of the analysis pertaining to two important aspects of aquaculture, the sex control in captive stocks of commercially important protogynous hermaphrodite grouper and the operation of integrated multi-trophic aquaculture systems is presented here. Both cases serve as outstanding examples of the relevance of examining and applying nature's principles for finding sustainable solutions to aquaculture problems.

Impact of growing medium composition on morphological development of chrysanthemum (Chrysanthemum morifolium Ramat cv. Snowball)

Tanya Thakur, H. S. Grewal and S. S. Kukal

Keywords: Chrysanthemum, cocopeat, growing medium, morphological development.

Abstract

The light-weight growing medium compositions were evaluated in the present study for optimum growth and flowering of potted *Chrysanthemum morifolium* Ramat cv. Snowball. Plants were grown in six different potted medium compositions – control: garden soil + (farmyard manure (FYM) 2 : 1), cocopeat + FYM (1 : 1), cocopeat + FYM (2 : 1), vermiculite + FYM (1 : 1), vermiculite + FYM (2 : 1) and cocopeat + vermiculite + FYM (1 : 1 : 1). Results revealed vegetative growth with maximum plant height, number of leaves and root suckers per plant in the case of cocopeat + FYM (2 : 1), whereas flower quality, i.e. duration of flowering and flower diameter was highest in media vermiculite + FYM (2 : 1). Moreover, plants showed significant ($P < 0.05\%$) vegetative growth with better flowering time and quality in cocopeat + vermiculite + FYM (1 : 1 : 1). Therefore, the present findings suggest that for growing potted chrysanthemum cv. Snowball for display, light-weight growing medium composition of cocopeat + vermiculite + FYM (1 : 1 : 1) is the best with better plant morphological development and sustained quality flower production.

Necessity of ‘two time zones: IST-I (UTC + 5 : 30 h) and IST-II (UTC + 6 : 30 h)’ in India and its implementation

Lakhi Sharma, S. De, P. Kandpal, M. P. Olaniya, S. Yadav, T. Bhardwaj, P. Thorat, S. Panja, P. Arora, N. Sharma, A. Agarwal, T. D. Senguttuvan, V. N. Ojha and D. K. Aswal

Keywords: Circadian clock, energy saving, Indian standard time, longitude, Sun graphs, two time zone.

Abstract

A strong demand of a separate time zone by northeast populace has been a matter of great debate for a very long period. However, no implementable solution to this genuine problem has yet been proposed. The CSIR-National Physical Laboratory, CSIR-NPL (the National Measurement Institute, NMI, of India and custodian of Indian Standard Time, IST) proposes an implementable solution that puts the country in two time zones: (i) IST-I (UTC + 5 : 30 h, represented by longitude passing through 82°33'E) covering the regions falling between longitude 68°7'E and 89°52'E and (ii) IST-II (UTC + 6 : 30 h, represented by longitude passing through 97°30'E) encompassing the regions between 89°52'E and 97°25'E. The proposed demarcation line between IST-I and IST-II, falling at longitude 89°52'E, is derived from analyses of synchronizing the circadian clocks to normal office hours (9 : 00 a.m. to 5 : 30 p.m.). This demarcation line passes through the border of West Bengal and Assam and has a narrow spatial extension, which makes it easier to implement from the railways point of view. Once approved, the implementation would require establishment of a laboratory for ‘Primary Time Ensemble – II’ generating IST-II in any of the north-eastern states, which would be equivalent to the existing ‘Primary Time Ensemble-I’ at CSIR-NPL, New Delhi.

Tactical water management in field crops: the key to resource conservation

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

Keywords: Field crops, pulses, resource conservation, sustainable development goals, tactical water management, technological interventions.

Abstract

Water is a critical input for productivity enhancement especially of field crops. Its judicious and optimum use is needed utmost for realizing higher resource use efficiency and plugging gaps in production. Resource conservation technologies or key technological interventions, which could alter or rectify the usage pattern or strategies in freshwater utilization in agriculture, are the need of the hour. Tactical or strategic approach in water management could help in conserving and making more-efficient use of scarce water resources through integrated management combined with selected external inputs/technologies. In this context, the scientific interventions on water management involving precision levelling of land, no tillage or reduced tillage systems, furrow irrigated raised bed planting or broad bed furrow systems, management of soil cover and crop diversification and other inclusive technological practices could enforce appropriate water management schedules.

The necessity to develop a comprehensive feed library for livestock production in south Asia

A B. V. Ramana, Abu Sadeque Md. Selim and Luis O. Tedeschi

Keywords: Feed library, green house gas, livestock, nutrient profile, ration formulation

Abstract

Regional feed library contains information in regional languages for available feeds/fodders and by-products that are being fed to the livestock. The lack of dynamic feed quality information containing complete nutrient profile, anti-nutritional factors, and digestibility information at the regional level for current varieties of feed and fodder species and their by-products leads to the misuse of valuable crop residues and supplements. The problem is more rampant in Southern Asian countries, like India and Bangladesh. This causes low per animal productivity, more green house gas (GHG) emissions, and wastage of valuable feed material. Modern feed libraries are dynamic and include latest varieties/cultivars/genotypes of feed and fodder along with the most common feeds/fodders available in that region. This assists the small scale and commercial livestock producers in selecting the best locally available fodders/feeds combinations to meet the nutrient requirement of their livestock depending on the physiological stage and productivity. This allows efficient use of available feed resources, low-cost ration formulations and enhance the income of livestock farmers while contributing lower GHG emission from ruminant animals.

Oxidized lipoproteins as the diagnostic target for cardiovascular diseases S. Sreeja¹, Anand

Manoharan and Krishnan Venkataraman

Keywords: Cardiovascular disease, cholesterol, diagnostic target, oxidized lipoproteins.

Abstract

Low HDL-cholesterol and high LDL-cholesterol in plasma have long been associated with cardiovascular disease (CVD) risk. The quantity of cholesterol associated with these lipoproteins is being traditionally used to predict CVD risk. However, recent studies have suggested that the quality and functionality of these lipoproteins are more important. The lipoproteins – HDL and LDL – undergo both enzymatic and non-enzymatic modifications which impair their functional capability and hence, test of such modification which reflects the quality of HDL can be a good predictor of CVD risk. The present article discusses oxidation-associated dysfunctionality of lipoproteins and their potential in laboratory diagnosis of CVD.

Lumen anatomy and localization of Wolbachia sp. in the thrips, Plicothrips apicalis (Bagnall)

Singh Ambika and Raman Rajagopal

Keywords: Gut, mycetome, thrips, termites, Wolbachia sp.

Abstract

A detailed anatomical study of digestive system of insects has been done in some of the major insect orders such as Lepidoptera, Diptera, Coleoptera and Hemiptera. For other insects such as thrips, their emergence as an important agricultural pest has brought order Thysanoptera to focus. We describe the alimentary canal of Plicothrips apicalis (Bagnall) (Phlaeothripidae) and localize Wolbachia sp. in P. apicalis. The digestive tract of P. apicalis, a grass feeding species, is observed to be well demarcated in the foregut, midgut and hindgut. We evince a new finding in this study that the midgut opens into a globular chamber containing the mycetome. It is from the globular chamber that the hindgut follows and at their juncture, two pairs of malphigian tubules originate. The presence of mycetome has been reported in order Hemiptera and Isoptera that bears a structure similar to mycetome, known as paunch that harbours protists which are known to be involved in cellulose digestion. Presence of mycetome has not been reported in other thrip species till date except in Bactothrips buffai. The finding of an additional structure in the alimentary canal of thrips

is suggestive of the significance it might hold in the evolutionary linking with other insect orders. We also tried localizing endosymbiont in *P. apicalis* and detected *Wolbachia* sp. in the abdominal region of both the larva and the adult.

Preparation and characterization of PLGA-based biocompatible nanoparticles for sustained delivery of growth factor for wound healing applications

E. Santhini, V. M. Pramila, M. Shalini, R. Vignesh Balaji and K. P. Chellamani

Keywords: PDGF-BB, PLGA, angiogenesis, wound healing.

Abstract

Platelet-derived growth factor-BB (PDGF-BB) loaded PLGA : poloxamer blend nanoparticles (PLGF) were studied for their physical, chemical and biological characteristics using in vitro and in vivo experimental models. The particle size of PLGF was between 100 and 150 nm with 85% encapsulation efficiency. In vitro released kinetics revealed a slow and sustained release of growth factor (GF) for a month. Furthermore, biological studies confirmed the non-toxic, and non-irritant nature of nanoparticles and angiogenesis stimulating ability of GF released from nanoparticles demonstrating their potential for the treatment of chronic wounds in future.

Expression of alpha-synuclein during eye development of *Bufo arabicus*

Amin A. Seleem and Fakhr El-Din M. Lashein

Keywords: Alpha-synuclein, anterior eye chamber, eye development, trabecular meshwork.

Abstract

Alpha-synuclein contributes to neurodegenerative diseases that are characterized with the increase of its expression and collectively known as synucleinopathies such as Parkinson's disease and dementia with Lewy's bodies. A healthy balance of alpha-synuclein is important for preventing synucleinopathies, whereas the normal physiological role of alpha-synuclein is still under investigation. The present study was designed to evaluate the involvement of alpha-synuclein in the eye of *Bufo arabicus* during development, metamorphosis and adult stage. Different larval and adult stages of *Bufo arabicus* were obtained for histological and immunofluorescent expression of alpha-synuclein during eye development. The results showed that alphasynuclein expression was associated with differentiation and migration of periocular mesenchyme cells that will form the trabecular meshwork. Also, alphasynuclein expression was detected in the ciliary body at the adult stage. This study confirmed an additional role of alpha-synuclein during the development of the anterior eye chamber. On the other hand, synuclein expressions in *Bufo arabicus* under study helps improve our knowledge about gene conservation studies and the mechanisms by which the anterior chamber of the vertebrate eye is differentiated during development. Also, synuclein might be considered as an evolutionary conserved gene expression during eye development of *Bufo arabicus*.

Intratumoural and peritumoural lymphangiogenesis in canine mammary tumour linked to tumour spread and poor survival

Parmeet Pal Singh, Naresh Kumar Sood, Kuldip Gupta and Deepti Narang

Keywords: Canine mammary tumour, immunohistochemistry, Kaplan Meier survival analysis, lymphangiogenesis.

Abstract

Canine mammary tumour (CMT) is an excellent, naturally occurring animal model for human breast cancer. Most research, so far, has focused on angiogenesis as a mode of tumour invasion and metastasis, but the role of lymphangiogenesis in mammary tumours is scarcely documented. The

present study was conducted on 45 cases of CMT and the extent of lymphangiogenesis, demonstrated as intratumoural vessel density (IVD) and peritumoural vessel density (PVD) was determined by immunohistochemical staining with lymphatic markers, viz. podoplanin, LYVE-1, PROX 1 and VEGFR-3. The highest vessel density in intratumoural area was recorded with VEGFR-3 (35.94 ± 3.45), followed by podoplanin (31.95 ± 2.77), LYVE-1 (11.11 ± 2.20) and PROX 1 (7.62 ± 1.11). In peritumoural areas, the vessel density was highest with podoplanin (11.48 ± 1.32), followed by VEGFR-3 (7.69 ± 0.51), LYVE-1 (5.19 ± 0.96) and PROX 1 (3.48 ± 0.48). The lymphatics in intratumoural areas were small, thin and collapsed, whereas the peritumoural lymphatics were large and conspicuous. Overall survival was less in patients with high lymphatic density in peritumoural areas for podoplanin, and with high vessel density in intratumoural areas for VEGFR-3. The survival was also low in cases with lymphatic tumour emboli. It was concluded that both intratumoural and peritumoural lymphangiogenesis seemed to play significant role in tumour invasion and spread rather than peritumoural lymphatics. Moreover, the podoplanin and PROX 1 were found to be more specific markers of lymphangiogenesis.

Photo-thermal effects on time to flowering in dolichos bean (*Lablab purpureus* (L.) sweet) var. *lignosus*

C. M. Keerthi, S. Ramesh, M. Byregowda, A. Mohan Rao and G. A. Mary Reena

Keywords: Base temperature, critical photoperiod, Dolichos bean, regression models.

Abstract

Prediction of time to flowering of crop plants (especially photoperiod sensitive (PS) ones) help make appropriate crop management decisions such as choosing optimum sowing and harvesting dates which in turn determine plant size and thus affect dry matter production and crop yield. Modelling time to flowering of dolichos bean, a highly PS short-day food legume crop species, indicated greater role of temperature than photoperiod in regulating time to flowering of PS genotypes. The PS and photoperiod insensitive (PIS) genotypes of dolichos bean differed for base (T_b) and optimum temperature requirement for time to flowering. However, they were comparable for critical minimum, maximum and optimum photoperiod requirement for time to flowering. Dolichos bean requires critical minimum, maximum and optimum photoperiods of 11.11, 12.28 and 12.21 h respectively, and critical minimum growing degree days of $372.05^\circ\text{C day}^{-1}$ and optimum temperature of 23.13°C for time to flowering. Using average daily air temperature, and working backwards in time, it is possible to predict the combination of dolichos bean cultivar and sowing date that will produce ready for harvest crop on a predetermined day when fresh pod quality is optimal.

Redox structure of Vindhyan hydrosphere: clues from total organic carbon, transition metal (Mo, Cr) concentrations and stable isotope ($\delta^{13}\text{C}$) chemistry

Arvind K. Singh, Partha Pratim Chakraborty and Subir Sarkar

Keywords: Hydrosphere, primary organic productivity, total organic carbon, transition metals, stable isotope chemistry.

Abstract

Trace metal concentration in black shales can hold valuable information regarding ancient deep-ocean redox state. The size of marine reservoir of redoxsensitive elements (particularly molybdenum and chromium) is principally controlled by the extent of anoxicity in marine conditions following the onset of oxidative weathering post Great Oxygenation Event ($\sim 2.5\text{--}2.3$ Ga). Hence, it is considered that coupled analysis involving redox-sensitive element/s and primary organic productivity (total organic carbon) may provide a clue for redox behaviour of ancient deep

ocean. Here, we use the redox behaviour of Mo and total organic carbon values of Vindhyan shales to show that the Vindhyan hydrosphere although initiated as a stratified sea with anoxic and sulphidic deep water as exemplified by the geochemical character of the Arangi Shale, the extent and veracity of anoxicity and euxinicity was never pervasive. It further suggests that the Vindhyan hydrosphere developed euxinic deep water only during deposition of Arangi, Rampur and Bijaygarh black shale and was anoxic but certainly not euxinic during Koldaha and Rewa sedimentation. The low concentration of Mo and Cr, in general, in argillaceous intervals suggests that the Vindhyan Sea behaved as a moderate Mo and depleted Cr reservoir. The consistent low concentration of Cr within the Vindhyan shales also suggests restriction in the availability of Cr in the water column in the absence of any significant detrital supply of Cr at very low atmospheric oxygen level

Eschewing poisons: an ingenious wisdom of foraging macrofungi by Karbi ethnic group in North East India

Prila Hansepi and Robindra Teron

Keywords: Ethnomedicine, indigenes, macrofungi, mycetism.

Abstract

This study explores ethnomycological knowledge and management of mycetism by the Karbis of Assam, North East India. Ethnomycological data are quantitatively analysed for factors for informants' consensus, importance value and use value of 12 remedies used for the management of mycetism. Three layers of defence to avoid mycetism, viz. (i) field identification of edible and poisonous macrofungi using morphoorganoleptic features, etymology and phenology; (ii) selective cooking with various sour herbs, and (iii) use of ethnomedicine are reported here. Ethnomycological study among indigenes has benefits of documenting human culture, languages and protection of their intellectual property.

Automatic crater classification framework based on shape parameters

Suchit Purohit, Savita Gandhi and Prakash Chauhan

Keywords: Classification algorithms, computational intelligence, impact craters, shape parameters.

Abstract

This communication presents a framework for automatically classifying a crater image into one of its preservation states namely fresh, floor-fractured and degraded introducing a class of algorithms known as crater classification algorithms (CCA). This study involves identification of discriminatory parameters of classes, development and implementation of algorithms to automatically evaluate the parameters from a given Digital Elevation Model testing on representative craters of each class and evolve a decision tree framework for automatically classifying given crater image into its preservation class. This classification can be applied to craters that exhibit ambiguous topographies to test whether they were formed by impact erosion or igneous modification.

Climate resilient agriculture in Manipur: status and strategies for sustainable development S.

S. Roy, M. A. Ansari, S. K. Sharma, B. Sailo, Ch. Basudha Devi, I. M. Singh, Anup Das, D.

Chakraborty, A. Arunachalam, N. Prakash and S. V. Ngachan

Keywords: Climate smart agriculture, climate change, Northeast India.

Abstract

Manipur in India is endowed with rich biodiversity and abundant natural resources. Despite inaccessibility, marginality and heterogeneity, the state has made good progress in agriculture and

allied sectors. About 80% of the state population depends on agriculture for livelihood. However, agriculture sector in Manipur is facing the consequences of climate change. Climate change is a reality and an increasing trend in temperature, precipitation and emission of greenhouse gases has been observed in Manipur. The state is also projected to experience more of extreme rainfall and reduction in crop yields. As subsistence level farming is coupled with prevalent shifting cultivation, the small and marginal farmers will be most affected due to climate change. Hence, there is an urgent need for devising climate proof plan and climate ready policy for climate compatible agricultural development in Manipur. Location-specific climate smart technology baskets need to be devised or introduced and should be demonstrated through participatory approach, for ensuring a climate resilient production system, and a climate resilient ecosystem. The interactions between the system's adaptation strategies and the mitigation potential should also be given due importance in the action plan for combating climate change. This article deals with the present status of agriculture and allied sector and various technological and policy options for climate resilient agriculture in the hill and mountain ecosystems of Manipur.

Identification of weather events from INSAT-3D RGB scheme using RAPID tool

A. K. Mitra, Shailesh Parihar, R. Bhatla and K. J. Ramesh

Keywords: INSAT-3D, RAPID, DMP, NMP, RGB.

Abstract

Real-time analysis of products and information dissemination (RAPID), a web-based quick visualization and analysis tool for INSAT satellite data has been presented for identification of weather events. The combination of channels using red–green–blue (RGB) composites of INSAT-3D satellite and its physical significant value content is presented. The solar reflectance and brightness temperatures are the major components of this scheme. The shortwave thermal infrared (1.6 μm), visible (0.5 μm) and thermal IR channels (10.8 μm) representing cloud microstructure is known as Day Microphysics (DMP) and the brightness temperature (BT) differences between 10.8, 12.0 and 3.9 μm is referred to as Night Microphysics (NMP). The thresholds technique have been developed separately for both the RGB products of two years (2015–17 of December to February) of data for the identification of fog, snow and low clouds. The validation of these thresholds has been carried out against in situ visibility data from IMD observatories. The RGBs, i.e. DMP and NMP have a reasonable good agreement with ground-based observations and Moderate Resolution Imaging Spectroradiometer (MODIS) data. This threshold technique yields a very good probability of fog detection more than 94% and 85% with acceptable false alarm conditions less than 8% and 10% for DMP and NMP respectively. The technique has significantly minimized the misclassification between low clouds, snow, and fog and found useful for day-to-day weather forecast.

Analysis of WorldView-2 band importance in tree species classification based on recursive feature elimination

Huipeng Liu, Huijun An and Yongxin Zhang

Keywords: Bands importance, maximum likelihood, recursive feature elimination, tree classification, WorldView-2.

Abstract

In tree species classifications, different spectral bands feature different importance, and the manner of determining the importance of one band is a problem that needs to be solved. In this study, eight bands of the WorldView-2 fusion data were used as information sources, and a recursive feature elimination based on maximum likelihood (MLC-RFE) was used to sort the importance of these

bands. According to the results, the importance of the eight bands was sorted as follows (from important to unimportant): nearinfrared 2 > red edge > yellow > red > near-infrared 1 > coastal blue > green > blue. The poorest band combination yielded the lowest overall accuracy (OA) and Kappa coefficient (40.9153%; 0.3080), whereas the optimal band combination presented the highest OA and Kappa coefficient (74.5479%; 0.7029), indicating the large difference in accuracies between the optimal and poorest band combinations. Therefore, selecting important bands bears significance in tree species classifications. The MLC-RFE method significantly solved the band selection problem. Thus, this method should be extended to more complex feature selections.

Effect of humic acid application rates on physicochemical and fertility properties of sandy loam soil grown with mung bean under different irrigation water regimes

Abdulmohsin R. Al-Shareef, Saleh M. Ismail and Fathy S. El-Nakhlawy

Keywords: Drip irrigation, macro-nutrients, soil properties, water stress.

A field experiment was carried out to evaluate the changes in some physicochemical and fertility properties of sandy loam soil treated with three different rates of humic acid (HA) under three different irrigation water regimes. Soil bulk density and saturated hydraulic conductivity were decreased while organic matter was increased by increasing HA rates. Decreasing water regime and increasing HA rate increased soil salinity. Decreasing irrigation water regime increased nitrogen and reduced available phosphorus and potassium. Increasing HA rate increased nitrogen and available phosphorus and potassium.

Morphological, cytological, palynological and molecular characterization of certain Mangifera species

M. Sankaran, M. R. Dinesh, N. Chaitra and K. V. Ravishankar

Keywords: Chromosome, ITS, mango, pollen grains, psbA-trnH and phylogenetic analysis.

Abstract

The *Mangifera* genus has more than 60 species, mostly distributed in tropical Asia. The wild relatives of *Mangifera* are considered reservoirs of potential genes that can confer tolerance/resistance to biotic and abiotic stresses. The morphological, cytological and molecular characterization of eight species was done to study the diversity and phylogenetic relationship among different *Mangifera* species. In order to study the evolutionary relationship and polymorphism among the mango species, the ITS1/ITS4 gene and partial chloroplast psbH-trnH genes were sequenced. Phylogenetic analysis of the nuclear and chloroplast marker revealed that the *M. indica* L. is closely related to *M. griffithii* and *M. camptosperma*, which belong to subgenus *Mangifera*. Results indicate that the taxonomic position of *M. andamanica* should be reconsidered as this species is very close to *Bouea oppositifolia* which is evident from both ITS and psbAtrnH rDNA analysis. The morphological traits such as tree, leaf, flowers and fruits and palynological and cytology of the genus mango were used to distinguish the species and its phylogenetic status. The morphological traits among various species indicate the high level of variability which were further confirmed with ITS sequences and cpDNA. Phylogenetic analysis illustrates that partial chloroplast psbH-trnH gene gave better polymorphism in mango species than nuclear ITS. The pollen morphology and chromosomal counts were also done in certain *Mangifera* species to study the phylogenetic relationship.

The height of fractured zones caused by strip Wongawilli mining in a shallow buried coal seam underlying a hard roof

Yi Tan, Wenbing Guo, Erhu Bai¹ and Daming Yang

Keywords: Fractured zone, hard roof, loses of drilling fluid, strip Wongawilli mining, subcritical mining.

Abstract

The exact determination of the height of fractured zones in overlying sedimentary strata is important in coal mining performed underneath water bodies and for a safe production. To prevent the inrush of water and sand during strip Wongawilli mining, we studied the height of fractured zones in shallow coal seams underlying a hard roof. Based on the geological setting and mining conditions at the Zhaowu coal mine, the height of the fractured zones in overlying strata was measured using the loss of drilling fluid method and by numerical simulation. The height of the fractured zones and its development characteristics during strip Wongawilli mining in shallow buried coal seam underlying a hard roof were obtained. The results demonstrate that the disturbance of the overlying strata during strip Wongawilli mining is reduced and the height of the fractured zones is smaller relative to that occurring during critical mining. The height of fractured zones increases with mining width in a steppedfinger line, and it manifests stable in each stage, but turns into the next stage by sudden increase. The existing method of calculation and the traditional empirical formula to obtain the height of the fractured zones are not suitable for strip Wongawilli mining. The calculation should be based on the size of mining.

Milk proteins, health issues and its implications on National Livestock Breeding Policy of India

Ashish Kumar, Bakul Rao and Arun Kumar De

Keywords: Beta-caseins, genotyping, livestock breeding policy, milk safety, milk proteins.

Abstract

Increasing evidence supporting the correlation between bovine beta-casein and disorders in milk consumers has led to the development and popularity of A2 milk and milk products worldwide. The indigenous cattle population of India harbours the preferred A2 allele of beta casein; however, genetic improvement of this cattle population by crossbreeding with exotic breeds is spoiling the gene pool as most of the exotic breeds contain A1 allele of the gene. In this study, we aim at evaluating the status of beta-casein in the Indian dairy sector and provide a discussion of future implications to the A2 milk industry. Our results show that the genotypic frequencies of A1 and A2 genes in a sample cattle population were 0.365 and 0.635 respectively. Based on the pure nature of the A2 allele in indigenous cattle, the presence of the A1 allele was assumed to be attributable to crossbreeding with exotic cattle breeds. Current options to drift the frequency of herds towards A2 are highly limited, raising serious questions regarding breeding policies in India and the lack of availability of certified A2 semen straws. The absence of any official standards and certification procedures in the country for A2 milk and milk products aggravates the situation from a food safety perspective. The future focus of sorted sexed semen and embryo transfers by the Department of Animal Husbandry, Dairying and Fisheries in India for dairy development should include A2 certification as an integral component. The Food Safety and Standards Authority of India should define and establish standard protocols for certification of A2 milk and milk products to safeguard the rights of consumers against the potential food fraud.

Exploitation of heterobeltiosis and economic heterosis for horticultural yield, and its attributes and biochemical traits in pumpkin (*Cucurbita moschata* Duch. ex. Poir) under salt affected soil

Vimlesh Kumar, D. P. Mishra, G. C. Yadav and Satish Yadav

Keywords: Diallel mating, fruit yield, heterobeltiosis, pumpkin, β -carotene.

Abstract

Pumpkin crop can be improved by exploitation of heterosis. This study was carried out during three different seasons, Kharif, 2015 (E1), Rabi 2015–16 (E2) and summer-season, 2016 (E3) in Eastern Uttar Pradesh, India. The objective was to find out the magnitude of heterobeltiosis, economic heterosis and suitable cross-combination for higher quality fruit yield in pumpkin. Fifteen F1 hybrids were developed through diallel mating design of six parental lines excluding reciprocals. The evolution of hybrids revealed significant heterobeltiosis as well as economic heterosis for all the traits in all three seasons independently (E1, E2 and E3) and combined. Crosses P1 \times P5, P4 \times P6 and P1 \times P2 may be exploited as commercial hybrids for profitable yield in pumpkin. Significant heterobeltiosis and economic heterosis indicates the importance of heterosis breeding for the developing high yield hybrids.

Estimates of losses caused in paddy due to rice hispa, *Dicladispa armigera* (Oliver) (Coleoptera: Chrysomelidae)

Urvi Sharma and Ajai Srivastava

Keywords: Grain number, grain weight, hispa release density, leaf damage, panicles, tillers, yield components.

Abstract

Studies were undertaken for two consecutive years (kharif 2015 and 2016) at the CSK Himachal Pradesh Krishi Vishvidyalaya, Rice and Wheat Research Centre, Malan (Himachal Pradesh, India) under field conditions using paddy variety 'Kasturi Basmati'. Losses in paddy due to rice hispa, *Dicladispa armigera* (Oliver) were quantified in terms of release density (number of adults per tiller) and phenological stages of crop. Results revealed that both these aspects significantly influenced leaf damage as well as yield of paddy. Early stage release (20 DAT, days after transplanting) contributed to maximum leaf damage (69.9 PLDI (per cent leaf damage index)) and at the same time exerted a significant negative influence on various yield components, viz. number of tillers, panicles, grains and grain weight (g) for which the respective regression coefficients were 5.82, 5.73, 441.4 and 8.06, respectively (per 4 rice hills).

Effect of light interception and penetration at different levels of fruit tree canopy on quality of peach

Yamini Sharma, Harminder Singh and Sompal Singh

Keywords: Canopy management, quality improvement, Peach, PAR, training systems.

Abstract

Peach trees were trained to four systems, viz. Yshaped, Hedge row, Espalier and V trellis. Irrespective of the training system in upper canopy total PAR increased from January to July and then a decrease was recorded. However, in lower canopy an inverse trend was recorded. The total radiation intercepted during the year was maximum (59.99%) in Espalier system followed by V trellis (57.76%). Minimum radiation interception (49.05%) was recorded in trees trained to Hedge

row. Upper canopy part of the tree received more PAR which influenced fruit quality in terms of size, weight, acidity, total sugars, firmness.

Ground surface warming in peninsular India: evidence from geothermal records

Vyasulu V. Akkiraju, Sukanta Roy and Shalivahan

Keywords: Borehole temperatures, ground temperature history, peninsular India, surface air temperature.

Abstract

Analyses of borehole temperature profiles provide useful information about regional climate change over a few centuries. Data from 146 borehole sites in the crystalline terrain of peninsular India were used to reconstruct surface ground temperature history. Depths of the boreholes ranged from 150 to 1522 m. The temperature profiles were characteristic of heat flow by conduction, being largely unaffected by perturbations due to groundwater flow. The profiles show temperature anomalies in the top few hundred metres that is consistent with changing surface temperature over the past two–three centuries. Analysis of individual profiles for a ramp change in temperature reveals predominant surface ground warming in peninsular India with a mean magnitude of $1.0 \pm 0.2^\circ\text{C}$ for 129 ± 18 years at 95% confidence level corresponding to onset ca 1860 AD for the change.

Bank material characteristics and its impact on river bank erosion, West Tripura district, Tripura, North-East India

Moujuri Bhowmik, Nibedita Das (Pan), Champakali Das, Istak Ahmed and Jatan Debnath

Keywords: Bank erosion, bank material, grain size, shear strength, West Tripura district.

Abstract

In West Tripura district, river bank erosion becomes very common during monsoons along the Haora River and the Sonai Gang. Erosion occurs across 45.39 km (96% of the total length) of the Haora River and 20.12 km (90% of the total length) along the Sonai Gang. The main cause of river bank erosion in the district is the nature of bank material with respect to its erodibility factor (resisting force). The objectives of this study were to identify the nature of bank material of the rivers in West Tripura district and to analyse the shear strength of these materials. Samples were collected from twelve sites at various depths from top of the river bank up to the water level. Hydrometer test and grain size were also analysed. Uniformity coefficient (Cu) and coefficient of curvature (Cc) were calculated to identify the shear strength of bank soil. Tests revealed that the bank soils contain more than 90% sand and less percentage of silt and clay. This makes the soil non-cohesive and leads to maximum erosion.

Garnetiferous metamorphic rocks in Jaspa granite, Himachal Pradesh, India: implication of Tethyan Himalayan metamorphism and tectonics

S. S. Thakur, A. K. Singh, D. Rameshwar Rao, Rajesh Sharma, Subhajit Pandey and Aliba

Keywords: Garnet-grade metamorphism, granite pluton, magmatic enclaves, pelitic xenoliths.

Abstract

Studies on the magmatic enclaves, pelitic xenoliths and host Jaspa granite pluton outcropped in the Lahaul area, NW Himalaya, India illustrate that the rocks have undergone garnet-grade metamorphism. The P–T pseudosection modelling shows that the metamorphic mineral assemblage is stable in the P–T range $\sim 4.5\text{--}7.3$ kbar and $\sim 440\text{--}500^\circ\text{C}$, matching quite well with the results obtained from the conventional geothermobarometers ($5.7\text{--}8.6$ kbar and $409\text{--}531^\circ\text{C}$). The observed garnet-grade metamorphism in and around the Jaspa pluton is proposed to be due to localized perturbation of high-temperature isotherms in the Tethys Himalaya, as a consequence of the

Cenozoic tectono-thermal event during Himalayan orogeny. Further, the Haimanta group of Tethys Himalayan rocks in the Lahaul area has been interpreted to have attained right-way-up metamorphic field gradient.

Fish short-term reproductive assay for evaluating the estrogenic property of a commonly used antioxidant, butylated hydroxyanisole

George Paul, R. N. Binitha and Francis Sunny

Keywords: Anabas testudineus, butylated hydroxyanisole, endocrine disruption.

Abstract

Fish short-term reproductive assay (FSTRA) is a tier one assay for screening the endocrine disrupting property of a compound. This study analysed the end points like variations in Gonado-Somatic index (GSI), sperm quality and count, serum hormone levels (FSH, LH, estrogen and testosterone) to study the endocrine disrupting properties of butylated hydroxyanisole (BHA). A fresh water teleost, *Anabas testudineus* was used as animal model in this study. LC50 value of BHA was 250 mg/kg body weight in fish. Effects of four different doses of BHA were studied – 2, 5, 50 and 75 mg/kg body weight. BHA is found toxic at high doses of 250 mg/kg body weight and above. All the four doses of BHA caused significant impact on GSI, sperm count and quality. Serum hormone assay by ELISA showed significant variations in treated groups compared to control group.

Biological suppression of coconut black headed caterpillar *Opisina arenosella* outbreak in East Godavari district of Andhra Pradesh – eco friendly technology

N. B. V. Chalapathi Rao, A. Nischala, G. Ramanandam and H. P. Maheswarappa

Keywords: Biological control, coconut, *Opisina arenosella*, outbreak, parasitoids.

Abstract

The leaf eating black headed caterpillar *Opisina arenosella* is a serious pest of coconut palm causing significant yield loss in all the coconut growing tracts of India. During 2015–16, a high infestation of black headed caterpillar was observed in all the coastal districts of Andhra Pradesh, and an incidence ranging from 42.82% to 62.86% was recorded. From October 2015 to April 2016 inundative releases of about 3,788,000 larval parasitoids *Bracon hebetor* and *Goniozus nephantidis* were carried out in pest affected gardens in Allavaram and Uppalaguptam mandals of East Godavari. To study the impact of the parasitoid releases, 10 leaflets/palm were randomly collected from 10 sample gardens in seven villages of these mandals and the pest population recorded. After three months of parasitoid release, the larval population of *O. arenosella* decreased by 34.08–75.88%, pupal population by 33.33–94.52%, and the paralysed larval population recovered was 8.30–26.92%. After six months, the larval population decreased by 59.65–100%, the pupal population up to 92.77–100% and the paralysed larval population recovery was also high, ranging from 18.68% to 34.61%. The impact of inundative release of bio agents for suppression of leaf eating caterpillar was prominent, after six months providing impetus to the role of biological control in pest management. The assumed overall economic loss prevented due to this intervention was 192.6 million rupees.

Forest laws, for whom, by whom? A concept mapping study of the Ecologically Fragile Lands Act, 2003 in Wayanad, Kerala, India

Jiss K. Varkey, S. Gopakumar, K. Vidyasagan, Joy Mathew and A. V. Santhosh Kumar

Keywords: Concept mapping, ecologically fragile lands, participatory approaches, Wayanad, Western Ghats.

Abstract

Kerala enacted the Kerala Forest (Vesting and Management of Ecologically Fragile Lands) Act, 2003 to conserve 'fragile ecosystems' lying contiguous to reserve forests. As this Act led to several litigations and conflicts, the current concept of Ecologically Fragile Lands (EFL) was concept mapped among the different stakeholders, including 'small and marginal' farmers in the context of Wayanad district, Kerala. Several dimensions of EFL, viz. 'Ecological', 'Situational', 'Socioeconomic', 'Framework' and 'Better EFL' were developed and debated to evolve a more acceptable EFL concept. The study also accentuates the relevance of public participation in conceiving socially inclusive forest laws and policies.

Scientific contribution of Professor Mahalanobis: a bio-bibliometric study

Dhiman Mondal, Nitai Raychoudhury and Juran Krishna Sarkhe

Keywords: Bio-bibliometric study, Prasanta Chandra Mahalanobis, scientometric study, statistics, Indian Statistical Institute.

Abstract

1 On the 125th birth anniversary of Professor Prasanta Chandra Mahalanobis, the authors analyse characteristic features, pattern and citation impact of the great Indian scientist and statistician's scientific works. A bibliography of his scientific contributions was prepared. It contained 6 books, 142 journal articles, 87 conference papers and 38 research reports. The study categorizes and presents the data according to year-wise contribution, authorship pattern, collaborators, preferred journals for communication, country-wise publications, top cited authors, citation history and citation impact. The study revealed that his research productivity peaked during 1934 to 1938 at the ages 41–45, with contribution of 77 scientific works. Further, the citation history of top 11 cited papers during 1990–2017 indicates that his publications are still being cited regularly which proves the continued relevance of his theory and applications over time.

Research preferences of the G20 countries: a bibliometrics and visualization analysis

Gege Lin, Zhigang Hu and Haiyan Hou

Keywords: Bibliometrics, country-level studies, G20 countries, research preferences, VOSviewer.

Abstract

The purpose of this study is to reveal the differences both in research output and research preferences of the G20 countries. The research outputs of the nineteen G20 countries (excluding the European Union) are measured based on their publications indexed in Web of Science. The research preferences of the G20 countries were studied by comparing their research output in each research subject. Clustering method was then employed to classify the countries according to their research preferences. Nineteen countries are classified into four clusters. Countries assigned to the same cluster are similar in distribution of research subjects. In the end, by VOSviewer, we showed the research pattern of each cluster. For example, USA in Cluster A is characterized by the emphasis on medical sciences and China in Cluster C is characterized by paying more attention to physical sciences.

A brief history of solitons and the KdV equation

Alex Kasman

Keywords: KdV equation, nonlinear partial differential equation, solitons, waves.

Abstract

Soliton theory is an interdisciplinary area at the interface of mathematics and physics. It studies a special class of nonlinear partial differential equations (NLPDEs) having solutions that are waves which behave like particles. Amazingly, unlike most NLPDEs, we can write exact formulas for the

solutions to these ‘soliton equations’. This article is a review providing the historical context necessary to appreciate these spectacular developments, a brief overview of the early history of the field, and a list of references to consult for additional information.

Fourth-generation refrigerant: HFO 1234yf

Pinklesh Arora, Geetha Seshadri and Ajay Kumar Tyagi

Keywords: Air-conditioning and refrigeration, fourthgeneration refrigerants, global warming potential, ozone depleting potential.

Abstract

Refrigeration is a process to transfer heat from the objects for cooling and freezing for maintaining the temperature of surroundings for preservation purposes and comfort. Refrigerants are the materials to use in air-conditioning and refrigeration system. This article describes the developments and history of the first-, second-, third- and fourth-generation refrigerants. Moreover, the focus is on a fourth-generation refrigerant, viz. HFO-1234yf having zero ozone depletion potential and very low global warming potential. Synthesis procedure, chemistry, applications and consumption norms of HFO-1234yf are explained.

First-principles study of the electronic, magnetic and structural properties of ZnO and Zn_{1-x}Cr_xO (x = 0.125, 0.25, 0.375, 0.5) in the room temperature wurtzite structure

Sarajit Biswas

Keywords: Bandgap semiconductor, Cr-doped ZnO, electronic and optical properties, density functional theory, wurtzite ZnO.

Abstract

First-principles electronic structure calculations were presented to study the electronic, magnetic and structural properties of pure ZnO and Zn_{1-x}Cr_xO (x = 0.125, 0.25, 0.375, 0.5) in the room temperature (293 K) wurtzite structure. Pure ZnO is found to be a non-magnetic insulator due to perfectly paired electrons in each Zn-3d orbital. This material encounters nonmagnetic insulator to a ferromagnetic half-metal for x = 0.125 and then to a ferromagnetic metal for x = 0.25. The ferromagnetic metallic phase maintains up to x = 0.5. It is revealed in this study that 100% spin polarization is responsible for the half-metallic behaviour of Zn_{0.875}Cr_{0.125}O. Nevertheless, partial filling of Cr-3d_{3z²-r²} orbital in the spin-up channel together with a minute, but finite contribution of electrons from the Cr-3d_{xy/z²-r²} orbitals at EF for the spin-down channel are together responsible for the metallic behaviour of Zn_{1-x}Cr_xO (x ≥ 0.25). The ferromagnetism in all the Cr-substituted compounds arises from strong Hund’s rule coupling. Eventually, a trivial variation in the Zn–O/Zn–Zn bond distances and ∠Zn–O–Zn bond angles caused by Cr doping is responsible for a minor structural distortion in Zn_{0.5}Cr_{0.5}O.

Automatic recognition of acute lymphoblastic leukemia using multi-SVM classifier

Pouria Mirmohammadi, Amirhossien Rasooli, Meghdad Ashtiyani, Morteza Moradi Amin and Mohammad Reza Deevband

Keywords: ALL, fuzzy c-means method, PCA analysis, SVM classifier.

Abstract

Acute lymphoblastic leukemia (ALL) is the most popular form of white blood cells cancer in children. It is classified into three forms of L1, L2 and L3. Typically, it is identified through screening of blood smears via pathologists. Since this is laborious and tedious, automatic systems are desired for suitable detection; but the high similarity between morphology of ALL forms and that of normal, reactive and a typical lymphocytes, makes the automatic detection a challenging

problem. This study tried to improve the accuracy of detection based on principle component analysis (PCA). After segmenting nuclei of cells, numerous features were extracted. The first six components of this feature space were used for the binary and multiclass support vector machine classifiers. An expert pathologist was used to appraise this method as a gold standard. A collation with similar work indicated that using PCA instead of using exclusively selected features enhanced the average sensitivity and specificity of classification up to 10%. The results demonstrate that this algorithm performs better than similar studies. Its permissible efficiency for identifying ALL and its sub-types as well as other lymphocyte forms makes it an associate diagnostic device for pathologists.

Bacillus amyloliquefaciens (VB7) with diverse antimicrobial peptide genes: A potential antagonist for the management of fairy ring spot in carnations

S. Vinodkumar and S. Nakkeeran

Keywords: Antimicrobial peptide, *Bacillus amyloliquefaciens* (VB7), *Cladosporium echinulatum*, fairy ring spot.

Abstract

Fairy ring spot incited by *Cladosporium echinulatum* is an unexplored yet disastrous disease of carnation. *Bacillus amyloliquefaciens* (VB7) with 10 diverse antimicrobial peptide genes, effectively reduced fairy ring spot intensity to 6.44 (per cent disease index, PDI) and increased flower yield (196.61 Nos/m²) compared to control (PDI – 60.33; flower yield – 140.70 Nos/m²). Plants treated with tebuconazole (250 EC, emulsifiable concentrate) and alternated with mancozeb (75% WP, wettable powder) were much effective and reduced disease intensity up to 3.46 PDI. However, flower yield was comparatively lesser to the treatment of *B. amyloliquefaciens* (VB7). Results revealed that *B. amyloliquefaciens* out-performed fungicides in growth promotion.

Pollution and environmental stressors modulate the microbiome in estuarine mangroves: a metagenome analysis

Mandar S. Paingankar and Deepti D. Deobagkar

Keywords: Anthropogenic stressors, bacterial communities, metagenomics, microbial ecology, pollution.

Abstract

The microbial communities of mangroves which form important links in elemental cycling and bioremediation have not been elucidated in most parts of the world. Due to urbanization and deforestation mangroves are also under threat. In the present study, high throughput next generation sequencing technology, based on 16S rRNA amplicon analysis using Illumina platform, was employed to unravel the microbial diversity present in different mangrove areas in the west coast of India. It could be seen that in mangroves, Proteobacteria and Bacteroidetes were most common, followed by taxon such as Firmicutes, Spirochaetes, Chloroflexi and Verrucomicrobia. In proteobacteria group, Gammaproteobacteria, Alphaproteobacteria and Deltaproteobacteria were most abundant. Interestingly, bacteria having the capacity to utilize sulphate were present along with methanogens in all samples, suggesting that anaerobic and sulphur-based metabolic pathways play an important role in these mangrove ecosystems. The differences in bacterial diversity can be partly attributed to biotic and abiotic factors such as physico-chemical characteristics of the samples, geographical location and natural and human-induced changes in the locality. The metagenomics analysis of mangrove sediment samples has helped in elucidating the baseline data on bacterial diversity along mangroves in Maharashtra along the west coast of India and can provide pointers for effective measures of conservation.

Udaria – a new liverwort genus of Lophocoleaceae from Eastern Himalaya, India

D. K. Singh, Shuvadeep Majumdar and Devendra Singh

Keywords: Bryophytes, Eastern Himalaya, liverwort, Marchantiophyta, new genus and species, Udaria lamellicaulis.

Abstract

A new genus and species of liverwort, Udaria lamellicaulis gen. & sp. nov., referable to the family Lophocoleaceae is described from Arunachal Pradesh and Sikkim in Eastern Himalaya, India. The new taxon can be easily differentiated from hitherto all the known genera of the family in the presence of longitudinal, 1–12 cells high seriatly arranged lamelliform strips on the surface of stem, leaves and female bracts, striolate–rugulose leaf cuticle, rhizoids arising from the lamina of underleaves, gynoecia with 1–2 subfloral innovations and gemmiparous female bracts and bracteoles.

Statistical analysis of performance in SMEs

Gaban Lucian, Masca Ema, Morar Dan Ioan, Fatacean Gheorghe and Moscviciov Andrei

Keywords: Assets, equity, sales, investment.

Abstract

Market economy is mainly characterized by private property. For entrepreneurs, private property allows action according to market realities, opportunities and strategies aimed to succeed. There is no doubt that all small and medium enterprise (SME) achievements are closely linked to profitability, as SMEs constitute a development engine that fuel country GDP. We examine the profitability implications of providing finance to 1233 Romanian SMEs during 2004–2008 based on financial structure ratios. In addition, we analyse the correlation between various return rates. We establish a correlation between performance and equilibrium of Romanian SMEs in five economic sectors: pharmaceutical, furniture manufacturers, leather garment, software and textiles.

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Periodic table of elements revisited for accommodating elements of future years

M. C. Rath

Keywords: Atomic numbers, atomic structure, inner orbitals, periodic table.

Abstract

The periodic table of elements shows only three columns and two separate rows for lanthanides and actinides called lanthanide and actinide series respectively. The newly discovered elements have already occupied the last row and last column of the table, which has the electronic orbital configuration, $7s^2 5f^{14} 6d^{10} 7p^6$. After the discovery of two more new elements with atomic numbers 119 and 120, the third new element with atomic number 121, will have to be entered in the g-block series, according to the electronic orbital configuration theory, $7s^2 5f^{14} 6d^{10} 7p^6 8s^2 5g^1$. Thus, in the present periodic table, such new g-series has to be written separately below the actinide series. Such a representation of elements would be quite confusing. Therefore, to avoid this and also to ensure the visibility of the ‘concept of inner orbitals like d, f, g, etc.’, a new and expanded form of the periodic table has been designed. This table is expected to accommodate all the new elements of higher atomic numbers and also give instant information on the electronic orbital structure of an element.

Biobusiness in brief: what ails clinical trials?

Gayatri Saberwal

Keywords: Biotech industry, clinical trials, ethics, pharma industry.

Abstract

Many academic researchers, while working on fundamental problems, hope that in due course their science will benefit humanity. Undoubtedly, they would be delighted if their science was to be the basis for drugs that reached patients. For that to happen, the candidate molecules must pass through clinical trials. Unfortunately, world over, trials have been beset with problems and have been heavily criticized on many fronts. Here we describe some of the points of contention, focusing on issues that have come to light in the West.

Bibliometric and social network analysis in scientific research on precision agriculture

José Luis Aleixandre-Tudó, Lourdes Castelló-Cogollos, José Luis Aleixandre and Rafael Aleixandre-Benavent

Keywords: Bibliometrics, precision agriculture, research collaboration, scientific analysis, social network.

Abstract

Precision agriculture (PA) is used to improve agricultural processes. A better understanding of PA as well as the evolution of the research status through the available literature are reported and discussed in this study. The Web of Science (WoS) was used to obtain the research records under study. Indicators of scientific productivity, collaboration between countries and research impact were evaluated through a social network analysis. The keywords included in the publications and subject areas under which the research was published were also evaluated through subject analysis. A total of 2027 articles were analysed from 1994 to 2014. The most productive journals were 'Computers and Electronics in Agriculture' (n = 191) and 'Precision Agriculture' (n = 110). The most frequent keywords were 'management' (n = 243), 'yield' (n = 231), 'soil' (n = 198) and 'variability' (n = 190). The collaboration network showed the United States occupying a central position, in combination with some leading countries such as Brazil, Germany, People's Republic of China, Canada, Australia and Spain. A steady increase in PA research was identified during the last decade, which was even more sharp between 2010 and 2014. The increased importance of PA research has recently led to the birth of specific journals such as Precision Agriculture. The increasing number of journals that publish articles related to the topics included in the WoS must also be considered. The network analysis identified a number of developed countries in the hotspot of international collaboration.

Occurrence of ice-bonded sediments in the Mackenzie Trough, Beaufort Sea

Young-Gyun Kim, Young Keun Jin, Sookwan Kim, Seung-Goo Kang and Jong Kuk Hong

Keywords: Beaufort Sea, IBRV Araon, Mackenzie Trough, subsea permafrost limit, subbottom profile, subsurface temperature.

Abstract

The Arctic continental shelves experienced subsea permafrost degradation because of the long-term warming and sea level rise since the Last Glacial Maximum (LGM), when the sea level was ~100 m lower than its present level. However, the current status of the subsea permafrost limit is not yet clearly defined due to a lack of evidence. New subbottom profiling and subsurface temperatures were acquired to examine the subsea permafrost limit on the eastern slope of the Mackenzie Trough during Korean Icebreaker R/V Araon expeditions in the summer of 2013 and 2014. We found anomalous subbottom acoustic features indicating ice-bonded sediments where cold bottom water

and a subsurface with subzero temperature exists. The cold bottom water belongs to the Arctic halocline. We conclude that with help from cold Arctic halocline, ice-bonded sediments can exist at shallow water depths of We argue that they are relict subsea permafrost from the LGM, but further investigation is required to clarify their origin. Our conclusion implies that ice-bonded sediments can occur at shallow water depths over the Arctic continental shelves and that their fate depends on the temperature change in seawater.

Ground-based observations for the upper atmosphere at Jang Bogo Station, Antarctica: preliminary results

Ji Eun Kim, Jeong-Han Kim, Geonhwa Jee, Changsup Lee, Hyuck-Jin Kwon, Young-Bae Ham, Terence Bullett, Qian Wu, Justin Mabie and Nikolay Zabotin

Keywords: Fabry–Perot Interferometer, polar upper atmosphere, Vertical Incidence Pulsed Ionospheric Radar

Abstract

The second Korean Antarctic station, Jang Bogo Station (JBS), Terra Nova Bay (74°37.4'S, 164°13.7'E), is operational since March 2014. A Fabry–Perot Interferometer (FPI) and Vertical Incidence Pulsed Ionospheric Radar (VIPIR) were installed in 2014 and 2015 respectively, for simultaneous observations of neutral atmosphere and ionosphere in the polar region. Neutral winds observed by FPI show typical diurnal and semi-diurnal variations at around 250 km and 87 km respectively. VIPIR observations for the ionosphere also show typical electron density distributions in the polar region. Unlike conventional ionospheric sounder, it can measure ionospheric tilts to provide horizontal gradients of electron density over JBS in addition to general ionospheric parameters from sounding observation. In this article, we briefly report the preliminary results of the observations for the neutral atmosphere and ionosphere in the polar cap region.

Palaeolimnological records of regime shifts from marine-to-lacustrine system in a coastal Antarctic lake in response to post-glacial isostatic uplift

Badanal Siddaiah Mahesh¹, Abhilash Nair, Anish Kumar Warriar, Anirudha Avadhani, Rahul Mohan and Manish Tiwari

Keywords: Diatoms, Holocene climate, Larsemann Hills, stable isotopes, sedimentary organic matter.

Abstract

Low altitude coastal lakes along the Antarctic margin often contain both marine and lacustrine sediments as a result of relative sea level changes due to deglaciation. The sediments also record changes in regional climate. A sediment core from a coastal lake in Larsemann Hills, East Antarctica, viz. Stepped Lake (Heart Lake), records distinct changes in C, N, C/Natomic ratio, $\delta^{13}\text{COM}$, $\delta^{15}\text{NOM}$ and diatom abundance during the mid-Holocene (8.3 to 4.6 kyr BP). Lower values (Corg ~1%; C/N 8, ^{13}COM ~ -18‰) during the early Holocene (8.3–4 kyr BP) are consistent with marine conditions, while higher values [Corg 6%; C/N 12; ^{13}COM ~ -12‰) suggest a shift to lacustrine conditions (5.5–4.6 kyr BP). The diatom community shows similar shift with the major part of Holocene (8.3– 5.5 kyr BP) dominated by sea-ice and open-ocean diatoms while the core-top sections (5.5–4.6 kyr BP) transitions to lacustrine diatoms (*Stauroforma inermis*). These observations confirm that the basin was marine, and later became isolated as a result of postglacial isostatic uplift after 4.7 kyr BP.

Effects of vertically propagating mountain waves during a strong wind event over the Ross Ice Shelf, Antarctica

Sheeba Nettukandy Chenoli, John Turner⁴ and Azizan Abu Samah

Keywords: Katabatic wind, mesoscale model, mountain wave, strong wind events.

Abstract

Weather forecasting in the Antarctic presents many challenges, with strong wind events (SWEs) often disrupting air and field operations. Here, we study the mechanisms responsible for a SWE (maximum wind speed 22 ms⁻¹) that occurred at the McMurdo/Scott Base region on the Ross Ice Shelf (Antarctica) over 12–13 October 2003. The study is based on in situ observations, satellite imagery and output from the Antarctic mesoscale prediction system (AMPS) model. The event occurred during the passage of a complex low pressure system that increased the pressure gradient between the northwest Ross Ice Shelf and the continental high, initiating a strong southerly flow. AMPS simulations as well as upper air sounding profiles from McMurdo station showed the involvement of large amplitude vertically propagating mountain waves over the area. The amplification of mountain waves by the self-induced critical level reflected all the energy back towards the surface to generate high downslope winds.

Population dynamics of bacterioplanktonic component associated with the phytoplankton biomass in Kongsfjorden, an Arctic fjord

Rupesh Kumar Sinha, K. P. Krishnan¹ and Savita Kerkar

Keywords: Arctic, bacterial diversity, Kongsfjorden, phytoplankton pigments.

Abstract

Temporal variation (June and October 2012) in bacterial and phytoplankton communities of Kongsfjorden was studied using 16S rRNA gene clone libraries and marker pigments respectively. Proteobacteria was the dominant phyla in Kongsfjorden with Gammaproteobacteria (42%) and Alphaproteobacteria (84%) dominating in June and October, respectively. Retrieval of sequences affiliated to Verrucomicrobia, Gammaproteobacteria and Bacteroidetes in June corresponded with high autotrophic biomass (Chl a, 33 ng l⁻¹) whereas abundance of SAR 11 coincided with decrease in the intensity of autotrophic biomass (Chl a, 24 ng l⁻¹) in October. Thus, the distribution of bacterioplankton community varied with change in phytoplankton composition indicating a significant coupling between these two groups in the fjord water.

Draft genome sequence of a novel actinobacterium from the family Intrasporangiaceae isolated from Signy Island, Antarctica

S. M. Thomas, P. Convey, H. M. Gan, D. A. Pearce and G. Y. A. Tan¹

Keywords: Actinobacteria, Antarctic soil, Humibacillus.

Abstract

Actinobacterium strain S63T isolated from a soil sample collected from Spindrift Col on Signy Island (South Orkney Islands, maritime Antarctic) is a new species of the Intrasporangiaceae family. Here we report a draft genome sequence with an approximate size of 5 Mbp contained in 54 contigs (69.33% GC content). Preliminary analysis revealed the presence of cold active protein coding sequences, which may indicate an adaptation to the harsh polar environment from which the strain was isolated.

Effects of field warming on a High Arctic soil bacterial community: a metagenomic analysis

P. P. J. Lim, K. K. Newsham, P. Convey, H. M. Gan, W. C. Yew and G. Y. A. Tan

Keywords: Arctic soil bacterial diversity, high throughput sequencing, open top chambers, Svalbard.

Abstract

Soil microbial communities in the Arctic, one of the most rapidly warming regions on Earth, play an important role in a range of ecological processes. This report describes initial studies of natural soil bacterial diversity at a High Arctic site on Svalbard, as part of a long-term field environmental manipulation study. The impact of increased soil temperature and water availability on soil microbial communities was investigated. The manipulation experiment, using open-top chambers, was installed in late summer 2014, and the soils were sampled soon after snow melt in July 2015. High throughput sequencing of 16S rRNA genes showed relatively uniform diversity across the study area and revealed no significant initial effect of treatments on bacterial communities over the first 10-month autumn–winter–spring manipulation period.

Analysis of bacterial communities of King George and Deception Islands, Antarctica using high-throughput sequencing

C. Y. Chua, S. T. Yong, M. A. González, P. Lavin, Y. K. Cheah, G. Y. A. Tan and C. M. V. L. Wong

Keywords: Antarctica, South Shetland Islands, soil bacterial diversity, 16S rDNA, pyrosequencing.

Abstract

King George Island (KGI) and Deception Island (DCI) are members of the South Shetland Islands in Antarctica, each with their own landscape and local environmental factors. Both sites are suitable for long-term monitoring of bacterial diversity shift due to warming, as temperature rises relatively faster than East Antarctica. This study was conducted to determine and compare the baseline diversity of soil bacteria in KGI and DCI. 16S rDNA amplicons of bacteria from both sites were sequenced using Illumina next generation sequencer. Results showed that major phyla in KGI and DCI were Actinobacteria, Proteobacteria, Chloroflexi, Verrucomicrobia, Bacteroidetes and Acidobacteria. The distribution and evenness of the soil bacterial communities varied at genus level. The genera *Sphingomonas* sp. was predominant at both sites while the subsequent six major genera differed. Two bacterial genera, *Legionella* and *Clostridium* were also found in low abundance in both sites, both of which may contain pathogenic members. Further verification will be required to determine whether the pathogenic members of these genera are present in both sites.

Genome sequences of two cold-adapted *Cryobacterium* spp. SO1 and SO2 from Fildes Peninsula, Antarctica

C. P. Teoh, C. M. V. L. Wong, D. J. H. Lee, M. A. González, N. Najimudin, P. C. Lee and Y. K. Cheah

Keywords: Fluctuation, genomes, King George Island, 16S rDNA, temperature.

Abstract

Psychrophilic and psychrotrophic bacteria play important roles in nutrient cycling in cold environments. These bacteria are suitable as model organisms for studying cold-adaptation, and sources of cold-active enzymes and metabolites for industrial applications. Here, we report the genome sequences of two *Cryobacterium* sp. strains SO1 and SO2. Genes coding major proteins related to cold- or thermal-stress adaptations and those with industrial applications found in their genomes are described.

Microbial eukaryotic diversity with emphasis on picoprasinophytes under the sea ice of the central Arctic Ocean in summer

Wei Luo, Huirong Li, Xiaoyan Gao, Ling Lin, Yong Yu and Yinxin Zeng

Keywords: Microbial eukaryotes, molecular probe, picoprasinophyte, sea ice.

Abstract

The central Arctic Ocean and its microbial ecosystem are shifting towards variable states due to climate change. In this study, diverse microbial eukaryotes belonging to Alveolata, Chlorophyta, Stramenopile, Telonemia, Picobiliphyta, Cercozoa, Choanoflagellida, Fungi and Haptophyta have been identified by pyrosequencing. Canonical correspondence analysis suggested that the microbial eukaryote communities sampled from lower latitudes were significantly correlated with temperature and nutrients in sea water, whereas those from higher latitudes were correlated with conditions of ice cover, latitude of sample site and chlorophyll concentration. Picoplankton *Micromonas*, with a total occurrence of 17% of all reads, was the most abundant taxon. Quantification of picoprasinophytes by FISH proved their absolute predominance in the central Arctic Ocean under heavy sea ice.

The malaise of under-representation of women in science: the Indian story

Charu Malhotra

Keywords: Bias, gender, STEM, under-representation, women in science.

Abstract

Under-representation of women in science is a global phenomenon and affects India as well. It deprives women of opportunities in science and is also a great loss to society and science itself. The scientific community can be an important pressure group for building greater focus on the issue and pushing for concrete measures to address the problem. This article reviews the discussions amongst the Indian scientific community on the subject since the early twentieth century and examines the suggestions made by it, based on research and personal experiences. There is a strong case for mandating women's presence in leadership and decision-making positions to address the issue. There is also a case for greater involvement of male colleagues in addressing this issue. Important suggestions have been put forth to make our scientific institutions women-friendly, but not many have been implemented. The resolution of the issue requires stronger will and deeper commitment from policymakers and the scientific community itself.

Tree-based classification of tabla strokes

Subodh Deolekar and Siby Abraham

Keywords: Classification, decision tree, random forest, tree classifiers, tabla strokes.

Abstract

This study attempts to validate the effectiveness of tree classifiers to classify tabla strokes especially the ones which overlap in nature. It uses decision tree, ID3 and random forest as classifiers. A custom made data set of 650 samples of 13 different tabla strokes were used for experimental purpose. Thirty-one different features with their mean and variances were extracted for classification. Three data sets consisting of 21,361, 18,802 and 19,543 instances respectively, were used for the purpose. Validation was done using measures like receiver operating characteristic curve and accuracy. All the classifiers showed excellent results with random forest outperforming the other two. The effectiveness of random forest in classifying strokes which overlap in nature is evaluated by comparing the known results with multi-layer perceptron.

Photocatalytic degradation of aqueous phenanthrene in a slurry photocatalytic reactor: optimization and modelling

C. Nirmala Rani and S. Karthikeyan

Keywords: Degradation, kinetic constants, mineralization, photocatalysis, TiO₂.

Abstract

A photoreactor with 254 nm, 16 W UV lamp was evaluated for phenanthrene (PHE) degradation. The effect of operating variables such as initial PHE concentration (1000–1500 µg/l), catalyst dosage (0.1– 0.9 g/l) and pH (3.0–9.0) on PHE degradation was investigated in detail. The batch study of photocatalytic process showed 83.5% PHE degradation and 60.2% TOC removal for optimized values (PHE concentration – 1000 µg/l, TiO₂ dosage – 0.5 g/l and pH – 3.0) during 3 h reaction. The photocatalytic degradation of PHE was found to follow pseudo-first-order kinetics. The results obtained from continuous process revealed that nano TiO₂ could be used for industrial applications because of its potential for long-term operations. Response surface methodology (RSM) with Design Expert software was used to analyse the obtained experimental data.

Microbial biomass carbon and nitrogen in relation to cropping systems in Central Himalaya, India

Kirtika Padalia, S. S. Bargali, Kiran Bargali and Kapil Khulbe

Keywords: Cropping systems, microbial biomass, microbial activity, tree plantation.

Abstract

In this study, the impact of cropping systems on physicochemical properties of soil and microbial biomass was evaluated. Soil was collected from four cultivated fields (cropland, crop + single tree species, crop + multiple tree species and homegardens) and one uncultivated (agriculturally discarded) field and analysed. The outcome of the present study indicated that cultivated land squandered about 14% C and 5% N in 8 years of cultivation to the nearby uncultivated land. Soil microbial biomass of cultivated land with multiple tree species (C + mT) was greater than other systems and showed an appreciable seasonal variation. The microbial biomass carbon (C_{mic}) assorted from 166 to 266 µg g⁻¹ and microbial biomass nitrogen (N_{mic}) from 11 to 41 µg g⁻¹. C_{mic} contributed 1.25–1.90% of soil C and N_{mic} 0.83– 3.77% of soil N. Among cultivated land, maximum C_{mic} and N_{mic} were reported in C + mT system which suggested that tree plantation in cultivated land has significant positive effects on microbial biomass and other soil properties by shifting natural soil properties under the similar environmental circumstances.

Population dynamics of *Betula ermanii* in response to climate change at the Changbai Mountain treeline, China

Xiaodong Wang, Weihua Dong, Huiqing Liu, Zhengfang Wu, Weihong Fan and Junhu Dai

Keywords: *Betula ermanii* population dynamics, climate change, Changbai Mountains, treeline shift, tree-ring analysis.

Abstract

To elucidate the mechanisms underlying the population dynamics of *Betula ermanii* in response to climate change over temporal and spatial dimensions, 310 quadrats were systematically sampled in 7 plots located in the upper treeline region on the north-facing slopes of Changbai Mountains. IKONOS images were used to identify the spatial distribution of *Betula ermanii* with the aid of a digital elevation model (DEM). Meteorological data were recorded in the field throughout the study area and collected from a nearby longterm weather station, to reconstruct the temperature and precipitation changes. We collected tree-ring samples from a total of 1197 *Betula ermanii* trees. The correlation coefficients between 14 eco-climate parameters (from 1953 to 2008) and the

aggregated annual indices of population dynamics for each quadrat (totaling 310 quadrats) in the corresponding years were calculated via statistical analysis facilitated by GIS technology. The results show that the *Betula ermanii* population is more sensitive to changes in air temperature, than to change in precipitation. During the period when air temperatures increased at a slower pace, the *Betula ermanii* population steadily expanded via asexual reproduction and showed higher survival rate. During the period when air temperatures increased rapidly, the *Betula ermanii* population responded via rapid sexual reproduction and produced a large number of progeny.

Semi-empirical model for predicting pot-hole depth in underground coal mining

Lokhande D. Ritesh, V. M. S. R. Murthy and Singh Kalendra

Keywords: Bord and pillar method, depillaring, pothole subsidence, pot-hole depth, underground coal mining.

Abstract

Pot-hole subsidence can be induced by extracting underground coal seam at shallow depth and is a matter of great concern. This has been the case in some of the coal mines of South Eastern Coalfields Limited, a subsidiary of Coal India Limited. Many of the old underground coal mines developed by bord and pillar method of mining lying at shallow depth are posing stability concerns to the habitat due to pillar collapse and gallery widening under the creep loading and weathering. This requires a systematic study for developing an in-depth analysis on various parameters which influence pot-hole occurrence and also for formulating suitable predictive models. A study was conducted to analyse the pot-hole subsidence data related to 34 pot-hole cases and develop a semi-empirical model for simulating pot-hole depth. This study was carried out in some of the Indian coal mines during different stages of coal extraction, i.e. development and depillaring. Data analysis indicates that height and width of extraction, thickness of soil and rock layers, weighted density and compressive strength are key contributing parameters for the occurrence of pot-hole subsidence. The predicted results match with the actual pot-hole depth measured in the field, validating the model.

Development of a unique full-scale real-fire façade testing facility at IIT Gandhinagar

Gaurav Srivastava, Chinmay Ghoroi, Pravinray Gandhi, V. Jagdish, G. Karthikeyan, Aravind Chakravarthy and Dharmit Nakrani

Keywords: Façade testing facility, green building regulations, leap frog effect, real-fire behaviour.

Abstract

Most modern buildings incorporate a façade system to conform to green building regulations. Several common façade systems utilize composite panels made of combustible materials and can significantly enhance the fire risk, as shown by many recent building fires. This study presents the development of a full-scale research facility at IIT Gandhinagar to better understand the behaviour of real fires involving façade systems. Such a facility will facilitate scientific studies pertaining to façade fires and help in improving fire safety of such buildings.

10Be/9 Be ratios of Cauvery river delta sediments, southern India: implications for palaeo-denudation rates in the catchment and variation in summer monsoon rainfall during Late Quaternary

Soumya Prakash Dhal, S. Balakrishnan, Pankaj Kumar, Pramod Singh, Alok Sharan and Sundeep Chopra

Keywords: Cauvery delta, denudation rate, Holocene, meteoric 10Be/9 Be, sediment cores, summer monsoon.

Abstract

Present and past denudation rates (D) of the Cauvery river catchment determined using meteoric $^{10}\text{Be}/^9\text{Be}$ on drill-core sediment samples from Uttarangudi and Valangaiman sites in the delta vary from 18.7 ± 1.6 to 48.1 ± 8.3 t/km² /a. The present day denudation rates of 37.7 ± 4.9 t/km² /a and 36.9 ± 5.2 t/km² /a estimated for these sites are higher by a factor of two than that based on solute and suspended load of the Cauvery river. Denudation rates estimated using $^{10}\text{Be}/^9\text{Be}$ (reactive) is more accurate as it is not affected by damming of rivers. Based on ^9Be fraction (reactive + dissolved) and previous studies, we infer that sediments for Valangaiman site were mainly sourced from Western Ghats and Mysore plateau, whereas highlands bordering southwestern margin of the delta mostly supplied sediments to the Uttarangudi site. The Western Ghats and the delta received rainfall mainly during summer monsoon and NE monsoon respectively. Comparison of palaeo-denudation rates with various proxies of the Indian summer monsoon shows inverse relationship between them. Lower denudation rates are estimated for Early to Mid-Holocene period which is characterized by intense rainfall. Drier conditions after 4.5 ka BP caused increase in denudation rates after 2.5 ka BP for the Valangaiman core, consistent with a response time of 2 ka required to change $^{10}\text{Be}/^9\text{Be}$ in sediments of the Cauvery basin.

Monitoring of total volatile organic compounds and particulate matter in an indoor environment

Manisha Gaur, Kirti Bhandari and Anuradha Shukla

Keywords: Indoor environment, particulate matter, office, volatile organic compounds.

Abstract

Indoor air pollution in the workplace is considered as one of the most potential environment risks to an occupant's health. Office employees are exposed to airborne pollutants that include particulate matter (PM), volatile organic compounds (VOCs), gases chemicals and microorganisms originating from indoor and outdoor sources. Exposure to PM and VOCs is likely to be higher in the workplace than outdoors due to the amount of time people spend in the indoor environment. A weekly monitoring of VOCs and PM with sampling period of 8 h was carried out in an indoor (office) environment in order to evaluate the exposure to pollutant concentration. The sampling was carried out with the help of a Grimm dust monitor and portable VOC monitor for PM and VOCs respectively. The results clearly show that exposure to PM and VOCs is much higher in an office building.

Developing a management plan for Loktak Lake considering Keibul Lamjao National Park and hydropower demand using a data driven modeling approach

Kh. Eliza, R. Khosa, A. K. Gosain and A. K. Nema

Keywords: Hybrid SHE-SWAT, Sangai deer, water balance model.

Abstract

Monthly water balance of Loktak Lake has been developed using catchment discharge obtained from a combination of hydrological models, MIKE SHE and SWAT, abbreviated as hybrid SHE-SWAT. A management plan has been proposed considering the variation of lake water level without compromising hydropower generation. The management plan aims to restore ecological balance of Keibul Lamjao National Park prioritizing Sangai deer. This will also prevent inundation of surrounding area without compromising hydropower generation.

Rift assessment and potential calving zone of Amery Ice Shelf, East Antarctica

Simone Darji, Sandip R. Oza, R. D. Shah, B. P. Rathore and I. M. Bahuguna

Keywords: Amery Ice Shelf–Lambert glacier system, rift system, potential calving zone.

Abstract

Ice shelves line the peripheries of Antarctica. Rift and crevasses are two main deformational structures affecting ice shelf stability. The present study deals with propagation-widening of five active rifts and future potential calving zones on Amery Ice Shelf (AIS), East Antarctica, between 2000 and 2017 using moderate resolution image spectroradiometer (MODIS) data. The widening and rift propagating rate, as well as advancement in AIS show abnormal behaviour. The expansion of AIS differs across the shelf. The highest rate of advancement was observed in 2012–2013 (~517 sq. km) and the lowest was observed in 2000–2001 (~35 sq. km). The rift system shows variability in its proportion and having poor relationship with environmental processes, which suggests heterogeneities in the AIS. The abnormal behaviour of rift propagation during the study period can be attributed to tsunamis, tide, current action, crevasses pattern and icequakes in the vicinity of the study region.

Phenology of a temperate fern *Dryopteris wallichiana* (Spreng.) Hyl. (Dryopteridaceae) in Uttarakhand, India

N. Punetha, J. N. Pant, R. Punetha and K. Bhakuni

Keywords: Dormancy of leaf primordia, *Dryopteris wallichiana*, Indo-Himalaya, phenology, temperate forest.

Abstract

Initiation and proliferation of leaf primordia, leaf expansion and maturation of a basket fern *Dryopteris wallichiana* are described based on two years of observation. The phenology of these events is strictly seasonal beginning with the onset of spring in the temperate Himalayan climate. Leaf primordia initiated during late summer often remain dormant but expand in the next growing season. Maturation of most of the leaves of a growing season is completed before the start of winter, but these withstand the winter cold. Leaves of the previous growing season remain erect on the rhizome for about 20 months after which they collapse. Significance of the presence of green and dry collapsed leaves on the rhizome is discussed.

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A decade of OSDD for TB: role and outcomes

Nisha Chandran and Samir K. Brahmachari

Keywords: Drug discovery, economic benefit, ITRDC, India NIPR, open source drug discovery, tuberculosis.

Abstract

In this article we estimate the economic benefit of open source drug discovery (OSDD) programme for its decade-long effort of developing newer and novel therapeutics for TB by streamlining the upstream research and development (R&D) of the drug discovery pipeline. The OSDD programme, presently subsumed into the India TB Research and Development Consortium (ITRDC) project led by ICMR, has opened up a novel method of asset utilization and capacity building at a negligible cost, leading to positive economic impact. The OSDD programme has also become an instrumental part of shaping the National Intellectual Property Rights (NIPR) Policy, 2016. This calls for a policy directive as programmes such as OSDD can be a powerful strategy in dealing with the

excruciating disease burden of TB and other neglected diseases that countries such as India are facing.

Expansion of boro rice in Meghalaya using space technology

Pratibha T. Das, B. K. Handique and P. L. N. Raju

Keywords: Boro rice, geospatial tools, Meghalaya, site suitability.

Abstract

Suitable areas for boro rice expansion in Meghalaya were identified using geospatial technology based on land evaluation using information on soil, slope, elevation, rainfall and temperature. The study showed that 635 ha area is highly suitable followed by 581.74 sq. km and 219.07 sq. km area is marginally and moderately suitable respectively. The suitable areas are distributed in 20 blocks of 8 districts. More than 50% of suitable areas are distributed in West Garo hills. The highest suitable areas are found in Selsella and Dadenggre block. The findings of this study are being used by the user department for expanding boro rice cultivation in the state.

Pivotal 20th century contributions to the development of the Anthropocene concept: overview and implications

Ricardo A. Correia, Zeynep C. H. Correia, Ana C. M. Malhado and Richard J. Ladle

Keywords: Bibliometrics, citations, multidisciplinary science, reference publication year spectroscopy, scientometrics.

Abstract

Humans have become such dominant drivers of planetary changes that scientists are now debating the establishment of a new epoch: the Anthropocene. The concept of the Anthropocene has gained rapid visibility, quickly becoming a trademark of 21st century scientific literature. Interestingly, some studies claim that this idea can be traced back to the 19th and 20th centuries, others suggest that this concept is strongly associated with emerging multidisciplinary views of humans as drivers of global environmental change. In this article, we analyse bibliographical data to trace the key 20th century contributions towards the development of this concept in scientific literature. Using data from Web of Science, we identify five historical citation peaks and show that their associated key publications stem both from natural and social sciences, clearly highlighting the multidisciplinary nature of Anthropocene science. With the ongoing debate for a formal definition of the Anthropocene epoch, we argue that a geological definition aligned with the interdisciplinary development of the concept may be the best way to ensure that it remains relevant to the wider scientific community.

Modern technologies for sustainable food and nutrition security

P. C. Kesavan and M. S. Swaminathan

Keywords: Green to evergreen revolution, modern technologies, nutrition security, sustainable food.

Abstract

In the hierarchy of human needs, food is absolutely the most basic. As the human population was increasing at an accelerated rate with concomitant depletion of natural resources during the 18th century, Malthus was greatly concerned about the sustainability of food availability. Despite the fact that the human population has been burgeoning, a total collapse in food supply has not yet happened. This is because of new technologies emerging from time to time to boost agricultural productivity and preventing the onset of the Malthusian scourge. However, none of these technologies, including the Green Revolution of the 1960s, has been truly sustainable largely because of their adverse environmental and social impacts. It is expected that the Evergreen

Revolution which eliminates the negative attributes of the Green Revolution would be more sustainable. Critical evaluation of the most modern technology, modern biotechnology, reveals that the Bt and herbicide-tolerant crops are highly unsustainable. In addition to causing environmental harm, these crops exhibit genotoxic effects. The original objective of reducing the need for application of chemical pesticides has also not been realized. There is need for basic research to understand the causes of 'unintended effects' associated with genetically engineered crops. It will be prudent to adhere to the recommendations of the Task Force on Agricultural Biotechnology, Government of India (2004) in the development and regulation of genetically engineered crops. These aspects are briefly discussed in this article.

Automation in transplanting: a smart way of vegetable cultivation

Abhijit Khadatkar, S. M. Mathur and B. B. Gaikwad

Keywords: Agriculture, automation, smart farming, vegetable transplanting.

Abstract

Vegetable transplanting is a labourious and time-consuming field operation when performed manually. The semi-automatic vegetable transplanters are cumbersome to operate due to limitations on manual feeding rates of seedlings which vary with respect to work duration and skill of the operator. Automation in the field of vegetable transplanters has provided opportunities for savings in labour and time required for transplanting operation in open field and controlled environmental structures, i.e. shade nets or polyhouse. The advent and recent advances in transplanting technologies suggest ample scope of working on automated seedling pickup and drop mechanisms using robotics. Use of seedling pickup mechanism in automatic transplanters can repeatedly extract single seedling automatically from the seedling pro-tray with the help of a pair of pins or forks and drop at predefined location. In general, these systems comprise either a machine vision system or end-effector mechanism for extracting the seedling; gripper and a manipulator; indexing drum-type seedling removal device with ejector; or a pick-up system, feeding system and a planting system. Such automated systems have helped ease the transplanting operation and efficient planting of seedlings by maintaining the accuracy, precision and effectiveness in planting seedlings with minimum human intervention. This study highlights the research gaps and developments in smart transplanting technologies used in the field of vegetable cultivation.

Synthesis and biological activities of some condensed oxazine and pyrimidine derivatives: cyclization, ring transformation and functionalization of oxazine

Reda A. Haggam, Essam Abdelghani Soylem, Mohammed Gomaa Assy and Mariam Fikery
Arastiedy

Keywords: Condensed oxazine, cyclization, functionalization, pyrimidine derivatives, ring transformation.

Abstract

2-Amino benzoic acid was acylated using chloroacetyl chloride followed by cycloaddition with benzylidene derivative to yield pyrimidine 3. Benzoxazine 4 reacted with nucleophilic carbon of phenols 5 and 6, active methylene compounds 11 and 12, and enaminic carbons of 16 and 17 to yield compounds 7, 10, 13, 14, 18 and 19 respectively. Also, benzoxazine 6 reacted with hydrazine to yield compounds 5 and 33. Aminoquinazoline 5 underwent a series of reactions using benzaldehyde, NH₄SCN in base/acid medium, chloroacetyl chloride and CS₂ followed by cyclization using ethyl chloroacetate to yield compounds 22, 26, 29, 32, 30 and 31 respectively. Hydrazide 33 underwent a series of cycloaddition and cyclocondensation reactions using compounds like ethyl chloroacetate and/or acetyl acetone, maleic anhydride and p-chlorocinnamoyl

isothiocyanate to yield compounds 34, 36, 37 and 40 respectively. Finally, compound 6 was reacted with ethyl cyanoacetate and/or acetyl acetone to form compounds 43 and 44 respectively.

Bubble size prediction in gas–solid fluidized beds using genetic programming

R. R. Sonolikar, M. P. Patil, R. B. Mankar, S. S. Tambe and B. D. Kulkarni

Keywords: Bubble diameter, bubble motion, fluidized bed, genetic programming.

Abstract

The hydrodynamics of a gas–solid fluidized bed (FB) is affected by the bubble diameter, which in turn strongly influences the performance of a fluidized bed reactor (FBR). Thus, determining the bubble diameter accurately is of crucial importance in the design and operation of an FBR. Various equations are available for calculating the bubble diameter in an FBR. It has been found in this study that these models show a large variation while predicting the experimentally measured bubble diameters. Accordingly, the present study proposes a new equation for computing the bubble diameter in a fluidized bed. This equation has been developed using an efficient, yet infrequently employed computational intelligence (CI)-based datadriven modelling method termed genetic programming (GP). The prediction and generalization performance of the GP-based equation has been compared with that of a number of currently available equations for computing the bubble diameter in a fluidized bed and the results obtained show a good performance by the newly developed equation.

Application of the ecological footprint method for measuring sustainability of agricultural land use at a micro level in Barddhaman district, West Bengal, India

Biswajit Ghosh and Namita Chakma

Keywords: Agricultural land use, biocapacity, ecological footprint, sustainability.

Abstract

In the present study we used the ecological footprint method to numerically measure the sustainability of agricultural production at the micro level. For this, two community development blocks of Barddhaman district, West Bengal, India were selected. As a consumption-based method, it is most suitable for measuring cropland footprint, biocapacity of croplands, and their ecological surplus and deficit status of an environmental indicator. The integrated result represents higher sustainability of agricultural system, but crop-wise assessment explores some negative aspects with respect to self-sufficiency of the study area that demand necessary transformation of existing cropping pattern.

Biological control of potato tuber soft rot using N-acyl-L-homoserine lactone-degrading endophytic bacteria

Nguyen Thanh Ha, Tran Quang Minh, Pham Xuan Hoi, Nguyen Thi Thanh Thuy, Naruto Furuya and Hoang Hoa Long

Keywords: AHL, *Pectobacterium carotovorum*, potato tuber soft rot, quorum sensing, quorum quenching.

Abstract

Pectobacterium carotovorum (Pc) causing potato tuber soft rot uses N-acyl-L-homoserine lactones (AHLs) to control the production of virulence factors via quorum sensing (QS). Some bacteria produce enzymes to inactivate the AHL signals of pathogenic bacteria via a phenomenon known as quorum quenching. One hundred bacterial isolates from potato tubers were screened for AHL-degrading activity using biosensor strain *Chromobacterium violaceum* CV026. Of these isolates, 20 were able to inactivate AHLs from the pathogenic bacteria in vitro. Of the 20 isolates, 6 attenuated

tissue maceration of potato tubers by Pc. Suppression of tuber soft rot was observed even when these isolates were applied 24 h after the pathogen was introduced. Their colonization in tubers was approximately 10³–10⁴ cfu/g tuber, 7 days after inoculation. These isolates were identified as *Bacillus* sp., *Variovorax* sp., *Variovorax paradoxus* and *Agrobacterium tumefaciens*. Four of these isolates showed putative AHL-lactonase activity and provided the most significant protection against Pc. Therefore, AHL-degrading endophytic bacteria can be utilized as a novel biocontrol agent of potato tuber soft rot in Vietnam.

Analysis of in vitro and in silico anti-hyperglycaemic action of bioflavonoids isolated from different citrus peels

A Sanmuga Priya, P. Senthamil Selvan and A. Syed Arshad

Keywords: Anti-hyperglycaemic activity, bioflavonoids, *Citrus maxima*, yeast cells.

Abstract

In this study, flavonoid-rich chloroform fraction (FRCF) of nine different citrus species was isolated by solvent fractionation technique and its effect on α -glucosidase, α -amylase, glucose uptake by yeast cells and glycosylation of haemoglobin was studied. FRCF of *Citrus maxima* was found to show higher activity in the in vitro assays and thus it was characterized by Electrospray Ionization Mass Spectrometry (ESI-MS) analysis. This led to the identification of icariin, hesperidin and diosmetin-6,8-di-C-glucoside. Their binding efficacy with targeted proteins such as glucokinase (GK), glycogen synthase kinases 3 β (GSK 3 β) and peroxisome proliferator-activated receptor- γ (PPAR- γ) was studied by in silico analysis using Schrödinger Maestro software. Icarin exhibited maximum docking energy with GSK 3 β , relatively less for GK and null for PPAR- γ . Hesperidin and diosmetin-6, 8-di-C-glucoside showed good binding affinity with PPAR- γ compared to GSK 3 β .

Fusion of multispectral and panchromatic data using regionally weighted principal component analysis and wavelet

J. Jayanth, T. Ashok Kumar and Shivaprakash Koliwad

Keywords: Fuzzy, RWPCA_WT, regionally weighted, WT.

Abstract

This study proposes a new multispectral (MS) and panchromatic (PAN) image fusion algorithm based on regionally weighted principal component analysis (RW-PCA) and wavelet. First, the MS images are segmented into spectrally similar regions based on the fuzzy c-means (FCM) clustering method. Secondly, based on the spectral vector's degree of membership in each region, a new RW-PCA method is proposed to fuse the MS and PAN images region by region, and fused MS images are obtained. In the traditional PCA-based fusion method, the MS and PAN images are fused globally with the same transform method. In the proposed RW-PCA-based fusion method, the local spectrum information of the MS images is employed, and the spectral information is better preserved in the fused MS images. Finally, in order to improve the quality of spectral and spatial details, the above fused MS images and the original PAN images are further fused using the wavelet-based fusion method, and the final fused MS images are obtained. Experimental results demonstrated that the proposed image fusion algorithm performs better in spectral preservation and spatial quality improvement than some other methods do.

Data visualization by alluvial diagrams for bibliometric reports, systematic reviews and meta-analyses

Andy Wai Kan Yeung

Keywords: Alluvial diagram, bibliometrics, metaanalysis, neuroimaging, taste.

Abstract

Alluvial diagram is a type of flow diagram traditionally used to illustrate the temporal changes in a network composition. However, alluvial diagram can also be utilized as a graphical summary of the demographic data of studies included in a bibliometric report, systematic review or meta-analysis. Such a graphical summary enables readers to quickly discover data patterns and notice the relationships between adjacent data columns. The current study demonstrates such an application of the alluvial diagram and discusses how it facilitates readers to better comprehend the data presented.

Prevalence and risk factors of hypertension among Mizo population: a population-based epidemiological study from North East India

Prasanta K. Borah, Suman K. Paine, Hem Ch Kalita, Dipankar Biswas, Dilip Hazarika, Chandra K. Bhattacharjee and Jagadish Mahanta

Keywords: Dietary salt, epidemiological study, hypertension, prevalence and risk factors.

Abstract

The aim of the present study was to assess the prevalence and risk factors of hypertension (HTN) in the Mizo population from Mizoram, North East India. We carried out a cross-sectional study among urban and rural populations. Socio-demographic and clinical information, including blood pressure and anthropometric measurements were collected by house-to-house visits and recorded in a predesigned and pretested questionnaire. The study included a total of 12,313 subjects (male: 5707, female: 6606) from urban (n = 5853) and rural (n = 6460) localities. All information was analysed using the statistical package SPSS17. Prevalence of HTN was 15.9% with significant urban-rural (18.9% versus 13.2%, $P < 0.001$) and gender variation (18.2% versus 13.9%, $P < 0.001$). Logistic regression analysis in the overall (rural and urban) model was carried out, which revealed that age, extra salt (salt as a side dish), tuibur (a special form of tobacco), high BMI and sedentary lifestyle were independently associated with HTN ($P < 0.05$). This study has public health implications, as community-based lifestyle intervention of these risk factors may alleviate the burden of HTN.

Comparative expression analysis of defence-related genes in Bacillus-treated Glycine max upon challenge inoculation with selective fungal phytopathogens

Shekhar Jain, Anukool Vaishnav, Ajit Varma and Devendra Kumar Choudhary

Keywords: Defence-related genes, induced systemic resistance, plant growth promoting bacteria, volatile organic compounds.

Abstract

Activation of defence-related genes by the application of beneficial bacteria leads to prior protection against pathogens through induced systemic resistance. The present study was carried out to examine the qRT-PCR-based relative quantification of differently expressed defence-related genes in soybean (*Glycine max* L. Merrill) plants primed with *Bacillus* sp. strain SJ-5 against the fungal pathogen *Rhizoctonia solani* and *Fusarium oxysporum*. In this context, molecular characterization of plant growth promoting and biocontrol genes of SJ-5 was done by PCR followed by homology analysis. In the GC-MS analysis of SJ-5 volatile organic compounds, potent antifungal compound bis(2-ethylhexyl) phthalate and antioxidant compound butylated hydroxy toluene were reported with the highest peak area 47.96% and 21.82% respectively, along with other

antifungal compounds in small proportion. Qualitative expression of different defence-related genes like lipoxygenase, phenylalanine ammonia-lyase 2, peroxidase, polyphenol oxidase, endo-1,3-beta-glucanase, catalase, defensin-like protein, vegetative storage protein and chitinase class I was found elicited in the plants primed with SJ-5 against the fungal pathogens. In the qPCR analysis, the highest upregulation was observed in the transcript profile of ppojh2 in the treatments T5 and T6 with 4.12- and 4.06-fold increase respectively.

Soil microbial characteristics in sub-tropical agro-ecosystems of North Western Himalaya

Rahul Singh, D. R. Bhardwaj, Nazir A. Pala, Rajesh Kaushal and Bhalendra Singh Rajput

Keywords: Microbial biomass carbon, CO₂ evolution, metabolic quotient, land uses.

Abstract

Eight predominant land use systems, viz. agriculture (T1), horticulture (T2), agrisilviculture (T3), silvopastoral (T4), agrihorticulture (T5), agrihortisilviculture (T6), forest (T7) and grassland (T8) of subtropical parts of Himachal Pradesh were selected along two altitudinal ranges A1 (365–635 m amsl) and A2 (636–914 m amsl) to observe the variation in soil microbial activity and microbial characteristics. Agroforestry land uses and forest ecosystems displayed significantly higher microbial counts and microbial biomass carbon than agriculture and grasslands. The CO₂ evolution (soil microbial activity) was found higher in agrisilviculture, agrihortisilviculture, forest and grassland use systems at both altitudinal ranges. Soil biological properties (microbial count, microbial biomass and microbial activity) were maximum in forest land use system. Among the agroforestry land-use systems, agrisilviculture had significantly higher microbial counts. The maximum microbial count (164.50×10^5 cfu g⁻¹ soil) was recorded in forest and remained statistically at par with agrisilviculture (162.34×10^5 cfu g⁻¹ soil). Minimum microbial count (80.66×10^5 cfu g⁻¹ soil) was observed in agriculture land use. At both the altitudinal ranges, the CO₂ evolution was highest at 48 h time interval and decreased thereafter. The metabolic quotient (qCO₂) indicated that C-use efficiency is higher in grassland use and agriculture land use systems than other studied systems.

Distribution pattern and population characteristics of *Impatiens johnii* E. Barnes, a stenotopic endemic and endangered Balsam in the mountain landscape of Munnar, Kerala, India

G. Prasad, P. Rajan, V. T. Antony and P. K. Shaji

Keywords: Distribution, endemism, habitat, *Impatiens johnii*, threats

Abstract

Impatiens johnii has high conservation concern due to its rarity and geographical narrow range. This species is a stenotopic endemic in the Munnar landscape and rediscovered after 67 years. This plant was found as part of epilithic along the streams and high canopy areas in high humidity locations at an elevation of 1600–1800 m amsl. *I. johnii* is distributed in less than 5 km² area near Eravikulam National Park and therefore this area needs to be protected for the conservation of *I. johnii*.

The host range of multi-host endophytic fungi

T. S. Suryanarayanan, P. T. Devarajan, K. P. Girivasan, M. B. Govindarajulu, V. Kumaresan, T. S. Murali, T. Rajamani, N. Thirunavukkarasu and G. Venkatesan

Keywords: Diversity, foliar endophytes, fungal endophytes, mutualism.

Abstract

Mature leaves of 224 angiosperm plant species belonging to 60 families and growing in Andaman Islands, and the states of Arunachal Pradesh, Kerala and Tamil Nadu were sampled for the presence of endophytic fungi. Fungal genera such as *Alternaria*, *Arthrinium*, *Aureobasidium*, *Chaetomium*,

Cladosporium, Glomerella/ Colletotrichum, Drechslera, Fusarium, Fusicoccum, Lasiodiplodia, Paecilomyces, Pestalotiopsis, Phoma, Diaporthe/Phomopsis, Guignardia/Phyllosticta, Sporormiella and Xylaria showed an isolation frequency of 5% or more. Species of Colletotrichum, Phyllosticta, Phomopsis and Xylaria occurred as endophytes in the leaves of many plant hosts including those that were taxonomically not closely related. The need to address the broad host range of some genera of fungal endophytes is discussed.

Monitoring and analysis of ground subsidence and backfill stress distribution in Jinchuan Mine, China

Rong Lu, Fengshan Ma, Jie Guo and Haijun Zhao

Keywords: Backfill deformation, ground subsidence, mining, stress redistribution.

Abstract

Backfilling is widely used in mining operations. Deformation of a large volume of backfill leads to rock movement and ground subsidence. This study analysed ground subsidence and backfill deformation, combined with ground subsidence monitoring and numerical simulation. The results showed that the ground subsidence trough was located at the centre of the hanging wall of the ore body. The maximum vertical displacement exceeded 2000 mm. Underground excavation and filling led to stress redistribution. The shear stress concentrated at the backfill boundary and contact zone of the backfill and surrounding rock. The shear stress distribution changed with the shape of the backfill. The corner of the backfill boundary was the key position of shear stress concentration. The Mohr's circle showed the envelope line where cohesion of 500 kPa could meet the strength requirement in the shallow part of the backfill; in the deep part, the cohesion required was 1500 kPa. The deep part of the backfill therefore failed more easily than the shallow part.

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Role of biotechnology in conservation and utilization of agricultural biodiversity

Kanupriya and V. Radhika

Keywords: Biodiversity, biotechnology, cryopreservation, database, markers, tissue culture.

Abstract

Biological diversity provides the variety of life on the earth and agricultural diversity forms a part of it. Agricultural biodiversity refers to the variability among and between all forms of life relevant to food and agriculture. The Indian subcontinent is recognized as one of the important centres of origin of crop plants. There are around 811 plant species under cultivation in India with more than 900 wild relatives which are distributed over different biogeographic regions of the country. However, rapid genetic erosion of the species and surrounding ecosystem due to various factors is a big threat to this diversity. Biodiversity conservation is a global concern and all the member states of the Convention on Biological Diversity are taking measures to preserve both native and agricultural biodiversity. Biotechnological tools are proving valuable for effective and efficient conservation efforts of agricultural plant genetic resources. Among the various applications available, tissue culture, molecular marker technology, establishment of DNA banks and genotypic database for various crops and accessions have been delineated in this paper.

Research performance of the National Institutes of Technology in India

Sumit Kumar Banshal, Tanu Solanki and Vivek Kumar Singh

Keywords: Bibliometric assessment, research performance, scientometrics, technological institutes.

Abstract

This article presents a bibliometric assessment of research performance of the National Institutes of Technology (NITs) in India. While many of these institutes were originally established in 1960s as Regional Engineering Colleges (RECs), they were upgraded to NITs around 2002 and later. Initially NITs offered only undergraduate programmes in engineering. However, during the last decade, several NITs have started postgraduate teaching and are focusing more on research activities. It is in this context that this article assesses the research performance of NITs during 2005–2016. The performance assessment uses research publication data obtained from the Web of Science index. The data collected are computationally analysed to identify productivity, productivity per capita, rate of growth of research, international collaboration pattern, citation impact and discipline-wise distribution of the research output for the NITs. The performance of NITs is also viewed vis-à-vis two top-performing Indian institutions, namely Indian Institute of Science, Bengaluru and Indian Institute of Technology Bombay, Mumbai. A simple single-value composite ranking of research performance of NITs is also presented by combining quantity and quality factors. The study presents an informative and useful account of assessment of research work in the NITs.

An analysis of biographical information on National Bioscience awardees from 1999 to 2016

Inderpal Singh

Keywords: S.S. Bhatnagar prize, career development, National Bioscience Award.

Abstract

Three institutions, viz. Council of Scientific and Industrial Research, Indian Institute of Science (Bengaluru) and National Institute of Immunology (New Delhi) dominate the number of recipients of the National Bioscience Award. The analysis revealed that Jadavpur University (Kolkata) has not won the National Bioscience Award compared to the Council of Scientific and Industrial Research and the National Institute of Immunology. Indian Institute of Science (Bengaluru) is the most balanced. The mobility analysis showed that most of the National Bioscience awardees were mobile after obtaining their Ph Ds/MDs. Of all the 140 National Bioscience awardees between 1999 and 2016, 37 of them are also recipients of Shanti Swarup Bhatnagar Prize. Moreover, a large number of awardees also became fellows of national science academies in the period 0–5 years after receiving the National Bioscience Award.

Omega automata and its classes

Natasha Singh and Ajay Kumar

Keywords: Büchi automata, co-Büchi automata and Muller automata, Rabin automata, Streett automata.

Abstract

ω -automata is a variant of finite automata which accepts infinite strings. It represents the behaviour of the infinite systems (hardware, operating system and control systems) which are not expected to end. A variety of conditions are used to represent the set of accepting strings in ω -automata. This paper summarizes various types of ω -automata, their transition functions and accepting conditions. In addition, this paper also summarizes the applicability of omega automata in various interdisciplinary fields.

Alternative sources of soil organic amendments for sustaining soil health and crop productivity in India – impacts, potential availability, constraints and future strategies

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Keywords: Climate change, crop productivity, organic amendments, soil health.

Abstract

Among the several causes, critical low soil organic matter status is predominant for decline in soil health and consequent fall in crop productivity. Over the years, availability of traditional source of soil organic amendment, viz. cattle manure drastically declined due to various reasons (domestic uses as fuel and plastering of the kachha houses). The present study highlights that there are many alternative sources of soil organic amendments available in the country which have tremendous potential to improve soil organic matter status and crop productivity, and rejuvenate and enhance the dying total factor productivity of Indian soils. Data from various sources reveal that about 300 million tonnes of alternative sources of soil organic amendments are available in the country. This study highlights that the application of alternative sources of organic amendments directly or indirectly improves soil health by influencing many soil properties (physical and chemical) and enzyme activities (biological) that regulate nutrient dynamics in the soil. Consequent upon improvement in soil environment, the application of alternative sources of soil organic amendments alone or along with recommended dose of fertilizers registered significantly higher yield in different crops across different agro-climatic conditions of the country. Composting and vermicomposting are the best strategies to convert the biomass of available alternative sources of organic amendments to plant nutrient-rich products.

Multilayer perceptron and evolutionary radial basis function neural network models for discrimination of HIV-1 genomes

Ashok Kumar Dwivedi and Usha Chouhan

Keywords: Artificial neural network, HIV-1 genome, machine learning, multilayer perceptron.

Abstract

High rate of mutation and frequent recombination cause evolution of HIV-1 very diverse and adaptive. Revealing the recombination patterns in HIV-1 is a computationally intensive problem. Techniques based on phylogenetic analysis are not suitable for genomelevel studies. Here we elucidate approaches based on multilayer perceptron and evolutionary radial basis function neural network for the analysis of 4130 HIV1 genomes. These techniques show remarkable improvement over other machine learning techniques used for such classification. The models outperformed other machine learning models having 92% classification accuracy. Multilayer perceptron achieved sensitivity and specificity of 82% and 96%, whereas radial basis function neural network achieved sensitivity and specificity of 78% and 98% on tenfold cross-validation respectively.

Density functional theory-based quantum rationalization of flavones from Oroxyllum indicum, their correlation with redox effect, molecular interaction studies and osmotic hemolysis

Nusrat Masood, Akhilesh Kumar Yadav, Naresh Kumar, Madan Mohan Gupta and Suaib Luqman

Keywords: Flavones, HOMO–LUMO, Oroxyllum indium, osmotic fragility, Raman spectra.

Abstract

Four flavones (chrysin, baicalein, oroxylin A and hispidulin) characterized from ethanolic root extract of Oroxyllum indicum (a traditional dietary nutraceutical supplement), were compared with both experimental (radical scavenging action and osmotic fragility test on human erythrocytes) and

theoretical (Density functional theory (DFT) (B3LYP/6-31G*) calculations and in silico docking with haemoglobin and albumin) for their redox properties. Raman spectra were examined specifically between 2900 and 3700 cm⁻¹ and the corresponding peaks were identified for hydroxyl group stretching vibrations. Baicalein and hispidulin had the highest and lowest binding energy respectively for oxyhaemoglobin (oxyHb) and vice versa for deoxyhaemoglobin (deoxyHb), which was one of the major findings revealed in their superposed docked structures where the position of baicalein was not changed unlike hispidulin. On the whole, baicalein is the preeminent flavone as it revealed maximum activity in various antioxidant assays, protection against osmotic fragility and binding energy with oxyHb which can be reasoned out by its least HOMO–LUMO energy gap.

Prevalence of extended spectrum beta-lactamases among Enterobacteriaceae isolated from intrahospital patients in Serbia

Slavica S. Ćirić, Dragana I. Stanišić, Božidar N. Milošević, Zoran Ž. Ilić and Zvonko Lj. Spasić

Keywords: Antibiotic resistance and susceptibility, Enterobacteriaceae, extended spectrum beta-lactamases, human isolates.

Abstract

The aim of this study was to determine the prevalence of extended spectrum beta-lactamases (ESBLs) production in hospital strains of Enterobacteriaceae isolated from various clinical specimens (urine, blood and wound swabs) from hospitalized patients at the Military Medical Academy, Belgrade, Serbia. During six months of study, a total of 1034 isolates of Enterobacteriaceae were tested for antimicrobial susceptibility and screened for ESBL production according to standard methods. The overall prevalence of ESBL production in the hospital isolates of Enterobacteriaceae was 57.4%. Among the isolates, minimum frequency of resistance was found for amikacin (25.2%), and maximum for ampicillin (84.5%). The strain resistant to imipenem could not be isolated. Resistance to the tested antibiotics was higher in ESBL producers than non-producers ($P < 0.05$). Among *Escherichia coli* isolates, the prevalence of ESBL production was less than 50% (33.9%). ESBLs were most often produced by isolates of *Serratia* spp. (85.2%) and *Klebsiella* spp. (81.8%). Blood specimens were the most common sources of ESBL-producing isolates (84.0%). These findings might help clinicians in deciding the appropriate empirical treatment for intrahospital patients and emphasize the increasing problem of antimicrobial resistance in Serbia.

Health-related analysis of uranium in Fazilka district, Punjab, India

Saurabh Narang, Deepak Kumar and Ajay Kumar,

Keywords: Annual effective dose, laser fluorimetry, safe limits, uranium.

Abstract

Laser fluorimetry technique has been used to estimate uranium concentration in groundwater samples collected from 20 villages of Fazilka district, Punjab, India. The uranium concentration was found to vary from 4.32 to 83.99 $\mu\text{g l}^{-1}$ at different locations with mean concentration of 26.51 $\mu\text{g l}^{-1}$. Also, 24% of the drinking water samples exceeded the safe limits set by WHO, while 9% was above the limit set by AERB. Certain health risk factors like annual effective dose, excess cancer risk and lifetime average daily dose were also evaluated. The study also included uranium estimation in soil samples collected from the same villages using wavelength dispersive X-ray fluorescence technique. All the values were found to be well within the safe limits. Topography of the region seems to be the most likely reason for higher uranium concentration at some locations.

Comparison of traditional grow-out test and DNA-based PCR assay to estimate F1 hybrid purity in cauliflower

Arpita Pattanaik, D. C. Lakshmana Reddy, S. Ramesh and Aswath Chennareddy

Keywords: Cauliflower, grow-out test, hybrid purity, PCR assay.

Abstract

Cauliflower (*Brassica oleracea*) is a cool-season crop belonging to the Brassicaceae family. Use of morphological differences between true-to-types and off-types in grow-out test (GOT) is the basic method for hybrid purity analysis. Traditional GOT is costly, tedious, time consuming and environment sensitive. To increase the speed and accuracy of genetic purity testing of hybrids, recent advances in DNA markers have shown promise. In the present study, the purity of cauliflower hybrid (NBH Tania-815) was assessed by traditional GOT and advanced molecular marker systems. The experiment was carried out by mixing 95% F1 hybrids with 5% female parents, individually in the sample sets of 400, 300, 200, 100, 80 and 40. For each sample size, PCR-based assay and GOT were carried out to check the hybrid purity. In the PCR-based assay, 220 pairs of SSR markers were screened, with 32 markers showing parental polymorphism including one codominant marker (BrgMS565). The purity level was determined by the co-dominant marker. A minimum sample size of 100 was standardized to confirm the hybrid purity as it showed the same result with that of higher sample sizes (200, 300 and 400). Hence, it is proposed that molecular marker-based hybrid purity assessment may serve as an effective substitute to traditional GOT.

Artificial seed for short-term storage: using nodal buds in *Aquilaria malaccensis* Lam.

Seram

Devika Devi, Bateimon Kharsahnoh, Suman Kumaria and Meera C. Das

Keywords: Artificial seeds, encapsulation, recalcitrant, storage, temperature.

Abstract

Artificial seed technology is known to be the best alternative for short-term storage of plant germplasm in recalcitrant species. *Aquilaria malaccensis*, being a recalcitrant seeded tree, possesses seasonal and highly desiccation-sensitive seeds which lose viability with slight decrease in their moisture content, hence storage becomes a difficult task. The present study deals with short-term storage of *A. malaccensis* nodal buds through artificial seed technology. Nodal buds encapsulated with 2.5% sodium alginate and 100 mM calcium chloride, and polymerized for 40 min were found suitable for artificial seed preparation. Maximum regeneration rate of 83.3% and 75.0% was observed from encapsulated nodal buds stored at 4°C and 23 ± 2°C respectively, for 10 days. Storage was possible for a period of 60 days at 4°C and 50 days at 23 ± 2°C with average regeneration rate of 8.3% and 16.7% respectively.

Bacterial diversity at a shallow-water hydrothermal vent (Espalamaca) in Azores Island

Rajasabapathy, Chellandi Mohandass, Raul Bettencourt, Ana Colaço, Joana Goulart and Ram Murti

Meena

Keywords: Bacterial diversity, clone library, hydrothermal vent, phylogeny, shallow water.

Abstract

A low-temperature shallow-water hydrothermal vent field was discovered during the summer of 2010 in the Faial-Pico channel off the Espalamaca headland, Faial Island, Azores, Portugal, NE Atlantic. The present study analyses bacterial communities present in shallowwater hydrothermal vent of Espalamaca using SSU rRNA-based clone library approach. Clones of shallow vent sediment sample revealed the dominance of Proteobacteria (including α , γ , ϵ , δ , ζ subdivisions) and

Bacteroidetes with 36% and 28% of the whole community respectively. The dominance of γ -Proteobacteria is the unique characteristic of this shallow vent and it coincides with the South Tonga Arc and Bahía Concepción (Pacific Ocean), whereas ϵ Proteobacteria groups were reported to be high in the majority of the hydrothermal vents. Though the sampling sites of the venting and non-venting regions of Espalamaca were only 500 m apart, high variation (>80%) of phylotypes was found between the regions.

Public acceptance study of environmentally suitable landfill sites

Debishree Khan, Atul Kumar and Sukha Ranjan Samadder

Keywords: Landfill sites, public awareness, population survey, solid waste management, statistical analysis.

Abstract

The present study was conducted to understand the public attitudes and preferences of location and operation of environmentally suitable solid waste landfill sites in Dhanbad city, Jharkhand, India. The research methodology used for obtaining data includes extensive questionnaire (prepared using the reported literature) survey and interview of the population. Statistical analysis (Pearson residuals and chi-square test) was done to understand the relationships among the responses received from the surveyed people of the study area. Most of the respondents (90%) were in favour of construction of engineered landfill sites, but many (70%) were not willing to pay any extra charges for solid waste management related services. This study will help the municipal authorities to identify a mechanism to gain public acceptance of the selected landfill sites and adapt the approach presented here to similar locations elsewhere.

Thiamine an unexplored, ecologically hormonizable, nontoxic catalyst for benzoylation

Deepak Chowrasia and Nisha Sharma

Keywords: Benzoylation, catalyst, clean water, thiamine.

Abstract

Numerous catalysts have been evaluated to assist benzoylation since its origin (1883), each having their own pros and cons with respect to synthetic environment. However, the one (thiamine) we report here is superior as well as multidimensionally advantageous with reference to non-hygroscopic characteristic, stability at room temperature and reaction conditions, unflammable, non-volatile, easy to handle, non-corrosive, environmentally harmonizable, biodegradable, recyclable and non-toxic. Our result denies the traditional concept of 'Inorganic alkaline assistance' for benzoylation. The percentage yield of benzoylated product obtained by thiamine assisted method was found to be comparable with traditional methods. Furthermore non-catalyst assisted benzoylation in neat water was also studied and the results coincide with traditional as well as thiamine-assisted method reported here with some limitations.

Degraded products of stem bromelain destabilize aggregates of β -amyloid peptides involved in Alzheimer's disease

Debratna Mukherjee, Payel Bhattacharjee, Reema Bhattacharya, Alok K. Dutta and Debasish Bhattacharyya

Keywords: Alzheimer's disease, A β peptide, disaggregation, stem bromelain.

Abstract

Deposition of fibrils originating from monomeric β amyloid (A β) peptide in brain cells is responsible for progressive neuronal damages in Alzheimer's disease. Peptides from bromelain, a cysteine protease from *Ananas comosus* (pineapple), were generated after digestion with proteases

under conditions similar to human gastrointestinal tract. These peptides not only inhibit the growth of A β -amyloid aggregates, but also irreversibly destabilize the preformed aggregates. Gel filtration followed by mass spectrometric analysis identified a pool of peptides of 700 Da in the digest. Probable composition of the peptides interacting with A β -peptide was predicted from homology alignment between A β -peptide and bromelain using bioinformatics tools. Corresponding synthetic peptides can also destabilize the preformed aggregates as observed from thioflavin T assay, transmission electron microscopy and atomic force microscopy. A β aggregates that were preincubated with the bromelain-derived peptides did not exert appreciable toxicity on human neuroblastoma cells (SH-SY5Y) cultured in vitro.

Responses of short-nosed fruit bat, *Cynopterus sphinx* (Vahl 1797) towards distress calls of their conspecifics from related and unrelated sites: implications for building a social relationship

A. F. P. Allwin Mages Raj, K. Emmanuvel Rajan and H. Raghuram

Keywords: Chiroptera, *Cynopterus sphinx*, conspecifics, distress calls, social relationship.

Abstract

Distress calls emitted by bats signal their conspecifics either to warn them or inform them about the situations. Conspecifics may also get attracted towards distress calls as a behaviour of cooperative mobbing or just selfishly assessing the potential source of danger. The exact functions of distress calls in bats therefore vary to a great degree and are very hard to pinpoint. We conducted playback experiments to test the response of short-nosed fruit bat, *Cynopterus sphinx* towards the distress calls of their conspecifics from related and unrelated sites. Bats were attracted to their conspecifics from both related and unrelated sites and in one occasion towards fruit bat (*Rousettus leschenaulti*) of another genus within the same family. The response towards the opposite sex was significant in most of the playback trials and the reasons remain unclear. This symmetric response towards conspecifics from related and unrelated sites suggests the possibility of fruit bats building social relationships among unrelated individuals and probably between species.

Performance analysis of South-Indian mushroom units: imperative policy implications for their preparedness for global competitiveness

Mahantesh Shirur, N. S. Shivalingegowda, M. J. Chandregowda and Rajesh K. Rana

Keywords: Global competitiveness, mushroom enterprises, performance index, policy implications.

Abstract

A highly specialized six-dimensional performance index was designed to comprehensively analyse complex mushroom enterprises having components and estimates, viz. scale/size of the enterprise (4.225), infrastructure/machinery employed (4.539), social capital indicators (4.696), efficiency indicators (6.346), good mushroom cultivation practices (5.246) and incremental expansion (3.597). Sixty edible mushroom growing enterprises of Karnataka were selected for this study which concludes that four out of six components showed poor performance. Along with an urgent need to work-out economically optimum size of mushroom units with suitable infrastructure and machinery requirements, the paper presents important policy implications for making Indian mushroom industry globally competitive.

Enumeration of total virioplankton and isolation of specific cyanophages from selected aquatic ecosystems in Goa, India

Judith Miriam Noronha, Amara Begum Mulla, Manguesh U. Gauns and Sanjeev C. Ghadi

Keywords: Aquatic ecosystem, cyanophage, flow cytometry, virus enumeration.

Abstract

Viruses are known to be highly abundant and, therefore, ecologically significant entities of all aquatic ecosystems. However, very few studies from marine and freshwater ecosystems in India have dealt with enumeration, isolation or characterization of their virus (virioplankton) populations. In the present study, we have estimated total virioplankton populations from several kinds of aquatic niches, viz. rice fields, lakes and estuaries, using flow cytometry. Rice field floodwaters displayed the highest virioplankton count of 1.21×10^7 particles per ml. As cyanophages form the second most abundant class of virioplankton (after bacteriophages), we also isolated four cyanophages from the same aquatic niches.

Response of methane diffusion in varying degrees of deformed coals to different solvent treatments

Pengpeng Li, Xiaodong Zhang and Shuo Zhang

Keywords: Deformed coal, diffusion coefficient, pore structure, solvent treatment, wettability.

Abstract

In the communication, we analysed four semianthracite coals with different degrees of deformation from the Huoerxinhe colliery in China that were extracted by tetrahydrofuran (THF) and carbon disulphide (CS₂), and treated with hydrochloric acid (HCl) solution. Low-temperature nitrogen adsorption, water contact angle measurement and methane diffusion of untreated coals and their residues were carried out. As well, mineral composition of untreated coals and their residues treated with HCl are performed. Overall, compared with untreated coals, specific surface area has increased tendency after THF and CS₂ extraction due to the removal of the soluble organic components in coal, depends jointly on mineral types and their respective content after HCl treatment. Regardless of coal un- or treated by solvents, diffusion coefficient grows with increasing coal deformation. Further study shows that the diffusion coefficient of coal with same deformation increases as follows: HCl treated coal residues, THF extracted coal residues, untreated coals, CS₂ extracted coal residues. The aforementioned phenomena result from two aspects: on one hand, the enlargement of pore after solvent treatment reduces the collision between methane molecule and pore walls, thus improving the efficiency of methane diffusion; on the other hand, pore is narrowed or even blocked completely due to the retention of foreign matters, which increases the resistance of methane diffusion. Therefore, methane diffusion after solvent treatment is jointly dependent on pore change because of the removal of soluble components and the retention of foreign matters.

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Kallar elephant corridor in the Western Ghats, India: trend of human interface vis-à-vis feasibility of wildlife-friendly flyover and land acquisition

Neha Midha, N. Krishna Kumar, D. Boominathan, Samuel Thomas and Chhavi Jain

Keywords: Elephant corridor, human-interface, traffic intensity, wildlife-friendly mitigation.

Abstract

The present account from Kallar elephant corridor is a case-history which elucidates that delay in implementing management recommendations leads to unmanageable trends in land-use pattern, traffic intensity, human–elephant interface, and escalation of costs for management options like

land acquisition and engineering structures as flyovers or ‘elephant underpass’. Ultimately, a situation may develop where elephants may take their own course of population reduction, fragmentation and shifting of interface problem to new areas.

Host–Plasmodium interaction: role of RNAi

Rohit Shrivastava and S. Rajasubramaniam

Keywords: Cerebral pathology, MicroRNAs, Plasmodium.

Abstract

Malaria is a global health problem that afflicts an estimated 90 million people worldwide. Significant improvement in the understanding of Plasmodium life cycle has been achieved, yet multitude of clinical effects seen in malaria remains unanswered. MicroRNAs (miRNAs) have been implicated in the pathogenesis of malaria. These miRNAs act as post-transcriptional regulators and control host’s cellular factors needed for Plasmodium multiplication and suppress immune responses. Dysregulated miRNA expression has been linked to malaria pathogenesis through modulation of signalling pathways involved in processes such as proliferation, metabolism, gene expression and immune response in the host. In humans, Plasmodium infection severely affects hepatic functions and erythrocytic life span while severe infection with *P. falciparum* can lead to cerebral pathology. The present review aims to gain insight into the contribution of miRNAs to the exo-erythrocytic and erythrocytic stage pathology of Plasmodium infection and coordinated regulation in Plasmodium-mediated progression to cerebral pathology.

Detection of solar cycle signal in the tropospheric temperature using COSMIC data

V. Kumar, S. K. Dhaka, V. Panwar, Narendra Singh, A. S. Rao, Shristy Malik and S. Yoden

Keywords: Radio occultation, solar cycle, sunspot number, tropospheric temperature.

Abstract

Influence of the solar cycle on temperature structure is examined using radio occultation measurements by COSMIC/FORMASAT-3 satellite. Observations from January 2007 to December 2015 comprising 3,764,728 occultations, which are uniformly spread over land and sea, have been used to study temperature changes mainly in the troposphere along with the solar cycle over 60°N–60°S geographic latitudes. It was a challenging task to identify the height at which the solar cycle signal could be observed in temperature perturbations as different atmospheric processes contribute towards temperature variability. Using a high spatial resolution dataset from COSMIC we are able to detect solar cycle signal in the zonal mean temperature profiles near surface at 2 km and upward. A consistent rise in the interannual variation of temperature was observed along with the solar cycle. The change in the temperature structure showed a latitudinal variation from southern to northern hemisphere over the period 2007–2015 with a significant positive influence of sunspot numbers in the solar cycle. It can be concluded that the solar cycle induces changes in temperature by as much as 1.5°C. However, solar cycle signal in the stratospheric region could not be identified as the region is dominated by large-scale dynamical motions like quasi-biennial oscillation which suppress the influence of solar signal on temperature perturbations due to its quasi-periodic nature.

Hybrid Bt cotton: a stranglehold on subsistence farmers in India

Andrew Paul Gutierrez

Keywords: Bt cotton, hybrid seed, high density short season cotton, farmer suicides.

Abstract

Cultivation of long season hybrid and GMO Bt-hybrid cottons is unique to India. The hybrid technology prevents seed saving, requires annual purchases of high cost seed that leads to sub

optimal planting densities. These factors contribute to stagnant low yields and to increases in insecticide use that induce new pests that are increasingly resistant to insecticide and Bt toxins. Subsistence farmers growing rainfed Bt cotton in south and central India have been particularly affected by this hybrid technology. Pure line high-density short-season (HD-SS) rainfed cotton varieties are available or in development that would greatly increase yields, reduce yield variability, decrease costs of seed and insecticides and increase profits. The high costs of Bt hybrid seed make the technology incompatible with the HD-SS applications. The article questions why pure line HD-SS technology has not been implemented in India.

DOMIS: a decision support system for design and cost estimation of micro-irrigation systems

Neelam Patel, T. B. S. Rajput, Deepak Kumar Dinkar, Sita Ram and Sushil Kumar Singla

Keywords: Decision support system, DOMIS, microirrigation software, micro-irrigation system design, precision farming software.

Abstract

The decision support system (DSS), namely Design of Micro Irrigation Systems (DOMIS) has been developed to design drip, sprinkler and micro-sprinkler irrigation systems. This provides expert opinion for optimal layout plans for MI system design by using the necessary data on crops, soil characteristics, groundwater and agri-climatic conditions as default options with a provision to modify as preferred by the user. The design includes selection of pipe sizes, pumping system, filters and fertilizer application systems along with possible shifts per day in case of sprinkler irrigation system and total time of irrigation. The web-based system (<http://domis.iari.res.in>) uses scientific algorithms and expert suggestions; the flexibility of DSS and ease of use make the DSSDOMIS a superior tool for designing micro-irrigation systems with a view to enhance water productivity in agriculture. It also provides general information about different Government schemes, central and state agencies promoting micro irrigation, approved system suppliers in different states and general information about different districts in the country. The DSS helps farmers as well as policy makers and researchers obtain optimal design and cost estimates of a micro-irrigation system.

Evapotranspiration and crop coefficient of okra under subsurface drip with and without plastic mulch

Ashish Patil and K. N. Tiwari

Keywords: Crop coefficient, evaporation, okra, plastic mulch condition, subsurface drip irrigation.

Abstract

Field experiments using lysimeters were conducted in sub-humid climatic condition to estimate water balance parameters, regional crop coefficient development and to evaluate yield response of okra crop under subsurface drip (SSD) irrigation with and without plastic mulch. In the year 2016, total crop evapotranspiration under SSD with and without plastic mulch was 403 and 512 mm respectively, whereas in 2017 it was 363 and 468 mm respectively. Average crop coefficient of okra was 0.31, 0.42, 0.68, 0.77 and 0.48 measured under SSD with plastic mulch condition, and 0.51, 0.72, 0.92, 0.93 and 0.53 without plastic mulch. High yield of okra with minimum crop evapotranspiration was observed under SSD with plastic mulch treatment due to lower irrigation water requirement, minimum evaporation and less weed transpiration under plastic film compared to nonmulch condition.

Impact of open burning of crop residues on air pollution and climate change in Indonesia

Ade Andini, Sébastien Bonnet, Patrick Rousset and Udin Hasanudin

Keywords: Crop residues, emission factors, global warming, Indonesia, open burning.

Abstract

Crop residues are subjected to open burning in Indonesia. These farming practices were studied to determine the proportion of open burned and their contribution to air pollution based on crop and air pollutant specific emission factors. On an annual basis, it was estimated that 45 million tonnes of crop residues are open burned. This leads to emission of greenhouse gases and toxic pollutants. On an average, CO₂ and CO dominate the overall emissions with 90% and 8% respectively. The remaining 2% are contributed by CH₄, SO₂, NO_x, NH₃, N₂O, NMVOC and particulate matter. Climate charging emissions were assessed to contribute 12–14% towards global warming potential by the global crop residues open burning.

Assessment of co-contamination in soil samples from agricultural areas in and around Lucknow city, Uttar Pradesh, India

Arpna Ratnakar and Shikha

Keywords: Agricultural lands, co-contamination, heavy metals, industrial area, soil samples.

Abstract

An environmental evaluation of agricultural lands situated close to industrial areas in and around Lucknow city was carried out to determine the effect of co-contamination in the study area. Analysis of soil samples revealed the presence of mercury and cadmium at higher levels than their normal distribution in soil. Apart from heavy metals, the herbicide Butachlor was also detected in most of the soil samples studied. Co-contaminated soils pose a major threat to agricultural ecosystems since the presence of different concentrations of heavy metals may inhibit biodegradation of organic pollutants, which further affects metal bioavailability and phytoremediation.

Growth profile of *Chaetoceros* sp. and its steady state behaviour with change in initial inoculum size: a modelling approach

Sayani Kundu, Joyita Mukherjee, Farhana Yeasmin, Samarпита Basu, Joydev Chattopadhyay, Santanu Ray and Sabyasachi Bhattacharya

Keywords: Cost-effective production, growth profile, hatchery industry, initial inoculum, optical density.

Abstract

Monitoring and modelling of the growth profile of microalgae species should be an important tool for the hatchery industries before standardizing the best yielding and cost-effective protocol for their unit. Several factors are responsible in determining the nature of the growth profile. The most important regulator of such growth profile should be the volume of the initial inoculum. In addition, identification and determination of different phases (lag, log, stationary, etc.) of the growth curves of microalgae may be an essential part in the growth profile monitoring. Estimation of growth phases will also help the hatchery scientists in standardizing the commercial culture for industry. Moreover, the transition of different phases can be accurately identified through theoretical models, which are mostly overlooked in simple analysis. Summing up, we have two precise objectives: (1) to study the effects of choice of initial inocula levels on the time to maturity of the *Chaetoceros* sp., (2) to model the growth profile of the species from which we can theoretically determine its different phases, based on the optical density measurement as a proxy of the biomass. The estimated values of each phase are compared under two initial inocula levels through statistical tests. Using the conceptual approach of the proposed theoretical technique, there is scope for developing a similar model, which can be used in determining cost-effective culture protocol for commercial use.

Synthetic modulation including structure establishment, antiproliferative activity of some p-aryl substituted (Z)-2-cyanoethylideneacetohydrazides, and their structure activity relationship

Deepak Chowrasia, Nisha Sharma, Ajay Kumar, Md Arshad, Sahabjada Siddiqui, Asif Jafri and Juhi Rahis

Keywords: Cancer, cyanoacetohydrazide, electron withdrawing ring substituent, MTT assay.

Abstract

A series of p-substituted aryl-2-cyanoethylideneacetohydrazides derivatives (2a-j) were successfully synthesized in the laboratory (yield 60–80%). The synthesized compounds were screened for their antiproliferative activity against MCF-7 (estrogen dependent human breast cancer cell line), SaOS-2 (osteosarcoma cell line), and K562 (myeloid leukemia cell line) by MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) reduction assay. They showed moderate to mild antiproliferative activity, (2j) being the most potent in the series with an IC₅₀ 55, 64 and 35 μM against MCF-7, SaOS-2 and K562 cell lines, depict p-nitro as a better antiproliferative substituent comparatively. We have also tested the hypothesis – ‘Electron withdrawing phenomenon affects antiproliferative activity’.

Absolute age evidence of Early to Middle Ordovician volcanism in Peninsular Malaysia

Long Xiang Quek, Azman A. Ghani, Yu-Ming Lai, Hao-Yang Lee, Mokhtar Saidin, Muhammad Hatta Roselee, Muhammad Hafifi Badrudin, Meor H. Amir Hassan, Jasmi Hafiz Abdul Aziz, Tham Fatt Ng, Muhammad Afiq Muhammad Ali and Mohamad Tarmizi Mohamad Zulkifley

Keywords: Absolute age, meta-volcanic rocks, petrographic data, tectonic elements.

Abstract

Evidence of Early Palaeozoic volcanism in Peninsular Malaysia is largely represented by felsic Gerik–Dinding meta-volcanic rocks; however, reliable absolute ages for the meta-volcanic rocks are still lacking. This restricts correlation of these meta-volcanic rocks with other Early Palaeozoic East Gondwana Proto-Tethys margin tectonic elements identified in the evolution of Southeast Asia. Here, we report petrographic data and zircon U–Pb age of the Gerik–Dinding metavolcanic rocks. Zircons from three Gerik–Dinding meta-volcanic rock samples yield Early to Middle Ordovician weighted mean ²⁰⁶Pb/²³⁸U ages between 480 and 460 Ma. The formation age of the meta-volcanic rocks coincides with the post-collision stage from the final amalgamation of Asian micro-continental fragments with the East Gondwana Proto-Tethys margin. Tectonic processes such as lithospheric delamination during the post-collision period could have induced the hot asthenosphere to underplate the continental crust and trigger crustal anatexis. With these findings, the Early Palaeozoic tectonic history of Peninsular Malaysia needs careful review.

Late Pleistocene relative sea-level changes from Saurashtra, west coast of India

S. P. Prizomwala, Gunjan Yadav, Nilesh Bhatt and Komal Sharma

Keywords: Fluvial response, optical dating, miliolites, sea-level change.

Abstract

The fluvial systems of Saurashtra, Gujarat, India have archived signatures of sea-level stands for the Late Quaternary Period. Based on geomorphology, sedimentology and optical dating, the lower reaches of Noli river in southwestern Saurashtra reveal the presence of marine, fluvially reworked and aeolian forms of miliolite. Optical chronology permits us to extend the age range of fluvially reworked miliolites from 75 (as previously believed) to 114 ka. The fluvial sequence of southwestern Saurashtra has responded to sea-level changes through meandering. Presence of aeolian miliolites dated to 23 ka suggests regional aridity during the time of their deposition and

preservation. Marine notches in Diu mark Middle Holocene high sea-level stand and their preservation implies active tectonism in the region.

Mesoscale model compatible IRS-P6 AWiFS-derived land use/land cover of Indian region

Biswadip Gharai, P. V. N. Rao and C. B. S. Dutt

Keywords: Land use/land cover data, land-surface processes, mesoscale model, spatial resolution.

Abstract

Mesoscale models, in general, are run using the US Geological Survey (USGS) 25-category land use/ land cover (LU/LC) data available at different spatial resolutions. The USGS data over the Indian region suffers from two types of errors, viz. misclassification of LU/LC data and non-availability of up-to-date satellite-based LU/LC data. To improve the accuracy and capture interannual changes better, the LU/LC data generated by the National Remote Sensing Centre (NRSC) using IRS-P6 AWiFS with 56 m basic resolution have been scaled to 5, 2 min and 30 sec resolution which is available at yearly intervals. In the next step, the Indian region of USGS data was replaced with IRS-P6 AWiFS-derived data and made compatible to MM5 and WRF mesoscale models. Thus the resultant product is a global USGS LU/LC data with the Indian region replaced by the information originally derived from AWiFS 56 m resolution imagery, for the years 2004–05 to 2012–13 (nine cycles). This communication describes the required LU/LC data format for MM5 and WRF models and the methodology adopted for compatible product generation. In addition, accuracy of AWiFS-derived LU/LC data converted to 30 sec resolution has also been determined. The present effort will provide the necessary reference for the atmospheric modelling community to address the Indian satellite based model compatible LU/LC data product. These data products are currently available on Bhuvan, the NRSC/ISRO geospatial portal.

Development of a bird habitat resource classification scheme based on vegetation structure analysis

Peter S. Lee and Brendan G. Mackey

Keywords: Bird habitat, functional group classification, landscape-scale analysis, sustainable management, vegetation structure analysis.

Abstract

In order to design a conservation strategy for birds inhabiting the Great Western Woodlands (GWW) in southwestern Australia, we adopted a new approach for classifying birds into functional groups (BHFGs) based on an analysis of vegetation structure-related habitat resources (VHR). On the basis of hierarchical cluster analysis of the VHR variables we selected here, we selected a model that incorporated nine-BHFGs. This yielded a classification system that, due to our different input sources, is distinct from an existing foraging guild-based system. In conjunction with GIS technique, this new classification system has potential for effectively predicting and mapping landscape-scale habitat distribution.

Fruit predation and adaptive strategies of *Garcinia imberti*, an endangered species of southern Western Ghats

M. Anto, P. S. Jothish, M. Angala and C. Anilkumar

Keywords: Agasthyamala Biosphere Reserve, *Garcinia imberti*, plant–animal interaction, seed germination, seed predation.

Abstract

The germination and seedling emergence capacity of partially predated seeds of *Garcinia imberti* Bourd., an endemic and endangered tree species of the southern Western Ghats, was assessed with

differentially devoured seeds. Pre-dispersal, fruit/seed predation by arboreal mammals especially *Ratufa indica* (Malabar Giant Squirrel) and to a smaller extent by *Trachypithecus johnii* (Nilgiri Langur) was observed. The fragmented seeds of natural predation as well as manually cut seed pieces showed speedy germination. Seed fragments with more than 50% of seed tissues showed high seed vigour index. The germination behaviour of cut seeds indirectly conveyed the simulated effect of predated seed germination in natural habitat. Germination of fragmented seeds overcomes the inevitable prolific predatory problems by frugivores. This study showed that *G. imberti* seeds tolerate predation to a certain extent as an adaptive character ensuring seed dispersal and seedling establishment through a unique plant–animal mutuality.

Trash on the menu: patterns of animal visitation and foraging behaviour at garbage dumps

Gitanjali Katlam, Soumya Prasad, Mohit Aggarwal and Raman Kumar

Keywords: Animal visitation, foraging behaviour, terrestrial vertebrates, unsegregated garbage.

Abstract

Garbage accumulation around terrestrial nature reserves poses a risk to many species. We monitored animal visitation patterns and foraging behaviour at garbage dumps near a forested area in Uttarakhand Himalaya, India, to examine plastic consumption by animals. We recorded 32 species of birds and mammals visiting garbage dumps and classified them as ‘peckers’, ‘handlers’ and ‘gulpers’ based on their foraging behaviour. Gulpers (carnivores and ruminants) were observed feeding more frequently and spent longer durations (3.8 ± 0.2 min) at garbage dumps. Our results highlight the importance of at-source segregation of waste to prevent wild and domestic animals from ingesting hazardous wastes, including plastics at garbage dumps.

Keywords Index

Keywords	Page	Keywords	Page
Abiotic factors	131 79	Air-conditioning and refrigeration	153
Absolute age	182	Airfield	52
Absorptive reservoir bottom	81	Airframe structure	4
Academic institutions	41	Alkaliphilic bacterium	29
Accelerated aging	32	ALL	153
Accessory minerals	84	Allelopathy	127
Acid detergent fibre	104	Allometric equation	103
Acid detergent lignin	104	ALL-protocol	30
Acid mine drainage	114	Alluvial diagram	169
Actinobacteria	158	Alluvial river	138
Active methylene	105	Alpha-synuclein	143
Adaboost algorithm	99	Altered gene expression	96
Adaptive coral bleaching	23	Alternaria burnsii	69
Added response	81	Altitude	82
Admixture	34	Altitudinal gradient	89
Adsorption	14	Aluminumrich inclusions	54
Adsorption affinity	28	Alzheimer's disease	42
Aegle marmelos	42	Alzheimer's disease	176
Aeolian activities	21	Amaranthus	46
Aerodynamic control surfaces	3	AMD control system	12
Aerodynamic design and characterization	1	Amendments fluoride excess	125
Aeromagnetic and satellite data	7	Amery Ice Shelf–Lambert glacier system	164
Aerosol optical depth	90	AMOVA	54
Aerospace alloys	4	Anabas testudineus	151
Affordability	72	Anaemia	119
African buffalo optimization	24	Anaerobic digestion	104
Agarose hydrogels BMG-1	128	Anaerobic germination	139
Agasthyamala Biosphere Reserve	183	Ancestry	34
Agent-based modelling	98	Ancient texts	104
Agents	125	Angiogenesis	143
Aggregation	42	Angle of attack	2
Aggregation-induced emission	85	Animal visitation	184
Agricultural commodities	124	Animal welfare	51
Agricultural engenderment	135	Anisotropy of Magnetic Susceptibility	67
Agricultural hierarchy process	89	Annual effective dose	174
Agricultural land use	167	Ant sampling	30
Agricultural lands	181	Antarctic meteorites	54
Agricultural mechanization	70	Antarctic soil	158
Agricultural sustainability	13	Antarctica	107
Agriculture	65,75, 166	Antarctica	159
Agro-climatic zone	68	Anterior eye chamber	143
Agroinfiltration	61	Anthropogenic stressors	154
Agronomic	129	Antibacterial activity	111
AHL	167	Antibacterial assay	15
Air quality	86		

Antibiotic resistance	66	Avalanche accident	130
Antibiotic resistance and susceptibility	174	Ayurveda	58
Anti-cancer therapy	73	Azo dye <i>Bacillus</i> sp	112
Antifungal activity	76	A β peptide	176
Anti-hyperglycaemic activity	168	B-carotene	149
Antimicrobial finishing	123	<i>Bacillus</i>	29
Antimicrobial peptide	154	<i>Bacillus amyloliquefaciens</i> (VB7)	154
Anti-nutritional properties	139	Back pain	128
Antioxidants	38, 42	Backfill deformation	171
Antiproliferative	15	Backpack design	128
Aquaculture	140	Bacteria	28
Aquatic ecosystem	178	Bacterial colonies	63
Arable land	122	Bacterial communities	154
Archaeology	31	Bacterial diversity	158
Arctic	158	Bacterial diversity	175
Arctic ocean	127	Bandgap semiconductor	153
Arctic soil bacterial diversity	159	Bands importance	146
Area of occupancy	21	Bank erosion	150
Artificial memory	110	Bank material	150
Artificial neural network	173	Barley (<i>Hordeum vulgare</i> L)	128
Artificial seeds	175	Base layer	14
Arunachal Pradesh	30	Base temperature	143
ASCAT	107	Basement depth	7
Ascent and descent phases	1	Bastar Craton	84
Asenapine	112	Batesian mimicry	80
Assemblage structure	79	Battery storage	25
Assets	155	Bay of Bengal	49
Assimilation	38	Bay of Bengal sediment	70
Association mapping	12	Bayesian network	91
Assortative mating	92	Beach	120
Asthenopodichnium	55	48,	
Astronomical data	102	Beam parameters	13
Asymptotic stability	101	Beam-forming algorithms	35
Atmospheric models	45	Beaufort Sea	156
Atmospheric waves	88	Beef gender	37
Atomic Absorption Spectrophotometry	67	Benchmark function	110
Atomic numbers	155	Bending angle	38
Atomic structure	155	Benefits and cost of city trees	109
Attitude community	66	Bengal tiger	86
Attrition index	125	Benzimidazoles	105
Authentication	126	Benzofuran	75
Authorship	80	Benzoylation	176
Automated cleaning process	133	Benzylideneacetophenone	15
Automatic identification system	89	Berberine	54
Automatic license plate method	68	Beta-caseins	148
Automation	166	<i>Betula ermanii</i> population dynamics	161
		Bhitarkanika	34

Bhutan	68	Black carbon	105
Bias correction	53	Black slipped ware	86
Bias gender	160	Black soils	111
Bibliometric analysis	56	Blasting scheme	97
Bibliometric and visual analysis	87	Bleaching	71
Bibliometric assessment	116	Blight conidia	69
Bibliometric assessment	172	Bloom	98
Bibliometrics 25,73,80,152,156,165	169	BN hybrid	5
Bi-clonal seed	91	Bok Bak fault	40
Big data	63	Bonafide	8
Binding docking energy	112	Bone formation	57
Bioactive compound	75	Bootstrap and confidence band	127
Bioactive metabolites	19	Bord and pillar method	162
Bioapatite	131	Borehole temperatures	150
Bio-bibliometric study	152	Boro rice	165
Biocalcification	37	Botrydiplodia theobromae	137
Biocapacity	167	Bottled water	1
Biochar	76	Bow-tie model	91
Biocompatibility and biodegradability	81	Brahmaputra	138
Biocontrol agent	39	Braiding	138
Biocontrol agents	131	Brain stroke	73
Biodiversity 17,127,	171	Brittleness evaluation index	138
Biodiversity conservation	109	Broodstock	8
Bioethanol production	136	Brown planthopper	63
Bioflavonoids	168	Bryophytes	155
Biofortification	129	Bt cotton	113, 179
Biofuels	43	Bubble diameter	167
Biogenic source	131	Bubble motion	167
Biogeographic region	115	Büchi automata	172
Bioinspired computing	110	Büchi automaton	118
Biological control	151	Bud necrosis disease	61
Bioluminescence	23	Buffer time index	68
Biomedical imaging	13	Buffer zone	98
Biomedical science	81	Buoyancy flux	30
Biopotentiometry	31	Burning rate	2
Bioremediation	28	Butylated hydroxyanisole	151
Bioremediation	121	Calcium	54
Biosensor	95	Calcium oxalate	28
Biotech industry	156	Camponotus compressus	80
Biotechnology	171	Cancer	182
Biotic factors	82	Cancer progression	118
Biplot	77	Candida tropicalis	39
BIRAC entrepreneurship	101	Canine mammary tumour	143
Bird habitat	183	Canopy management	149
Birds	94	Capacity	68
Birds calls	84	Carbohydrate	102
Birth rate	61	Carbohydrate-hydrolysing enzymes	75
		Carbon capture and storage	50

Carbon dioxide	118	Ciliates	66
Carbon dioxide emission	46	Circadian clock	141
Carbon emission	94	Citation characteristics	50
Carbon films	79	Citations	80
Carbon sequestration rate	103	Citations	165
Carbonaceous chondrite	9	Citespace	80
Cardinal vowels	84	Citrus maxima	75, 168
Cardiovascular disease	142	CITZ	24
Career development	172	Cladosporium echinulatum	154
Carrying capacity	13	Classic articles	73
Catalyst	176	Classification	102
CATSPER2	92	Classification	160
Cauliflower	175	Classification algorithms	145
Cauvery delta	162	Clean water	176
Cave geomicrobiology	37	Clearance condition	52
Cavern	117	Climate	11,50, 68
Caverns and palaeo-channels	130	Climate change	14,26,27,34,35,46,53, 56
Cavitation	10	Climate change	63,71,94,145,161, 173
CDOM	63	Climate smart agriculture	145
Cell division	118	Climatic variables	82
Cell viability	136	Climatology	30
Cellulase activity	52	Clinical trials	156
Cellulose degrading microorganism	44	Clone library	175
Central Asia	34	Cloud computing	102
Cerebral pathology	179	Cluster	68
Chalcone oxime	111	Clustering	48
Changbai Mountains	161	CMRI-ISM RMR	79
Change detection	113	CO ₂	50
Change detection analysis	106	CO ₂ evolution	170
Channel	68	Coal flue gas	118
Characterization	76	Coal mining	114
Charge density wave	31	Coastal upwelling	98
Chemical composition	9	Co-authorship	108
Chemical reduction	67	Cobra venom	42
Chemical treatment	28	Co-Büchi automata and Muller automata	172
Chilika lagoon	63	Co-contamination	181
Chiroptera	177	Coconut	151
Chitosan nanoparticles	76	Cocopeat	140
Chlorophyll	134	Coliforms	94
Chlorophyll a	30	Collaboration	108
Chlorpyrifos	121	Collaboration pattern	41
Cholesterol	142	Collaborative index	41
Chorabari	26	Collaborative research	93
Chromitite	60	Collision risk value	89
Chromobacterium violaceum	96	Combination weight based on game theory	97
Chromosome	148	Combinatorial optimization	110
Chromosomes	51		
Chrysanthemum	140		

Commission agents	124	Crop coefficient	180
Commodity specific zones/ areas	129	Crop establishment methods	113
Community phylogenetics	127	Crop lands	49
Complement-dependent cytotoxicity	90	Crop productivity	46
Computational complexity	110	Crop productivity	173
Computational intelligence	145	Crop residues	180
Computational quantum chemistry	75	Crop rhizosphere	92
Concentrated solar power	100	Cropping systems	161
Concept mapping	151	Cryogenic grinding	131
Condensed oxazine	166	Cryopreservation	171
Conducting bodies	62	Cryosphere	26
Conservation	17,19,20, 127	Culture	61
Conservation incentive	35	Cumulus parameterization	137
Conservation measures	97	Curriculum development	64
Conservation strategy	16	Customized fertilizer	102
Conservation strategy	19	CW-GT	97
Conspecifics	177	Cyanoacetohydrazide	182
Constraints	133	Cyanobacteria	102
Constructed wetlands	6	Cyanophage	178
Construction aggregates	124	Cyclization	166
Contact application	53	Cyclodextrins	91
Contamination	6	Cyclone	48, 49
Contiguous gene deletion	92	Cyclone Vardah	137
Control	4	Cynopterus sphinx	177
Control electronics	3	Cysteine protease	85
Control measures	54	Cytokines;	128
Convention on biological diversity	109	Cytotoxicity activity	105
Cooking	139	Damage	108
Coral bleaching	14	Data structure	108
Coral reefs	39, 71	Database	171
Coregistration problem	74	DBH	8
Coronation garden	103	DC magnetron sputtering	51
Corridor	76	DCPA and TCPA	89
Coseismic rupture	55	Deboning data	37
Cost-effective production	181	Deccan volcanism	55
Co-substrate	112	Deception	32
Cotton	129	Deciduous forest	127
Cotton hybrid	119	Decision rules	43
Cotton twill tape	123	Decision support system	180
Country-level studies	152	Decision tree	160
Coupled systems	81	Decolourization	112
Craters	21	Deenanath grass	5
Cr-doped zno	153	Defence-related genes	169
Critical gap	52	Defluffing	5
Critical photoperiod	143	Deforestation	113
Critical position	52	Deformed coal	178
Criticality index	13	Degradation	161
		Dehradun Fan	130

Delayed triggering	55	Diversity	170
DEM	48	Diversity and conservation	115
Demand	10	DMP	146
Demography	18	DNA sequencing	86
Demography	61	Dnabased diagnosis and molecular epidemiology	72
Dengue	81	Docking	42
Density functional theory	153	Docking combinatorial library	73
Dentistry	31	Dolichos bean	143
Dentures	31	DOMIS	180
Denudation rate	162	Dongargarh	84
Deodar and oak forest types	40	Dormancy of leaf primordia	164
Depigmentation	139	Dosage form	23
Depillaring	162	Double negative meta-atoms	90
Derivative analysis	115	Double-diffusive convection	71
Desertification	106	Doubling	118
Design fire	105	DPPH scavenging activity	91
Detection	61	D-region ionosphere	69
Detection and separation	126	Drifting buoy	106
Determinants	82	Drip irrigation	147
Developing nations	28	Drought	85
Developing nations	132	Drought characteristics	107
Developmental plasticity	16	Drought indicators	107
Device packaging	134	Drought resistance	12
Dhauladhar mountain	82	Drought stress	34
Diagenesis	78	Drought vulnerability	107
Diagnostic target	142	Drug discovery	164
Diallel mating	149	Dryopteris wallichiana	164
Diatoms	75, 157	DSAS	93
Dietary salt	169	Dual-band	90
Differential expression	128	Dust	133
Differential scanning calorimetry	91	Dye sensitized solar cells	87
Differentiation assessment	71	Dyes	28
Diffraction efficiency	87	Dynamic load balancing	101
Diffusion coefficient	178	E Coli	121
Digital accessible knowledge	94	Earthquakes	7
Digital library	117	Earthquakes	55
Direction of arrival estimation	35	Earthworm–microorganism interactions	52
Disaggregation	176	Easterase isozyme	52
Discovery of Oxygen	10	Eastern Himalaya	155
Discriminant function analysis	37	EBL	51
Disease mortality	73	Ecological footprint	167
Dissolution features	130	Ecological interactions	17
Dissolved oxygen	115	Ecologically fragile lands	151
Distress calls	177	Economic benefit	164
Distributed algorithms	102	Economic dispatch	110
Distributed system	101	Economic water productivity	120
Distribution	170		
Divergence	48		

Edible insects	133	Enhanced fire risk	105
Effective medium ratio	90	Ensemble learning	99
Effective saturation	36	Entacapone-related substances	23
Efficient spraying	135	Entamoeba complex	72
Eigen value	77	Enterobacteriaceae	174
Electric vehicle	87	Enterocytozoon hepatopenaei	122
Electric vehicles	25	Entrainment velocity	71
Electrodynamic screening	133	Entrepreneurship	64
Electroencephalography signals	7	Environment pollution	135
Electrohydraulic actuation system	3	Environmental engineering	108
Electromagnetic system	62	Environmental pollution	73
Electromagnetic waves	31	Epidemiological study	169
Electron density	45	Equity	155
Electron withdrawing ring substituent	182	Erodibility	97
Electronic and optical properties	153	Erosion	93
Electronic markets	124	ESAT-6 secretion	118
Electronic processes	60	Essential oil	123
Electro-oxidation	67	Ethics	156
Electrophoresis	126	Ethnomedicine	145
Elemental composition	105	European Public Sector Accounting Standards	77
Elephant corridor	178	European System of National Accounts	77
Elephant landscape	113	European Union	77
Elevated carbon dioxide	97	Eurycoma longifolia	126
Elevated CO ₂	63	Evaluation and management	52
Elevation change	26	Evaporation	180
Elite germplasm	19	Evolutionary algorithms	110
Embryogenesis	96	Evolutionary allometry	99
Embryological studies	20	E-waste	6
Emission factor	86	Exopolysaccharides	102
Emission factors	180	Extended spectrum beta-lactamases	174
Emissivity	5	Extension strategies	28
Empowerment	70	Extent of occurrence	21
Encapsulation	175	Extinction risk	18
Endangered plants	17	Extract concentration	127
Endemism	170	Extreme events	36
Endocrine disruption	151	Extreme precipitation	53
Endocrinology osteoblasts	57	Extreme scales	93
Endophytic fungi	128	Eye blinks	7
Energy	10	Eye development	143
Energy	50	Fabry–Perot Interferometer	157
Energy data	75	Façade testing facility	162
Energy saving	141	Facial asymmetry	32
Energy security	25	Facial expression	32
Energy-dispersive X-ray spectroscopy	86	Factor analysis	29, 121
Engineering education	64	Failure stress	55
Engineering education	100	Fairy ring spot	154

Family planning	116	Fluoride toxicity	119
Farm equipment	70	Flush air data system	1
Farmer suicides	179	Flushed air data system	2
Farmers	124	Fluvial response	182
Fast ice	107	Foliar endophytes	170
Fault detection and isolation	12	Food preference	7
Fault-tolerant control	12	Food products	133
Feature detection	121	Food security	10
Fecundity	99	Food sustainability	13
Feed library	142	Foraging behaviour	184
Feline immunodeficiency virus	56	Foraging strategies	7
Feline leukaemia virus	56	Force degradation study	23
Fe–Mn micronodules	78	Forcing	120
Fenneropenaeus indicus	93	Forest	34
Fertilizer grades	102	Forest fire	90
Fertilizer policy	102	Forest inventory parameters	8
Fertilizer subsidy	102	Forging microstructure	4
Fe–Ti-oxide	67	Fossil charcoal	55
FIB	51	Fossil fuel	50
Fibrous minerals	111	Fourthgeneration refrigerants	153
Field crops	141	Foxtail lily	14
Financial time series forecasting	99	Fracture network	111
Finger millet	96	Fracture propagation	111
Fire load energy density	105	Fractured zone	148
Fire load survey	105	Fragilariopsis sp	98
Firefly	23	Fragile ecosystems	97
Fires	130	Free electron laser	13
Firing technique	86	Free field response	81
Fish communities	79	Freshwater content	96
Fish scales	131	Freshwater environment	55
Fisheries	98	Freshwater fish	122
Fissile materials	132	Fruit infection	135
Flavones	173	Fruit quality	39
Flexible buildings	12	Fruit yield	149
Flexible external insulation	5	Fuel quality	86
Flight performance	1	Functional filler	31
Flight performance	3	Functional group classification	183
Floral biology	20	Functionalization	166
Floriculture genetic diversity	41	Funding agencies	64
Floristic composition	59	Fundus retinal image	121
Floristic composition	89	Fungal endophytes	170
Flow cytometry	136	Fungal genomes	59
Flow cytometry	178	Fusarium species	128
Fluctuation	159	Fuzzy	168
Fluidized bed	167	Fuzzy C-means	135
Fluorescence	58	Fuzzy c-means method	153
Fluorescence spectroscopy	85	Fuzzy logic approach	125
Fluoride distribution	66	G20 countries	152

Galvanic currents	31	Grain number	149
Galvanosis	31	Grain quality	38
Gap acceptance	52	Grain size	70
Garcinia imberti	183	Grain size	150
Garnet-grade metamorphism	150	Grain weight	149
Gcms	53	Granite	84
GC-WTOPSIS	97	Granite pluton	150
GDP	95	Graphic user interface	53
Gender	10	Green algae	102
Gender classification	37	Green building regulations	162
Gene expression	34	Green house gas	142
Genetic diversity	35	Green to evergreen revolution	165
Genetic enrichment	17	Greenhouse gas research	56
Genetic programming	167	Grid	87
Genetic variability	19	Ground motion time history	60
Genomes	159	Ground penetrating radar	31, 35
Genomic variation map	119	Ground penetrating radar surveys	26
Genotyping	148	Ground residual displacement	60
Geochemistry	70	Ground subsidence mining	171
Geoelectronic imaging	70	Ground temperature history	150
Geoengineering	36	Groundwater	6, 62, 66
Geographic distribution pattern	16	Groundwater level	88
Geographic information system	97	Groundwater modelling	94
Geological domain	126	Groundwater quality	24
Geometric coefficient of variation	90	Groundwater recharge	24
Geospatial tools	165	Groundwater recharge	94
Geotechnical and geological investigations	117	Groundwater recharge modelling	22
Geotechnical site characterization	70	Groundwater storage	88
Germination	127, 134	Group B Streptococcus	61
Germination properties	32	Group size	61
Germplasm	48	Growing medium	140
Germplasm bank	17	Grow-out test	175
GIS ordinary kriging	88	Growth profile	181
Glaciers	26, 27	Guidance	4
Global change	94	Guinea grass	5
Global competitiveness	177	Guinea-worm disease	66
Global optimization	24	Gujarat dairy development	77
Global trends	56	Gulf of Mannar	23
Global warming	73, 180	Gut	142
Global warming potential	153	Gut bacteria	115
Glyphidrilus spelaeotes	52	Habitat	170
Gneiss	67	Habitat suitability	76
Godavari estuary	63	Haematobiochemical parameters	122
Gondwana shale	119	Halophytes	97
GPR	107	Hand tools	70
GPSRO	38	Hangul	76
Gradient magnitude	35	Hanwoo	37
		Haplogroup	34

Hard roof	148	Hopper burn	63
Hatchery industry	181	Horizontal flow	6
HCN channels	16	HPLC	121
Health	124	HR	95
Health issues	125	HR– type resistance	95
Health policy	41	HR+ type resistance	95
Healthcare	57	Human isolates	174
Healthcare	132	Human safety	133
Healthcare provision and expenditure	95	Human toxicity	126
Heat flux	2	Human-interface	178
Heat shock protein	66	Human–machine interface	7
Heavy metal stress	66	Humibacillus	158
Heavy metals	181	Hybrid flow	6
130,		Hybrid purity	175
Heavy metals soil	6	Hybrid seed	179
Heavy rainfall events	137	Hybrid SHE-SWAT	163
Helopeltis theivora	78	Hybridization	41
Herbal products	126	Hydration swelling	138
Herbarium	17	Hydraulic fracturing	111
Herbicide	47	Hydraulic power unit	3
Herbivorous myrmecomorphs	80	Hydrazines	105
Heterobeltiosis	149	Hydrocarbon	126
Heterogeneous traffic conditions	49	Hydrocarbons	7
Heterojunction bipolar transistor	11	Hydrofluorosis	66
High density nursery	5	Hydrogen-bond radius	45
High density short season cotton	179	Hydrophobic interaction	42
High school	103	Hydrosphere	144
High throughput sequencing	159	Hydrothermal vent	175
High tidal mudflat	93	Hydrous magmas	24
Highly cited articles	108	HYDRUS and MODFLOW	22
Highly enriched uranium	132	Hydrus modflow	94
High-tech industry	29	Hyperglycaemia	75
High-throughput genotyping	32	Hypersonic flight test	1
Himalayan Orogenic migmatite	68	Hypersonic flight vehicles	2
Himalayas	27	Hyperspectral data	115
H-index	108	Hypertension	169
Hispa release density	149	IBRV Araon	156
HIV-1 genome	173	Igniter	2
Holocene	162	Illicium griffithii	20
Holocene	75	Image analyser	53
Holocene climate	157	Image segmentation	48
Holocene-LGM	70	Image segmentation	35
Home garden	134	Imitation	84
Homegarden size	89	Immersion time	138
HOMO–LUMO	173	Immunochemistry	56
Honey	103	Immunohistochemistry	143
Honghe wetland	37	Immunomodulator	63
		Impact craters	145

Impact factor	50,	82	Interference patterns	23
Impatiens johnii		170	Intermittent cracked rock mass	108
Implementation gap		1	International collaboration	116
Importance value index		103	International collaboration	124
Impulsive and switching system		101	International projects	93
In situ conservation		35	International Public Sector	77
In vitro maturation		5	Accounting Standards	52
In vitro regeneration		20	Intestinal microbiology	24
Incubation		101	Intrusive bodies	39
India	94,	108	Invasion	30
India NIPR		164	Inventory of ants ³⁰	155
Indian banking system		121	Investment	125
Indian Himalayas		82	Iodine deficiency	58
Indian pharmaceutical industry		41	Ionosphere	114
history			Iron oxide	68
Indian standard time		141	Irrigation	129
Indian Statistical Institute		152	Irrigation	54
Indigenes		145	ISSR	164
Indirect organogenesis		96	ITRDC	69
Indo-Himalaya		164	ITS	148
Indonesia		180	ITS	21
Indoor environment		163	IUCN classification	45
Induced systemic resistance		169	Jet streams	50
Induction arrows		79	Journals	46
Induction programme		100	Kabul River Basin	138
Industrial area		181	Kajjali	143
Infectious hypodermal		8	Kaplan Meier survival analysis	76
haematopoietic necrosis virus			Kashmir stag	158
Infiltration test		50	Katabatic wind	153
Influencing factors		82	Kdv equation	72
Infrared power		13	Kerosene	161
Inhibitor peptide		42	Kinetic constants	159
Initial inoculum		181	King George Island	47
Inner filter effect		85	Kitchen gardens	110
Inner orbitals		155	KMTOA	66
Innovation		64	Knowledge	15
Innovation ecosystem		57	Knowledge construction	158
Innovative conceptual framework		125	Kongsfjorden	24
Inorganic chemistry		103	Kottukal stream	115
Inquiry-oriented education		15	Labeo rohita	105
INSAT-3D		146	Lactambenzimidazole	28
Insecticides		126	Lactobacillus plantarum	75
Integrated design cycle		4	Lahuradewa lake	37
Integrated simulation		4	Land cover types	117
Intellectual property		57	Land resource database analysis	117
Interacting proteins		16	and interpretaion	117
Interaction energy		45	Land resource inventory	117
Intercropping systems		113	Land resources portal	117

Land use policy	129	Longitude	141
Land use/land cover data	183	Longmaxi Formation shale	138
Land uses	170	Loses of drilling fluid	148
Landfill sites	176	Lost river	104
Landscape-scale analysis	183	Low latitude	69
Landslides	54	Low temperature measurement probe	134
Land-surface processes	183	Low-carbon economy	25
Landuse dynamics	98	Lucantin	93
Lapse rate	27	Luminescent solar concentrator	58
Large cardamom	78	Lymphangiogenesis	143
Larsemann Hills	107	Maastrichtian	55
Larsemann Hills	157	Machine learning	102
Larval rearing	63	Machine learning	173
Laser fluorimetry	174	Mackenzie Trough	156
Latent pathogens	128	Macroeconomic factors	95
LD slag	130	Macrofungi	145
Leaf damage	149	Macro-nutrients	147
Leaf streak	78	Mafic–ultramafic complex	24
Leafy vegetables	42	Magmatic enclaves	150
Leap frog effect	162	Magnetic permeability	62
Lepidocephalichthys guntea	115	Magnetic resonance imaging	135
Leucogranite	68	Malanjkhanda	84
Levelized cost of electricity and poly-generation	100	Male breast cancer	124
Liana	134	Male involvement	116
Life insurance companies	125	Maleate	112
Light harvesting	117	Malwa group	55
Lineage	34	Management	34
Linear infrastructure intrusions	22	Mango	148
Linear parameters	45	Mango orchard	131
Linear stratification	71	Mangrove	48
Linearization	11	Mangrove forest ecosystems	34
Liquid chromatography	23	Mangroves	115
Liquid helium cryostat	134	Mangroves	115
Liquid metal	10	Manufacture	10
Litchi	39	Marchantiophyta	155
LITCHI (<i>Litchi chinensis</i> Sonn)	39	Marine sanctuary	14
Literature survey	73	Markers	126
Lithium-ion battery	87	Markers	171
Lithological zoning	24	Markers morphology	35
Liverwort	155	Mass balance	26
Livestock	142	Mass spectrometry	130
Livestock breeding policy	148	Maternal and child health	116
Living fence	76	Mating system	14
Localization	72	Mature seeds	96
Locomotion sensing	53	Maximum likelihood	146
Lognormal distribution	36	Mean function	127
Long short-term memory network	99	Mean-variance	112

Mechanical properties	71	Mineralization	161
Mechanism	29	Minimum viable population	18
Mechatronics	125	min–max approach	112
Median opening	52	Mission design	5
Medical optics instrumentation	13	Mission design	3
Medicinal plants	19	Mitigation and prevention	66
Medicinal plants	82	Mixing layer depth	71
MEGA	69	Modal analysis	60
Mega-science	93	Model testing	10
Meghalaya	165	Modern portfolio theory	112
Megha-Tropiques	38	Modern technologies	165
Menispermaceae	134	Moisture	32
Mentha longifolia	76	Mole ratio	111
Mercury	58	Molecular characterization	92
Merit review	64	Molecular markers	12
Mesoscale model	183	Molecular markers	19
Mesoscale model	158	Molecular probe	160
Metaanalysis	169	Molecular properties	75
Metabolic engineering	43	Monsoon	123
Metabolic quotient	170	70,88,	
Metabolomics	80	Monsoon circulation and ITCZ	45
Metacinnabar	138	Monsoon season	137
Metagenomics	154	Montipora divaricata	39
Metal complex	111	Morphological closing	121
Metallothionein	66	Morphological development	140
Metapopulation	18	Morphology	21
Meta-volcanic rocks	182	Mortality	14, 71
Meteoric $^{10}\text{Be}/^{9}\text{Be}$	162	Motor case	2
Meteorite fragments	9	Mountain wave	158
Mica	92	Mountainous terrain	130
Microbial activity	161	MTT assay	15, 182
Microbial biomass	161	Mud bank	98
Microbial biomass carbon	170	Mudbank	123
Microbial ecology	154	Mulching	47
Microbial eukaryotes	160	Multichannel analysis of surface waves	130
Microcontroller	53	Multidisciplinary approach	103
Microirrigation software	180	Multidisciplinary science	165
Micro-irrigation system design	180	Multilayer perceptron	173
Micronutrient deficiency	102	Multinutrient deficiency	43
Microphysics parameterization	137	Multiparent	32
Micromas	179	Multiple attribute decision making	25
Microscopy	72	Multiple criteria decision making	25
Microshoots	20	Multiple exciton generation	117
Microsporidia	122	Multi-regression	81
Micro-watershed	24	Multi-regression analysis	70
Miliolites	182	Multi-satellite product	85
Milk proteins	148	Multiscan	8
Milk safety	148		

Multivariate analysis	79	Non-parametric multivariate	85
Municipality biowaste	44	drought index	
Mushroom enterprises	177	North East India	113
Mutation	41	North eastern India	137
Mutational hotspots	119	Northeast India	145
Mutualism	170	Northeast India	9
Mycetism	145	Northeastern India	114
Mycetome	142	Northern China	62
Mycobacterium tuberculosis	118	Northern India	103
Myristica forests	59	Novel genes	119
Myrmarachne spp	80	NTC thermistor sensor	106
Naiïve Bayes	81	Nuclear weapons	132
Nanda Devi National Park	133	Nutraceutical property	38
Nanobiotechnology	65	Nutrient profile	142
Nanocellulose	31	Nutrients	10
Nanomaterials	65	Nutrition security	165
National Biodiversity Strategy and		Nutritional habit	122
Action Plan	109	Nutritional potential	42
National Biodiversity Targets	109	Nutritional regime	128
National Bioscience Award	172	Nutritional security	133
National Institutional Ranking		OBIA	48
Framework	40	Occupancy time	49
National Park	98	Odd–even rule	47
Natural disasters	63	Office	163
Natural spine	128	Okra	180
Nature’s design	140	OMNI buoy	49
Navigation	4	OMZ	70
Navigation systems tropospheric		Open burning	180
delay	58	Open source	11, 41
Net primary productivity	49	Open source drug discovery	164
Neural networks	135	Open top chambers	159
Neural stem cells	71	Opisina arenosella	151
Neuroimaging	169	Optic disc and cup	121
Neurosciences	73	Optical alignment	134
Neurotoxic effects	58	Optical coherence tomography	13
Neutral detergent fibre	104	Optical dating	182
New genus and species	155	Optical density	181
NGFS	38	Optical fibre	95
Niche modelling	17	Optimization	14, 132
Niche modelling	18	Organic amendments	173
Niobium nitride	51	Organic chemistry	41
Nitrogen loss	44	Organics and nutrients	6
NJ tree	54	Orientation programme	100
NMP	146	Oroxylum indium	173
Non-citable documents	50	Orthotospovirus	61
Non-citation	82	Osmotic fragility	173
Nonlinear partial differential		Osmotic pressure	127
equation	153	Outbreak	151
Non-native species	109		

Oxalate decarboxylase	28	Phosphatase	29
Oxidized lipoproteins	142	Phosphate solubilization	29
Oxygen minimum zone	78	Phosphatidylcholine	112
Ozone depleting potential	153	Photocatalysis	161
Paddy field	75	Photopolymer	87
Pakistan	132	Photosynthetic activity	49
Palaeofire	55	Photosynthetic pathway	97
Palk Bay	23	Photovoltaic cells	100
Palygorskite	111	Phragmites australis	6
Panicles	149	Phylogeny	19
PAR	149	Phylogeny	175
Parasitoids	151	Physical model studies	62
Pareto dominance	135	Physical properties	32
Parkia timoriana	137	Physical properties	77
Participatory approaches	151	Phytochemicals	42
Particle removal	133	Phytoplankton pigments	158
Particulate matter	163	Phytosociological analysis	59
Passenger car equivalents	49	Phytosociology	115
Pathogenic and beneficial bacteria	44	Phytostabilization	114
Patient satisfaction	95	PI35S	92
PCA	77	Picoprasinophyte	160
PCA analysis	153	Pigments	41
PCR assay	175	Planar complicated stress condition	108
PDGF-BB	143	Plant diversity	109
Peach	149	Plant growth promoting bacteria	169
Peak ground displacement	60	Plant oil	43
Pearl millet	139	Plant phenology	82
Pectobacterium carotovorum	167	Plant–animal interaction	183
Pegmatites	67	Planthoppers	87
Pelagic and demersal fishery	123	Planting geometry	113
Pelitic xenoliths	150	Plasmodium	179
Peninsular India	150	Plastic mulch condition	180
Peninsular Malaysia	40	Platinum nanoparticles	67
Performance assessment	25	PLGA	143
Performance index	177	Plus trees	48
Performance prediction	2	PM25	105
Periodic table	155	Pneumatic seed metering	135
Persons with disabilities	7	Poaceae	63
Pervious concrete pavement	14	Point clouds	11
Pestalotiopsis royenae	78	Polar upper atmosphere	157
Pesticides	103	Policy	132
Petrographic data	182	Policy implications	177
Petrography	54	Policy scientists	65
Ph regulation	85	Pollen grains	148
Pharma industry	156	Pollination	14
Pharmacokinetic profile	58	Pollution	154
Phenology	164	Pollution	47
Phonon energy	31	Poly (methyl methacrylate)	58

Polymerase chain reaction	61	Protandry	14
Population	99	Protective ceramic coating	5
Population characterization	18	Protein engineering	85
Population density	82	Protocol	125
Population dynamics	61	Proto-historic	86
Population size	21	Psba-trnh and phylogenetic analysis	148
Population survey	176	Pseudomonas fluorescens	121
Pore structure	178	PTR-MS	47
Portfolio selection	112	Public and private institutions	25
Positional accuracy	58	Public awareness	176
Positioner	125	Public transport	86
Postharvest life	39	Publication ethics	46
Post-independent India	65	Publication rate	40
Potassium solubilizing bacteria	92	Public-private partnership	57
Potato tuber soft rot	167	Pulses	141
Potatoes tillage	77	Pumpkin	149
Potential areas	129	Puri	104
Potential calving zone	164	Purification	28
Potential yield	68	P-wave velocity	79
Pot-hole depth	162	Pyrimidine derivatives	166
Pothole subsidence	162	Pyrosequencing	159
Power amplifier	11	Quality and quantity perspective	25
Power spectral density	81	Quality assurance	90
Power tiller	135	Quality assurance challenges	5
Power-law	120	Quality drinking water	16
Practice	66	Quality improvement	149
Prasanta Chandra Mahalanobis	152	Quantitative analyses	54
Precipitation	11	Quantitative trait	32
Precipitation	46	Quantum dots	117
Precipitation Rhodococcus sp	37	Quechers	103
Precision agriculture	156	Questionnaire	82
Precision farming software	180	Quorum quenching	167
Precision planter	135	Quorum sensing	167
Predaceous ladybirds	99	Rabin automata	172
Predatory and dubious journals	46	Radial basis function	135
Preferential sorption	118	Radiative cooling	71
Pre-flight predictions	3	Radio frequency interference	81
Pre-mrna	59	Radio occultation	179
Pre-sowing seed treatment	139	Rail haulage accidents	91
Prevalence and risk factors	169	Rainfall	26
Primary biodiversity data	94	Rainfall	53
Primary organic productivity	144	Raman spectra	173
Priming	139	Random forest	160
Probit regression model	89	Ranking heis	40
Productivity	122	RAPD	54
Prolinerich proteins	34	RAPID	146
Pro-peptide	85	Ration formulation	142
Prosopis juliflora	76	Rcps	53

Rcps	46	Rice	12
Real-fire behaviour	162	Rice landraces	35
Recalcitrant	175	Rice varieties	38
Recursive feature elimination	146	Rice viruses	87
Red and lateritic soil	129	Rice–wheat system	28
Red deer	76	Rift system	164
Reduviid predator	131	Ring transformation	166
Reenvision	100	Risk assessment	54,91, 103
Reference publication year	165	Risk factor	56, 72
spectroscopy	165	Risk mitigation framework	121
Reflection coefficient	81	Rituximab	90
Regeneration	82	River basin	11, 120
Regeneration	134	River floodplains	16
Regional analysis	36	Riverine ecosystem	79
Regional climate models	34	Rmrdyn	79
Regional competitiveness	29	Road traffic accidents	44
Regional disparity	77	Roadkill road ecology	22
Regionally weighted	168	Robotic micromanipulation system	71
Regression models	143	Rock	117
Regulation-making	1	Rock load	79
Rehabilitation	125	Root architecture	43
Relative spread index	129	Root properties	43
Relative yield index	129	ROS	95
Remote sensing	11,27,38,34, 74	Rose breeding	41
Remote sensing analysis	26	Rubber plantation	9
Remote sensing and GIS	9	Rural	72
Renewable energy	89	Rural livelihoods	76
Replication	118	RWPCA_WT	168
Reproductive bottlenecks	20	S330–440	63
Research collaboration	156	Saccharomyces cerevisiae	136
Research output	25	Sacred grove	40
Research performance	108	Safe limits	174
Research performance	172	Safety	124
Research preferences	152	Safety measures	44
Research productivity	116	Sales	155
Research proposals	64	Saline blanks	115
Research publications	124	Salinity	97
Resistance	121	Salinization	106
Resource allocation	132	Salix alba	48
Resource conservation	141	Sandbars	138
Resource disparity	132	Sangai deer	163
Resourcesat-2	48	Saponification	91
Reusable Launch Vehicle	1,2,3,4, 5	SAR	95
Reusable Launch Vehicle	1	Satellite data	93
Technology	1	Satellite image	74
Reusable Launch Vehicles	4	Satellite imagery	104
Reusable missions	5	Satellite images	113
RGB	146	Satellite navigation system	81

Saturation	72	Sesuvium portulacastrum	97
Scaling	36	Sexed semen of cattle	51
Scanning electron microscopic study	86	Shale	111
Scholarly journal publishing – India	56	Shale gas	119
School children	119	Shallow water	175
School children	128	Shape parameters	145
SCI	56	Shear strength	150
Sciaenidae	99	Shear test	43
Science and engineering	64	Shear zone	137
Science and technology policy	41	Shifting cultivation	38
Science communication	65	Shrimp aquaculture	122
Science education	65	Shrimp aquaculture	8
Science policy history	41	Shrimp quality	93
Science-based standards	1	Simultaneous perturbation	74
Science-in-theatre	10	Single nucleotide polymorphism	86
Scientific analysis	156	Single-scan	8
Scientific value – Indian journals	56	Sintering	131
Scientometric study	152	Site suitability	165
Scientometrics	165	Size and speed	99
80,		Sleeping beauties	73
Scientometrics technological institutes	172	Slope	38
Scientometry	108	Slope stability	54
Scopus	40	Slope streaks	21
Sea ice	160	Smallholder farmers	28
Sea ice extent	127	Smart farming	166
Sea surface salinity	96	Snakebite	42
Sea surface temperature	14	Snow storm	130
Sea surface temperature	71	Snowmelt runoff model	27
Sea-level change	182	Snrnps	59
Search landscapes	24	Social media	65
Seasonal	120	Social network	156
Seasonal patterns	82	Social network analysis	25
Seasonal variability	96	Social networking sites	63
Sediment cores	162	Social relationship	177
Sedimentary organic matter	157	Social sciences and humanities	80
Sedimentation	78	Societal needs	64
Seed germination	183	Society	65
Seed predation	183	Socio-economic costing	44
Segmentation	135	Sodium centrifugal pump	10
Seismic exploration	126	Soil aggregate	114
Selfaffinity	120	Soil bacterial diversity	159
SEM	119	Soil cementation process	114
Semi-arid region	22	Soil fauna	52
Sensor array	106	Soil fertility	43
Seropositivity	56	Soil health	173
Servo design	3	Soil matric potential	36
		Soil moisture movement	50
		Soil organic carbon	37

Soil properties	147	Stabilization	58
Soil quality	111	Stable isotope chemistry	144
Soil samples	181	Stable isotopes	157
Soil temperature	46	Starch film	31
Solar cells	117	Start-ups	101
Solar cycle	179	State observer	12
Solar flare solar cycle 24	69	Statistical analysis	122
Solar greenhouse water stability	114	Statistical analysis	176
Solar photovoltaics	133	Statistical techniques	74
Solar radiation management	36	Statistics	152
Solar water purifier	94	Status of PCB journal – India	56
Sol–gel process	109	Steel making	130
Solid rocket booster	2	Steinhart–Hart coefficients	106
Solid waste management	176	STEM	160
Solid-state emitters	85	Stem bromelain	176
Solitons waves	153	Stimulated reservoir volume	111
Solvent treatment	178	Stochastic optimization	74
Somatic millets	96	Stone quarry	124
Sonic stimulation	96	Storage	175
Sorption capacity	118	Strain energy density criterion	108
South China	82	Strain typing	72
South Shetland Islands	159	Strap ballasting technique	11
Southern ocean	127	Stratified media	13
South–North Water Transfer Project	62	STRC	92
Southwest monsoon	85	Streett automata	172
Spatial and temporal variability	74	Stress intensity factor	108
Spatial resolution	183	Stress redistribution	171
Spatial v	43	Strike slip	40
Spatial variations	11	Strip Wongawilli mining	148
Spawning	99	Strong wind events	158
Species diversity	89	Structural equation model	82
Species diversity	133	Structure and diversity	59
Species recovery	17	Structure from motion	11
Speciesspecific	103	Student feedback	100
Specific capacitance	109	Style movement	14
Specific heat capacity	91	Suaeda nudiflora	97
Specific pathogen free	8	Subbottom profile	156
Spectral analysis	9	Subcritical mining	148
Spectral feature	60	Submergence tolerant	139
Spectral slope	63	Subsea permafrost limit	156
Speech production	84	Subsonic wind tunnel	2
Spherical k-means	81	Subspecies	86
Spliceosomal proteins	59	Subsurface drip irrigation	180
Sponge	39	Sub-surface investigations	130
SS Bhatnagar prize	172	Subsurface structures	126
SST	49	Subsurface temperature	156
ST radar	88	Sudden death or decline disease	137
		Suitability analysis	122

Sujala-III project	117	Tectonic elements	182
Sulphur	138	Temperate forest	164
Summer monsoon	162	Temperature	2,11,129,159, 175
Sun graphs	141	Temporal and spatial coherence	23
Sunda arc	60	Temporal variation	27
Sundaland	40	Termites	142
Sundarbans	34	Terpios hoshinota	39
Sun-induced fluorescence	49	Terrestrial laser scanner	8
Sunspot number	179	Terrestrial vertebrates	184
Supercapacitor materials	109	Testing and evaluation	5
Superconducting nanostructure	51	Texture	60
Superconductivity	31	THE Bay of Bengal (bob) is an important	96
Superoxide dismutase	66	Theranostics	65
Supplementary feed	93	Thermal activity	79
Supplementation	63	Thermal degradation	94
Supply	10	Thermal protection system	2
Supply chain	87	Thermal protection system	4
Support design	79	Thermo-gravimetric analysis	91
Supraglacial debris cover	27	Thermosensitive hydrogels	81
Surface air temperature	150	Thiamine	176
Surface plasmon resonance	95	Thin films	51
Survivability	118	Thin sheet modelling	79
Susceptibility	62	Thin-layer chromatography	126
Suspended sediments	123	Third culture	10
Sustainability	124,140, 167	Threat assessment	18
Sustainable agriculture	28	Threatened plants	16,18,19, 21
Sustainable development goals	141	Threatened species	20
Sustainable food	165	Threatened species conservation	20
Sustainable management	183	Threats	170
Svalbard	159	Three-dimensional modelling	52
SVM classifier	153	Thrips	142
Swarm intelligence techniques	24	Thrust faulting	55
Swept-source laser	13	Tidal channel	93
Synergetic inhibition	136	Tillers	149
Synthesis	76	Time delay	101
Synthetic polymers	81	Tinospora	54
System dynamics approach	44	Tinosporaside	54
Systems approach	140	Tio2	161
Tabla strokes	160	Tissue culture	171
Tactical water management	141	Titanium alloys	31
Target imaging	35	Tobacco leaves	43
Targeted drug delivery	65	Tomato	47
Taste	169	Tomato33	34
Taxonomy	17	Top universities	116
Tea	91	Total internal reflection	58
Teaching metals	103	Total organic carbon	144
Technological interventions	141	Tourism	63
Tech-transfer	101		

Trabecular meshwork	143	Underutilized	42
Trace gas	90	Undulator	13
Trace-fossils	55	Unequilibrated carbonaceous chondrites	54
Traders	124	Unethical practices	46
Traffic	47	Universal soil loss equation	97
Traffic intensity	178	University source component	46
Training systems	149	Unmanned aerial vehicle	11
Trans-disciplinary thinking	15	Unsaturated fatty acids	91
Transition elements	78	Unsaturated hydraulic conductivity	36
Transition metals	144	Unsegregated garbage	184
Transition-metal compound	31	Unsignalized intersections	49
Transmission holographic grating	87	Upper limb	125
Transport sustainability	86	Upper ocean region	96
Travel time index	68	Upwelling	123
Travel time reliability	68	Uranium	174
Treatment procedure	119	Urban arterial	68
Tree bean	137	Urban sprawl	74
TREE bean136	137	Urbanization	109
Tree classification	146	Urea biosensor	31
Tree classifiers	160	Urease immobilization	31
Tree plantation	161	Urolithiasis	28
Tree regeneration	133	Uttarakhand Himalaya	122
Tree species	7	U-turning vehicles	52
Treeline shift	161	UV-visible absorbance	63
Tree-ring analysis	161	Vadoze zone processes	22
Triaxial compression	138	Validation	4
Tribal communities	133	Vegetable cowpea	113
Trichrome staining	122	Vegetable transplanting	166
Triticum aestivum L	129	Vegetal degradation	106
Tropical islands	134	Vegetation structure analysis	183
Tropical volcanic eruptions	45	Velocity and thickness estimation	26
Tropospheric temperature	179	Vertical distribution characteristics	37
Trunk angle	128	Vertical flow	6
Tuberculosis	164	Vertical Incidence Pulsed Ionospheric Radar	157
Tubular collectors	94	Very low frequency waves	69
Tunable band gap	117	Vgdgat1a gene	43
Tunnelling	117	VHF radar	88
Turbulence	88	Vibrational processes	60
Twitter	65	Violacein	96
Two time zone	141	Virtual water flow	120
Udaria lamellicaulis	155	Virulence	118
Ultrasonic	119	Virus enumeration	178
Ultrasonic quality	4	Visitation rates	63
Ultrasonic sensing technology	135	Visualization analysis	80
Uncitedness	82	Vitamin B12	57
Underground coal mining	162	Vocs	47
Underground excavations	117		
Under-representation	160		

Volatile fatty acids	104	Wing body	1
Volatile organic compounds	163	Winged-body configuration	1
Volatile organic compounds	169	Winter precipitation	26
Vosviewer	25	Winter warming and precipitation	26
Vosviewer	152	Wolbachia sp	142
Washing fastness	123	Women in science	160
Water	129	Women pregnancy	61
Water balance model	163	Women workers	70
Water content	70	Women's perspective	116
Water flux	50	Wood-feeding termites	7
Water footprint	120	Wood-rotting fungi	55
Water pollution	28	Workforce challenges	121
Water quality	40	Workforce challenges assessment	121
Water reservoirs	31	Worldview-2	146
Water stress	147	Wound healing	143
Water sustainability	13	WRF model	137
Water table fluctuation method	88	WT	168
Waterlogging	106	Wurtzite zno	153
Watermelon	61	X-ray crystallography	85
Watershed	35	XRD	119
Wayanad	151	XRD	138
Weakening mechanism	138	Yeast cells	168
Weapons grade plutonium	132	Yield components	149
Weather parameters	81	Yield gap	68
Weed control	47	Yield loss	63
Weed density	53	Y-index	108
West Tripura district	150	Zeolite modified electrode	67
Western Ghats	151	Zinc deficiency	129
Western Ghats	22	ZSM-5	67
Western Himalaya	27	134-oxadiazole	73
Western Himalaya	133	14C dating method	62
Wettability	178	16S rdna	159
White shrimp	63	16S rdna	159
Wi-Fi signals	81	3D aggregates	128
Wildlife-friendly mitigation	178	3D reconstruction	11
Wildlife-vehicle collisions	22	3D reverts	128
Wind confluence	137	3D-QSAR	73
Wind mixing	30	40Ar– 39Ar dating	40
Wind portal	89	8-way hybrids	32
Wind power plant	89		