ENVIRONEWS

INTERNATIONAL SOCIETY OF ENVIRONMENTAL BOTANISTS

Newsletter

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IN THIS ISSUE

An Earth Anthem penned by poet Abhay, K. is sung to celebrate World Environment Day

Our cosmic oasis, cosmic blue pearl
the most beautiful planet in the universe
all the continents and the oceans
united we stand as flora and fauna
united we stand as species of one earth
different cultures, beliefs and ways
we are humans, the earth is our home
all the people and the nations of the world
all for one and one for all
united we unfurl the blue flag.

WORLD ENVIRONMENT DAY | UN environment

WORLD ENVIRONMENT DAY – 5TH JUNE 2019

World Environment Day is the United Nations Special day for encouraging worldwide to protect our environment through awareness and action. It started in 1974, since then this event has become a global outreach platform for public to do something to take care of the Earth. The celebration of this day provides us with an opportunity to broaden the basis for an enlightened opinion and responsible conduct by individuals, enterprises and communities in preserving and enhancing the environment.

Each year World Environment Day is organized around a theme to draw attention to a particularly pressing environment concern. The theme for 2019 is 'Air Pollution'. One cannot stop breathing but definitely do something about the quality of air one breathe. Air pollution affects the people worldwide. Air has no boundary, bad air quality in one country can increase the premature death in other country. According to the latest air quality database of WHO, 97% of cities in low- and middle-income countries do not meet WHO air quality guidelines. However, in high-income countries, that percentage decreases to 49%. As the air quality declines, the risk of stroke, heart disease, lung cancer and chronic respiratory diseases like asthma, increases in people living in air polluted places.

China will be global host of 2019's World Environment Day celebrations. The Government of China has committed to organizing the Day across multiple cities, with Hongzhou, in the province of Zhejiang, to host the main event.

Air pollution facts (UN)

- 92 per cent of people worldwide do not breathe clean air
- Air pollution costs the global economy $ 5 trillion every year in welfare costs
- Ground level ozone pollution is expected to reduce staple crop yields by 26% by 2030.

WELCOME NEW LIFE MEMBERS

Dr. B Lalitha Kumari, Assistant Professor, Department of Botany, Kakatiya University Warangal, Telangana, India. (lalitha21prasad@gmail.com)

Dr. Omesh Bajpai, National Post Doctoral Fellow, Babasaheb Bhimrao Ambedkar University, Lucknow, India. (omeshbajpai@gmail.com)

Dr. Pankaj Kumar Verma, Dr. D.S. Kothari Post Doctoral Fellow, University of Lucknow, Lucknow, India. (pankajverma66@gmail.com)

Dr. Gaurav Kumar Mishra, National Post Doctoral Fellow, Lichenology Laboratory, CSIR-National Botanical Research Institute, Lucknow, (gmishrak@gmail.com)

Mr. Komal Kumar Ingle, Technical Officer, Lichenology Laboratory, CSIR-National Botanical Research Institute, Lucknow, India. (ingle.komal@gmail.com)

Prof. P.K. Khare, Department of Botany, Dr. Harisingh Gour Sagar University, Sagar, MP, (p.k.khare@gmail.com).

NEWS FLASH

Dr. Penna Suprasanna, Life Member ISEB, has become Head of Nuclear Agriculture and Biotechnology Division, Bhabha Atomic Research Centre, Mumbai. Dr. Suprasanna made significant contributions to crop biotechnology research through radiation-induced mutagenesis, plant genomics, and abiotic stress tolerance. His research on radiation-induced mutagenesis in sugarcane yielded several agronomically superior mutants for yield and stress tolerance. He has made intensive efforts to apply radiation mutagenesis techniques in vegetatively propagated plants through collaborative research projects with national and international bodies (IAEA, Vienna). He is also serving as the DBT Expert/Nominee on Biosafety committees. He is the recipient of the "Award of Scientific and Technical Excellence" by the Department of Atomic Energy, Government of India; is the Fellow of Maharashtra Academy of Sciences, Andhra Pradesh Academy of Sciences, Telangana Academy of Sciences, and Association of Biotechnology. Dr. Suprasanna has published more than 250 research papers/articles in national and international journals/books, edited two Springer books, and has guided several doctoral students. The research group led by him has been successful in investigating novel microRNAs, mechanism of halophytic adaptation, plant bioregulators besides validating the concept of redox regulation toward environmental stress tolerance and crop productivity.

Dr. Seema Mishra, Life Member, ISEB Fellow 2018 and Editor Environews of International Society of Environmental Botanists (ISEB) was conferred with LMA Outstanding Woman Achievers' Award 2019 (Category – Academics) by Lucknow Management Association. Dr. Seema Mishra is Assistant Professor in the Department of Chemistry in Deen Dayal Upadhyay Gorakhpur University, a teacher and distinguished researcher. After working for four years in CSIR-National Botanical Research Institute as a researcher, Dr. Mishra spent two years as Alexander von Humboldt Fellow for postdoctoral research at Hemholtz Center for Environment Research UFZ, Lipzig, Germany and thereafter as Guest Scientist at University of Konstanz, Konstanz, Germany.

Dr. Rana D.P. Singh, Former Joint Director & Head, Div. of Plant Breeding, UP Council of Sugarcane Research, Gorakhpur (U.P.) and Life Member of International Society of Environmental Botanists (ISEB), received the Distinguished Scientist Award by ENR Foundation, Etawah (U.P.); Lifetime Achievement Award by Astha Foundaton, Meerut (U.P.); RASSA Maharshi Samman by The Royal Association for Science-led Socio-Cultural Advancement, New Delhi; Lifetime Achievement Award by The Society of Tropical Agriculture, New Delhi, India in the year 2018-19. The prestigious awards were presented to Dr. Singh for his outstanding research and remarkable role in the field of Genetics & Plant Breeding. He is working on crop improvement (germplasm evaluation & utilisation), stress breeding and physiological phenotyping aiming in doubling farmer's income as well as contributing in the socio–economic development of rural regions of the nation.

Dr. Amit Pal, Assistant Professor and former Head of Institute of Environment & Development Studies, Bundelkhand University, Jhansi and Life Member of ISEB has been honored by prestigious SBBS Sr. Scientist Award for 2018 by the Society of Bioinformatics and Biological Sciences (SBBS), Allahabad (Prayagraj) for his significant research contribution in the field of Plants and Environmental Pollution monitoring, on the occasion of International Conference on Advances and Innovations in Biotechnology for Sustainable Development (AIBioSD 2019) during April 5-7, 2019 at AKS University, Satna, MP.

OBITUARY - PROF. RADHEY SHYAM TRIPATHI

The country mourns the sad demise of Prof. Radhey Shyam Tripathi, who recently passed away in Lucknow. With his death, India lost a great ecologist, a loving teacher and a visionary plant scientist.

Professor Radhey Shyam Tripathi was born in Raveli, Bhadohi to Late Shri Gadadhar and Mrs. Amarawati Tripathi, on 22 June, 1942. He completed his High school education from Gandhi Vidyalaya, Kachva, Karnal; Intermediate from Queens College, Varanasi; B. Sc. from Banaras Hindu University, Varanasi and M. Sc. from P.G. College, Gyanpur under Agra University. He was awarded 1st division with 2nd position in Agra University. During his M. Sc. days, he was Editor of the College Magazine, and also a keen football and hockey player. He was the President of College Students' Union.

Prof. R.S. Tripathi did his Ph.D. in weed ecology from Banaras Hindu University, under the guidance of Late Prof. R. Misra, the father of Indian Ecology. He started his teaching career in 1963 as a Lecturer at Banaras Hindu University, while he was still pursuing his doctoral research. After obtaining his Ph.D. degree, he joined as a faculty member in the Department of Botany at University of Gorakhpur, Gorakhpur in 1966, and later on, he moved to North-Eastern Hill University (NEHU), Shillong. He did postdoctoral research in plant population biology at University College of North Wales, Bangor, UK for over two years (1971-1973) with Late Prof. John L. Harper, FRS, under the Commonwealth Fellowship Plan. During 1993, he visited the Imperial College of Science and Technology, University of London for six months and worked on plant population interactions at its famous Biology Department at Ascot supported by the award of Bursary-Marie Curie of the European Commission. Prof. Tripathi taught at NEHU, Shillong as Reader and Professor for 28 years, where he built a strong and vibrant school of ecology.

His research interests include weed biology, dynamics and regulation of plant populations, ecology of invasive alien weeds, gap-phase regeneration of forest tree species, eco-restoration of degraded ecosystems, forest fragmentation and biodiversity management. He is widely known for his pioneering researches in plant population ecology and gap-phase regeneration of forests in India. He published over 200 research papers and review articles in peer-reviewed scientific journals, and authored several scientific reports and book chapters. Thirty six (36) students have been awarded Ph.D. degree under his supervision, who are occupying key positions in the universities, research organizations, state forest departments, administrative services and other sectors.

Prof. Tripathi served as Head, Department of Botany; Coordinator, UGC's SAP Programme in Botany; Dean, School of Life Sciences, at NEHU, Shillong, and Director/Coordinator of NEHU Regional Centre for Afforestation and Eco-development Board of the Ministry of Environment and Forests, Government of India. After his retirement from NEHU, in 2005, he joined CSIR-National Botanical Research Institute (CSIR-NBRI), Lucknow as Indian National Science Academy (INSA) Senior Scientist and in 2011 as INSA Honorary Scientist. At CSIR-NBRI, he was engaged with the studies on "Ecological analysis of invasive alien weeds with particular reference to their impact on native biodiversity, ecosystem processes and forest regeneration" supported by INSA, New Delhi. He was associated with the activities of several universities, R&D Organizations, INSA, MoEF&CC, DST, UGC, IIRS, CSIR, Union Public Service Commission in advisory capacity or as an expert member of their decision making bodies. He was the leader of the Indian Delegation in the General Assembly of Scientific Committee on Problems of Environment (SCOPE) held at Bremen in Germany, in 2001. He was Member of the National Mission for Sustainability of Himalayan Ecosystems, Coordinator for the Northeast Eco-region under the National Biodiversity Strategy and Action Plan (NBSAP) launched by the Ministry of Environment and Forests, Govt. of India, and Chairman of the Committee for Identification and Status of Forests in Arunachal Pradesh in 1996, constituted by the Govt. in pursuance of the Interim Order of the Hon'ble Supreme Court of India banning the non-forest activities in forest areas. Prof. Tripathi was nominated by the Govt. of India as the Chairman of Research Advisory and Monitoring Committee of the Centre of Ecological Sciences, Indian Institute of Science, Bangalore, and as Chairman of Ecosystem Research Committee of the Ministry of Environment and Forests. In recognition of his outstanding contribution in the field of ecology, Prof. Tripathi was elected as the Fellow of Indian National Science Academy (FNA), Fellow of National Institute of Ecology (FNIE), and Fellow of The National Academy of Sciences, India (FNASc.). He was elected as the President of Indian Botanical Society in 2004, and Vice-President of National Institute of Ecology for three years (2004-2006).

He was the member of Executive Council of the International Society for Tropical Ecology, member, Editorial Board of *Journal of Indian Botanical Society*, Advisor, International Society of Environmental Botanists (ISEB) and Editor of

Environews - the Newsletter of ISEB, and Editor of *International Journal of Plant and Environment*. He was also a member of the editorial board of *Everyman's Science* published by the Indian Science Congress Association (ISCA). Prof. R. S. Tripathi was conferred the "Prof. Birbal Sahni Medal Award" for 2012 by the Indian Botanical Society for his significant researches in the field of Plant Ecology. In recognition of his outstanding research contribution in ecology and environmental sciences and great relevance of his researches for the socio-economic development of the country, he was honoured with the Vigyan Vibhushan award by the Hon'ble Chief Minister of Uttar Pradesh in 2013. In January, 2016, Prof. Tripathi was conferred the coveted "Dr. V. Puri Memorial Award (2015-2016)" of the ISCA at its 103rd Session for his pioneering and outstanding researches in plant population ecology, forest ecology, biodiversity, ecology of invasive alien weeds, ecosystem studies and environmental sciences.

On the morning of 14 February, 2019 he bade farewell to this physical world peacefully at his Indira Nagar residence in Lucknow. He was actively involved in his research pursuits till the very end. His legacy and memories will live forever among his large number of admirers, students, colleagues and relatives throughout the country. He is survived by his wife Dr. Asha Rani (Pandey) Tripathi, a great scholar of Sanskrit literature and two daughters Mrs. Anupama, a Civil servant of United Kingdom and Dr. Mudita, an established physician in UK.

- Compiled by Prof. S.K. Barik and Dr. R.D. Tripathi with inputs from Anupama and Mudita

CONDOLENCE MESSAGES

Very sad to know about the sudden demise. May his soul rest in peace.

Mr. Jamal Masood, Lucknow, India (jamalmasood@gmail.com)

Please convey my condolence to the Tripathi family. I had an honour to meet him in Lucknow. He was truly great personality. I am really sad.

Dr. Gordana Medunić, Zagreb, Croatia (gmedunic@geol.pmf.hr, gordana.medunic@gfz.hr)

I am deeply saddened by the news of his loss! May he rest in peace.

Ms. Elham Shafeian, Karlsruhe, Germany (e.shafeian90@gmail.com)

It is a great loss for the scientific community and for India. May Professor Tripathi rest in peace.

Dr. Teresa Fidalgo Fonseca, Portugal (tfonseca@utad.pt)

Yesterday I received a devastating email from Dr. Ahmad of NBRI and came to know that Prof. R. S. Tripathi is no more with us. He passed away yesterday morning while having tea at his home possibly due to heart attack. I and Tamalika are very sad and speechless.

His departure is a great loss not only for us and scientific community, but also for the forests of India. They loss another good steward. They loss a big crown tree who is protecting them for decades. His pioneering work on the ecology of Himalayan oaks in 1970s and 1980s shall never be forgotten. His continuous effort to highlight and advocacy for augmenting oak research in India is a big motivation for us. We shall never forget his support for IUFRO's Oak Symposium in India. We will have to continue the unfinished work of Prof. Tripathi to conserve the oak forests of India. He will live among us, because, like a grand oak tree he also produced so many good acorns who shall fight to save oak forest ecosystems of India from climate change impacts and uncontrolled human exploitation. In coming days, I will prepare a letter of condolence and will send you to collect your signatures.

Dr. Somidh Saha, Karlsruhe, Germany (somidh.saha@kit.edu)

It is sad to receive such news (thank you, Somidh, for informing us). We all remember Dr. Tripathi, who was a great and famous scientist, but personally a modest man, able to talk with everybody without "allures". We will keep his personality and ideas in mind.

Prof. Dr. Reif Albert, Freiburg Germany (albert.reif@waldbau.uni-freiburg.de)

I am deeply saddened by this news. It was an honor for me to meet Dr. Tripathi recently in India and to talk with him about oak forests. I could tell I was in the presence of a wise and kind man whose gentle spirit filled the room and infused the conversation. I consider myself a very little acorn that has fallen from his crown as I hope to contribute to being a good steward of India's oaks. We shall all honor him by carrying on his pioneering and noble work.

Dr. Daniel Clyde Dey, Columbia Missouri, USA (ddey@fs.fed.us)

Rudraksh: Prospect for population expansion by Conservation Through Cultivation approach

M. L. Khan and R. S. Tripathi

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Rudraksh (*Elaeocarpus ganitrus*, Elaeocarpaceae) is well known in ancient Indian Holy Scriptures (Puranas) for divine and magical qualities of the beads. Rudraksh (eyes of Rudra *i.e.* Lord Shiva) nuts are traditionally used for prayer beads in Hinduism and treatment of various diseases in traditional Indian medicine (GBIF 2013). More importantly, nuts are worn around the neck and wrist to touch the skin for the benefit of its magnetic power. The most crucial concept of Rudraksh nuts is its number of grooves or 'mukhi'. The grooves arise based on the locules of the ovary which are visible on the surface of the stony nuts as ridges and divide into segments from top to bottom (Figure 1 a). The nuts may have one to 14 grooves however, majority of them possess five to six grooves (Khan et al. 2004). One to three or nine to 14 grooved as well as 'twin' nuts are the rarest and most sought after for spiritual purposes. It is believed that the wearer of Rudraksh beads (especially with single groove) maintain good health, feels the presence of Lord Shiva and help abstain the mind from negative thoughts (Rudraksh 2003). Rudraksh nuts are highly ornamental and also popular as hatpins, coat buttons and pendant either directly or coated with copper, silver and gold. The beads are admired world-wide and the demand is increasing with the popularity of Indian spirituality, especially in the Western societies.

Indian subcontinent possesses about 25 *Elaeocarpus* species and they are found in the states of Arunachal Pradesh, Assam, Bihar, Madhya Pradesh, Maharashtra, Meghalaya, and Uttar Pradesh (Zmarzty 2001, Pant 2013). *E. ganitrus*is mostly distributed in the foot hills of Himalayas, especially in Assam and Arunachal Pradesh (Khan et al. 2003). However, the species is facing the danger of extinction due to habitat loss for construction of roads, hydroelectric dams, clear felling of forest for agricultural activities (Bhuyan et al. 2003) and overharvesting of the nuts for use as beads (Khan et al. 2005). Further, dispersal of the Rudraksh seeds is negatively impacted due to the decline of population of nut-dispersing animals in the region, and also due to anthropogenic activities (Khan et al. 2005). Khan and co-workers (2003, 2004, 2005) have reported a significant decline in fruit production due to forest disturbance. Further, they have also reported very few or no regenerating population in its native range. Hence, alternative approaches to augment the dwindling populations of Rudraksh are warranted.

One such approach could be 'Conservation Through Cultivation' (CTC) which gained remarkable success for many plant species of high extinction risk. The Limbe Botanic Garden in Mount Cameroon first envisioned the concept of CTC for conservation of *Prunus africana*, which was facing extinction risk because of acute harvesting pressures (Sunderland & Nkefor 1996). The CTC program has also been successful in case of American ginseng, Mahogany, and several orchid species including the most promising example of *Ginkgo biloba*, which is the oldest tree on earth, commonly known as 'living fossil'. Ginkgo remained unchanged on this planet since the time of Dinosaur, however, extinct in the wild for centuries. People in many countries like China, Japan, Korea, America and Canada planted Ginkgo along the streets as ornamental tree for its beauty, longevity and medicinal values. The CTC has now become an important toolkit for conserving plant diversity, especially the rare/endangered species.

E. ganitrus is an elegant tree with light green leaves and beautiful appearance. Mature trees are 20-25 m tall having moderately spread branches and upright silhouette (Figure 1 b). Leaves are often spread and therefore partial sunlight can penetrate the ground, giving a mixed feeling of sunlight and shade during hot and humid summer in tropics. Rudraksh flowers during May to June in raceme inflorescences which appear white in color and gives wonderful eyeshot of the tree (Figure 1c). Rudraksh could be a favorite tree for home garden owners throughout India for its precious nuts. The tree has already shown its promising performance as a shade tree and road side plantation in the campuses of educational institutions (e.g. North Eastern Regional Institute of Science & Technology, Nirjuli, Arunachal Pradesh, India Figure 1 b), Rajiv Gandhi University, Itanagar, Arunachal Pradesh, India and highways (along National Highway 52 from Assam to Itanagar) in Arunachal Pradesh. Nuts of Rudraksh are extremely hard and affect natural regeneration negatively (Bhuyan et al. 2003). Germination experiments revealed that mechanical scarification

through cracking the endocarp by vise could give raise one to four seedlings per nuts (Khan et al. 2003). Therefore, human intervention is urgently required to enhance the population of Rudraksh. Since there is high demand for Rudraksh beads, CTC can play significant role to revitalize the species in parks, botanical gardens, road-side plantations and other social forestry programs. The tree starts fruit production at the age of three to four years (Bhuyan et al. 2003), thus, can fulfill the demand of nuts within short duration. Population expansion of Rudraksh will also support survival of different animal species such as frugivorous birds (hornbills,, bats, flying squirrels etc.), monkeys, deer and wild pigs. Therefore, Rudraksh can show a promising way of CTC and help to continue the ancient Indian tradition in coming days.

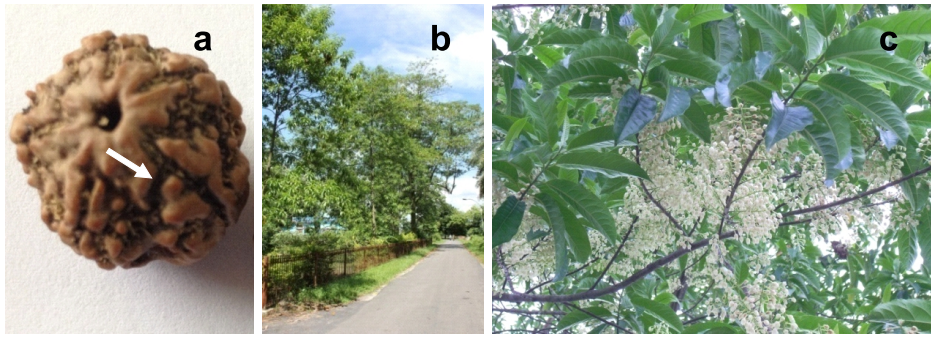

Figure 1:(a) Rudraksh nuts showing horizontal ridges (with arrow); (b) Plantation of Rudraksh in the campus of North Eastern Regional Institute of Science & Technology, Nirjuli, Arunachal Pradesh, India; (c) White inflorescence of Rudraksh.

Phytoremediation of Indoor Organic Air Pollution Using House Plants

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Contamination of indoor air by harmful chemicals and other particulate matter is called as Indoor Air Pollution. It is up to 12 times higher than the outdoor air pollution. Indoor air pollution in India may contribute to 22-52 % of the overall pollution as per UNEP (United Nations Environmental Programme) studies. Their recommendations include reduction of household pollutant sources to improve indoor air quality. As stated in the report, around 93% of the world's children under the age of 15 years are at risk due to polluted indoor air.

The main source of air pollution can be different household sources like kitchen exhaust, smoke from mosquito coil, phenyls, room fresheners, heavy-smelling incense sticks, paper towels, plastic bags, wooden furniture, carpets, paints, cement walls etc. Pollutants emitted through these sources may have adverse effect on our health. Some of the organic pollutants like formaldehyde, xylene, toluene, volatile and semi-volatile compounds are produced from household sources. Some biological pollutants like pollens, moulds and dust mites also contribute adversely to Indoor environment.

Research states that there are about two million premature deaths per year, 54% due to Chronic Obstructive Pulmonary Disease (COPD), 44% due to pneumonia and 2% due to lung cancer. It is observed that most affected category due to indoor pollution is women and children as they spend most of the time at home. There are many ways to overcome indoor pollution. Using air filtration systems and air purifiers are some examples of the same. People keep on using these to reduce Indoor air pollution. A more reliable way to reduce this problem is using greenhouse indoor plants. Many of the indoor pollutants can be remediated with plants which survive in low light. This technology is called as "phytoremediation," which aims at solving and reducing indoor air pollution problem aesthetically, naturally and technically.

Phytoremediation technology works on simple principle of selecting various plant species having capacity of absorbing different types of pollutants through distinct plant parts; and helping in removing or minimizing these pollutants. These absorbed pollutants can either be stored in the plant (phytoextraction), volatized by the plant (phytovolatization), metabolized by the plant (phytodegradation) or any combination of the above. Absorbed pollutants are degraded by plants cells. The metabolized compounds which are non-poisonous, can be either volatized or stored in the plant. This technology can be used to safeguard health of people spending more time in the non-ventilated indoor spaces.

Phytoremediation is an aesthetically pleasing, solar-energy driven, efficient, environmentally friendly, low-cost and passive technique that

can be used at sites with low to moderate levels of contamination. It is well suited for problems involving indoor pollution. House plants can absorb indoor volatile organic compounds, metabolize them into simpler compounds. In this process bacteria from rhizosphere help to absorb and metabolize pollutants.

In project sponsored by Department of Science and Technology (D.S.T.), New Delhi, a close chamber study was undertaken. Some indoor plant species were exposed to different pollutants released through various household sources like mosquito coil, naphthalene balls and heavy smelling incense sticks. It was observed that these plant species absorbed different hazardous indoor pollutants. The observations were confirmed by GLC and GC-MS studies. Five plant species were exposed to pollutants smoke from mosquito coil. The coil smoke releases 'Allethrin', a poisonous pesticide used to kill mosquitoes. It was observed that plants absorbed Allethrin successfully. The range of absorption varied from plant to plant. *Chlorophytum comosum* showed highest absorption of Allethrin, which was 1075 ppb. The lowest absorption was observed in *Aglaonema commutatum* plant which was 23.11 ppb. To speed up absorption, activated charcoal was added to the potting mixture. The activity of phytoremediation was accelerated by adding a consortium of Sphingomonas in the growth medium. Activated charcoal increases the absorption surface and bacteria helps to metabolize pollutants endophytically and in the rhizosphere. Quantification of pollutants absorbed was done on a Triple Quadrupole GC/MS/MS with Electrospray Ionisation (ESI).

List of some indoor plants studied for their phytoremediation activity of indoor pollutants:
Syngonium (*Syngonium podophyllum)* 'Maza Red',
Green spider plant (*Chlorphytum comosum*),
Chinese evergreen (*Aglonema commutatum*),
Peperomia (*Peperomia meridiana*),
Ficus (*Ficus benjamina*)
Pthos (*Epipremnum aureum)*
Ming Aralia *(Polyscias fructicosa)*
Agave *(Sansevieria trifasciata)*
Peace lily *(Spathiphyllum wallisii)*
Aloe *(Aloe barbadensis)*
Heart leaf Philodendron (*Philodendron cordatum)*

In future, from these observations, absorption of gaseous pollutants per unit leaf area as well as per unit volume of room can be calculated. Pollution removal rate of each species can be easily determined. With the help of results obtained, standards of phyto-remediators can be established e.g., type of potting mixture, size of the plant and number of leaves required to achieve specific levels of phytoremediation in the presence of specific pollutants.

This technology would especially benefit the households, IT parks, shopping malls, banks, hospitals, schools, R&D laboratories, telecom industries, production industries, food processing units etc.

FRONTIERS OF KNOWLEDGE AWARD (FUNDACION BBVA) 2019 NOMINATIONS NOW OPEN

The **BBVA Foundation Frontiers of Knowledge Awards,** whose twelfth edition is now open, recognize and reward world-class research and artistic creation, prizing contributions of singular impact for their originality and significance. The name of the scheme is intended to denote not only research work that substantially enlarges the scope of our current knowledge–pushing forward the frontiers of the known world–but also the meeting and overlap of different disciplinary areas and the emergence of new fields.

The **BBVA Foundation Frontiers of Knowledge Awards** are undertaken in collaboration with the **Spanish National Research Council (CSIC)**.

CATEGORIES: Basic Sciences (Physics, Chemistry, Mathematics), Biology and Biomedicine, Information and Communication Technologies, Ecology and Conservation Biology, Climate Change, Economics, Finance and Management, Humanities and Social Sciences.

The closing date for submissions is June 30, 2019, at 23.00h GMT.

Further information and full entry conditions:

https://www.frontiersofknowledgeawards-fbbva.es/conditions/

ISEB Fellowship/Young Scientist Medal

Nominations for ISEB Fellowship/Young Scientist Medal for the year 2019 are invited.
Last date for nomination is 15th July 2019.
Please visit our website (www.isebindia.com) for detailed information

Seaweeds Role on Biosorption and Biomonitoring of Metal Pollution

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Marine algae are commonly known as "Seaweeds", found on the rocky seashore area. They are considered as primary producers, for maintaining their role in marine ecosystem. Marine organisms may commonly used as bioindicator for heavy metal pollution which is considered as an environmental problem of worldwide concern. Many researchers referred seaweeds as biosorption indicator, which accumulate the free metal ions, from suspended particulate matter, sediments and phytoplankton. The uptake of metal ion depends on the nature of varied species of seaweeds. Out of three types of seaweeds, researcher identified that the brown seaweeds were the best in bioaccumulation of heavy metals, in comparison to green and red seaweeds. Lead (Pb), Copper (Cu), Cadmium (Cd), Zinc (Zn) and Nickel (Ni) are important metals found in seawater. Lead poisoning not only damage bones but also the reproductive and nervous system, Cadmium cause renal dysfunction and bone degradation. However, although copper and zinc are required as trace metal but higher concentration may be harmful for health.

In contrast to seaweed, biomass may serve as an economically feasible and efficient alternative to the existing physicochemical methods of metal removal and recovery from waste water. They bioaccumulate free metals ions from suspended particulate matter, sediments and phytoplankton. The capacity to uptake metals ion depends on the nature of cellular structure of plant species. Alginates, an important polysaccharide present in the cell wall of brown algae, plays an important role in adsorption of water, widely used in food additives. Due to presence of these polysaccharides in food, they strongly absorb the toxic metals which comes along with food material.

However, investigators put their arguments in favour of absorbing capacity of toxic ions by sulphated fucan. There are reports regarding the role of functional groups such as hydroxyl (OH-), Phosphoryl (-PO_3^{2-}), amino group (-NH_2), Carboxyl group (-COOH), Sulphydryl (-SH) group, in adsorption of metal ions. These negative ions may bind with peptidoglycan, teichouronic acid, polysacharides and also protein molecule present in the cell wall of algae or Peptidoglycan (N-acetyl glucosamine and Beta- 1,4, N-acetylmuranic acid) and peptide chain present in the cell wall of cyanobacteria. Carboxylic group (-COOH) play a major role in metal binding while phosphoryl groups are associated with the accumulation of lipopolysacharides, lipids and peptidoglycan. In relation to amino groups, metals are strongly associated with membrane protein and peptide component of peptidoglycan .

The term "biosorption" is used for the accumulation of higher concentration of heavy metals in the extracellular and intracellular matrix of cell wall of dead biomass. In several reports, it has been shown that washing of cells with 2M EDTA removed the surface bound metals. The intracellular metal can be quantified after digesting the cells with EDTA. The quantification of absorbed metal on the cell surface can be done by subtracting intracellular metals from the total metal accumulated by the cell. In relation to adsorption contribution, approx. 80% metal is accumulated algal cells.

Young et al. (1993) have shown the interaction of ionic charge among the heavy metal and cellular component on the cell surface. The absorption of cadmium (Cd) and lead (Pb) in different species of *Sargassum* was studied. Raw biomass of different species of *Sargassum* replaced Mg and Ca ion through Cadmium cations. However, uranium (a radioactive element) has been recovered from seawater by using immobilized cells of algae. Similarly, such ionic exchange through calcium alginate binds with copper has also been studied by Chen et al (1993). Raize et al (2004) reported replacement of calcium and magnesium by using cadmium cation (solution) in the cell wall matrix and created stronger cross-linking. He showed that after binding of cadmium and other heavy metals, Ca and Mg concentration were reduced in the raw *Sargassum*. Presence of cations and anions including metal ions significantly affects metal sorption by seaweeds. However, the presence of multi-metallic species in the solution had no significant effect on biosorption of Gold (Au) by *Sargassum natans*. Besides, alteration of pH may also effect the adsorption capacity of metals ion, which also depends on the type of species. Schiewer et al. (1995) have shown the variation of adsorption of metallic ions among different species of *Sargassum* such as *S. wightii, S. fluitans, S. johnstonii, S. vulgare*.

Similarly, biomonitoring and bisorption method was also employed in microalga. For example, in cyanobacteria, lipopolysacharides,

lipids, protein and peptide molecule present in the outer sheath of capsule are anionic in nature. They show strong affinity of metal binding sites. Different strains of bacteria easily capture the toxic metal ions on the outer sheath or capsule present on the cell surface.

Although many researchers have approached the biological method for binding large amount of metal but in comparison to fungal and other biosorbent, a few researcher have conducted experiments to increase the sorption of metals by algae. In Spirulina, $CaCl_2$ pretreatment increase Pb sorption capacity nearly 84-92% (Gong et al. 2005). Similar result was also observed in *Ecklonia maxima* for Pb, Cu and Cd by using $Cacl_2$. Subsequently pretreatment of dil. HCl, increases the sorption of Cu and Ni in *Chlorella vulgaris*. Gaur et al. (2007) showed the role of dried biomass of *Spirogyra* in the sorption of Pb (II) [116.1 mg/g] and Cu (II) [115.3 mg/g] in 0.1 gm/lit biomass and 100 mg/lit metal concentration in the solution. pH was found to influence the adsorption. With increasing pH the surface charges site of Ca Alginate become more negative so uptake of metal ion increasing with increase of pH. It has been reported that the functional group between metal ions has an important role in adsorption of toxic metals. The use of dead marine macroalgae biomass showed more effective than living cells in the removal of mettalic ions.

The heavy metal binding capacities of the seaweeds were found to be directly proportional to their respective total carboxyl group content and related to electro-negativity of the element investigated (Ca, Zn, Cd, Cu and Pb). The uronic acid composition or sequence of the alginate component did not affect the metal uptake properties of the biosorbents. Besides these, the alginate leaching owing to its solubilization by Na ions was observed to decrease with increasing intrinsic viscosity of the extracted alginate. Furthermore, studies between seaweeds of different families have shown that Phaeophyta family showed a greater tendency to concentrate heavy metals compared to Chlorophyta The fluctuation of metal content has also been observed due to variation of salinity and dynamic factors such as water movements, currents and winds in oceanic level.

The inherent metal accumulation capability of algae could be used to alleviate the burden of toxic metal load and to recover precious metal (e.g. Gold & Silver) from waste water. By following the method of active and passive method, a simple method was employed for distinguishing the adsorption of intracellular metal in algal cells. Out of these two methods, passive method proved to be beneficial, because it takes a short time in the absorption of metals on the cell surface. Moreover, active method is a dependent process, as the captured metal ion is inducted first on the cell membrane, before it crosses the cytoplasm of cell wall. Hence overall literature survey shows that seaweeds are good source of absorption of marine metal pollutants.

NEWS & VIEWS

How Women are Saving the Planet

You might think that the most significant parts of environmental efforts are recycling or energy reduction, but there's a far more vital tool at work — women. This half of the population could be the key to effective change for the earth.

While there remains a glaring gap in gender parity, gender equality is slowly on the rise, and the planet stands to benefit from it. From economic conditions to global climate change, flourishing women are making a substantial impact. The roles that women play in society are irreplaceable, and when they are properly equipped and given much-deserved platforms, they are active contributors to the planet. Let's look at the range of benefits that women are providing around the globe.

Reduced Carbon Footprint through Education

Managing climate change is a huge feat, but informing women and girls about reproductive health can diminish the strain of the environment. When females are educated about contraception, they can intentionally participate in family planning and provide a stronger framework for the next generation.

For every dollar spent on contraceptive supplies, developing regions and countries save $2.20 on maternal and newborn healthcare. With the protection against unwanted pregnancies, women can focus their attention, resources and skills elsewhere. Ultimately, women who are educated on birth control can invest more in the children they intend to have. Uninhibited population growth is a major factor in climate change, but contraceptive education can regulate this unrestrained escalation.

Protection for Wildlife

Many women exhibit care for creatures and their habitats, and they are taking great pains to promote wildlife conservation. At Kruger National Park in South Africa, a band of young women called the Black Mambas patrols the grounds to turn away poachers.

These local women are dedicated to saving rhinos, which were slaughtered by poachers every seven hours in South Africa at the time the Black Mambas started. Female guards

like Leitah Michabela want future generations to enjoy wildlife, too.

Other female activists are spreading the word about endangered species and animal cruelty. However, even those who don't claim to be outright activists, like Gabriela Cowperwaith, are exposing the public to the upsetting state of animal treatment. She directed a film about SeaWorld's violent practices toward their orcas, and this documentary incited a large-scale protest of the theme park's behavior.

As wildlife benefits from concerned women, nature has a better chance of thriving down the road.

Stewardship of Land and Awareness of Voting Rights

When women are empowered, it has a positive effect on their community and the environment. This is specifically true in matters of land ownership, as the rights of women can boost economic growth. Without the potential for upward mobility, the risk for poverty and familial instability are higher.

In many developing areas, men only possess a clear ability to own and control land. Especially in communities that depend on agriculture, property is a critical economic resource. A woman's income can spike up to 380 percent when she holds the right to own or inherit land. However, clear rights to property are withheld from women in places like South Sudan and Afghanistan.

In Tanzania, Leah Orwangas nearly lost her land when her husband passed away. A Maasai man attempted to possess the property, but the Ujamaa Community Resource Team stepped in to educate her about her rights. Now as the rightful owner of her land, she uses her knowledge to teach other local women about their property and voting rights.

Forward-Thinking Leadership

A higher percentage of women take environmental issues seriously, which presents implications for leadership. Recognizing the potential for progress seems to be an insight that a large number of women hold. Women in charge prize diversity and are in tune with the issues plaguing the planet. In many industries, women in leadership hire more women. Not only are women benefitting the environment — they're building up other women for success.

Support Revolutionary Women

As females around the world tirelessly work to create a better planet, it's crucial to encourage women in their efforts. Providing more women with opportunities can open up greater hope for the earth. Reinforce the groundwork that women are constructing across countries and cultures for improved economics, wildlife conservation and climate health.

Emily Folk

(Source- E The Environmental Magazine, Mar 8, 2019)

Vegetarian or Vegan Diet: Key to Personal and Environmental Health? Vegetables may just be the answer to our Environmental Woes

Environmentalists work to improve the sustainability of the human impact on earth by advocating for the reduction of greenhouse gas emissions, protection of biodiversity and conservation of natural resources. Often, we think only of the environmental impacts of enterprises like industry, energy production, construction. These are all areas of great concern. But what if another important piece of the puzzle was missing?

Perhaps we imagine farmers as stewards of the land and thus forget to factor in their importance to the health of our ecosystem. It's true that many farmers take environmental responsibility seriously. But it's also true that food production contributes to environmental issues like climate change and resource depletion more than we might like to think.

As environmentalists, we should consider not only what we do but also what we eat. Not all dietary choices are equal when it comes to the environment.

The Environmental Impact of Meat Production and Consumption

In some communities around the world, keeping animals provides household food security during difficult times. However, as demand for animal products has grown in industrialized countries, farming animals is often no longer a family affair. Instead, industrial farming complexes raise as many animals as possible as "efficiently" as possible for widespread sale and consumption.

When we say "efficient" though, we mean cost-efficient, not resource efficient. Quite contrary, meat production is extremely resource inefficient. Beef is particularly costly. Beef requires 160 times more land to produce than plant staples like wheat, rice and potatoes, according to one study. It's the most resource-intensive of all varieties of livestock, in fact. Producing just one hamburger takes 2500 liters of water.

The cost becomes even greater when you recognize that producing animal feed for meat production takes valuable land and resources away from other agriculture for even less caloric payoff. People dedicate some 80 percent of worldwide agricultural land to growing animal feed. Not all those calories make it back to humans. Some people fear that over-reliance on meat may affect our ability to provide for a growing global population.

In addition to use of valuable resources, raising animals for consumption also contributes to climate change. When ruminants like cows digest food, they release copious amounts of the greenhouse gas methane. Though methane disperses quicker than carbon dioxide, it also has a higher warming potential in the atmosphere, so it's an environmental concern on par with fossil fuel emissions. Raising livestock on its own isn't a bad thing, but problems do

arise with wasteful overproduction.

Globally, livestock accounts for between 14.5 and 18 percent of all human-caused greenhouse gas emissions. That's not a number that's easy to swallow, especially if you're already concerned about the effect climate change may be having on the planet and on human lives.

Vegetarianism and Veganism as a Solution?

Preventing the negative environmental impacts associated with raising excessive numbers of livestock starts with changing individual diets, especially since government subsidies in the U.S. currently keep livestock industries afloat.

In one study, both vegetarian and vegan diets had reduced carbon, water and ecological footprints when compared to diets including meat. So, for environmentalists looking to make a direct impact, these dietary choices could be the way to go.

Going vegan or vegetarian doesn't have to be difficult. Contrary to popular belief, animal products aren't essential to a healthy diet as long as other options are available. By following a few of these simple guidelines, beginners can make the switch to a more environmentally friendly diet:

Know Your Nutritional Needs — When switching to a new diet, you need to find replacement sources for the nutrients in the foods you're cutting out. For example, you may replace meat protein with sources of plant protein like nuts, beans or seeds. Consult with a doctor to learn what nutrients you need and how you can get them.

Transition Slowly — Going vegan or vegetarian to help the environment isn't about being perfect. Instead, it's about reducing how much you rely on animal products in your overall diet. Eliminate foods you won't miss and slowly work up to others. Any effort you make is better than no effort.

Search for Alternatives — Meat-eating pervades our culture. However, there are many environmentally friendly options available nowadays. Technology has allowed us to create plant-based foods that taste similar to meat and dairy products without the same negative environmental impact. Do your research and find food alternatives with lower carbon footprints to satisfy your cravings.

Veganism won't solve all of the world's problems. However, it could be a step in the right direction for many. By reducing demand for animal products, you can help limit greenhouse gas emissions and free up important resources for more productive forms of agriculture. If nothing else, try to buy your animal products from local, ethical farmers. They are less likely to participate in wasteful, cruel overproduction of animal products.

Kate Harveston

(Source- E-The Environmental Magazine, Oct 12, 2018)

Predicted deforestation in Brazil could lead to local temperature increase up to 1.45°C

A new model quantifies how forest change affects local surface temperatures by altering sunlight-reflection and evapo-transpiration properties, and predicts that Brazilian deforestation could result in a 1.45°C increase by 2050, in a study published in the open-access journal *PLOS ONE* scientists from Brazil's Rio de Janeiro State University and the University of California, Santa Cruz (UCSC).

Forests are known to reflect less sunlight and have higher evapo-transpiration than open vegetation, meaning that deforestation and forestation could affect local land surface temperature. However, until recently there were limited high-resolution global data. The authors of the present study used a global dataset from 2000-2010 to quantify impacts of forest change on local temperatures. They used newly-released data on forest cover, evapo-transpiration rates, sunlight-reflection and land surface temperature and built a model to quantify the relationship between these variables for tropical, temperate, and boreal regions.

The authors found that deforestation and forestation generally appeared to have opposite effects of similar magnitude on local temperature. However, the nature of the effect and the magnitude of the temperature change depended on latitude: in tropical and temperate regions, deforestation led to warming, while forestation had cooling effects. In boreal regions, deforestation led to slight cooling, though the magnitude of the effect was smaller. The magnitude of the forest change effects was greatest in tropical regions, with, for example, deforestation of approximately 50 percent leading to local warming of over 1°C.

The authors used their model to predict local temperature change in Brazil between 2010 and 2050. Assuming the current rate of illegal deforestation is maintained, this predicted an annual land surface temperature rise of up to 1.45°C in some areas by 2050. However, if no further illegal deforestation occurred, the temperature rise could be far more limited.

This new model quantifies the effect of forest change on local surface temperatures, through changes in sunlight-reflection and evapo-transpiration. The authors note that their Brazil case study "illustrates that current land use policies can impact future local climate."

"Forests have the potential to attenuate the levels of local warming even in the face of ongoing climate change, but this is most pronounced in tropical regions compared to temperate regions of the world," explained study co-author Barry Sinervo of the UCSC Department of Ecology and Evolutionary Biology in a Mongabay. He further said that an active reforestation program is crucial to off-setting the impacts of global temperature increases.

(Source – Science Daily, 20 March 2019)

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