ENVIRONEWS

INTERNATIONAL SOCIETY OF ENVIRONMENTAL BOTANISTS

Newsletter

LUCKNOW (INDIA) VOL. 22, No. 4 October, 2016

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NEW DIRECTOR OF NBRI AND PRESIDENT ISEB

Dr. S. K. Barik Professor and Head, Department of Botany, Centre for Advanced Studies in Botany, North-Eastern Hill University, Shillong (NEHU) has joined as Director, CSIR-National Botanical Research Institute, Lucknow. Being Director of the Institute, he would also be the President of International Society of Environmental Botanists (ISEB). He is an eminent ecologist with twenty eight years of research experience in the field of Plant ecology and Natural Resources management. He has been leading a strong group of researchers at NEHU pursuing frontline research in diverse areas such as plant diversity including inventory, bioprospection, and conservation of threatened species, ecological modeling, population and molecular ecology, chemical ecology, carbon sequestration, and impact of climate change on species and ecosystems. He has been serving as Chairman/Member of several Expert Committees/Task Forces constituted by Ministry of Environment, Forests and Climate Change (MoEF&CC), Planning Commission, Department of Biotechnology (DBT), and Ministry of Science and Technology, Govt. of India. He has published eleven books and 71 research papers, many of which are in internationally reputed scientific journals with high impact factor and are cited extensively world-wide. He is Member of the Editorial Boards of *Tropical Ecology* and *Journal of Biodiversity*. Fourteen students have been awarded Ph. D. degree under his supervision. He is the Coordinator of three major R & D projects of national importance funded by DBT and MoEF&CC. He is a LEAD Fellow, awarded by Leadership in Environment and Development (LEAD) International, Rockefeller Foundation, USA.

Prof. Barik has done his Ph.D. from NEHU, Shillong under the guidance of renowned Ecologist Prof. R.S. Tripathi, FNA.

Prof. Barik has been associated with ISEB for a long time, as its Life member and member of its executive Body.

ISEB extends warm welcome to Prof. Barik.

Editors, EnviroNews

LETTERS

In Africa and parts of Latin America, wild animal attacks on humans are often attributed to witch craft and black magic practices. In several Indian states there are quite high levels of witchcraft belief and also large number of cases of human/animal conflicts is regularly reported. But are animal attacks ever blamed on witchcraft or black magic and other superstitions in India? It might seem an odd question but in Africa and parts of Latin America, rich in forests and wildlife resources; witchcraft and black magic and related superstitions and beliefs are found to be associated with human-animal conflict. However, similar cases are not observed in India particularly in the remote rural tribal areas, forest belts and remote heavily forested border areas. There may be some odd cases reported but generally this is not as common as observed in several African or Latin American countries. Instead several religious faiths among different communities across this vast nation are socially as well culturally associated with direct or indirect conservation of wildlife and forests. The crux of human-animal conflict in India is fragmentation of habitats as well illegal encroachments into forested belts bringing wildlife into direct conflict with local inhabitants. Furthermore, wildlife trafficking, trade and poaching are promoted in belts where there is less economic and infrastructural developments or there are problems of local insurgency. Often not including local populations as stakeholders in conservation efforts in India has been failing promising conservation initiatives. Also there is lack of education and awareness regarding conservation as well as human-animal conflict. This strength of the facts therefore should be directed towards conservation and wildlife across India, it is an important part of the social and cultural life of many communities and religious and/or socio-cultural faiths and beliefs. Concept of sacred animals and grooves can be well utilized for conservation of many fragile ecosystems of the nation.

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The UIA invites International Society of Environmental Botanists (ISEB)–the governing body, staff, and members – to the 4th Associations Round Table Asia-Pacific on Wednesday 28 and Thursday 29 September in Busan, Korea and to the 10th Associations Round Table European Thursday 3 and Friday 4 November in Monaco. The UIA Round Table is an educational seminar where associations meet to learn through networking and through practice, to meet other international associations and to share experience and knowledge.

The UIA is a research institute founded in 1907 to promote and document the work of international associations. Its primary task is the collection and dissemination of information on international associations. International Society of Environmental Botanists (ISEB) is described in the UIA's Yearbook of International Organizations. With absolutely no charge, fee, or obligation. The UIA also promotes the work of international associations by organizing educational activities, such as the Round Table. For over 100 years the UIA has been working to promote and document the work of international associations. We look forward to welcoming you at our Round Tables this year.

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FIREWORKS LEAVE PLANTS HIGH AND DRY

To maintain the bloom in the garden, it is advisable to avoid bursting of crackers near plants and trees. Atmospheric toxicity increases because of fireworks, affecting growth of the plant and its productivity.

According to **Dr. Aradhna Mishra,** Senior Scientist at CSIR-National Botanical Research Institute Lucknow, toxic gases and chemicals emitted during bursting of crackers affect the rate at which carbon dioxide enters, or water vapour emanates through the leaves. Moreover, transportation system of plants is disturbed and minerals and food and water don't reach leaves and stems of the plant leaving them dry. The metabolic rate of the plant is also disturbed affecting its growth. Bursting of crackers near edible plants like curry, coriander, tulsi and others should be avoided as the dust particles and chemicals emitted from crackers will lead to health hazards on consumption of such plants. Covering of plants is not at all advisable as it will affect the carbon dioxide concentration of the plants affecting the process of photosynthesis.

According to another senior scientist of NBRI, **Dr. Vivek Pandey,** stomata of leaves are closed at night but in the morning the harmful chemicals enter affecting the plant health.

Source: TIMES NEWS NETWORK

WELCOME NEW LIFE MEMBERS

Dr. (Maj.) Neerja Masih, Department of Biotechnology, Isabella Tho*burn College, Lucknow.*
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NEWS FLASH

Dr. (Mrs.) Renu Tripathi, a Life Member of ISEB has been elected as a Fellow of the Academy of Sciences (FNASc), Allahabad. She is working as a Senior Principal Scientist &Professor (ACSIR) at CSIR-Central Drug Research Institute, Lucknow, where she has made outstanding contribution on malarial parasite which has won her international recognition. She visited Thailand, U.K and Japan to attend international Conferences.

Earlier she was conferred with INSA young scientist Award and INSA young Scientist Award in 1992.

Dr. Ms. Seema Mishra, DST SERB Scientist at CSIR-NBRI, Lucknow, India and a Life Member of International Society of Environmental Botanists delivered a lecture entitled "Transformation and Subcellular Distribution of Arsenic and Mechanism of its Sub-lethal Toxicity in Plants" in session T24: Metal Metabolism of Plant Biology Europe EPSO/FESPB 2016Congress held at Prague, Czech Republic during June 20-30, 2016. The lecture highlighted the importance of chemical speciation and compartmentation of arsenic in understanding the mechanisms of arsenic uptake, its toxicity and detoxification in plants. The delegates present at the Conference were highly impressed by the talk delivered by her and appreciated the research work carried out by her.

Dr. Sudhakar Srivastava, who is a Life Member of the International Society of Environmental Botanists and is working as an Assistant Professor in the Institute of Environment and Sustainable Development, Banaras Hindu University, has recently been awarded with Young Scientist Award by Uttar Pradesh Council of Science & Technology for his research contributions in the field of arsenic-plant interactions.

Dr. (Mrs.) Preeti Tripathi, a Life member ISEB and DST Young Scientist of SERB, New Delhi working at CSIR-National Botanical Research Institute, Lucknow has been conferred "Sir J.C. Bose Medal" for her Best Ph.D. Thesis entitled "Response of Thiol metabolism and antioxidative defense system in Rice (*Oryza sativa* L.) during arsenic stress" in the field of Life Science at National level in a function organized by Prof. H.S. Srivastava Foundation at Babasaheb Bhimrao Ambedkar University, Lucknow.

Dr. Preeti delivered award lecture related to her Ph.D. Thesis "Response of Thiol metabolism and antioxidative defense system in Rice (*Oryza sativa* L.) during arsenic stress". The award lecture session was very interactive and informative with special reference to arsenic tolerance and toxicity mechanism in rice.

Dr. Mridul Shukla, a Life Member of the International Society of Environmental Botanists working as Senior Technical Officer National Botanical Research Institute, has been recently awarded Vishist Nagrik Samman by NAVIK for his outstanding contribution in the field of environmental education and research.

Multifunctional Role of Selenium for Reducing Arsenic Risk in Crop Plants and Humans

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Selenium and arsenic distribution in soils throughout the world

Globally, many areas have been mapped for the soil selenium (Se) and arsenic (As) content. Worldwide soils generally contain 0.01-2 mg kg^{-1} of Se, however, global average concentration of As in soil is about 5 mg kg^{-1}. Soil in New Zealand, Australia, Denmark, Finland, Central Siberia, North-East to South Central China, Turkey, parts of India, Nepal and Bangladesh are deficient in Se. Soils of the great plains of the USA and Canada, the Ensti region in China, Ireland, Colombia and Venezuela are naturally rich in Se. Due to alluvial origin, high rain fall and flooding upon the soils of Bangladesh appear to be low in soluble Se.

Arsenic is highly toxic to all forms of life. Widespread chronic inorganic As poisoning is prevailing in the regions of South and Southeast Asia, South America, China, Vietnam, Taiwan and elsewhere, due to the consumption of contaminated drinking water containing geogenically elevated level of inorganic As extracted from shallow underground aquifers. The permissible limit of As is 20 mg kg^{-1} in agricultural soil. Arsenic level in uncontaminated region ranges below 10 μg kg^{-1}, while in the contaminated soils, As level is beyond the concentration of 30,000 μg kg^{-1}.

Selenium and arsenic status in crop plants especially rice

The level of Se in crop plants varies between areas and its high level (> 2 ppm) can lead to toxicity. Although, there is no question that consumption of As-contaminated drinking water is the most important route of As exposure in affected areas, whereas, high availability of As in paddy field makes rice a significant contributor for As intake in humans. Arsenic also interferes with uptake of nutrient elements *viz.*, P, Si, S, Mn, Zn, Co, Cu, and Mo also either by direct competition with transport pathway or

altering cellular metabolism in plants. Various field trial results demonstrated that As also perturbed grain Se content genetically in paddy rice, resulting in low grain Se content. Total As concentrations in rice grains of different countries is 0.005 to 0.710 mg kg^{-1}. Se content in Indian rice has been shown to be within the range of 0.005-0.233 mg kg^{-1}.

Rice from the US and India are most enriched in Se, while major rice-producing and consuming countries, such as Egypt (~32 fold lesser Se than their North American equivalents), China and Thailand produce the rice with lesser Se level. China possessed the greatest variation of 1368 ng g^{-1} Se. As and Se concentration in wheat also shows large regional variation in India, China and Egypt as rice cultivars. Surveys of Se concentrations in grain of ancestral and wild relatives of wheat, wheat landraces and commercial cultivars grown in Australia and Mexico found no significant genotypic variation in grain Se among the modern wheat cultivars, but diploid wheat and rye had relatively higher grain Se concentrations. Soil Se bioavailability seems to be the predominant factor in determining grain Se, as was also reported recently in wheat. Genotypic variation in Se concentration might become more prominent when the Se bioavailability in the medium is high.

Selenium mediated reduction of arsenic toxicity in crop plants especially rice

Essentiality of Se is well proven for human beings, while its presence also considered beneficial for plants. As plants are the important source of dietary Se, the Se metabolism is important for nutrition of humans and other animals. Inorganic forms of Se, selanate [Se(VI)] and selenite [Se(IV)] are the predominantly available in the terrestrial environment. Selanate is transported through sulphate transporter, while silicon influx transporter (OsNIP2;1, gene of aquaporin family) is known for Se(IV) uptake in rice. Inorganic form of As, arsenate [As(V)] is transported through phosphate transporters (Tripathi et al. 2007), while arsenite [As(III)] through aquaporins such as Nodulin 26 like intrinsic proteins (NIPs) in rice. Thus, As and Se chemistry and dynamics in paddy fields are complex.

Selenium has also been shown to counteract various abiotic stresses induced in plants by cold, drought, high light, water, salinity and heavy metals and metalloids. Numerous studies have implicated Se in the following mechanisms: the regulation of reactive oxygen species (ROS) and antioxidants, the inhibition of uptake and translocation of heavy metals, changes in their speciation and finally, rebuilding of the cell membrane and chloroplast structures and recovery of the photosynthetic system. Selenium plays a significant role for ameliorating As toxicity by acting a cofactor of enzyme glutathione peroxidase, which is an antioxidant system in plants. The role of Se supplementation on heavy metals (Pb, Cd, Zn, Cu, Al, Sb) uptake has been identified including As. In some plants such as *Pteris, Phaseolus, Oryza, Arabidopsis, Triticum* and *Medicago* etc., Se lowers As accumulation thus the associated toxicity, while As uptake and associated toxicity were increased sometimes depending on the supplied Se levels. Rice is a good accumulator of Se and As. The negative correlation between Se and As level in different part of rice *viz.,* root, shoot and grain is evident in solution culture and field experiments. The studies on interaction of As and Se for reducing As uptake and associated toxicity should be investigated further in rice plants.

Selenium as an organ protector

The role of Se is identified as organ protector during As stress in mice. Selenium plays hepatoprotective role during As induced liver injury in rats. Exposure of rats to As caused a significant increase in liver thibarbituric acid reactive substances level, but the co-administration of Se was effective in reducing its level. Higher dietary Se intake may reduce the risk of As related skin lesions and also reduce the skin cancers risk. Supplementation of Se prevents cytotoxic effects of As by antimutagenic action of organoselenium, which upregulate the selenoproteins glutathione peroxidase and thioretoxin reductase which would protect against spontaneous and arsenite induced oxidative DNA damage.

Possible association between modulated Se intake and arsenicosis in human

Daily intake of inorganic As tainted rice grains may comprise an impending As exposure pathway for humans leading to serious health issues such as bladder, lung, skin and prostate cancer. A survey on As-exposed population of West Bengal found a possible link between increased arsenical skin lesions and low dietary intake of animal protein, as well as other micronutrients. There is some epidemiological evidence that low Se intake may influence the development of arsenicosis and the As-linked Blackfoot disease in As-contaminated areas of Taiwan. Similarly, liver biopsies from severely affected arsenicosis people found high levels of As, while Se was undetectable. Selenium reduces inorganic As toxicity by promoting As methylation and increased content of dimethylarsenic acid and monomethylarsenic acid and further these species are excreated form the body through urination. A study on 93 pregnant Chilean women exposed to As found a strong positive correlation between excreted urinary Se and As, as well as increased % dimethylarsenic acid and decreased % of inorganic As. Similarly, a study on 252 arsenic-exposed Taiwanese people, found that urinary Total Se was correlated with decreased inorganic As and increased methylated As, suggesting that Se facilitates As methylation.

Outlook

The multifunctional role of Se has been well recognized for prevention of heavy metal toxicity in plants and humans. Lower level of Se (0.01-2ppm) is expected to reduce the toxicity of As mainly by inhibiting its uptake and/or

translocation in plants and partially by its antioxidant properties and conversion of As to the lesser toxic form through Se-As bonding. Plants used in Se phytoremediation could be used as fortified foods. Studies are already done to evaluate the impact of feeding Se rich canola meals to cows and sheep. Crops used for Se phytoremediation purposes may be subsequently utilized as fortified foods especially for people who are exposed to food chain As contamination. Effort is needed to produce Se rich and low grain As crops using molecular breeding and plant biotechnology methods. Further, the use of Se fertilizers in As contaminated paddy fields may be an effective strategy to produce low grain As rice cultivars with high nutritional quality. Besides, consumption of Se rich diet may reduce the As risk in humans by protecting from the cancer risk and increasing the excretion of methylated As from the body. Further, investigations are required to reveal the complex interaction of Se and As by analyzing their time dependent speciation in soil rhizosphere, within the plant tissue and also in human blood and urine.

Nuclei of the plant cells are the first loading site for arsenic

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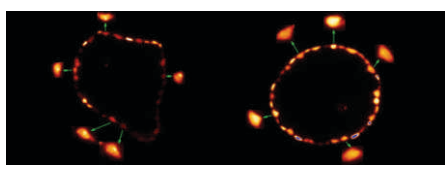
Arsenic initially accumulates in the nuclei of plant cells. This has been revealed by an x-ray examination of the aquatic plant rigid hornwort (*Ceratophyllum demersum*). The distribution study of the toxic metalloid in plant leaves by Dr. Seema Mishra at the Deutsches Elektronen-synchrotron hamburg using the x-ray source PETRA III demonstrated that at low cellular concentration arsenic predominantly occupies the nucleus of the leaf cells. Even at comparatively low concentrations, arsenic floods the vacuole, which takes up most of the cell. Dr. Seema Mishra (now working at National Botanical Research Institute in Lucknow) made this discovery in the course of a project which she initiated during her Humboldt post-doctoral research on speciation and distribution of arsenic in plants. The experiment was set up in the lab of Prof. Kuepper in University of Konstanz, Germany. The findings have been reported in the "**Journal of Experimental Botany**". The results could help researchers breed plants that absorb less arsenic.

Arsenic is highly toxic and poses a growing environmental and health problem all over the world. The concentration of arsenic in the soil is increasing as a result of human activities, and in many countries – especially on the Indian subcontinent – the concentration of arsenic in the groundwater has become a problem. Although arsenic is a naturally present in the environment, due to human intervention for example drilling of wells it mobilised gets from the underground rock, contaminating the drinking and irrigation water. In human beings, arsenic can cause cancer, necrosis, or acute renal and circulatory failure. The metalloid is also toxic to plants. It is taken up by the same transport mechanism as phosphorus, an element that is essential to plants, and even at levels far below the lethal concentration, it impairs plant growth and therefore reduces the yield of crops.

On top of this, human beings consume the plant produce and feed them to their livestock, in whose bodies arsenic accumulates and eventually ends up in human beings, through food chain. The project was aimed to find out exactly how arsenic poisoning occurs in plants at ecologically and physiologically relevant concentrations. The results showed that concentrations of just one micromole per litre are already relevant in terms of plant physiology while in arsenic contaminated areas the concentration over 30μM is not uncommon in irrigation water and soil solution. The initial findings were published in '**Plant physiology** in 2013'.

In this experiment the plants exposed to arsenic concentrations between one and five micromoles per litre were subjected to narrowly focused x-ray beam from PETRA III through leaves. PETRA III made it possible to look inside the individual cells of the plant for the first time and allowed to localise the arsenic more precisely within the cell. The plant first deposits the toxin in its outer layer, the epidermis. It was surprising to see that arsenic initially accumulates in the cell nuclei. Only when the concentration rises to five micromoles per litre, a level that the plants are unable to withstand for prolonged periods, arsenic floods the vacuole and thus ` more or less the entire cell. "This means that the capacity of the epidermis is exhausted and the plant can no longer get rid of the toxin, and that's when it spreads to the mesophyll, where photosynthesis takes place.

The second part of the current study shows that arsenic damages the enzymes that are responsible for producing chlorophyll. Arsenic first inhibits photosynthesis, which is not due to the removal of chlorophyll but rather to the reduced production of the pigment.



At low concentrations (1μM), arsenic accumulates predominantly in the nuclei of epidermal cells while at high concentrations (5μM), it floods the whole cell (Mishra *et al.*, Journal of Experimental Botany, doi:10.1093/jxb/erw238).

New techniques to manage post-harvest diseases of fruits and vegetables

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Introduction

"Substantial amounts of vegetables and fruits are lost to spoilage after harvest. This thrashing can range from 10-50% depending on the product and country".

Currently, synthetic chemicals are the primary resources of checking post harvest diseases of vegetables and fruits. Public worry about food safety, though, increased concern to find out the efficient alternatives to unsafe chemical pesticides to control post harvest diseases of perishables. The eventual aim of recent research programmes in this area has been the advancement and assessment of various alternative control strategies to trim down reliance on synthetic fungicides.

In India, post-harvest losses in vegetables at different regions of the country have been estimated, which were for Delhi 7.2-34.7%; Maharashtra 15-20 % and Uttar Pradesh 4-10 %. In Delhi, the percentage loss reported by the retailers who have permanent shop was around 6.75% and around 8.8% for pushcart vendors. Post harvest pathogen not only affects the produce quantitatively but also qualitatively. A perusal of literature on the changes occurring during pathogenesis in various fruits clearly revealed that the quantity of various free and bound amino acids and organic acids was altered and a gradual decrease in sugar and ascorbic acid content was observed with the advancement of diseases.

A number of enabling technologies are available for optimizing product quality through manipulation of nutrition, water and light to minimize post harvest disorders and quality deterioration as well as to optimize carbon assimilation, distribution and accumulation in harvested organs. Common practices used for the control of post-harvest diseases of fruit are controlled atmosphere storage, refrigeration and fungicides.

Physical agents

Physical agents have been used to control the post-harvest diseases of fruits and vegetables. A different type of physical method applies in the control of plant pathogens. There are various types-

Ultraviolet light treatment (UV Treatment)

Low dose of ultraviolet light especially UV-C hormesis have emerged as alternative technology to avoid chemical fungicides. Low dose UV C hormesis was shown to induce resistance in postharvest commodities to harvest decay and to extend shelf life of fruits by delaying the ripening and senescence process. Application of a low dose of UV-C light reduced the development of post-harvest decay in horticulture crops such as onion, sweet potato, apple peach, citrus fruits, bell pepper, tomato, carrot and strawberry. UV-C therapy effectively reduced storage rot 60-90 % compared with 100 % decay for the non-irradiated control.

Heat treatment

Pre-storage heating holds potential as a nonchemical method for control of post-harvest diseases by directly inhibiting pathogen growth, activating the natural resistance of the host and slowing down the ripening process. Heat treatments are promising and have been used with success in eradication or suppressing the development of fungi on the surface as well as those situated just below the surface as a result of pre harvest infection. Post-harvest curing at 34–36°C for 48–72 h effectively controls citrus decay and reduces chilling injury symptoms.

Irradiated Fruits

Emission and propagation of energy through material medium in the form of waves is called irradiation. Both ionizing and non-ionizing irradiation have been used for post-harvest storage studies. Irradiation basically controls the post-harvest diseases by sterilizing the fruits. Microwave treatments were found effective against fungi viz- *Botrytis cinerea* and *Penicillium expansum*.

Low Pressure storage

Storage life is influenced by atmospheric pressure and at low pressure it is extended. Low pressure (180-190 mm) has been reported to reduce fruit ripening. At low atmospheric pressure the availability of O_2 for respiration is reduced besides controlled storage, use of fungicides under reduced atmospheric pressure helps from rotting of storage fruits by protecting them.

Low storage temperature

Low temperature also reduces the ripening and the respiration rates. At 13°C fruits have been kept in the best condition. The temperature requirement for slow ripening depends upon the stage of maturity; green fruit at 15°C, orange green fruit at 10°C and red fruit at 8°C have been kept for a longer period. However, under very low temperature conditions chilling injury is caused and such situation arises below 10°C. Alternations of low and high temperatures, 2°C and 20°C respectively have prolonged storage tissues. At ambient temperature fruits can be stored for longer duration.

Chemical agents

Calcium chloride ($CaCl_2$) and Sodium bicarbonate

A post-harvest calcium and

sodium treatment was reported safe and effective methods of improving the quality and shelf life of fresh fruits. Selected organic and inorganic salts are active antimicrobial agents and have been widely used in the food industry. Among these, Calcium delays ripening and particularly softening by altering intracellular and extra cellular processes. It also reduces disorder and decay losses. Sodium bicarbonate (SBC) and potassium sorbate are used for controlling pH, taste and texture, and they also exhibit broad-spectrum antifungal activity .The potential of bicarbonate salts for the control of post-harvest pathogens has been demonstrated in citrus, carrot, bell pepper and melon. Sodium bicarbonate at a concentration of 2% (w/v) has potential for controlling *Rhizopus*, *Alternaria* and *Fusarium* decay on 'Galia' and 'Ein Dor' fruit.

Chitosan

Chitosan and its derivatives, including glycolchitosan, were reported to inhibit fungal growth and to induce host-defence response in plants and harvested commodities. Chitosan, a high molecular weight cationic polysaccharide, is soluble in dilute organic acids, and have been used as a preservative coating material for fruits. It has ability to form a semi-permeable film and chitosan coating have definite potential to modify the internal atmosphere as well as decrease transpiration losses in fruits. Chitosan coatings have been found to extend the storage life of fresh fruit and that too without causing anaerobiosis. Moreover, they have also been reported to reduce decay by inhibiting the growth of several fungi.

Organic Fungicides

A number of fungitoxic chemicals for controlling postharvest diseases have been developed. These chemicals are mostly used as dilute solutions into which the fruit or vegetables are dipped before storage or as solutions used for washing or hydrocooling of fruits or vegetables immediately after harvest. Benomyl, triforine, dichloran etc. are used as dips, sprays or wax formulations. Taken together, all these factors have resulted in reframing of government policies which not only allows restricted use of fungicides but also provides the impetus to develop alternative and effective natural methods of controlling post-harvest diseases.

Biological agents

Biocontrol

In the recent past, biological control has emerged as an effective strategy to combat major postharvest decays of fruits. However, compared to the long-standing interest in biological control of soil borne pathogens research into biological control of post-harvest decays is still in its infancy. Thus, biological control of post-harvest diseases of fruit and vegetables offers a viable alternative to the use of present day synthetic fungicides. Today biological control of postharvest diseases of fruit has become an important field for research. Microbial antagonists have been reported to protect a variety of harvested perishable commodities against a number of post-harvest pathogens Post-harvest treatment of fruits with microorganisms recovered from fruit surfaces is being developed as an alternative method for control of post harvest diseases of Citrus, Apples, and other fruits and vegetables. A number of yeasts and bacteria have been reported to inhibit post-harvest decay of fruit effectively. Utilization of antagonistic yeasts as an alternative appears to be a promising technology.

Botanicals

Drawbacks of synthetic chemical methods have increased interest in developing further alternative control methods, particularly those that are environmentally sound and biodegradable. Thus, replacement of synthetic fungicides by natural products (particularly of plant origin), which are non-toxic and specific in their action, is gaining considerable attention. Because of greater consumer awareness and concern regarding synthetic chemical additives, foods preserved with natural additives have become popular. This has led researchers and food processors to look for natural food additives with a broad spectrum of antimicrobial activity .The plant kingdom represents an enormous reservoir of potential fungicidal compounds that could be useful alternatives to synthetic fungicides.

Recently, there have been several attempts to use naturally occurring compounds for the control of postharvest decay. Plants also produce a variety of essential oils and volatile substances that could have potential as antifungal preservatives for harvested commodities. Both plant essential oils as well as similar compounds in wood smoke have shown promise as natural antimicrobials. Essential (volatile) plant oils occur in edible, medicinal and herbal plants, which minimize questions regarding their safe use in food products. Essential oils and their constituents have been widely used as flavouring agents in foods since the earliest recorded history and it is well established that many have wide spectra of antimicrobial action.

The advantage of essential oils is their bioactivity in the vapour phase, a characteristic that makes them attractive as possible fumigants for stored product protection. There have been some studies on the effects of essential oils on post-harvest pathogens. Some of the essential oils have been reported to inhibit post-harvest fungi in *in vitro* conditions. The potential of essential oils to control post harvest decay has also been examined by spraying and dipping the fruit and vegetables. A promising recent development involves incorporating these antimicrobials into packaging materials, rather than the food itself. This concentrates the antimicrobial at the surface of the product, which is where noxious organisms grow and reduces interference from food constituents. Although the fungitoxic

properties of the volatile constituents of higher plants have been reported, little attention has been paid to the fungitoxicity of these substances when combined. This information is desirable since the fungitoxic potency of most of the fungicides has been reported to be enhanced when combined.

Discussion

Although many alternatives to chemical control have been investigated, none, when used alone, is as effective as fungicides. Hot air treatment either reduced or completely eradicated decay of apple fruit caused by *Penicillium expansum* but the pathogen was not completely eradicated in the case of decay by *Colletotrichum acutatum*. Heat treatment, while a good eradicant, has no residual activity. The reduction of decay by biological control is generally more variable than for fungicides since biocontrol is affected more by environmental factors. There is also a narrower spectrum of activity than is found with chemical control.

Similarly, SBC is not effective in providing protection if fruit are infected after treatment. Integrating different physical control options such as radiation and ultraviolet illumination was found to be effective against fungi sensitive to low gamma doses such as *Colletotrichum* spp. Combining physical and chemical alternatives has also been extended to combine radiation and fungicide applications. In this case, both dosages could effectively be reduced to provide cumulative protection. Integrating hot water treatments with SBC and fungicides have been known to be effective in reducing decay.

Combining fungicides in natural or edible waxes has also resulted in increased effectiveness of the products compared to using the products on their own. Korsten et al. (1991) also described successful control of mango postharvest diseases when the antagonist was incorporated into the natural waxes applied on the packing line. Shrink or plastic wrapping the fruit after heat treatments has also proven to be an effective integrated approach. Fungicides used at low concentrations when combined with biocontrol agents have been shown to be effective against several postharvest diseases. Biocontrol products could effectively be integrated with chemicals used at lower concentrations or when used with softer chemicals or disinfectants.

Combining chemical elicitors such as chitosan with Bacillus subtilis was found to increase the effectiveness of postharvest biocontrol treatments of *Penicillium* spp. on citrus. Other combinations such as calcium salts and sodium bicarbonate with biocontrol agents proved similarly. Adding SBC to the heated or antagonist treated fruit had little effect on decay caused by either pathogen, but on non-heated fruit, it slightly reduced decay caused by *P. expansum*. An increase in control of decay on oranges caused by *Penicillium digitatum* and *Penicillium italicum* occurred when *Bacillus subtilis* antagonists were combined with SBC. Combining SBC with another antagonist also improved decay control of *P. digitatum* on oranges and grapefruit.

At present quite a few promising biological approaches that include the natural plant based antimicrobial substances (volatile aromatic compounds, acetic acid, essential oils, jasmonates, glucosinolates, plant extracts and propolis), the application of microbial antagonists (bacteria, fungi, yeasts), the antimicrobial substances from soil (deoxyfusapyrone and fusapyrone) and the natural animal-based antimicrobial substances like chitosan have been advanced to curb the menaces of post harvest diseases in perishables. Compounds that activate host plant defense responses potentially recommend socio environmentally potent alternative methods for disease control. Amalgamation of the above complementary techniques could well lead to efficient control of post harvest diseases.

Challenges of Dissemination of Accurate Scientific and Technical Information in the South Asian Print Media

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A lot of unfortunate misinformation is noted in the media; particularly the print media regarding wildlife and forests across the Indian subcontinent (broadly across South Asia). I have scanned several online versions of Indian newspapers and located incorrect information related to wildlife in different states and union territories. I have included few examples for the benefit of the readers. On several occasions human-elephant conflicts in India are reported with images of African elephants; possibly the images of the latter being more easily available. But the truth is that Asiatic (Indian) and African elephants are located in two different continents in distinctly different ecosystems and are two separate genera with distinct genetic, morphological and anatomical differences. Similarly reports on poaching on Indian one-horned rhinoceros have been found to be accompanied with images of two-horned African rhinoceros images; and similarly they are two different genera and geographically separated.

On some occasions I have noticed human-leopard conflict reports across

India and Nepal, unbelievably misidentified leopards with cheetahs, two entirely different cat species. Cheetah has been extinct in India since 1951; while leopards are quite common across the entire Indian subcontinent found in most dominant ecosystems. Not only India, cheetah is extinct throughout the continent of Asia except in small protected sanctuaries of Iran and are now referred to as Iranian (Asiatic) cheetahs. Pakistan has claimed unconfirmed reports of cheetah in the deserts of Baluchistan province adjoining Iran. However, there has not been a single recorded (scientific) sighting of any cheetah in Pakistan in the past six decades. Another common mistake that I have noted are that blue bulls (nilgai) and black bucks been regarded as different deer species in several news reports; while they are actually two different species of Indian antelopes.

Similarly several African antelopes are wrongly referred to as deer in print media. Most reports identify blue peafowls (the National Bird of India) always as peacocks. But again this is wrong, the correct terminology should be blue peafowl, the males of which are peacocks and the females are peahens. Another example is that of the misidentification of Indian striped hyena with African spotted hyena. Africa is the home of four different species of hyena, namely- spotted hyena, brown hyena, striped hyena and aardwolf. The Indian striped hyena is a distinctly different species from the African spotted hyena. But possibly due to easy availability of the spotted hyena images that are often accompanied with reports on Indian (Asiatic) striped hyena. Similarly amphibians like toads and frogs; salamanders and newts are mixed up in several reports. It is important for the print media to provide scientifically accurate information to the readers and should be careful enough to review the reports before publication by relevant experts. Possibly there is lack of technical editors or scientific editors in the Indian media houses (both English and vernacular) with relevant backgrounds in Biological/Life sciences that such errors continue to surface quite repeatedly and needs to be changed. The issue is not just restricted to India and is observed across the entire South Asian region.

NEWS AND VIEWS

RADIOACTIVE WASTE AND POLLUTION

Every exposure to radiation increases the risk of damage to tissues, cells, DNA and other vital molecules. Each exposure potentially can cause programmed cell death, genetic mutations, cancers, leukemia, birth defects, and reproductive, immune and endocrine system disorders. There is no safe threshold to exposure to radiation.

Government regulations allow radioactive water to be released from Indian Point nuclear power plant to the environment containing "permissible" levels of contamination. However, since there is no safe threshold to exposure to radiation, permissible does not mean safe. It doesn't take an accident at the Indian Point nuclear power plant to release radioactivity into our air, water, and soil. As a matter of regular operation, radiation is released from Indian Point in the form of liquid, gaseous, and solid radioactive wastes. Solid radioactive wastes include laundry (considered low-level waste) and irradiated spent fuel (considered high-level waste.)

Each reactor routinely emits relatively low-dose amounts of airborne and liquid radioactivity. This radioactivity represents over 100 different isotopes only produced in reactors and atomic bombs,. Humans ingest them either by inhalation or through the food chain (after airborne radioactivity returns these chemicals to earth). Each of these chemicals has a special biochemical action; iodine seeks out the thyroid gland, strontium clumps to the bone and teeth (like calcium), and cesium is distributed throughout the soft tissues. All are carcinogenic.

These chemicals are different from "background" radiation found in nature in cosmic rays and the earth's surface. Background radiation, while still harmful, contains no chemicals that specifically attack the thyroid gland, bones, or other organs. Radioactive releases result from plant accidents and accidents happen. On February 15, 2000, IP-2 suffered a ruptured steam generator tube that released 20,000 gallons of radioactive coolant into the plant. The incident resulted from poor plant maintenance and lax oversight by the Nuclear Regulatory Commission. One week after the accident, 200 gallons of radioactive water were accidentally released into the Hudson River.

Since at least August 2005, radioactive toxins such as tritium and strontium-90 have been leaking from at least two spent fuel pools into the groundwater and the Hudson River. In January 2007 it was reported that strontium-90 was detected in four out of twelve Hudson River fish tested. The Nuclear Regulatory Commission relies upon self-reporting and computer modeling from reactor operators to track radioactive releases and their projected dispersion.

However, radioactive releases from routine operation often are not fully detected or reported. In fact, accidental releases may not be completely verified or documented. And, they occur throughout the nuclear fuel cycle, which includes uranium mining, uranium milling, chemical conversion, fuel enrichment and fabrication, the process by which electricity is generated at plant via controlled reaction, and the storage of radioactive waste, both on-site and off-site.

Finally, radioactive by-products continue giving off dangerous radioactive particles and rays for enormously long periods–described in terms of half lives.

Source: Riverkeeper

Website: http://www.riverkeeper.org/campaigns/stop-polluters/indian-point/radioactive-waste/

BIRDS ON TOP OF THE WORLD, WITH NOWHERE TO GO

Climate change could make much of the Arctic unsuitable for millions of migratory birds that travel north to breed each year, according to a new international study. Suitable breeding conditions for Arctic shorebirds could collapse by 2070, according to biologists. This means that

countries throughout the world will have fewer migratory birds reaching their shores.

Arctic breeding shorebirds undertake some of the longest known migratory journeys in the animal kingdom, with many travelling more than 20,000 kilometres per year to escape the northern winter. The bar-tailed godwit flies from Alaska to New Zealand in a single flight of 12,000 kilometres without landing. The study predicts that, in a warming world, migratory birds will become increasingly restricted to small islands in the Arctic Ocean as they retreat north.

This could cause declines in hard-hit regions and some birds could even completely change migratory pathways to migrate closer to suitable habitat. Climate change is also opening up the Arctic to threats such as mining and tourism, and we must make sure we protect key places for all Arctic species, including these amazing migratory birds. Most migratory populations followed well-defined migratory routes. This makes shorebirds an excellent group to investigate how climate change might impact breeding grounds and conservation actions that could address these impacts. Climatically suitable breeding conditions could shift and contract over the next 70 years, with up to 83 per cent of Arctic bird species losing most of their currently suitable area. This far exceeds the effects of the last major warming event on Earth.

Source: University of Queensland

(Global Change Biology).

INDIA'S FIRST TRANSGENIC FOOD CROP LIKELY TO BE APPROVED

India has moved a big step closer toward embracing its first genetically modified (GM) food crop. In a safety review released recently, the environment ministry finds that GM mustard does not raise any public health or safety concerns for human beings and animals. Deepak Pental, a well known plant geneticist at the University of Delhi developed the GM variety.

India in 2004 introduced GM cotton, which now comprises more than 90% of all cotton cultivated in the country. But it has been leery of allowing widespread cultivation of GM food crops. In 2010, the environment ministry put on holds the commercial planting of GM brinjal, an eggplant variety, equipped with a bacterial gene that thwarts insect pests. The moratorium continues and is unlikely to be lifted anytime soon.

Prospects are looking brighter for GM mustard. India is one of the world's biggest producers of mustard (*Brassica juncea*), which is cultivated for its edible leaves and oil. The GM variety is equipped with genes from a soil microbe that manipulate pollen development such that the variety produces hybrids more easily in the usually self-pollinating crop. The GM-derived hybrids produce about 25% more seeds—and thus more oil, which is pressed from the seeds—than traditional varieties now in cultivation.

The 133-page safety review raises one cautionary note: It calls for more studies on whether GM mustard could harm honey bees and honey production in mustard-growing areas. And it calls for continued monitoring of insects and other organisms that live in or near mustard fields.

Source: Pallava Bagla (In: Science)

LESSONS FROM TREE? NEW PHOTOSYNTHESIS MODEL DEVELOPS FUEL FROM SUNLIGHT

Researchers at the University of Illinois at Chicago have developed a solar cell that can convert carbon dioxide in air into usable hydrocarbon fuel, using only sunlight for energy.

In their device, solar cells instead of converting sunlight into electricity, works on the lines of the work done by plants by converting atmospheric carbon dioxide into fuel. It can solve two crucial problems at once — climate change as the solar farm of such "artificial leaves" could remove significant amounts of carbon from the atmosphere and secondly, produce energy-dense fuel efficiently.

The new solar cell is not photovoltaic — it's photosynthetic, said Amin Salehi-Khojin at UIC and lead author on the study. Instead of producing energy in an unsustainable one-way route from fossil fuels to greenhouse gas, we can now reverse the process and recycle atmospheric carbon into fuel using sunlight. Unlike plants which produce fuel in the form of sugar, the artificial leaf here delivers synthesis gas, a mixture of hydrogen gas and carbon monoxide called Syngas that can be burned directly.

The ability to turn CO_2 into fuel at a anegligible cost would make fossil fuels obsolete. Moreover, there is no complaint from climate change advocates, The new catalyst is 1,000 times faster than noble-metal catalysts — and about 20 times cheaper. The UIC artificial leaf consists of two silicon triple-junction photovoltaic cells of 18 square centimeters to harvest light; the tungsten diselenide and ionic liquid co-catalyst system on the cathode side; and cobalt oxide in potassium phosphate electrolyte on the anode side. When average light of 100 watts per square meter reaches the Earth's surface, it energizes the cell, hydrogen and carbon monoxide gas bubble up from the cathode, while free oxygen and hydrogen ions are produced at the anode.

Source: July 29 issue of Science

ONE-TENTH OF EARTH'S WILDERNESS DESTROYED IN JUST 2 DECADES

When most people think about conservation, they probably imagine saving the panda, or some other threatened creature, or maybe protecting whatever remains of its habitat. But some leading scientists think we are missing the big picture. Large swaths of wilderness also really need our help according to them. They have compared the extent of Earth's wilderness areas in 1993 and 2009, documenting almost a 30% loss in South America and a 10% loss globally.

Similar estimates in the past have focused on deforestation, but the recent studies look at the disappearance of a broader range of wild landscapes. Wilderness areas contain the world's most undisturbed biodiversity. Such unspoiled regions, scientists argue, are also critical for allowing the planet to cope with climate change.

Watson, a conservation biogeographer at the Wildlife Conservation Society based at the University of Queensland, Brisbane, Australia, and his colleagues earlier determined the extent of the "human footprint" on Earth by incorporating maps and data on crop lands, pastures, night lighting, railways, roadways, navigable waterways, population densities, and "built" environments, which included urban areas and other settlements.

Wilderness is as pristine landscapes mostly free of human disturbances, including roads. By 2009, about 23% of Earth's land remained as wilderness—about 30.1 million square kilometers spread mostly across North America, North Asia, North Africa, and Australia. That's 3.3 million square kilometers less than in 1993, an area about twice the size of Alaska. South America has lost almost 30% of its wilderness in that time and Africa has lost 14%. The losses included the total devastation of several large swaths of forest and swamp in the Congo and in New Guinea.

One reason for the trend is that governments and conservation organizations often prioritize their

protection efforts on habitat that is severely threatened or degraded. But left unguarded, remote land is vulnerable to homesteading farmers and claim-seeking miners.

Work on remote coral reefs drive home why pristine places are important to biodiversity and suggests why other types of wilderness areas need protection. Even the oldest, best managed marine protected area lacks the variety of organisms that we find in wilderness areas. Moreover, by storing carbon and buffering local climate, wilderness areas, particularly forests, can be "by far and away the most effective way to deal with climate change. Scientists argue for the preservation of half Earth's land (even if it is not all wildernesses) and oceans. Protecting that fraction of forests can be 50% of the climate change solution. For all these reasons, protecting these areas will require a much stronger effort than has been made to date.

Elizabeth Pennisi

(In: Science)

EFFECTS OF CLIMATE CHANGE TODAY

Over 100 years ago, people worldwide began burning more coal and oil for homes, factories, and transportation. Burning these fossil fuels releases carbon dioxide and other greenhouse gases into the atmosphere. These added greenhouses gases have caused Earth to warm more quickly than it has in the past.

How much warming has happened? Scientists from around the world with the Intergovernmental Panel on Climate Change (IPCC) tell us that during the past 100 years, the world's surface air temperature increased an average of 0.6° Celsius (1.1°F). This may not sound like very much change, but even one degree can affect the Earth. Below are some effects of climate change that we see happening now.

Sea level is rising. During the 20th century, sea level rose about 15 cm (6 inches) due to melting glacier ice and expansion of warmer seawater. Models predict that sea level may rise as much as 59 cm (23 inches) during the 21st Century, threatening coastal communities, wetlands, and coral reefs.

Arctic sea ice is melting. The summer thickness of sea ice is about half of what it was in 1950. Melting ice may lead to changes in ocean circulation. Plus melting sea ice is speeding up warming in the Arctic.

Glaciers and permafrost are melting. Over the past 100 years, mountain glaciers in all areas of the world have decreased in size and so has the amount of permafrost in the Arctic. Greenland's ice sheet is melting faster too.

Sea-surface temperatures are warming. Warmer waters in the shallow oceans have contributed to the death of about a quarter of the world's coral reefs in the last few decades. Many of the coral animals died after weakened by bleaching, a process tied to warmed waters.

The temperatures of large lakes are warming. The temperatures of large lakes world-wide have risen dramatically. Temperature rises have increased algal blooms in lakes, favor invasive species, increase stratification in lakes and lower lake levels.

Heavier rainfall cause flooding in many regions. Warmer temperatures have led to more intense rainfall events in some areas. This can cause flooding.

Extreme drought is increasing. Higher temperatures cause a higher rate of evaporation and more droughts in some areas of the world.

Crops are withering. Increased temperatures and extreme drought are causing a decline in crop productivity around the world. Decreased crop productivity can mean food shortages which have many social implications.

Ecosystems are changing. As temperatures warm, species may either move to a cooler habitat or die. Species that are particularly vulnerable include endangered species, coral reefs, and polar animals. Warming has also caused changes in the timing of spring events and the length of the growing season.

Hurricanes have changed in frequency and strength. There is evidence that the number of intense hurricanes has increased in the Atlantic since 1970. Scientists continue to study whether climate is the cause.

More frequent heat waves. It is likely that heat waves have become more common in more areas of the world.

Warmer temperatures affect human health. There have been more deaths due to heat waves and more allergy attacks as the pollen season grows longer. There have also been some changes in the ranges of animals that carry disease like mosquitoes.

Seawater is becoming more acidic. Carbon dioxide dissolving into the oceans is making seawater more acidic. There could be impacts on coral reefs and other marine life.

Jennifer Bergman

(Windows to the Universe)

CLIMATE CHANGE CAN ALTER THE PLANET'S SHAPE

As melting glaciers erode the land, global warming could alter the shape of the planet, says a new study. Antarctica is warming up, and as it moves to temperatures above zero degrees Celsius, the glaciers are all going to start moving faster. We are already seeing that the ice sheets are starting to move faster and should become more erosive, digging deeper valleys and shedding more sediment into the oceans. The repercussions of this erosion add to the already complex effects of climate change in the polar regions.

Faster moving glaciers deposit more sediment in downstream basins and on the continental shelves, potentially impacting fisheries, dams and access to clean freshwater in mountain communities, the study noted. When the researchers compared glaciers in Patagonia and in the Antarctic Peninsula over a period of five years, they found that glaciers in warmer Patagonia moved even faster and caused more erosion than those in Antarctica, as warmer temperatures and melting ice helped lubricate the bed of the glaciers. It was found that glaciers erode 100 to 1,000 times faster in Patagonia than they do in Antarctica.

Times of India Oct 3, 2015

(The findings appeared in journal Nature)

LIVESTOCK CAUSES 80% OF AGRICULTURE EMISSIONS

Livestock production is the dominant cause of EU agriculture's impact on clfimate change, air pollution and biodiversity loss, EU-funded research has found. Its contribution is 78 per cent for terrestrial biodiversity loss, 80 per cent for soil acidification and air pollution (ammonia and nitrogen oxides emissions which contribute to the formation of particulate matter and tropospheric ozone with a detrimental impact on air quality), 81 per cent for global warming, and 73 per cent for water pollution (both nitrogen and phosphorus). The agriculture sector itself is one of the major contributors to these environmental impacts, ranging between 12 per cent for global warming and 59 per cent for nitrogen water quality impact.

The figure includes emissions caused by agriculture in other sectors or occurring outside of the EU territory, such as feed imports and transport, and emissions from land-use change. To address these environmental impacts, a combination of technical measures reducing emissions and land-use intensity, and demand-side measures to reduce food waste and change dietary habits is needed, according to the authors.

Acid News

CONFERENCES

ICGTES 2016
International Conference on Green trends in Environmental Sustainability.
15-16 December, 2016; Mehdipatnam, Hyderabad, India
Contact: Dr. Elizabeth Margaret/Mrs. Radhika
Convenors-ICGTES2016
St. Ann's College for Women, Santoshnagar Colony
Mehdipatnam, Hyderabad - 500 028, India
Email: margaret_nje@yahoo.com
Website: http://www.icgtes2016.org/

First International Conference on Environment Management and Sustainability (ICEMS-2017)
4 – 6 January, 2017 Mumbai, India
Contact: Organizing Secretary, ICEMS-2017
SIES-Indian Institute of Environment Management
Sri Chandrasekarendra Saraswati Vidyapuram, Plot 1E, Sector V, Nerul, Navi Mumbai - 400 706
Email: icems2017@sies.edu.in
Website: www.siesiiem.net/icems2017

8th International Conference on Environmental Science and Development (ICESD 2017)
8-10 February, 2017; Frankfurt, Germany
Contact: Ms. Eve Lee
CBEES Senior Editor, Asia-Pacific Chemical, Biological & Environmental Engineering Society (APCBEES)
E-mail: icesd@cbees.org
Website: http://www.icesd.org/

2nd International Conference on Pollution Control & Sustainable Environment
13-14 March, 2017 London, UK
E-mail: pollutioncontrol@conferenceseries.com
Website:
http://pollutioncontrol.conferenceseries.com

7th International Conference on Environment and Industrial Innovation (ICEII 2017)
24-26 April, 2017; Kuala Lumpur, Malaysia
Contact: Ms Eve Lee
CBEES Senior Editor, Asia-Pacific Chemical, Biological & Environmental Engineering Society (APCBEES)
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http://www.iceii.org/

12th ICBEN Congress on Noise as a Public Health Problem,
18-22 June 2017; Zurich, Switzerland.
Contact: SGA-SSA (Swiss Acoustical Society)
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Uberlandstrasse 129, CH-8600 Dubendorf, Switzerland
E-mail: ICBEN2017@sga-ssa.ch

BOOKS

Soil Remediation and Plants: Prospects and Challenges
(Eds.) K. Hakeem, M. Sabir, M. Ozturk & A. Ruhi Mermut
Elsevier 2014
ISBN: 978-0-12-799937-1
Price: USD 130.00

Applied Plant Genomics and Biotechnology 1st Edition
(Eds.) Yiguo Hong & Palmiro Poltronieri
Elsevier 2015
ISBN: 9780081000687
Price: USD 210.00

Plant Responses to Air Pollution
(Eds.) Umesh Kulshrestha, Pallavi Saxena
Springer 2016
ISBN: 978-981-10-1201-3
Price: USD $119.00

Mangrove Ecosystems of Asia: Status, Challenges and Management Strategies
(Eds.) Faridah-Hanum, I, A. Latiff, K.R. Hakeem, M. Zturk,
Springer 2014
ISBN: 978-1-4614-8581-0
Price: € 192,39

Biodiversity of Lianas
(Ed.) Parthasarathy, N.
Springer 2015
ISBN 978-3-319-14591-4

Climate Change and Environmental Issues
(Eds.) Narayan Singh and Amit Kumar Thakur
Teri Press 2016
ISBN: 9788179935903
Price: Rs. 715.00 / US $50.00

Biotechnological strategies for the conservation of medicinal and ornamental climbers
(Eds.) Shahzad, Anwar; Sharma, Shiwali and Siddiqui, Saeed A.
Springer 2016
ISBN: 978-3-319-19287-1
Price: 155,99 €

Tropical Tree Physiology
Adaptations and Responses in a Changing Environment
(Eds.) Goldstein, Guillermo, Santiago, Louis S.
Springer 2016
ISBN 978-3-319-27420-1

Published by
International Society of Environmental Botanists,
CSIR-National Botanical Research Institute,
Rana Pratap Marg, Lucknow 226001, India

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