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A REPORT OF NATIONAL CONFERENCE ON

Current Trends in Plant Science and Molecular Biology for Food Security and Climate Resilient Agriculture (PSMB 2018)

View of Inaugural Session and release of Abstract Book.

The National Conference was organised jointly by **Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya (RVSKVV), Gwalior, Madhya Pradesh** and **National Environmental Science Academy (NESA), New Delhi** at Auditorium, College of Agriculture, Gwalior from **15 to 16 February, 2018.**

The inauguration of the National Conference took place in the auspicious presence of Chief Guest, **Prof. (Dr.) A.S. Tiwari**, Former Vice Chancellor, Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur and Guest of Honour **Prof. (Dr.) N.K. Singh,** National Professor & Project Director ICAR-NRCPB, Pusa Campus, New Delhi. The inaugural session was presided over by **Prof. (Dr.) S. K. Rao**, Vice Chancellor, RVSKVV, Gwalior and (Patron PSMB_2018). Also present on stage were dignitaries Prof. **Javed Ahmad**, President, NESA (Co-Patron PSMB_2018), **Dr. B. S. Baghel,** Director Research Services, RVSKVV, Gwalior (Convener PSMB_2018), **Dr. M. P. Jain**, Dean, College of Agriculture, Gwalior (Co-Convener PSMB_2018) and **Dr. R. S. Tomar** (Organising Secretary PSMB_2018).

The conference was inaugurated by the **Chief Guest, Prof. A.S. Tiwari.** Former VC, JNKVV, Jabalpur. The Chief Guest presented his valuable views on Impact of changing climatic conditions. The excerpts of his speech are as follows. I quote:

Prof. A. S. Tiwari, Chief Guest (PSMB 2018) delivering inaugural speech

I am delighted to be here in this two day conference on very timely and vital aspects of Current Trends in Plant Science and Molecular Biology for Food Security and Climate Resilient Agriculture. Agriculture and rain-fed

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farming, in particular is highly dependent on climate. The global change in climate is a challenge to all those involve or dependent on agriculture, so also for the researchers in the field of cross disciplines of plant sciences like Plant Physiology, Plant Pathology, Plant Ecology, Environmental Science, Plant Biotechnology, Horticulture, Forestry, etc.

Looking to the wide and varied gathering of a large number of participants and the programme of technical sessions, I compliment the organisers for their skill and efforts. RVSKVV and NESA are presently headed by very worthy and dynamic leadership. **Dr. S.K. Rao** is an eminent, experienced and very hard working researcher, organiser and worthy leader of great repute. Prof. Javed Ahmad is an experienced and novel personality having knowledge of basic and allied Plant Sciences.

RVSKVV has a very rich history and research contribution in the field of agriculture. Madhya Pradesh with its large area of forests and tribal population is very rich in Plant and Animal Biodiversity, which is capable of giving us resource for the food security and climate resilient agriculture. So conservation, restoration and judicial use of this biodviersity is very vital to agricutlure. Modern tools of biotechnology/genetic engineering like cell and tissue culture, genetically modified organisms (GMO's) transgenic can contribute a lot to address the issues facing the challenge of increasing and sustenance of food production.

With the rich history of green, yellow and white revolution due to scientists, farmers, administrators and leaders, we are sure that the present bench, particularly of young scientists will rise to the occasion and give the country the technology to mitigate the challenges of climate, increasing food production and ensuring food and nutritional security.

• Jai Bharat • Jai Kisan • Jai Jawan

Prof. (Dr.) S. K. Rao
VC, RVSKVV, Gwalior

Prof. (Dr.) S. K. Rao, Hon'ble Vice Chancellor of RVSKVV, Gwalior presided the inaugural session in the National Conference on "***Current Trends in Plant science and Molecular biology for Food Security in the change in Climate Scenario***". In the presidential address, Dr. Rao welcomed the Guests, faculty, participating students, press and media. He laid emphasis on the importance of contribution of agriculture economy to the Gross Domestic Product (GDP) of the State. The highest growth rate of 24.9% has been achieved in Madhya Pradesh and consequently growth rates are being maintained above 20% in subsequent years. Excellent farmer friendly policies of state government supported by the latest developed technologies made remarkable impact on the overall agriculture development in Madhya Pradesh. In majority, the field crops like wheat, rice, soybean etc. had stagnated yield globally as well as in India and MP except in Maize. Similar condition prevails in pulses and oil seed crops. The concentrated efforts are regularized to search for new genes from the wild relatives as well as from existing genetic resources. Scientists and plant breeders addressing the development of improved varieties/hybrids that can with stand biotic/abiotic stresses.

The introduction of Bt. Cotton has paid devidends to the farmers but created problems for cultivation over year due to biotic stress. Now the cotton breeders collected the genetic resources of aroborium in Madhya Pradesh and promoting organic cotton cultivation to get the better returns to the farmers and will be getting 20% of the enhanced returns than Bt. cotton. Future, growth in the agriculture sector has come from horticulture, livestock and farm mechanization. Lack of adequate qualified manpower has been the major concerned resulting in the poor status of the products/services in the public domain in horticultural sector. There is a need for strengthening the horticulture and livestock sector with the huge investment in research & development for focused research. In the natural resources management, soil health management, water management, conservation agriculture, organic farming are the priority sectors to get better net returns to the farmers. Recent reports in biotechnology indicated of placing a rice gene in the maize crop resulted in enhanced productivity due to increased accumulation of sucrose content as well as number of grains in maize. This can be true with the rice varieties as well as other cereals. Hence, inter disciplinary research efforts are needed to achieve the future food security targets by maintaining sustainable production through soil health and water management systems.

Prof. Javed Ahmad, President, NESA delivering his address.

Prof. Javed Ahmad, President, NESA introduced the Academy and unfolded the theme of the National Conference. He also presented his message and emphasized for a careful analysis of impact caused by environmental changes which will help to devise new strategies, techniques or genetic approaches to improve plant systems.

Prof. (Dr.) N.K. Singh, B.P. Pal Chair & Project Director ICAR-NRCPB Pusa, New Delhi

Prof. (Dr.) N.K. Singh, National Professor, B.P. Pal Chair & Project Director ICAR-NRCPB, Pusa Campus, New Delhi, was invited as Guest of Honour of the National Conference. He also delivered keynote address with the focus on

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"Genomics Assisted Breeding for infusing climate resilience into high yielding mega varieties of rice" during the inaugural function. The talk included the result of their efforts in finding the genes and QTLs for quality, drought, heat and salinity tolerance in the landraces and wild relatives of rice and transfers these into the modern high yielding mega varieties of rice.

Dr. M.P. Jain, Dean, RVSKVV, Gwalior & Joint Co-Convener, PSMB 2018

Dr. M.P. Jain, Dean, College of Agriculture, Gwalior (Joint Co-Convener, PSMB 2018) welcomed the guests, delegates and invited speakers. Also apprised the educational activities going on in the College of Agriculture, RVSKVV, Gwalior. The Souvenir & Abstract Book was also released on the occasion along with the Bioinformatics Lab Manual of Deportment of Biotechnology, College of Agriculture, Gwalior.

Release of Bioinformatics Lab Manual of Dept. of Biotechnology, College of Agriculture, Gwalior

Dr. B.S. Baghel, Director Research Services RVSKVV, Gwalior & Convener, PSMB 2018

Dr. B.S. Baghel, Director Research Services, RVSKVV, Gwalior (Convener, PSMB 2018) gave the brief introduction of the RVSKVV, Gwalior. He concluded his speech with vote of thanks to each and every delegates, event organizers and the Invited speakers who came from various parts of the country to share their knowledge.

Dr. R.S. Tomar, Organising Secretary of the National Conference was also acknowledged for his whole hearted efforts in raising fund in the form of sponsorships from various Organizations i.e. ICAR, NABARD, PPV & FRA and to invitation of the participants, delegates, Invited Speakers, experts in their field of work.

Refreshment in the form of High Tea and snacks were served to all the participants and delegates at the College Lawn in the RVSKVV campus. After the tea break, the deliberations started and the poster session was organised separately with each scientific theme. Keynote Address, Invited Lectures and Oral presentations were also held regularly in the auditorium as per Technical programme made by **Dr. A.K. Singh** (Co-Convener, PSMB 2018), **Dr. R.S. Tomar** (Organising Secretary, PSMB 2018) and **Dr. Sushma Tiwari** (Jt. Org. Secretary, PSMB 2018).

Theme I entitled "**Plant Breeding and Molecular Biology**" started after the refreshment. The Chairman of the session was **Dr. N. K. Singh**, National Professor, BP Pal Chair & Project Director ICAR-NRCPB, New Delhi. The Rappoteur of the session were Dr. Sharad Tiwari, Director Farm Services, JNKVV, Jabalpur and Dr. P. K. Mandal, Principal Scientist, ICAR-NRCPB, Pusa Campus, New Delhi.

Dr. A.K. Singh, Head, Division of Genetics & Plant Breeding, IARI, New Delhi

The first keynote lecture was delivered by **Dr. A.K. Singh**, Head, Division of Genetics & Plant Breeding, IARI, New Delhi. His talk was centric on molecular breeding for developing climate smart rice varieties with their status and prospects in detail. He also explained impact of abrupt climatic conditions in rice leading to susceptibility to various biotic stresses such as bacterial blight (BB), blast, sheath blight (ShB), brown plant hopper and abiotic stresses such as drought and salinity.

Dr. A.K. Joshi, Director, South East Asia CIMMYT, NASC Complex, New Delhi

Dr. A.K. Joshi, Director, South East Asia, CIMMYT, NASC Complex, New Delhi delivered talk on challenges and progress in wheat improvement. He explained the importance of biofortified wheat cultivation. He also highlighted the stem black rust fungus in wheat as a new challenge (Ug99) for the wheat growing areas. The future activities & programme of CIMMYT were also highlighted by the speaker.

Dr. S.V. Saiprasad, Head & Principal Scientist, IARI Regional Station, Indore also delivered an invited talk on competence of heat tolerance potential and its improvement in wheat to control climate change.

Dr. A.H. Rizvi, ICARDA, NASC complex, New Delhi gave oral presentation on genetic broadening through pre breeding in lentil and chickpea.

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Dr. Amolkumar Solanke, Scientist, ICAR-NRCPB, Pusa Campus, New Delhi also presented orally on the Role of genetic fidelity testing in tissue culture raised plants. Its scope and purpose were also discussed by him during the talk.

Dr. Prashant Vikram, Associate Scientist, CIMMYT delivered oral presentation on global food security and climate resilience.

Theme II was entitled "Plant Biotechnology" started after the lunch. The two Chairman of the session were **Prof. S. K. Rao**, VC, RVSKVV, Gwalior and **Prof. A. K. Singh**, Head, Division of Genetics, ICAR-IARI, Pusa Campus, New Delhi. The Rappoteur of the session were **Dr. A. K. Sharma**, Division of Genetics & Plant Breeding, College of Agriculture, RVSKVV, Gwalior and **Dr. C. Bhardwaj,** Principal Scientist, Division of Genetics, ICAR-IARI, Pusa Campus, New Delhi.

Sharad Tiwari, Director Farm, JNKVV, Jabalpur, giving his invited lecture

Dr. Sharad Tiwari, Director Farm, JNKVV, Jabalpur delivered an invited talk on molecular techniques for species barcoding. He also discussed the genetic quality of wheat seed. He concluded that molecular markers like SSR are very efficient tool for testing genetic purity and varietal identification.

Dr. Rohini Sreevathasa, Principal Scientist, ICAR-NRCPB, Pusa Campus, New Delhi, also delivered an invited talk on biotechnological approaches for engineering resistance to the insect herbivore (*Helicoverpa armigera*) in pigeon pea. She discussed in detail about the borer. Crop wild relatives were also mentioned of Cajanus platycarpus and C. cajan.

Dr. S.V. Amita Mithra, Scientist, NRCPB Pusa, New Delhi delivering oral presentation

Dr. Amitha Charu Mithra, Scientists (SS), ICAR-NRCPB, gave oral presentation on integrating expression data in rice: an effort towards deciphering biotic and abiotic stress tolerance. Functional and structural genomics were described in detail. Available data base in rice was also presented.

Dr. Deepa Garg, Kurukshetra University, Haryana gave her oral presentation on markers for terminal heat stress in wheat.

Dr. S.L. Krishnamurthy, Scientist, ICAR-CSSRI, Karnal presented oral on breeding for safe tolerance in rice. He differentiated between conventional and molecular approaches in his lecture. Salinity and alkalinity hazards were also discussed. Salt tolerance varieties of rice were high-lighted during the lecture. He recommended for molecular marker for correct testing of germplams.

Dr. A. K. Singh, Secretary NAAS & Former VC, RVSKVV, Gwalior, Singh, Head, Division of Genetics & Plant Breeding, RVSKVV, Gwalior & Dr. Amitha Mithra, Scientist, ICAR-NRCPB

Theme III entitled "Agriculture Sciences" commenced on next day i.e. 16th February 2018. The Chairman of the session was **Dr. A. K. Singh**, Secretary NAAS & Former VC, RVSKVV, Gwalior. The Rappoteur of the session were **Dr. A. K. Singh**, Head, Division of Genetics & Plant Breeding, College of Agriculture, RVSKVV, Gwalior and **Dr. Amitha Mithra**, Scientist, ICAR-NRCPB, Pusa Campus, New Delhi.

In this theme, Keynote lecture was delivered by **Dr. S.K. Rao**, VC, RVSKVV, Gwalior. He spoke on Agro biodiversity. He explained its conversation and management through modern trends for crop improvement. It was very informative talk. He also discussed the threatened species of plant diversity with their modern measures of conservation. Type of genetic erosion was also discussed in detail by the learned speaker.

Dr. Bhupinder Singh, Principal Scientist ICAR-IARI, Pusa Campus, New Delhi

Dr. Bhupinder Singh, Principal Scientist, ICAR-IARI, Pusa Campus, New Delhi gave an invited talk on molecular and physiological basis of micronutrient efficiency in crops: Challenges and opportunities. The speaker explained about the wide variations of NPK in the three states i.e. Punjab, Haryana and U.P. of the country. He also described the challenges in plant mineral nutrition. Micronutrient deficiency (Zn and Fe) was also high-lighted. He put forward the physiological approaches to compare plant mineral efficiency. He also described root response, root architecture and root characteristics. Root to shoot translocation was also discussed. He described about Zn transporter genes.

Dr. Akshay Talukdar, Principal Scientist, ICAR-IARI, Pusa Campus, New Delhi, gave invited talk on "Creation of Genetic Variability through wide hybridization in soybean".

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Dr. V. Shubhashini, Principal Scientist CTRI, Rajamoundry

Dr. V. Shubhashini, Principal Scientist, CTRI, Rajamoundry gave invited talk on "Plant Promoting Rhizobacterium to improve crop growth in tobacco. She discussed in detail about the technologies developed as biofertilizer kits. The speaker apprised about the positive role of Rhizo bacterium.

Dr. Sangeeta Singh, Research Associate (PDF), NRCPB, New Delhi talked on pigean pea (Cajanus cajan) and its importance. She also highlighted the constraints in its production and molecular breeding in pigeon pea.

Dr. Devendra Payasi, RRS, JNKVV, Sagar had thrown light on aerobic rice hybrids. He also talked about drought prone area of India. He also elaborated the heterosis phenomenon in rice.

Theme IV and V entitled "Crop Science and Crop Protection & Biosafety and Statistical Tools for Agricultural Data Management" started after the refreshment. The Chairman of the session was Prof. A. S. Tiwari, Former VC, JNKVV, Jabalpur. The Rappoteur of the session were Dr. Ashok Ahuja, Former Scientist-F, CSIR-IIIM, Jammu and Dr. Rajesh Kumar Associate Dean-cum-Principal, Bhola Paswan Shastri Agricultural College, (Bihar Agricultural University, Sabour), Bihar.

Prof. V.S. Tomar, Founder Vice Chancellor RVSKVV & Former Vice-Chancellor JNKVV, Jabalpur

Prof. V.S. Tomar, Founder Vice Chancellor, RVSKVV, Gwalior & Former Vice-Chancellor, JNKVV, Jabalpur, delivered his keynote lecture on "Management of soil and water resources for climate Resilient Agriculture". He emphasized on soil resource management strategies. He advised for providing balanced nutrition of crops as far as N, P & K are concerned. He also threw light on the role of soil carbon and organic farming. Soil qualities (physical, chemical and biological) were also discussed in detail. Soil protection was also elaborated during the talk. Benefits of bio-fertilizers were also high-lighted as well as residues of rice crop. i.e. straw and stalk.

Dr. P.K. Mondal, Principal Scientist, NRCPB, New Delhi gave an invited talk on Biochemical and Molecular basis of Nitrogen use efficiency in wheat.

Dr. Sunil Londhe, Senior Scientist World Agro-forestry Centre

Dr. Sunil Londhe, Senior Scientist, World Agro-forestry Centre delivered an invited talk on Agro-forestry: policy, practices and way forward. He also emphasized the importance of trees along with main agro-forestry systems & designs in different states of India. The increase in forest cover by 1% since last two years was pointed out by the speaker. Agroforestry mapping is the new technique widely in uwas also shown by him.

Dr. N.C. Gupta, Scientist, NRCPB, IARI, New Delhi had oral presentation on "Molecular aspects of Sclerotinia stem rot disease in Indian mustard and their future implications. He also discussed the quantification of seed oil Brassica (white), black and rapeseed.

Dr. S.B. Pal, Genesis Technologies also gave oral presentation on climate change studies featuring Co2 level and elevated OTC technology. Presentation included various Technologies (FACE&FATE) along with awareness in using customized green houses.

Dr. Subodh Kumar Sinha, Sr. Scientist, ICAR-NRCPB, Pusa Campus, New Delhi also presented his talk on nitrate uptake and translocation. Hydroponics were also described as one of the growth conditions.

Poster evaluation was done by **Dr K P S Malik**, Former DFA, RVSKVV, Gwalior, **Dr. V. Shubahshini**, Principal Scientist, CTRI, Rajamoundry, **Dr S L Krishnamurthy,** Scientist, ICAR-CSSRI, Karnal, Haryana, and **Dr Dr R K Pandya**, Professor, Department of Plant Pathology, College of Agriculture, Gwalior

Valedictory Session - dignitaries on dias

The valedictory session was held after lunch at 3:00 pm on **16th February, 2018.** The guest of honour of the occasion was Prof. **(Dr.) V.S. Tomar**, Founder, V.C. RVSKVV, Gwalior & Former, VC, JNKVV, Jabalpur who high-lighted the important issues, themes and sub themes of the conference. **Prof. S.K. Rao**, Vice Chancellor, RVSKVV, Gwalior graced the occasion. Also present on stage were dignitaries **Prof. Javed Ahmad** (Co-Patron PSMB_2018), **Dr. M. P. Jain**, (Co-Convener PSMB_2018) and **Dr. R. S. Tomar** (Organising Secretary PSMB_2018).

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Prof. Javed Ahmad, Co-Patron and President, NESA, New Delhi

Prof. Javed Ahmad, President, NESA apprised about the academic activities of two days. He informed the house and dignitaries that about sixty three papers were presented in the conference in various forms. Total posters were displayed on both the days during conference under five sub-themes at different venues. Keynote, invited lectures and oral presentations were twenty three during deliberations of the two days conference.

Dr. M.P. Jain, Dean, gave his views on successful completion of the conference.

Dr. Sushma Tiwari
Jt. Organising Secretary, PSMB-2018

Dr. Sushma Tiwari, Jt. Organising Secretary, PSMB_2018 addressed the delegates and compiled the report of two days scientific event. Two days scientific event included five themes and 24 sub-themes designed very meticulously and invited speakers, poster and oral presentations were organized theme-wise by her. All the possible outcomes of the lectures/talks and their panel discussions were shared with the delegates. Total numbers of oral and poster presentations with research papers in each session were briefed. The Best poster and Oral awards in each theme were also presented to the winner students who participated in various sessions during the National Conference. Appreciation certificates and awards were presented to the staff and students who helped in conducting this event. Appreciation award was given to Dr Ashok Ahuja (Former Ex-Chief Scientist, CSIR Jammu & Guest Faculty, Department of Biotechnology, RVSKVV, Gwalior), Dr V S Kandelkar (Professor, Department of Plant Breeding & Genetics, College of Agriculture, Gwalior), Dr K P S Malik (Former DFA, RVSKVV), Dr Shobhana Gupta (Sr Scientist, Department of Agricultural Extension), Dr Y D Mishra (Sr Scientist, RVSKVV), Dr Radha Gupta (Guest Faculty, Department of Biotechnology, RVSKVV, Gwalior) and Dr Reshu Tiwari (Guest faculty, Department of Plant Breeding & Genetics, RVSKVV, Gwalior) for their outstanding contribution in conference. The students of Department of Plant Breeding & Genetics and Biotechnology were also appreciated for their outstanding work in conference i.e., Sanjeev Yadav, Chitralekha Shyam, Asha, Pramod, Sonali, Anushree Pramanik, Sushmita, Kanchan, Vinod, Poonumchand, Piyush Upadhyay, Bipratip Dutta and many others. Mementos and certificates were also distributed to **Dr. M.P. Jain, Dr. A.K. Singh, Dr. R.S. Tomar and Dr. Sushma Tiwari** during the valedictory session.

Dr. R. S. Tomar
Organising Secretary, PSMB 2018

In the last, **Dr. R. S. Tomar**, Organising Secretary, PSMB 2018, gave vote of thanks. In his speech, he thanked **Dr. A. K. Singh** former VC, RVSKVV, Gwalior who initiated this scientific event. Organising Secretary also thanked **Dr. S. K. Rao,** Vice Chancellor, RVSKVV, Gwalior for his untiring approach towards the event, whole hearted support, cooperation and guidance. **Dr. Rao** took keen interest in proceeding of all the sessions of the National Conference. **Dr. Tomar** thanked **Prof. Javed Ahmad**, President NESA and **Dr. Kshipra Misra**, Vice President NESA, for their full support, guidance and having faith in conducting the event. Chief Guest of the inaugural session **Dr. A. S. Tiwari**, Former VC, JNKVV, Jabalpur was also thanked for his auspicious presence. Organizing Secretary also thanked Chief Guest of the valedictory session **Dr. V. S. Tomar**, Founder VC RVSKVV, Gwalior and Former VC, JNKVV, Jabalpur who graced the occasion. He also thanked **Dr. B.S. Baghel** (DRS), Convenor **Dr. J.P. Dixit** (Director Farm Services) Co-Convenor, **Dr. M.P. Jain** (Dean), Jt. Convenor and **Dr. A. K. Singh** (Head, Division of Plant Breeding & Genetics), Jt Co-convenor, PSMB 2018 for their timely support and guidance. All the Invited speakers of every session were thanked for delivering very informative talk and sharing intellectual knowledge with the delegates. While Chairman, Co-chairman and Rappoteurs were thanked for the smooth conduct of the session. The Conveners of seventeen different committees viz., Hall and Stage, Registration, Poster presentation, Transport, Accommodation, Coordination, Food, Publication and Press & Media were appreciated and thanked for their kind contribution and support. The students of Plant Molecular Biology & Biotechnology department viz.,

Winners of Best Oral and Poster Awards - PSMB 2018

Ms. Anushree Pramanik, Mr. Vinod Kumar Sahu, Mr. Sanjeev Kumar, Mr. Poonamchand and several others were acknowledged for their efforts and support. **Mr. Gian Kashyap** and **Mr. Rakesh Kumar Roy** from NESA, New Delhi, were acknowledged for their contribution in printing, editing of Conference Brochures, publication of Book of Abstracts. All the funding agencies viz.,

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Glimpses of Inauguration Session of PSMB 2018 @ Gwalior

ICAR, NABARD, PPV & FRA, New Delhi and sponsors viz., Genesis Technologies, Himedia, Eppendrof, Alice Biotech Pvt Ltd., Genetix Biotech Asia Pvt. Ltd. and Ehsaan Group of Enterprises were acknowledged and thanked for providing financial support. Last but not the least he thanked **Dr. Sushma Tiwari**, (Scientist, PMBB, College of Agriculture, Gwalior) Jt. Organising Secretary, PSMB 2018 for her hardwork, commitment towards her role and organizing the event with passion and dedication. The conference ended on high note. Services rendered by the staff and students of College of Agriculture, Gwalior were commendable.

The conference was declared closed with the permission of Patron of Conference after the feed-back from the delegates at 6:30 pm on 16.02.2018.

The Life Members are requested to please send small articles for the E-Newsletter which published monthly - NESA Publication Division

Glimpses of Valedictory Session of PSMB 2018 @ Gwalior

Memento given for Chair the session during the Conference

Memento given during the valedictory Session

Dr. Trilochan Singh receiving NESA Fellowship of the Year from Prof. S.K. Rao, VC, RVSKVV, Gwalior

Memento given for invited talk during the conference

NESA Award Winners

Appreciation awards received by students of RVSKVV, Gwalior

Post valedictory session - I

Post valedictory session - II

Current Trends in Plant Science and Molecular Biology for Food Security and Climate Resilient Agriculture

Sushma Tiwari, R S Tomar[1] and A.K. Singh
Department of Molecular Biology and Biotechnology
College of Agriculture, Rajamata Vijayaraje Scindia
Krishi Vishwa Vidyalaya, Gwalior
[1]ICAR-NRC on Plant Biotechnology, Pusa campus, New Delhi
Corresponding author: sushma2540@gmail.com

Climate change is a major threat to food security for the raising population worldwide. To increase crop production use of fertilizer and chemicals to control weed and pest is commonly being utilized but they are not eco-friendly and are often unsustainable. Recent advances in genomics and biotechnology are foundations for sustainable intensification of agriculture and helping in resilience of crops to climate change. Marker assisted breeding is providing more reliable result in less time and better understanding of metabolic pathways and gene responsible. Due to availability of reference genomes sequence, genotyping can be done in more comprehensive manner to understand genomic variation. High throughput genomics-assisted breeding is allowing rapid identification of genes having major role in climate related agronomic traits and for crop improvement adapted to a changing climate.

Key words: Plant breeding, Molecular biology, Genomics, Climate Resilient Agriculture

Introduction

Climate change and variability are major limiting factor for crop productivity worldwide. Due to climate change, more frequent hot days, heat waves and warm spells are expected to increase. It may alter weather patterns, rainfall regimes, temperature and carbon dioxide concentrations in particular regions. These changes can lead to increased biotic and abiotic stress in crops and an overall reduction in crop yield. During recent decades, increased crop production has been mainly achieved through proper agronomic management and improved crop varieties. Current climate prediction models indicate that in the next 50-100 years average surface temperatures will rise by 3-5°C and it will drastically affect global agricultural systems. Due to that more frequent hot days, heat waves and warm spell are expected to increase and will directly affect frequency of drought, flood, and heat stress. Producing sufficient food to feed the rapidly rising global population is a huge challenge for agriculture, due to unpredictable consequences of climate change. However, maintaining a continued increase of crop yield using fertilizers and chemicals to ensure food security is unsustainable. Genomics-assisted breeding is considered to have the greatest potential for overcoming these challenges and for increasing sustainable food production by making popular crop varieties resistance to biotic and abiotic stresses.

Advances in genomics for crop breeding:

With high quality genome sequence, high throughput genotyping for accurate characterisation of genomic diversity, and precise association of heritable agronomic traits and genotypes, crop yield and environmental resilience can be improved. Furthermore, genome editing approaches hold great promise for developing climate-adapted crops and accelerating breeding. Building on the increasing amount of genomic data and advances in genome editing, genomics-assisted breeding will play an important role in ensuring food security in a changing climate. Major advances in capturing crop diversity includes genotyping by sequencing, SNP genotyping arrays and data management system or bioinformatics tools for crop genomic studies.

Genotyping by sequencing (GBS) has revolutionised crop genotyping, providing powerful tools for rapid, high-throughput identification of genetic variation underlying agronomic traits. The rising popularity of these methods has led to single nucleotide polymorphisms(SNPs) becoming the marker of choice for genotyping. These markers are heritable, abundantly distributed across the genome, and allow single base resolution, facilitating the detection of causal, or 'perfect', markers. GBS approaches are in wide use for crop genotyping, providing SNPs that can be applied for practical molecular breeding applications. With the costs of sequencing continuing to decrease, GBS data will become increasingly available for both major and minor crops, and these resources will be invaluable for adapting crops to climate change.SNP array technology has made major contributions to genetics by allowing rapid genotyping of many markers across the genome without the need for sequencing. Today, commercial SNP arrays available from Illumina and Affymetrix allow genotyping of large numbers of samples with hundreds of thousands, to millions of SNPs. These arrays remain popular because they allow targeting of alleles of interest, timely data generation and simple computational analysis. Because SNPs implemented in arrays are often derived from GBS data, these two

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Mushrooms: The environmental Purifiers

Anuja Bhardwaj
Research Scholar
Defence Institute of Physiology and
Allied Sciences, Timarpur, Delhi-110054
E-mail: bhardwaj.anuja@yahoo.in

Mushrooms have always fascinated the world for their nutritive values and have been used traditionally in various cultures for their medicinal benefits. They also act as purifiers in their natural environments. This is attributable to their ability to transform a wide variety of hazardous chemicals or pollutants through what is called as 'bioremediation' or more aptly 'mycoremediation'. Although there are other candidates such as plants and bacteria which have been employed for bioremediation, yet, fungal bioremediation or mycoremediation has gained the interest of scientists and environmentalists globally. This could be reasoned with the fact that the fungi are the most robust agents for the decomposition of waste matter, and are an essential component of the soil food web, providing nourishment for the other biota as well. Moreover, unlike bacteria, fungi do not require pre-treatment and could express the genes required to produce proteins essential for degrading the pollutants and xenobiotics. All the three types of fungi namely, saprophytic, parasitic and mycorrhizal are used in bioremediation processes. Among them white rot fungi and particularly *Pleurotus* species are considered the most effective in degrading pollutants. The main genera of white-rot fungi which have shown potential for bioremediation are *Phanerochaete*, *Trametes*, *Bjerkandera* and *Pleurotus*. The species of theses genera most studied for bioremediation include; *Pleurotus ostreatus, Trametes versicolor, Bjerkandera adusta, Lentinula edodes, Irpex lacteus, Agaricus bisporus, Pleurotus tuber-regium, Pleurotus pulmonarius* (Figure 1).

The great potential of fungi in bioremediation is by the virtue of their rapid growth, great biomass production and extensive mycelium growth in the environment. The branching filamentous mode of fungal growth i.e. the mycelium allows for more efficient colonization and exploration of contaminated soil. The mycelium being a network of intertwined hyphae has the property of translocating nutrients to the surroundings another important feature for exploring heterogeneous environments. Additionally, it is ubiquitous and could grow all over the planet, from cold hill regions to warm, tropical rainforests. The mycelium has the unique feature of producing extracellular enzymes and acids which could breakdown recalcitrant molecules such as lignin and cellulose, the two main components of plant litter in the forests. As the fungus breakdowns wood and leaves, a rich nutritive material called humus is formed. Several enzymes which are produced by fungi, include cellulase, extracellular peroxidase, hemicellulase, laccase, ligninase, oxidase, pectinase and xylanase. These extracellular lignin modifying enzymes (LMEs) have very low substrate specificity which makes them suitable for degradation of many toxic, hazardous recalcitrant pollutants such as non-polymeric

Figure 1: The main species of white-rot fungi which have shown potential for bioremediation.

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genotyping approaches are complementary. Commercial SNP arrays are available for many important crops providing valuable data for high density genetic mapping, association studies and genomic selection.

Bioinformatics tools for Data management systems are essential to capture and manage the vast quantities of genomic data for applied breeding. However, storage and integration of the increasing amounts of data are a major challenge. While central sequence repositories such as GenBank, the DNA Databank of Japan (DDBJ) and European Molecular Biological Laboratory (EMBL) will continue to play an important role, more specialized databases focusing on particular crop species or clades will likely grow in importance. There are currently a range of specialised crop databases. These community databases feature customized genome browsers to access genomic sequences and associated annotation datasets, as well as genotypic data often including diversity data, transcriptomic data, gene models and metabolic pathways. Nevertheless, the general lack of well-integrated high-throughput phenotypic data in such databases remains an important limitation, particularly for breeding applications. Ongoing advances in crop phenotyping and better integration of phenotypic data into databases will drive a more multidimensional understanding of genotype-phenotype interactions, with major benefits for crop breeding.

Genomics assisted breeding in a changing climatecan be utilized to do

- QTL analyses and association studies to identify candidate genes: High density array based genotyping give dense linkage mapping and Genome wide association studies (GWAS) make use of past recombination in diverse association panels to identify genes linked to phenotypic traits at higher resolution than QTL analysis
- Genomic selection (GS) is one of the most promising developments in genomics-assisted breeding, allowing rapid crop improvement without detailed study of individual loci. A breeding population can then be developed from selected individuals and bred over multiple generations without the need for further time-consuming phenotyping

Future Perspectives

Crop improvement in terms of productivity having desirable traits and resistance to multiple stress is a pre-requisite in modern agriculture system. Conventional breeding for developing stress resistant crop varieties is time-consuming and labour intensive due to the quantitative nature of most of the stress trait sand difficulty in phenotypic screening. To identify the contrasting parents to develop population and genomic regions suitable for marker-assisted breeding strategies, establish accurate phenotyping methods, develop highly saturated molecular marker-based genetic linkage maps, and then identify QTLs (Quantitative Trait Loci) associated with traits of interest. Advances in genomic technologies are providing important tools for genomics-assisted breeding to adapt crops to a changing climate. Integration of these tools from sequencing to genome assembly, genotyping, marker discovery and genome editing, together with improved bioinformatics methods and high-throughput phenotyping, supported by sustainable funding models will allow molecular breeding of climate ready crops.

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and lignin peroxidases being involved in the degradation process. In conclusion, the inclusion of fungi in element cycling at local and global levels has important implications for living organisms, plant production and human health. The elimination of wide ranges of pollutants and wastes from the environment is an absolute requirement to promote a sustainable development with low environmental impact. Therefore, due to the magnitude of this problem and the lack of a reasonable solution, a rapid cost-effective

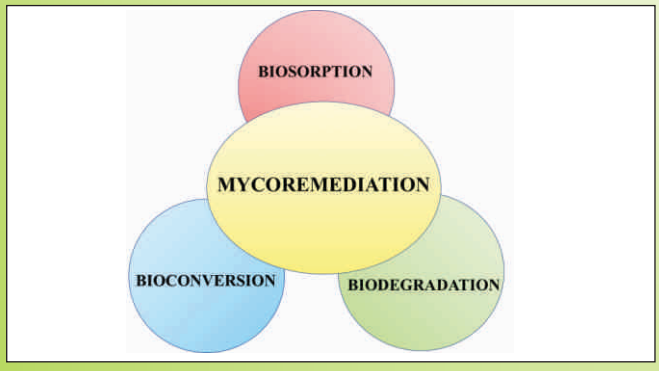

Figure 2: Mushrooms contribute in bioremediation of pollutants and metals by the processes of biodegradation, biosorption and bioconversion.

ecologically responsible method such as bioremediation through fungi (mushrooms) is essentially required.

Zoo Gardens as Window of Exploration, Education and Knowledge for the Public

S. K. Basu
UFL, Lethbridge AB Canada
Email: saikat.basu@alumni.uleth.ca

Zoological gardens or zoo gardens has a nostalgic connection to most of our lives. There are hardly any kids these days where the family has not made stop at the zoo for exploring the vibrant and divergent animal life at some point of his/her life. Zoos have strong impacts on all school going kids in knowing about mysterious animal life and behavior; and also to appreciate the diversity of our natural world. Several schools shave programs to take students to the zoos to introduce them to the spectacular diversity of animal life, to connect the kids to the natural world outside the four walls of the classroom in a practical nature based laboratory as well as an eye opener with opportunities of supervised exploration and gathering knowledge about our diverse natural world. Several countries include visit to zoos with various objectives at the primary, secondary and tertiary levels of education. The basic idea however is the same; and that is to respect and appreciate the diversity of life that we often forget in the din and bustle of our busy daily life.

Private zoos across different continents were in fact first established by the existing monarchy of the land, aristocrats, noblemen, influential courtesans and rich social elites as a part of their proud and exquisite collection of wild animals, birds and reptiles. Hence credit must be given to the monarchy and other elites of the society in establishing and maintaining the first of its kind of private zoos. With democratic reforms hitting various societies; private zoos slowly transformed into public zoos keeping in pace with the evolution of human social history and the rise and popularity of democratic values. When the need and importance of modern electorate and ordinary citizens started getting recognized; private

zoos slowly started transforming into public zoos.

The process was initiated in Europe and then spread to the rest of the world over time during the post colonial era. Many of these zoos were stocked with animals from different continents either by explorers and travelers or through armed campaigns during pre colonial era; and through army personnel, adventurers, explorers, hunters and researchers during the colonial and post colonial period. The collection of live and dead animals and birds from distant continents thus started rapidly filling in the shelves and galleries of natural history museums and cages of the zoos respectively. Such global collections enriched premier zoos with spectacular diversity of life from around the planet during the classical age of exploration, adventurism and post industrial revolution era.

However, it is important to remember that most zoos however started with a single point agenda; and that has been entertainment of the public primarily. The display of animals in the age old conventional or traditional zoos have been guided by the notion of capturing the interest of the public, to provide visiting families with an opportunity to have an enjoyable or memorable day out with their kids watching spectacular wildlife outside the confines of their homes without having the trouble to visit natural ecosystems or forests in far off lands and continents.

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Zoo management has been at its infancy with very little or almost no proper care for the animals housed in congested and over crowded cages. Appropriate veterinary diagnostics and treatments as well as modern vet medications were not available for the inmates. Many precious animals, birds and reptiles died during transportation and due to lack of suitable care, proper diet and nutrition or any facilities for modern animal care. Furthermore, unhygienic condition of the cages, cross contamination, injury and diseases also took a number of animal lives in the traditional zoos of the past.

But out of this chaos and confusion, modern zoo gardens got their basic foundation laid and established over few centuries to transform into world class public zoos from their initial humble beginning as private zoos for the aristocrats. Today, modern zoos around the world have evolved into different specialized forms such as zoological parks or gardens, fresh water and marine aquariums, eco parks, animal theme parks, vivarium, reptile houses, snake parks, animal laboratories for study of animal physiology and animal behavior, aviaries, animal nurseries and hatcheries, nature interpretation centers, animal rescue and rehabilitation centers, butterfly gardens, insect gardens, open air zoo, captive breeding centers, animal education and interpretation centers to mention only a handful.

The zoos and aquariums around the world are now governed by the World Association of Zoos and Aquariums (WAZA). The Padmaja Naidu Himalayan Zoological Park in Darjeeling, West Bengal is a member of WAZA. Otherwise, nodal central administrative units in individual country like the Central Zoo Authority (CZA) in India manage the zoo at the national level; following stringent international guidelines, protocol and procedures for zoos across the country. Zoo management has reached a new height now across the globe with respect to the management of zoo animals like housing them in artificial natural habitat like enclosures, better treatment for animals under captivity, zoo based breeding, modern veterinary treatment for sick or injured animals, catering to animal specific diet and nutrition, paying special attention to research on zoo animal physiology and behavior; and attempting to make zoo as an effective and efficient tool for public education and awareness rather than simple entertainment as in the past.

Zoos around the planet have now developed more into education and interpretation centers for wildlife, human-animal interaction platform; and for showcasing the spectacular global biodiversity. Zoos have travelled a long distance from the traditional agenda as showbiz into nature based education hub for the public to explore and educate themselves about nature, wildlife and biodiversity; and the value of natural world in our social and economic life. Such institutions and organizations have big funding with support from the government and public to conduct captive breeding for many endangered species to be able to replenish the natural ecosystems which they represent. The evolution of modern zoos from their traditional humble beginning is an inspirational story in itself. They have slowly undergone transformation from exhibitionism into knowledge centers with high focus on conservation.

Photo credit: **S. K. Basu & K. Arnica**
Source: **Shillong Times & Sikkim Express**

The Jipijapa palm and its relationship with the livelihood of indigenous families in Latin American countries

W. S. Poot-Pool[1*], W. Cetzal-Ix[1], S. K. Basu[2], M. Cuevas[1], E. Arcocha-Gómez[1]& A. A. Pascual-Baeza
[1]Tecnológico Nacional de México, Instituto Tecnológico de Chiná, Campeche, México; [2]UFL, AB, Canada;
*email: wilbert_poot@hotmail.com

Artisanal activity is one of the economic and cultural strategies used by indigenous families in many Latin American countries. The cultivation of Jipijapa palm (*Carludovicapalmata* Ruiz & Pav., Cyclanthaceae) relates to the livelihoods of indigenous families for the development of their socio-economic activities. The cultivation of the Jipijapa palm represents a source of employment for producers, artisans and merchants of diverse indigenous communities in the Latin American countries from Mexico to Ecuador. This consists of making hats, earrings, bracelets among others with the fibers obtained from the Jipijapa palm. For the manufacturingof these handicrafts, the young leaf of the palm is required, with which crafts are made; especially the production of hats, such as the famous hat called "Panama hat" (toquilla straw hat). The cultivation of Jipijapa palm in the indigenous families represents a source of employment for producers, artisans and merchants. However, one of the critical problems that artisan families face for manufacturing the handicrafts is the lack of adequate raw materials due to low agricultural production of Jipijapa palms.

The term "livelihood" includes the capacities, assets, material and social resources and all those activities of families to make a living; these can be characterized through five capitals (or assets): social, financial, natural, physical and human capital.Social capital refers to networks and relationships (whether informal or formal, such as governmental organizations and institutions) developed for the purpose of mutual benefit, generally associated with access to some type of resource. This capital could be used by individuals and groups to increase their production, lower transaction costs or access government funds more easily. Financial capital refers to the monetary-financial resources that people use to achieve their livelihood goals. Examples are credits, savings and remittances. Financial capital can contribute to the production of Jipijapa palm or manufacture of handicrafts. The natural capital is defined by the area of the agricultural, livestock or forestry lands that the families have at their disposal for the cultivation of the palm. Physical capital represents the machinery, tools, equipment, means of transport and infrastructure that people need to satisfy their basic needs and make their activities more productive related to the Jipijapa palm.Human capital represents the skills, knowledge and work skills that together enable communities to engage in different strategies and achieve their livelihood goals. It is measured by the number of adults of working age, the level of schooling, experience in labor markets, size and composition of the family and the age of the head of the family. This capital can influence the management of the Jipijapa palm, since the age of the producer defines in some way the quantity and intensity of the work activities carried out within the family. ***Photo credit:*** **Authors**

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Joint Conservation Initiative (JCI)

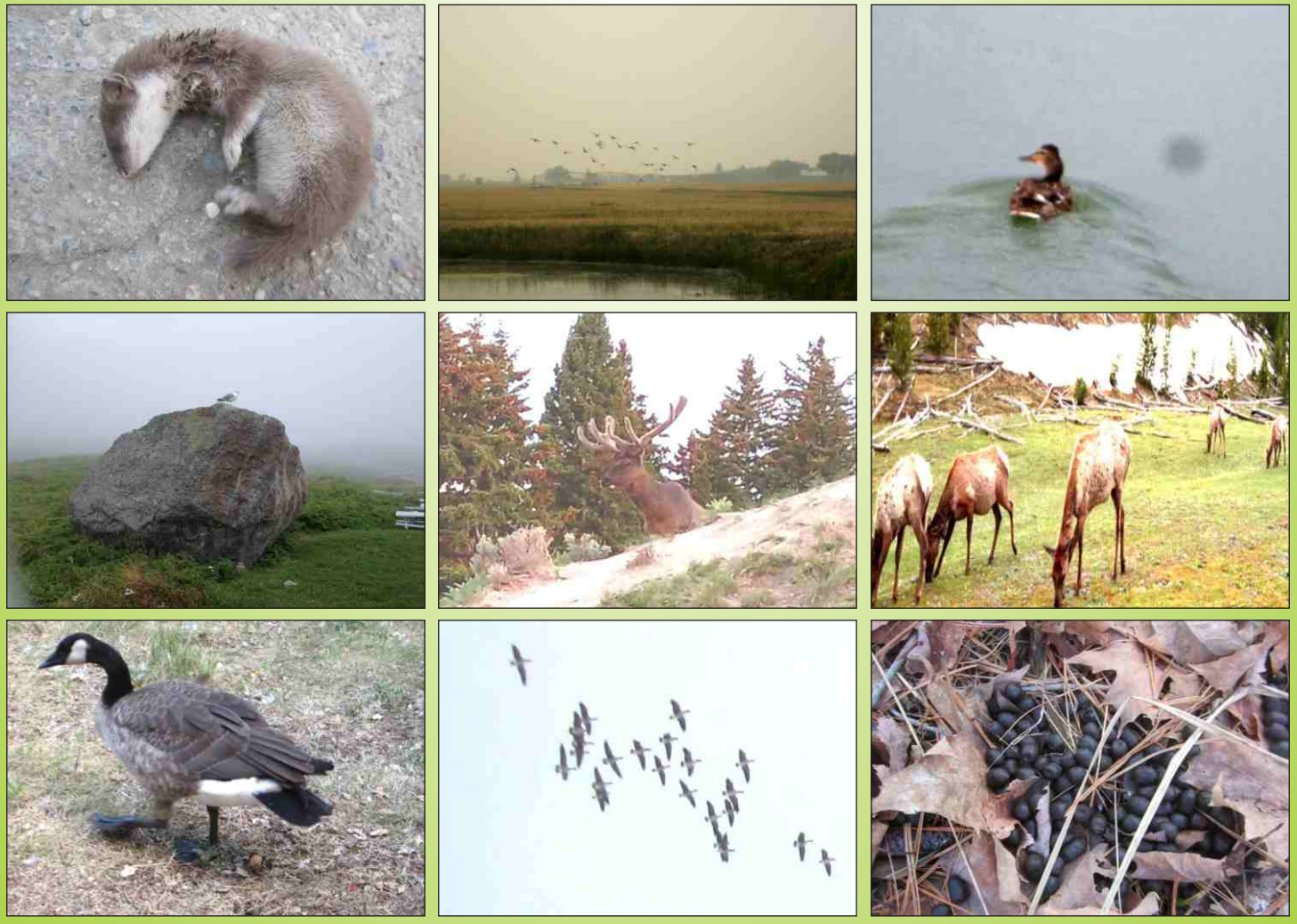
S. K. Basu[1] & W. Cetzal-Ix[2*]
[1]UFL, AB, Canada; [2]Tecnológico Nacional de México, Instituto Tecnológico de Chiná, Campeche, México;
*email: rolito22@hotmail.com

The South and SE Asia is one of the most populous parts of our planet. Yet the region represents one of the richest and spectacularly biodiverse area of the globe too. This vast biogeogrphical area is represented by four megabiodiverse nations like India, the Philippines, Indonesia and Malaysia. If we also add China and the Papua and New Guinea; two more megabiodiverse nations with geographical, geological, biological and anthropological continuity with South and SE Asia; this vast biogeographic region can certainly be described as the highest biodiverse area of our planet Earth.

However, the region being over populated with two of world's largest populous nation (India and China) located in the region; together with a young population base across the vast stretches of South and SE Asia, there are serious issues in protecting and conserving this spectacular biodiversity. Several anthropogenic factors like overpopulation, heavy dependence of rural and fringe communities on the local forest resources for their daily sustainability, poor economy, unstable political system, rising unemployment, insurgency and ethnic tensions, illegal infringement into forested areas, major infrastructural developments without paying any attention to vulnerable local ecosystems, anthropogenic wildfires, over grazing in forested areas, human-animal conflicts, poaching, trafficking of wildlife and wildlife parts across porous international borders, thriving illegal wildlife markets in several pockets of south China and SE Asia have been detrimental towards the fragile forests and rich wildlife of this majestic global biodiversity hotspot.

Under these circumstances it will be important for all the countries in the region to join hands and work together to develop a comprehensive common platform to protect the vast forests and the rich biodiversity of the region as well as the various indigenous communities that are dependent on these forests for several generations. China together with the South Asian Association of Regional Cooperation (SAARC) and the Association of South East Asian Nations (ASEAN) representing South and SE Asia respectively could work together in developing a Joint Conservation Initiative (JCI). Under this proposal, joint management of the international borders to prevent cross border trafficking, illegal migration and transportation of wildlife and wildlife parts, poaching etc could be successfully restricted.

Establishing safe migration corridors for transboundary species, sharing conservation data, expertise, research and development in forest and wildlife conservation, training and educating the border security forces, vigilance and customs department staffs and forest



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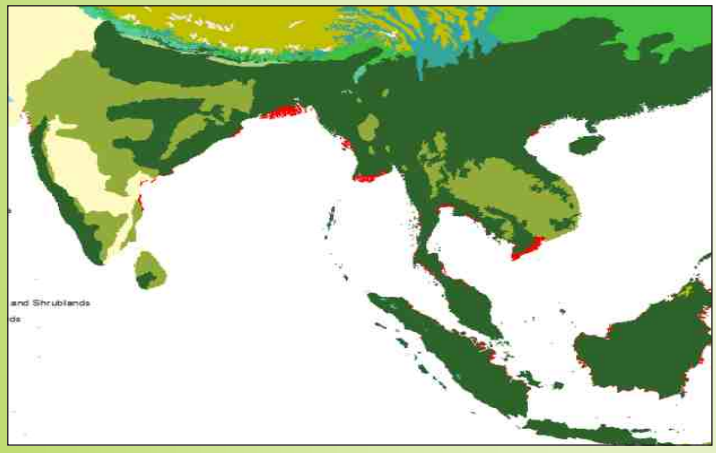

guards between adjacent nations could greatly help in conserving the local biodiversity and curb poaching and trafficking activities under JCI. Exchange of breeding stocks of similar species to aid the gene pool in one country by anther or joint captive breeding and release of wildlife could help in building conservation cooperation among all the countries in the region. This proposal if implemented diligently and sincerely with joint funding through BRICS Bank, Asian Development Bank, World Bank, IMF, IUCN, UN etc could easily transform into a global model among countries in other continents sharing common international border. ***Photo credit:*** **S. K. Basu**

NATIONAL ENVIRONMENTAL SCIENCE ACADEMY
206 Raj Tower -1, Alaknanda Community Centre,
New Delhi -110019. **Ph.: 011-2602 3614**
E-mails: nesapublications@gmail.com; nesapub@yahoo.co.in