National Seminar on

PLANT BIODIVERSITY FOR FOOD NUTRITION AND HEALTH SECURITY IN NORTH-WEST HIMALAYAS

Proceedings and Recommendations

27 - 28 November 2023

Venue : Shoolini University, Solan, Himachal Pradesh

Organized by

भाकृअनुप ICAR

ISPGR 1987

Shoolini University

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National Seminar on

Plant Biodiversity for Food, Nutrition and Health Security in North-West Himalayas

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Organized by

Indian Society of Plant Genetic Resources (ISPGR), New Delhi
Shoolini University (SU), Solan, Himachal Pradesh
ICAR-National Bureau of Plant Genetic Resources (NBPGR), New Delhi

Co-organized by

Protection of Plant Varieties and Farmer's Rights Authority (PPVFRA), New Delhi
Alliance for Bioversity International and CIAT, New Delhi
Trust for Advancement of Agricultural Sciences (TAAS), New Delhi
Chaudhury Sarwan Kumar Himachal Pradesh Krishi Vishwavidyalaya (CSKHPKV), Palampur
Dr YS Parmar University of Horticulture and Forestry (YSPUHF), Solan

Sponsored by

Mahyco Private Limited, Jalna
HP Council for Science Technology and Environment (HIMCOSTE), Shimla
Satluj Jal Nigam (SJVN), Shimla
Ambuja Cement Foundation
Jaypee Scientific

Published by:

Indian Society of Plant Genetic Resources, New Delhi, India

Citation:

Paroda R.S., P.K. Khosla, R.K. Tyagi, A. Agrawal (eds) (2024) **Proceedings and Recommendations of National Seminar on Plant Biodiversity for Food, Nutrition and Health Security in North-West Himalayas**. Shoolini University, Solan, Nov. 28-29, 2023. Indian Society of Plant Genetic Resources, New Delhi, India, p. 70 + x.

ISBN: **978-81-950114-8-3**

Date of Publication:

April 30, 2024

Youtube Link:

Day 1: https://www.youtube.com/watch?v=33uX55dnhrs&t=4526s

Day 2: https://www.youtube.com/watch?v=1LbMRcF04AQ

Contents

Preface

The North-West Himalayas (NWH) are home to a rich tapestry of plant biodiversity, with a wealth of species that have been used for food, nutrition, and health for centuries. Biodiversity plays a vital role in the cultural and economic life of the region. It provides food, medicine, and other essential resources for millions of people. However, biodiversity is increasingly under threat from climate change, habitat loss, and other anthropogenic factors.

This **National Seminar on Plant Biodiversity for Food, Nutrition and Health Security in the North-West Himalayas (PBFNWH)** was held to bring experts together from a range of disciplines to discuss the challenges and opportunities for conserving and using plant biodiversity for food, nutrition, and health security in the region. The event was organized in hybrid mode by Indian Society of Plant Genetic Resources (ISPGR), New Delhi, Shoolini University (SU), Solan, Himachal Pradesh and ICAR-National Bureau of Plant Genetic Resources (NBPGR), New Delhi, which was held at Shoolini University Campus in Bajhol, Himachal Pradesh.

The seminar covered a wide range of topics, ranging from the importance of plant biodiversity for food security and nutrition, threats to plant biodiversity, traditional knowledge and practices for using plant biodiversity for food and medicine, conservation strategies, access, exchange, and benefit sharing, entrepreneurship and value addition, role of youth including women and enabling policies on conservation and sustainable use. It brought together over 200 participants, from various organizations including the institutes of Indian Council of Agricultural Research (ICAR), Alliance for Biodiversity International and CIAT, Central and State Agricultural Universities, Council for Scientific and Industrial Research (CSIR), Defense Research and Development Organization (DRDO), Himachal Pradesh State Government agencies, private stakeholders, and progressive farmers.

Over the course of two days, the PBFNWH featured 21 plenary/keynote/invited/evening lectures and 20 rapid oral presentations in the five technical sessions, one Plenary Session, an evening lecture and a Valedictory Session. A concurrent poster session by young scientists, faculty and students showcased some 51 posters. The papers presented at the seminar provide a valuable resource for researchers, policymakers, and practitioners and communities working on plant biodiversity conservation and utilization in the North-West Himalayas (NWH). A special cultural program by students of Shoolini University added flavor to the academic feast.

The organizers of the PBFNWH would like to express their deepest gratitude to **Padma Bhushan Dr R.S. Paroda,** President, ISPGR & Chairman, TAAS, New Delhi, for being the driving force behind the organization of this National Seminar through his invaluable guidance and insightful suggestions in conceiving and steering the program. The immense support extended by **Dr P.K. Khosla,** Founder & Chancellor, Shoolini University, Solan, was instrumental to the successful organization of the event. Heartfelt thanks are also extended to **Dr Himanshu Pathak,** Secretary, Department of Agricultural Research and Education (DARE) and Director General, Indian Council of Agricultural Research (ICAR), **Dr Trilochan Mohapatra,** Chairperson of the Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA), **Dr. Sanjay Kumar,** Chairperson of the Agricultural Scientists' Recruitment Board (ASRB) and **Dr P.L. Gautam,** Chancellor, Dr Rajendra Prasad Central Agricultural University (RPCAU), Samastipur, Bihar. Their leadership and support were essential to the event's planning and execution. Unwavering technical and administrative support provided by **Dr Gyanendra Pratap Singh, Director,** ICAR-National Bureau of Plant Genetic Resources (NBPGR) and **Dr Atul Khosla,** Vice Chancellor, Shoolini University, was crucial in the seamless conduct of PBFNWH. Special thanks are extended to both the Vice Presidents of ISPGR, **Dr R.K. Tyagi** and **Dr J.C. Rana** for their support in developing the technical program and conduct of the sessions during the conference. Special thanks to the Poster

Evaluation Committee comprising **Dr B.S. Dhillon,** Former VC, PAU (Chairperson), **Dr Laxmi Kant**, Director, ICAR-VPKAS, **Dr R.K. Sharma**, Chief Scientist, CSIR-IHBT, **Dr Santanu Mukherjee**, Assistant Professor, Shoolini University and **Dr M.C. Yadav,** Principal Scientist, ICAR-NBPGR (Convenor). We extend very warm thanks to **Dr Shashi Paroda, Mrs Saroj Khosla, Mrs Atul Khosla** and **Dr & Mrs Ashish Khosla** for their support and presence in the seminar.

While all the members of the Organizing Committee are gratefully acknowledged for their help in smooth conduct of the event, it is prudent to mention the names of few individuals. **Dr Mohar Singh,** Officer-in-Charge, ICAR-NBPGR, Shimla, **Dr Saurabh Kulshreshtha,** Dean, School of Biotechnology, Shoolini University, **Dr Y.S. Negi,** Dean, MS Swaminathan School of Agriculture, Shoolini University along with large number of their team members, were the faces behind the scene who worked tirelessly for making PBFNWH a success. A special word of thanks goes to all members of Executive Council (EC) of ISPGR, especially **Dr Monika Singh,** Councillor (NZ) and **Dr Kuldeep Tripathi,** Treasurer & Councillor (NZ) for undertaking a major chunk of work related to organizing this seminar, and **Dr Manjusha Verma, Joint Secretary** for helping in publishing the Souvenir. Support provided by staff of Shoolini University, ISPGR, ICAR-NBPGR, and TAAS in technical and logistic matters is sincerely appreciated. We would also like to thank all the Vice Chancellors, Directors, invited speakers and authors from various Universities and institutes, whose papers were presented at the seminar, and all the delegates and guests who contributed to the discussions.

We duly acknowledge the financial support provided by Protection of Plant Varieties and Farmers Rights Authority (PPV&FRA), New Delhi, Alliance for Bioversity International and CIAT, New Delhi, Mahyco Pvt Ltd., H.P. State Council for Science Technology and Environment (HIMCOSTE), Shimla, Satluj Jal Vidyut Nigam (SJVN), Shimla, and Ambuja Cement Foundation and J.P. Scientific Ltd., New Delhi. Knowledge partners are gratefully acknowledged especially Trust for Advancement of Agricultural Science (TAAS), New Delhi, CSKHP Krishi Vishwavidyalaya (CSHPKV), Palampur, and Dr Y.S. Parmar University of Horticulture and Forestry (YSPUHF), Solan. All the support staff of Shoolini University, NBPGR, ISPGR, TAAS are thanked, with special mention of Mr Sunil Bhardwaj and Mr Arup Das from ISPGR. Ms Ruchi Jha is thanked for her inputs in designing of the document.

We hope that the proceedings of this seminar will help to raise awareness of the importance of plant biodiversity for food, nutrition, and health security in the NWH and will promote further research, action and collaboration to conserve this vital biological resource. The recommendations emanating from the deliberations are expected to be useful to research managers, scientists, academicians, educators, farmers and students, especially from the NWH region.

(Anuradha Agrawal)
Organizing Secretary, PBFNWH
& General Secretary, ISPGR

April 25, 2024

Abbreviations and Acronyms

ABS	Access and Benefit Sharing
AI	Artificial Intelligence
BDA	Biological Diversity Act, 2002
BMC	Biodiversity Management Committee
CBD	Convention on Biological Diversity
CGIAR	Consultative Group for International Agricultural Research
CIAT	International Centre for Tropical Agriculture (Centro Internacional de Agricultura Tropical)
CITH	Central Institute of Temperate Horticulture
COVID	Corona Virus Disease
CSIR	Council of Scientific and Industrial Research
CSKHPKV	Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishwavidyalaya
CWR	Crop Wild Relatives
DAC&FW	Department of Agriculture, Cooperation and Farmers' Welfare
DARE	Department of Agricultural Research and Education
DIHAR	Defence Institute of High-Altitude Research
DMR	Directorate of Mushroom Research
DRDO	Defence Research and Development Organisation
DST	Department of Science and Technology
FGR	Forest Genetic Resource
FPO	Farmer Producer Organization
GI	Geographical Indication
GWAS	Genome-Wide Association Studies
HDP	High Density Planting

HIMCOSTE	Himachal Pradesh Council for Science, Technology & Environment
HPTDC	Himachal Pradesh Tourism Development Corporation Ltd.
IARI	Indian Agricultural Research Institute
ICAR	Indian Council of Agricultural Research
IHBT	Institute of Himalayan Bioresource Technology
IIHR	Indian Institute of Horticulture Research
IPR	Intellectual Property Right
ISPGR	Indian Society of Plant Genetic Resources
LFS	Local Food Systems
MAHYCO	Maharashtra Hybrid Seed Company Private Limited
NABMGR	National Agro-Biodiversity Board for Management of Genetic Resources
NAHEP	National Agricultural Higher Education Project
NATP	National Agricultural Technology Project
NBAGR	National Bureau of Animal Genetic Resources
NBAIM	National Bureau of Agriculturally Important Microorganisms
NBAIR	National Bureau of Agricultural Insect Resources
NBFGR	National Bureau of Fish Genetic Resources
NBPGR	National Bureau of Plant Genetic Resources
NGB	National Genebank
NGO	Non-Governmental Organization
NWH	North-West Himalayas
PGR	Plant Genetic Resources
PPP	Public Private Partnership
PPV&FR	Protection of Plant Varieties and Farmers' Rights Act, 2001
PPV&FRA	Protection of Plant Varieties and Farmers' Rights Authority

PBFSNWH	National Seminar on Plant Biodiversity for Food, Nutrition and Health Security in North-West Himalayas
QTL	Quantitative Trait Loci
R&D	Research and Development
RPCAU	Dr Rajendra Prasad Central Agricultural University
SBB	State Biodiversity Board
SDGs	Sustainable Development Goals
SKUAST-K	Sher-e-Kashmir University for Agricultural Science and Technology, Kashmir
TAAS	Trust for Advancement of Agricultural Sciences
TRIPs	Trade Related Intellectual Property Rights
UUHF	Veer Chandra Singh Garhwali Uttarakhand University of Horticulture and Forestry
VPKAS	Vivekananda Parvatiya Krishi Anusandhan Sansthan
YSPUHF	Dr Y.S. Parmar University of Horticulture & Forestry

Background

Context and Rationale

The world continues to face ever-growing challenges such as combatting hunger, ensuring food security, and malnutrition persist and eradicating all forms of malnutrition. The COVID-19 pandemic has exacerbated these issues, exposing vulnerabilities in our agricultural and food systems and pushing the number of food-insecure individuals from 800 million to a staggering 957 million, globally.

To address these pressing concerns and build resilience against potential future pandemics, a, renewed emphasis on plant diversity is essential, particularly within local food systems (LFS). By doing so, we can make significant strides towards achieving the Sustainable Development Goals (SDGs), specifically Goal 1 (No poverty), Goal 2 (Zero hunger), Goal 3 (Good health and well-being), and Goal 12 (Responsible consumption & production). The UN Food Systems Summit, held on September 23, 2021, marked a significant turning point by introducing bold new initiatives as part of the UN's Decade of Action to achieve the SDGs by 2030, refocusing on regenerative agriculture and LFS.

Furthermore, recognizing the potential of millets to offer sustainable market opportunities for producers and consumers, the UN General Assembly declared 2023 as the 'International Year of Millets (IYM 2023)' during its 75th session in March 2021. This declaration reinforces the importance of harnessing the power of millets to address global challenges. Millets represent traditional crops with high nutrient value that can thrive on marginal land with minimal inputs. They also exhibit resilience to climate change and offer significant nutritional and health benefits.

The Himalayas, recognized as one of the 36 global biodiversity hotspots, stand out for their exceptional richness and representation of diverse plant life. This region is endowed with a remarkable array of plant biodiversity, including agrobiodiversity, due to wide range of climatic and ecological conditions. It is a hotspot for an extensive diversity of cereals, millets, pseudo-cereals, pulses, oilseeds, vegetables, fruits, spices, condiments, medicinal plants, herbs, and fibres. Further, local foods are gaining recognition as the optimal choice for ensuring the food, nutrition, and health security of the people living in these regions.

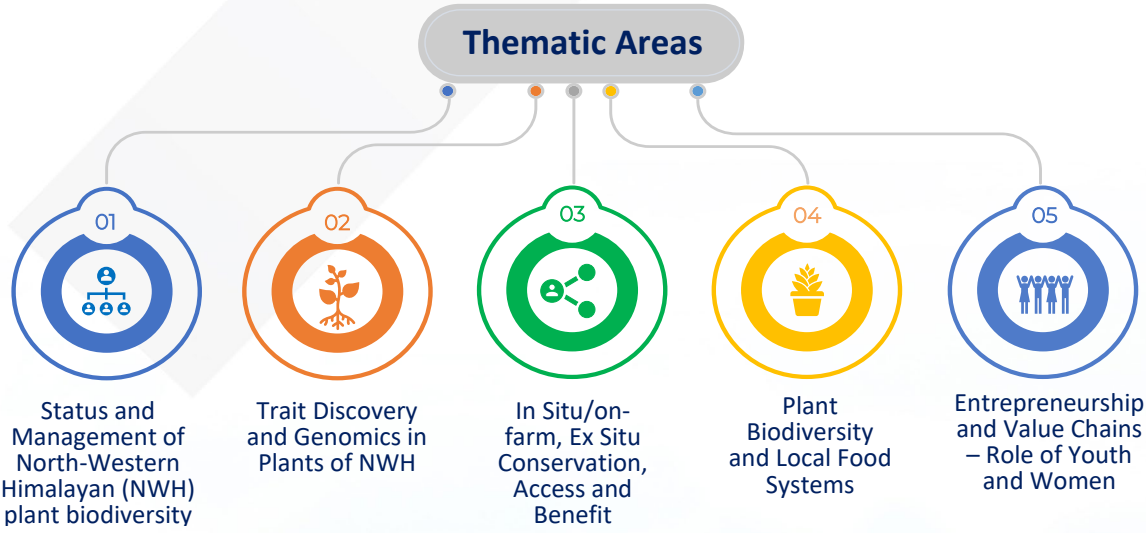
The North-Western Himalayan region is a treasure trove of plant genetic resources (PGR). It boasts approximately 273 cultivated crop species, 898 wild relatives, 744 wild edible plants, and 591 plants with industrial potential. The rich inter-specific diversity exists for genera like *Avena, Amaranthus, Chenopodium, Fagopyrum, Allium, Hordeum, Linum, Pyrus, Prunus, Rubus, Fragaria, Sorbus, Rosa, Lilium, Vicia, Lepidium, Lathyrus, Cucumis, Solanum* and *Trichosanthes* contributing significantly to the maintenance and improvement of the traditional Himalayan agro-ecosystems. The region is also home to numerous endemic crops and varieties, such as red rice, hill maize, naked barley, saffron, black cumin, pine nuts, walnuts, dry apricots, almonds, various *Allium* species, black soybean (bhatt), Kinnauri pea and several others. The North-West Himalayas (NWH) harbor diverse millet and pseudocereal varieties, including finger millet, barnyard millet, foxtail millet, amaranth, buckwheat, and chenopod. These crops, with their high nutritional value, can thrive on marginal land with minimal inputs and are resilient to climate change. They offer a valuable opportunity to promote sustainable millet production in the region.

o address the need for nutritious diets that boost immunity and remain affordable, a critical strategy is the development of biofortified and nutrition-rich plant varieties. This can be achieved through sustainable utilization of PGR. This calls for accelerating the incorporation of PGR into national crop breeding programs to create improved varieties that not only withstand climate change but also offer

enhanced nutritional value. Achieving this goal necessitates collaboration among various stakeholders, including public-private partnerships (PPP), inter-institutional cooperation, and international collaborations. Utilizing cutting-edge scientific techniques such as phenomics, marker-assisted selection, genomics, and genome editing can expedite the development of new plant varieties.

In the light of rapid habitat/species loss, climate changes and changes in food consumption patterns, it is imperative to conduct a comprehensive assessment of plant biodiversity in the North-Western Himalayan region. This assessment should encompass their production potential, the current status of genetic improvement research, conservation practices through utilization, their nutritional and medicinal values, options for value chains, socio-economic considerations (including consumption patterns, costs, and affordability), and the necessary policy support required to promote them as alternative sources of food, nutrition, and health security.

To address the above-mentioned critical issues, a seminar was organized, bringing together all stakeholders, including researchers, intellectuals, regulators, policymakers, farmers, NGOs, and private sector representatives, on a neutral platform. The Indian Society of Plant Genetic Resources (ISPGR), Shoolini University, Solan, ICAR-National Bureau of Plant Genetic Resources (NBPGR), in collaboration with the Alliance of Bioversity International and CIAT, Trust for Advancement of Agricultural Sciences (TAAS), and other knowledge partners, organized the 'National Seminar on Plant Biodiversity for Food, Nutrition, and Health Security in the North-Western Himalayas (PBFSNWH)' during November 27-28, 2023. The aim was to contribute to the development of a roadmap for the optimal, efficient, and sustainable utilization of NWH plant biodiversity, along with the formulation of enabling policies. Ultimately, this will enhance food and nutritional security and improve overall health in the region.



Venue

University Auditorium, Shoolini University, Village Bajhol, PO Sultanpur, Bajhol, Solan-173229, Himachal Pradesh

DAY 1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NATIONAL SEMINAR
Plant Biodiversity for Food, Nutrition and Health Security in North-West Himalayas

Inaugural Session

The Seminar commenced on November 27, 2023, with an inaugural address delivered by Padma Bhushan Dr R.S. Paroda, Chief Guest and President of the ISPGR, and Chairman of TAAS, New Delhi. The session was presided over by Prof. P.K. Khosla, Founder and Chancellor of Shoolini University, Solan. Also present on the dais were distinguished guests including Dr P.L. Gautam, Chancellor of Dr Rajendra Prasad Central Agricultural University (RCPAU), Samastipur, and Dr Sanjay Kumar, Chairperson of the Agricultural Scientists Recruitment Board (ASRB), New Delhi, along with Prof Atul Khosla, Vice Chancellor (VC) of Shoolini University, Solan, and Dr Anuradha Agrawal, General Secretary of ISPGR, New Delhi & National Coordinator of the National Agricultural Higher Education Project (NAHEP), ICAR, New Delhi.

The seminar encompassed a broad spectrum of topics, attracting over 200 participants from various organizations, including the institutes of ICAR, Alliance for Biodiversity International and CIAT, Central and State Universities, Council for Scientific and Industrial Research (CSIR), Defense Research and Development Organization (DRDO), Himachal Pradesh State Government agencies, private stakeholders, and progressive farmers.

Prof. Atul Khosla, VC of Shoolini University, extended a warm welcome to the Chief Guest, Guests of Honour, distinguished dignitaries, speakers, and participants from various organizations. He underscored the intricate relationship between biodiversity and economics, emphasizing the critical importance of biodiversity conservation for economic advancement, drawing parallels with Switzerland's economic growth. To expedite economic progress, he advocated for promoting the industry and service sector, alongside the adoption of biotechnological innovations. Prof. Khosla expressed optimism that over the next two days, experts of the seminar would deliberate on leveraging biodiversity to enhance horticultural and agricultural production in Himalayan states. Highlighting the economic significance of biodiversity, he proposed government subsidies for its conservation.

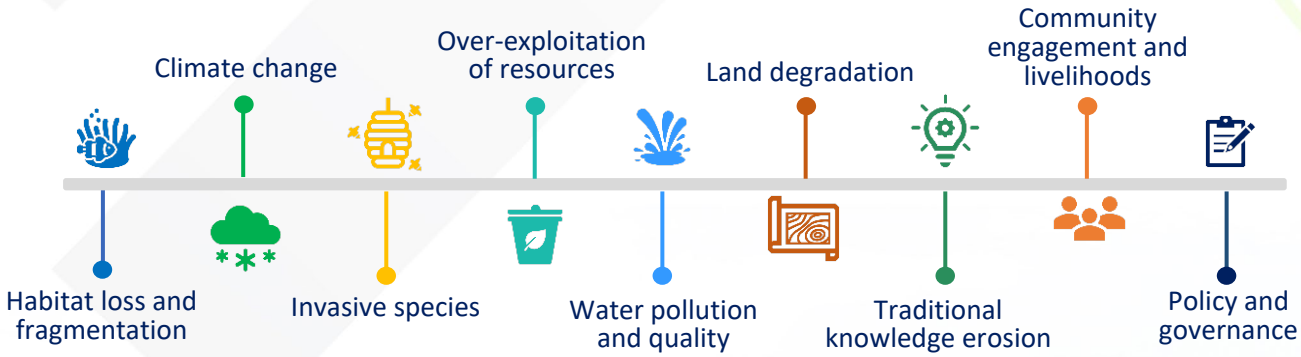
Dr Sanjay Kumar, Chairperson of ASRB, reiterated the significance of Himachal Pradesh's biodiversity in resource generation, particularly through innovative floriculture. He emphasized the need for focused research to harness plant biodiversity effectively, advocating not just data generation but also strategies to enhance productivity and bolster the region's economy. Dr Kumar proposed the establishment of protected plant corridors and the development of a policy paper for conserving the biodiversity of the NWH region.

Dr P.L. Gautam, Chancellor of RPCAU, reminisced about the times when biodiversity conservation was uncontroversial, as biodiversity was considered as a common heritage of global community. Since then, many developments have taken place through international and national treaties and other legalities, amidst climate change and environmental degradation. He proposed a mission-mode approach to collect and conserve Himalayan biodiversity, akin to the National Agricultural Technology Project (NATP) wherein about 200 institutions

were involved for agrobiodiversity conservation. Additionally, he suggested developing a policy paper for managing PGR in India.

Prof. P.K. Khosla, Chancellor of Shoolini University, while welcoming the dignitaries and participants of the seminar, echoed sentiments regarding the richness of Himalayan plant biodiversity. He stated that there is ample potential to use the flora which is abundantly available in the region in various agricultural and horticultural crops to increase production, productivity and economic growth. Prof. Khosla underscored the role of Shoolini University in training students with entrepreneurial skills and quality education, contributing to the region's socio-economic growth.

Dr R.S. Paroda, Chief Guest, President of ISPGR and Chairman of TAAS, delivered the inaugural address. He extended his gratitude to all the delegates and thanked Prof. Khosla for hosting this significant seminar at Shoolini University Campus. Dr Paroda emphasized the critical importance of the biodiversity of the NWH in maintaining ecological balance and supporting the livelihoods of local communities. He outlined key issues and concerns regarding biodiversity and local food security in this region, including:



Addressing these issues, he advocated for a holistic approach involving collaboration between local communities, government bodies, NGOs, and researchers. Conservation strategies should strive to balance biodiversity conservation with the needs of local communities, ensuring sustainable development and food security in the NWH region.

Dr Paroda proposed several strategies for holistic management of plant biodiversity:

1. *Research* and Monitoring

- Conduct research to understand the specific ecological dynamics of the NWH and the impacts of interventions
- Establish monitoring programs to track changes in biodiversity and evaluate the effectiveness of conservation measures

2. International Collaboration

- Collaborate with neighbouring regions and countries to address transboundary issues affecting biodiversity
- Seek support and partnerships from international organizations to implement large-scale conservation initiatives

3. Promote Traditional Knowledge

- Document and promote traditional knowledge related to biodiversity conservation and sustainable resource management
- Integrate traditional practices into conservation strategies and engage local communities as stewards of their ecosystems

4. Capacity Building

- Build the capacity of local communities, government agencies, and non-governmental organizations (NGOs) to actively lead/ participate in conservation initiatives
- Foster collaboration between scientists, policymakers, and local stakeholders for knowledge exchange and capacity building

Dr Paroda concluded his address by underscoring that the implementation of these strategies will require coordinated efforts from various stakeholders, including government bodies, NGOs, local communities, and the scientific community. He called for establishment of a 'Centre of Excellence for Himalayan Biodiversity', possibly in Shoolini University or any other institute in the region willing to take up the initiative. A participatory and inclusive approach will contribute to the long-term success of biodiversity conservation and food security in the NWH.

During the Inaugural Session, Dr R.S. Paroda, Chief Guest and other dignitaries on the dais released the following publications:

- **Souvenir- National Seminar on Plant Biodiversity for Food Nutrition and Health Security in North-West Himalayas (PBFSNWH)** (2023). *Compiled and Edited by* Manjusha Verma, Mohar Singh, Jyoti Kumari, Sherry Rachel Jacob, Padmavati G. Gore, Santanu Mukherjee, Saurabh Kulshreshtha, Y.S. Negi, Monika Singh and Kuldeep Tripathi.
- **French Bean Diseases Diagnosis, Epidemiology and Management** (2023). *Authored by* Satish K. Gupta and Monika Sharma.
- **E-Book of Abstracts of PBFSNWH** (2023). *Compiled and Edited by* Anuradha Agrawal, Monika Singh, Kuldeep Tripathi, Vartika Srivastava, R.K. Pamarthi, Narendra Negi.
- **Indian Journal of Plant Genetic Resources (IJPGR),** Volume 36 (3), 2023.

The Inaugural Session was concluded with a formal vote of thanks delivered by **Dr Anuradha Agrawal,** General Secretary, ISPGR, expressing gratitude to the Chief Guest, other dignitaries on the dais, invited guests, and delegates.

Technical Session 1

Theme: Status and Management of Plant Biodiversity of North-West Himalayas (NWH)

Conveners

Dr R.K. Gautam
ICAR-NBPGR, New Delhi

Dr B.D. Sharma
Eternal University Baru Sahib, Rajgarh, Sirmaur

Co-Chairs

Dr P.L. Gautam
Chancellor, RPCAU, Samastipur

Prof. P.K. Khosla
Chancellor, Shoolini University, Solan

Rapporteurs

Dr Kuldeep Tripathi
ICAR-NBPGR, New Delhi

Dr Vinaykumar Rachappanavar
Shoolini University, Solan

The agenda for Technical Session I included a plenary lecture, four invited presentations and three rapid oral presentations.

Plenary Lecture

Dr Sanjay Kumar, Chairman of ASRB, delivered a plenary lecture titled ***'Generating Bio-economy Using Bioresources of North-West Himalayas',*** wherein he underscored the significance of bio-processing of plants and tissue culture-based planting material multiplication specific to the Himalayan region. He delineated the challenges associated with bioresources in generating bioeconomy, including issues such as the quality and quantity of plant material, value addition, skill development, processing, packaging for branding products, and market linkage. Dr Kumar illustrated the changing landscape of rural economy and the phenomenon of reverse migration by advocating for farmer empowerment through the promotion of floriculture in Ladakh and Himachal Pradesh via mission floriculture. Case studies on the socio-economic impacts of cultivating *Stevia* and *Ferula* (heeng) in Himachal Pradesh and Ladakh, and apple cultivation in North-

eastern states were presented to highlight the profitability of these ventures supported by existing government programs. The introduction and cultivation of new fruits and spice crops like monk fruit, cinnamon, and mulethi were identified as lucrative avenues for enhancing farmers' income in Himachal Pradesh. Dr Kumar emphasized the adoption and practice of new-generation farming systems such as tissue culture, aeroponic, and hydroponic techniques, particularly for medicinal and floriculture crops. Additionally, he discussed several initiatives undertaken by CSIR-IHBT to establish start-ups, which have successfully launched useful products, and facilitated the transfer of numerous technologies to industries in Himachal Pradesh.

Invited Lectures

Dr O.P. Chaurasia, Director of Defence Institute of High-Altitude Research (DIHAR) under the Defence Research and Development Organisation (DRDO), Leh, Ladakh, delivered a presentation on ***'Plant Diversity in Cold Desert Himalayas: Challenges and Opportunities in Food, Nutrition & Health'***. He highlighted the diverse plant species used for medicinal, edible, spices, and fruit purposes in the Ladakh region. Dr Chaurasia discussed about the vast genetic diversity among 200 seabukthorn accessions. At DIHAR, package of practices for growing Seabuckthorn and commercialized Seabuckthorn-based products were developed for which raw material was supplied by the Farmers' Cooperative Societies. By virtue of its economic potential, Seabuckthorn has been included as horticulture crop in five Himalayan states. Recently, The Geographical Indication (GI) Registry has officially granted the GI tag to 'Ladakh Seabuckthorn' in 2023. He emphasized the economic potential of seabuckthorn, as evidenced by its inclusion as a horticulture crop in five Himalayan states and the official grant of the GI tag to 'Ladakh Seabuckthorn' in 2023. Furthermore, research findings on apricot at DIHAR, including the existence of world's sweetest (TSS=37,9%) apricot, establishment of an apricot processing plant to enhance farmers' income, were presented. Ladakh Apricot' also got first GI tag. Alpine herbal garden established at DIHAR conserves high-value medicinal plant wealth of cold desert region. Dr Chaurasia concluded by stressing the need for sustainable utilization of trans-Himalayan plant biodiversity, given the fragile nature of the cold desert and trans-Himalayan ecosystem.

Dr Lakshmi Kant, Director of ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan (VPKAS), Almora, Uttarakhand, delivered the second invited lecture entitled ***'Genetic Enhancement of Local Food Systems in North-Western Himalayan Region'***. He emphasized the importance of local food systems (for ensuring food and nutritional security, highlighting their adaptation to local ecological, social, cultural, and economic settings. Dr Kant discussed the social, economic, and environmental domains of local food systems, citing the successful model of 'Barahnaaza' in Uttarakhand as an example wherein the practice of mixed cropping of 12 cereals, pulses, oilseed, vegetables and fruit meet all food, nutrition and fodder security and maintaining the soil fertility. At ICAR-VPKAS, about 17,500 accessions of 25 crops are conserved which are being utilized in varietal improvement programs. He concluded his discussion by suggesting possible strategies for mitigating the challenges of hunger, food insecurity and malnutrition by:

Divert more investment in LFS for improving agricultural productivity and strengthening supply value chain

Creating awareness about the nutritional benefits of LFS and promoting proper marketing

Using new tools to increase productivity and nutritional values for sustainable LFS

Developing robust database related to food and nutritional crops and improvement in food distribution system

Bridging the gaps in nutritional composition through dietary diversity including the biofortified crops

Dr M.K. Verma, Director of ICAR-Central Institute of Temperate Horticulture (CITH), Srinagar, Jammu & Kashmir, made an online presentation on ***'Current Status and Potential of Temperate Horticulture'***. He discussed the national and international status of temperate fruit crops, their role as nutraceuticals and improving livelihoods, varietal development in India, improved production and protection technologies to increase production of temperate fruit crops. He delved on the role of fruits and nuts to combat the various diseases, as source of macro and micronutrients. A comparative account on nutraceutical properties of various temperate fruit and nuts was presented. Dr Verma highlighted the challenges faced in temperate horticulture, such as low production and productivity, trade deficits, and pest management issues. He suggested strategies for increasing production and productivity, including the use of new genetic resources, high density planting (HDP) using high yielding varieties, identification of superior rootstocks, and development of designer tress with balance shoots and roots, and crop diversification and gave examples from work done at CITH.

Dr Jagadish Singh, Scientist and Head Extension at Himalayan Forest Research Institute (HFRI) under the Indian Council of Forestry Research and Education (ICFRE), spoke about the ***'Status and Role of Agroforestry in the Himalayan Agricultural Production System'***. Dr Singh emphasized that agroforestry is the best alternative to reduce the pressure on existing forests, providing the much-needed products *viz*. food, fibre, fodder, fuel wood, timber and medicine etc to meet needs of increasing cattle and human population. It covers land use systems in which trees and shrubs are grown in association with herbaceous crops, either in a spatial arrangement or a rotation. Agroforestry envisages the sustainable land management systems, which enhance both the output per unit area as well as lost productivity of land. Dr Singh advocated for intercropping of medicinal plants for diversification and income generation amongst rural communities such as *Aconitum heterophyllum, Picrorhiza kurroa, Angelica glauca,* and *Valeriana jatamansi*. He advocated about horti-agri system, horti-silviculture, silvipastoral systems being practiced in Himachal Pradesh, and their benefits for water and soil conservation in different agro-climatic zones (Shivalik Hill Zone, Mid Hill Zone, High Hill Zone, and Cold Dry Zone) of Himachal Pradesh. He discussed about establishment of different intercropping trials in high hills region practicing under the horti-agri system and economics of the intercropping of high temperate medicinal plants with apple cultivation.

Rapid Oral Presentations

Presenter	R.K. Pamarthi
Title	**Expedition of PGR diversity in North Western Himalayas of India**
Key Findings	▸ The NWH, spanning Himachal Pradesh, Jammu and Kashmir (J&K), and Uttarakhand, is rich in plant diversity, including cultivated crops and wild species. ▸ 53 samples of various crops and their wild relatives were collected from unexplored areas. This included black gram, cowpea, French bean and wheat. ▸ The survey yielded 14 unrepresented taxa new to J&K, along with valuable collections of French bean, black gram, sesame, wheat landraces, and other vegetables with high variability.

Presenter	D.D. Sharma
Title	**Reaching the unreached farming community through recent extension methods**
Key Findings	▸ There is a significant gap between the advanced farm technologies developed by scientists and their actual use by farmers, particularly small and marginal ones. ▸ To improve farmer income, extension workers need better training and methods to bridge the technology gap and encourage diversification into allied sectors like dairy, fisheries, or horticulture. ▸ Modern communication technologies like the internet, radio, and call centers offer cost-effective ways to deliver agricultural information and empower farmers to become successful entrepreneurs in the global market.

Presenter	Vipan Guleria
Title	**Interventions for conservation, productivity enhancement and nutrient assessment of medicinal and edible forest species**
Key Findings	▸ A variety of valuable tree species that provide ecological and economic benefits are harar, baheda, and aonla, offer products that support the livelihoods of rural and urban communities. ▸ Identification of superior genotypes of Codia myxa, development of mass propagation methods, and increased fruit availability for farmers. ▸ The conservation and transplantation of improved germplasm of Terminalia chebula has increased farm productivity on marginal lands and farmers obtained early, high-value produce in a short timeframe.

Technical Session II

Theme: Traits Discovery and Genomics in Plants of NWH

Co-Chairs

Prof. B.S. Dhillon
Former VC, PAU, Ludhiana

Dr Atul Khosla
VC, Shoolini University, Solan

Conveners

Dr M.C. Yadav
ICAR-NBPGR, New Delhi

Dr D.P. Walia
ICAR-IARI, Regional Station, Shimla

Rapporteurs

Dr Monika Singh
ICAR-NBPGR, New Delhi

Dr Salej Sood
ICAR-CPRI, Shimla

The agenda for Technical Session II included a keynote lecture along with three invited presentations and seven rapid oral presentations.

Keynote Lecture

Dr S.K. Yadav, Director of CSIR-IHBT, delivered a presentation *on* ***'Functional Genomics for Enhancing Plant Germplasm and Health Security'***. He provided an overview of CSIR-IHBT, and then delved into the biosynthetic pathways of caffeine and flavonoids in tea (*Camellia sinensis*), steviol glycosides in *Stevia rebaudiana*, picroside in *Picrorhiza kurrooa*, and the developmental biology of saffron, focusing on the regulation of flowering and corm development, as well as the biological significance of prickles and their molecular basis in roses. Dr Yadav presented his research on delaying flowering in *Stevia* through precise gene editing to modulate the expression of negative and positive regulators of floral transition. This approach aimed to enhance the synthesis and accumulation of non-calorific steviol glycosides in leaf tissue. He also discussed efforts to understand the molecular mechanisms regulating flowering and corm development in saffron, including the exploration of thermos-responsive pathways. Additionally, he highlighted CRISPR-

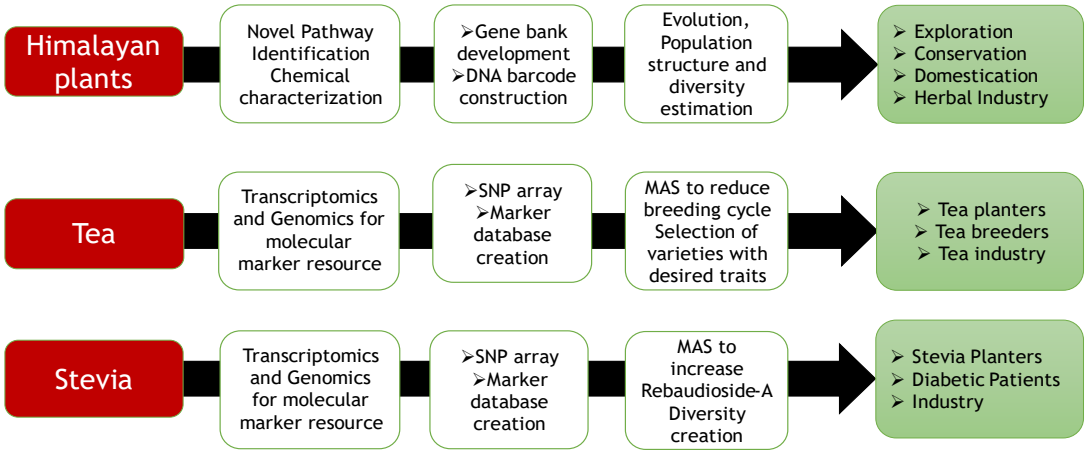
mediated gene editing work aimed at enhancing tuber yield and thermos-tolerance in potatoes. Dr Yadav further outlined the CSIR AI Missions, including CSIR-IHBT's mission for Industry 5.0, which focuses on AI-based technological interventions to boost the bioeconomy using Himalayan bioresources. He also mentioned the collaborative efforts with IIT Mandi iHub & HCI Foundation, involving selective grading of tea leaves using deep learning integrated with hyperspectral images and metabolites to improve tea quality.

Invited Lectures

Dr R.K. Chahota, Associate Professor at Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya (CSKHPKV), Palampur presented work on ***'Genomics for Conserving Himalayan Food Crops'***. The discussion revolved around the rich Himalayan genetic diversity, particularly focusing on landraces of various native crops such as rice, maize, beans, kulthi, buckwheat, amaranth, chenopods, millets, and numerous vegetable crops. Dr Sharma highlighted how the ongoing genomic revolution offers the necessary technical innovations and expanded knowledge crucial for establishing programs integrating genomic approaches into conservation and utilization efforts of genetic diversity. He emphasized that genomic data not only yields new insights into the ecology and evolution of these habitats but also facilitates initiatives like reforestation. Specifically, Dr Sharma elaborated on the use of genomics for the conservation and utilization of horsegram germplasm. He concluded by emphasizing three key points: firstly, acknowledging that fully sequenced and annotated genomes are available for only a limited number of species, thus emphasizing the need to utilize existing reference genomes and expand their coverage across various crops. Secondly, he stressed the importance of focusing on threatened and keystone species within major habitats to establish healthy ecosystems and enhance the impact of genomics on preserving plant diversity and ecosystem restoration efforts. Lastly, he emphasized the urgency of addressing research questions concerning the genomics of extinction and preservation of genomic diversity among threatened species, highlighting the significance of supporting not only single species conservation but also sustaining ecosystem restoration endeavors.

Dr R.K. Sharma, Chief Scientist at Division of Biotechnology, CSIR-IHBT, Palampur, spoke on ***"Genomics of Medicinal Plants: Status and Prospects"***. He extensively discussed the creation of genomic resources, including identification of key genes/regulators and pathways, as well as the development of high-throughput genotyping platforms such as array-based methods, GBS (Genotyping-by-Sequencing), and low-coverage sequencing/re-sequencing. Additionally, he highlighted the importance of plant diversity evaluation and genome mapping techniques, including GWAS (Genome-Wide Association Studies), bi-parental mapping, and the utilization of core genotypes/populations, along with conservation strategies, for targeted medicinal plants. Dr Sharma also elaborated on the genomic research conducted on *Stevia* and tea plants. Notably, he identified 105 core germplasm and made diversity inferences from 1,763 tea accessions using 31 morphological traits. Furthermore, he identified 8,267 SSR markers for diversity analysis. These extensive research and development efforts culminated in the release of a superior tea cultivar named "HIM SPHURTI" tailored for the Kangra region. Based on

his research work, he proposed a way forward for application of genomics in improvement of Himalayan plants, tea and *Stevia* as mentioned below:



Mr Aashish R. Barwale, Director of Seven Star Fruits Pvt Ltd., Mumbai, delivered a talk on ***'An opportunity to revolutionize apple production in India'***. He discussed the status of apple production and productivity in India, highlighting that they fall below global standards. Reasons for this low productivity include factors such as low temperatures during flowering and fruit setting, reliance on outdated varieties, insufficient introduction of new or club varieties, cultivation practices based on conventional systems, minimal adoption of high-density planting (HDP) methods, and the lack of high-quality dwarfing rootstocks suitable for HDP cultivation, along with soil health issues. These challenges are exacerbating the difficulty in meeting the increasing domestic demand for apples, which is rising at a rate of 4.2% annually. Mr Barwale emphasized the potential of GENEVA® series rootstock cultivars developed by Cornell University and United States Department of Agriculture - Agricultural Research Service. These cultivars exhibit superior traits such as early flowering and fruiting, increased productivity, resistance to diseases like crown and root rot, fire blight, woolly aphid, and burr knot, as well as cold hardiness. They are also well-suited for HDP of apple trees. Additionally, GENEVA® rootstocks offer advantages such as rapid multiplication, availability through domestic production, assurance of quality planting material that is true-to-type and disease-free, and accessibility in the required volume in India. To address the rising domestic demand and facilitate apple exports, he advocated for the adoption of the HDP method over traditional cultivation practices, citing potential operational profits that could exceed sevenfold. To facilitate HDP trials, an MoU has been signed with Sher-e-Kashmir University for Agricultural Science and Technology, Kashmir (SKUAST-K) for demonstration and extension activities. Elite Geneva rootstocks have been planted at the SKUAST-K campus since January 2019, and limited field trials have been conducted in Himachal Pradesh at five locations in 2019, with further trials planned in Uttarakhand and Arunachal Pradesh in 2022.

Rapid Oral Presentations

Presenter	Akshay Singh
Title	**Characterization and core set development of Amaranth using high-density 64K SNP Array**
Key Findings	▸ SNP array is useful for characterizing amaranth germplasm and providing new insight in understanding the genetic diversity level and genetic structure of amaranth populations. ▸ Core set will be utilized for GWAS, trait discovery and will prove useful for future breeding programs. ▸ The information related to population structure and diversity analysis of *A. hypochondriacus* proved to be beneficial for further genomic selection, marker-assisted selection, and GWAS studies.

Presenter	Jyoti Kumari
Title	Search of novel donor germplasm for powdery mildew resistance in wheat minicore
Key Findings	▸ Core and minicore, a diverse set of genetic resources are rich source of novel traits and genes and may be used for identification of gene/QTLs using Genome Wide Association Study. ▸ Tetraploid species are more tolerant to powdery mildew disease in comparison to hexaploidy species. ▸ Multiple disease resistant donors/reference set identified and will be used for allele mining and trait discovery.

Presenter	Madhu Patial
Title	**Identification and development of yellow rust resistant sources in wheat using conventional, molecular and doubled haploidy breeding**
Key Findings	▸ DH-1, DH-4-Seedling and Adult Plant Resistance to yellow and brown rust (except 77-5 race) ▸ DH-7, DH-8- Seedling resistance to yellow rust ▸ DH-18-Adult Plant Resistance to yellow rust ▸ DH-23- Seedling resistance to yellow and brown rust

Presenter	M.C. Yadav
itle	**Morphological characterization of magic population reveals extensive genetic variation for morpho-physiological and yield-related traits in bread wheat (*Triticum aestivum* L.)**
Key Findings	▸ TGW (Thousand Grain Weight) showed highly significant associations with grain width, grain length, and NGP (Number of Grains per Panicle) under both late and extreme late sown conditions

	▸ The MAGIC (Multiparent Advanced Generation Inter-Cross) lines would provide useful germplasm resources with diverse allelic combinations offering a greater chance of detecting QTLs (Quantitative Trait Loci) for different traits ▸ These MAGIC lines have been genotyped using a 35K Breeder's SNP (Single Nucleotide Polymorphism) Array chip for the identification of QTLs for different traits

Presenter	**Avantika Maurya**
Title	**Genome-wide association mapping of grain quality traits in rice using single-locus and multi-locus models**
Key Findings	▸ Four key annotated genes LOC_Os01g66110, LOC_Os01g66140, LOC_Os07g44910, and LOC_Os02g14120 governing aroma, HRR% (Head Rice Recovery), and PGC% (Polished Grain percentage), were mined. ▸ This investigation provides valuable information for functional characterization in the future and marker-assisted selection-based breeding design for improving grain quality in rice.

Presenter	**Ragul S.**
Title	**Mapping and mining of major genomic regions conferring resistance to Bruchid (*Callosobruchus maculatus*) in blackgram (*Vigna mungo* (L.) Hepper)**
Key Findings	▸ One QTL each for adult emergence at 50 days after infestation and seed damage was identified on LG 5. and another QTL for developmental time was identified at LG 8. ▸ Each QTL is responsible for 17% of phenotypic variation. These QTLs were flanked by SSR markers CEDG020 & CEDG067 and CEDG 302 & GMES 1248 respectively, with LOD ranges 3.34 – 3.49 on 1000 times of permutation. ▸ Validation on other population revealed that the makers CEDG020 and CEDG302 were found to be potential against bruchid beetles thorough SMA.

Presenter	**Pooja Pathania**
Title	**Molecular and tepal morphology in delineating vegetable *Amaranthus* species complex conserved in Indian National Gene Bank**
Key Findings	▸ The broad taxonomic delimitation of *A. tricolor* and *A. blitum* can be done using tepal morphology ▸ Variation in phylogenetic clusters may be the reflection of variant available in both the species complexes. ▸ However, correlating the DNA barcode variation with the varietal classification require further morphometric analysis and more barcoding loci sequences

Evening Lecture by Padma Bhushan Dr R.S. Paroda

Convener

Dr J.K. Sharma
Baddi University,
Baddi, Solan

Co-Chairs

Dr R.C. Agrawal
DDG (Agric. Education), ICAR, New Delhi

Dr R.K. Tyagi
Vice President, ISPGR, New Delhi

Rapporteurs

Dr Lokender Kumar
Shoolini University, Solan

Dr Anil Kumar
ICAR-DMR, Solan

Dr R.K. Tyagi, Vice President, ISPGR and Co-Chair of the session introduced the speaker, Dr R.S. Paroda, and invited him to deliver his lecture.

Padma Bhushan Dr R.S. Paroda, President, ISPGR and Chairman, TAAS, delivered Evening Lecture on ***'Global Concerns for PGR Management'*** which was attended by ~200 participants. He elaborated on the significance of biodiversity and discussed the crucial aspects of agrobiodiversity management. Emphasizing its global importance, he underscored the necessity for global initiatives to manage and utilize agrobiodiversity effectively in the ever-changing geopolitical landscape through partnership models. Addressing the global challenges linked to biodiversity loss due to climate change, over-exploitation, genetic erosion, and access benefit sharing, he stressed the urgent need for conservation solutions. This includes upgrading existing genebanks and establishing new ones as per

requirement, including those for conserving safety duplicates.

Acknowledging the global interdependence for expanding the food basket across countries, he highlighted the introduction of new crops in India through germplasm exchange with other nations. Dr Paroda delved into the evolutionary timeline of various national and international treaties and agreements affecting germplasm exchange. He noted the paradigm shift of germplasm from 'Public Domain' to 'Proprietary Domain,' with bureaucracies increasingly handling germplasm exchange over plant breeders. Major concerns regarding germplasm use were enumerated, including overall complacency for pre-breeding initiatives, insufficient research on traits of interest, limited access to information, underutilization of wild relatives, restrictions on germplasm exchange, and lack of funding support.

Proposing the creation of international agrobiodiversity funds to support research and development for the conservation and utilization of PGR, he emphasized the necessity to develop undergraduate and postgraduate programs on agrobiodiversity in every university. Dr Paroda's central message was to "Think Globally and Act Locally" to address local issues using international experiences. Stressing the need for guidelines and procedures for sharing germplasm resources, he advocated for collaboration with farmers and the harvesting of traditional knowledge, particularly concerning medicinal plants.

Expressing concern over the decline in germplasm imports by public institutions due to the 2002 Biological Diversity Act, Dr Paroda highlighted the negative impact on national research and breeding programs. He urged revisiting the guidelines and procedures for germplasm sharing, as well as collaboration with farmers and the harvesting of traditional knowledge, especially regarding medicinal plants. He emphasized the necessity of a robust germplasm information system and suggested digitizing data, including traditional knowledge, and enhancing data accessibility through online and offline means. He proposed the creation of online search query databases (Virtual Genebanks) and capacity building in information and communications technologies.

Building upon the outcomes of the 1st Agrobiodiversity Congress and the "Delhi Declaration on Agrobiodiversity Management", Dr Paroda proposed a comprehensive plan for holistic PGR management. This includes streamlined germplasm access procedures, collaborative germplasm evaluation involving public and private sectors, balanced focus on *ex situ* and *in situ* conservation, encouragement of innovative technologies for PGR conservation and utilization, and incentives for ecosystem services. Dr Paroda made vital policy recommendations related to promoting the conservation and utilization of PGR for contributing to local food systems.

Dr R.C. Agrawal, Deputy Director General (Agricultural Education) at ICAR, and Co-chair of the session summarized Dr Paroda's lecture by recapitulating the important messages given by him. Dr Agrawal expressed his sincere gratitude to Dr Paroda for his very thoughtful and important lecture. Dr Y.S. Negi, Shoolini University, proposed vote of thanks to the speaker and all the participants.

DAY 2


Role of Potato in entrepreneurship developments
(Seed Production Technologies)
Brajesh Singh
Director, ICAR-Central Potato Research Institute, Shimla


NATIONAL SEMINAR


NATIONAL SEMINAR
Plant Biodiversity for Food, Nutrition and Health Security in North-West Himalaya
Shoolini University

Technical Session III

Theme: In situ/On-farm, Ex situ Conservation and Access & Benefit Sharing

Co-Chairs

Dr K.R. Dhiman
Former VC, YSPUHF, Solan

Dr J.C. Rana
Vice President, ISPGR, New Delhi

Conveners

Dr Anju Mahendru Singh
ICAR-NBPGR, New Delhi

Dr S.K. Gupta
Shoolini University, Solan

Rapporteurs

Dr Jyoti Kumari
ICAR-NBPGR, New Delhi

Dr Narender Negi
ICAR-NBPGR, Shimla

There were three invited lectures and four rapid oral presentations in Technical Session III.

Invited Lectures

Dr Mohar Singh, Officer-in-Charge at ICAR-NBPGR Regional Station in Shimla, delivered an invited lecture on *the **'Utilization of Genetic Resources in Crop Improvement'***. He commenced by discussing the status of Himalayan plant diversity, highlighting its designation as one of the 36 global hotspots. During his presentation on the importance of PGR, he delved into the traits of promising accessions of amaranth, buckwheat, chenopod, French bean, and their utility in developing new varieties across various crops. Additionally, he presented his team's work on screening PGR of different crops for disease resistance and leveraging crop wild relatives in the improvement programs of lentil, rice bean, and chickpea. To enhance crop improvement initiatives, Dr. Singh recommended several strategic approaches:

Dr Singh's insights underscored the significance of harnessing genetic resources and employing diverse strategies to bolster crop improvement programs, thereby addressing the evolving challenges in agricultural sustainability and food security.

Unlocking the available genetic potential to enhance productivity through refined production and protection technologies

Identifying trait-specific germplasm, including wild varieties and traditional named landraces, and promoting their registration to address Intellectual Property Rights (IPR) concerns

Initiating hybridization involving potential donors to broaden the genetic base, including the development of MAGIC populations

Facilitating the sharing of germplasm populations for multi-locational evaluations across varied agro-ecological regions

Utilizing Marker Assisted Selection (MAS) and speed breeding techniques to expedite the development of marketable genotypes

Developing ideotypes tailored to different cropping systems to ensure adaptability

Dr Vaneet Jishtu, Scientist at ICFRE-HFRI, Shimla, delivered a presentation on ***'Conservation of Native Arboreal Flora of the Northwestern Himalayas: Status, Challenges, and Prospects'***. He extensively discussed the status, approaches, and challenges concerning *in situ* and *ex situ* conservation of arboreal flora of forest genetic resources (FGR) in Himachal Pradesh. He emphasized the importance of these resources in various aspects such as land use patterns, horticulture, animal husbandry (especially in providing fodder during lean periods), carbon sequestration, ecosystem services, and in enhancing the income and livelihoods of local communities. Dr Jishtu also addressed global conservation strategies for FGR, stressing the need to promote sustainable use and raise awareness about their significance. Expressing concern about endangered forest species, he highlighted the need to update the Red List, which has become somewhat redundant. Furthermore, he presented the efforts undertaken by HFRI to promote the conservation of rare, endangered, and threatened species of FGR through the establishment of arboretums, shrubberies, and bambusetums, as well as through the conservation of aconite, orchids, and ferns in Himachal Pradesh.

Dr M.L. Thakur, Project Coordinator, Himachal Pradesh State Biodiversity Board (HP SBB), made a presentation on ***'The Biological Diversity Act, 2002 and its Relevance in Conservation of Unique Himalayan Biological Resources'***. He extensively discussed the importance, current status, and market scenario of herbal medicines. Dr Thakur provided a detailed overview of the Biological Diversity Act (BDA) 2002, with a specific focus on the role of SBBs and the functions and duties of Biodiversity Management Committees (BMCs) in preparing People's Biodiversity Registers (PBRs) in consultation with local communities. He elaborated on various Sections of the BDA dealing with definitions, notification of threatened species, biodiversity heritage sites, and more. Dr Thakur highlighted the proposal to re-notify *Aconitum heterophyllum*, *Podophyllum hexandrum*, and *Taxus contorta* of Himachal Pradesh as threatened plant species, with an exemption clause for cultivated material from the provisions of Section 38 of the BDA. Discussing benefit-sharing models as case studies in Himachal Pradesh, Dr Thakur proposed several action points specific to the context of H.P. These action points included:

- Implementing powers delegated under Section 16 read with 25 of the BDA, 2002:
  - Granting approvals for access to biological resources upon application for transit/export passes by traders on a regular basis, accompanied by signing Access and Benefit Sharing (ABS) agreements.
  - Involving or consulting BMCs during the grant of approval, if applicable.
- Reporting details of ABS approvals granted on a fortnightly basis, following Notification No. HPSBB/F(27)-2/18 dated 23rd August 2023, using the provided format.
- Sensitizing traders within the next three months.
- Ensuring compliance with previous utilizations of biological resources by traders within the next three months.

Rapid Oral Presentations

Presenter	**K.M. Rai**
Title	***Ex-situ* conservation of wild *Allium* genetic resources at ICAR-NBPGR, Bhowali field genebank**
Key Findings	- The Indian Himalayas harbor a remarkable diversity of wild alliums, with 45-50 species found at high elevations (above 3,000 m) across cold deserts and humid alpine regions - Identified economically important species like *A. victorialis* and *A. stracheyi*, suggesting potential for further research and development - Across NWH, collected 62 accessions representing 15 distinct wild *Allium* species; currently conserved in a field gene bank

Presenter	**Sherry R. Jacob**
Title	**Conservation of wheat and barley genetic resources of North-Western Himalayas in the National Genebank**
Key Findings	- The National Genebank (NGB) holds a significant collection (4,791 accessions) representing 18 wheat and barley species from the NWH. This includes landraces and wild relatives - The collection contains valuable genetic resources like wild triticeae (*Elymus* and *Leymus*) and *Aegilops tauschii*, offering potential resistance to drought and pests - The genebank holds a diverse barley collection (400 accessions), including wild barley (*Hordeum vulgare* ssp. *himalayense*) and unique naked barley landraces

Presenter	**Faizan Ahmad**
Title	**Conservation and characterization of Protected Farmer's Varieties of apricots in cold arid regions for future breeding programmes in Kargil (UT-Ladakh)**
Key Findings	- Traditional drying methods and a ban on fresh fruit exports threatened the rich apricot diversity in Kargil. Farmers were forced to convert orchards to a single drying-suitable variety (Halman), leading to potential loss of unique genetic variations - Characterized and conserved 30 elite apricot varieties (registered germplasm) at the MARES farm

	▸ The conserved apricot varieties possess desirable characteristics like resistance to harsh weather, pests, and diseases. They also have high sugar content and yield potential ▸ Further research aims to identify drying-friendly and dwarf varieties suitable for high-density planting

Presenter	**Neha Rani**
Title	**Advanced methods of conservation of plant biodiversity**
Key Findings	▸ Mountain habitats are crucial for plant conservation due to their high species diversity and unique ecosystems ▸ Efforts should focus on in situ (on-site) and ex situ (off-site) conservation strategies ▸ Discussed limitations of above methods, suggesting the need for advanced conservation techniques like in vitro conservation, cryoconservation, etc.

Technical Session IV

Theme: Plant Diversity and Local Food Systems

Conveners

Dr Manjusha Verma
ICAR-NBPGR, New Delhi

Dr Somesh Sharma
Shoolini University, Solan

Co-Chairs

Dr R.S. Chandel
Vice Chancelor, YSPUHF, Solan

Dr Brajesh Singh
Director, ICAR-CPRI, Shimla

Rapporteurs

Dr Rakesh Sharma
YSPUHF, Solan

Dr Ravi K. Pamarthi
ICAR-NBPGR, New Delhi

There was one keynote lecture, four invited lectures and two rapid oral presentations in Technical Session IV.

Keynote Lecture

Dr J.C. Rana, Alliance of BI and CIAT (Alliance), made a presentation on ***'Mainstreaming agrobiodiversity for enhancing climate resilience, nutrition, livelihoods and ecosystems service'***. He discussed about role, new initiatives and approaches of the Alliance to mitigate the food security challenges through sustainable utilization of agrobiodiversty – distribution of seeds of selected varieties and crowdsourcing trails, suitable on-farm participatory varietal selection, strengthening local seed systems through Community Seed Banks, improve nutrition, income and livelihoods, and developing holistic value chain system. Dr Rana also presented nutritional profiling of promising rice landraces (unpolished) from Assam and rancidity index of pearl millet. He emphasized on importance of branding, trademark, tagline, packaging, labeling, nutrition information, FSSAI licensing and use of media in developing a value chain. A case study on the impact of value chain and IPR (GI) protection was also presented. He concluded his discussion by outlining various challenges in

mainstreaming agricultural biodiversity, including the complexity of its utilization, the necessity fora, systems approach that acknowledges connectivity among elements and multiple viewpoints, conflict between specialization for productivity increase and sustainability, and the difficulty in cross-sectoral collaboration due to differences in sector accountability, reward lines, and potential competition among sectors.

Invited Lectures

Dr V.P. Sharma, Director of ICAR-Directorate of Mushroom Research (DMR), Solan, made a presentation on ***'Status of Indian mushroom industry and nutritional value of mushrooms'***. He outlined mushroom cultivation history and global production scenarios. He detailed mushroom production, highlighting their role in food, supplements, drugs, and cosmeceuticals due to beneficial compounds activating epidermal growth, antioxidative, anti-allergic, antibacterial, and anti-inflammatory effects, stimulating collagen, and treating acne. In SWOT matrix analysis of the mushroom industry, he emphasized four key drivers: Diversification, high-yielding strains, quality spawn availability, and policy support.

Dr K.K. Jindal, Former ADG (Horticulture), ICAR, spoke on ***'Underutilized temperate fruit species in the Western Himalayas - Scope for enhancing rural livelihoods and improving food security'***. He discussed the prospects, nutritional, medicinal values and economics of cultivation of underutilized exotic crops in Himalayan region e.g. kiwi fruits and other nut fruits. Dr. Jindal advocated for the adoption of hi-tech farming techniques for kiwi fruits aimed at crop improvement and enhanced agro-techniques. He highlighted the advantages of intercropping kiwi with large cardamom, especially in vital regions like Sikkim and Arunachal Pradesh where cardamom farming is essential for livelihoods. This method, involving kiwi plants providing partial shade to cardamom, shows a synergistic impact on growth, yield, and quality of both crops, ultimately aiding in doubling farmers' income. He closed his presentation with several recommendations.

Advocating for the development of value-added products rich in nutrients, along with efficient post-harvest management and marketing strategies, to optimize utilization and business opportunities

Emphasizing that the genetic resource of major fruits is valuable, but underutilized temperate fruit crops hold the status of a diamond mine, requiring substantial long-term investment to exploit their full potential

Highlighting that sustainable advances in fruit science and industrial production depend on intelligent and judicious conservation and utilization of bio-resources

Proposing the effective utilization and patenting of genes derived from genetic resources to enhance global competitiveness and ensure national food and nutritional security

Stressing the importance of conservation as the top priority, as the loss of any gene, species, ecosystem, or bioresource limits future options

Dr Bhupinder Dutt, Professor at Dr YS Parmar University of Horticulture & Forestry (YSPUHF), Solan, made presentation on ***'Medicinal value of local plant diversity of N-W Himalayas'***. He briefly discussed various recognized indigenous systems of medicine in India, such as Ayurvedic, Unani, Siddha, and Natural medicine. He noted that the global preference for natural products derived from herbs has created immense prospects for medicinal and aromatic plants, making it a sunrise industry sector. Dr Dutta presented a detailed account of the diversity of medicinal plants found from the Shivalik (low hills) to the Greater Himalayas (higher hills in temperate zones) in Himachal Pradesh. While discussing the Ashthaverga group of medicinal plants, he also highlighted local medicinal plants of the NWH, which possess significant industrial potential for drug development. Various issues affecting the marketing side were addressed, including inadequate marketing linkages such as mandis and marketplaces, an unorganized supply chain of medicinal plants, and a lack of proper post-harvest management practices like drying, storing, and grading. Dr Dutta enumerated the limitations of the medicinal and aromatic plant sector, including poor databases that do not align with production, utilization, and supply, a lack of well-defined quality standards for raw drugs and ISM products, insufficient knowledge on quality aspects of variability present in nature, inadvertent use of wrong plant species, inefficient and informal marketing practices, and a lack of desire to collaborate among stakeholders. He emphasized that biodiversity conservation efforts will continue to fall short of targets if scientists and practitioners cannot efficiently partner with stakeholders and indigenous landowners to establish novel and dynamic institutions. Dr Dutta stressed that local communities are central to any conservation program and that efforts should be made to maintain a balance among scientists, conservationists, policymakers, and people's livelihoods. Therefore, the participation of local communities in the preparation and execution of conservation policies and management plans could facilitate achieving biodiversity conservation objectives. Dr Dutta opined that there is an immediate need for the creation of understanding and educational programs on conservation and the permissible utilization of plant genetic resources, as well as intensified coordination with various governmental departments, NGOs, and local institutions.

Chef Nand Lal Sharma, Deputy General Manager at Himachal Pradesh Tourism Development Corporation Ltd. (HPTDC), Shimla, spoke on ***'Traditional food of Himachal Pradesh'***. He provided a detailed account of the regional and cultural diversity of Himachal Pradesh. Mr Sharma highlighted that despite the differences in regional and cultural cuisines across the state, non-vegetarian dishes with a liberal use of spices such as cardamom, cinnamon, cloves, and red chilies are prevalent. He also discussed the potential for processing and developing food products based on the diversity of local cuisines using indigenous crops like morel, zedoary, chenopods, and black peas. His focus extended to the preparation of various cuisines in general, with a particular emphasis on traditional dishes such as *dham, sidu*, and *babru*. In the barren regions of Kinnaur and Lahaul-Spiti, locally-grown coarse grains like buckwheat, millet, and barley are predominantly utilized, while regions with a pastoral tradition incorporate large quantities of milk and its products into their dishes. Mr Sharma noted that the cuisine of Himachal Pradesh also bears influences from neighboring regions such as Punjab and Tibet.

Rapid Oral Presentations

Presenter	Ramya K.R.
Title	**Reviving grasspea (*Lathyrus sativus* L.) - a potential green leafy vegetable source for the Himalayan regions**
Key Findings	▸ Study revealed high levels of protein, sugar, total dietary fiber (TDF) phenolics, variety of amino acids (e.g. sarcosine) in the leaves of various grasspea accessions. This indicates the potential of grasspea leaves as a nutritious food source ▸ Identified grasspea accessions with significantly lower β-ODAP levels compared to the typical range; suggests the possibility of breeding low-toxin varieties for safe human consumption ▸ Findings offer hope for reintroducing grasspea as a valuable crop by mitigating concerns about β-ODAP toxicity and highlighting its nutritional benefits

Presenter	Vikender Kaur
Title	**Understanding genetic variability for morphological and nutritional traits in the linseed germplasm collection at the National Genebank of India**
Key Findings	▸ Linseed germplasm (~ 2,800 accessions) revealed a wide range of variation in key traits like seed yield, oil content, and maturity time ▸ This study identified diverse germplasm excelling in specific traits like high seed yield or superior oil content ▸ Developed a 'core collection' of 259 linseed accessions easier for breeders to access the genetic variation and use in development of new linseed varieties

Technical Session V

Theme: Entrepreneurship and Value Chains – Role of Youth and Women

Co-Chairs

Prof. Parvinder Kaushal
VC, UUHF, Pauri Garhwal

Dr Anuradha Agrawal
National Coordinator, NAHEP, ICAR, New Delhi

Conveners

Dr Pankaj Sood
KVK, Mandi

Dr Ramesh Bhardwaj
YSPUHF, Solan

Rapporteurs

Dr Vikender Kaur
ICAR-NBPGR, New Delhi

Dr Anil Kumar
ICAR-DMR, Solan

There was one keynote lecture, two invited lectures and four rapid oral in Technical Session V.

Keynote Lecture

Dr Brajesh Singh, Director, ICAR-Central Potato Research Institute (CPRI), delivered a keynote lecture on ***'Role of Potato in entrepreneurship developments (Seed Production Technologies)'***. He discussed the status and gap in seed production of potato and called for adoption of new seed production innovations like tissue culture, aeroponics, virus free potato seed, early supply of pre nucleus/nucleus seed to commercial growers by reducing the field exposure time, improved tuber quality, reducing the load of degenerative diseases, optimal utilization of the resources and trained manpower year the round, and vertical growth and reduce pressure on land. Details of aeroponics technology commercialized (non-exclusive licensed) by ICAR-CPRI, Shimla to 17 firms in India and their future projections for quality seed production was presented. Dr Singh suggested that as an alternative of rapid seed multiplication like integration of apical rooted cutting (ARC) into breeder seed production with stringent health precautions needs to be revisited. He also discussed various challenges in quality

potato seed production and suggested future strategies to address the challenges through possible solution:

The seed sector needs to be reformed/ structured by pooling the land holdings of small and marginal farmers and creating FPOs to make potato a profitable venture, especially for small and marginal farmers

Involvement of SAUs, KVKs, private sector companies, growers associations, cooperative societies and progressive growers for multiplication of breeder seed in three assured multiplication cycles by Government of India

Involvement of above agencies by the state government for multiplication of Foundation-I in two multiplication cycles

Dr Singh concluded his lecture by suggesting the technologies which can be taken by the entrepreneurs:

Since limited land resources are available with the Institute, the generation advancement can be done with the help of registered seed growers

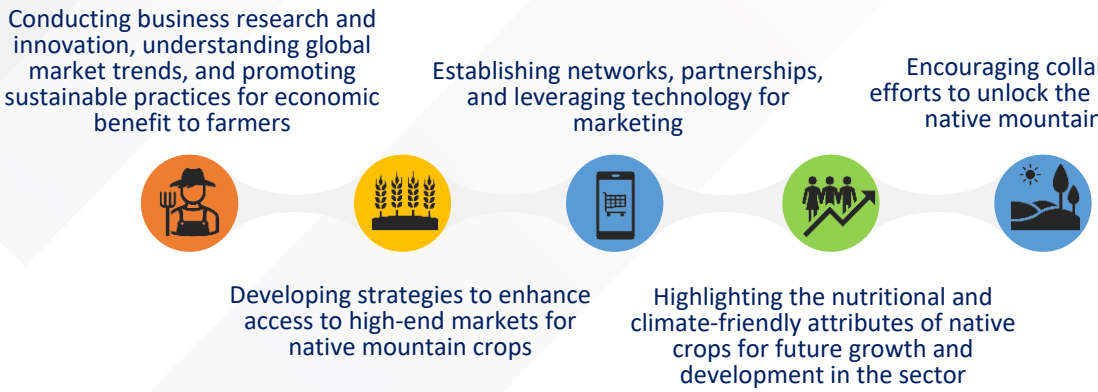
FPOs/registered growers may consult the state departments/SAUs to put up the indent to Department of Agriculture and Cooperation (DAC), New Delhi, for procurement of breeder seed. Further, this breeder seed needs to be multiplied in assured multiplication cycles and can be supplied to the farmers

Popularization of low-cost rapid multiplication technologies which have been revisited recently *i.e.*, sprout cutting, stem cutting and apical rooted cuttings for the quality seed production

Invited Lectures

Dr D.P. Sharma, Professor and Head at Department of Fruit Science, YSPUHF, Solan, delivered a presentation on ***'High Density Apple Plantation (HDP)'.*** He discussed the apple production scenario in Himachal Pradesh, providing a brief historical overview of high-density plantation practices in various countries. The focus was on maximizing both vertical and horizontal space utilization over time, aiming to optimize returns on inputs and natural resources. Within the framework of a World Bank-funded project, a package of practices for HDP on clonal rootstocks was developed at YSPUHF, which Dr Sharma elaborated on. He presented a comparative analysis of apple production between conventional plantations and HDP at different locations and altitudes in Himachal Pradesh, such as mid hills (Solan), high hills (Mashobra), and the dry temperate zone (Sharbo). Furthermore, he identified suitable high-yielding varieties for HDP, which not only increased productivity but also enhanced farmers' income per unit area. To facilitate the adoption of HDP techniques, farmers were trained through events like the Kisan Mela-cum-Apple Day organized at YSPUHF, promoting the practice of HDP for apple cultivation in Himachal Pradesh.

Dr Lal Singh, Director at Himalyan Research Group (HRG), Shimla, spoke on ***'Unlocking native mountain crops for livelihood and enterprise development'***. Based on the nutritional profiling, he identified potential local landraces of target crops suitable for mainstreaming and enterprise development. For example, he highlighted Red Rice (*Oryza sativa)*-1–Annani; Barley (*Hordeum vulgare)* -1–Jau; Kidney Bean (*Phaseolus vulgaris)*-3 Chitra, Peuli, Saphed; Amaranth (*Amaranthus hypocondriacus)* -2 Bithu, Jhuli Bithu; Buckwheat (*Fagopyrum esculentum, F. tataricum)*-2 Bharesa and Kathu; Rice Bean (*Vigna umbellata)*-1 Dhangru, and conducted multilocation trials in farmers' fields. Dr Lal discussed a case study illustrating a complete value chain from production to processing, branding, and establishing farmers' producing companies to create opportunities for farmers and entrepreneurs, thus enhancing income and improving livelihoods. He also presented a vision for the mountain native crops' value chain and enterprise, emphasizing the following actions:



Presentations by Farmers

Mr Rahul Saxena, Partner at Back to Basics Naturally LLP, Palampur, made a presentation on ***'Developing Recipes with Alternate (Read Healthy) Ingredients'***. He spoke about the need of healthy food and discussed the case study of healthy snacks prepared by naked barley processed first for sprouting, long soaking in water, fermenting, slow drying, and then roasted in rock salt, which is rich in fiber, polyphenols, pre- and pro-biotics.

Mr Joginder Walia, Society for Farmers Development, who manages a Production-cum-Facility Centre, made a presentation on ***'Processing of fruits and vegetables'***. He counted on the benefits of processing of fruits and vegetables like elimination of middle man/commission agents, value-addition through processing/preservation, networking of small growers/women, remunerative prices to growers, and reduction in wastage/spoilage. Mr Walia discussed the technology used at his centre for pulping, juicing and bottling (tomato, apple, citrus fruits, rhododendron), carbonation of juices [orange and hill lemon (galgal)], preparing biscuits, cookies

and crackers (using Amaranthus, finger millet, wheat flour, soybean, aonla, beetroot, maize and Bengal gram) and extraction of non-edible oil from wild apricots.

Ms Sneha Sharma, CEO of Rural Farmers Society of Himachal Pradesh, made presentation on ***'Entrepreneurship development through Integrated farming'***. She described her journey from a farmer to successful entrepreneur through integrated farming system (IFS) practicing crop production including value addition of agriculture produce (fruits, vegetables, pulses and millets), dairy management, vegetable nursery production, and oyster mushroom cultivation. Ms Sharma also presented the economic benefits of IFS over the traditional farming system. Since year 2023 was International Year of Millets, Ms Sharma was actively engaged in motivating the farm women in production as well as processing and value addition of millets. She is an inspiration to her friends and family, especially to her young daughter, who aspires to become as vibrant and active as her mother one day. Ms Sharma is not only earning for family but at present giving employment to many women in the area and is recognized as a role model and a mentor for several women entrepreneurs. She concluded her talk emphasizing the need to replicate such success stories of similarly enthusiastic and energetic farm women by benefiting through different flagship schemes. The key message from her was that she is making all out efforts to empower the rural women.

Mr Nek Ram Sharma, Padma Shri Awardee, a local farmer, has worked extensively on the conservation of biodiversity of Himachal Pradesh. He started work on restoration of his own village land in with the held of students, teachers and state departments. He also addressed the problem of loss of seeds of local landraces of crops, especially millets. He propagated cultivation of 18 types of crops each year, rather than just a few. He concluded by saying that more work is required for conservation of biodiversity, since erosion continues to occur.

Concluding Session

Co-Chairs

Dr R.S. Paroda
President, ISPGR and Chairman, TAAS, New Delhi

Prof. P.K. Khosla
Chancellor, Shoolini University, Solan

Conveners

Dr R.K. Tyagi
Vice President, ISPGR, New Delhi

Dr Y.S. Negi
Shoolini University, Solan

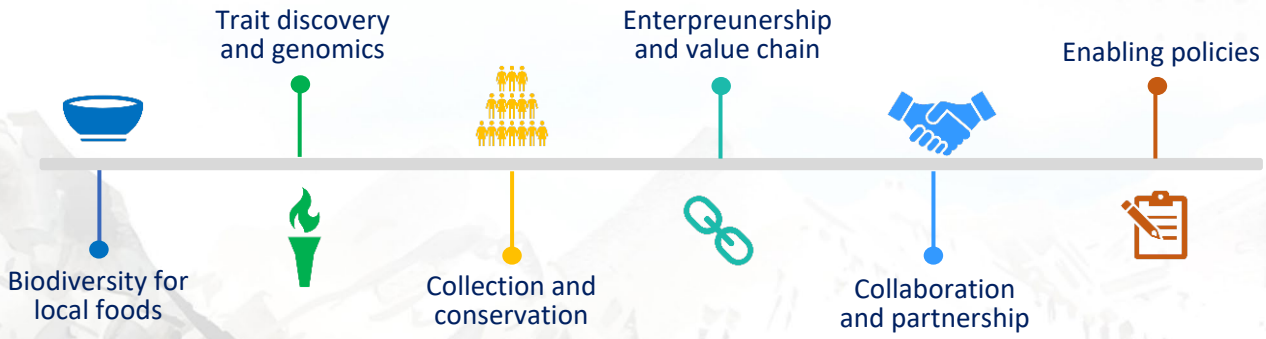
Rapporteurs

Dr Sherry R. Jacob
ICAR-NBPGR, New Delhi

Dr Pankaj Chauhan
Shoolini University, Solan

Both the Co-Chairs expressed great satisfaction about the organization of this seminar which was evident by the presence of the about 200 participants who attended the concluding session.

Dr R.K. Tyagi made a presentation on the recommendations made in each session. The recommendations were consolidated and categorized into the following:



The recommendations and enabling policies emanating from the discussions are presented in the next section.

Dr P.K. Khosla expressed gratitude to Dr Paroda for providing a platform for students and faculty of Shoolini University to partner and participate in the National Seminar, which brought together the best minds and experts in the subjects discussed. He emphasized that agriculture is the future, highlighting that no country, particularly India, can survive without food security. While acknowledging the persistent challenges of biodiversity, agriculture, and the environment, he noted that the discussions held in various sessions of the seminar would enlighten students about potential solutions. Dr Khosla assured that Shoolini University would endeavor to produce the best students in agriculture. In conclusion, he thanked the entire team of Shoolini University for their hard work and dedication towards the successful organization of the seminar. Additionally, he commended all the invited speakers for their contributions.

Dr R.S. Paroda remarked that the two-day deliberations had been highly rewarding. He expressed his hope that seminars like the present one would inspire the staff and students at Shoolini University to work even harder towards achieving the goal for a Center of Excellence (CoE) on Himalayan Biodiversity. Dr Paroda emphasized that nations which effectively evaluated and utilized genetic resources experienced faster development than others. He cited examples such as soybean, oil palm, and kiwi, where nations other than country of origin of these crops reaped significant benefits. India, too, had benefitted from the introduction of various crops, such as sweet apples like 'Delicious' in Himachal Pradesh by Mr. Samuel Evan Stokes, which became a vital source of income and livelihood for generations of farmers. With climate change prompting shifts in apple cultivation to higher elevations, regions like the mid hills have become suitable for crops like kiwi, introduced in India by the National Bureau of Plant Genetic Resources (NBPGR) in the 1960s through the efforts of late Dr. Harbhajan Singh. Dr Paroda stressed the need to identify India's genetic wealth and explore ways to add value to it for the global market. Seminars like the present one offer opportunities to assess biodiversity wealth, associated knowledge, institutional efforts, and areas for future work. Dr Paroda illustrated the role of research and development (R&D) by highlighting advancements such as aphid management enabling seed production in potatoes in plains, which was previously limited to hilly regions. He emphasized the importance of institutions and human resources in driving continuous agricultural growth through genetic resource management and agricultural diversification via innovative technologies.

Dr Paroda also highlighted concerns about climate change, citing recent floods in Himachal Pradesh adversely affecting biodiversity. He proposed forming a small working group within ISPGR to assess the status of biodiversity in the NWH, advocating for a partnership approach across international, national, public, and private sectors. Dr Paroda underscored the need for technical support from institutions to meet farmers' knowledge needs and attract youth towards agriculture and agri-entrepreneurship. He stressed the importance of policy advocacy for optimal utilization of bioresources and models for access and benefit sharing. He noted a growing demand for nutritious food post-COVID, highlighting the significant opportunities in gene discovery and precise breeding offered by science. In conclusion, Paroda expressed his appreciation to Dr. Khosla for establishing Shoolini University and his happiness at the successful organization of the seminar.

Dr Saurabh Kulshreshtha proposed Vote of Thanks to the co-chairs, dignitaries, invited guests, speakers, participants, logistic committee members, organizers and organizations provided funding support to hold the seminar.

Recommendations

Biodiversity of Local Foods

- A comprehensive status paper on plant biodiversity of NWH needs to be documented collectively by the institutions located in the region.
- An integrated effort is required to mainstream regional and seasonal crop diversity for food and nutritional security, as well as to enhance farmers' economy through the utilization of bioresources of the Himalayan region via value chains.
- Introduction of novel fruit germplasm from different countries should be a continuous process to enrich local biodiversity, while respecting the international conventions/treaties. To ensure this, policy support and targeted efforts are needed to strengthen existing germplasm exchange mechanisms.
- Documenting success stories involving the utilization of local germplasm to develop promising varieties, including traditional technical knowledge, to be given priority.

Traits Discovery and Genomics

- It is recommended to foster inter-institutional collaboration in the NWH to fully harness the potential of local genetic resources and develop climate-resilient varieties, given the rich genetic diversity and exceptional traits present in many plant species in the Himalayan region, including cold and drought tolerance, nutritional attributes, and medicinal properties.
- In addition to evaluating germplasm for nutritional traits, it is crucial to assess germplasm for trait-specific responses to biotic and abiotic stresses, especially in the context of climate change. This should involve employing elite germplasm lines for pre-breeding and utilizing modern biotechnological tools such as phenotyping, genome-assisted breeding, and genome editing in a mission-oriented approach. This recommendation applies to institutions like NBPGR and others located in the NW Himalayan region.

Collection and Conservation

- It is recommended to establish a ‘Centre of Excellence’ at DRDO-Defence Institute of High-Altitude Research (DIHAR), Leh, specifically for endemic crops of the cold desert. A targeted germplasm collection program for this region should be conducted in collaboration with ICAR-NBPGR, involving its regional station based in Srinagar.
- To promote the study, research, and propagation of local fruits and medicinal plants, the establishment of a dedicated plant arboretum is necessary. Site-specific germplasm explorations should be planned to collect local minor fruits of economic importance, such as *Cordia myxa*.
- Directed efforts should be made towards *ex situ* conservation, including the establishment and/or strengthening of existing community genebanks and field genebanks. Rootstocks should be propagated using tissue culture techniques, and specific clonal rootstocks should be maintained in stool beds as self-rooted plants or planted as self-rooted trees.

- Conservation of the rich forest genetic resources (FGRs) of the NW Himalayan region is crucial for the national economy. Therefore, priority should be given to conserving FGRs in the form of arboreta, clonal repositories, in vitro genebanks, and cryogenebanks.

- The NW Himalayan region is strategic for safeguarding agrobiodiversity through establishment of safety duplicate genebank, community seed bank and *in situ* conservation of genetic resources.

Entrepreneurship and Value Chain

- It is recommended to strengthen regional collaboration among S&T institutes, extension agencies, farmers, FPOs, and self-help groups. Such collaboration will nurture entrepreneurial skills crucial for business growth in the agricultural sector. There is an opportunity to transform the perception of farming from "poor" to "inspirational" by developing high-value, local food products.

- The immense diversity of medicinal plants in the NWH offers extraordinary potential for developing one health solutions. To fully realize this potential, there is an urgent need to establish rigorous quality standards for raw medicinal plant materials. It is imperative to invest in research and development initiatives and facilitate collaboration between traditional knowledge holders, researchers, and pharmaceutical industries to ensure ethical practices, benefit-sharing with local communities, and efficient drug development.

- Enhancing productivity and farmers' income can be achieved by reducing input costs and adopting high-density apple plantations using precision agro-technologies. For this, providing proper training to farmers and extending necessary financial and logistical support, including easy market access and fair pricing, is essential.

- Given the significance of potato as a major crop in the region, vocational training should be provided to young farmers to establish high-tech, high-value "potato seed production startups" using techniques such as tissue culture aeroponics, fertigation, high throughput, and seed quality management.

Collaboration and Partnerships

- To optimize Himalayan plant biodiversity and ensure the economic welfare of hill farmers, it is recommended to establish a collaborative task force through a consortium comprising State Agricultural Universities of Himachal Pradesh, Uttarakhand, and Jammu & Kashmir, CSIR-IHBT, Palampur, ICAR institutes such as NBPGR, VPKAS, IIHR, DIHAR, Leh, and institutes under the Ministry of Environment, Forest and Climate Change. This consortium should focus on developing innovative agro-technologies tailored for genetic enhancement, efficient production systems, and value addition to provide higher income to farmers of the NWH.

- The above-proposed consortium should also establish a unified online database for the genetic resources of the Himalayan region to ensure easy access to comprehensive information on the region's genetic resources.

- It is imperative to build strong public-private and public-public partnerships to accelerate efforts on germplasm evaluation, improvement, and utilization through value chain and market linkages, benefiting smallholders and women farmers. There is a need to incentivize and document successful partnerships and benefit-sharing initiatives.

Enabling Policies

- The authority for the management of agrobiodiversity, including the international exchange of germplasm meant for agricultural research and development, should be delegated by NBA to DARE/ICAR. Both DARE/ICAR and NBA must deliberate and take necessary corrective measures on priority in the larger national interest

- State Biodiversity Boards can play a significant role in the conservation and utilization of genetic resources. They should be led by eminent experts and activated with substantial funding support from the governments of Himachal Pradesh, Uttarakhand, Jammu and Kashmir, and Ladakh.

- Urgent steps should be taken to reinvigorate the National Agro-Biodiversity Board for Management of Genetic Resources (NABMGR) and provide strategic advisories to ICAR for managing genetic resources holistically across all ICAR bureaus (NBPGR, NBAGR, NBFGR, NBAIM, and NBAIR). This board should catalyze the process of conservation and utilization, involving the private sector and designing collection, characterization, conservation, and sustainable use of genetic resources.

- NBPGR needs to

  - establish a permafrost facility to house "safety duplicates" of important crop germplasm, ensuring long-term conservation against potential risks
  - establish a Legal Cell to proactively address legal complexities and facilitate responsible PGR utilization and exchange at both national and international levels

- NBPGR should develop an offshore quarantine facility to strengthen the entry point quarantine system, mitigating the risk of introducing harmful pests to domestic agriculture. This facility should conduct pre-border quarantine procedures and streamline the import process for valuable germplasm, accelerating research and development initiatives


जलगवद्रव्य संरक्षण व्यूरो का जन है।
सी प्रयास किसान कि उन्नति का साथ है।


NATIONAL SEMINAR
Plant Biodiversity
for


SCHOOL OF BIOENGINEERING
& FOOD TECHNOLOGY


NATIONAL SEMINAR
Plant Biodiversity for
Food, Nutrition and Health Security

TECHNICAL PROGRAM

Day 1: November 27, 2023 (Monday)

08:30-09:3 **Registration**

INAUGURAL SESSION (9.30-11.15 a.m.)

Chief Guest	**Dr R.S. Paroda** President, ISPGR & Chairman, TAAS, New Delhi
Chair	**Prof. P.K. Khosla** Chancellor, Shoolini University, Solan
Guests of Honour	**Dr P.L. Gautam** Former Chairperson NBA & PPV&FRA, Palampur **Dr Sanjay Kumar** Chairman, ASRB, New Delhi
Convenor	**Prof. Atul Khosla** Vice Chancellor, Shoolini University, Solan

09.30-09.40	**Arrival of Dignitaries and Lighting of Lamp**	
09.40-09.50	**Welcome & Setting the Context**	**Prof. Atul. Khosla** VC, Shoolini University, Solan
09.50-10.20	**Special Remarks**	**Dr Sanjay Kumar** Chairman, ASRB, New Delhi **Dr P.L. Gautam** Former Chairperson NBA & PPV&FRA, Palampur **Dr P.K. Khosla** Chancellor, Shoolini University, Solan
10.20-10.40	**Address by Chief Guest**	**Dr R.S. Paroda** President, ISPGR & Chairman, TAAS, New Delhi
10.40-10.50	**Vote of Thanks**	**Dr Anuradha Agrawal** General Secretary, ISPGR & Organizing Secretary, PBFSNWH, New Delhi

TECHNICAL SESSION I
Status and Management of Plant Biodiversity of North-West Himalayas (NWH)
(11.20 a.m. –2.45 p.m.)
(Concurrent Poster Session)

Co-Chair	**P.L. Gautam,** Former Chairperson NBA & PPV&FRA, Palampur
	P.K. Khosla, Chancellor, Shoolini University, Solan
Convenor	**R.K. Gautam,** ICAR-NBPGR, New Delhi
	B.D. Sharma, Eternal University Baru Sahib, Rajgarh, Sirmour
Rapporteurs	**Kuldeep Tripathi,** ICAR-NBPGR, New Delhi
	Vinay Kumar Rachappanavar, Shoolini University, Solan

11.20-11.25	**Welcome**	**Convenor**
11.25-11.50	**Plenary Lecture** *Generating bioeconomy using biore-sources of North-West Himalayas*	**Sanjay Kumar,** ASRB, New Delhi
11.50-12.05	**Invited Lectures** *Plant diversity in Cold Desert Himalayas: Challenges and opportunities*	**O.P. Chaurasia,** DIHAR, Leh, Ladakh
12.05-12.20	*Genetic enhancement in local food sys-tems in NWH*	**Lakshmi Kant,** ICAR-VPKAS, Almora

12.20-12.35	*Current status and potential of temperate horticulture*	**M.K. Verma,** ICAR-CITH, Srinagar
12.35-12.50	*Status and role of Agroforestry in the Himalayan Agriculture Production system*	**Jagdish Singh,** ICFRE-HRFI, Shimla
12.50-13.35	**Rapid Oral Presentations** (4; 6 min. each)	
	TSI-OP1: Expedition of PGR diversity in North Western Himalaya of India	**R.K. Pamarthi,** ICAR-NBPGR, New Delhi **Co-authors -** D.P. Semwal, Soyimchetan & P.K. Singh
	TSI-OP2: Ampelographic characterization of grape genotypes from HimachalPradesh	**Sharmistha Naik,** ICAR-National Research Centre for Grapes, Pune **Co-authors -** D.P. Sharma, Jagesh Tiwari, Rasna Zinta, Gopal Singh & Arun Kumar
	TSI-OP3: Interventions for conservation, productivity enhancement and nutrient assessment of medicinal and edible forest species	**Vipan Guleria,** Forestry Regional Horticultural RS Jachh (Kangra), Dr Y.S. Parmar University of Horticulture and Forestry **Co-authors -** Amol Vashisth, Renu Kapoor, Rajesh Kaler & Dharmender Kumar
	TS1-OP4:Reaching the unreached farming community through recent extension methods	**D.D. Sharma,** Shoolini University, Solan **Co-author -** Shareya
13.35-13.45	**Discussion and Co-Chairs' Remarks**	
13.45-14.45	**Lunch Break**	

TECHNICAL SESSION II
Traits Discovery and Genomics in Plants of NWH
(2.45 p.m.–5.40 p.m.)
(Concurrent Poster Session)

Co-Chair	**B.S. Dhillon,** Former VC, PAU, Ludhiana
	Atul Khosla, VC, Shoolini University, Solan
Convenor	**M.C. Yadav,** ICAR-NBPGR, New Delhi
	D.P. Walia, ICAR-IARI, Regional Station, Shimla
Rapporteurs	**Monika Singh,** ICAR-NBPGR, New Delhi
	Salej Sood, ICAR-CPRI, Shimla

14.45-14.50	**Welcome**	**Convenor**
	Keynote Lecture	
14.50-15.10	*Genomics for germplasm improvement and utilization*	**S.K. Yadav** CSIR-IHBT, Palampur
	Invited Lectures	
15.10-15.25	*Genomics for conserving Himalayan food crops*	**R.K. Chahota** CSKHPKV, Palampur
15.25-15.40	*Genomics of medicinal plants: status and prospects*	**R.K. Sharma** CSIR-IHBT, Palampur
15.40-15.55	*Harnessing synergies in PGR utilization through public-private partnership*	**Aashish Barwale** Seven Star Fruits Pvt Ltd., Mumbai
15.55-16.15	**Tea/Coffee Break**	
16.15-17.15	**Rapid Oral Presentations** (7-6 min. each)	
	TSII-OP1: Characterization and core set development of Amaranth using high density 64K SNP Array	**Akshay Singh** ICAR-NBPGR, New Delhi

		Co-authors - Avantika Maurya, Rajat Gupta, Dimpi Das, Gautam Vats, Ajay Kumar Mahato, S. Rajkumar, A.K. Singh, Rakesh Bhardwaj, S.K. Kaushik, Sandeep Kumar, Veena Gupta, Kuldeep Singh & Rakesh Singh
	TS-II-OP2: Search of novel donor germplasm for powdery mildew resistance in wheat minicore	**Jyoti Kumari,** ICAR-NBPGR, New Delhi **Co-authors--**Shivani Sharma, Sherry Rachel Jacob, Arun Gupta, Ashwani Basandrai, Sivasamy M., Vikas V.K., Lakshmi Kant, K K Mishra, Preeti Jakhar, Gaurav Kumar, Vasudha Jadon, Sundeep Kumar, Ashok Kumar, R.K. Gautam & G.P. Singh
	TSII-OP3: Identification and development of yellow rust resistant sources in wheat using conventional, molecular and doubled haploidy breeding	**Madhu Patial, I**CAR-IARI, RS Shimla
	TSII-OP4: Morphological characterization of magic population reveals extensive genetic variation for morpho-physiological and yield-related traits in bread wheat (Triticum aestivum L.)	**Sharmila M,** ICAR-NBPGR, New Delhi **Co-authors-** Shailesh Tiwari & Mahesh C. Yadav
	TSII-OP5: Genome-wide association mapping of grain quality traits in rice using single-locusand multi-locus models	**Avantika Maurya,** ICAR-NBPGR, New Delhi **Co-authors -** Rakesh Singh, Supriya Sachdeva, Vikas K. Singh, Uma M. Singh, Arvind Kumar & G.P. Singh
	TS-II-OP6: Mapping and mining of major genomic regions conferring resistance to Bruchid (Callosobruchus maculatus) in blackgram (Vigna mungo (L.) Hepper)	**Ragul S.** TNAU, Coimbatore **Co-author -** Manivannan N
	TS-II-OP7: Molecular and tepal morphology in delineating vegetable Amaranthus species complex conserved in Indian National Gene Bank	**Pooja Pathania,** ICAR-NBPGR, New Delhi **Co-authors -** Venugopal Gowda R. & S. Rajkumar
17.15-17.30	**Discussion & Co-Chairs Remarks**	
17.30-17.40	**Comfort Break**	
	Evening Lecture and Cultural Program	
Co-Chair	**R.C. Agrawal,** DDG (Agric. Education), ICAR, New Delhi	
	R.K. Tyagi, Vice President, ISPGR, New Delhi	
Convenor	**Sanjeev Kumar Chauhan,** YSPUHF, Solan	
	J.K. Sharma, Baddi University, Baddi, Solan	
Rapporteurs	**Lokender Kumar,** Shoolini University, Solan	
	Anil Kumar, ICAR-DMR, Solan	
17.40-17.45	**Introduction of Speaker**	**Convenor**
17.45-18.30	Global Concerns for PGR Management	**R.S. Paroda, TAAS** New Delhi
18.30-18.35	**Chairperson Remarks**	
18.35-18.40	**Vote of Thanks**	**Yashwant Singh Negi** Shoolini University, Solan
18.40-18.50	**Break**	
18.50-19.45	**Cultural Program**	
19.45 onwards	**Welcome Dinner (Hosted by Chancellor, Shoolini University, Shoolini)**	

Day 2: November 28, 2023 (Tuesday)

TECHNICAL SESSION III
In situ/on-farm, *ex situ* Conservation and Access & Benefit Sharing
(9.30 a.m. – 11.55 a.m.)
(Concurrent Poster Session)

Co-Chair	**K.R. Dhiman,** Former VC,YSPUHF, Solan
	J.C. Rana, Vice President, ISPGR, New Delhi
Convenor	**Anju Mahendru Singh,** ICAR-NBPGR, New Delhi
	S.K. Gupta, Shoolini University, Solan
Rapporteurs	**Jyoti Kumari,** ICAR-NBPGR, New Delhi
	Narender Negi, ICAR-NBPGR, RS Shimla

9.30-9.35	**Welcome**	**Convenor**
9.35-10.00	**Plenary Lecture** *Protection of plant varieties and farmer's rights in context of N-W Himalayas (Could not participate)*	***Dipal Roy Chaudhury,** PPV&FRA, New Delhi
10.00-10.15	**Invited Lectures** *Use of genetic resources in crop improvement*	**Mohar Singh,** ICAR-NBPGR, RS, Shimla
10.15-10.30	*Conservation of native arborial flora of N-W Himalayas: status, challenges and prospects*	**Vaneet Jishtu,** ICFRE-HFRI Shimla
10.30-10.45	*Biological Diversity Act and its relevance in conservation of unique Himalayan flora*	**Murari Lal Thakur,** HIMCOSTE, Shimla
10.45-11.15	**Tea/Coffee Break**	
11.15-11.35	**Rapid Oral Presentations** (4-6min. each)	
	TSIII-OP1: Ex situ conservation of wild Allium genetic resources at NBPGR Bhowali field genebank	**K.M. Rai,** ICAR-NBPGR, RS Bhowali **Co-authors -** Pavan Malav, Pankaj Kumar Kannaujia, Narendra Negi & Mamta Arya
	TSIII-OP2: Conservation of wheat and barley genetic resources of North-Western Himalayas inthe National Genebank	**Sherry Rachel Jacob,** ICAR-NBPGR, New Delhi **Co-authors -** Shashank H.G., Sampa Saha, Aradhana Mishra, Aravind J., Padmavati Gore & Anju Mahendru Singh
	TSIII-OP3: Conservation and Characterisation of Protected Farmer's Varieties of Apricot of Cold Arid Region for future breeding programmes in Kargil (UT-Ladakh)	
	TSIII-OP4: Advanced methods of conservation of plant biodiversity	**Faizan Ahmad,** Mountain Agriculture Research and Extension Station, Kargil SKUAST-Jammu and Kashmir
	TSIII-OP4: Advanced methods of conservation of plant biodiversity	**Neha Rani,** Dr Y.S. Parmar, College of Horticulture and Forestry **Co-authors -** B.S. Dilta & Bhavna
11.35-11.55	**Discussion & Co-Chairs Remarks**	

TECHNICAL SESSION IV
Plant Biodiversity in Local Food System
(11.55 a.m.–3.00p.m.)
(Concurrent Poster Session)

Co-Chair	**R.S. Chandel,** YSPUHF, Solan
	Brajesh Singh, Director, ICAR-CPRI, Shimla
Convenors	**Manjusha Verma,** ICAR-NBPGR, New Delhi
	Somesh Sharma, Shoolini University, Solan

Rapporteurs	**Rakesh Sharma,** YSPUHF, Solan	
	Ravi K. Pamarthi, ICAR-NBPGR, New Delhi	
	Keynote Lecture	
12.00-12.20	*Mainstreaming agrobiodiversity for enhancing climate resilience, nutrition, livelihoods and ecosystems service*	**J.C. Rana,** Alliance for BI and CIAT, New Delhi
	Invited Lecture	
12.20-12.35	*Status and nutritional value of mushroom*	**V.P. Sharma,** ICAR-DMR, Solan
12.35-12.50	*Underutilized temperate fruit species in the Western Himalayas - scope for enhancing rural livelihoods and improving food security*	**K.K. Jindal,** Former ADG (Horticulture), ICAR, New Delhi
12.50-13.05	*Medicinal value of local plant diversity of N-W Himalayas*	**Bhupinder Dutt,** Professor YSPUHF, Solan
13.05-13.20	*Traditional food of Himachal Pradesh*	**Nand Lal Sharma,** Himachal Pradesh Tourism Development Corporation
13.20-14.20	**Lunch break**	
14.20-14.45	**Rapid Oral Presentations** (4-6 min. each)	
	TSIV-OP1: Evaluation of potato germplasm in early crop season	**Babita Chaudhary,** ICAR-CPRI, Modipuram, Meerut **Co-authors –** S.K. Luthra , Anuj Bhatnagar, V.K. Gupta, Dalamu & Vinod Kumar
	TSIV-02: Reviving grasspea (Lathyrus sativus L.) - a potential green leafy vegetable source for the Himalayan regions	**Ramya KR,** ICAR-NBPGR, New Delhi **Co-authors -** Kuldeep Tripathi, Ravi K. Pamarthi, Padmavati G. Gore, Rinky Reshma Panda, Rakesh Bharadwaj & K.C. Bhatt
	TSIV-OP3: Understanding genetic variability for morphological and nutritional traits in the linseed germplasm collection at National Genebank of India	**Vikender Kaur,** ICAR-NBPGR, New Delhi **Co-authors -** Sunil S. Gomashe, Shashank K. Yadav, Devender Singh, Vinay Kumar, Sheela, Shubhendra Singh Chauhan, Balram Jat, Munisha Kheralia, Sapna Langyan, Nutan Kaushik, Mamta Singh, D.P. Wankhede, J Aravind, Ashok Kumar & G.P. Singh
	TSIV-OP4: Agricultural biodiversity: participatory knowledge and autonomous learning for rural food systems	**Bhavna Rajkumari,** Dr Y.S. Parmar, College of Horticulture and Forestry **Co-authors -** B.S. Dilta, Chinglembi Laishram & Neha Rana
14.45-15.00	**Discussion & Co-Chairs Remarks**	

TECHNICAL SESSION V

Entrepreneurship and value chains – Role of youths and women

(3.00p.m. –5.15p.m.)

(Concurrent Poster Session)

Co-Chair	**Parvinder Kaushal,** VC, UUHF, Pauri Garhwal
	Anuradha Agrawal, National Coordinator, NAHEP, ICAR, New Delhi
Convenors	**Pankaj Sood,** KVK, Mandi
	Ramesh Bhardwaj, YSPUHF, Solan
Rapporteurs	**Vikender Kaur,** ICAR-NBPGR, New Delhi
	Anil Kumar, ICAR-DMR, Solan

15.00-15.05	**Welcome**	**Convenor**
	Keynote Lecture	
15.05-15.25	*Role of potato in entrepreneurship development*	**Brajesh Singh,** ICAR-CPRI, Shimla
	Invited Lectures	
15.25-15.40	*High density apple plantation (HDAP)*	**D.P. Sharma,** YSPUHF, Solan
15.40-15.55	*Unlocking native mountain crops for livelihood and enterprise development*	**Lal Singh,** HRG, Shimla
15.55-16.20	**Tea/Coffee Break**	
16.20-16.30	*Developing recipes/products of traditional crops of N-W Himalayas*	**Rahul Saxena,** Back to Basics Naturally LLP, Palampur
16.30-16.40	*Developing recipes/products of Himalayan plant diversity*	**Joginder Walia,** Society for Technology and Development, Mandi
16.40-16.50	*Value addition of millets*	**Sneha,** Women Self Help Group, Gohar, Mandi
16.50-17.00	*Promotion of local plant diversity of N-W Himalayas for developing products and value chain in Uttarakhand*	**Nav Bharat,** Mount Valley Development Association, Doni, Tehri Garhwal
17.00-17.15	**Discussion & Co-Chairs Remarks**	
	Concluding Session (5.15 p.m. –6.45 p.m.)	
Co-Chair	**R.S. Paroda,** President, ISPGR, New Delhi	
	P.K. Khosla, Chancellor, Shoolini University, Solan	
Convenors	**R.K. Tyagi**, ISPGR, New Delhi	
	Yashwant Singh Negi, Shoolini University, Solan	
Rapporteurs	**Sherry R. Jacob,** ICAR-NBPGR, New Delhi	
	Pankaj Chauhan, Shoolini University, Solan	
17.15-17.30	**Summary of Major Recommendations**	**R.K. Tyagi,** Vice-President, ISPGR
17.30-18.05	**Felicitations and Award Distribution**	
18.05-18.35	**Remarks by Co-Chairs**	
18.35-18.45	**Vote of Thanks**	**Saurabh Kulshreshta,** Organizing Secretary, Shoolini University, Solan
18.45 onwards	**Dinner** (Hosted by Mahyco Pvt. Ltd.)	

Awards and Appreciation

Best Oral Presentation Awards

TS-I: Status and Management of Plant Biodiversity of North-West Himalayas (NWH)

1. **R.K. Pamarthi,** D.P. Semwal, Soyimchetan and P.K. Singh. Expedition of PGR diversity in North Western Himalayas of India

TS-II: Traits Discovery and Genomics in Plants of NWH

1. **Ragul S.** and Manivannan N. Mapping and mining of major genomic regions conferring resistance to Bruchid (*Callosobruchus maculatus*) in blackgram (*Vigna mungo* (L.) Hepper).

2. **Pooja Pathania,** Venugopal Gowda R. and S. Rajkumar. Molecular and tepal morphology in delineating vegetable Amaranthus species complex conserved in Indian National Gene Bank.

3. **Madhu Patial** Identification and development of yellow rust resistant sources in wheat using conventional, molecular and doubled haploidy breeding.

4. **Jyoti Kumar,** Shivani Sharma, Sherry Rachel Jacob, Arun Gupta, Ashwani Basandrai, Sivasamy M., Vikas V.K., Lakshmi Kant, K.K. Mishra, Preeti Jakhar, Gaurav Kumar, Vasudha Jadon, Sundeep Kumar, Ashok Kumar, R.K. Gautam and G.P. Singhi. Search of novel donor germplasm for powdery mildew resistance in wheat minicore.

TS-III: *In situ*/on-farm, *ex situ* Conservation and Access & Benefit Sharing

1. **Neha Rani,** B.S. Dilta and Bhavna Rajkumari. Advanced methods of conservation of plant biodiversity.

2. **Sherry Rachel Jacob**, Shashank H.G., S. Saha, A. Mishra, Arvind J., P.G. Gore and Anju M. Singh. Conservation of wheat and barley genetic resources of North-Western Himalayas in the National Genebank.

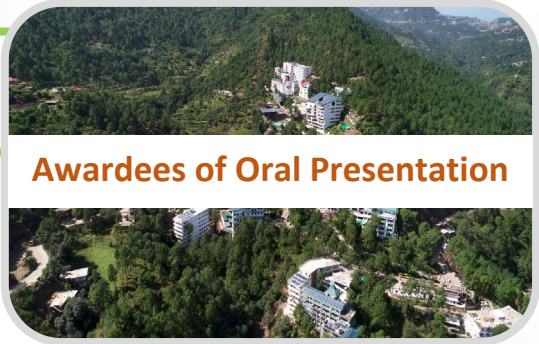
TS-IV: Plant Biodiversity in Local Food System

1. **Ramya K.R.**, Kuldeep Tripathi, Ravi K. Pamarthi, Padma G. Gore, Rinky Reshma Panda, Rakesh Bharadwaj and KC Bhatt. Reviving grasspea (*Lathyrus sativus* L.) - a potential green leafy vegetable source for the Himalayan regions.

TS-V: Entrepreneurship and value chains – Role of youths and women

1. **Sneha Sharma** Entrepreneurship development through Integrated farming.

2. **Nek Ram.** Conservation of Himalayan biodiversity.



Awardees of Oral Presentation

Best Poster Presentation Awards

TS-I: Status and Management of Plant Biodiversity of North-West Himalayas (NWH)

1. **Thendral Uma Shankar**, Dinesh Prasad Semwal and Kuldeep Tripathi Impact of climate change on the temporal and spatial distribution of crop wild relatives (CWRs) of *Vigna* spp. in India using BioClim Model
2. **Deepa Pal**, **Raghavendra Aminedi**, Amit Kumar Singh, Vartika Srivastava and Monika Singh.Detection strategies for checking unauthorized GMOs in fruit and vegetable crops of North-Western Himalayan Region: a precautionary approach
3. **Ritesh Kumar Singh,** Kuldip S, Dogra and Kumar Ambrish . Alien plant species invasion in Himachal Pradesh: Present and future scenario

TS-II: Traits Discovery and Genomics in Plants of NWH

1. **Priyanka**, Vijay Rana, V.K. Sood, Jyoti Kumari and Aakriti Sharma. Resistance to stripe rust in elite wheat germplasm from Northern Western Himalayan zone of India
2. **Daniya Shahid**, Ankit Saroha, Akash, Deepa Pal, Vikender Kaur, Sunil S Gomashe, S. Rajkumar, Ashok Kumar, Gyanendra Pratap Singh, and Dhammaprakash Pandhari Wankhede. Transcriptome study for identification of key genes involved in flowering time regulation in linseed (*Linum usitatissimum* L.)
3. **G. Prasanna Kumar**, Pooja Pathania, Prabhanshu Kuma and S Rajkumar. Comparative studies on diversity in safflower germplasm with SSR and SNP markers
4. **Jyoti Kumari,** Vedna Kumari, Amar Singh, V.K. Sood, Ronika Thakur and Priyanka. Deciphering resistance to frogeye leaf spot in soybean germplasm under mid-Himalayan region

TS-III: *In situ*/on-farm, *ex situ* Conservation and Access & Benefit Sharing

1. **Rinky Resma Panda** and Sandhya Gupta. Sustaining wild edible fruit treasures: Ex situ conservation of *Artocarpus lacucha* Buch.-Ham.
2. **A. Siva Kumar**, S. Manonmani and K. Hemaprabha. Validation of the droplet vitrification protocol for cryo-conservation of in vitro grown Grand Naine banana (*Musa* spp) shoot apices
3. **Monika Chauhan**, Vaneet Jishtu, Neha Sharma and Brij Bhushan. Plant diversity and edible macro-fungi in food systems of tribal communities in Baspa Valley, Kinnaur (Himachal Pradesh)

TS-IV: Plant Biodiversity in Local Food System

1. **Abhilash Padhan**, Dinesh Singh Thakur, Akriti Chauhan and Narender Negi. Expanding kiwifruit cultivation to higher hill regions of the North-West Himalayas through wild kiwi selections (*Actinidia callosa* var. *strigillosa* C. F. Liang)
2. **Prerna Thakur** and Amandeep Singh Brar. *Momordica balasamina*: an under utilized species plays imperative role in nutritional and economical upliftment in North western plains of India

TS-V: Entrepreneurship and value chains – Role of youths and women

1. **Krishna Aayush**_and Somesh Sharma, Creating and evaluating an active xanthan gum nanoemulsion coating infused with betel leaf extract for enhancing fresh produce shelf life
2. **Ankush Moran** and Vipan Guleria. Impact of tourism on plant biomass and carbon stock in North-West Himalayas
3. **Gurvendra Pal Singh** and Dinesh Kumar. Transforming food waste into versatile and high-performance edible packaging using starch nanoparticles

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List of Posters

S. No.	Authors	Presenter's Designation & Affiliation	Title
TS-I: Status and Management of Plant Biodiversity of North-West Himalayas (NWH)			
P-1	**Mrinalini Singh** and Rajnish Sharma	Department of Biotechnology, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh mrinalinisingh820@gmail.com	Plant biodiversity: importance, management and status in North-Western Himalayas
P-2	**K. M. Rai,** Badal Singh, Narendra Negi and Mamta Arya	ICAR-National Bureau of Plant Genetic Resources, Regional Station, Bhowali, Nainital-263132, Uttarakhand Krishna.Rai@icar.gov.in	Genetic resources of wild edibles in high altitude of Kumaon region of Uttarakhand
P-3	**Kajal Bhardwaj**	CSKHPKV, Palampur-176062, Himachal Pradesh - kajal96bhardwaj@gmail.com	Therapeutic and Aromatic Plant Resources of Himachal Pradesh: A Review
P-4	**Shreedhar Beese**, S R Dhiman, Puja Sharma and Divesh Thakur	Department of Floriculture and Landscape Architecture, Dr. Y.S Parmar, UHF Nauni, Solan, Himachal Pradesh-173230 shridhar.rb38@gmail.com	Edible Flowers: A Blooming culinary Trend
P-5	**Ritesh Kumar Singh**, Kuldip S, Dogra and Kumar Ambrish	Botanical Survey of India, High Altitude Western Himalayan Regional Centre, Solan-173230, HP riteshksingh1998@gmail.com	Alien Plant Species Invasion in Himachal Pradesh: Present and Future Scenario
P-6	**Thendral Uma Shankar**, Dinesh Prasad Semwal and Kuldeep Tripathi	ICAR-National Bureau of Plant Genetic Resources (ICAR-NBPGR), New Delhi – 110012 thendralshankar1153@gmail.com	Impact of Climate Change on the Temporal and Spatial Distribution of Crop Wild Relatives (CWRs) of *Vigna* spp. in India Using BioClim Model
P-7	**Shiwani Kumari**, Dushyant Sharma, Rajeev Kumar and Reena Kumari	Dr Y S Parmar, College of Horticulture and Forestry, Thunag, Mandi drshiwani2125@gmail.com	Assessment of morphological variability in *Cyclanthera pedata* (L.) Schrad, an underutilized vegetable found in wet temperate zone of Himachal Pradesh
P-8	**Raghav Sood**, Gopal Katna, Uttam Chand	ICAR-NBPGR RS, Shimla; CSKHPKV, Palampur rs23.sood@gmail.com	Evaluation of maize genotypes under Subhash Palekar natural farming in lower hills of Himachal Pradesh
P-9	**Deepa Pal**[†], Raghavendra Aminedi[†], Amit Kumar Singh, Vartika Srivastava and Monika Singh	ICAR-NBPGR, New Delhi [†]Equal contribution monika.singh@icar.gov.in; deepapal93@gmail.com	Detection strategies for checking unauthorized GMOs in fruit and vegetable crops of North-Western Himalayan Region: a precautionary approach

TS-II: Traits Discovery and Genomics in Plants of NWH			
P-10	**Ananya Thakur**, Neelam Bhardwaj and V.K. Sood	Department of Genetics and Plant Breeding, CSKHPKV Palampur-176062, Himachal Pradesh (HP) ananyathakur622@gmail.com	Characterization of elite germplasm of North Western Himalayas using DUS traits
P-11	**Poonam Sharma**, Kajal Bhardwaj and Neelam Bhardwaj	Department of Genetics and Plant Breeding, CSKHPKV, Palampur-176062, Himachal Pradesh poonam20061998@gmail.com	Trait discovery and genomics in plants of North-Western Himalayan
P-12	**Gauri Sood[1*]**, RK Dogra[1], Gopal Singh[1], Narender Negi[2] and Girish Dangi[1]	[1]Department of Fruit Science, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan-173230, HP, India [2]National Bureau of Plant Genetic Resources Regional Station, Shimla-171 004, HP gauri78sood@gmail.com	Foliar, floral and fruit characterization of some Japanese Plum (*Prunus salicina* Lindl.) germplasms (updated)
P-13	**Girish Dangi[1*]**, Dinesh Singh[2], Pramod Verma[1] and Gauri Sood[1]	[1]Department of Fruit Science, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan-173230, HP [2]Regional Horticulture Research and Training Station, Mashobra, Shimla-171 007, HP girishdangi@yspuniversity.ac.in	Characterization and evaluation of sweet cherry (*Prunus avium* L.) germplasm under the North-West Himalayan region
P-14	**Poonam Kumari** and Mahender Singh Thakur	Department of Biosciences, Himachal Pradesh University, Summerhill, Shimla-171005 drmahender74@gmail.com	Molecular characterization and identification of insect pollinators of *Punica granatum* L. from Western Himalaya, India
P-15	**Anamika Thakur**, Rajnish Sharma, Sita Ram Dhiman, Reshma Negi and Anupama Singh	Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan-173 230, HP inuthakur95@gmail.com	Genetic Characterization and Mutant Analysis of Chrysanthemum Genotypes Using SSR Markers
P-16	**Rishita Kapoor,** Neelam Bhardwaj and V.K. Sood	Department of Genetics and Plant Breeding, CSKHPKV Palampur-176062, Himachal Pradesh rishitakapoor98@gmail.com	Evaluation of red rice (*Oryza sativa* L.) germplasm of Himachal Pradesh using agro morphological markers
P-17	**Priyanka[1]***, Vijay Rana[2], V.K. Sood, Jyoti Kumari and Aakriti Sharma	[1]Department of Genetics and Plant Breeding, CSK Himachal Pradesh Agricultural University, Palampur-176062 [2]CSK Himachal Pradesh Agricultural University, Rice & Wheat Research Centre, Malan-176 047 guleriapriyanka033@gmail.com	Resistance to stripe rust in elite wheat germplasm from Northern Western Himalayan zone of India

P-18	**Daniya Shahid**, Ankit Saroha, Akash, Deepa Pal, Vikender Kaur, Sunil S Gomashe, S. Rajkumar, Ashok Kumar, Gyanendra Pratap Singh, and Dhammaprakash Pandhari Wankhede*	ICAR-National Bureau of Plant Genetic Resources, New Delhi d.wankhede@icar.gov.in	Transcriptome study for identification of key genes involved in flowering time regulation in linseed (*Linum usitatissimum* L.)
P-19	**Manisha Kumari** and Deepa Sharma	Department of Vegetable Science, Dr Y S Parmar University College of Horticulture and Forestry Neri, Hamirpur 177001 manisha94590@gmail.com	Estimation of genetic parameters for morphological and quality traits in Pea (*Pisum sativum* L.)
P-20	**Jyoti Kumari**[1]*, Vedna Kumari[1], Amar Singh[2], V.K. Sood, Ronika Thakur[1] and Priyanka[1]	[1]Department of Genetics and Plant Breeding, CSK Himachal Pradesh Krishi Vishwavidyala, Palampur-176062, HP [2]Department of Plant Pathology, CSK Himachal Pradesh Krishi Vishwavidyala, Palampur-176062, HP jyotikumarijk2427@gmail.com	Deciphering resistance to frogeye leaf spot in soybean germplasm under Mid-Himalayan region
P-21	**Debjani Roy Choudhury**[1], Rakesh Singh* [1] , Laxmi Sharma[1] and Suma A[2]	[1]Division of Genomic Resources, ICAR-National Bureau of Plant Genetic Resources, New Delhi-110012 [2]ICAR-National Bureau of Plant Genetic Resources, Regional Station, Thrissur, Kerala, Vellanikkara, KAU, P.O. Thrissur - 680656 * rakesh.singh2@icar.gov.in	Exploring the genetic diversity and population structure of *Bacopa monnieri* (L) using random amplified (RAPD and ISSR) and gene targeted (SCoT and CBDP) markers
P-22	**Akriti Sharma**[1], S.K. Rai* [2], Vijay Rana[3] , Priyanka[1] , Amit Rana[1] , and Chetan Gupta[1]	[1] Department of Genetics and Plant Breeding, CSK Himachal Pradesh Krishi Vishwavidyalaya, Palampur, (H. P.) [2] Division of Plant Breeding and Genetics, SKUAST, Jammu, Chatha [3] Rice and Wheat Research Centre, Malan, CSK Himachal Pradesh Krishi Vishwavidyalaya, Palampur, HP suniliivr@gmail.com	Screening of diverse *Brassica* germplasm for white rust resistance under northern-Himalayan conditions
P-23	**G Prasanna Kumar** [1,2], Pooja Pathania [1], Prabhanshu Kumar [2] and S Rajkumar [1 *]	[1] Division of Genomic Resources, ICAR-National Bureau of Plant Genetic Resources, New Delhi 110012 [2]Amity Institute of Biotechnology, Amity University, Noida, Sector-125, Uttar Pradesh 201313 * s.rajkumar@icar.gov.in	Comparative studies on diversity in Safflower germplasm with SSR and SNP markers
P-24	**Siddharth Kumar**[1*,] A. K.	Department of Fruit Science, College of Horticulture, Banda university of	Physio-chemical characterization of tendu fruit

	Srivastava2 and Om Prakash3	Agriculture and technology, Banda Uttar Pradesh *Corresponding Author: siddharthhort20@gmail.com	(*Diospyros melanoxylon* Roxb) and selection of plus trees from Majhgawan forest of Madhya Pradesh
P-25	**Madhu Rana**, Mahender Singh Thakur	Department of Biosciences, Himachal Pradesh University, Shimla, Himachal Pradesh drmahender74@gmail.com ; madhuamar08@gmail.com	Molecular Characterization And Identification of Insect Pollinators of *Valeriana jatamansi* Jones from Shimla Hills, Western Himalayas
P-26	**Akriti Sharma**	Department of genetics and plant breeding, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur – 176062, HP akriti19907@gmail.com	Recent advances in plant breeding methods for self and cross-pollinated crops: A Review
TS-III: *In situ*/on-farm, *ex situ* Conservation and Access & Benefit Sharing			
P-27	**Pradeep Kumar[1]**, [2]*, Mohar Singh[1], Narender Negi[1] and G.K. Dhingra[2]	[1] ICAR-National Bureau of Plant Genetic Resources Regional Station, Phagli, Shimla-171004 (HP) [2]Department of Botany, Sri Dev Suman Uttarakhand University, Pt. L.M.S Campus, Rishikesh, Uttarakhand *pradeepkthakurbotanist@gmail.com	Traditional uses and conservation of *Fritillaria roylei* Hook. a critically endangered Himalayan medicinal plant: an overview
P-28	**Akash Sharma** [1*] , Dhram Pal Sharma [1] , Gopal Singh [1] and Nitin Sharma [2]	[1] Department of Fruit Science, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan-173230, HP [2] Department of Basic Science, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan-173230, HP *akashfr7@gmail.com	Effect of rooting media on nursery production of M.9 T337 apple rootstock
P-29	**A. Siva Kumar** [1*], S. Manonmani and [1]K. Hemaprabha [2]	[1]Department of Plant Genetic Resources, [2]Department of Fruit Science, TNAU, Tamil Nadu * Sivakumar80156@gmail.com	Validation of the droplet vitrification protocol for cryo-conservation of in vitro grown Grand Naine banana (*Musa* spp) shoot apices
P-30	**Rinky Resma Panda[1]** and Sandhya Gupta[2]	ICAR-National Bureau of Plant Genetic Resources (ICAR-NBPGR), Pusa Campus, New Delhi-110012 [1]Presenter's email: bgrinkyresma6@gmail.com [2]Corresponding author's email: sandhya.gupta@icar.gov.in	Sustaining Wild Edible Fruit Treasures: Ex Situ Conservation of *Artocarpus lacucha* Buch.-Ham.
P-31	**Suman** [1*] , Jitender Kumar Chauhan [2] , Uday Sharma [3] , Gopal Singh [1] and Divya Pandey [1]	[1] Department of Fruit Science, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan-173230, HP [2] Horticultural Research & Training Station and Krishi Vigyan Kendra, Kandaghat, Solan- 173215, HP	Influence of Plant Growth Regulators on Growth, Yield and Fruit Quality of Strawberry (*Fragaria × ananassa*) cv. Camarosa

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P-32	**Vinay Kumar**[1,*], Rajnish Sharma[1], Parul Sharma[1], Kamal Thakur[1] and Yash Pal Sharma[2]	[1]Department of Biotechnology, [2]Department of Forest ProductsDr YS Parmar University of Horticulture and Forestry, Nauni, Solan 173 230, HP vinaybanyal123@gmail.com,	Factors affecting *in vitro* propagation of an endangered medicinal herb *Trillium govanianum* (Himalayan Trillium): useful insights towards conservation practices
TS-IV: Plant Biodiversity in Local Food System			
P-33	**Abhilash Padhan**, Dinesh Singh Thakur, Akriti Chauhan and Narender Negi	Dr Y S Parmar, College of Horticulture and Forestry, Thunag, Mandi fruitbreederabhilash9020@gmail.com	Expanding kiwifruit cultivation to higher hill regions of the North-West Himalayas through wild kiwi selections (*Actinidia callosa* var. *strigillosa* C. F. Liang)
P-34	**Monika Chauhan[1]***, Vaneet Jishtu[1], Neha Sharma[2] and Brij Bhushan[1]	ICFRE-Himalayan Forest Research Institute, Panthaghati, Shimal itsmonikachauhan.10@gmail.comorthor	Plant Diversity and Edible Macro-Fungi in Food Systems of Tribal Communities in Baspa Valley, Kinnaur (Himachal Pradesh)
P-35	**Prerna Thakur** and Amandeep Singh Brar	Punjab Agricultural University, Ludhiana prerna-coavs@pau.edu	*Momordica balasamina*: an under utilized species plays imperative role in nutritional and economical upliftment in north western plains of India
P-36	**Shailja Sharma**[*1], Sanchit Thakur[2] , Surinder Singh Rana[3], and Rhitisha Sood[4]	1- CSKHPKV- Moutain Agricultural Research and Extension Centre, Sangla 2-Shoolini University, Solan 3,4 – CSK Krishi Vishvavidalaya, Palampur Shailjasharma567@gmail.com	Evaluation of common bean genotypes for yield and related traits in zone IV of Himachal Pradesh
P-37	**Sudarshna Negi**, Neelam Bhardwaj and V.K. Sood	Department of Genetics and Plant Breeding, CSKHPKV Palampur, Himachal Pradesh, 176062 darshiinegi@gmail.com	Characterization of basmati rice genotypes of North Western Himalayas
P-38	**Aakash Kausha[l],** Gopal Katna and V.K. Sood	[1] Department of Genetics and Plant Breeding, CSKHPKV Palampur, Himachal Pradesh, 176062 aakashkaushal77@gmail.com	Analysis of genetic diversity in grain amaranth (*Amaranthus* sp.)
P-39	**Banlambhabok Khongthaw** and P. K. Chauhan**	School of Bioengineering and Food Technology, Shoolini University, Bajhol, Distt Solan-173229, HP	Comparative evaluation of phytochemical and antioxidant properties of *Rauwolfia serpentine* and

		khongthawbanlam@gmail.com	*Picrorhiza kurroa* wild plant species
P-40	**Manisha Joshi**, Ipsheta Bose,Krishna Aayush and Somesh Sharma	School of Bioengineering and Food Technology, Shoolini University, Solan-173229, Himachal Pradesh someshsharma@shooliniuniversity.com	A Comparative Analysis of Biosolvents for Efficient Extraction of Polyphenolic Phytochemicals from Diverse Citrus Peel Varieties in Western Himalayan Region
P-41	**Nikki Kumari**	Patliputra University, Patna nikki.kri267@gmail.com	Food security in India
P-42	**M.S.Thakur**	Department of Biosciences, Himachal Pradesh University, Shimla- 171 005, HP drmahender74@gmail.com; mstbios@hpuniv.ac.in	Studies on diversity, Distribution and Relative Abundance of Insect Pollinators on *Bergenia ciliata* (Haw.) Sternb. And *Vinca major* (Linneaus) in Shimla Hills, Himalaya
P-43	**Shikha Rangra Chandel[1]* Kumari Shalini[2]#, Anju Bala[2], Shriyanshu Thakur[2]**	[1]Division of Microbiology, School of Pharmaceutical and Health Sciences, Career Point University, Hamirpur, HP [2]Research Scholar, Division of Microbiology, School of Pharmaceutical and Health Sciences, Career Point University, Hamirpur, HP	Pharmaceutical and Microbial Potential of Acorus Calamus Linn.: An endangered Highly Valued Medicinal Plant Species
TS-V: Entrepreneurship and value chains – Role of youths and women			
P-44	**Shareya** and D.D. Sharma	Swaminathan School of Agriculture, Shoolini University of Biotechnology and Management Sciences, Bajhol, Solan-173229, HP ishreyak@gmail.com	Promoting Entrepreneurial Skills among the Youths of Indian Himalayan Region
P-45	**Rijwal Rajta**, D.D. Sharma and Shareya	MS Swaminathan School of Agriculture, Shoolini University of Biotechnology and Management Sciences, Bajhol, Solan-173229, HP rajtarj69@gmail.com	Empowering Women Entrepreneurship in India
P-46	**Ankush Moran[1]*** and Vipan Guleria[2]	[1]Department of Silviculture and Agroforestry, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, HP [2]Regional Horticultural Research & Training Station, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Kangra 176201, HP ankushmoran3@yspuniversity.ac.in	Impact of tourism on plant biomass and carbon stock in north-west Himalaya
P-47	**Nousheen** and P.K Chauhan	School of Bioengineering and Food Technology, Shoolini University, Bajhol, Solan-173229, HP	Development of Wheat flour cookies fortified with Carrot, pomace and Beetroot

P-48	**Krishna Aayush** and Somesh Sharma	School of Bioengineering and Food Technology, Shoolini University, Bajhol, Solan-173229, HP someshsharma@shooliniuniversity.com	Creating and evaluating an active xanthan gum nanoemulsion coating infused with betel leaf extract for enhancing fresh produce shelf life
P-49	**Gurvendra Pal Singh**[1] and Dinesh Kumar[*1]	[1] School of Bioengineering and Food Technology, Shoolini University, Bajhol, Solan-173229, HP dineshkumar@shooliniuniversity.com	Transforming food waste into versatile and high-performance edible packaging using starch nanoparticles
P-50	**Parneet Kaur** and Saurabh Kulshrestha	Faculty of Applied Sciences and Biotechnology, Shoolini University of Biotechnology and Management Sciences, Bajhol, Solan-173229, HP parneetkaur@shooliniuniversity.com	Study on the development of a novel biological consortium for the efficient treatment of wastewater
P-51	**Avantika Sharma** and Rajesh Kumar Kaushal	Department of Soil Science and Water Management Dr Y S Parmar University of Horticulture and Forestry Nauni, Solan173 230Himachal Pradesh avantika1J.K. Sharma 2@gmail.com	Role of fermented organic manure in fruit cultivation and sustenance of soil health

About the Organizers

Indian Society of Plant Genetic Resources (ISPGR): The Society was founded in 1987 as a multidisciplinary scientific body involved in various issues of plant genetic resources (PGR) and related fields. The genesis of the Society was from the initiative taken by the scientists at the National Bureau of Plant Genetic Resources (NBPGR), New Delhi, under the leadership of Dr R S Paroda, the then Director of NBPGR and presently President, ISPGR and Chairman, TAAS. The primary objective of the Society is to provide a forum to those interested in the field of PGR for expressing their views, publishing their findings and interacting with different stakeholders. Membership of the ISPGR is open to all persons involved in PGR in India and abroad.

Shoolini University : Located in Solan, Himachal Pradesh, India, this is a private research institution established in 2009. Accredited by NAAC with an 'A' grade and recognized by the UGC, it offers diverse undergraduate, postgraduate, and doctoral programs in fields like engineering, management, pharmaceutical sciences, agriculture, biotechnology, and humanities. Shoolini University provides a holistic education experience, emphasizing academic excellence, extracurricular activities, and community engagement. One of the distinguishing features of Shoolini University is its strong focus on sustainability and environmental consciousness. The university has been recognized for its efforts in promoting green practices and sustainable development.

ICAR-National Bureau of Plant Genetic Resources (NBPGR): The ICAR-National Bureau of Plant Genetic Resources, (ICAR-NBPGR) in 1976 with its headquarters at New Delhi. The Bureau is the nodal organization in India with the national mandate to plan, conduct, promote and coordinate all activities concerning plant exploration and collection, characterization and also for safe conservation and distribution of both indigenous and introduced genetic variability in crop plants and their wild relatives. It is also vested with the authority to issue Import Permit and Phytosanitary Certificate and conduct quarantine checks on all seed materials and plant propagules introduced from abroad or exported for research purpose (including transgenic material). The Bureau has a network of 10 RS / BCs to fulfill the mandate of PGR management across different agro-ecological conditions of the nation.

Alliance of Bioversity International and CIAT: It is a global research-for-development organization. Its vision is that agricultural biodiversity nourishes people and sustains the planet. It delivers scientific evidence, management practices and policy options to use and safeguard agricultural and tree biodiversity to attain sustainable global food and nutrition security. Bioversity International works with partners in low-income countries in different regions where agricultural and tree biodiversity can contribute in improving nutrition, resilience, productivity and climate change adaption. Bioversity International is a CGIAR research centre. CGIAR is a global research partnership for a food-secure future.

Protection of Plant Varieties and Farmers' Right Authority (PPV&FRA): In order to provide for the establishment of an effective system for protection of plant varieties, the rights of farmers and plant breeders and to encourage the development of new varieties of plants it has been considered necessary to recognize and protect the rights of the farmers in respect of their contribution made at

any time in conserving, improving and making available plant genetic resources for the development of the new plant varieties. Moreover, to accelerate agricultural development, it is necessary to protect plants breeders' rights to stimulate investment for research and development for the development of new plant varieties. Such protection is likely to facilitate the growth of the seed industry which will ensure the availability of high-quality seeds and planting material to the farmers. India having ratified the Agreement on Trade Related Aspects of the Intellectual Property Rights (TRIPs) has to make provision for giving effect to Agreement. To give effect to the aforesaid objectives the Protection of Plant Varieties and Farmers' Rights Act, 2001 has been enacted in India and Protection of Plant Varieties and Farmers' Rights Authority was established.

Photo Gallery

Photo Gallery

पश्चिमी हिमालय की सुरक्षा में उद्योग और जैव प्रौद्योगिकी के महत्व पर दिया जोर

शूलिनी में हिमालय क्षेत्र में पौधों की जैव विविधता पर संगोष्ठी

सोलन, (आपका फैसला)। शूलिनी यूनिवर्सिटी ऑफ प्लांट जेनेटिक रिसोर्सेज ने आईसीएआर नेशनल ब्यूरो ऑफ प्लांट जेनेटिक रिसोर्सेज (एनबीपीजीआर) नई दिल्ली और एमएस स्वामीनाथन स्कूल ऑफ एग्रीकल्चर के सहयोग से शूलिनी में एप्लाइड साइंसेज और बायोटेक्नोलॉजी संकाय द्वारा समर्थित दो दिवसीय राष्ट्रीय सेमिनार का आयोजन किया गया। सेमिनार,जिसका विषय था उत्तर-पश्चिम हिमालय में खाद्य पोषण और स्वास्थ्य सुरक्षा के लिए पादप जैव विविधता, इस क्षेत्र में जैव विविधता संरक्षण की तत्काल भारतीय बच्चों में कुपोषण के मुद्दों का समाधान करने की आवश्यकता पर प्रकाश डाला। शूलिनी विश्वविद्यालय के कुलपति प्रो.अमूल खोसला ने सभी गणमान्य व्यक्तियों का स्वागत किया और साथ अर्थशास्त्र की अभिन्न भूमिका पर भी प्रकाश डाला। एएसआरबी कुमार ने मानवता और हिमालय की समृद्ध जैव विविधता के बीच गहरे संबंध पर अंतर्दृष्टि साझा की। प्रयासों की आवश्यकता पर जोर दिया। शूलिनी विश्वविद्यालय के चांसलर प्रोफेसर पीके खोसला ने जैव विविधता संरक्षण में योगदान देने के लिए अपनी सर्वसेष्ठ क्षमता के साथ चमकने के लिए संस्थान मोनिका शर्मा द्वारा संकलित फ्रेंच कीन जिजीव नामक पुस्तक का आधिकारिक विमोचन भी हुआ। यह प्रकाशन पौधों के स्वास्थ्य से संबंधित ज्ञान को बढ़ाता है और जैव विविधता संरक्षण पर चल रही बातचीत में योगदान देता है। विशेषज्ञों की एक समर्पित टीम द्वारा संकलित राष्ट्रीय संगोष्ठी की स्मारिका, जिसका शीर्षक उत्तर पश्चिम हिमालय में खाद्य, पोषण और स्वास्थ्य सुरक्षा के लिए पादप जैव विविधता है जारी किया गया, जिसमें हिमाचल प्रदेश के राज्यपाल के प्रमुख संदेश शामिल हैं। डॉ. मंजुषा


NATIONAL SEMINAR
Plant Biodiversity for
Food, Nutrition and Health Security
in North-West Himalayas