SOUVENIR

INTERNATIONAL CONFERENCE ON MEDICINAL, AROMATIC AND NUTRACEUTICAL PLANTS FROM MOUNTAINOUS AREAS

9th Annual Conference

AMERICAN COUNCIL FOR MEDICINALLY ACTIVE PLANTS

(ACMAP)

February 14-16, 2019

www.acmap.org
www.geu.ac.in



Jointly organized by

The Departments of Life Sciences & Biotechnology
Graphic Era (Deemed to be University), Dehradun, Uttarakhand, India

American Council for Medicinally Active Plants
(ACMAP), USA

THANK YOU SPONSORS

भारत सरकार GOVERNMENT OF INDIA | विज्ञान और प्रौद्योगिकी मंत्रालय MINISTRY OF SCIENCE AND TECHNOLOGY

जैवप्रौद्योगिकी विभाग
DEPARTMENT OF
BIOTECHNOLOGY
सत्यमेव जयते

GraphicEra
Deemed to be University
Accredited by NAAC with Grade A
Approved by AICTE, Ministry of HRD, Govt. of India

tgtri

STAR Health Insurance
Personal & Caring
The Health Insurance Specialist

MAX HEALTHCARE
Caring for you... for life

CSIR-INDIA

USTST
SCIENCE & TECHNOLOGY COUNCIL
UTTARAKHAND

राष्ट्रीय जैव विविधता प्राधिकरण
National Biodiversity Authority India
2003

UTTARAKHAND COUNCIL FOR BIOTECHNOLOGY
UCB

NABARD

आर्य वस्तु भण्डार

VELMED HOSPITALS
Redefining Healthcare with Empathy

IMMUNOMAX
improving life through science

Dabur

nidco
HERBAL HERITAGE

PATANJALI

BOHECO
BOMBAY HEMP COMPANY

iNSERB
INDIA

ML Irrigation
Specializing in Greenhouse & Nursery Irrigation


GRAPHIC ERA
DEEMED TO BE UNIVERSITY

Graphic Era Deemed to be University

In 1993 a young man with just twenty nine thousand and loads of determination embarked on a mission to transform the higher education landscape of the Doon valley. Graphic Era Deemed to be University is the culmination of the vision of its founder, Prof (Dr) Kamal Ghanshala, who had the dream to change the destiny of thousands of youth, through quality and holistic education and his vision took a concrete shape in the form of Graphic Era Institute in 1996.

In 2008, the Institute was accorded the status of Deemed University under Section 3 of the UGC Act, 1956 vide Notification F.9-48/2007-U.3 (A) dated August 14, 2008 and approved by Ministry of Human Resource Development, Government of India. In 2015 Graphic Era University was accredited by NAAC with grade 'A'.

University has acquired transnational dimensions through student exchange and knowledge sharing programs with many foreign universities and has been acclaimed and honored at international forums for its brilliance in upholding the highest standards of education. With recognition from prestigious institutions, Graphic Era University is setting new benchmarks in education. It has taken big initiative in engineering programs by getting into Partnerships with Tata Technologies and IBM to create next age Engineering Professionals through Industry Collaborations. Graphic Era hosts Technology Business Incubator that provides support for technology-based entrepreneurship. At present, Graphic Era has innumerable students on its rolls, pursuing education in different disciplines, ranging from engineering, science, business, management, commerce, hospitality to humanities and social sciences. The alumni of Graphic Era can be encountered worldwide in marquee brands like Apple, Google, Microsoft, HSBC, to name a few and in the service of the nation in all wings of the Armed forces.

Department of Life Science & Department of Biotechnology

The Department of Biotechnology was also established in 2008 and the Department of Life Sciences bifurcated from the parent department in 2016. The Departments offer UG (B.Tech, B.Sc. (Hons.) and PG (M.Tech, M.Sc.) programs in Biotechnology and Microbiology along with Ph.D. programs and B.Sc. (Hons) in Food Technology

American Council for Medicinally Active Plants (ACMAP)

The primary purpose of ACMAP is to promote and foster research, development, production, and conservation of medicinal, aromatic, and other bioactive plants useful to human health. ACMAP currently envisages basic and applied research on plant production, product development and evaluation as well as marketing to provide better healthcare products for healthy life for both human and animal population (www.acmap.org)

SOUVENIR

INTERNATIONAL CONFERENCE ON MEDICINAL, AROMATIC AND NUTRACEUTICAL PLANTS FROM MOUNTAINOUS AREAS

9th Annual Conference

AMERICAN COUNCIL FOR MEDICINALLY ACTIVE PLANTS

(ACMAP)

February 14-16, 2019

www.acmap.org
www.geu.ac.in

Jointly organized by

The Departments of Life Sciences & Biotechnology
Graphic Era (Deemed to be University), Dehradun, Uttarakhand, India

American Council for Medicinally Active Plants
(ACMAP), USA

About Uttarakhand

Uttarakhand is one of the mountainous states of India situated north - east of New Delhi (250 km by road, 305 km by train). Dehradun is the capital of Uttarakhand and well connected by Air, Rail and Road. The state is located in the Indian Himalayan Region (IHR) which is a treasure trove of medicinal plants and around 1700 medicinal plants are known to occur in IHR. Dehradun presents a good blend of modern city life with hill culture. Climate of Dehradun in February is moderate with minimum and maximum temperatures ranging between 70C to 210C. The days are normally pleasant and clear, occasional rains may be expected. Light woolens are recommended (visit: www.weather.com for weather details).

Graphic Era Deemed to be University

In 1993 a young man with just twenty nine thousand and loads of determination embarked on a mission to transform the higher education landscape of the Doon valley. Graphic Era Deemed to be University is the culmination of the vision of its founder, Prof (Dr) Kamal Ghanshala, who had the dream to change the destiny of thousands of youth, through quality and holistic education and his vision took a concrete shape in the form of Graphic Era Institute in 1996.

In 2008, the Institute was accorded the status of Deemed University under Section 3 of the UGC Act, 1956 vide Notification F.9-48/2007-U.3 (A) dated August 14, 2008 and approved by Ministry of Human Resource Development, Government of India. In 2015 Graphic Era University was accredited by NAAC with grade 'A'.

University has acquired transnational dimensions through student exchange and knowledge sharing programs with many foreign universities and has been acclaimed and honored at international forums for its brilliance in upholding the highest standards of education. With recognition from prestigious institutions, Graphic Era University is setting new benchmarks in education. It has taken big initiative in engineering programs by getting into Partnerships with Tata Technologies and IBM to create next age Engineering Professionals through Industry Collaborations. Graphic Era hosts Technology Business Incubator that provides support for technology-based entrepreneurship. At present, Graphic Era has innumerable students on its rolls, pursuing education in different disciplines, ranging from engineering, science, business, management, commerce, hospitality to humanities and social sciences. The alumni of Graphic Era can be encountered worldwide in marquee brands like Apple, Google, Microsoft, HSBC, to name a few and in the service of the nation in all wings of the Armed forces.

Department of Life Science & Department of Biotechnology

The Department of Biotechnology was also established in 2008 and the Department of Life Sciences bifurcated from the parent department in 2016. The Departments offer UG (B.Tech, B.Sc. (Hons.) and PG (M.Tech, M.Sc.) programs in Biotechnology and Microbiology along with Ph.D. programs and B.Sc. (Hons) in Food Technology

American Council for Medicinally Active Plants (ACMAP)

The primary purpose of ACMAP is to promote and foster research, development, production, and conservation of medicinal, aromatic, and other bioactive plants useful to human health. ACMAP currently envisages basic and applied research on plant production, product development and evaluation as well as marketing to provide better healthcare products for healthy life for both human and animal population (www.acmap.org)

How to reach Dehradun

Dehradun is well connected to major cities in India by road, rail and air. To reach the campus, taxis are available

Option 1: Taxi from Railway Station/ Inter State Bus Terminal (ISBT), Dehradun to University Campus (Distance Approximately 10 Km / 2 Km, respectively).

Option 2: Taxi from Jolly Grant Airport, Dehradun to University Campus (Distance approximately 33 km; fare approximately INR 800)

Conference Themes

- Medicinal Plant wealth of the Himalayan region.
- Human health and plants.
- Micropropagation, conservation and sustainable production of medicinal plants.
- Plant bioactives: Identification, isolation and clinical studies.
- From traditional knowledge to nutraceutical and pharmaceutical products.
- Functional foods.
- Molecular approaches to elucidate the biosynthesis of bioactive natural products in plants.
- Intellectual property and commercialization of plant products for human health.
- Farmers' forum.

Presentations will be of three types: (i) Plenary Lectures - 30 min (ii) Key note lectures - 20 min + 5 min discussion (iii) Contributed Lectures - 12 min + 3 min discussion)

Call for Abstracts/ Papers

Abstract(s) of paper (s), related to the conference themes should be sent through e-mail to josheen@fvsu.edu and ashish.thapliyal@geu.ac.in

The following format should be followed for the preparation of abstracts.

Abstract: Word limit 300 (Font: Times New Roman, Font Size: 10 (title font size -10 bold)

Author(s) name(s) and affiliations: Second line below the title; first name followed by last names of all authors. Authors with different addresses shall be marked with a superscript Arabic number associated with corresponding address(es) which should be complete with affiliation, city, state, postal code and country. The corresponding author to be marked with an asterisk (superscript) following the name. The corresponding author's email should be placed in line below author affiliations

All contributed papers will be scrutinized and selected for oral (12+3 min duration) or poster presentation (size: 4ft Long x 3 ft Wide); in this regard decision of the committee of experts shall be final; corresponding author may, however, indicate preference for oral/poster presentation through mail/registration form. The outstanding contributed presentations and posters would be given awards.

* Industry representatives from SAARC/other countries will need to pay 20% over and above delegate fee for the respective country.

**Accompanying person charges: 25% of Delegate fee for the concerned category + accomodation (actual basis)

Tours (Details to be communicated separately on request. Contact ID: ismp@geu.ac.in)

• Pre-conference Tour *(optional on payment basis)- Dehradun- Rishikesh- Haridwar

Rishikesh is well known as a place of faith based healing. The Beatles Ashram- Beatles visited Rishikesh in 1968; they were here to learn transcendental meditation at Maharishi Mahesh Yogi's Ashram. It is said that about 30 songs were written while they stayed in the ashram. (www.haridwarrishikeshtourism.com/beatles-ashram-rishikesh.html)

Haridwar is an ancient city and important Hindu pilgrimage site in North India's Uttarakhand state, where the River Ganges exits the Himalayan foothills. The place is well known for several famous temples. Har Ki Pauri hosts the famous evening Ganga Aarti (River- worship ceremony). (www.haridwarrishikeshtourism.com/ganga-aarti-haridwar.html)

• Post-conference Tours* (optional on payment basis)

(1)Delhi-Agra (2) Dehi- Agra-Jaipur

Contact Person (Travel/ Accomodation/Pre & Post Conference tours/any other travel-tour-accommodation requirements)

Mr. Gaurav Joshi, Paramount Pathfinders, New Delhi, 110063,India

Contact number: (Mob) +91-9868454521, +91-9810992927,

Email: joshigaurav73@gmail.com, paramount@paramountonline.net

Visits during conference (complementary)

Buddha Temple: A Buddhist monastery. Provides a glimpse of Buddhist heritage amidst scenic surroundings. (www.khenchenrinpoche.org)

Forest Research Institute (FRI): Initially the Imperial Forest Research Institute (established 1906), FRI is renowned for its museums. (www.fri.res.in)

Regional Science Centre: Established by Uttarakhand State Council of Science and Technology. (www.ucost.in/blog/rsc/)

Accommodation

Single or shared accommodation can be availed at the following hotels in the vicinity of conference venue (within 5 Kms) at Graphic Era (Deemed to be University), Dehradun.

- Hotel Softel Plaza (www.hotelsoftelplazadehradun.com)
- Seyfert Sarovar Portico (www.sarovarhotels.com)
- Hotel Sandstone (www.hotelsandstone.com)
- Hotel Viceroy Inn(www.hotelviceroyinn.com)
- Hotel Pearl Grand (www.thepearlgrand.com)

The room rates shown on the websites of respective hotels are indicative. Actual tariff can be negotiated once bulk bookings are done. (Contact Mr. Gaurav Joshi)

Program Chairs

- Prof. (Dr.) Joshee Nirmal, Fort Valley State University, USA

- Prof. (Dr.) Palni L.M.S., Graphic Era (Deemed to be University), India

International Committee

- Prof. (Dr.) Adelberg J. W., Clemson University, USA
- Prof. (Dr.) Bhatnagar A. K., Retd. Professor, University of Delhi, India
- Dr. Chandra S., University of Mississippi, USA
- Prof. (Dr.) Chhibber R. N., University of Saskatchewan, Canada
- Ms. Corredor M. C., Embassy of Switzerland in India, Swiss Agency for Development and Cooperation
- Dr. Hartingh B. D., Counsellor for cooperation & cultural affairs, French Institute of India, Country Director
- Prof. (Dr.) Hendrickson C., National University, USA
- Dr. Lee Sun-Ok, University of Arkansas, USA
- Dr. Medina-Bolivar F., Arkansas State University, USA
- Dr. Meenakumari B., Chairperson, National Biodiversity Authority, Govt. of India
- Dr. Molden D.J., Director General, ICIMOD, Nepal
- Prof. (Dr.) Rao M.S., Alabama A & M University, USA
- Dr. Rimando A. M., USDA ARS, USA
- Prof. (Dr.) Shetty K., North Dakota State University, USA
- Dr. Swarup R., Secretary, Dept. Biotechnology, Govt.of India
- Prof. (Dr.) Tripathi A. K., Director, Central Institute of Medicinal and Aromatic Plants, India

National Committee

- Dr. Aslam Mohd., Advisor, DBT, New Delhi
- Dr. Badri Narayan D, Dabur Research Foundation, India
- Dr. Bagchi S., IISC, Bangalore
- Prof.(Dr.) Barik S. K., Director, NBRI, Lucknow
- Ms. Biswas S., CEO, NMPB, New Delhi
- Dr. Chauhan N., CEO, SMPB, Dehradun
- Dr. Das P., CSIR- IIIM Jammu, Jammu
- Prof. (Dr.) Deb C. R., Nagaland University, Nagaland
- Dr. Dobhal R., Director General, UCOST, Govt. of Uttarakhand, Dehradun
- Dr. Farooq S., President, Himalaya Herbal Drug, Dehradun
- Dr. Haridaasan K., Retd. Scientist, FRLHT, Bangalore
- Dr. Jankiram T., ADG, ICAR, New Delhi
- Dr. Kumar S., IHBT, Palampur, Himachal Pradesh.
- Dr. Nandi S. K., GBPNIHESD, Kosi-Katarmal, Almora
- Prof. (Dr). Nautiyal C. S., VC, Doon University, Dehradun
- Prof. (Dr.) Nautiyal M. K., Director, UCB, Govt. of Uttarakhand, Haldi-Pantnagar
- Prof. (Dr). Purohit S. D., Retd. Professor, MLS University, Udaipur, Rajasthan
- Prof. (Dr.) Pushpangadhan P., Former Director, TBGRI, Kerela
- Dr. Ramaiah D., Director, CSIR, NEIST, Jorhat-Assam
- Dr. Rawal R. S., Director, GBPNIHESD, Kosi-Katarmal, Almora
- Prof. (Dr). Rawat G., Wildlife Institute of India, Dehradun
- Prof. (Dr.) Sahoo D. B., Director, IBSD, Imphal, Manipur
- Dr. Savita, Director, FRI, Dehradun
- Dr. Shah R. K., CEO, Uttarakhand Biodiversity Board, Govt. of Uttarakhand, Dehradun
- Dr. Sharma E., DDG, ICIMOD, Kathmandu
- Dr. Singh S. B., Director, NIPER, Hyderabad
- Dr. Singh S., Rtd. Sr. Scientist, IIRS, Dehradun
- Prof. (Dr). Tandon P., Former VC, NEHU
- Mr. Vaidya R. K., Secretary, Ministry of Ayush, Govt. of India
- Dr. Yadav A., ICAR, Tadong, Sikkim

Local Organizing Team

Chief Patron

- Prof. (Dr.) Ghanshala K., President, Graphic Era Group of Institutions

Patron

- Prof. (Dr.) Palni L. M. S., Vice Chancellor, Graphic Era (Deemed to be University)

Advisory Board

- Prof. (Dr.) Awasthi A. K., Advisor, Graphic Era (Deemed to be University),DDN
- Prof. (Dr.) Gangodkar D., Dean, Intl. Affairs, Graphic Era (Deemed to be University),DDN
- Prof. (Dr.) Jasola S., Vice Chancellor, Graphic Era Hill University,DDN
- Prof. (Dr.) Joshi R. C., Chancellor, Graphic Era (Deemed to be University),DDN
- Prof. (Dr.) Mittal A., Director Research, Graphic Era (Deemed to be University),DDN
- Prof.(Dr.)Nagraja H. N., Pro-Vice Chancellor, Graphic Era (Deemed to be University),DDN
- Prof. (Dr.) Pant D., Director, Uttarakhand Science Education and Research Centre, DDN
- Prof. (Dr.) Patil P., Dean Research, Graphic Era (Deemed to be University), DDN
- Prof. (Dr.) Singh M. P., Professor in Management (Deemed to be University),DDN
- Prof. (Dr.) Tewari V. K., DG, TBI, Graphic Era (Deemed to be University),DDN

Local Organizing Committee (LOC)

Overall Coordination

- Prof. (Dr.) Thapliyal Ashish, Chair, Dept.of Life Sc., Graphic Era (Deemed to be University)

Organizing Secretary

- Dr. Pant Manu, Dept. of Life Sciences, Graphic Era (Deemed to be University)

Technical Committees

Oral presentations

- Prof. (Dr.) Arunachalam Kusum, Doon University, Dehradun
- Dr. Ginwal H. S., Forest Research Institute, Dehradun
- Dr. Mishra Ashutosh, UCOST, Dehradun
- Prof. (Dr.) Nautiyal A. R., HNB GU, Srinagar-Garhwal
- Dr. Pant Kumud, Dept. of Biotechnology, Graphic Era (Deemed to be University)
- Dr. Rai Nishant, Dept. of Biotechnology, Graphic Era (Deemed to be University) [Coordination]
- Dr. Sharma Pradeep, Dept. of Environmental Science, Graphic Era (Deemed to be University)

Poster presentations

- Dr. Bhatt I. D., GBPNIHESD, Garhwal Unit, Srinagar- Garhwal
- Dr. Maikhuri Rakesh, GBPNIHESD, Kosi-Katarmal, Almora
- Prof. (Dr.) Nautiyal M.C., HNB Garhwal University, Srinagar-Garhwal
- Dr. Rani Anju, Dept. of Life Sciences, Graphic Era (Deemed to be University) [Coordination]
- Dr. Sundriyal Manju, USERC, Dehradun
- Dr. Uniyal D. P., UCOST, Dehradun

Venue Management Committee (Inaugural, Technical Sessions and Valedictory)

- Dr. Joshi K. K., Dept. of Environmental Science, Graphic Era Hill University
- Dr. Rai Nishant, Dept. of Biotechnology, Graphic Era (Deemed to be University)
- Dr. Rana Pankaj, Registrar, Graphic Era (Deemed to be University) [Coordination]
- Er. Lal Ankita, Dept. of Biotechnology, Graphic Era (Deemed to be University)
- Er. Minocha Puneet, Dept. of ECE, Graphic Era (Deemed to be University)
- Mr. Rawat D. S., Chief Administrative Officer, Graphic Era (Deemed to be University)
- Prof. (Dr.) Swamy M. R., Dept. of Mathematics, Graphic Era (Deemed to be University)

Registration Committee

- Dr. Anand Jigisha, Dept. of Biotechnology, Graphic Era (Deemed to be University)
- Dr. Baccheti Archana, Dept. of Environmental Science, Graphic Era (Deemed to be University)
- Er. Minocha Geetanjali, Dept. of ECE, Graphic Era (Deemed to be University)
- Dr. Sharma Promila, Dept. of Life Sciences, Graphic Era (Deemed to be University) [Coordination]

Lodging Arrangements

- Dr. Kumar Navin, Dept. of Biotechnology, Graphic Era (Deemed to be University) [Coordination]
- Dr. Panwar Varij, Dept. of ECE, Graphic Era (Deemed to be University)
- Dr. Rawat Balwant, Dept. of Agriculture, Graphic Era Hill University.
- Dr. Waheed S. M., Dept. of Biotechnology, Graphic Era (Deemed to be University)

Transport Arrangements

- Mr. Chauhan A., Assistant Registrar (Exams), Graphic Era (Deemed to be University)
- Mr. Kaul B.K., SeniorAdministrative Officer, Graphic Era (Deemed to be University)
- Mr. Negi B. S., Senior Administrative Officer, Graphic Era (Deemed to be University)
- Dr. Pal Manoj, Dept. of Life Sciences, Graphic Era (Deemed to be University) [Coordination]
- Dr. Sati Bipin, Dept. of Biotechnology, Graphic Era (Deemed to be University)
- Dr. Semwal Prabhakar, UCOST

Food Committee

- Er. Chaudhry Vaishali, Dept. of Biotechnology, Graphic Era (Deemed to be University)
- Mr. Dhaundiyal Chandramouli, Dept. Of Hospitality Management, Graphic Era (Deemed to be University)
- Dr. Gautam Pankaj, Dept. of Life Sciences, Graphic Era (Deemed to be University) [Coordination]
- Dr. Sufi Tahir, Dept. of Hospitality Management, Graphic Era (Deemed to be University)
- Dr. Wilson Ivan, Dept. of Life Sciences, Graphic Era (Deemed to be University)

Coordinators-Higher Education

- Dr. Bag N., Dept. of Horticulture, Sikkim Central University, Gangtok
- Dr. Chandra Tribhuvan, Dept. Of Zoology, Govt. PG College, Gopeshwar
- Dr. Joshi G., Dept. Of Zoology and Biotechnology, HNB Garhwal University, Srinagar-Garhwal
- Dr. Pande K. K., Deputy Director, Higher Education, Haldwani [Coordination]
- Dr. Pandey Veena, Dept. of Biotechnology, Kumaun University, Nainital
- Dr. Purohit V.K., HAPPRC, HNB Garhwal University, Srinagar-Garhwal
- Dr. Tamta Sushma, Dept. Of Botany, Kumaun University, Nainital
- Dr. Thapliyal Madhu, Dept. of Zoology, Govt. PG College, Raipur, Dehradun
- Dr. Verma S., Centre for Biodiversity Studies, B.G.S. Badshah University, Rajouri

NOTE: Individual names in various committees are in alphabetical order
Venue: Graphic Era (Deemed to be University)
566/6, Bell Road, Clement Town, Dehradun-248002, Uttarakhand, India

INTERNATIONAL CONFERENCE ON MEDICINAL, AROMATIC AND NUTRACEUTICAL PLANTS FROM MOUNTAINOUS AREAS

9TH ANNUAL CONFERENCE

AMERICAN COUNCIL FOR MEDICINALLY ACTIVE PLANTS (ACMAP)

February 14-16, 2019

JOINTLY ORGANISED BY

THE DEPARTMENTS OF LIFE SCIENCES & BIOTECHNOLOGY,

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), 566/6, BELL ROAD, CLEMENT TOWN,

DEHRADUN-248002 (UTTARAKHAND), India

AND

AMERICAN COUNCIL FOR MEDICINALLY ACTIVE PLANTS (ACMAP), USA

Wednesday- February 13, 2019		
Preconference Tour (Patanjali/ Haridwar)- Coordinators Dr. Navin Kumar, Er. Sanjay		
Day 1. Thursday–February 14, 2019		
9:00 am onwards	Registration *(Ground floor, GEHU)*	
9:30 am - 10:30 am	Opening –cum-Inaugural *Venue: Auditorium, Fifth floor, GEHU* Prof. Kamal Ghanshala (President, Graphic Era Group of Institutions) Prof. R.C. Joshi, Chancellor, Graphic Era Deemed to be University Dr. Jeffery Adelberg (Current President-ACMAP) Dr. Rakesh Sharma (Vice Chancellor, Graphic Era Deemed to be University) Prof. Sanjay Jasola (Vice Chancellor, Graphic Era Hill University) Dr. Fabricio Medina - Bolivar (Executive Director)-ACMAP Dr. S. Rao Mentreddy (Ex-President-ACMAP) Dr. N. Joshee (Co-chair, Program and current Vice-President, ACMAP) Chief Guest for the inaugural- Dr. R. S. Sangwan, Director, AcSIR Guest of Honour- Sh. Rajendra Dobhal, Director General, UCOST	
10:40 am - 11:10 am	**Plenary I**- Dr. Fabricio Medina-Bolivar, Professor of Metabolic Engineering, Arkansas State University, USA **Title:** Harvesting a healthy future from peanut hairy roots…*and a little stress* *Venue: Auditorium, Fifth floor, GEHU*	
11:15 am- 11:45 am	**Plenary II**- Dr. Rajendra Dobhal, Director General, Uttarakhand Council for State Science and Technology (UCOST), Dehradun **Title:** A policy perspective with relevance to the bioresource development of Uttarakhand *Venue: Auditorium, Fifth floor, GEHU*	
11:50 am- 12:15 pm	**Tea break**	Registration

	Venue: Lounge, Ground floor, GEHU		
12:20 pm	Group photograph (Open Auditorium, ground floor, GEHU)		
12:45 pm- 1:45 pm	**Lunch break** *Venue: Lounge, Ground floor, GEHU*		
2:00 pm- 3:30 pm	**Session 1a – Human health and Plants –I** *Venue: Seminar Hall, Ground floor, GEHU* Session Chairs: Dr. Ashish Yadav, ICAR Sikkim Centre, India and Dr. Nirmal Joshee, Fort Valley State University, USA Coordinator: Dr. Promila Sharma **Keynote Address**: *Hippophae rhamnoides*- a promising solution for effective medical radiation countermeasure – Dr. Madhu Bala, Director DIBER, DRDO, Haldwani, India **Speaker 1:** Development of liquid meals for use during radiation scenarios -Dr. O. P. Chauhan, DFRL, India **Speaker 2:** Turmeric (*Curcuma spp.*): A potential medicinal crop for small-farm owners in Alabama, USA. Dr. S. Rao Mentreddy, A&M University, Normal, AL, USA **Speaker 3:** Organic kiwifruit production for health and nutrition -Dr. Ashish Yadav, ICAR Sikkim Centre, Gangtok, India **Speaker 4:** Hydroponically grown lettuce (*Lectuca sativa*): A healthier food with better	**Session 1b – Human Health and Plants-II** *Venue: Auditorium, Fifth floor, GEHU* Session Chair: Dr. Anait S Levenson, Long Island University, USA Coordinator: Dr. Pankaj Gautam (Dedicated to late Dr. Agnes M Rimando) *Special Address: In the memory of friend and colleague, Dr. Agnes M Rimando* **Keynote Address:** Chemopreventive and therapeutic effects of stilbenes in prostate cancer- Dr. Anait S Levenson **Speaker 1:** Plants in treatment of metabolic syndrome – a modern epidemic-Dr. S K Verma, Pacific Medical College and hospitals, Udaipur, India **Speaker 2:** The nutraceutical bioactive compound berberine protects against endothelial dysfunction caused by inflammation-Dr. Paola Rizzo, University of Ferrara, Italy **Speaker 3:** Effects of *Ginkgo biloba* extract on hypobaric hypoxia induced memory	**Session 1c**: **Medicinal Orchids** *Venue: Meeting room, Ground floor, GEHU* Session Chairs: Dr. Bijaya Pant Tribhuvan University, Kirtipur Kathmandu, Nepal and Dr. S. M. Khasim, Acharya Nagarjuna University, India. Coordinator: Er. Ankita Lal **Keynote Address:** Cytotoxic efficacy and antimicrobial studies in *Acampe praemorsa* and *Aerides odorata* (Orchidaceae): An *in vitro* approach.- Dr. S. M. Khasim **Speaker 1.** Biological activities of some *Dendrobium* species. Mukti Ram Paudel Tribhuvan University, Nepal

	antioxidant and flavonoids- Dr. Ankur Agarwal, DIBER, DRDO, Haldwani, India	deficit and neurodegenaration in rats - Dr. Nilofar Khan, Defense Institute of Physiology & Allied Sciences, DRDO, India	**Speaker 2.** Medicinal orchids of Nepal, prospects and their conservation strategies. Dr. Bijaya Pant **Speaker 3:** Medicinal Orchids Of foot hills of eastern Himalaya and measures of conservation -Mr. Asish Roy, Siliguri, West Bengal, India
3:30 pm	**Tea break** *Venue: Lounge, Ground floor, GEHU*	Registration	
3:45 pm- 5:30 pm	**Session 1 d: Cannabis: Past, Present and Future** *Venue: Auditorium, Fifth Floor GEHU* Session Chair: Dr. Suman Chandra, The University of Mississippi, USA Coordinator: Dr. S. M. Waheed **Keynote Address:** Cannabis pharmacology and human health- Dr. Ethan Russo, International Cannabis and Cannabinoids Institute, Czech Republic Speaker 1: Cannabinoids Biosynthesis- Dr. Oliver Kayser, Technische Universität Dortmund, TUD·Germany **Speaker 2.** Cannabis: Botany, Chemistry and Drug Development - Dr. Suman Chandra, The University of Mississippi, USA **Speaker 3:** Cannabis and human health: Industry prospective' Jahan Pestonjamas and Brij Kishore Mishra, Bombay Hemp Company Pvt. Ltd., India **Round table discussion**		
5:30 pm- 6:30 pm	**Poster Session** (Open Auditorium, Ground floor, GEHU) Coordinators: Dr. Anju Rani, Er. Ankita Lal, Er. Vaishali	**Session O1: Oral presentations I (Young scientist)**	**Session O2: Oral presentations II (Young scientist)**

		Coordinator: Dr. Deependra Singh, Dr. Ivan Wilson Venue: *Meeting room, Ground floor GEHU*	Coordinator: Dr. Jigisha Anand, Er. Somya *Venue: Seminar Hall, Ground floor, GEHU*
6:30 pm- 7:30 pm	**CULTURAL PROGRAM** *Venue: Auditorium, Fifth floor, GEHU*		
7:30 pm- 8:30 pm	**Dinner** *Venue: Lounge, Ground floor, GEHU*		
Day 2. Friday – February 15, 2019			
9:00 am	Registration		
9:00 am- 9:30 am 9:30 am- 10:00 am	**Plenary III**- Dr. S. Farooq, President, Himalaya Drug, India **Title:** Medicinal, aromatic, and nutraceutical plants from mountainous areas *Venue: Auditorium, Fifth floor, GEHU* **Plenary IV**- Prof. (Dr.) Ravindra N Chibber W. J. White Professor & Canada Research Chair Crop Quality (Molecular Biology & Genetics), Department of Plant Sciences, University of Saskatchewan, Canada **Title:** Utilizing biodiversity in underutilized native grains towards food and nutritional security for improved human health *Venue: Auditorium, Fifth floor, GEHU*		
10:10 am- 10: 25 am	**Tea Break** *Venue: Lounge Ground Floor, GEHU*		
10:30 am- 12:30 pm	**Session 2 a: Micropropagation for Conservation, Breeding and Production of Medicinal Plant Species** *Venue: Seminar Hall, Ground floor, GEHU* Session Chair: Dr. Jeffrey Adelberg Clemson University, USA Co-chair: Dr. A. K. Datta	**Session 2b**: **Molecular Approaches to Elucidate the Biosynthesis of Bioactive Natural Products in Plants** *Venue: Auditorium, Fifth floor, GEHU* Session Chair: Dr. Sanjay Kumar, Director, CSIR-IHBT Palampur Coordinator: Dr. Anju Rani **Keynote Address**: Molecular approaches to decipher pathways	**Session O3- Invited Lectures / Oral presentations** Coordinator: Dr. Balwant Rawat, Er. Vaishali Chaudhary *Venue: Meeting room, Ground floor, GEHU*

	Thapar Institute of Engineering & Technology, India Coordinator: Dr. Nishant Rai **Keynote Address**: Mineral nutrition *in vitro* affects subsequent plant quality in the nursery: Studies with turmeric and Echinacea. Dr. J. Adelberg, Clemson University, USA **Speaker 1.** *In-vitro* organogenesis and callus conservation in *Rauwolfia serpentina* and *Withania sonifera*. Dr. S. S. Gantait, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, India **Speaker 2.** Thin cell layer culture system revisited- Dr. N. Joshee, Fort Valley State University, USA **Speaker 3.** Selection and conservation of elite clones of *Bacopa monnieri* using biotcechnological approaches. Dr. A. K. Datta, India **Speaker 4:** Conservation of Forest Genetic Resources of Himalayas through *in vitro* approaches Dr. Ajay Thakur, Forest Research Institute, India	for secondary metabolite synthesis in plants from Himalayas- Dr. Sanjay Kumar, Director, CSIR-IHBT Palampur, India **Speaker 1**: Bioengineering of secondary metabolism in medicinal plants to improve the yield of therapeutic ingredients- Prof. M Z Abdin, Jamia Hamdard, India **Speaker 2**: Pathway engineering of flavonoid biosynthesis for improved crop productivity and human health-Dr. Prabodh Trivedi, CSIR-NBRI, India **Speaker 3**: Secondary Metabo lite channeling and pathway genomics: Route to better harvest-Dr. Ajit Kumar Shasany, CSIR-CIMAP, India **Speaker 4**: Understanding the gene to metabolites networks in medicinal plants of Sikkim Himalaya-Dr. Pradeep Bhardwaj, Institute of Bioresources Plenary and Sustainable development, India **Speaker 5**: Molecular characterization of structural and regulatory aspects of saponin biosynthesis in *Chlorophytum borivilianum* -Dr. Kashmir Singh, Panjab University, India	
12:45 pm- 1:45 pm	**Lunch** *Venue: Lounge, Ground floor, GEHU*		
2:00 pm- 2:30 pm	**Poster Competition II** (for students) Coordinators: Er. Sanjay, Er. Somya Sinha		

2:35pm- 3:50 pm	**Student Interaction with International Delegates:** Open Forum (Q&A) [Coordinated by: Dean, International Affairs, Graphic Era (Deemed to be University) and Dr. Ashish Thapliyal		
4:00 pm- 6:30 pm	**Local tour**		
7:00 pm- 8:00 pm	**Dinner**		
Day 3. Saturday- February 16, 2019			
9:30 am-	Registration		
9:30 am- 10:00 am	**Plenary V**- Dr. Bhimanagouda Patil Director of the Vegetable and Fruit Improvement Center Texas A&M University AgriLife, USA **Title:** Fruits, vegetables, and medicinal plants for the prevention and treatment of disease: untapped potential and unanswered questions *Venue: Auditorium, Fifth floor, GEHU*		
10:15 am- 10:30 am	**Tea Break** *Venue: Lounge, Ground floor, GEHU*		
10:30 am- 12:30 pm	**Session 3a** – **Metabolic engineering strategies for the production of health-related compounds in food and medicinal plants** *Venue: Meeting Room, Ground floor, GEHU* Session Chair: Dr. Fabricio Medina-Bolivar, Arkansas State University, USA Coordinator: Dr. Manoj Pal **Keynote Address:** Molecular approaches for artemisinin biosynthesis in plant and oral delivery of whole plant material for coherent malaria treatment -. Dr. Shashi Kumar, International Centre for Genetic	**Session 3b –Medicinal Plants and Animal Health** *Venue: Seminar Hall, Ground floor, GEHU* Session Chair: Dr. Govind Kannan, Fort Valley State University, USA Co-chair: Prof. H. Gopi, Post Graduate Research Institute in Animal Sciences, India Coordinator: Dr. Navin Kumar **Keynote Address:** Tannin-rich Nutraceuticals for Animal Health and Nutrition-	**Session 3c – Herbal Sector in the Himalayan Region: Policy Issues on Trade, Sustainable Use and Access & Benefit Sharing Mechanisms** *Venue: Auditorium, Fifth floor, GEHU* Session Chair – Dr Gopal Rawat, Dean, Wildlife Institute of India, India Coordinator: Dr. Kumud Pant **Keynote Address:** Conservation and management

	Engineering and Biotechnology, New Delhi, India **Speaker 1:** Metabolic engineering of terpenoids in bacteria and plants- Dr. Chhandak Basu, California State University, USA **Speaker 2:** Regulation of glucosinolates in plant-insect interaction. Dr. Dhiraj Vyas - CSIR-IIIM- Jammu, India	Dr. T. Terrill, Fort Valley State University, USA **Speaker 1:** Brown Seaweed Extract Supplementation in Goats –Dr. G. Kannan, Fort Valley State University, USA **Speaker 2:** Ethnoveterinary practices in Animal Health care- Dr. H. Gopi, Post Graduate Research Institute in Animal Sciences, Kattupakkam, India **Speaker 3:** Medicinal plants use and animals-Dr. George McCommon, Fort Valley State University, USA	of high value MAPs in the Himalayan region - An overview- Dr. Gopal Rawat **Speaker 1:** Dr. G. S. Goraya, former PCCF & Head of Forest Force (HP), India **Speaker 2:** Mr. S. S. Rasaily, Secretary Uttarakhand BD Board, India **Speaker 3:** Dr. C. S. Sanwal, Director Herbal Research and Development Institute, India **Speaker 4:** Sustaining demand for Himalayan Medicinal Herbs: Role of conservation assessment and management prioritization -Dr. Vaneet Jishtu, Scientist HFRI, India **Panel Discussion**
12:30 pm-1:30 pm	**Lunch break** *Venue: Lounge, Ground floor, GEHU*		
1:30 pm- 3:30 pm	**Session 4a- Medicinal and Aromatic Plants-Industry perspective** *Venue: Auditorium, Fifth floor, GEHU*	**Session 4b- Functional Foods** *Venue: Seminar Hall, Ground floor, GEHU*	**Session 4c- Conservation of medicinal plants** *Venue: Meeting Hall, Ground floor, GEHU*

	Session chair- Dr. R K Gupta Senior GM, New Product development – Patanjali, Haridwar, India Coordinator: Dr. K.K. Joshi **Keynote Address-** Clinically proven reversal of premature hair graying through herbal ingredients- Dr. R. K. Gupta **Speaker 1:** Dr. Aditya Arya - Director, Aryavastubhandar and NIDCO, Dehradun, India **Speaker 2:** Dr. A. K. Singh - MBBS, MD - Max Hospital , Dehradun, India **Speaker 3:** Dr. K. K. Pandey, Directorate of Higher Education, Uttarakhand, India **Speaker 4:** Preventing heart disease-myths and realities"- Dr. Chetan Sharma, DM Cardiology, Chairman Velmed Hospitals, Dehradun, India **Speaker 5:** Medicinal Plants Conservation and Industry-Dr. Pankaj Kumar, New Products Division, Dabur Research Foundation, Sahibabad, India	Session Chairs: Dr. R. N. Chibber, University of Saskatchewan, Canada Dr. Kalidas Shetty, North Dakota State University, USA Coordinator: Er. Sanjay Kumar. **Keynote Address:** Microbiome and metabolic innovations for medicinally active functional foods using food diversity Dr. Kalidas Shetty, North Dakota State University, USA **Speaker 1:** Functional role of feruloyated arabinoxylan-oligosaccharides generated from rice bran. Dr. Sun-Ok Lee, University of Arkansas, USA **Speaker 2.** Antimicrobial activity and phytochemical analyses of *Syzygium polyanthum* (Wight) Walp. leaf Dr. Yaya Rukayadi, University Putra Malaysia, Malaysia **Speaker 3.** Personalized diet in post industrial revolution era. Dr. Dae-Young Kwon, Korea Food Research Institute, Korea **Speaker 4**: Diversity of genus *Curcuma* l. (Zingiberaceae) in southern India, a promising source of edible starch. Dr. Dan Mathew, Jawaharlal Nehru Tropical Botanic Garden & Research Institute, Kerala, India	Session Chairs: Dr. Manu Pant, Graphic Era Deemed to be University, Dehradun, India and Dr. R. Chandrasekaran, Vellore Institute of Technology, Vellore, India Coordinator: Dr. Priyank Vyas **Keynote Address:** Plant Tissue culture a potent tool for conservation of Medicinal and Aromatic plants and elicitation of secondary metabolite- Dr. Rajasekaran Chandrasekaran, Vellore Institute of Technology, Vellore, India **Speaker 1**: *In vitro* propagation of *Swertia chirata* Buch.-Ham. ex Wall.- an endangered medicinal plant-through different regeneration pathways- Dr. Manu Pant, Graphic Era Deemed to be University, Dehradun, India **Speaker 2:** *In vitro* propagation of *Hedychium spicatum* Buch.-Ham ex Smith - a vulnerable medicinal and aromatic

			plant. Dr. R. Gowthami, ICAR-NBPGR, New Delhi, India **Speaker 3:** *In vitro* mass propagation and identification of high proliferating superior *Azadirachta indica* genotypes**.** So nalika Roy, Forest Research Institute, Dehradun, India **Speaker 4:** Comparative studies of different methods of vegetative propagation of *Paris polyphylla* Smith towards effective conservation. Arcadius Puwein, Department of Biotechnology, Assam Don Bosco University, Guwahati, India **Speaker 5:** Establishment of in vitro cultures of valuable medicinal plant *Valleriana jatamansi* Jones and modification strategies for conservation and production of bioactive metabolites- Sushma Pandey, Central University of Botany, Tribhuvan University, Kathmandu, Nepal
3:30 pm- 3:45 pm	**Tea Break** *Venue: Lounge, Ground floor, GEHU*		
3:45 pm- 6:30 pm	**Session 5a - Farmers' Forum** *Venue: Seminar hall, Ground floor, GEHU*		

	Session Chairs: Dr. Mentreddy S Rao, Alabama A & M University, USA, Dr. I. D. Bhatt, GBPNIHESD, India, Dr. Nirpendra Chauhan, Centre for Aromatic Plants (CAP), Government of Uttarakhand, India **Part I: Production: Challenges and Opportunities:** Coordinator: Dr. Deepak Kholiya, Dr. Ivan Wilson Keynote Address: Indian Perspective on production Challenges and opportunities- Dr. Nirpendra Chauhan Keynote Address: US perspective on Production Challenges and Opportunities- Dr. S. Rao Mentreddy Invited Speaker: Prof. (Dr.) Durgesh Pant, USERC, Dehradun, India **Farmer Speaker 1:** Cultivation, distillation and marketing of Lemongrass in Uttarakhand- Mr. Rao Farooq Khan, Progressive Aromatic Farmer, Uttarakhand **Farmer Speaker 2:** Cultivation, distillation and marketing of Damask Rose in Uttarakhand- Mr. Umrao Singh, Progressive Aromatic Farmer, Uttarakhand **Farmer Speaker 3:** Cultivation and processing of Cinnamon (Cinnamomum tamala)- Mr. Madhav Singh, Progressive Aromatic Farmer, Uttarakhand **Part II: Markets and Marketing** Keynote Address: Indian perspective on Markets and marketing of MAPs- Dr. I. D. Bhatt Brief Overview of Markets and Marketing in the USA - Dr. S. Rao Mentreddy
6:30 pm- 6:45 pm	**Speaker 1 (From Industry):** Marketing of essential oils - Mr. Piyush Gupta, Industrialist, M/s Kanha Natural Oils, Delhi **Speaker 2:** Enterprise development through production and marketing of aromatic produce - Mr. Vikas Sharma, Progressive Aromatic Farmer-Entrepreneur **Speaker 3:** Prospects and challenges of Medicinal plant cultivation and trade in Uttarakhand. Dr. J. S. Butola, Trader **Panel Discussion**
6:45 pm- 7:15 pm	Valedictory: **Dr. Jeffrey Adelberg (ACMAP)** , **Dr. Nirmal Joshee (ACMAP), Prof. Ashish Thapliyal** (Graphic Era Deemed to be University) and Prize Distribution

	Venue: Auditorium, Fifth floor, GEHU
7:15 pm- 8:15 pm	ACMAP Board Meeting and Networking session for delegates *Venue: Seminar Hall, Ground floor, GEHU*
8:15 pm- 9:30 pm	**Dinner: Banquet speaker Dr. Kalidas Shetty**. Human resilience and relevance of medicinally active plants in living a resilient life
Day 4. Departure and Post- Conference Tours Sunday – Feb 17, 2019	
10:00 am	Post Conference tours

PI-1

Fabricio Medina-Bolivar, Ph.D.

Professor of Plant Metabolic Engineering, Arkansas State University
Chief Scientific Officer, Nature West Inc.
Executive Director, American Council for Medicinally Active Plants

Dr. Fabricio Medina-Bolivar is currently Professor in the Department of Biological Sciences at Arkansas State University (A-State) and directs a Plant Metabolic Engineering research laboratory at the Arkansas Biosciences Institute of A-State. He received his B.S. in Biology from Cayetano Heredia University (Peru) and Ph.D. degree in Plant Physiology from the Pennsylvania State University. He conducted postdoctoral research at Virginia Tech. Dr. Medina-Bolivar has over 25 years of experience in plant biotechnology and is one of the world's leading scientists using hairy root cultures as production systems of valuable natural products. His cutting edge technology has provided means to study the biological activity of novel natural products, in particular prenylated stilbenoids from peanut, and identify their benefits to human health. Dr. Medina-Bolivar is a founding member of the American Council for Medicinally Active Plants (ACMAP) and currently serves as Executive Director of this organization. He was President of ACMAP in 2014-2015 and Program Chair and Host of the 3rd ACMAP conference at Arkansas State University and 7th ACMAP conference in Lima, Peru.

Dr. Medina-Bolivar has received several awards for his research related to the bioproduction, biosynthesis and bioactivity of prenylated stilbenoids. He was recognized with the Arthur Neish Award from the Phytochemical Society of North America in 2006 and the Statewide Arkansas Investigator of the Year in 2015. His research has produced several peer-reviewed publications and his innovative work has been granted patents in the United States of America and Europe. Dr. Medina-Bolivar, along with his research team, has given over 250 presentations at scientific forums including invited talks in Argentina, Chile, China, France, Mexico, Peru, United Kingdom and United States of America.

Dr. Medina-Bolivar has an active role in mentoring undergraduate and graduate students as well as postdoctoral fellows. Many of which have also received high honors in the field of natural products. He would like his research to move forward in industry and ultimately support the development of products that will improve the quality of life. Towards this endeavor, he co-founded and currently serves as Chief Scientific Officer of Nature West, a start-up biotechnology company focused on the production of specialty plant natural products.

In addition to his research interests, Dr. Medina-Bolivar is an active member of the Hispanic community. He currently serves as Chair of the Northeast Arkansas Hispanic Professional Network and was previously awarded as the Outstanding Hispanic Achiever of the Year in 2011. Dr. Medina-Bolivar's devotion for research is also shared with his passion for music. He enjoys playing piano and composing music. In 2016, he was invited to perform at Doctors in Concert, a fundraiser event for St. Jude Children's Research Hospital.

For more information about Dr. Medina-Bolivar's research check his TEDx talk and laboratory website:
https://www.youtube.com/watch?v=cCO9BTRjLEA
https://www.fabriciomedinabolivarlab.com

Harvesting a healthy future from peanut hairy roots…*and a little stress*

Fabricio Medina-Bolivar. Arkansas Biosciences Institute and Department of Biological Sciences, Arkansas State University, Jonesboro, AR 72401. E-mail: fmedinabolivar@astate.edu

The peanut plant originated in South America and it is currently grown as an economically important oil and food crop, being China, India and United States the top producers in the world. Peanut produces prenylated stilbenoids to protect itself against various types of stresses, particularly fungal pathogens. Among this group of compounds are the prenylated analogs of resveratrol known as arachidins. In the last 12 years, the Medina- Bolivar research team has developed hairy root cultures of peanut to produce arachidins, elucidate their biosynthesis and study their biological activities. Hairy root cultures produced via genetic transformation with *Agrobacterium rhizogenes* were shown to provide a sustainable platform for the stress-inducible production and discovery of bioactive arachidins. Hairy roots from several cultivars of peanut and its wild relatives were developed and have been maintained as clonal cultures. By manipulating feedback inhibition of the stilbenoid biosynthetic pathway, the yield of the arachidins was increased more than 1,000 times. This patented technology has led to high levels of arachidins which are being tested in different bioassays. Hairy root extracts enriched in arachidins and purified arachidins have shown antioxidant, anti-adipocytic, anti-rotavirus and anticancer activities. Furthermore, the arachidins were shown to modulate the cannabinoid receptors and exhibit favorable metabolic profiles when compared to resveratrol. Leveraging the hairy root culture bioproduction system with a combined transcriptomic and metabolic approach, we identified the first stilbenoid-specific prenyltransferase involved in the prenylation of resveratrol. This prenyltransferase is being used in metabolic engineering strategies to produce bioactive prenylated stilbenoids in different plants. We have demonstrated that peanut hairy roots are a valuable biotechnological tool for production of arachidins and other stress-inducible prenylated stilbenoids. Our current efforts are to develop these bioactive compounds as novel nutraceutical and pharmaceutical products for the prevention and treatment of human diseases.

PI-2

Dr. Rajendra Dobhal
Director General, Uttarakhand State Council for Science & technology (UCOST)

Dr Rajendra Dobhal is currently serving as Director General, Uttarakhand State Council for Science and Technology, Govt. of Uttarakhand. He had a distinct privilege to occupy the positions like Chairman and Managing Director, National Research Development Corporation (NRDC), Govt. of India; Director, Uttarakhand Science Education and Research Centre (USERC); Director, Uttarakhand Space Application Centre (USAC); Senior Scientific Advisor/Project Director, Uttarakhand State Biotechnology Board; Scientist/Tech. Advisor to DG and Science Advisor, Govt. of Madhya Pradesh, Bhopal, in the past. He is also Chairman of the Sustainable Development Forum, Uttaranchal.A Fellow of The National Academy of Sciences, India, Dr Dobhal is a known Intellectual Property (IP) professional trained from Dept. Science & Technology, GoI; Washington University, USA; International Law Development Institute (ILDI), Manilla, Phillipines and National Law University, Bangalore.

Dr Dobhal is a member of various important committees of Central and State Govt. A few are:

Chairman — Constitution of task force on mountain agriculture and allied sectors in Uttarakhand (Rural Development and Migration Commission, Uttarakhand); Member — Appellate Authority (Admission and Fixation of Fee) Unaided Private Professional Education Institutions, Uttarakhand; Secretary — National Academy of Sciences India, Uttarakhand Chapter; Chairman — Sustainable Development Forum Uttaranchal, Dehradun; Councillor — Integrated Mountain Initiative, New Delhi; Member —TIFAC, Global Technology Watch Group (GTWG) for Green Forestry Sector; Member —TIFAC, Technology Needs Assessment (TNA) Project for Forestry Sector; Member — State Level Executive Committee, Uttarakhand Bamboo and Fiber Development Board; Member — Task Force for Implementation of National IPR Policy; Study of Himalayan Glaciers; Academic audit, and Board of studies, Good Governance committee of different Universities.

Dr Dobhal has monitored over 250 R&D projects leading to national/ international publications and patents. Successfully organized 11 Science Congresses in Uttarakhand leading to benefit over 10,000 scientists. He has written over 40 technical reports, 12 books, published over 150 research papers in various journals of national & international repute.

Dr Dobhal, a widely travelled scientist was instrumental in signing numerous MoU's with organizations like Council of Scientific & Industrial Research (CSIR), Ministry of Science & Technology, Govt. of India; European Business and Technology Center (EBTC) while serving Government of India and Riverbank Filtration (RBF) Technology transfer from the University of Applied Sciences, Dresden, Germany.

Major Awards

- Royal Australian chemical institute award (2007)
- International Commonwealth youth sliver Award (2008)
- Uttarakhand Ratan (2010)
- Uttarakhand Gaurav (2012)
- Pride of Uttarakhand (2016)

A Few Achievements

- Shaping the S&T structure in Uttarakhand.
- Establishing of VIGYAN DHAM, Dehradun; Sub Regional Science Centre, Almora (in progress); Centre for Advance Study in Mathematics, Centre for Climate Change Studies, Patent Information Center;

Center of Excellence on Forest based Livelihood System; Spatial Data Infrastructure (SDI); Water Testing Lab; Tissue Culture Lab, Naugaon, Uttarkashi and 07 Technology Resource Centres.

- Preparation S&T VISION document under the chairmanship of Prof. M.G.K. Menon.

A policy perspective with relevance to the bioresource development of Uttarakhand

Rajendra Dobhal**.** Director General, Uttarakhand State Council for Science & technology (UCOST)

The Indian Himalayan Region (IHR) extends over about 2400 km across the northern border of India, covering an area of about 5.3 lakh sq km. It supports climate, water security, and livelihoods in the region, both upstream and downstream. Entire Himalayan stretch has a great wealth of medicinal & aromatic plants and traditional medicinal knowledge. About 45% plants among floral diversity have medicinal properties. About 400 plants are used in regular production of *Ayurvedic*, *Unani*, *Siddha* and tribal medicine, among which about 25% belongs temperate forests prevailing in Himalaya. Uttarakhand alone harbours more than 100 high value plants of medicinal and aromatic importance. Besides, a rich diversity of nutraceutical crops and fruits is also produced in the Himalaya. Government has taken major initiatives for conservation and sustainable cultivation of medicinal, aromatic plants. With sensitive ecosystem of IHR, development of medicinal & aromatic plant sector in Himalaya will largely depend on adoption of advanced technology. Advanced techniques may pave a way for sustainable cultivation and utilization of this high valued plant diversity. Transgenic and transient expression techniques have emerged as powerful technique to produce biological components, vaccines and therapeutics in plants. Efforts are being made to develop recombinant vaccines and therapeutics in edible plant material and to transfer the omega-3 biosynthesis pathway from microalgae to oilseed plants, etc. Two such products have already brought to the market in the Europe: Glucocerebrosidase in carrot and canine interferon-alpha in genetically modified strawberries. Uttarakhand Council for Biotechnology (UCB) has developed Uttarakhand Medicinal Plants Database (UMPDB), which provides user-friendly taxonomic, genomic, and chemical descriptions of the medicinal plants exclusively found in various regions of Uttarakhand (http://multiomics.in/umpd/). An effective policy encourages anticipated cooperation among research & academic institutions, industry and the government. It is imperative to foster innovation, development of new product or productivity-enhancing technologies. UCOST has contributed in formulating the Uttarakhand Biotechnology Policy 2018-23. It is a novel effort to strengthen the ecosystem required to give boost to the R&D and innovation on Himalaya and state specific problems, in particular. It will mediate an effective support system for innovators and startups to access Biotech Corpus for R&D and product development. It also encompasses various fiscal incentives for aspiring biotech industry in the state. Policies of state and central government are inevitable to promote innovation ecosystem in bioresource research & developmentin the Himalaya.

PI-3

Dr. S. Farooq, President, Himalaya Drug, India

Title: Medicinal, aromatic, and nutraceutical plants from mountainous areas

Venue: Auditorium, Fifth floor, GEHU

Dr. S. Farooq President, The Himalaya Drug Company was born on 09th January 1955 in Dehradun, in the family of Janab Syed Rashid Ahmed, a renowned researcher of Ayurvedic remedies and a freedom fighter. Dr. S. Farooq obtained his M.Sc., Ph. D. & two D. Sc. Degrees, one from H.N.B. Garhwal University (DAV PG College Dehradun) & one Honoris Causa from Cambridge (England). Subject of his Ph.D. thesis was "Study of Chemical Changes in Cell Membrane and was awarded a Gold Medal. The subject of his D.Sc. thesis was "Newer alkaloids for therapeutic effect on infected respiratory tract along with its Pharmacodynamic & kinetic studies". He also holds a Post Graduate Diploma in Business Management. He has published and presented over 200 papers in National and International Conferences. He is the Chief Editor of the Universities Journal of Phytochemistry & Ayurvedic Heights. He is the author of "555 Medicinal Plants", "101 Herbal Remedies for Cough & Cold" and Biography of his father (Aap Yaad Aate Hain). Dr. S. Farooq is also associated with number of Government Bodies, Universities and Colleges. He was nominated for Padamshree Award in the year 2004. Dr. S. Farooq has traveled world vide and participated in the sports delegation, Horse Riding & Polo. He is prominently known for his research work, philanthropy, oratory & for his multifaceted personality.

PI 4:

Dr. Ravindra (Ravi) N. Chibbar

W. J. White Professor & Canada Research ChairCrop Quality (Molecular Biology & Genetics),
Department of Plant Sciences, University of Saskatchewan, Canada

Dr. Ravindra Chibbar received his Ph.D from University of Western Ontario. Currently, he is working as Professor in University of Saskatchewan.Dr. Chibber, Canada Research Chair in Molecular Biology for Crop Quality, is helping farmers reach those goals by using genomics to improve the quality of wheat and barley, and of pulse crops like lentils and chickpeas. Dr. Chibbar is bringing together the expertise of molecular biologists, biochemists, cereal chemists, plant breeders and food scientists.His research research interest includes Biochemical and molecular characterization of the genetic determinants of grain quality in cereal and pulse crops, Genomics. He has authored several publications.Consumers are increasingly demanding that crops provide them with such wholesome qualities as high fibre, antioxidants, a low glycemic index, and a balanced mix of minerals and vitamins. Obtaining these qualities requires crops that are able to survive harsh growing conditions and remain productive in the face of climate change, while also producing the quality and yields that allow farmers to stay competitive.

Dr. Chibbar is aiming to improve the profile of slow-digestible carbohydrates in cereals and pulses. Carbohydrates in these crops provide protection against diabetes and cardiovascular diseases, and are a major source of calories. Chibbar is also targeting winter wheat, which produces high yields, uses moisture efficiently, protects against erosion, out-competes many weeds and avoids disease, but which struggles against the challenging winters of the Canadian Prairies.So far, Dr. Chibbar has described genes that contribute to carbohydrate composition, seed dormancy and winter hardiness. He has also produced a wheat bacterial artificial chromosome library and genetic maps of wheat and barley.Dr. Chibbar's application of genomics is opening up new ways to use biotechnology to improve crops without requiring genetic modification.

Utilizing biodiversity in underutilized native grains towards food and nutritional security for improved human health

Ravindra N Chibbar, Manu P Gangola, Bharathi R Ramadoss and Monica Båga. Department of Plant Sciences, University of Saskatchewan, Saskatoon, SK, Canada S7N 5A8. Email Ravi.chibbar@usask.ca

Food and nutritional security is a key component affecting human health and wellbeing. Modern agriculture during the latter part of twentieth century made significant progress towards achieving food security. However, agricultural production system intensification and homogenization combined with population growth, economic development and climate change has changed food systems around the world. The homogenization of food systems has resulted in an increase in the incidence of chronic diseases severely impacting human health and wellbeing. Diet diversification has been suggested as one of the strategies to overcome the challenges of chronic diseases. An estimated 300,000 edible plant species are available to humans, only 7,000 are cultivated for food, but only 30 species contribute to ninety percent of world dietary energy. Thousands of species and there ecotypes are defined as underutilized or neglected crops. Several of the underutilized crops are part of traditional diets providing energy and nutrients to achieve food and nutritional security. Genotype, environmental conditions, agricultural practices and growth stages affect the grain composition, which in turn affects food quality and end-use by consumers. In a recent research project we analyzed grain composition in quinoa (*Chenopodium quinoa*), a pseudocereal (grain like) native to South America, where it formed an important component in the diet of Incan civilization. A significant amount of

variation was observed in grain carbohydrates, proteins and bioactive constituents. Similar diversity in grain composition and bioactive compounds was observed in chickpea (*Cicer arientinum*) germplasm obtained from diverse geographic regions. Another target of our studies is wild rice (*Zizania sp.*) that grows in the lakes of Northern Saskatchewan and consumed by the First Nations peoples of Canada. Similarly grains such as millets native to hill regions of Northern India can be a very good source of nutrients and bioactive compounds to provide food and nutritional security. The utilization of grains native to the regions can be very beneficial to the local economy while contributing to diet diversity and human health benefits.

PI-5

Dr. Bhimu Patil
Director - Vegetable and Fruit Improvement Center
Professor Department of Horticultural Sciences, Texas A&M University
Email: b-patil@tamu.edu; Phone: 979-458-8090

Dr. Bhimu Patil is a Professor and the Director of the Vegetable and Fruit Improvement Center at Texas A&M University AgriLife. He has devoted his career to understand the role of the health-promoting factors by promoting the consumption of fresh, healthful, and delicious varieties of fruits and vegetables. His broad, multi-disciplinary research spans all aspects of fruit and vegetable production, from isolation and characterizations of the health-promoting compounds to plant breeding aimed to develop improved varieties, and post-harvest handling practices that will prevent soil-borne contamination of vegetables.Dr. Patil has been actively involved in both research and educational activities related to global level '**Foods for Health'**. His research, in collaboration with trans-disciplinary scientists, related to bioactive-derived assays led to isolation and characterization of certain bioactive compounds in citrus and turmeric and other vegetables. His research is also focused on pre and postharvest effects on bioactive compounds in citrus, onion and recently his work is focused on other vegetables, fruits and spices including turmeric. He works with 26 VFIC industry members such as seed companies (Monsanto, Lark Seeds), retailers and wholesalers (HEB, Kroger), processors (Campbell Soup Company, Tropicana Nutrition Institute [Pepsico Inc], Beverage Institute of Health and Wellness [Coca-Cola] and Texas Citrus Exchange), and other commodity groups. He has published extensively in scientific papers in peer-reviewed journals, editor reviewed proceedings, book chapters, edited a book. He has extensive experience in handling and implementation of multi-state and multi-disciplinary grants. For example, he was the lead PI on USDA-IFAFS grant which was focused on multi-state effort to isolate and characterize citrus limonoids and understand their biological activities. During the last three years, Dr. Patil has completed two leadership training programs hosted by the Texas A&M University as well as he completed two-year advanced leadership program in February 2012, which is sponsored by the Texas A&M AgriLife Research. This training provides additional experience in administration of large multi-state grants.

Dr. Patil's mission also has encompassed education and outreach to colleagues, students, producers, and the general public. He co-founded an International Symposium on **Human Health Effects of Fruits and Vegetables (FAVHealth)** and this global-level biennial conference continue to draw premier researchers from almost 40 countries to share their latest findings on enhancing the healthy aspects of fruit and vegetables. He also served as chair of the Division of Agriculture and Food Chemistry of the American Chemical Society and this division celebrated its centennial anniversary during his leadership. He has chaired or co-chaired 25 national and international symposia. Moreover, with USDA support, he developed three multi-disciplinary and multi-state first-of-their-kind courses, "Science of Foods for Health" and "Phytochemicals in Fruits and Vegetables to Improve Human Health"; and "The Nexus of Food & Nutritional Security, Hunger and Sustainability".

He has chaired or co-chaired 25 national and international symposia. Moreover, with USDA support, he developed three multi-disciplinary and multi-state first-of-their-kind courses, "Science of Foods for Health" and "Phytochemicals in Fruits and Vegetables to Improve Human Health"; and "The Nexus of Food & Nutritional Security, Hunger and Sustainability".

Fruits, vegetables, and medicinal plants for the prevention and treatment of disease: untapped potential and unanswered questions

Bhimanagouda S. Patil, Jayaprakasha, G.K, Jashbir Singh, Vegetable and Fruit Improvement Center, Department of Horticultural Sciences, Texas A&M University, College Station, TX 77843; E-mail:B-patil@tamu.edu

Plant-derived products, including medicinal plants, as well as regular fruits and vegetables, hold great promise for developing new approaches to treat or prevent a diverse range of human diseases. However, we are faced with a diversity of evidence and many unanswered questions. Do we have sufficient evidence for the activities of plant-derived products to help treat or prevent disease? For example, more than 85,000 plant species have been documented for medical use in traditional medicine systems. Medicinal plants contain diverse bioactive compounds and extracts or purified compounds from medicinal plants have been used to treat human diseases for thousands of years. Now, modern epidemiological, *in vivo*, and *in vitro* studies suggest the protective effects of medicinal plants and fruits and vegetables for lowering the risk of chronic diseases including cancer, neurodegenerative disease, and cardiovascular diseases. Moreover, fruits and vegetables contain numerous health-promoting compounds with potential health benefits. Furthermore, certain vegetables and fruits are rich in free amino acids, some of which act as neurotransmitters or precursors to neurotransmitters such as GABA, tryptophan, glutamine, etc. Fruits and vegetables are also a major source of dietary fiber, which affects the composition and function of the gut microbiota, thus influencing human metabolism. In this talk, I will examine the evidence for the health-promoting effects of various plant products, with an eye to answering the question of whether this evidence is sufficient to allow development of products to treat or prevent disease, and where our research should go from here. This talk will also cover the Vegetable and Fruit Improvement Center's (VFIC) signature program "Foods for Health" and its "Farm to Table" approach for developing crops rich in health-promoting compounds to improve human health. This study was supported by USDA-SCRI- 2017-51181-26834 through National Center of Excellence for Melon at the VFIC of Texas A&M University.

SESSION DETAILS AS PER PROGRAM

Day 1. Thursday–February 14, 2019

10:40 am -11:10 am

Plenary I- Dr. Fabricio Medina-Bolivar, Professor of Metabolic Engineering, Arkansas State University, USA

Title: Harvesting a healthy future from peanut hairy roots…*and a little stress* *Venue: Auditorium, Fifth floor, GEHU*

11:15 am -11:45 am

Plenary II- Dr. Rajendra Dobhal, Director General, Uttarakhand Council for State Science and Technology (UCOST), Dehradun

Title: A policy perspective with relevance to the bioresource development of Uttarakhand*Venue: Auditorium, Fifth floor, GEHU*

11:50 am - 12:15 pm	Tea break *Venue: Lounge, Ground floor, GEHU*
12:20 pm-	Group photograph (Open Auditorium, ground floor, GEHU)
12:45 pm-1:45 pm	**Lunchbreak***Venue: Lounge, Ground floor, GEHU*

2:00 PM – 3:30 PM

Session 1a – Human health and Plants –I*Venue: Seminar Hall, Ground floor, GEHU*

Session Chairs:
Dr. Ashish Yadav, Senior Scientist, ICARRC for NEH Region, Sikkim Centre, India and
Dr. Nirmal Joshee, Professor, Fort Valley State University, Georgia, USA

Keynote Address: *Hippophae rhamnoides*- a promising solution for effective medical radiation countermeasure – Dr. Madhu Bala, Director DIBER, DRDO, Haldwani, India

Speaker 1: Development of liquid meals for use during radiation scenarios -Dr. O.P. Chauhan, Scientist 'E', DFRL, Mysore, India

Speaker 2: Turmeric (*Curcuma spp.*): A potential medicinal crop for small-farm owners in Alabama, USA. Dr.S. Rao Mentreddy. A&M University, Normal, AL, USA

Speaker 3: Organic kiwifruit production for health and nutrition -Dr. Ashish Yadav, Senior Scientist, ICAR RC for NEH Region, Sikkim Centre, India

Speaker 4: Hydroponically grown lettuce (*Lectuca sativa*): A healthier food with better antioxidant and flavonoids. Dr.Ankur Agarwal. DIBER, DRDO, Goraparao, Haldwani, Uttarakhand, India

KN-1

***Hippophaerhamnoides*- a promising solution for effective medical radiation countermeasure**

Dr Madhu Bala, Director, Defence Institute of Bioenergy Research (DIBER), DRDO, Ministry of Defence, Haldwani, Distt- Nainital, Uttarakhand, INDIA, Email:director@diber.drdo.in; bala44@gmail.com

Despite seven decades of research, development of an effective and non-toxic medical intervention for protection against lethal dose of ionizing radiation has remained unmet globally. While single molecules have failed miserably due to unacceptable toxicity, the herbal drugs, are generally neglected because of their mild efficacy. At DRDO the radio-protective potential of Himalayan herb,*Hippophaerhamnoides*L.(common name Sea Buckthorn), family *Eleagnaceae*was discovered. A single dose of the radio-protective preparation developed from leaves of Sea buckthorn (code SBL-1), administered 30 min before lethal dose of ionizing radiation (10Gy), and rendered more than 90% radio-protection in experimental animals. However, complex composition of herbal preparationand multiple targeted action, poses enormous challenges in understanding mechanisms of action. With the completion of genome sequencing of human, mouse and many other simpler experimental models, it now relatively easy to evaluate the metabolism, safety and efficacy of herbal drugs using genomic and metagenomic approaches together with traditional biochemical & pharmacological approaches. This talk will present some of our experiences with SBL-1, and its radioprotective action on multiple organs of experimental animals. Some prominent molecular pathways, genes affected by SBL-1 treatment in mice and the effects of SBL-1 on the jejunal microbiota will also be briefly discussedas microbiota influences the ADME of herbal drugs.

Development of radio-protective foods from plant sources

O. P. Chauhan, Janifer Raj X. Vani Vijay and PE Patki, Defence Food Research Laboratory, DRDO, Mysore, India 570011. Email:opchauhan@gmail.com

Rapid advancement in technology and existence of radionuclide's created a new threat to humanity in the form of radiation stress. Radiation exposure is not only from strategic explosions, fallouts and terrorist attacks; it can also be from planned sources like industrial, diagnostic, therapeutic and natural sources. Numerous studies are going on for the development of radio protectors to save the biological system from the harmful effects of radiation. It resulted in development of a series of compounds of synthetic origin such as vitamins, glycosides, nucleic acid derivatives and phosphorothioates such as amifostine. But still problems persist in form of fewer efficacies and associated toxicity with their effective doses. As an alternative source many plants have been studied and proved for their radio protective efficiency. Studies are available for the radio-protective properties of natural products such as *Podophyllum hexandrum*, *Spirulina plantensis*, *Chlorella vulgaris*, *Centella asiastica*, *Tinosora cordifolia* etc. But, developments of products with the incorporation of specific active ingredients are very less. Therefore, development of radio-protective food products from plant sources has been carried out with the incorporation of the natural active ingredient. Screening of the phyto/phyco ingredients carried out by systematic and standardized approach using *in silico* bio-prospection which involves bioactivity parameter selection based on literature, priority indexing by random and advanced search model, scoring and decision matrix by using fuzzy set membership analysis, optimization and validation. *In vitro* and *in vivo* analysis further supported this bio-prospective study. This study would help to collect and analyze data systematically to obtain a logical output in terms of identification of leads pertaining to molecules from natural products with radio-protective nature.

Turmeric (*Curcuma spp.*): A Potential Medicinal Crop for Small-Farm Owners in Alabama, USA

S. Rao Mentreddy, Thilini Ranatunga, Kamala Bhat, Keonna Hunter, Lam Duong, and Andrea Byars.
A&M University, Normal, AL 35762. Email: srinivasa.mentreddy@aamu.edu

Turmeric (*Curcuma longa*), a popular condiment, industrial, and a medicinal crop in Asia is currently gaining popularity as a medicinal plant due its anti-inflammatory properties in the U.S.A. However, the lack of adapted varieties that combine high rhizome yield with high curcumin levels, and production methods are major factors limiting its commercial production in the U.S. To address this limitation, fourteen turmeric genotypes of Vietnamese and Indian origin were assessed for their growth, yield, curcuminoid, and elemental content using organic production methods in North Alabama. The genotypes were planted in a randomized block design with four replications. Three plants from the middle row of each plot were harvested to determine dry rhizome yields and their curcumin, and elemental content. The curcumin and elemental contents were determined using HPLC and Inductively Coupled Plasma Spectrophotometer, respectively. There was a significant genotypic variation for all variables measured. The fresh and dry rhizome yields ranged from 1.70 (CL7) to 0.24 Kg/Plant (CL3). The dry rhizome yields ranged from 0.011 to 0.85 kg/Plant. The percentage curcumin content varied between 0% in C. Zedoaria genotypes to 2.47% in CL6. Among three curcuminoids measured, curcumin content was greater than besdesmethoxy or desmethoxy curcumins. In general, potassium was the most dominant (36 mg/g) element followed by Ca, Fe, and AL. The study showed that turmeric has the potential for commercial production in Alabama and perhaps the southeastern U.S.. The wide variation for both rhizome yield and curcumin content among these genotypes indicates the potential for variety improvement.

Organic kiwifruit production for health and nutrition

Ashish Yadav*, R.K. Avasthe, Adarsh Kumar, Zangmit Lepcha and Rajeni Pradhan
ICAR-National Organic Farming Research Institute (formerly ICAR Research Complex for NEH Region, Sikkim Centre), Tadong, Gangtok, Sikkim, India, *E-mail: 2005ash@gmail.com

Fruits are important sources of minerals, vitamins, fibers and antioxidants, which has been associated with reduction in chronic diseases *viz*., cardiovascular, cancer, diabetes, neurological and digestive disorders. The nutritional status of diet is on a declining trend due to low intake of fruits because of heavy use of pesticides in their production system. Kiwifruit (*Actinidia deliciosa*) is highly nutritive and renowned for an excellent source of antioxidants *viz*., vitamin C, vitamin E, vitamin K, carotenoids, flavonoids, polyphenol, pigments; minerals especially in phosphorous, potassium, calcium and magnesium; sugars, carbohydrates *etc*., and is very much suitable for organic production system. All these nutraceutical compounds of kiwifruit have strong antioxidant functions and play very vital role in health and nutrition. Studies have been undertaken on hand pollination along with partial protection for maximization of 'A' grade organic kiwifruit production. Results revealed that the time of hand pollination and partial protection of kiwifruit significantly increased the fruit set per cent which varied from 73.3% to 100%, average fruit weight varied from 68.4g to 114.4g and yield varied from 18.38 kg/plant to 35.2 kg/plant. Hand pollination and partial protection also influenced the no. of days taken to fruit set (5 to 8 days) and fruit maturity (176.3 to 184.7 days) of kiwifruit. The ICPMS analysis of kiwifruit samples of different treatments showed significant variations in macro nutrients (N, P, K, Ca, Mg and S) and micro nutrients (Zn, Cu, B, Fe, Ni and Mn) contents. The time of hand pollination and partial protection of kiwifruit also significantly influenced the various quality parameters *viz*., TSS, Vitamin C and Total acidity. The best time of hand pollination was observed between 10-12 am to get the maximum per cent fruit set under partial protection with 50% agro-shade net for 60 days.

Hydroponically grown lettuce (*Lectuca sativa*): A healthier food with better antioxidant and flavonoids

Ankur Agarwal[1*], Om Prakash[1], Devi Sahay[1], Swati Arya[1], S K Dwivedi[2] and Madhu Bala[1]. [1]Defence Institute of Bio-Energy Research (DIBER), DRDO, Goraparao, Haldwani-263139, Uttarakhand, India; [2]Defence Research Laboratory (DRL), Tezpur, Post Bag No. 2, Assam-784001, India. E-mail: ankurdr@rediffmail.com

The present study was carried out at DIBER (DRDO) Haldwani, Uttarakhand (India) to study the effect of three different growing conditions viz., soil grown system, soil-less and hydroponics system on productivity and quality of lettuce. Considering the shrinking land resources and water scarcity problem, techniques with efficient use water, space and nutrient are getting popular. Soil-less cultivation is one such technique. Experimental findings have revealed that soil-less system offers better productivity of lettuce crop to the tune of 3-4 times higher than soil grown system with better quality produce. Lettuce crop under hydroponics system developed profuse root system with average root length of 31.0 cm and fresh weight of 1.12 kg whereas under soil grown system the average root length was the minimum (10.0 cm) with minimum fresh weight of roots (0.152 kg). Ascorbic acid was the highest in the hydroponically grown crop of lettuce (11.2 mg/100g). Crop grown under soil-less vertical system exhibited the highest phenol content. Flavonoid content was at par among the hydroponics and soil-less system but was quite low in the soil grown lettuce.

Session 1b – Human Health and Plants-II *Venue: Auditorium, Fifth floor, GEHU*

(Dedicated to late Dr. Agnes M Rimando)*Special Address: In the memory of friend and colleague, Dr. Agnes M Rimando*

Session Chair: Dr. Anait S Levenson, Long Island University, USA

Coordinator: Dr. Pankaj Gautam

Keynote Address: Chemopreventive and therapeutic effects of stilbenes in prostate cancer- Dr. Anait S Levenson,

Speaker 1: Plants in treatment of metabolic syndrome – a modern epidemic-Dr. SK Verma, Pacific Medical College and hospitals, Udaipur, India

Speaker 2: The nutraceutical bioactive compound berberine protects against endothelial dysfunction caused by inflammation-Dr. Paola Rizzo, University of Ferrara, Italy

KN

Chemopreventive and therapeutic effects of dietary stilbenes in prostate cancer

Anait S. Levenson. Department of Biomedical Sciences, College of Veterinary Medicine, Long Island University, Brookville, NY 11548, USA. E-mail: anait.levenson@liu.edu

Prostate cancer is the most common male malignancy and the second cause of cancer-related death in the US. Nutritional chemoprevention is a particularly promising approach for prostate cancer management because of its slow progression and predominance in elderly men. Stilbenoids such as resveratrol, pterostilbene and Gnetin C have been reported to possess anti-inflammatory, antioxidant and anticancer activity. In our studies, we identified metastasis-associated protein1 (MTA1)-targeted chemopreventive and therapeutic properties of stilbenes in prostate cancer. Our published *in vitro* and *in vivo* studies demonstrated that pterostilbene potently inhibits MTA1 expression and MTA1-guided signaling in prostate cancer cell lines and blocks the progression of PIN and adenocarcinoma in xenografts and transgenic mouse models. In our mechanistic studies, we identified MTA1 associated axes as important pathways that contribute to prostate cancer progression and, importantly, demonstrated that stilbenes, specifically Gnetin C, a resveratrol dimer found abundantly in melinjo (*Gnetum gnemon*) plant, has potent anticancer effects on MTA1-mediated cell viability, colony formation and wound healing. The lecture will give an overview on the potential of stilbenes as MTA1-mediated chemopreventive and therapeutic strategy in prostate cancer.

Plants in treatment of Metabolic Syndrome – A Modern Epidemic

S.K. Verma, Department of Medicine, Pacific Medical College and Hospitals, Udaipur-313001, Rajasthan, INDIA. E-mail: skvermaster@gmail.com

Metabolic syndrome is a global problem and emerging epidemic in developing East Asian countries where the prevalence ranges from 2-8%. It is a combination of risk factors for coronary heart disease, diabetes, fatty liver and cancers. Clinically, it manifests as combination of hypertension, hyperglycemia, hypertriglyceridemia, reduced high density lipoprotein cholesterol (HDL-C) and abdominal obesity. The management rests on life style change and the medications to treat the components. Many plants have the properties to modify the involved components to a variable extent. However, the need is to research a plant or a combination of herbal compound that may affect all or the maximum number of syndrome components. In this direction, we have studied many plants to mention few are root of *Bombaxceiba*, tuber of *Puerariatuberosa*(Indian Kudzu) and fruit of *Elettariacardamomum* (Small Cardamom). The root of *B. ceiba* has antihyperglycemic, hypolipidemic, antioxidant and fibrinolysis enhancing properties in man. The tuber of *P.tuberosa* is effective antihypertensive, has significant hypolipidemic and distinct HDL-C raising property comparable to statin and with property to improve endothelial dysfunctions. The fruit of Small Cardamom has significant systolic, diastolic and mean blood pressure lowering effect with hypolipidemic, antioxidant and fibrinolysis enhancing properties in man. All these plant components were evaluated in raw powdered form in appropriate selected study subjects with single blinded placebo controlled study for a reasonably long duration.There were no significant undesirable effects observed. These herbal components can be considered in future for the management of metabolic syndrome either alone or in combination.

The nutraceutical bioactive compound berberine protects against endothelial dysfunction caused by inflammation

Paola Rizzo[1,2] and Cristiana Caliceti [3].[1]Department of Morphology, Surgery and Experimental Medicine, University of Ferrara, Ferrara, 44121, Italy. [2] Maria Cecilia Hospital, GVM Care & Research, E.S. Health Science Foundation, Cotignola, Italy; [3]Department of Chemistry "Giacomo Ciamician" - Alma Mater Studiorum, University of Bologna, Bologna, Italy; Centro Interdipartimentale di Ricerca Industriale Energia e Ambiente (CIRI EA) - Alma Mater Studiorum, University of Bologna, Italy. E-mail rzzpla@unife.it

Atherosclerosis is a chronic inflammatory disease caused by the accumulation of oxidized low-density lipoproteins (oxLDL) in the intima of large arteries. oxLDLs bind to a specific receptor on endothelial cells, oxLDL receptor-1 (LOX1) induced by many inflammatory cytokines, oxidative stress and hemodynamic stimuli. LOX1 is involved in increased oxidative stress and expression of adhesion molecules, such as vascular cell adhesion protein 1(VCAM-1) and intercellular adhesion molecule 1 (ICAM-1), which mediate the adhesion of monocytes to the endothelium, thus initiating the inflammatory response which leads to atherosclerotic plaque formation. Preclinical and clinical studies have shown that berberine (BBR), an alkaloid extracted from plants of gender Berberis, has a beneficial role in preventing endothelial dysfunction with molecular mechanisms still partially known. We investigated the effect of BBR on oxLDL- and TNFα-induced endothelial dysfunction in human umbilical vein endothelial cells (HUVECs). HUVECs exposure to oxLDL (30 μg/ml) or TNFα (10 ng/ml) for 24 h led to a significant increase in LOX1 expression, effect abrogated by BBR (5 μM). Furthermore, BBR treatment reduced intracellular ROS levels, MAPK/Erk1/2 activation and NF-κB target genes VCAM and ICAM expression, induced by TNFα. These findings demonstrated that BBR could prevent the oxLDL and TNFα - induced LOX1 expression and oxidative stress, key events leading to endothelial dysfunction.

Session 1 c: Medicinal Orchids *Venue: Meeting room, Ground floor, GEHU*

Session Chairs:

Dr. Bijaya Pant, Tribhuvan University, Kirtipur, Kathmandu, NEPALand

Dr. S. M. Khasim, Acharya Nagarjuna University, Nagarjunanagar, Guntur, Andhra Pradesh, India.

Keynote address: Cytotoxic efficacy and antimicrobial studies in *Acampe praemorsa* and *Aerides odorata* (Orchidaceae): An *in vitro* approach.Dr. S. M. Khasim, Acharya Nagarjuna University, Nagarjunanagar, Guntur, Andhra Pradesh, India.

Speaker 1. Biological activities of some *Dendrobium* species.Dr.Mukti Ram Paudel, Assistant Professor, Tribhuvan University, Kirtipur, Kathmandu, NEPAL

Speaker 2. Medicinal orchids of Nepal, prospects and their conservation strategiesDr. Bijaya Pant

Tribhuvan University, Kirtipur, Kathmandu, NEPAL

Speaker 3: Medicinal orchids of foot hills of eastern Himalaya and measures of conservation -Mr. Ashis Kumar Roy, Siliguri, West Bengal, India

Cytotoxic efficacy and antimicrobial studies in *Acampe praemorsa* and *Aerides odorata* (Orchidaceae): An *in vitro* approach.

S. M. Khasim and K. Jhansi. Orchid Biology Lab., Department of Botany and Microbiology, Acharaya Nagarjuna University, Nagarjunanagar 522 510, Guntur, Andhra Pradesh, India. Email: prof.smkhasim@gmail.com

Besides ornamental value, innumerable orchid species have been used in herbal medicine and also as food supplements by the tribal communities across the globe. Screening of bioactive compounds has led to the invention of novel drugs and they have an efficient protection against various diseases. The present study deals with the cytotoxic efficacy and antimicrobial activity of orchids, viz. *Acampe praemorsa* and *Aerides odorata* distributed in Visakhapatnam area of Eastern Ghats of Andhra Pradesh. Plants were collected, identified, shade dried and, methanol and ethyl acetate extracts were prepared for the systematic investigation of antimicrobial activity of plant extracts. Antibacterial activity against three gram positive bacteria *Bacillus megaterium, Lactobacillus acidophillus* and *Enterococcus faecalis*, three gram negative bacteria *Proteus vulgaris, Klebsiella pneumoniae* and *Escherichia coli* was done using Agar Well Diffusion method; antifungal activity was carried against *Candida albicans, Aspergillus flavus* by Cpzapak Dox agar media, MIC by broth dilution method and zones of inhibition were recorded. Ethyl acetate extracts showed maximum antimicrobial activity against all bacteria and fungi. *Aeridis odarata* ethyl acetate extract showed highest zone of inhibition 17 mm against *Lactobacillus acidophilus*. Ethyl acetate extract of *Acampe praemorsa* showed highest zone of inhibition 17 mm against *Candida albicans* fungus. The leaf extracts were tested for its inhibitory effect on HeLa and MCF-7 cancer cell lines and evaluated by the MTT assay. Methanolic leaf extract of *Aerides odarata* has significant cytotoxic effect on MCF-7 cell line in concentration range between 5 to 100µg/ml.

Biological activities of some *Dendrobium* species.

Mukti Ram Paudeland Bijaya Pant. Central Department of Botany, Tribhuvan University, Kathmandu, Nepal. Email: mr.paudel@cdbtu.edu.np

Dendrobium, second largest genus of the family Orchidaceae in Nepal, used in traditional medicine to treat fever and coughs as well as in tonic. Several compounds, such as alkaloids, phenolic compounds, bibenzyl, phenanthrenes, phenanthraquinone and lignin glycoside have been isolated from *Dendrobium* species. Due to presence of such compounds, *Dendrobium* species are used in Chinese and Indian traditional medicinal system. Our research focused on the four *Dendrobium* species, *D. amoenum, D. crepidatum,D. longicornu* and *D. moniliforme*. They were collected from Makawanpur district of Central Nepal to screen the antioxidant, antibacterial and cytotoxic activities. We have also developed *in vitro* culture system for the mass propagation and production of secondary metabolites. We have also assessed the antioxidant, antibacterial and cytotoxic activities of in vitro developed plant materials of some *Dendrobium* species to conserve their natural population. This study explores potential sources of natural products and pharmacological uses of in vitro developed *Dendrobium* species.

Medicinal orchids of Nepal, prospects and their conservation strategies.

Bijaya Pant, Central Department of Botany, Tribhuvan University, Kathmandu, Nepal. Email: b.pant@cdbtu.edu.np

Orchids are distributed from the tropical to alpine region in the unique and highly diverse ecosystem of Nepal. Orchidaceae is the largest family of the flowering plants comprising of estimated 450 species with 18 endemic species and 90 species to be beneficial medicinal value. More species are expected to be medicinal in further investigation. A wide range of chemical compounds such as alkaloids, bibenzyl derivatives; flavonoids, phenanthrenes, and terpenoids have been reported in many orchid species. Extensive research on their medicinal benefits and application is further required. Medicinal orchids of Nepal are under serious threat as a result of rapid agricultural and urban development, deforestation, and over-collection and illegal trade. Thus challenges in their conservation have become a serious concern, as they are also very important from commercial point of view. We are undertaking germplasm conservation of some threatened but also commercially important medicinal orchids for their *ex situ* conservation. Various techniques of *in vitro* culture have been applied for the mass scale propagation different species of medicinal orchids. We have been conducting an education, awareness and orchid species restoration programme in participation with Community Forests Users Groups (CFUs) in Central Nepal. This initiative is expected to contribute how local people can be encouraged to conserve nature preciously. We are also disseminating knowledge and demonstrating the local people as how their conservation efforts and cultivation of artificially propagated species are a source of long term economic benefit and upgrade their livelihood.

Medicinal orchid of foot-hills of eastern Himalayas and measures of conservation

Ashis Kumar Roy, Buraganj Kalkut singh high school, P.O. Rangali, Dist. Darjeeling 734429, Email: ashiskumarroy13@gmail.com

The Himalayas are well-known for its Orchids and the foot hills of the Himalaya is the paradise of orchids to me.Tarai and Dooars, a well-known place of North West Bengal.Orchid has been used as medicine since ancient ages.According to the Rig-Veda, The Sushruta Samhita ,The Charaka Samhita the number of 0rchid plants were used in Ayurveda medicine, such as Rasna(Vanda tessellate), Vridhi(Habenaria sp.) etc.Local tribal people of Tarai and Doooars and medical practitioners use the different wild orchid species as *Dendrobium fimbriatum, Dendrobium aphyllum, D. nobile, D. moschatum, Acampe papillosa* etc. to prevent different diseases. Most of these orchid species are facing threats due to the destruction of natural habitat by different way. So, immediately, there is an urgent need for awareness among the local people and to take measures of conservation with the help of the students throughout the year.

3:30 pm **Tea break** *Venue: Lounge, Ground floor, GEHU*

3:45 pm-5:30 pm

Session 1d: Cannabis: Past, Present and Future*Venue: Auditorium, Fifth Floor GEHU*

Session Chair: Dr. Suman Chandra,The University of Mississippi, USA

Coordinator: Dr. S. M. Waheed

Keynote Address: Cannabis pharmacology and human health- Dr. Ethan Russo, International Cannabis and Cannabinoids Institute, Czech Republic

Speaker 1: Cannabinoids Biosynthesis- Dr. OliverKayser, Technische Universität Dortmund, TUD·Germany

Speaker 2. Cannabis: Botany, Chemistry and Drug Development - Dr. Suman Chandra, University of Mississippi, USA

Speaker 3: Cannabis and human health: Industry prospective' Jahan Pestonjamas and Avnish Pandya, Bombay Hemp Company Pvt. Ltd., India

Round table discussion

My Journey with Cannabis: Botany, Chemistry and Drug Development

Mahmoud A. ElSohly, Suman Chandra and Hemant Lata. National Center for Natural Products Research, Research Institute of Pharmaceutical Sciences, School of Pharmacy, The University of Mississippi, University, MS 38677-1848, U.S.A. Email: suman@olemiss.edu

Cannabis is an annual, dioceous (occasionally monoecious) and wind pollinated species. The plant has been reported to contain more than 500 different compounds belonging to a diverse group of chemical classes, the most important of which is the cannabinoids. There are 120 phytocannabinoids reported so far. Among cannabinoids, Δ^9-tetrahydrocannabinol (Δ^9-THC), commonly known as THC, is the major biologically and most important psychologically active compound, which accumulates mainly in the glandular trichomes of the plant. Beside THC, cannabidiol (CBD) is another important compound which is non-psychoactive and highlighted for its activity against childhood epilepsy syndromes and other disorders. In this presentation, cannabis botany, chemistry, biotechnology, micropropagation, indoor and outdoor cultivation and our efforts towards drug development will be discussed.

Understanding cannabinoid biosynthesis by learning lessons from *Cannabis sativa*, *Helichrysum umbraculigerum* and *Radula marginata*.

Oliver Kayser[1] and Tajamul Hussain[1]. [1]Technical Biochemistry, TU Dortmund University, Dortmund, D-44227. E-mail: oliver.kayser@tu-dortmund.de

Cannabinoids play a major role in pharmacology as new upcoming chemical scaffolds for the treatment of various diseases like chemotherapy, multiple sclerosis, trauma and ophthalmology. Besides their almost unique cannabinoids as terpenophenolics are found only in few plants like *C. sativa*, *H. umbraculigerum* und the liverworth *R. marginata*. Based on genome and transcriptome analysis followed by studies on the metabolic profile important differences are discussed. Cannabinoids are biosynthesized in plants in glandular trichomes as mostly less understood organ and trafficking and storage of THC and related precursors remains unclear. In this talk, we highlight the molecular basis for precursor delivery, localization of biosynthesis in trichomes by Imaging-MS and CARS microscopy, gene regulation by qPCR and metabolome analysis of THC and CBD over the standard cultivation time of 8 weeks. Briefly the heterologous expression and cannabinoid pathway assembly in yeast is explained. Here, the concept of bioengineering an artificial biosynthesis of cannabinoids following engineering principles (systems biotechnology, in silico prediction) is outlines. More recent cannabinoids have been detected in the liver moss *Radula marginata*. Latest findings will be introduced to the taxonomy, phylogenicity and anatomical structure of these unique cannabinoid producing mosses.

Cannabis pharmacology and human health.

Ethan Russo.International Cannabis and Cannabinoids Institute, Jachymova 26/2, CZ 11000 Prague 1, Czech Republic. E-mail: ethan.russo@icci.science

From 1964 when Raphael Mechoulam isolated and synthesized tetrahydrocannabinol, it has been the primary focus of cannabis research. More recently, the synergistic contributions of cannabidiol to its pharmacology and analgesic medicinal value have been demonstrated. Other phytocannabinoids including tetrahydrocannabivarin, cannabigerol, and cannabichromene harbour additional effects of therapeutic interest. Innovative conventional plant breeding has yielded cannabis chemotypes expressing high titres of each component for future study. Another echelon of phytotherapeutic agents are produced by the plant, the cannabis terpenoids: limonene, myrcene, α-pinene, linalool, β-caryophyllene, et al. These half-siblings of phytocannabinoids are all flavour and fragrance components common to human diets that have been designated Generally Recognized as Safe (GRAS) by the US Food and Drug Administration and other regulatory agencies. Terpenoids are quite potent, and affect animal and even human behaviour when inhaled from ambient air, at serum levels in the single digits ng/ml. They display unique therapeutic effects that may contribute meaningfully to the entourage effects of cannabis-based medicinal extracts. Cannabis additionally produces flavonoids such as cannflavin A with an unusually promising anti-inflammatory profile, as well as triterpenoids in the roots that have promising pharmacological properties. Particular focus will be placed on phytocannabinoid-terpenoid interactions that could produce synergy with respect to treatment of pain, inflammation, depression, anxiety, addiction, epilepsy, cancer, fungal and bacterial infections (including MRSA). Cannabis-based drugs have already proven safe and effective in treatment of nausea and vomiting, spasticity in multiple sclerosis, chronic and neuropathic pain, and in the case of cannabidiol, severe epilepsy syndromes and schizophrenia. The synergistic benefits of cannabis components in this mountain plant will be emphasised.

Cannabis and human health: Industry prospective

Jahan Pestonjamas[1], and Avnish Pandya.[1]Co-Founder & Director, Strategic Development and Collaborations. Email: jahan.pj@boheco.org

Since its origin in the lower Himalayas, the diverse cultural, medical and religious uses of the Cannabis plant slowly disseminated around the world. The first evidence of its use for medicinal or cultural purpose was found in China. In India, in the ancient books of traditional knowledge Cannabis was revered as an 'alleviator of pain'. It was used as a medicine, as a source of food and fibre and also used for recreational and spiritual purposes. The earliest written reference to Cannabis in India may occur in the *Atharvaveda*, dating to about 1500 BCE. In the *Sushruta Samhita* (verses of Sushruta), dating around 500 BCE, Cannabis was recommended for phlegm, catarrh and diarrhoea. The endocannabinoid system is found consistently across the mammalian species.Modulating the endocannabinoid system utilising Cannabis receptor-based agonists and antagonists holds promise for future treatment as implicated by scientists based on animal models. Classical endocannabinoid deficiency is characterised as a deficiency of the body to produce neurotransmission molecules which are endocannabinoids due to this the body slips into a diseased state suffering from various illness. Supplementation using phytocannabinoids like THC and CBD have shown to improve the diseased state in a particular human without causing serious adverse events. In the past decade, the endocannabinoid system has been implicated in a growing number of physiological functions, both in the central and peripheral nervous systems and in peripheral organs. Owing to the workings of the Endocannabinoid system many diseases like chronic pain, epilepsy, fibromyalgia, eczema, multiple sclerosis is being treated successfully utilising phytocannabinoids.For an industry perspective, these molecules need to be understood well with respect to their PK and PD actions in the human body. Hence, research into the endocannabinoid system could hold answers to diseases for which there are currently no drugs available. The Cannabis plant has about 100-120 cannabinoids of which we have only scratched the surface- two molecules, namely THC and CBD.

5:30 pm-6:30 pm

Poster Session (Open Auditorium, Ground floor, GEHU)- Coordinators: Dr. Anju Rani, Er. Ankita Lal, Er. Vaishali

Session O1: Oral presentations I (Young scientist)

Coordinator: Dr. Deependra Singh, Dr. Ivan Wilson Venue:*Meeting room, Ground floor GEHU*

Session O2: Oral presentations II(Young scientist)

Coordinator: Dr. Jigisha Anand, Er. Somya *Venue: Seminar Hall, Ground floor, GEHU*

6:30pm- 7:30 pm

CULTURAL PROGRAM *Venue: Auditorium, Fifth floor, GEHU*

7:00 pm-8:00 pm

Dinner *Venue: Lounge, Ground floor, GEHU*

Day 2. Friday – February 15, 2019

9:00 am-9:30 am *Venue: Auditorium, Fifth floor, GEHU*

Plenary III- Dr. S. Farooq, President, Himalaya Drug, India

Title: Medicinal, aromatic, and nutraceutical plants from mountainous areas

9:00 am- 9:30 am *Venue: Auditorium, Fifth floor, GEHU*

Plenary IV- Prof. (Dr.) Ravindra N Chibber, W. J. White Professor & Canada Research ChairCrop Quality (Molecular Biology & Genetics),Department of Plant Sciences, University of Saskatchewan

Title: Utilizing biodiversity in underutilized native grains towards food and nutritional security for improved human health

10:10 am-10:25 am **Tea Break** *Venue: Lounge Ground Floor, GEHU*

10:30 am-12:30 pm

Session 2a:Micropropagation for Conservation, Breeding and Production of Medicinal Plant Species*Venue: Seminar Hall, Ground floor, GEHU*

Session Chairs

Dr. Jeffrey AdelbergProfessor of Horticulture, Clemson University, USA

Dr. A. Datta, Coordinator, TIFAC-Centre of Relevance and Excellence in Agro and Industrial Biotechnology, Thapar Institute of Engineering & Technology, Patiala, Punjab, India

Keynote address: Mineral nutrition in vitro affects subsequent plant quality in the nursery: Studies with turmeric and Echinacea.J. Adelberg, Clemson University, USA

Speaker 1.*In-vitro* organogenesis and callus conservation in *Rauwolfia serpentina* and *Withania sonifera*S. S. Gantait, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, India

Speaker 2. Thin cell layer culture system revisited- N. Joshee, Fort Valley State University, USA

Speaker 3. Selection and conservation of elite clones of *Bacopa monnieri* using biotcechnological approaches.Dr. A. K. Datta, Thapar Institute of Engineering & Technology, Patiala, India

Speaker 4: Conservation of Forest Genetic Resources of Himalayas through *in vitro* approaches. Ajay Thakur, Forest Research Institute, Dehradun, Uttarakhand, India 248006

Mineral nutrition in vitro affects subsequent plant quality in the nursery: Studies with turmeric and Echinacea

Jeffrey Adelberg, Professor of Plant and Environmental Sciences, Clemson University. Email: jadlbrg@clemson.edu

Turmeric buds were propagated in bioreactors with liquid medium in different combinations ofPO_4^{3-}(1.25-6.25 mM), Ca^{2+}(3-9 mM), Mg^{2+}(1.5-4.5 mM), KNO_3(20-60 mM) and with 6-18 buds/vessel using response surface methods, with periodic supplementation of sucrose (SF) or nutrients and sucrose (NSF) for 5-months. The bioreactor plants were transferred to the greenhouse and fertilized with either high-input (NSF) or low-input treatments (SF). After 6-months in the greenhouse, curcuminoids and essential oils in dry rhizomes were analyzed by HPLC-MS and GC-MS respectively. Plants from bioreactors treatments with high plant density and KNO_3, and low PO_4^{3-} and Mg^{2+} gained the most fresh mass (20x) under high-input fertilizer. Major sesquiterpenes, curcumenol were well correlated (r=0.7) with mass, and poorly correlated (r=0.1) with curcumin. In NSF, the interaction of $PO_4^{3-}$with Ca^{2+} and Mg^{2+} maximized curcumin and demethoxycurcumin. Three week in vitro mineral treatments of *Echinacea* shoot cultures were tested with (0.125-1.5x) NH_4NO_3, (0.5-1.5x) KNO_3, (0.5-1.65x) meso-nutrients, (0.5-2x) micro-nutrients, (0.5-1.5x) iron chelate (0.25-2x), (x=MS 1962); with 3-9 plants per vessel using response surface methods. Plants were acclimatized under mist or in a fog tunnel for 4 wks, transferred outdoors for 10 wks. Plants from the tunnel flowered at 6±0.6 wks and from mist flowered in 7±0.9 wks with highest minerals and most plants per vessel, and 0.25x iron. Meso-nutrients reduced to 0.5x and iron to 0.25x increased the number of flowers to 17±3.5 flowers/plant under tunnel and to 13±3.5 flowers/plant under mist (after 10 wks outdoors). Controlled environments and clonal varieties reduce error so multifactor methods can optimize processes subsequent to in vitro treatments.

***In vitro* organogenesis and callus conservation in *Withania somnifera* (L.) Dunal and *Rauwolfia serpentina* L.**

Subhendu S. Gantait[1], Koushik Dutta[2] and Sachin Sharma[2]. [1]Dept. of Floriculture & Landscape Architecture, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, India. [2]Uttar Banga Krishi Viswavidyalaya, Pundibari, West Bengal. Email: ssgflori@gmail.com

In vitro seedling and direct regeneration in *Withaniasomnifera* (L.) Dunal, and *in vitro* organogenesis and callus conservation protocols were standardized in *Rauwolfia serpentina* L. The results revealed that MS medium containing 3.0 mgL^{-1} GA_3 and 3.0 mgL^{-1} Kn was found effective for maximum germination percentage (92.67), germination rate (1.83), germination value (56.07) and seedling vigour index (875.73). Wherein, minimum days, maximum germination speed, shoot length, weight of shoot, weight of root was noticed in MS medium containing 5.0 mgL^{-1} GA_3 and 5.0 mgL^{-1} Kn. *W. somnifera* seeds should be germinated in MS media containing 3.0 mgL^{-1} GA_3 and 3.0 mgL^{-1} Kn followed by seedling development by subculturing of germinated seeds in MS medium supplemented with 5.0 $mgL^{-1}GA_3$ and 5.0 mgL^{-1} Kn. In direct regeneration MS medium fortified with BAP 4.0 mgL^{-1} and IAA 2.0 mgL^{-1} took least days for primordial appearance (5.34) and multiple shoot initiation (5.45). The maximum response and number of shoots was found in MS medium fortified with BAP 1.0 mgL^{-1} and IAA 2.0 mgL^{-1}. Highest evidences of rhizogenesis in shortest time were recorded in MS medium containing 5.0 mgL^{-1} IBA. In *R. Serpentina* the ½ MS medium fortified with 5.0 mgL^{-1} 2,4-D and 2.0 mgL^{-1} NAA was found most suitable for qualitative and quantitative callus production. The plant multiplication was highest in full MS medium containing 6.0 mgL^{-1} BAP and 2.0 mgL^{-1} GA_3, and rhizogenesis was highest (55.00%) in ½ MS medium containing 3.0 mgL^{-1} IBA. The callus were conserved for nine months in its best condition by repeated sub-culturing in *in vitro* condition on MS medium fortified with 0.2 mgL^{-1} 2,4-D. It was evidenced that the regeneration capacity of callus was reduced as the time of callus conservation was increased.

Thin cell layer culture system revisited

Nirmal Joshee, Agricultural Research Station, College of Agriculture, Family Sciences and Technology, Fort Valley State University, Fort Valley, GA 31030, USA. Email: josheen@fvsu.edu

Various mechanisms governing plant growth and development are one of the most fundamental and applied areas of modern plant research. The thin cell layer (TCL) system consists of explants of a small size excised from different plant organs (stems, leaves, floral inflorescences, flower primordia or floral organs, cotyledons, hypo-/epicotyl, apical zone or embryo), either longitudinally (lTCL), or transversally (tTCL). True lTCLs contain only one tissue type, such as a monolayer of epidermal cells, whereas tTCLs include a small number of cells from different tissue-types: epidermal, cortical, cambium, perivascular and medullar tissue, parenchyma cells. TCL systems allow for the isolation of specific cell or tissue layers, which, depending on the genetic state and epigenetic requirements, and in conjunction with strictly controlled growth conditions (light, temperature, pH, PGRs, media additives and others) may lead to the *invitro* induction of specific morphogenic programs. We have employed tTCL approach in two major medicinal plants, *Scutellaria spp*. and *Bacopa monnieri*. Major focus in these studies was to study the potential of thin layer cultures in multiple shoot production and also use them for *Agrobacterium* mediated gene transfer. Recently we have initiated thin cell layer cultures in a woody tree species *Paulownia* and and the results are encouraging.

Selection and conservation of elite clones of *Bacopa monnieri* using biotcechnological approaches.

Anil Kumar, Mahima Bansal and M. Sudhakara Reddy. TIFAC-Centre of Relevance and Execellance in Agro & Industrial Biotechnology, Thapar Institute of Engineering & Technology, Patiala -147 004. E-mail: adatta@thapar.edu

Bacosides, well-known brain tonic and restorative, are the active principle extracted from *Bacopa monnieri*. These compounds find their applications in various pharmaceutical preparations for the treatment of mental problems and improvement of cognition. Owing to its extensive medicinal and commercial applications, this species has been over-exploited and presently facing a high risk of getting endangered. Therefore, present work was taken up for the collection and characterization of wild population from different geographical regions to document diversity and identification of elite accessions (based on growth and active principle) based on biochemical and molecular markers. A significant variation was recorded in bacoside A contents of these accessions. Maximum bacoside content was recorded in accession BM1, whereas accession BM14 contained minimum bacoside content. Similarly, about 35 % variations were detected in these populations based on combined data of random amplified polymorphic DNA (RAPD) and inter simple sequence repeat (ISSR). Individually, ISSR markers detected higher variation (44.9 %) as compared to RAPD markers (23 %). Clustering based on molecular marker data grouped these accessions into two major groups and also placed accession BM14 as an out group. Efficient micropropagation protocol was developed for rapid multiplication of collected accessions for *in vitro* conservation. The shoot organogenic potential of leaf explants taken from microshoots and rooting of microshoots also varied among accessions. Maximum shoot organogenic potential was observed in accession BM5 and maximum rooting potential was observed in accessions BM1, BM2, BM7, BM10 and BM14. Somatic embryogenesis was also achieves in some of the clones which were germinated to produce plants in culture. Both somatic embryos as well as shoot apices were encapsulated alginate gels to produce synthetic seeds and storage of these seeds was studied at both room temperature and 4 ^{0}C. Present study is an important step for developing long-term strategy for conservation of this important medicinal herb.

Conservation of Forest Genetic Resources of Himalayas through *in vitro* approaches

Ajay Thakur, Scientist F and In-charge Tissue culture Laboratory, Forest Research Institute, Dehradun, Uttarakhand, India 248006. Email: thakura@icfre.org

Forest Genetic Resources (FGRs) constitute a very important sub-set of plant biodiversity. Conserving FGR is vital, as they are unique and irreplaceable resources for the future and contain a huge potential in ensuring food and health security of human population and its livestock. Loss of any population or small population size of plant species have many genetic consequences and pose apparent threat of extinction of the species. In Indian context, FGRs constitutes more than 80% of higher plant biodiversity (>14000). In Himalayas, some species are under severe threat and already in red data list. These rare, endangered and threatened (RET) FGRs are of very high conservation concern.*In vitro* long run storage is one of the solutions for their conservation. RET FGRs are being conserved in aseptic area for medium and long run through *in vitro* storage of cultures on slow growing medium and cryopreservation. *In vitro* storage and complete plant regeneration is being conducted on *Desmodium oojeinense, Taxus contorta, Albizzia julibrissin, Butea pellita, Pittosporum eriocarpum, Diploknema butyraceae, Aristilochia punjabensis, Catamixis baccharoides* and *Ilex pseudo-odorata* using different explants *viz.* shoots, leaves, seedlings, seeds etc. Callus is most reliable method of *in vitro* storage which has been achieved. The calli is being maintained through subcultures. Once complete propagation protocol for thesespecies from stored cultures i.e. callus, shoot tips, embryo cultures protocols has been established.Also, *in vitro* stored FGRs primarily for conservation though can be used for benefit sharing through *in vitro* propagation.

Session 2b: Molecular Approaches to Elucidate the Biosynthesis of Bioactive Natural Products in Plants *Venue: Auditorium, Fifth floor, GEHU*

Session Chair: Dr. Sanjay Kumar, Director, CSIR-IHBT Palampur

Coordinator: Dr. Anju Rani

Keynote Address: Molecular approaches to decipher pathways for secondary metabolite synthesis in plants from Himalayas- Dr. Sanjay Kumar, Director, CSIR-IHBT Palampur, India

Speaker 1: Bioengineering of secondary metabolism in medicinal plants to improve the yield of therapeutic ingredients- Prof. M Z Abdin, Jamia Hamdard, India

Speaker 2: Pathway engineering of flavonoid biosynthesis for improved crop productivity and human health-Dr. Prabodh Trivedi, CSIR-NBRI, India

Speaker 3: Secondary Metabolite channeling and pathway genomics: Route to better harvest-Dr. Ajit Kumar Shasany, CSIR-CIMAP, India

Speaker 4: Understanding the gene to metabolites networks in medicinal plants of Sikkim Himalaya-Dr. Pradeep Bhardwaj, Institute of BioresourcesPlenary and Sustainable development, India

Speaker 5: Molecular characterization of structural and regulatory aspects of saponin biosynthesis in *Chlorophytum borivilianum* -Dr. Kashmir Singh, Panjab University, India

Biotechnological approaches for biosynthesis of plant secondary metabolites

Shashi Bhushan and Sanjay Kumar. CSIR-Institute of Himalayan Bioresource Technology, Palampur-176061 (HP). Email: sanjaykumar@ihbt.res.in

Himalayan region is home of medicinal and aromatic plants that contain metabolites of industrial importance. We initiated work on regulation of picrosides, shikonins, catehcins, podophyllotoxin and steviol glycosides synthesis in picrorhiza (*Picrorhiza kurrooa*), arnebia (*Arnebia euchroma*), tea (*Camellia sinensis*), podophyllum (*Sinopodopyllum hexandrum*) and stevia (*Stevia rebaudiana*), respectively. Molecular regulation of flavonoid biosynthesis in tea, mevalonate pathway in *A. euchroma*, and mevalonate and *2-C-methyl-D-erythritol 4-phosphate* pathways in *P. kurrooa*were deciphered and analyzed. An importance of temperature and light in regulating picrosides accumulation in *P. kurrooa* was obtained, wherein *cis*-acting motifs in the promoters were identified. Also, an importance of GATA and SORLIP motif in promoter of *3-hydroxy-3-methylglutaryl-CoA reductase* (*HMGR*) in regulating light mediated gene expression was established. Promoter analysis of *S. rebaudiana* also identified a role of day and night in regulating steviosides biosynthesis. Further, transcriptome of *P. kurrooa* on next generation sequencing platform identified intense transcriptome adjustments in response to the temperature. Utilizing basic knowledge of biosynthetic pathway in tea, the critical component of the pathway was transplanted in tobacco for production of catechin. The expression of *HMGR* and *p-hydroxybenzoate-m-geranyltransferase* was found to play a critical role in shikonins biosynthesis under low and high pigment producing cell suspension cultures of *A. euchroma*. We also developed *in vitro* technologies for production of shikonin derivatives in bioreactors. In addition, the adventitious root culture systems were also developed to produce valpotriates and picrosides from *Valeriana jatamansi* and *P. kurrooa*, respectively. The work has implications in metabolite biosynthesis through metabolic engineering, synthetic biology and transgenic approaches.

Understanding the gene to metabolite networks in medicinal plants of Sikkim Himalaya (Oral)

Pardeep Kumar Bhardwaj. Institute of Bioresources & Sustainable Development (IBSD), Meghalaya, 6th Mile, Upper Shillong-793009, Meghalaya. *Email: pardeepbiotech@rediffmail.com

Sikkim Himalaya is a part of Eastern Himalaya, which is globally known for its biological diversity. Due to its unique geographical dynamics, moisture-laden winds generated from the Bay of Bengal results in high precipitation throughout the year, which differentiate this region of Himalaya (Moist Himalaya) from Western Himalaya (Cold desert). The climate, altitude, rainfall and soil conditions of this region, along with varied ecological habitats have contributed to the development of rich vegetation with unique diversity of medicinal plants. Realizing the uniqueness of niche environment, these medicinal plants offer an advantage in having much greater possibilities of novel biomolecules (metabolites). In medicinal plants, the production of these metabolites enhances their nutritional values and resistance against microorganisms, insects and various stresses. Therefore, it is necessary to understand gene regulatory networks and the functioning of appropriate biosynthetic pathways. We are using modern omics approaches for the discovery of biosynthetic genes/ pathways of specialized metabolites and integrating gene expression networks with their metabolome.

Molecular characterization of structural and regulatory aspects of saponin biosynthesis in *Chlorophytum borivilianum*

Shikha Kalra[1], Sunil Kumar[1], Monika Kajal[1], Kashmir Singh[1]; [1]Department of Biotechnology, Panjab University, Chandigarh 160014 E-mail: kashmirbio@pu.ac.in

Chlorophytum borivilianum, an endangered medicinal plant species is highly recognized for its aphrodisiac properties provided by saponins present in the plant. To gain molecular insight of saponins biosynthesis in this plant, RNA-seq data of transcriptome and smRNAome was generated using Illumina's HiSeq 2000 sequencing platform. Available (e.g., De-Bruijn/Eulerian graph) and in-house developed bioinformatics tools were used for assembly and annotation of transcriptomeBioinformatics analysis, using non-redundant proteins, gene ontology (GO), enzyme commission (EC) and kyoto encyclopedia of genes and genomes (KEGG) databases, extracted all the known enzymes involved in saponin and flavonoid biosynthesis. Few genes of the alkaloid biosynthesis, along with anticancer and plant defence genes, were also discovered. MicroRNAs are known to regulate various primary and secondary plant metabolic processes. Therefore, deep sequencing of small RNAs was carried out to identify known and novel miRNAs regulating saponins biosynthesis in C. borivilianum. Total 442 known miRNAs and 5 novel miRNAs were identified from young leaf small RNA library. Experimental validation with stem loop RT-PCR confirmed the in silico identification. Based on transcriptome data of root and leaf of C. borivilianum, Oryza sativa, and Arabidopsis thaliana target gene prediction was done using psRNAtarget and mirRanda. BLAST2GO helped in localization of predicted targets and KEGG (Kyoto Encyclopedia for Genes and Genomes) pathway analysis concluded that miR9662, miR894, miR172, and miR166 might be involved in regulating saponin biosynthetic pathway. The correlation between miRNA and its target gene was further validated by RT-qPCR analysis. Our studies provided the first elaborated glimpse of mRNA and miRNA pool of *C. borivilianum*, which can help to understand the saponin biosynthesis and to design further metabolic engineering experiment to enhance their contents in the plant.

Session O3- Invited Lectures / Oral presentations *Venue: Meeting room, Ground floor, GEHU*

Coordinator: Dr. Balwant Rawat, Er. Vaishali Chaudhary

12:45 pm-1:45 pm	**Lunch** *Venue: Lounge, Ground floor, GEHU*
2:00 pm-2:30 pm	**Poster Competition II** (for students)Coordinators: Er. Sanjay, Er. Somya Sinha
2:35pm-3:50 pm	**Student Interaction with International Delegates:** Open Forum (Q&A) [Coordinated by: Dean, International Affairs, Graphic Era (Deemed to be University) and Dr. Ashish Thapliyal
4:00 pm-6:30 pm	**Local tour**
7:00 pm-8:00 pm	**Dinner**

Day 3. Saturday- February 16, 2019

9:30 am-10:00 am

Plenary V- Dr. Bhimanagouda Patil Director of the Vegetable and Fruit Improvement Center
Texas A&M University AgriLife, USA

Title: Fruits, vegetables, and medicinal plants for the prevention and treatment of disease: untapped potential and unanswered questions
Venue: Auditorium, Fifth floor, GEHU

10:15 am-10:30 am **Tea Break***Venue: Lounge, Ground floor, GEHU*

10:30 am-12:30 pm

Session 3a –Metabolic engineering strategies for the production of health-related compounds in food and medicinal plants *Venue: Meeting Room, Ground floor, GEHU*

Session Chair: Dr. Fabricio Medina-Bolivar, Professor of Metabolic Engineering, Arkansas State University, USA

Coordinator: Dr. Manoj Pal

Keynote address: Molecular approaches for artemisinin biosynthesis in plant and oral delivery of whole plant material for coherent malaria treatment.Dr. Shashi Kumar,International Centre for Genetic Engineering and Biotechnology (ICGEB), India

Speaker 1. Metabolic engineering of terpenoids in bacteria and plants.Dr.Chhandak Basu.
California State University. USA.

Speaker 2. Dr. Dhiraj Vyas "Regulation of glucosinolates in plant-insect interaction"-, Head, Plant Sciences, CSIR-IIIM, Jammu

Molecular approaches for artemisinin biosynthesis in plant and oral delivery of whole plant material for coherent malaria treatment

Shashi Kumar, International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi-110 067, India. Email: skrhode@icgeb.res.in

Artemisinin, a plant-derived is a highly oxygenated sesquiterpene, proven to be a lifesaver in treating malaria, which impacting nearly half of the global population and kills over 500,000 people per year. Artemisinin clears the blood of malarial parasites quicker than any other drug currently available in the market. However, artemisinin drug is not affordable by the poor due to the high cost of extraction and purification process from the low yielding native plant (*Artemesia annua*). By compartmentalized metabolic engineering approach, we have successfully produced this drug in tobacco plants. The rationalized expression of the biosynthetic pathways in different compartment of plant has enabled us to reach the yield at clinically meaningful levels (Mol. Plant. 2016, 9, 1464-1477). Extracts from transgenic plants inhibited the progression of *Plasmodium falciparum*-infected red blood cells. Oral feeding of whole intact plant cells bioencapsulating the artemisinin reduced the parasitemia levels more effectively in challenged mice compared to the pure form of commercial artemisinin. Further, we are interested to produce this life-saving drug in an edible plant to make it affordable and coherent in treating malaria using bioencapsulated whole edible plant material with defined drug doses

Metabolic engineering of terpenoids in bacteria and plants

Chhandak Basu[1], Dinesh Gupta[2], Tina Ip[1], Destinney Cox-Georgian[1], Christopher Cerda[1], and Michael Summers[1]. [1]Dept. of Biology, California State University, Northridge, CA, USA, [2]Dept. of Biology, Washington University, St. Louis. MO, USA. E-mail: chhandak.basu@csun.edu

Terpenes and terpenoids are widely found in bacteria, plants and fungi. Terpenes are hydrocarbons. When terpenes are oxidized through the process of drying or curing, the resultant compounds are known as terpenoids. Terpenes are one of the important secondary metabolites in plants and have important medicinal properties. They are known for their roles as antibacterial, antiseptic, analgesic, and bronchodilator agents. Terpene synthase is a broad class of enzymes, which use isopentenyl pyrophosphate (IPP) and dimethylallyl pyrophosphate (DMAPP) as the fundamental building blocks to synthesize terpenoids. In our work, we attempted to produce 5C volatile hemiterpene alcohol, 2-Methyl-3-buten-2-ol (MBO) in *Escherichia coli* and *Nostoc punctiforme*. A codon-optimized MBO synthase gene from *Pinus sabiniana* was expressed in *E. coli* to produce MBO. We also used the same MBO synthase gene in photosynthetic microbe *Nostoc punctiforme* and attempted to produce MBO. Although we could not detect MBO in *Nostoc* cells, we were able to detect the production of another diterpene alcohol, phytol. Phytol, an important constituent of chlorophyll, is routinely used to manufacture synthetic forms of vitamin K1 and vitamin E. Gas chromatography was used to confirm the production of MBO and phytol in *E. coli* and *Nostoc* respectively. We also transformed cyanobacteria *Synechocystis sp.*for enhanced production of beta caryophyllene. Beta caryophyllene is used as an analgesic compound. Recently we transformed *Arabidopsis thaliana* plants with a germacrene synthase gene. Geramcrene, a volatile organic hydrocarbon, is a sesquiterpene (C15). It is known for antimicrobial and insecticidal properties. We are in the process of confirming germacrene production in *Arabidopsis plants* by gas chromatography. Our work shows promise of metabolic engineering of photosynthetic and non-photosynthetic microbes and plants for the production of bioactive compounds with important medicinal uses.

Regulation of Glucosinolates in Plant-Insect Interactions

Dhiraj Vyas. Biodiversity and Applied Botany Division, CSIR-Indian Institute of Integrative Medicine, Canal Road, Jammu, J&K, India 180001. E-mail: dvyas@iiim.ac.in

In brassicales, the glucosinolate-myrosinase system plays an important role during the insect interactions. Given the multifunctionality of glutathione and its involvement during glucosinolate biosynthesis, it is hypothesized that the two might exist as part of adaptive regulatory mechanism during biotic interactions. For understanding their dynamic equilibrium, a high altitude plant *Lepidium latifolium* L. growing in Ladakh was selected that was earlier shown to have robust glutathione homeostasis. It was observed that the differential accumulation of glucosinolates corroborated with the GSH/GSSG ratios more than the metabolic content of glutathione alone.*Lepidium latifolium* was grown in Jammu and different insect interaction stages based on oviposition data of *Pieris brassicae* were characterized. Results suggest that the reducing conditions, where the GSH/GSSG ratio was higher, results in the higher accumulation of the indolic/aromatic glucosinolates (IGLS). The expression analysis suggests that these effects are mainly under transcriptional regulation of *MYB51* and *MYB122*. Further, the GSH/GSSG ratios were modulated using different concentrations of GSH, BSO, DTT, H_2O_2, MJ and SA during *in vitro* and *in vivo* experiments. GSH and MJ increased the GSH/GSSG ratio and the IGLS, which in turn increased the herbivory by *Pieris brassicae* larvae in both choice and non-choice bioassays. The larvae did not prefer treatments where the GSH/GSSH ratio decreased. The hypothesis was validated on another plant and insect species. A redox regulated glucosinolate hydrolysing enzyme, myrosinase, was also characterized. In conclusion, a putative role of redox in glucosinolate-myrosinase system was observed that results in differential biotic interactions in subtropical region.

Session 3b –Medicinal Plants and Animal Health

Session Chair: Dr. Govind Kannan, Professor, Fort Valley State University, Georgia, USA

Co-chair: Prof. H. Gopi, Head, Post Graduate Research Institute in Animal Sciences, Kattupakkam, India.

Coordinator: Dr. Navin Kumar

Keynote Address: Tannin-rich Nutraceuticals for Animal Health and Nutrition,Dr. T. Terrill, Fort Valley State University, Fort Valley, Georgia, USA

Speaker 1: Brown Seaweed Extract Supplementation in GoatsDr. G. Kannan, Fort Valley State University, Fort Valley, Georgia, USA

Speaker 2: Ethanoveterinary practices in Animal Health careDr. H. Gopi, Professor and Head, Post Graduate Research Institute in Animal Sciences, Kattupakkam - 603 203.

Speaker 3: Medicinal plants use and animalsDr. George McCommon, Fort Valley State University, Fort Valley, Georgia, USA

Tannin-rich nutraceuticals for animal health and nutrition

Thomas H. Terrill, Fort Valley State University, Fort Valley, GA 31030. Email: terrillt@fvsu.edu

Nutraceutical plants are noted for both their nutritional and pharmaceutical (health-promoting) properties in animals. Tannin-containing nutraceuticals represent a largely untapped low-input (lower cost) resource for natural control of internal parasites and pests, reduced incidence of bloat, and lowered ruminal production of methane in both small and large ruminants. While condensed tannins (CT) and other compounds in a number of different temperate/subtropical/tropical plants have shown high bioactivity, particularly against different life stages (eggs, larvae, adults) of gastrointestinal nematodes and other internal parasites, including *Eimeria* spp. (coccidia), there are a number of different factors that influence the bioactivity of these compounds, as well as the nutritive value of these forage/browse plant resources. These include CT concentration, chemical structure, size (molecular weight) and solubility (bound or unbound) in different plant species, how the plant is utilized in forage-livestock systems (grazed/browsed directly, sun-dried as hay, processed as leaf meal or pellets, preserved as silage), the target parasite species or life stage, and the host species. Agronomic and nutritional properties of CT-containing plants also interact with these factors to influence bioactivity of CT and the use of these plant resources in forage-livestock systems. Activities of CT in ruminant systems have been identified prior to ingestion, within the rumen, during passage through the intestines, as well as in fecal material. The growing body of evidence from *in vitro* and *in vivo* studies indicates that CT in temperate/subtropical/tropical forage/browse plants, or CT extracted from these plant resources have excellent potential for use as nutraceuticals for sustainable nutrition and health management with both domesticated and wild ruminant species.

Brown seaweed extract supplementation in goats

Govind Kannan, Thomas H. Terrill, Brou Kouakou, and Jung H. Lee, Agricultural Research Station, Fort Valley State University, Fort Valley, GA 31088, USA. E-mail: govindak@fvsu.edu

In ruminant animals, brown seaweed (*Ascophyllum nodosum*) extract supplement has been reported to positively affect antioxidant activity, Vitamin E status, immune cell response, shelf stability of meat, and carcass characteristics. Preharvest diet containing brown seaweed extract has also been reported to reduce fecal shedding of Escherichia coli and other enteric bacteria in livestock. The effects of brown seaweed extract supplementation on antioxidant status, immune function, oxidative stability of meat, E. coli shedding in goats will be reviewed in this presentation. Goats are transported long distances to abattoirs that accommodate goat processing in the US. Studies conducted on the performance of goats during stressful situations show that seaweed extract does not differentially influence physiological stress responses. However, antioxidant activities increase with a simultaneous decrease in oxidative stress-induced lipid damage after the beginning of stressful situations, such as transportation, as shown by elevated glutathione peroxidase activity and decreased lipid peroxidation, respectively. Brown seaweed supplementation does not affect live weight shrinkage due to transportation stress in goats but increases color stability of meat by minimizing metmyoglobin formation, particularly during the first 24 h postmortem. Small ruminants shed E. coli into the environment through feces without showing any clinical signs. Although dietary seaweed extract does not seem to influence skin or dressed carcass bacterial loads in goats, it significantly lowers rumen E. coli counts without affecting rumen pH or volatile fatty acid concentrations. The effects of brown seaweed on rumen pH and volatile fatty acids have not been consistent across studies in goats and need further investigation. Brown seaweed supplementation may help goats combat the negative effects of stressors through increased antioxidant activity, better disease resistance, and increased color stability and prolonged shelf life of meat, in addition to reduced fecal shedding of bacteria.

Ethanoveterinary practices in animal health care

H Gopi. Post Graduate Research Institute in Animal Sciences, Tamilnadu Veterinary and Animal Sciences University, Kattupakkam - 603 203. India. E-mail: drhgopi@gmail.com

Ethnoveterinary practices in animal healthcare is an age- old practices in various livestock species. Livestock owners in India have been using this traditional medication based on plant formulations since time immemorial. All parts of plants, including leaves, bark, fruits, flowers and seeds are used in medicinal preparations. At least 1,00,000 species of plants are used as food, medicine, fibre, fuel, oils, shelter, ornamentals and other purposes. At present 35,000 plants are known to have healing properties. Phenolics, terpenoids, sulphur and nitrogen compounds are the four main active principles used in Ethnoveterinary practices. Ethnoveterinary practices are used in conditions such as poisonous bite, agalactia, downer cow, Foot and Mouth disease, anorexia and worminal infestations, dystocia, infertility, upper respiratory tract infections, ephemeral fever and habitual abortions due to their various pharmacological properties like antibacterial, antifungal, anthelmintic, immunostimulant, wound healing, anti-inflammatory, analgesic etc. A total of 16 recipes have been documented. It is economical and easily available to farmers. For example, *Andrographis paniculata* is used to treat Poisonous bite. The leaves should be ground and made into a paste and administered orally once a day for 7-15 days. Complete recovery from the effects of poisonous bite will be noticed within 15- 20 days. *Azadirachta indica, Solanum trilobatum, Adathoda vasica, Acalypha indica, Achyranthes aspera* are some of the herbs used effectively in ethnoveterinary medicines. Thirty species of herbs are being maintained in PGRIAS as a model unit for preparing ethnoveterinary medicines. Key challenges are to find out the effectiveness and contemporary relevance of these practices. Further research has to be made to explore its pharmacological potentials of these herbs to make the ethnoveterinary as an effective practice.

Use of medicianl plants in animals

George W. McCommon, DVM Department of Veterinary Science and Public Health Fort Valley State University, Fort Valley, GA, 30130, USA. Email: mccommog@fvsu.edu

In the USA, approximately 30 % of pet owners have used or considered the use of medicinal plants and approximately 90 % of veterinarians prescribe and/or dispense some form of botanical product. While the use of plant based products has been part of human and animal culture for thousands of years, the current acceptance by the public has risen greatly in the past 20 years. Whether it be a natural sedative for horses or a novel approach to neoplasia in companion animals. The need to understand the interactions between modern medicine and plant based medicines for their potential for reactions is critical and the knowledge that in sports where drug testing is common to understand that some medicinal plants will render a positive drug result. A working knowledge of medicinal plants is critical in providing appropriate and efficient care to animals.

Session 3c –Herbal Sector in the Himalayan Region: Policy Issues on Trade, Sustainable Use and Access & Benefit Sharing Mechanisms *Venue: Auditorium, Fifth floor, GEHU*

Session Chair – Dr Gopal Rawat, Dean, Wildlife Institute of India, India

Coordinator: Dr. Kumud Pant

Keynote Address: Conservation and management of high value MAPs in the Himalayan region - An overview- Dr. Gopal Rawat

Speaker 1: Dr. G. S. Goraya, former PCCF & Head of Forest Force (HP), India

Speaker 2: Mr. S. S. Rasaily, Secretary Uttarakhand BD Board, India

Speaker 3: Dr. C. S. Sanwal, Director Herbal Research and Development Institute, India

Speaker 4: Sustaining demand for Himalayan Medicinal Herbs: Role of conservation assessment and management prioritization -Dr. Vaneet Jishtu, Scientist HFRI, India

Panel Discussion

12:30 pm- 1:30 pm **Lunch break** *Venue: Lounge, Ground floor, GEHU*

1:30 pm-3:30 pm

Session 4a- Medicinal and Aromatic Plants-Industry perspective *Venue: Auditorium, Fifth floor, GEHU*

Session chair- Dr. R K Gupta Senior GM, New Product development – Patanjali, Haridwar, India

Coordinator: Dr. K.K. Joshi

Keynote Address- Clinically proven reversal of premature hair graying through herbal ingredients- Dr. R K Gupta

Speaker 1: Dr. Aditya Arya - Director, Aryavastubhandar and NIDCO, Dehradun, India

Speaker 2: Dr. A K Singh - MBBS, MD - Max Hospital , Dehradun, India

Speaker 3: Dr. K K Pandey, Directorate of Higher Education, Uttarakhand, India

Speaker 4: Preventing heart disease-myths and realities"- Dr. Chetan Sharma, DM Cardiology, Chairman Velmed Hospitals, Dehradun, India

Speaker 5: Medicinal Plants Conservation and Industry-Dr. Pankaj Kumar, New Products Division, Dabur Research Foundation, Sahibabad, India

Session 4b- Functional Foods*Venue: Seminar Hall, Ground floor, GEHU*

Session Chairs:

Dr. R. N. Chibber, University of Saskatchewan, Canada

Dr. Kalidas Shetty, North Dakota State University, USA

Coordinator: Er. Sanjay Kumar.

Keynote Address: Microbiome and metabolic innovations for medicinally active functional foods using food diversity. Dr. Kalidas Shetty, North Dakota State University, USA

Speaker 1: Functional role of feruloyated arabinoxylan-oligosaccharides generated from rice bran. Dr. Sun-Ok Lee, University of Arkansas, USA

Speaker 2. Antimicrobial activity and phytochemical analyses of *Syzygium polyanthum* (Wight) Walp. Leaf.Dr. Yaya Rukayadi, University Putra Malaysia, Malaysia

Speaker 3. Personalized diet in post industrial revolution era. Dr. Dae-Young Kwon, Korea Food Research Institute, Korea

Speaker 4: Diversity of genus *Curcuma* l. (Zingiberaceae) in southern India, a promising source of edible starch. Dr. Dan Mathew, Jawaharlal Nehru Tropical Botanic Garden & Research Institute, Kerala, India

Microbiome and metabolic innovations for medicinally active functional foods using food diversity

Kalidas Shetty and Dipayan Sarkar, GIFSIA (Global Institute of Food Security & International Agriculture), Department of Plant Science, North Dakota State University, Fargo, ND 58108 USA; E-mail: kalidas.shetty@ndsu.edu

Global food security challenges are burdened with continuing challenge of inadequate macro and micronutrients from the burden of hunger with major impacts on children and maternal health in communities with extreme poverty. A further layer of food security challenges with public health consequences is the rapidly growing burden of excess calories from hyper processed and low micronutrient based diets. This challenge of higher intake of hyper processed high soluble carbohydrate rich foods is leading to increase in non-communicable chronic disease (NCD) such as type 2 diabetes and its complications and is further burdened with global increase in obesity. These challenges are complicated by lack of food diversity leading to lower intake of whole grains, legumes, fruits and vegetables with reduced fiber to support beneficial microbiome and also medicinally active phytochemicals that can better modulate the key redox protective digestive and vascular pathways away from cellular breakdown towards NCD. To address these twin challenges of global food security burdens with public health implications we must support a scientific paradigm that advances local food diversity that is linked to adaptation in local ecological diversity, which is resilient to climate change. In particular such food diversity built on local food systems that are more resilient to climate change has the potential to provide nutritional and health solutions to hunger, malnutrition and NCD challenges. To sustain these advances built on local food diversity, innovations have to couple metabolic biotransformation of food systems for increased medicinally active metabolites to address these challenges along with microbiome rich foods that synergize health targeted benefits. My presentation will focus building metabolically robust and microbiome supporting functional foods for community food security and health challenges.

Functional role of feruloyated arabinoxylan-oligosaccharides generated from rice bran

Sun-Ok Lee[1], Tung Pham[1], Brett J Savary[2] and Ming-Hsuan Chen[3]. [1]University of Arkansas, Fayetteville, AR 72704, [2]Arkansas Biosciences Institute, Jonesboro, AR 72401 and [3]USDA Agricultural Research Service, Dale Bumpers National Rice Research Center, Stuttgart, AR. E-mail: sunok@uark.edu

Rice bran is a rich source of functional biopolymers that have potentials to promote gastrointestinal health. Functional biopolymers, arabinoxylan (AX) and feruloylated arabinoxylan oligosaccharides (FAXOs), have been implicated for having prebiotic-like activities because of their ability to pass through the upper gastrointestinal tract undigested to the colon where they are hydrolyzed and sequentially fermented by gut microbiota to produce short-chain fatty acids (SCFAs), which play important roles in regards of colon health. However, there is limited information available on colon health promoting activities of biopolymers from rice bran. In order to understand the prebiotic-like properties of functional biopolymers in rice bran, we investigated the fermentation patterns of FAXOs and their impacts on the composition of human gut microbiota. Fresh fecal samples collected from healthy adults (n=10) were diluted with anaerobic medium. SCFA concentrations were measured quantitatively using gas chromatography. Microbial populations were analyzed via Illumina MiSeq platform and QIIME (Quantitative Insights Into Microbial Ecology). Results showed that SCFA productions were significantly increased with FAXOs and were comparable to fructooligosaccharides, well-established prebiotic. Changes in microbiota population indicate that FAXOs may modulate microbiota profiles. Results from this study suggested that FAXOs from rice bran can potentially promote colon health through a prebiotic function.

Antimicrobial activity and phytochemical analyses of *Syzygium polyanthum* (Wight) Walp. leaf

Yaya Rukayadi[1,2], Suzita Binti Ramli[1] and Abdelgani Mohamed Abobaker[2]. [1]Faculty of Food Science and Technology and [2]Institute of Bioscience, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia. Email:yaya_rukayadi@upm.edu.my

Food products can be subjected to contaminate by bacteria and fungi. The growth of these microorganisms in food products can cause foodborne illness. To overcome this problem, the prevention should be done at the early stage of food processing such as sanitizing. Commonly, chemicals sanitizer had been apply in food industry. However, application of these chemicals for long term was affected human health. Therefore, developments of natural sanitizers derived from plant sources are gaining more attention nowadays. In this study, the antimicrobial activity of *salam* [*Syzygium polyanthum* (Wight) Walp.] leavesextract was evaluated against 21 types of pathogenic microorganisms.The susceptibility test showed that all tested pathogenic bacteria were inhibited by *S. polyanthum* extract, with the range of inhibition zone between 8.00 to 14.00 mm. The growth of all tested microorganisms can be inhibited with minimum inhibitory concentration ranged 0.63 mg/ml to 1.25 mg/mL.Cell constituents release analysis, crystal violet assay and observation by using scanning electron microscope showed altering in cell wall linearity, cells ruptured and leakaged of the cytoplasm. Generally, the antimicrobial activities of *S. polyanthum* extract were not affected by different pH and temperatures. GC-MS analysis identified the presence of active compounds which responsible to contribute antimicrobial properties in *S. polyanthum* extract included pyrogallol, phytol, hexadecanoic acid, α-Tocopherol and β-Sitosterol while gallic acid, bergenin, quercetin 3-(6''-galloylgalactoside), madecassic acid, quillaic acid and asiatic acid were detected by using LC-MS. Generally the significant reduction of natural microflora in tested food samples were started at 0.50% (v/v) of extract at 5 min. During storage, 5% (v/v) showed better effect in controlling the microbial survival throughout the storage time. In conclusion, *S. polyanthum* extract exhibited antimicrobial activity, thus it can be developed as natural sanitizer for washing raw food materials and prevent the food spoilage during storage.

Personalized diet in post industrial revolution era

Dae Young Kwon, Korea Food Research Institute, 55365, Republic of Korea. E-mail: dykwon@kfri.re.kr

The characteristics of the future society are the entry into the era of social-life economy in the age of super aging society and AI (artificial intelligence) out of the industrial economy. It is predicted that the economy of life centered on the happiness of human beings will come out of the framework of industrial economy which emphasizes efficiency. AI, the main technology of 4th industrial revolution technology, has become personalized and decentralized to be serviced with deep learning technology using big data rather than centralized mass production or automation. It is not only productivity but also the ability to create individual unique 'life' and 'lifestyle'. If we know precisely the noneun style (noneun is Korean like as leasure style) and the diet style, it can be accurately provided personalized food and personalized lifestyle. Particularly, providing healthy eating habits as a personalized diet and lifestyle is important in the age of future super-aged society. Personalized nutrition will be based on the structured data of human genome for each person, however, personalized diet will be based on unstructured data of life style in addition to human genome data. For example, unstructured data of life style will be created by epigenomes and microbiomes which are affected by diets and habits. These structured and unstructured data are very important for personalized diet as a big data. Without creation of big data, the 4th industrial revolution and development of AI cannot be expected or cannot be progressed. In personalized diet fields, how can we create the big data? The big data can be created from human, nature, culture and history and tradition from each individual food and traditional foods by modern biotechnology as we called foodomics and life style sciences. Foodomics are expressed by DNA sequencing technology including whole genome sequence, nutrigenetics, nutrigenomics, proteomics and metabolomics, nutriepigentics and nutriepigenomes, and microbiomes. These foodomics works could be conducted for each foods and food materials for individual persons. The science of life style such as diet style and noneun style are sensomics for tastes, culturomics for culture and history, and sikdanomics for dietary service system. We adopted these technology and sciences for future personalized foods. In super aged era, living long without diseases is more important, dietary style and noneun style are critical for healthy longevity. With the development modern biotechnology and AI, personalized diet can be served based on individual genomes, dietary style and noneun style for centenarian life.

Diversity of Genus *Curcuma* L. (ZINGIBERACEAE) in Southern India, A promising source of edible starch.

Anu S., Mathew Dan, Plant Genetic Resource Division, Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Palode, Thiruvananthapuram, Kerala – 695 562, India.

The genus *Curcuma* L. belongs to the family Zingiberaceae comprises over 1200 species of rhizomatous herbs. The genus has over 120 species chiefly distributed in South East Asia. In India it is represented by around 29 species and in South India 20 species. *Curcuma* possesses a significant position among the under- exploited tuber crops in different parts of the country. The rhizomes of several *Curcuma* species are being exploited by tribals or natives, as source of edible starch. Starch is a valued component of many foods and has an important role both as a macronutrient and structural component. The starch isolated from *Curcuma* species was used for fever and other ailments due to easy digestion and instant release of energy, indicates its medicinal and nutritional significance. Crude starch powder was isolated from mature rhizomes through grinding, repeated washing, straining and drying. Various physico-chemical characters determined the edible value of *Curcuma* starch was found comparable to the starch powder isolated from *Maranta arundinacea* L., the popular Arrowroot. Five traditional food products of Kerala such as 'Kurukku', 'Ada', 'Halwa', 'Roasted stick' and 'Sarbat', were prepared using starch powder isolated from *Curcuma* species. The species studied were *C. aeruginosa* Roxb.,*C. amada* Roxb., *C. aromatic* Salisb., *C. haritha* Mangaly & M. Sabu, and *C. zanthorrhiza* Roxb. The prepared products were validated by expert panel by measuring different parameters such as appearance, colour, smell, taste etc. There is an excellent scope in exploiting *Curcuma* species for its edible starch as functional food for the nutritional wellbeing.

Session 4c- Conservation of medicinal plants *Venue: Meeting Hall, Ground floor, GEHU*

Session Chairs: Dr. Manu Pant, Graphic Era Deemed to be University, Dehradun, India and Dr. R. Chandrasekaran, Vellore Institute of Technology, Vellore, India

Coordinator: Dr. Priyank Vyas

Keynote Address: Plant Tissue culture a potent tool for conservation of Medicinal and Aromatic plants and elicitation of secondary metabolite- Dr. Rajasekaran Chandrasekaran, Vellore Institute of Technology, Vellore, India

Speaker 1: *In vitro* propagation of *Swertia chirata* Buch.-Ham. ex Wall.- an endangered medicinal plant- through different regeneration pathways- Dr. Manu Pant, Graphic Era Deemed to be University, Dehradun, India

Speaker 2: *In vitro* propagation of *Hedychium spicatum* Buch.-Ham ex Smith - a vulnerable medicinal and aromatic plant. Dr. R. Gowthami, ICAR-NBPGR, New Delhi, India

Speaker 3: *In vitro* mass propagation and identification of high proliferating superior *Azadirachta indica* genotypes**.** Dr. Sonalika Roy,Forest Research Institute, Dehradun, India

Speaker 4: Comparative studies of different methods of vegetative propagation of *Paris polyphylla* Smith towards effective conservation. Dr. Arcadius Puwein,Department of Biotechnology, Assam Don Bosco University, Guwahati, India

Speaker 5: Establishment of in vitro cultures of valuable medicinal plant *Valleriana jatamansi* Jones and modification strategies for conservation and production of bioactive metabolites - Sushma Pandey, Central University of Botany, Tribhuvan University, Kathmandu, Nepal

Plant Tissue culture a potent tool for conservation of Medicinal and Aromatic plants and elicitation of secondary metabolite

Rajasekaran Chandrasekaran, Maria Doss A, Nidhi Sabade, Radha Navapara, Richha Doshi and Kalaivani Thiagarajan, Dept. of Biotechnology, School of Bio Sciences and Technology, Vellore Institute of Technology, Vellore – 632014. E-mail: drcrs70@gmail.com

India is one among the eight mega biodiversity countries in the world, has forest cover and possesses 4 out of 35 hot spots in the world. Because, India is endowed with tremendous diverse group of biological resources, it is known as treasure house for medicinal and aromatic plants (MAPs). These resources have several roles such as improvement of health, generation of economy, maintenance of cultural integrity and ultimately the well-being of people, particularly the rural and poor. Plants are the sources of medicine till date, and 40% of modern medicine is also plant based only. As per IUCN, past three decades, most of the medicinal plants are listed under threatened and endangered category because of inclination on usage of herbal medicine is increasing every year. This is the basic reason to put tremendous pressure on the natural habitat. Conventional conservation approaches are not up to the level to conserve our plant resources. The plant growth promoting bacteria (PGPB) and plant growth promoting endophytes (PGPE) associated with plants have been playing an important role in growth and development besides regulating secondary metabolic path ways. Understanding biotic and abiotic stress on growth and biomass accumulation and screening of such plant growth promoting bacteria will be a better option to use as elicitors and setting of bioreactors to scale up biologically active compounds to meet our commercial requirements and conserved the medicinal plants on its natural habitat.

In vitro propagation of _Swertia chirata_ Buch.-Ham. ex Wall.- an endangered medicinal plant-through different regeneration pathways

Manu Pant[1], Prabha Bisht[2] and Manju P. Gusain[3]. [1]Department of Life Sciences, Graphic Era (Deemed to be University), Dehradun, Uttarakhand, India, [2]Tissue Culture Laboratory, Genetics and Tree Propagation Division, Forest Research Institute, Dehradun, Uttarakhand, India and [3]Department of Zoology and Biotechnology, HNB Garhwal University, Srinagar Garhwal, Uttarakhand, India 72401. E-mail: himaniab@gmail.com

Swertia chirata is a medicinal herb native to the temperate Himalaya. Prized for its bitter bioactive compounds, chirata has an increasing pharmaceutical demand in the indigenous and world market. However, extensive collection and unscientific harvesting practices, aided by problems in natural regeneration, have led to a decline in natural populations. *S.chirata* is now categorized as critically endangered by the new IUCN criteria. Consequently, there is a need to develop alternative mass propagation techniques for the species. An efficient procedure for *in vitro*propagation of *Swertia chirata* through direct and indirect organigenesis was developed. Axillary shoot bud induction and multiplication from nodal explants was achieved. A combination of BAP, IAA and Ads proved to most optimal giving 11.8 fold multiplication (average shoot length 1.9cm) after 4 wks. Best rooting (92 %) with maximum mean number of roots per shoot 35.3 (mean root length 2.8 cm) after 4 wks was observed on half-strength MS medium supplemented with IBA. Root explants from axenic shoot cultures were further used for shoot induction. Optimal shoot regeneration without any callus intervention was observed on half-strength MS containing BAP and NAA. Maximum shoot multiplication was achieved on MS medium fortified with BAP, IAA and adenine sulphate (Ads). Individual elongated shoots regenerated through both the pathways gave the best results of rooting on half-strength MS medium supplemented with IBA. Plants with well-developed shoots and roots were successfully hardened, acclimatized and transferred to field conditions where they exhibited with over 80% survival.

In vitro mass propagation and identification of high proliferating superior _Azadirachta indica_ genotypes

Sonalika Roy, Ajay Thakur, Ashok Kumar, Shambhavi Yadav. Genetics and Tree Improvement Division, Forest Research Institute, Dehra Dun, Uttarakhand, India.Email: rsonalika1@gmail.com

Azadirachta indica A. Juss., commonly known as neem, is native to the Indian-subcontinent. It is described in Ayurveda'sancient document *Charak-Samhita*as *sarva roganivarini* (that which keeps all diseases at bay). Most of its plant parts, contain compounds with medicinal value and have been used in Ayurveda for thousands of years. Therefore, mass multiplication of neem is necessary for its continuous availability and this can be achieved through plant tissue culture technique. *In vitro* clonal propagation of neem tree has been achieved though reports for shoot multiplication and rooting vary hugely. It implies that there exists variation with respect to *in vitro* response of different genotypes. In the present study, *in vitro* propagation of a number of *A. indica* genotypes, was done through axillary shoot proliferation where nodal explants were cultured in MS medium supplemented with 0.1 mg/l 6-BAP and FRIH12 genotype gave 100% sprout percent. The genotypes were further multiplied in MS medium supplemented with varying concentrations of 6-BAP. For most genotypes, 0.2 mg/l 6-BAP concentration was found to be suitable for shoot multiplication whereas higher concentrations resulted in callus formation. However, the results observed were genotype specific. AFRIC5 genotype exihibited maximum growth response in 0.4 mg/l 6-BAP. Genotype FRIH5 showed elongated shoots with large leaves whereas short shoots with small sized leaves was observed in genotype FRIH6. Genotypes FRIH12, FRIH22, and T1 revealed maximum shoot multiplication. Neem, when cultured in liquid MS medium, in the same hormone concentration, resulted in rapid multiplication in the initial days but soon succumbed to hyperhydricity within 15 days. The superior genotypes rooted well in ½ MS supplemented with higher concentrations of IBA *i.e.* (0.8, 1, 1.2) mg/l. Thus, mass multiplication and identification of superior *A. indica* genotypes with desirable features, can be achieved.

In vitro propagation of _Hedychium spicatum_ Buch.-Ham ex Smith - a vulnerable medicinal and aromatic plant.

Gowthami, R, Neelam Sharma and Ruchira Pandey. Tissue Culture and Cryopreservation Unit, ICAR-National Bureau of Plant Genetic Resources- New Delhi-110 012. E-mail: Gowthami.R@icar.gov.in

Hedychium spicatum (Ham-ex-Smith) (Zingiberaceae), commonly known as kapoorkachri, vanhaldi, palashi or ginger lilly is a high value medicinal and aromatic perennial rhizomatous herb. It is distributed in the Himalayan region of India and Nepal at altitude of 1800–2800m. Rhizome have been widely used in traditional medicines for treatment of skin diseases, liver complaints, asthma, bronchitis, pains, vomiting, and as analgesic, antiinflammatory, blood purifier, antiemetic, laxative, stomachic, carminative, stimulant, tonic to the brain and also used in food, cosmetic industry for fragrance. The rhizome contains essential oils, limonene, linalool, camphor, sesquiterpenes, sesquiterpene alcohols and cinnamaldehyde. The overexploitation of species for essential oil and herbal medicines has put the species as vulnerable plant and also listed in near threatened category of the essential oil bearing plants. In general, the plant is propagated by rootstocks and the conventional vegetative propagation via rhizomes is very slow. Thus, the species needs immediate attention with regard to rapid propagation using in vitro techniques. Keeping aforementioned in view, the present investigation directed to optimize in vitro clonal propagation protocol, an essential prerequisite for implementation of any in vitro conservation programme. The first step involves establishment of aseptic cultures. Sterilization protocol was successfully standardized to establish aseptic shoot cultures using rhizome buds explants. Experiments were conducted to induce multiple shoots on MS medium supplemented with different concentrations of cytokinins, BAP and Kn (0 - 10.0 mg/l). Multiple shoots were obtained on MS + BAP (5.0 mg/l) in more than 40% cultures. Experiments are underway to standardize complete and repeatable protocol in vitro propagation with an objective of conservation in the in vitro genebank of ICAR- National Bureau of Plant Genetic Resources- New Delhi. The present paper will highlight the experimental approach adopted and success achieved towards conservation of the important vulnerable medicinal plant.

Comparative studies of different methods of vegetative propagation of _Paris polyphylla_ Smith towards effective conservation.

Arcadius Puwein[1], Shiny C. Thomas[2]. [1]Department of Biotechnology, Assam Don Bosco University, Guwahati, India. [2]Department of Biochemistry, Assam Don Bosco University, Guwahati, India.Email - arcadiuspuwein@yahoo.co.in

Paris polyphylla is a member of the family of *Melanthiaceae* (earlier *Trilliaceae* or *Liliaceae*). It is an herbaceous and erect plant which is mostly found in South East Asia andwas documented for the first time in 1985 in the Chinese pharmacopeia. This traditional medicinal herb known as love apple in English has many medicinal properties like anticancer, antimicrobial, anti-tumor, cytotoxicity etc. Recently, its rhizomes have been unsustainably harvested from the wild to extract many bioactive chemical compounds such as alkaloids, flavonoids, saponins, terpenoids, sterols, quinones, phenols, and tannins. This has pushed the herb on the edge of vulnerability. Therefore, innovative and efficient propagation both *in vivo* and *in vitro* is urgent for better conservation. Albeit, some efforts have been carried out, this paper illustrates new method of conservation through vegetative propagation via potted plants using various plant growth regulators (PGRs) such as indole-3-butyric acid (IBA), naphthalene acetic acid (NAA), 6-benzylaminopurine (BAP), combination of BAP and NAA at different concentrations (0, 50, 100, 150 mg/l), and propagation *in-situ* and *ex-situ* method using various soil compositions. Combination of 100 mg/l BAP and 100mg/l NAA showed the highest percentage of sprouting (93.33%) and flowering (53.33%). The *ex-situ* cultivation with soil combination of humus and sand in the ratio 3:1 produces the maximum sprouting, flowering, and length of the plant.

Establishment of *in vitro culture* of valuable medicinal plant *Vallerenia jatamansii* Jones and modification strategies for conservation and production of bioactive metabolites

Sushma Pandey[1] and Bijaya Pant[1]. [1]Central Department of Botany, Tribhuvan University, Kathmandu, E-mail: sushmapandey349@gmail.com

Valeriana jatamansi Jones is a perennial herb, belonging to the family Caprifoliaceae. The pharamaceutical significance of this plant is mainly because of the rhizomes and roots. The species has become threatened in its natural habitats due to exploitation of its rhizomes for drug preparation in herbal and pharmaceutical industries. Rhizomes are used as a substitute of valerian, an essential oil which is in great demand. *In vitro* plant cell and tissue culture would not only surmount the limitations of vegetative propagation but also can hasten the production of clonal material for field planting and production of unlimited amount of secondary metabolites. A reproducible protocol was established using different explants, inoculated in Murashige and Skoog media supplemented with different combination of plant growth growth hormones to obtain callus and whole plant. Phytochemical analysis is carried out for total phenolics, flavanoids, alkaloids, antioxidants using standards qualitatively and quantitatively. Different modification strategies using hairy root cultures, fungal endophytic elicitors applied in the *in vitro* cultures studying the growth pattern enhancing the production of bioactive metabolites and thus comparing both wild and *in vitro* plant.

3:30 pm-3:45 pm **Tea Break** *Venue: Lounge, Ground floor, GEHU*

3:45 pm-6:30 pm

Session 5a - Farmers' Forum *Venue: Seminar hall, Ground floor, GEHU*

Session Chairs: Dr. Mentreddy S Rao, Alabama A & M University, USA, Dr. I. D. Bhatt, GBPNIHESD, India,Dr. Nirpendra Chauhan, Centre for Aromatic Plants (CAP), Government of Uttarakhand, India

Part I: Production: Challenges and Opportunities:

Coordinator: Dr. Deepak Kholiya, Dr. Ivan Wilson

Keynote Address: Indian Perspective on production Challenges and opportunities- Dr. Nirpendra Chauhan

Keynote Address: US perspective on Production Challenges and Opportunities- Dr. S. Rao Mentreddy

Invited Speaker: Prof. (Dr.) Durgesh Pant, USERC, Dehradun, India

Farmer Speaker 1:

Cultivation, distillation and marketing of Lemongrass in Uttarakhand- Mr. Rao Farooq Khan, Progressive Aromatic Farmer, Uttarakhand

Farmer Speaker 2:

Cultivation, distillation and marketing of Damask Rose in Uttarakhand- Mr. Umrao Singh, Progressive Aromatic Farmer, Uttarakhand

Farmer Speaker 3:

Cultivation and processing of Cinnamon (Cinnamomum tamala)-Mr. Madhav Singh, Progressive Aromatic Farmer, Uttarakhand

Part II: Markets and Marketing

Keynote Address: Indian perspective on Markets and marketing of MAPs- Dr. I. D. Bhatt

Brief Overview of Markets and Marketing in the USA - Dr. S. Rao Mentreddy

Speaker 1 (From Industry):

Marketing of essential oils - Mr. Piyush Gupta, Industrialist, M/s Kanha Natural Oils, Delhi

Speaker 2:

Enterprise development through production and marketing of aromatic produce - Mr. Vikas Sharma, Progressive Aromatic Farmer-Entrepreneur

Speaker 3: Prospects and challenges of Medicinal plant cultivation and trade in Uttarakhand. Mr. J. S. Butola, Trader

6:30 pm-6:45 pmPanel Discussion

6:45 pm-7:15 pm Valedictory: **Dr. Jeffrey Adelberg (ACMAP)** and **Prof.Ashish Thapliyal** (Graphic Era Deemed to be University)

Venue: Auditorium, Fifth floor, GEHU

7:15pm - 8:15 pm ACMAP Board Meeting and Networking session for delegates *Venue: Seminar Hall, Ground floor, GEHU*

8:15 pm-9:30 pm **Dinner: Banquet speaker Dr. Kalidas Shetty**. Human resilience and relevance of medicinally active plants in living a resilient life

Day 4. Departure and Post- Conference Tours Sunday – Feb 17, 2019

10:00 am Post Conference tours

ABSTRACTS (Oral and Posters)
Alphabetically Arranged

Marine Compounds as a Nutraceutical agents with higher efficacy (Poster)

Afroz Jahan[1],Prof. (Dr.) Iffat Zareen Ahmad [2, 1]School Of Pharmaceutical Sciences, Integral University,Lucknow, India.[2]Department of Bioengineering, Integral University, Lucknow, India.email : jahanafroz22@yahoo.com.

Marine based ingredients have been a source of attraction for cosmetic companies. The marine environment is a rich source of biological and chemical diversity. This diversity is the source of novel chemical compounds with the potential for industrial applications as cosmetics, pharmaceuticals, molecular investigations, dietary supplements, fine chemicals and agrochemical. The multi-billion dollar global skin care and cosmetic business is already seriously looking at micro alga UV-screening compounds as its wave of the future. Nanoemulsion formulation offers several advantages such as delivery of drugs, biological or diagnostic agents.nano-mulsion.UV-B is mostly studied radiation for UV-protectants as UV-A is not harmful and UV does not reach the earth's surface and cyanobacteria are never exposed to UV-C radiations. This is the reason that the study on scytonemin is conducted in the presence of UV-B radiation. During the course of evolution the absence of ozone layer resulted in the penetration of UV B in the atmosphere and because of this evolutionary pressure cyanobacteria developed UV protecting mechanisms. Cyanobacteria produce an array of bioactive compounds, which are well known UV protectants, and the application of these compounds to produce new cosmetic ingredients is the need of the hour and much progress has already been made in this direction. They have shown antioxidant, anticancer and anti-skin aging effects.Nanodermatology, an emerging field, employs nanomaterial's fordiagnostic, therapeutic, and cosmetic applications in dermatology.

Medicinal and aromatic plants (MAPs) of Kashmir Himalaya. (Oral)

Aijaz Hassan Ganie[1]and Bilal A Tali[2].[1]Department of Botany, University of Kashmir, Kargil Campus, 194105, J & K, India, [2]SAM Degree College Budgam, J&K- 191111, India. Email: aijazku@gmail.com

Humans have used plants to alleviate suffering and disease since times immemorial. The extensive field surveys and exhaustive perusal of the relevant literature revealed that 833 plant species are being used as medicine in Kashmir Himalaya. Of these 89.91% are dicotyledons, 7.92% are monocotyledons, and gymnosperms and pteriodophytes include 1.20% and 0.96% species, respectively. Of these 85.14% are herbs, 7.06% are shrubs, 3.71% are subshrubs and 3.60% are trees. Most of these species inhabit terrestrial habitats; however, some are aquatic and parasitic herbs. The present study revealed that either whole plant or different plant parts are used to treat different ailments and in majority of the species (253 spp.) are used as whole herb. These MAPs are used to treat more than 50 types of diseases of human beings and livestock. It is also observed that some of the medicinal plants are used to treat more than one diseases; likewise more than one medicinal plant is used to treat a particular disease. The present study revealed that these MAPs are distributed in temperate (plains), sub-alpine and alpine regions with an altitudinal gradient of 1580 – 4100m above sea level. A large number of these MAPs have been rendered threatened due to various anthropogenic threats operative in the region.

Vegetables-a potent source of the bioactives (Oral)

Amit Dixit, Pravin Kumar Sharma, Pappu Lal Bairwa and Subhradeep Pramanik Department of Vegetable Science, Indira Gandhi KrishiVishwavidayalya, Raipur (C.G.) Email:amitdixit1872@yahoo.com

Bioactive compounds" are extranutritional constituents that typically occur in small quantities in foods. Vegetable and the bioactives in them are being intensively studied to evaluate their effects on health. The impetus sparking this scientific inquiry was the result of many epidemiologic studies that have shown protective effects of plant-based diets on cardiovascular disease and cancer. Many bioactive compounds have been discovered. These compounds vary widely. Phenolic compounds, including their subcategory, flavonoids, are present in all plants and have been studied extensively in cereals, legumes, nuts, olive oil, vegetables, fruits, tea, and red wine. Cardiovascular disease and cancer are ranked as the first and second leading causes of death in the industrialized and developing countries. Regular consumption of vegetables and other horticultural crops is associated with reduced risks of cancer, cardiovascular disease, stroke, Alzheimer disease, cataracts, and some of the functional declines associated with aging. Prevention is a more effective strategy than is treatment of chronic diseases. Functional foods that contain significant amounts of bioactive components may provide desirable health benefits beyond basic nutrition and play important roles in the prevention of chronic diseases. There are various vegetables which are source of neutraceuticals or phytoceuticals which are bioactive compounds that helps in maintaining the immunity in the body. L-dopamine from celery, glucophoraphin and sulphoraphane from cole crops, lycopene from tomato and there are several examples to count. But there are various are underutilized vegetables which are the source of abundance of these bioactive materials. These vegetables are to be assessed for their disease fighting qualities and to be added to the plate for their regular consumption.

Assessment of nitrogen management in symbiotic partners of *Hippophae salicifolia* under salt stress (Poster)

Amrita Srivastava[1], Arun Kumar Mishra[2], [1]Department of Life Science, Central university of South Bihar, Panchanpur, Gaya - 824236, [2]Centre for Advanced Study in Botany, Banaras Hindu University, Varanasi-221005. E-mail- amritasrivastava@cub.ac.in

Hippöphae salicifolia is a member of family Eleagnaceae and prevalent in high altitude areas of Himalayas. It is known for various products of immense commercial value. It also forms a significant symbiotic association that increases its nitrogen use efficiency. It's symbiotic partner, *Frankia* is an actinomycete having high G+C content of 66 - 75%. It proves to be an effective survivor under cold and nitrogen stress conditions. In the present work, *Frankia* strains were isolated from *Hippöphae salicifolia* D. Don growing at different altitudes of the Eastern Himalayan region of North Sikkim, India. Strains were identified on the basis of small subunit rRNA (16S rRNA) sequencing.Effect of salinity (NaCl supplement) was observed on growth and some important physiological parameters of nitrogen metabolism such as nitrate uptake, intracellular and extracellular ammonium status and activity of nitrogenase enzyme among Frankia strains differing in their salt tolerance capacity. Nitrogenase activity closely followed the growth pattern with regular decline on NaCl supplementation. Co-regulation of the nitrate uptake system and sequential enzyme activities plays a crucial role in governing the nitrogen status of strains during salt stress. HsIil0 experiencing minimum decline in nitrogenase activity and best possible nitrogen regulation under NaCl replete condition showed adequate nutritional management. Among all the strains, HsIil0 proved to be salt tolerant and able to manage the cellular nitrogen status under salinity. Thus, Frankia strain HsIil0 can potentially serve as a potential biofertilizer in the saline soil.

Some medicinally active plants and their active compounds in the regulation of Cardio-vascular problems in rats: Efficacy and safety evaluation (Oral)

Anand Kar[1]andSunanda Panda[2]. [1]School of Life Sciences, [2]School of Pharmacy,Devi Ahilya University, Takhshila Campus, Khandwa Road, Indore 452017,M.P.,India. Email: karlife@rediffmail.com

Cardiovascular disease (CVD), particularly in the adults, commonly results from metabolic disorders. While some plant extracts are known to ameliorate CVD, systematic studies on Indian plants and on their phytochemicals are meager. Since last one decade we have been working on role of indigenous plant extracts and on their active compounds in the regulation of CVD. This presentation reviews the findings made on the efficacy and safety nature of some plant extracts and their isolated bioactive compounds, mostly investigated in our laboratory, with respect to the prevention and treatment of chemically-induced cardiovascular problems and cardiac damage. Here we present the importance of plant extracts and their active compounds, isolated from officinal parts of *Moringa oleifera, Catharanthus roseus and Trigonella foenum-graecum* in amelioration of chemically-induced cardiac damage and associated problems in rat model. Also effort has been made to provide an outline of the possible mechanism(s) of action of the active compounds.

Application of DNA barcoding for precise identification of medicinally important *Cichorium* and *Agave sp*. found in Uttarakhand region and evaluation of their anti-microbial, and antioxidative potential. (Poster)

Ankita H. Tripathi[1], Rekha Gahtori[1], Ashutosh Paliwal[1], Amrita Kumari[1], Penny Joshi[2], Santosh K. Upadhyay[1], [1]Dept. of Biotechnology, Bhimtal Campus, Kumaun University, Nainital, India-263136; [2]Dept. of Chemistry, DSB Campus, Kumaun University, Nainital, India-263101. E-mail: tripathi.ankita730gmail.com

Medicinal plants play an important role in the arena of human health care system and natural products. In the traditional medicinal system of Uttarakhand numerous phytoextracts from various plants are known for their medicinal potential. However, the medicinal properties of plants vary from species to species. Therefore, precise identification of any plant characterized for its pharmacological/medicinal properties by traditional healers/modern age scientist is a prerequisite for ensuring the reproducibility of results. Thus, DNA-barcoding technique has emerged as a powerful molecular systemic identification tool. *Cichorium and Agave* are important medicinal plants which belong to Asteraceae and Asparagaceae family. Here, we explored four barcoding amplicons, rbcL, matK, ITR and trn for molecular identification of both *Cichorium* and *Agave* species. Additionally, antibacterial screening of *C. intybus* and *Agave sp*. leaves extract was carried out by using phytoextracts obtained from different solvent systems. The pathogenic microorganisms tested include *Bacillus subtilis, Salmonella typhimurium, Pseudomonas aeruginosa*, *Escherichia coli* and *Aeromonas salmonicida*. The results reveal the antimicrobial potentials of phytoextracts tested. Preliminary phytochemical analysis and antioxidant potential analysis of methanolic and ethanolic extract of leaves of *Cichorium*, and *Agave sp*. was also carried out. The leaves were found to possess high levels of flavonoids and phenolics. The phytochemical screening confirmed the presence of tannins, saponins, flavonoids, in the leaves of both the plants. In view of good anti-microbial and antioxidant composition, *Cichorium*, and *Agave* extracts could be further analyzed for their phytomedicinal potentials using more advanced assays.

***In vitro* culture *of Rhynchostylis retusa* and role of mycorrhiza in *ex vitro* establishment of orchid species (Poster)**

Ankita Lal[1], Manu Pant[2] and Lok Man S Palni[1]. [1]Dept. of Biotechnology, Graphic Era (Deemed to be) University, Dehradun, and [2]Dept. of Life Sciences, Graphic Era (Deemed to be) University, Dehradun. E-mail: ankita.lal88@gmail.com

Orchids, owing to the exquisite beauty of flowers, are highly valued in the cut flower trade and as potted plants. Apart from their diversity in colour, foliage and fragrance, orchids are immensely used in folk medicines as they are endowed with phytoconstituents which are significant in healthcare. Given to the topographical features and climatic suitability, Uttarakhand harbors several medicinally important orchids. *Rhynchostylis retusa*, a monopodial, epiphytic orchid native to this region, is used in the treatment of rheumatism, asthma, malaria and blood dysentery. Juice of roots and leaves is applied for curing wounds and ear pain. It is also utilized as an emollient and insect repellent. Due to its high commercial value but slow rate of conventional propagation coupled with loss of habitat, tissue culture technology can be effectively used as an alternative to furnish the demand. In the present study different PGR (BAP and NAA) and growth additives (coconut water, yeast extract, and peptone) were screened for seed germination and plantlet development and the best results were observed in MS medium fortified with BAP and coconut water with activated charcoal. Further studies to establish the role of mycorrhiza as PGPM for in vitro culture and as a biofertilizer for improved ex vitro establishment of *R. retusa* are underway.

Bioactive content and antioxidant activity in *Mahonia jaunsarensis*: an endemic species of Himalaya. (Poster)

Arti Bisht, Amit Bahukhandi, Sashi Upadhyai, Monika Bisht, I.D Bhatt, R.S Rawal. G. B. Pant National Institute of Himalayan Environment & Sustainable Development Kosi - Katarmal, Almora, Uttarakhand. Email:bishtaarti61@gmail.com

Mahonia jaunsarensis (Family Berberidaceae), commonly known as Khoru is an endemic shrub species of Uttarakhand state. The species is distributed at an altitudinal range of 1800-2200 m asl and occurred in Banj-Oak forest of Himalaya. Traditionally different plant parts of the species are used by local inhabitants but specific information is not reported. Considering the importance of the species, present study focused on the investigation or polyphenolics and antioxidant activity of *Mahonia jaunsarensis.* Results revealed the variation in analyzed parameters. Fresh berries of the species confirmed were phenolics 1.84 mg GAE/g; tannins 1.79 mg QE/g; flavonoids 1.06 mg QE/g and flavonols 0.63 mg QE/g fresh weight. Similarly, antioxidant activities determined by in vitro assays in the fresh berries showed varying concentration of natural antioxidant activity such as total radical scavenging antioxidant ABTS activity 1.33; ferric reducing antioxidant power FRAP 5.30; free radical scavenging antioxidant DPPH activity 1.36; hydroxyl ion scavenging antioxidant activity OH· activity 0.97 mM AAE/100g fw fresh weight. The results of the study indicate that the fruits of *Mahonia jaunsarensis* is potent sources of natural bioactive constituents and can be utilized for preparation of various health benefit compounds.

Genetic analysis in Buck Wheat (*Fagopyrum esculentum* Moench): a nutraceutical crop of Garhwal Himalyan region (Poster)

Anajy Singh Bist[1], Arun Bhatt[2], and Pavan Kumar Agarwal[2],[1]Department of Seed Science and Technology,Dr.Y.S.Parmar University of Horticulture and Forestry, Solan (HP),[2]Department of Biotechnology,G.B.Pant Institute of Enginering and Technology,Ghurdauri, Pauri Garhwal, Uttarakahnd. Email: arun.bhatt@rediffmail.com

Buckwheat (*Fagopyrum esculentum* Moench)is one of the most important pseudo cereal and nutraceutical crop of the mountain region widely cultivated in the middle and higher Himalayas during kharif season. The thirty diverse genotypes of buckwheat including four checks *viz.,* PRB-1, Himpriya, VL-7 and Shimla-B1 was laid out in Randomized Block Design with three replication. Observations were recorded for different field parameters. The data was utilized for estimation of mean, range, coefficient of variation, heritability, genetic advance, correlation coefficient, path coefficient and genetic divergence. The present study was under taken to elucidate analysis of variance revealed significant differences among the genotypes for all the characters. Considering cluster mean and genetic distance the crossing between genotypes of cluster I, cluster III and cluster IV would be fruitful for obtaining transgressive segregants for developing high yielding and better quality buckwheat varieties.On the basis of salient findings of present study, it is concluded that the genotypes PRB-1, IC-412762, IC-276627, RSR/SKS-71, IC-294344, Himpriya, IC-

13507, IC-341661 and VL-7 were found promising as they contained more than one desirable trait and for the seed quality parameters the genotype VL-7, IC-107988 and IC-26599, which was suitable for under laboratory condition. So these germplasm can be further utilized in crop improvement programme which is suitable for mid hills of Uttarakhand.

Tissue culture approaches and conservation of *Pterocarpus marsupium* (Roxb.) an important medicinal plant (Poster)

Asha Patel and Illa Patel.Department of Life Sciences, Hemchandracharya North Gujarat University, Patan, Gujarat, India. Email: patel881985@gmail.com

The Indian kino tree (*Pterocarpus marsupium* Roxb. Fabaceae) is listed in the IUCN red data list as a direct result of the excessive exploitation of its wood. *In vivo* seed germination and conventional multiplication in this plant is very slow. The seeds of this plant are facing so many problems due to its hard seed coat and poor viability. In the present study, seeds were inoculated in MS, 1/2 MS, Nitsch and white media and the best responding media was selected and used for the multiplication. A combination of BA with IAA proved best for *in vitro* multiplication from the seedling compare to other hormonal combination in both direct and indirect type of shoots multiplication. Rooting was best induced in microshoots excised from shoot culture and transfer in half-strength MS liquid medium containing indole- 3- butyric acid. The *in vitro* raised plantlets were potted and acclimatized under culture room condition then transfer to a green house, where 70 % survived. So, it is concluded that media type, strength, PGRs concentration have tremendous effect on seed germination of *Pterocarpus* which will help in its mass multiplication and conservation.

Chemical fingerprint of 'Kutki' (*Picrorhiza kurroa*) for understanding its mechanism of action in Arogyavardhini vati, an Ayurvedic formulation used as adjunct treatment in cancer (Poster)

Bhagyashri Kumbhalkar[1], Chavan Sandeep[1], Vidya Gupta[1,2], Vineeta Deshmukh[1] Sadanand Sardeshmukh[1]. [1]Bharatiya Sanskriti Darshan Trust's Integrated Cancer Treatment and Research Centre, Wagholi, Pune, INDIA 412 207,[2]CSIR National Chemical Laboratory, Pashan, Pune, INDIA 411 016. E-mail: k.bhagyashri@gmail.com

Ayurveda, the ancient Indian system of health-care has been using herb *Kutki(Picrirrhiza kurroa* Royle ex Benth*)* in the treatment of various diseases for thousands of years. It is one of the important drug resources originating from the mountainous regions with high commercial value. The phyto-compounds from *Kutki* like Apocynin (anti-inflammatory), Cucurbitacins (Cytotoxic and antitumor), Kutkoside, iridoid glycosides like picrosides (hepatoprotective, antioxidant and immune-modulating) has been reported. *Arogyavardhini vati* (AV) having *Kutki* as its major ingredient, is one of the potent poly-herbal metallic and mineral formulations described in *Rasaratnasamuchchaya* mainly for the treatment of fever, liver and skin disorders and used by Ayurvedic practitioners on large scale. The name suggests '*Arogya*' means health and '*vardhini*' means promoter/improver. Traditionally it is used in various chronic diseases and can act as cell rejuvenator drug with antioxidant potential. "*Kutki*" [from Scrophulariaceae family] being a major ingredient of AV plays an important role in its therapeutic action. Individually, it has been evaluated for chemical compounds as well as pharmacological activities. However, the drug development steps like trituration demonstrated in traditional preparation of AV and combination with *Bhasma* like copper, iron, mica may alter chemical compositions in *Kutki* as well as responsible to enhance its efficacy. The chemical fingerprinting plays important role in drug standardization to understand its mechanisms of action. In recent clinical studies in our institute, a wide array of this Ayurvedic medicine combined with chemotherapy and radiotherapy have shown effective supportive care for cancer patients. Hence, in the present study an attempt has been made to understand the mechanistic actions of *Kutki* along with other components in AV in several cancers like breast, hepatocellular carcinoma, colon etc. considering anti-oxidant, immune-

modulator, anti-inflammatory and anti-cancer potential of this drug. It can be developed as an adjunct drug in cancer treatment with wider acceptance.

An ethnobotanical study of medicinal weeds from Mandakini valley, Uttarakhand (Poster)

Bharti Rautela and P. Tiwari, Department of Botany and Microbiology, HNB Garhwal University, Srinagar Garhwal, Uttarakhand. Email: bhartirautela77@gmail.com

Weeds are the undesirable plants which can grow where they are not required. They can cause adverse effects on plant productivity and health hazards in animals but they can be exploited for numerous beneficial purposes. The present study is aimed to collect data on the weeds used medicinally from the Mandakini valley, Uttarakhand. A total of 129 weed species had been recorded from the study area which possesses medicinal properties. The study recommended a tremendous scope of utilizing these weeds, to promote additional income to the inhabitants. The ethnobotanical data collected from the study site were recorded and documented which revealed that some weeds are quite effective remedies for different diseases such as headache, diabetes, toothache, jaundice, intestinal diseases, asthma, dysentery, diarrhea, fever, urinary tract, bleeding piles, skin disorders and cough.

Screening medicinal plants of Uttarakhand for active components targeting beta secretase enzymes in pathogenesis of Alzheimer's (Poster)

Ashish Thapliyal[1], Bipin K Sati[1], Madhu Thapliyal[2], Prashant Anthwal[3], Navin Kumar[1], Rashmi Verma1, Prabhakar Semwal[4]. [1]Department of Biotechnology, Graphic Era (Deemed To Be University), Dehradun. [2]Department of Zoology, Govt. PG College, Raipur, Dehradun.[3]Department of Biochemistry, Hemvati Nandan Bahuguna, Garhwal University Central University Srinagar (Garhwal) Uttarakhand. [4]UCOST, Dehradun.

Dementia can be the most common cause of disability in later life. Alzheimer's disease (AD) is most prevalent form of dementia. Current indications show that 46.8 million people are living with dementia worldwide. About 9.9 million cases of dementia have been reported in 2015 worldwide. The projection of the people living with dementia is estimated to around double in every 20 years. There are 22.9 million people in Asia followed by Europe, America and then Africa with 10.5, 9.4 and 4.0 million people respectively. Economically, total estimated cost for dementia is about 1 trillion US$ in 2018 and will be around 2 trillion US$ in 2030. Generally accepted hypothesis about genesis of AD is β -secretase enzyme dependent formation and aggregation of Amyloid beta (Aβ) peptide leading to formation of plaques in the brain. This most well known pathway leading to formation of Aβ is still most prominent target for drug development. Besides all these factors mention above the "Aβ hypothesis" occurs because of the alteration in function of secretase enzymes. Medicinal plants were scanned for active components that could inhibit the activity of secretase enzyme. The extract was fractionated and each fraction was scanned for inhibitory activity using Abcam kit ab65357. The samples showing inhibition were subjected to HPTLC separation and GCMS analysis. We report here that extract of *Picrorhiza kurroa* from tungnath region of Uttarakhand showed significant inhibitory activity *invitro* and can have potential therapeutic / nutraceutical application.

Pteridophytes used by peoples of Himalayan Mountains (Poster)

B. S. Kholia[1] and B. K. Sinha [2]. [1] Botanical Survey of India, 192-Kaulagarh Road Dehradun, India. [2]Botanical Survey of India, Headquarters, Salt Lake City, Kolkata, India. E-mail: bskholiabsigmail.com

Pteridophytes are used by human beings from time immemorial. About 800 species of Pteridophytes occurs in Indian Himalayan region and distributed from lowest elevation to alpine climates. Pteridophytes are being used traditionally by different ethnic groups and local peoples of Himalayan states of India and Nepal from centuries as food, fodder, in local remedies, as starter in making yeast, for making houses and cattle sheds and more recently in nursery practices etc. but these are not documented properly. However, due to recent

modernization and change in society this traditional knowledge is depleting generation to generation, therefore needs to be documented correctly. As compared to flowering plants economic potential of ferns and fern-allies are still neglected, however, many species of Pteridophytes have great economic potential in vegetable, traditional medicine and horticulture industry but needs to be highlighted and popularized. Keeping this in mind the socioeconomically useful Pteridophytes of Indian Himalayan regions are discussed in detail in present presentation.

Optimization of process parameters for improved production of bioactive metabolites "resveratrol" by endophytic fungus *Aspergillus niger* VVE1 isolated from *Vitis vinifera* plant (Poster)

Chetana Roat and Meenu Saraf. Department of Microbiology & Biotechnology, University School of Sciences, Gujarat University, Ahmedabad-380 009, India.E-mail:chetana.roat@gmail.com

Plant bioactive molecule resveratrol belongs to small class of stilbenes of polyphenolic group of plant secondary metabolites. resveratrol, has recently gained the focus of a number of studies in medicine, chemistry as well as has emerged as promising molecules that potentially affect human health. The biosynthetic potential of endophytic fungi has gained impetus in recent times owing to the continual discovery of fungal endophytes capable of synthesizing plant compound. In this present study the resveratrol was isolated from the endophytic fungi from the leaf of *Vitis vinifera* and was aimed to optimize the physicochemical condition of the endophytic fungus. On the basis of morphological and molecular characteristic, the fungus was identified as *Aspergillus niger* and designated as VVE1. The fungus was optimized for growth and maximum production of resveratrol in batch culture system. The fungus produced optimum resveratrol in potato dextrose broth (PDB) at 26°C, pH 6 supplemented with carbon source xylose and yeast extract as a nitrogen source, followed by incubation period of 8 days and enhanced secondary metabolite productivity from 2% to 22%. Phenylalanine with xylose and yeast extract enriched PDB promoted the production of resveratrol, whereas methionine amended in PDB with mannitol promote higher biomass accumulation.

Traditional Iranian and Central Asia Medicine (TICAM) systems (Poster)

Chonour Mahmoudi[1] and Nirmal Joshee[2]. [1]Department of Biology, Herbarium Division, Bu-Ali-Sina University, PO Box 65175/4161, Hamedan, Iran, and [2]Agricultural Research Station, Fort Valley State University, Fort Valley, GA 31030, USA. Email: chonour.mahmoudi@yahoo.com

The genus *Scutellaria* (Lamiaceae, Scutellarioidae) includes taxa with a wide range of pharmacological traits, which make this genus economically important. Species of the genus are distributed in both Old and New Worlds, mostly prominent in the northern hemisphere. The main center of diversity of *Scutellaria* is the Irano-Turanian Region, particularly Central Asia and Afghanistan. Iran is located in the southwest Asia and according to the latest records, there are 39 *Scutellaria* species reported from Iran. Previous taxonomical studies on *Scutellaria* from Iran were mainly based on morphological and chromosomal characters but in recent years, because of its significant role in traditional medicine in Iranian culture, renewed interest has been seen. *Scutellaria* based traditional medicines are basically employed to help maintenance of general health and treatment of disease. It provides immune system stimulation and antibacterial effects in traditional medicine in Iran. Some *Scutellaria* species used in the Traditional Iranian and Central Asia Medicine(TICAM) are *S. lindbergii*, *S. litwinowii*, *S. luteo-caerulea*, *S. platystegia*, and *S. pinnatifida*. Common distribution of *S. lindbergii* is limited to Iran and Afghanistan. However, *Scutellarialuteo-caerulea* distribution is wider stretching to neighboring regions of Iranian covering Afghanistan, Turkmenistan and Iran. The indigenous people of the Zangelanlo district in Northeast Iran traditionally relied upon the aerial parts of *S. luteo-coerulea* to treat indigestion, gas, and skin problems. Additional regional areas of Iran consider *Scutellaria pinnatifidassp*. *alpina* a customary gastrointestinal remedy. In addition to the

distribution and traditional uses, various species will be discussed in relation with conservation status and current status of research.

Ethno-botanical recordings from Doonagiri Sacred Groove in Dwarahat, Kumaun Himalayas, India. (Poster)

Deepak Kholiya[1], Laxmi Rawat[2] and Preeti Joshi[3]. [1]Associate Professor, Dept. of Env. Sci. Graphic Era Hill University, Dehradun Campus (UK), [2]Ex-HOD & Scientist F Ecology & Environmental Div. FRI D.DUN, [3]Ex-Women Scientist FRI, Dehradun.Email: deepak151176@gmail.com

In Uttarakhand state villages have their sacred groove (ancient temple forests) both in Garhwal and Kumaon regions, where deities or spirits are worshipped by local communities. These protected forests containing different indigenous wild life species and natural water springs are on the verge of disappearance due to numerous anthropogenic activities. Uttarakhand has a age-old tradition of having protected temple forests near villages, where deity / deities are worshipped in a grove or groups of trees. The trees / vegetation growing in these groves are not allowed to cut / fell, as it is believed to belong to the deity. Only the dead / dried parts are sometimes used by them. Sudden death of trees / plants of these forests are said to be bio-indicator of mishappenings / misfortune for the villagers. This type of restriction in these forests have helped conservation of native/indigenous species of these areas. The future studies should be conducted because documentation / enlisting of medicinal plants present in these sacred forests / temple forests has not been done so far. Hence this study can work for future references / guidance before planning them as a tourism products. Most of the plant species growing there are native as they grow naturally in these forest habitat. Thus, these protected sacred grooves can serve as germplasm bank of these species and a model for biodiversity conservation too. In some of the villages of Garhwal and Kumaon regions, where temple forests are present/practiced in so many areas, present an excellent example of conservation of local flora and fauna. No such research has been done in these areas so far, hence this will be the pioneer work with important findings for the future reference / guidance.

Bioprospective role of *Usnea longissima* against pathogenic microorganisms. (Poster)

Devashree[1], Anupam Dikshit[1] and Sanjeeva Nayaka[2]. [1]Biological Product Laboratory, Department of Botany, University of Allahabad and [2]National Botanical Research Institute, Lucknow. Email: devashreerishabh021@gmail.com

Lichens are one of the best examples of symbiotic association where two dissimilar organisms, a fungus and an alga or a cyanobacterium live together physiologically synchronized and well intermixed so as to form a single biological unit. The lichen substances also do have great biological potentials including antibiotic, antimycobacterial, antiviral, antioxidant, anti-inflammatory, analgesic, antipyretic, antiproliferative and cytotoxin. In the present study, crude extracts of *Roccella montagnei* were tested for its antimicrobial activity. *Usnea* is a genus of mostly pale grayish-green fruticose lichens in the family Parmeliaceae. It grows all over the world. Members of the genus are commonly called old man's beard, or beard papa. It resembles *Evernia*, which is also called tree moss. *Usnea* looks very similar to the plant Spanish moss. *Usnea* is very sensitive to air pollution, especially sulfur dioxide. It can sometimes be used as a bioindicator, because it tends to only grow in those regions where the air is clean and of high quality. The usnic acid in *Usnea* is effective against gram positive bacteria such as *Streptococcus* and *Staphylococcus*, making *Usnea* a valuable addition to herbal formulas for sore throats and skin infections. Samples were collected from Sikkim and its organic extract was prepared using solvents methanol, ethanol, acetone and ethyl acetate by the soxhlet setup of extraction. Common negative control used was DMSO i.e. Dimethyl Sulphoxide and specific positive control streptomycine for antibacterial and ketoconazole for antifungal. This present work was promulgated to explore the lichen *Usnea longissima* with special reference to its antimicrobial testing against pathogenic bacteria such as *Staphylococcus aureus, Streptococcus mutans, Agrobacterium, E.coli, Pseudomonas aeruginosa, Klebsiella pneumonia* and pathogenic fungus *Candida albicans, Aspergillus niger and Fusarium oxysporium.* Maximum inhibition zones were observed in methanolic extracts of *Usnea longissima* against bacteria *Escherichia coli* and it can be used as a herbal

formulation in future use. This will definitely provide a base and for the future perspectives and highlight the need for further studies of this promising source to harvest more beneficial in the field of bioprospection.

In-silico approach towards the development of potential herbal drug with multi target drug discovery for tuberculosis. (Poster)

Devvret Verma[1], Neema Tufchi[1], Kumud Pant[1], Ashish Thapliyal[2]. [1]Department of Biotechnology and [2] Department of Life Sciences, Graphic Era Deemed to be University Dehradun, Uttarakhand India – 248002. E-mail: devvret@gmail.com

Being a top ten leading cause of death worldwide, tuberculosis has become a major threat for humans. Multidrug resistance and extensive drug resistance are major issues for the treatment of tuberculosis. The causative agent *Mycobacterium tuberculosis* is smart enough that it escapes the host immunological response to make it survivability inside the host. The bacterium is showing resistance against the drug available in the market for the treatment of tuberculosis and they are expensive. To design new and inexpensive drug leads that have potent activity against *Mycobacterium tuberculosis*, the information of the plants having antitubercular property has been mined through literature by using Text mining approach. All the phytochemicals from these plants were scanned through the ADMET and Lipinski's filter for the docking analysis. The potential drug target was identified by the host pathogen interaction analysis. ATP synthase subunit alpha (ATPA) and Cytochrome c oxidase subunit 1 (COX1) was identified as potential drug target. Molecular docking approach was implemented to find out the best target-ligand interaction and revealed that the compounds of Tinospora cordifolia (giloy plant) have the most potential compounds for inhibiting the growth of *Mycobacterium tuberculosis.*

Evaluation of antioxidant and anticancer properties of *Isariatenuipes* from Darjeeling Himalaya. (Oral)

Abhijit Chhetri and Dhani Raj Chhetri, Department of Botany, Sikkim University, 6th Mile, P.O. Tadong, Gangtok, Sikkim-737102. E-mail: drchhetri@cus.ac.in

The genus *Isaria*is an entomopathogenic fungi associated with diverse range of insect host. Crude methanolic extract were prepared from the mycelia of *Isaria*tenuipes and their antioxidant activities *in vitro* were studied by various antioxidant assays, including 1,1-diphenyl-2-picrylhydrazyl radical (DPPH) radical scavenging, hydroxyl radical scavenging, hydrogen peroxide (H_2O_2) scavenging and total antioxidant/ABTS radical scavenging activity along with total phenolic, flavonoid , flavanol and tannin quantitative estimation. The assay revealed that, all tested concentrations (1–10 mg ml^{-1}), fungal extract was a good free radical scavenger and the activity increased in a dose-dependent manner. The methanolic extract quenched significant DPPH and ABTS radicals at relatively higher concentrations. Reducing power showed dose dependent increase in concentration absorption compared to the standard, gallic acid. Quantitative analysis showed that methanolic extract had a high content mycochemicals characterized by a high total phenolic and flavonoid content. The total phenol and flavonoid content being 11.58 ± 0.12µg/mg and 9 ± 2.1 µg/mg, gallic acid equivalent respectively. Cell viability was assessed by the MTT assay on the three human carcinoma cells, HeLa (cervical cancer), PC3 (prostrate cancer) and HepG2 (hepato carcinoma). Amongst them HeLa was recorded to be more susceptible (53.48 %) towards the amount tested (100 µg $ml^{-1)}$ in a similar trend observed in antioxidative assay. The evidence presented herein suggests that the mycelial methanolic extract indicates a positive correlation between the presence of antioxidative and cytotoxic activities. This may pave ways for future drug research. This is the first report of its kind from this part of the world.

Approach for *in vitro* conservation of Glory lily (*Gloriosa superba* L.) and assessment of Genetic stability through RAPD markers (Poster)

Rathod Dipika[1] and Patel Illa[1] Department of Life Sciences, Hemchandracharya North Gujarat University, Patan, Gujarat, India Email: rathod.dipika7@gmail.com

The protocol of *in vitro* propagation has been established for multiplication of *Gloriosa superba* L. which is an important plant of colchicaceae. In nature, this plant propagated by seeds and tubers on other hand these two parts were important source of high priced bioactive compound Colchicine so, explore highly. Colchicine is known to possess several medicinal values and help to cure various diseases like gout, fatigue etc and have anti cancerous activities. Shoot tip explants were excited and cultured on Murashige and Skoog's medium supplemented with BAP or Kin alone or in combination with NAA. The maximum numbers of shoots were obtained when MS medium fortified with combination of Kin and NAA. The maximum numbers of roots were obtained when *in vitro* shoots were transferred on MS medium supplemented with lower concentration of Kin in combination with higher concentration of NAA. Further, acclimatization was done using sterilized soil and coco peat mixture at (1:1) ratio, which produced almost 75% survival. The genetic stability of *in vitro* regenerated plants was assessed by using random amplified polymorphic DNA (RAPD) markers. It confirms that the *in vitro* regenerated plants were genetically similar to mother plants and its true to type. This rapid and protocol can be used for mass multiplication of genetically stable plants and hence used for conservation of it.

Ampleocissus latifolia (ROXB.) PLANCH. fruit: a potential source of polyphenol with rich antioxidant, anti-elastase, anti-collagenase, anti-tyrosinase, anti-cancer and anti-inflammatory activities (Poster)

Himani Singh[1], Madhuri Kaushish Lily[2], and Koushalya Dangwal[1]. Department of Biotechnology, Modern Institute of Technology, Dhalwala, Rishikesh, 249201, Uttarakhand, India. Email: kdangwal1@yahoo.co.in

The Uttarakhand province of the Indian-Himalayan-Region owns a large number of wild edible fruits serving as dietary staples and medicines for thousands of years, particular in rural areas. Majority of fruits remained unexplored for polyphenol contents and associated bioactivities regardless of their higher nutritional values. Ampleocissus latifolia (roxb.) Planch fruit (jungle grape-vine), is an unexplored wild edible fruit of Indian Himalayan region, the plant species grows abundantly in nature between 1500-3300 m amsl in Uttarakhand, Jammu and Kashmir and North East. A. latifolia berries are purplish black in color and broadly oblong fruits, ripen in August-September. Present study analyzed A. latifolia berries extracts (80 % aqueous acetone) for total polyphenol contents, antioxidant, anti-elastase, anti-collagenase, anti-tyrosinase, anti-proliferative and anti-inflammatory activities using in vitro assays. High values of total phenolic contents of 4496.39 ± 318.00mg gallic acid equivalents/ 100 g fruit weight and total flavonoid contents of 1280.00 ± 40.00mg catechin equivalents/100 g fruit weight were observed. A. latifolia fruit extracts showed outstanding antioxidant activities (against ABTS+, 1,1-diphenyl-2-picrylhydrazyl, superoxide anion, linoleate peroxyl radicals radicals) including ferric reducing activities and excellent anti-elastase, anti-collagenase, anti-tyrosinase, anti-proliferative and anti-iflammatory activities. High resolution liquid chromatography–mass spectroscopy analysis revealed presence of large numbers of phenolic compounds, namely, Dihydrorobinetin (3,3',4',5',7-, pentahydroxyflavanone), Dihydromyricetin, Pentahydroxyflavanone (tricetin), Catechin, Lecanoric acid, Diethylstilbestrol monosulfatemonoglucuronide (stilbene derivative), Diosmin, Rutin, 2-Isoprenylemodin, 4-(2-hydroxypropoxy)- 3,5-dimethyl-Phenol, Peucenin, 6,7-Dihydroxy-4-methylcoumarin (4-methylsculetin) in fruit extracts. This study recommends utilization of A. latifolia fruit as functional food with prospective pharmaceutical, nutraceutical, and cosmeceutical properties.

Effect of plant growth regulator on stimulating growth and production of diosgenin in fenugreek callus cultures (Poster)

Himanshu Dwivedi[1], Jaidev Chauhan[1], Vijay Kant Purohit[1], Sanjeev Agrawal[2]. [1] High Altitude Plant Physiology Research Center, HNB Garhwal University, Srinagar, Uttarakhand, India; [2]Department of Biochemistry, C.B.S.H., G.B.P.U.A. &T., Pantnagar, Uttarakhand, India. Email: himanshu.phd12@gmail.com

Fenugreek (*Trigonella foenum graecum* L.) is one of the most widely used vegetable, spice and medicinal plant that contains a number of bioactive constituents and possesses health promoting properties. Diosgenin, a naturally-occurring steroid saponin, a major ingredient of fenugreek often used as a raw precursor for the production of steroidal drugs and hormones such as testosterone, glucocorticoids and progesterone. It has also great potent pharmacological properties such ashypoglycemic and hypocholesterolemic activity. The production of the diosgenin from *In vitro* grown leaf callus cultures of fenugreek var. Pusa Early Bunching is described. The levels of this secondary compound were examined by spectrophotometer in different days with different level of plant growth regulator. The highest rate of callus induction (100%) from leaf explants was observed in BAP 1.5mg L^{-1}. The levels of diosgenin detected in leaf callus after 40 days was higher in comparison to levels detected at 20 and 60 days. The highest diosgenin levels *i.e.* 2.28±0.059 mg/g dry wt. was recorded in presence of BAP 1.5 mg L^{-1} and 2-4 D 1.5 mg L^{-1} in 40 days. While, the most effective production of diosgenin *i.e.* 1.14±0.081 mg/jar callus dry weight was recorded in combination with BAP 1.5 mg L^{-1} and 2,4-D 1.0 mg L^{-1} at 60 days.

Elicitor enhancedproductionof Daidzein- an important isoflavonoid in callus culture of *Pueraria tuberosa* (Roxb. Ex. Willd.) (Oral)

Illa Patel [1] and Tank Nirali[1]. [1]Department of Life Sciences, Hemchandracharya North Gujarat University, Patan, Gujarat, India. Email: illa.botany@gmail.com

Pueraria tuberosa (Roxb. Ex. Willd.)is a woody climber of Fabaceae having an important medicinal value. The tuberous roots of plant are rich source of some important isoflavonoids like daidzein, puerarin, genistein and genistin. Daidzein is known to possess antithrombotic, antiallergic and antidiabetic properties. In the present investigation, the daidzein content of different plant parts and its accumulation in callus cultures of *P. tuberosa* was evaluated through HPTLC analysis. Chemical elicitors like silver nitrate, phenyl alanine, tyrosine, tryptophan, salicylic acid and Biotic elicitor like Yeast extract were used for treatment of callus cultures from tuber. Initial callus cultures were developed by inoculating tuber explants on MS medium incorporation with BAP and 2,4-D then the obtained callus was treated with elicitors in *in vitro* media. The HPTLC method was validated for linearity, accuracy, precision, LOD, LOQ etc by ICH guideline. The densitometric evaluation of Daidzein accumulation in *in vivo* parts and callus cultures was done using validated HPTLC method. Among all the elicitor used silver nitrate and tyrosine were accumulated maximum amount of diadzein than control callus and all the *in vivo* plant parts. The results revealed that the application of elicitors can boost up the production and accumulation of daidzein in callus cultures of *P. tuberosa.* This finding may help pharma company and drug formulation.

A novel therapeutic approach to control cancer cell progression using by natural product (Oral)

Parvez Khan, Huma Naz, Farha Naz and Md. Imtaiyaz Hassan. Center for Interdisciplinary Research in Basic Sciences, Jamia Millia Islamia, Jamia Nagar, New Delhi – 110025, India. E-mail: mihassan@jmi.ac.in.

Microtubule affinity regulating kinase 4 (MARK4) and calcium/calmodulin-dependent protein kinase IV (CAMKIV) are Ser/Thr kinase belonging to AMPK-like family have recently become an important drug target against neurodegenerative, cancer and other related metabolic disorders. In this study, we have evaluated different natural dietary polyphenolics including rutin, quercetin, ferulic acid, hesperidin, gallic acid and vanillin as MARK4 inhibitors. To study the binding, initial screening of all these compounds was done using molecular docking in the active site cavity of MARK4. The in silico observations were further complemented by fluorescence binding studies and ITC measurements. Binding results shows that out of all studied compounds only rutin and vanillin showed significant binding with MARK4. To signify the extent of enzyme inhibition ATPase assay was performed. Cell proliferation, ROS quantification and Annexin-V staining elucidated the apoptotic potential of rutin and vanillin. Results suggest that rutin and vanillin act as a potential inhibitor for MARK4 and can be further studied as a pharmacophore for MARK4 implicated diseases. To see the role of β-carotene on cell proliferation and apoptosis, cancerous cells (HeLa, HuH7and MCF-7) and normal (HEK-293-T) cell lines were used. An admirable anticancer activity of β-carotene was

observed. We further performed propidium iodide and DAPI (4',6-diamidino-2-phenylindole) assays to understand the mechanism of anticancer activity of β-carotene at molecular level. Our findings provide a newer insight into the use of β-carotene in cancer prevention and protection via inhibition of CAMKIV by regulating the signaling pathways.

Genetic stability and phytochemical profiling of the *in vitro* regenerated plants of *Angelica glauca* Edgew. (Apiaceae): an endangered medicinal plant of Himalaya. (Oral)

Janhvi Mishra Rawat[1], Aakriti Bhandari[2], Balwant Rawat[3], Ajay Thakur[2] and Anup Chandra[1]. [1]Systematic Botany Discipline, Botany Division, Forest Research Institute, Dehradun, Uttarakhand, India; [2] Genetics and Tree Propagation Division, Forest Research Institute, Dehradun, Uttarakhand, India; [3]Department of Agriculture and Forestry, Graphic Era Hill University, Dehradun, India.

The present study describes the first successful, efficient and reproducible *in vitro* propagation protocol for multiple shoot induction of *Angelica glauca* (Apiaceae). Rhizomes were used as explant, and maximum shoot multiplication was observed on MS medium supplemented with 6-Benzylaminopurine 8.0 µM and Indole-3-acetic acid 0.1 µM. Roots were observed within 14 days in the MS medium enriched with 0.5 µM IAA and 0.1 µM Naphthalene acetic acid (NAA) with an average production of 4.2 roots per shoot. Rooted plantlets were successfully hardened under greenhouse conditions and subsequently established in field, with a recorded survival rate of 72 % after 45 days. The total phenolic content showed significant difference ($p<0.05$) between in vitro raised plants (5.87 mM AAE/ g DW) and control (2.36 mM AAE/ g DW). Antioxidant activity, calculated through two in vitro assays, i.e. 1,1-diphenyl-2 picrylhydrazyl (DPPH) radical scavenging and Ferric Reducing Antioxidant Power (FRAP) assays revealed higher antioxidant activity in *in vitro* grown plants in comparison to control plants. Essential oil constituent's analysis was also carried out in control and *in vitro* raised plants. Thirty-one compounds were identified in the oil samples through Gas chromatography (GC) and gas chromatography-mass spectrometry (GC–MS) analysis also identified 31 compounds in the essential oil, representing 98.1–98.7 % of total oil compositions. The major components of the essential oils were (Z)-ligustilide (51.1–51.5 %), (Z)-butylidene phthalide (31.2–31.6 %), (E)-butylidene phthalide (2.6–2.9 %) and (E)-ligustilide (2.1–1.8 %). Genetic stability of *in vitro* raised plants, evaluated using 20 Inter Simple Sequence Repeats primers, proved true to typeness of *in vitro* raised plants.

Heritability and genetic advance for yield and its attributes in coriander in high hill regions of Uttarakhand. (Poster)

Jaidev Chauhan[1],Himanshu Dwivedi[1], Vijay Kant Purohit[1], Manuj Awasthi[2] and Ajaya Palliwal[2*]. [1]High Altitude Plant Physiology Research Centre, HNB Garhwal University, Srinagar Garhwal, Uttarakhand, India. [2*]Department of Genetics and Plant Breeding, V.C.S.G. U.U.H.F, Bharsar, Pauri Garhwal, Uttarakhand, India. E-mail: jaidevchauhan678@gmail.com

Large amount of variation in the germplasm provide better chance of selecting desired genotypes. Hence, knowledge of the magnitude and kind of variability existing in the germplasm for yield and its attributing traits is an essential pre-requisite to carry out any crop improvement programme. In the present study twenty four coriander (*Coriandrum sativum* L.) genotypes were evaluated to estimate the correlation coefficient in Randomized Complete Block Design with three replications. Evaluation for different horticultural traits Pali LC, KP Local, Pant Haritma, Dhulet Local, Siku LC and Pant LC recorded highest fruits per umbel and also performed better for other horticultural traits like seed yield per plot (g) than check cultivar HL Normal. Genetic analysis indicated that Phenotypic Coefficient of Variation (PCV) was higher than Genotypic Coefficient of Variation (GCV) in all of the attributes studied. The selection for the characters like plant height (cm), seed yield per plot (g), test weight (g), umbel per plant, secondary branches per plant and seed yield per plant (g) can be performed to achieve improvement. The Phenotypic Coefficient (PC) and Genetic Coefficient (GC) were found high for almost all the traits except maturity duration, days to 50% flowering and days to first umbel unfolding. High Heritability estimates coupled with high genetic gain were

observed for almost all the traits studied except fruits per umbellate, umbellates per umbel, days to 50% flowering, days to first umbel unfolding, test weight (g) and number of primary branches per plant and plant height (cm). Environment and its interaction with the genotypes were observed to be significant for all the traits in the present study.

Siderophores biosynthesis inhibition in *Pseudomonas aeruginosa* using EGCg encapsulated copper nanoparticles functionalized with Ampicillin. (Poster)

Jigisha Anand*, Nishant Rai. Department of Biotechnology. Graphic Era Deemed to be University, Dehradun, Uttarakhand, India. Email: jiggs21@gmail.com.

Use of conventional antibiotics has resulted into an increase in multi-drug resistant strains of *P. aeruginosa*, which is one of the most worrying opportunistic factors in nosocomial infections. The genetic diversity and repertoire of virulence factors confers evasion of antimicrobial treatment in *P. aeruginosa*. Notably, due to increasing emergence of infection and development of antibiotic resistance, WHO has indicated *P. aeruginosa* as the one of the most gruesome pathogen against which development of novel therapeutic drugs is urgently required. The biosynthesis of siderophores in *P. aeruginosa* provides an additional edge to the bacterial pathogen for successful infection in humans and since there are no human homologues for siderophores biosynthesis enzymes, it makes them an alternative drug targets. Epigallocatechin gallate (EGCg) is one the most prominent and promising flavonoids present in green tea and there are plethora of evidence which have demonstrated defensive activity of EGCg against bacterial infection. However limited bioavailability of these active phyto-compounds is one of the reasons that restrict their effective therapeutic application. The encapsulation of EGCg in the form of nano-carriers has shown to enhance its stability, bioavailability and therapeutic potential against microbial infection. Henceforth, considering the antibacterial potency of EGCg, the present study aimed to develop an EGCg and Ampicillin encapsulated copper nanoparticles (EGCg/Ab-CuNPs), and investigating its potential for inhibition of siderophore biosynthesis and antimicrobial activity against *P. aeruginosa*. With multi-targeted approach of catechins based nanoparticles and antibiotic, the novel EGCg based nano-composite functionalized with antibiotic can have a significant impact against the multidrug resistant and pathogenic *P. aeruginosa*.

Traditional ethnobotanical knowledge: Conservation and bioprospecting strategies of medicinal and aromatic plants (Oral)

Kalaivani Thiagarajan and Rajasekaran Chandrasekaran Department of Biotechnology, School of Bio Sciences and Technology, VIT, Vellore – 632014 TN. Email: tkvani72@gmail.com

Nation or country can attain developed status, only when bio resources are used in a sustainable manner. Biodiversity has multiple values such as aesthetic, cultural, religious, medicinal and philosophical uses. Floral biodiversity is very important as plants are not only used in the preparation of food, medicine, fodder, timber etc., but is also required for the maintenance of ecosystems. There should be a balance between biodiversity conservation and development, as both are part of human life that makes our life better. Indian sub-continent has blessed with enormous plant resources as well as ethnic groups are well versed with traditional applications. Floral biodiversity is at the verge of extinction worldwide due to habitat transformation, over-exploitation, pollution and climate change. Therefore, biodiversity conservation is vital and it presents one of the greatest challenges worldwide. Therefore, it is essential to stop the biodiversity destruction, which is required not only to meet the present requirements but also to serve the future needs of mankind. Documentation of traditional knowledge systems, conserve and validate the precious Medicinal and Aromatic Plants scientifically with bioprospecting approaches are mandatory for attain the sustainability.

From traditional knowledge to pharmaceutical and phyto-pharmaceutical product- with special reference to quality and standardization of medicinal plant herbal medicine (Oral)

Mohammad Kamil, Head TCAM Research, DHLME, DOH, Abu Dhabi. E.mail mkamil@doh.gov.ae; drkamil55@hotmail.com

The talk seeks to enlighten physicians, pharmacists, consumers and stakeholders in Medicinal Plants and Herbal Medicine on the need to establish quality parameters for collection, handling, processing, manufacturing and production of safe Plant Products as well as employ such parameters in ensuring the safety of the global botanical market, which is directly linked to the safety of public health. In the recent years with ever growing commercialization in the field of herbal medicines, there has been an instant demand for quality control of the drugs used in this system. The studies on the identity, purity and quality of the genuine drug will enhance information in checking the adulteration. A set of standards would not doubt be detterent on substitution and adulteration and also an aid for 'Drug law Enforcement'. In the present paper an attempt has been made for a sequential study starting from Selection of Medicinal Plants; Good Agricultural Practices (GAP) Cultivation; Good Field Collection Practices(GFCP); Source and Period of Collection; Identification; Storage; Chemical Standardisation; Assay; Adulteration; Good Manufacturing Practices (GMP) and Pharmacological studies to Clinical Approach, with special reference to maintain Standardisation at each and every stage. Different stages, i.e Quality control studies of Raw Medicinal Plants, Controlled Studies of Method of Processing, Quality Control Studies of Finished Product, Standardisation Proceedures at each stage from birth of the plants up to clinical application of herbal medicine have been described with reference to medicinal plants. Adulteration of prescribed and non prescribtion medicines in Herbal Formulations will be dealt in detail as practical laboratory experience. An emphasis have been given on the protocols which are required for Registration of Herbal Medicinal Products (HMP) and adulteration of undeclared chemicals in HMP.

Exploring relevance of reproductive biology in conservation of critically endangered temperate Himalayan medicinal *Angelica glauca*.(Oral)

[1]Kamini Gautamand [2]Ravinder Raina.[1]Grassland and Silvipasture Management Division, ICAR-Indian Grassland and Fodder Research Institute, Jhansi-284003, Uttar Pradesh, India and [2]Amity Food and Agriculture Foundation, Amity University, Noida-201313, U.P., India.Email: kaminigautam1989@gmail.com

Angelica glauca (Family: Apiaceae), commonly known as *chora,chokhara,gandrayan* etc., is a valuable medicinal as well as aromatic plant of temperate Himalaya.Internationally renowned for its roots which are used in treating dismenhorrea, polycystic ovary, dyspepsia, flatulence, anorexia, rheumatism etc. as well as flavor imparting quality of its root essential oil. Unscientific wild harvesting, habitat destruction, overharvesting, illegal trade, grazing pressure, climate change are often cited as the reasons of its endangerment. Species survival is incumbent not only due to socioeconomic reasons but also can be hastened by inherent genetic (and/or breeding) system operating in a species. Scientific conservation plan has to consider the inherent reproductive biology features wherein we believe some such features can address conservation issues. Literature is replete with examples of reproductive bottlenecks impairing species survival. Perusal of literature revealed that comprehensive reproductive biology details are lacking in *Angelica glauca* and efforts have been made here to unravel these features. Our studies have revealed for the first time i) Occurrence of cross pollination (up to 95%), ii) Setting of embryo less seeds to a great proportion, iii) Presence of cytomixis besides normal meiosis with 2n=22 chromosomes iv) Extreme protoandry and v) differences in seed setting behaviour amongst the umbels of various orders in this ecologically & commercially important species. These unknown aspects have implications for developing conservation plan for this species. Our presentation shall focus on discussing their relative implications on planning long & short term conservation of *Angelica glauca*.

Development of beetroot and honey fortified lassi (Poster)

Karuna Meghwal[1], Manvesh Kumar Sihag[1], Ankit Goyal[1] and Falguni Patra[2].[1]Assistant Professor, Department of Dairy Chemistry and [2]Assistant Professor, Department of Dairy Microbiology, MIDFT, Mehsana. E-mail: karuna@midft.com

Beetroot is one of the richest sources of antioxidants and phytochemicals. Apart from having betalains, it also contains a significant amount of phenolic acids such as catechin, epicatechin, ferulic, protocatechuic, vanillic, *p*-coumaric and p-hydroxybenzoic acid, which have been shown to possess antioxidative, antitumor, antimicrobial, cytotoxic and anti-inflammatory activities. In the present study, *lassi* fortified with beetroot and honey was developed and the ratio of curd and water; level of honey and sugar; and beetroot shreds were optimized. Results of preliminary trials suggested a ratio of 3:2 of curd and water among studied 2:1, 3:2, 1:1, 3:4 and 1:2 combinations. Sucrose syrup was partly replaced by natural therapeutic agent *i.e.,* honey due to its health promoting effects such as antioxidant, antimicrobial, anti-inflammatory, anti-proliferative, anti-cancer, and anti-metastatic effects. Beetroot shreds were blanched by microwave (2,450 MHz/1 min) and water (90°C/5 min), out of which, water blanching method was selected on the basis of sensory attributes. Sensory scores (9-point hedonic scale) suggested that final optimized product contained 8% beetroot shreds, 8% sugar and 2% honey as compared to control (10% sugar). The optimized product showed 15 days shelf-life at low temperature storage (4-7°C). The developed product would appeal the consumer due to its natural, healthy and added nutrients without addition of synthetic colour and flavours.

Understanding the potential habitat characters influencing the survival of *Homalomena aromatica* (Roxb.) Schott. in the foot hills of eastern Himalayas. (Oral)

Khumukcham Ronald, P. R. Gajurel*, and B. Singh Forest systematic and Ethnobiology Laboratory, Department of Forestry, North Eastern Regional Institute of Science and Technology, Nirjuli-791109, Arunachal Pradesh. Co-responding author E-mail address: prgajurel@gmail.com

The present study was undertaken to examine the microhabitat preferences and adaptiveness of preferences for medicinally and commercially important, rare and threatened species. *Homalomena aromatica* is a rhizomatous aromatic perennial herb, belonging to the family Araceae. Extensive field survey was conducted in the three districts of Arunachal Pradesh i.e. Papumpare, Lower Dibang Valley and Changlang. Study sites were selected by consulting the local community, traders, forest department and regional research institutes of the state. Four important habitat characters viz. canopy cover%, light intensity, aspect and elevation were determined in 25, 1 x 1 sqkm plots within the 9 selected sites of three district. Pearson's multi-correlation analysis was performed to understand the favorable niche of the targeted species. A total of 219 individuals were recorded along with the different habitat characters. The multi-correlation analysis determined that the species population are positively correlated with canopy cover % (0.77) whereas, light intensity (-0.857) was negatively correlated with population of the species. Which has supported the fact that *H.aromatica* has better survival in the habitat where canopy cover are more (>60%) with lesser light intensity (99.8-450 lux). The altitudinal distribution of the species was recorded under 100m-600m msl and it was found that in the range of 400-500 meters it has the highest number of species. Moreover, the species are distributed more in north west aspect followed by south east. From the present study it was confirmed that *H. aromatica* survive better in a well shaded habitat with elevation ranges from 100-600 m msl. The present data will be helpful for conservationist and progressive farmers in reintroduction and commercial cultivation of the species.

A pilot study on effect of gamma rays on an undervalued wild medicinal plant *Andrographispaniculata* (Kalmegh) (Oral)

Kshama Dwivediand Girjesh Kumar. Naithani Plant Genetics Laboratory, Department of Botany, University of Allahabad, India-211001, E-mail:kshama.dwivedi@gmail.com

Over the past few years, interest in medicinal plants has grown enormously from the use of herbal products as natural care for several frequent and chronic ailments. Owing to possessing narrow genetic base, increasing demand of herbal drug in various medicinal systems and adverse effect of natural calamity on their natural habitat and genetically active component; wild medicinal plants have become more prone to extinction. Considering the above fact in mind present investigation has been planned to create some stable novel genetic variation in an undervalued medicinal plant-*Andrographis paniculata* (a wonder herb in all natural medicinal system of India) for better survival in the present changing climate. Seeds were treated with four doses of gamma rays selected on the basis of LD50 i.e. 25Gy, 50Gy, 100Gy and 200Gy along with one set of non irradiated seeds and sown immediately in triplicates in the pre prepared earthen pots. Observation revealed that, 50Gy dose of gamma rays found stimulatory and had induced some significant ($p>0.5$) variation in several lucrative traits of *Andrographis paniculata* (Kalmegh) viz. Plant height, leaf area, number of branches per plant, length of internodes (mm), fruit length and seeds per fruit along with some novel induced mutant with low cytological aberration. Hence this very dose of gamma rays could be suggested for further mutation breeding experiments in mass scale for sustainable development of *Andrographis paniculata* (Kalmegh) by breeders.

In vitro antimicrobial activity of essential oils of medicinal plants against pathogenic bacteria (Poster)

Lokesh Kumar Tripathi[1], Pragya Pandey[2] and Tapan K. Nailwal[1]. [1]Department of Biotechnology, Kumaun University Nainital, Bhimtal Campus, Bhimtal- 263136, [2]CSIR- CIMAP, Pantnagar, U.S. Nagar, Uttarakhand. E-mail: lokeshtripathi16@gmail.com

Essential oils of medicinal and aromatic plants have been widely used as anti-inflammatory, antimicrobial, food enhancing and flavouring agents. In this study, essential oils of different medicinal and aromatic plants viz, Lemongrass, Geranium, Basil and Patchouli, were screened for their antibacterial activity against five MTCC bacteria namely *Pseudomonas aeruginosa, Salmonella typhimurium, Aeromonas hydrophila, Klebsiella pneumoniae and Staphylococcus aureus*. For antimicrobial activity, all essential oil were obtained by hydro-distillation and determined using agar well diffusion assay at the concentration of 50 µl. MIC was also calculated ranging from 50 µl to 5µl concentration by broth dilution method The lowest volume of oil which showed inhibition zone was regarded as MIC. All the oils were found to possess antibacterial activities with *P. greveolens* exhibiting higher level of inhibition on Gram negative bacteria and *C. citratus* on both Gram positive and Gram negative bacteria. *S. aureus* was most susceptible to *C. citratus* and *P. cablin*. *O. basilicum* exhibited greater response against *A. hydrophilla* and lowest response to *P. aeruginosa*. The inhibitory effects of all the oils increased with increasing concentrations. Investigations using higher oil concentrations is suggested and also its effect on long term activities in food products as potential preservatives.

Prospects of commercial medicinal plant farming in district Uttarkashi in Uttarakhand, India (Oral)

Madhu Thapliyal, Department of Zoology, Government PG College, Raipur, Uttarakhand. Email:madhuthapliyal@gmail.com

Himalayan region of Uttarakhand state of India has been well known to be a treasure trove of medicinal plants. Several of the tribal like Bhotiya, Jaunsari, Tharu, Raji, Buxa etc. have traditionally and sustainable used medicinal plants with some commercial success. Uttarkashi district (30°73′N 78°45′E) of Uttarakhand is also rich in medicinal plants and several studies/surveys have been carried out enlisting medicinal, aromatic and Nutraceutical plants. These include Kutki (*Picrorhiza kurroa* Royle), Bajradanti (*Potentilla fulgens*), Archu (*Rheum emondi* Wall.), Atis (*Aconitum heterophyllum*), Kaudi (*Gentiana kurroo* Royle), Salam Panja or Hath Panja (*Dactylorhiza hatagirea*) etc. but it is almost difficult to quote any commercial

level cultivation especially in remote mountain regions. During our 10 years of visiting these remote areas like Harsil, Chaurangi Khal, Bhatwari, the locals do have all the traditional knowledge but still are weary of taking up the commercial level mainly because of marketing. It is also necessary to implement the access benefit sharing mechanism as per biodiversity act because all these years the companies who have used locals to collect huge quantities of medicinal plants for a dirt cheap price have never made any contribution towards the local communities. It is hence important to first develop awareness, sensitization and a marketing system and this will lead to huge impact on commercial farming of medicinal plants in this remote region.

Characterization of nutritional and genetic diversity in millets of Uttarakhand (Poster)

Madhulika E. Prasad[1], Ishita Joshi[2], Navin Kumar[1], L.M.S. Palni[1]. [1]Dept. of Biotechnology, Graphic Era-Deemed to be University, UK 248002, India, [2]RMIT University, Melbourne VIC 3001 Australia. Email: navinbajpai@gmail.com

An increase in amylose concentration of starch granules reduces starch digestibility, making it resistant to digestion in the small intestine, causing a slow release of glucose into the bloodstream for a lower glycemic index. Such grains with increased amylose are highly desirable for populations challenged with diabetes mellitus and cardiovascular ailments. Although, Green Revolution in the twentieth century had resulted in rapid food security that provided adequate calories for body functions, it led to the excessive use of high yielding crop varieties that over time has caused micronutrient malnutrition. In countries challenged in resources but rich in biodiversity, lesser known grains such as millets is a very attractive candidate for diet diversification. They are a highly nutritious resource of nutrients and provide the highest number of calories (75%) next to wheat and rice. Millets are categorized as 'Functional Food' due to low glycemic value, high fiber content and therapeutic features. Since crops growing at cold temperatures exhibit a different interaction of phytohormones and starch accumulation, an extensive study of the influence of cold temperature on starch accumulation will identify the environmental niche of high altitude millet populations. We propose that studying available biodiversity grown in cold temperatures of hilly regions have potential for unravelling germplasm that exhibit higher resilience to environmental stresses and low-input farming. We are in the process of studying the available biodiversity in grain composition, genetic constitution and environmental adaptability of millet populations from high altitudes in Uttarakhand. Proximate analysis of Finger millet, Barnyard millet and Foxtail millet has revealed differences in different parameters. In the present study, we have also proposed to characterize the alleles of GBSS1 (an amylose encoding gene) in different field races of millets.

Ethno-botanical Application by Bhotiya Tribal Community (Jad) of Uttarkashi district of Uttarakhand State (Oral)

Mahendra Pal Singh Parmar[1], Madhu Rana[2] and Shanti Parmar[3] Department of Botany Govt. P.G College Uttarkashi(UK) [1,2] Sankalp Samajik Sanstha Uttarkashi[2]Email-mahen2004@rediffmail.com

Bhotiyas are transhumant community of semimongoloid people of Tibetan origin, mainly inhabiting the high altitude region of Indian Central Himalaya and Indo-Nepal border, a zone of ethnic intermixing and cultural assimilation. The eight major Bhotias groups of Uttarakhand are Johari, Jeethora, Darma, Chaudansi, Byansi, Marchha, Tolcha, and **Jad** are scattered over the eight main river valleys known as Johar, Darma, Byans, Chaudans (Pithoragarh district of Uttarakhand), Mana, Niti (Chamoli district of Uttarakhand), Nilang, Jadung(Uttarkashi district of Uttarakhand) respectively.

Among the native societies of the Central Himalaya the **Jad** (Bhotia) are still one of the under developed and smallest separate tribal society. **Jad** are the native of Nelang and Jadung remote village (a part of Indian Trans-Himalaya), a high altitude cold desert area, harbouring many rare and endangered plant and animal species. This area, falls at the height of over 11,000 ft Mean Sea level (MSL) and characterized by high solar intensity, high aridity, low temperature, inadequate soil and short growing season has low plant productivity in Uttarkashi district of Uttarakhand. After Indo Tibet War 1962, they Indian Army shifted in Harsil, Bagori and Beerpur Villages of Uttarkashi district.

They have a excellent knowledge on the use of high altitude medicinal plants due to their constant and close association with the Alpine and sub-alpine forests. These people use the medicinal plants for their effectiveness, lack of conventional health care facility and cultural preferences and they have attained quite a good knowledge on both valuable and adverse effects of plants. However, this huge knowledge on medicinal plants verbally which had been passed down from their ancestral generation, is slowly diminishing and deteriorating due to changing socio-economic and cultural practices and shifting of young generation to urban areas. Several medicinal plants have been listed as endangered, vulnerable and threatened due to commercial over exploitation, unsustainable harvesting practice and climate change. The loss of traditional knowledge is irreversible just as the loss of species.

The documentation on ethno medicinal plant practices of Bhotiya tribe of Uttarakhand was done by various workers in a sporadic manner to recognize the use of plant species for different purposes. In the Central Himalayan region documentation of ethnobotanical knowledge was done by various workers to understand the use of plant species for different purposes. Though some of them have been reported about the medicinal plants uses in health care system among the tribal communities living in similar geographical region however, small community residing in same area having own traditional knowledge is not documented yet by workers properly.

Hence, there is an immediate need to document the various uses of the medicinal plants used by the tribe before some of them disappear from the areas or before switching over of the tribe to modern system of medicine. The following is the list of some important high altitude medicinal plants used by the Jad tribe along with their local names, Sanskrit names or names as mentioned in the Ayurvedic system of medicine, locality of collection, habit, part/s used, source of collection and period of collection.

The antioxidant and antibacterial activity of *Ocimumbasilicum* against human and plant pathogenic bacteria (Oral)

Manjula Bomma, F.A. Okafor, and S.R. Mentreddy. Biological and Environmental Sciences, Alabama A&M University, Normal, AL 35762. USA. Email: mbomma@bulldogs.aamu.edu

Plant bioactive compounds, known for their antioxidant and antimicrobial activity are often considered safer than synthetic antioxidants. Basil *(Ocimum basilicum),* well known for its antioxidant activity and medicinal properties is widely used in natural therapeutics. In this study, free radical scavenging activity and antibacterial activity of crude chloroform (CE) and methanolic leaf extracts (ME), as well as the essential oil (EO) of four accessions of *Ocimum basilicum* were assessed for their activity against endospore forming bacteria *B. subtilis* (BS) and fire blight causing plant bacteria Erwinia *amylovora* (EA). Free radical scavenging activity was determined by the DPPH method. The leaf extract and essential oil effect on the growth rate of bacteria were determined by using the BioScreen Analyzer. The basil extracts inhibited the growth of the test organisms more than the positive control (standard antibiotic streptomycin sulfate). The DPPH assay shows that the highest antioxidant activity occurred in the EO extract at 100 µl. mL^{-1} across all *O. basilicum* accessions (85%), followed by CE (37%), and ME (28%). The IC_{50} values of ME of PI 354872, CE of PI 652071 and EO of PI 172996, were 7.65 µl. mL^{-1}, 10.03 µl. mL^{-1}, and 14.25 µl. mL^{-1}, respectively compared to 15.25 µl. mL^{-1} of the standard, ascorbic acid. The growth of BS was reduced by 89% by the ME extract of accession PI 172996; 68% by the EO of PI 354872; and 31% by the CE of PI 652071. The methanolic leaf extracts and EO of accession PI 652071 reduced the growth of EA by 75% and 45% respectively. This study suggests that different leaf extracts and essential oil of *O. basilicum* have potential antimicrobial activity against both, human and plant pathogenic bacteriaperhaps due to their free-radical scavenging compounds.

Medicinal use of lemon grass in treating cancer and diabetes (Poster)

PP. Sreevidya, Mansi Singh, Kerala agricultural University Aromatic and Medicinal Plant Research Station, Graphic Era (deemed to be university). E mail: mansigeusingh@gmail.com

The abstract consists of medicinal use of lemon grass oil in terms of treating cancer and diabetes, oil of lemon grass has a promising anticancer activity and cause loss in tumor cell viability by activating the apoptotic process as identified by electron microscopy, results also show that lemongrass has stopped cervical cancer cell from spreading, but it also intuited cancer cell apoptosis also aerial parts of cymbopogan have folkloric medicinal use in diabetes. The abstract presented here has profound implications for future studies of lemon grass and may one day help solve the problem of cancer and diabetes.

Ashwagandha a rejuvenator and an anti-cancerous herb (Poster)

Mariam Nawaz, Department of biotechnology,Graphic Era University, Dehradun, Uttarakhand248001 ,
Email : mariamnawaz2016@gmail.com

Withania somnifera (Ashawagandha)(Indian Ginseng) is very revered herb of the Indian Ayurvedic system of medicine as a Rasayana(tonic) , it contains highly potent phytochemicals which are alkaloids (isopelletierine, anaferine, cuseohygrine, anahygrine, etc.), steroidal lactones (withanolides, withaferins) and saponins (Mishra, 2000 et al., 2000). It is used for various kinds of disease processes and specially as a nervine tonic ,many scientific studies were carried out and its adaptogenic / anti-stress activities were studied in humans.
In experimental models it increases the stamina of rats during swimming endurance test and prevented adrenal gland changes of ascorbic acid and cortisol content produce by swimming stress. Pretreatment with Withania somnifera (WS) showed significance protection against stress induced gastric ulcers. WS have anti-tumor effect on Chinese Hamster Ovary (CHO) cell carcinoma ,and the researches are being done against human cancer also found effective against urethane induced lung-adenoma in mice and in some cases of uterine fibroids, dermatosarcoma and is useful against Parkinson's, Huntington's and Alzheimer's diseases.

An effective validated method for HPTLC-fingerprinting of alkaloids and glycosides from multiple plant parts of three *Terminalia* spp. (Poster)

Hakim Masuma[1] and Illa Patel[2].Department of Life Sciences, Hemchandracharya North Gujarat University Patan-384265, Gujarat, India E mail: hakim.masuma1@gmail.com

Present study is to develop a HPTLC fingerprint profile of alkaloids and glycosides obtained from the methanol extracts of four different plant parts of *Terminalia arjuna*, *T. bellerica* and *T. chebula*. These three trees have several curative properties for several diseases like cardio-protective values. The qualitative phytochemical analyses of plants parts viz. stem, leaf ,root, and fruit using solvents like water, acetone, petroleum ether and methanol the extracts of all the plant parts of *Terminalia* spp were prepared separately wherein the methanol extracts exhibited the presence of maximum alkaloids and glycosides. The HPTLC fingerprinting analysis of methanol extracts was carried out on silica gel $60F_{254}$ HPTLC aluminum sheets with CAMAG Linomat 5 applicator. The plates were developed using ethyl acetate:toluene:formic acid (10:10:1; *v*/*v*/*v*) mobile phase. Alkaloids and glycosides were detected at 254 nm, 366 nm and 540 nm (after derivatization). These developed fingerprints would eventually be of great benefit in identifying or differentiating the alkaloids and glycosides in the form of marker compounds in the three *Terminalia* spp. mentioned.

Global Economy of Medicinal Plants (Oral)

Mohammad Hossain Karim[1]Department of Recourse Economics, Kharazmi University,Tehran-Iran, Alireza Karbasi[2] and Seyed hossein Mohammadzadeh[2], Agricultural Economics Department, Ferdowsi University of Mashhad, Iran. E-mail: karimsistani482@gmail.com.

Recent years experiences show that emphasis of economy on income of single product same as petroleum selling results in instability of export income. Orientation of export policies may be changed for exporting of non-oil goods including export of agricultural products to decrease dependence of Iran economy to export of petroleum and moving toward goals of resistance economy policy. Among agricultural products, herbs are the most important export items of agriculture which have great portion in creating added value in this sector and making foreign exchange. Study of statistics and previous years' time series information shows that export of these products has not suitable situation despite good rank of Iran in production and cultivation of herbs, although India had an acceptable and good rank. This research is going to study position of Iran and India in global market of herbs emphasizing on damask rose and its comparison with various countries. Although recent years drought and contraband occurrence have result in fluctuation of production but expert views to chain of production to export cause increase of production and export. The most important challenges of herbs commerce and becoming undesirability of Iran position in foreign market of herbs are lack of technical knowledge in export, weakness of foreign marketing, weak support of government, high expenses of standardizing products for export, lack of cooperation between export trade unions and agencies in herb industry and their negative competition, incorrect recognition of aiming market, lack of having trade mark for many export items of herbs, political risks and decrease of bargaining power of foreign trade sector in foreign markets. Finally, four strategies based on Iran/India related study are provided for Herbs Global market improvement.

Morphology and *In vitro* propagation of kidney stone curing plant *Corbichonia decumbens* – A lithophytes (Poster)

Meena Barupal, NS Shekhawat and Vinod Kataria. Department of Botany, Jai Narain Vyas University, Jodhpur, Rajasthan, India. E-mail: meena.barupal@gmail.com

Corbichonia decumbens (Forsk.) Exell, is one of lithophytes favourably grow on rocky or pebbly rough surface. It is a decumbent or prostate herb belong to family Lophiocarpaceae, order Caryophyllales. The plant is a hot evader by shortening their life cycle with in few favourable months and for rest of time remain perennial only in form of buried woody roots. It is grazed by camels with gusto. Locally plant known as Pather-Chatti (rock- bed), Moti-Luni, or prostrate purslane or stone plant. *C. decumbens* has antioxidant, anti-inflammatory, antiulcer, antimicrobial and antinociception medicinal properties. The plant is used as a folk medicine to cure kidney stone and gonorrhoea. Therefore to avail the plant throughout the year and for large scale propagation, the *in vitro* profile of the plant was studied. *In vitro* regeneration of the plant was obtained by axillary bud activation from old and new nodal explants of the plant on optimum concentration 4.44 µM of 6-Benzylaminopurine, and by callus obtained from whole seed. The callus were proliferated optimum on combination of 1 Naphthalene acetic acid; 6-Benzylaminopurine and Kinetin with concentration 1.34, 1.89, and 0.46 µM respectively. The optimum callus regeneration was found on combination of 6-Benzylaminopurine and Kinetin with concentration 2.22 and 0.46 µM respectively. *In vitro* rooting of plantlets was obtained after pulse treatment of Indolebutyric acid (1x) to basal part of the regenerated plantlets.

Economic growth in pharmaceutical industries using sustainable traditional knowledge flow in Himalayan region: Future trends and challenges (Poster)

Megha Upreti, Shivangi Solanki and Sachin Sharma. Department of Biotechnology and Department of Computer science and Engineering, Graphic Era University, Dehradun, 248002. E-mail: sachin.cse@geu.ac.in

Himalaya has been supreme benefactor in many ways from millions of years. Medicinal plants have played key roles in the lives of tribal peoples who are living in the Himalaya by providing products for both food and medicine. Traditional knowledge refers to the knowledge, innovations, and practices of indigenous and local communities around the world. The Pharmaceutical Industry in India is one of the largest, ranks 4th in the world, pertaining to the volume of sales. The estimated worth of the Indian pharmaceutical industry is US$ 6 billion and the growth rate is 13% per year. Pharmaceutical industries are using traditional knowledge to develop various pharmaceutical and nutraceutical products. This research discusses the effects of traditional knowledge of medicinal plants which is used by top pharmaceutical industries. It explains the sustainable methods, strategies and post-manufacturing treatments for the development of traditional knowledge based pharmaceutical products. The main objective of this research is to discuss the future challenges faced by top pharmaceutical industries and development of their future trends which can ultimately account for immense economic growth of India.

Genetic diversity analysis of Garlic (*Allium sativum*) genotypes, using ISSR markers (Poster)

Mehak Gupta[1], Akhilender Deep[1], Aman Shrivastav[1], Ankit Maderna[1]and Dr. Susheel Sharma[2]. [1]Graphic Era University and [2]Sher-e-Kashmir University of Agricultural Sciences and Technology. E-mail: aman.edu.in@gmail.com

Garlic (*Allium sativum* L.) is second most widely consumed Alliums, next to onion worldwide. Garlic cloves are consumed as a condiment and seasoning vegetables in many recipes. Its young leaves are also consumed as green vegetable. Garlic cloves are used as flavouring agent in many processed food as garlic paste, powder, pearls, pharmaceutical etc. Garlic belongs to the family alliaceae genus *Allium* and species *sativum.* It is herbaceous annual for the bulb production. Samples were collected from different region of Jammu and Kashmir (Baramulla, Budgam, Pulwama). The genetic diversity of 20 garlic accessions were investigated using five inter-simple sequence repeat (ISSR) primer. A total of 83% of polymorphic loci were detected among these accessions. Cluster analysis using the un-weighted pair group method with arithmetic averages (UPGMA) based on the allele frequency data, classified the accessions into three groups. The results of principal component analysis (PCA) were consistent with those of the cluster analysis. PCA showed that each of these three groups exhibited significant variation in agro-morphological traits. These findings suggest that 5 ISSR primers identified could define valuable markers for genetic diversity for use by plant breeders.

Turmeric (*Curcuma spp.*): A potential medicinal crop for small-farm owners in Alabama, USA (Oral)

S. Rao Mentreddy, Thilini Ranatunga, Kamala Bhat, Keonna Hunter, Lam Duong, and Andrea Byars. Alabama A&M University, Normal, AL 35762. Email: srinivasa.mentreddy@aamu.edu

Turmeric (*Curcuma longa*), a popular condiment, industrial, and a medicinal crop in Asia is currently gaining popularity as a medicinal plant due its anti-inflammatory properties in the U.S.A. However, the lack of adapted varieties that combine high rhizome yield with high curcumin levels, and production methods are major factors limiting its commercial production in the U.S. To address this limitation, fourteen turmeric genotypes of Vietnamese and Indian origin were assessed for their growth, yield, curcuminoid, and elemental content using organic production methods in North Alabama. The genotypes were planted in a randomized block design with four replications. Three plants from the middle row of each plot were harvested to determine dry rhizome yields and their curcumin, and elemental content. The curcumin and elemental contents were determined using HPLC and Inductively Coupled Plasma Spectrophotometer, respectively. There was a significant genotypic variation for all variables measured. The fresh and dry rhizome yields ranged from 1.70 (CL7) to 0.24 Kg/Plant (CL3). The dry rhizome yields ranged from 0.011 to 0.85 kg/Plant. The percentage curcumin content varied between 0% in C. Zedoaria genotypes to 2.47% in CL6. Among three curcuminoids measured, curcumin content was greater than besdesmethoxy or desmethoxy curcumins. In general, potassium was the most dominant (36 mg/g) element followed by Ca, Fe, and AL. The study showed that turmeric has the potential for commercial production in Alabama and perhaps the southeastern U.S. The wide variation for both rhizome yield and curcumin content among these genotypes indicates the potential for variety improvement.

Comparative efficacy of different extracts of *Murraya koenigii* leaves in the treatment of experimentally induced rheumatoid arthritis (Oral)

Mythily Subramaneyaan[1] and Rafat Sultana Ahmed[2].[1]Division of Biochemistry, School of Basic and Applied Sciences, Galgotias University, Greater Noida and [2]Department of Biochemistry, University

College of Medical Sciences and Guru Teg Bahadur Hospital (University of Delhi), Delhi. Email: drmythily.s@gmail.com

Despite recent successes with biological agents as therapy for rheumatoid arthritis (RA), many patients fail to respond adequately to these treatments, necessitating a continued search for new therapies. Plant-derived medicinals continue to occupy an important niche in the treatment of diseases worldwide. *Murrayakoenigii* (curry leaves, MK) is an edible herb used in traditional medicine and is known to possess anti-inflammatory, anti-oxidant activity. The present study investigated the efficacy of aqueous and methanolicextract of MKleaves (MKAq and MKMe) in treatment of RA using collagen induced arthritis model.Rats were randomly divided into nine groups. Group-2, 3, 4, 5, 6, 7, 8 and 9 were induced for RA and treated with vehicle, methotrexate (0.25mg/kg b.wti.p. once weekly), MKAq and MKMe – 100, 200 and 400 mg/kg b.wt orally, daily respectively for 20 days. Group 1 (un-induced) served as control. The effect of treatment in rats was monitored by assessing biochemical parameters in serum and macroscopic and histological evaluation in knee joints. Arthritic rats showed significant increase in autoantibodies, CRP, MMP-8, TNF-α, IL-1β, IL-6, MDA and GST activity along with depletion of GSH and decrease in FRAP and IL-10 in arthritic animals. Treatment with different doses of MKAqand MKMe significantly ameliorated these biochemical changes and the results are comparable to that of methotrexate treated rats. MKAq limited the erosive action of the disease in articular joints of knee and synoviocytes infiltration effectively as compared to MKMe.These findings suggest that MKAqand MKMehas the ability to remit the symptoms of RA and could have therapeutic potential for treatment of RA.

Evaluation of CASPASE – 3 mediated apoptotic activity of *Mansoa alliacea* (Lam.) A. H. Gentry on A-431 cell line. (Oral)

L. Rajanna and N.Vinod. Department of Botany, Bangalore University, Bengaluru – 560 056. Email: mr.v202544@gmail.com

Mansoa alliacea (Lam.) A. H. Gentry is a woody vine commonly called as “Garlic vine”, belonging to the family Bignoniaceae. Diallyl disulphide is one of the major components present in the leaves of *M. alliacea*. The present study aims at evaluating CASPASE-3 mediated apoptotic effect of *M. alliacea* leaf extracts against Human epidermoid carcinoma cell line A-431. Leaf extracts were prepared by using different solvents like petroleum ether, chloroform, ethyl acetate, ethanol and water and tested for cell viability using MTT assay. Ethyl acetate and ethanol extracts showed 71.31µg and 73.32 µg IC_{50} values respectively. Annexin V and PI stains were used to check apoptosis and CASPASE-3 expression was evaluated by FITC Caspase 3 antibody and Campothecin as positive control. Ethyl acetate and ethanol extract showed 7.29% and 17.63% of Late Apoptotic cells and 90.42% and 79.82% of early apoptotic cells compared to Standard drug Campothecin showing 21.31% of late apoptotic cells and 74.53% of early apoptotic cells. The results revealed that the Ethyl acetate and ethanol leaf extracts of *M. alliacea* may have possible therapeutic potential against Human epidermoid carcinoma cell line A-431.

An Ethno-botanical Study in Gurez Valley of Jammu and Kashmir State. (Oral)

Gowher Guna[1] and Nazima Rasool[2]. [1]Department of Botany, ICSC, Hawal, Srinagar, J&K, India; [2]Department of Botany, Satellite Campus KU, Kargil, 194105, J&K, India. rasoolnazima@gmail.com

An ethno-pharmacognostic survey was conducted in the Gurez Valley of the Jammu and Kashmir State to document the therapeutic uses of different plant species along with method of preparation and administration of drugs. Structured interviews were conducted to gather the traditional knowledge from local people inhabiting the Valley, survey in each locality usually started with the interview of elderly and experienced people. In the present study, 56 plant species belonging to 53 genera in 28 families, growing in Gurez valley, were found to have medicinal uses. Scientific names, vernacular names and medicinal use of these species along with the part /parts used and method of preparation of the drug have been recorded in the present study.

***In vitro* screening of wild edible fruits for their free - radical scavenging properties (Poster)**

Neelaxi Pandey, Satpal Singh Bisht, Mahendra Rana, Arvind Jantwal. Department of Zoology, D.S.B. Campus, Kumaun University Nainital, Uttarakhand, India. Email: neelaxihrdp@gmail.com

Kumaun Himalaya is characterized by a rich diversity of wild edible fruits and a rich heritage of medicinal plants. During this investigation seven wild edible fruits species from different families were selected. It was observed that *Diploknema butyracea* (Chura), *Rubus biflorus* (Kala Hisalu), *Pyracantha crenulate* (Ghighharu), *Ficus semicordata (*Khunia), *Pyrus pashia* (Mehal) are the commonly and *Rubus biflorus* (Kala Hisalu) are edible but less consumed wild edible fruits. This Qualitative and Quantitative analysis of wild fruits indicates that even at low concentrations, these fruits species contain high nutraceuticals values. This study suggests that wild edible fruits can be used as valuable natural antioxidant, analgesic drug and has immense scope as an effective source to fight against the free radical generated disorder by modulating the immune system.

Ethnomedicine for the treatment of Schizophrenia: An approach for the improvement of therapeutics. (Poster)

Neema Tufchi, Devvret Verma, Kumud Pant, Syed Mohsin Waheed. Department of Biotechnology, Graphic Era deemed to be University, Dehradun, UK, India. E-mail- neematufchi@gmail.com

Schizophrenia is a severe disorder of brain development and plasticity; it affects the most basic human processes of perception, emotion, and judgment. It results from abnormalities that arises in early life and disturbs the normal development of brain with a lifetime risk of 1%.The symptoms of this psychotic disorder include hallucinations, delusions, flat affect, forgetfulness, alogia, avolition, and anhedonia. Although there are many antipsychotic drugs marketed (chlorpromazine, clozapine, haloperidol, olanzapine and risperidone) for the treatment of schizophrenia, but they have some serious unsympathetic effects like weight gain, dizziness, tardive dyskinesia, diabetes, neuroleptic malignant syndrome.Also approximately 20% of the patients do not respond effectively to the treatment. Ayurvedic herbal medicines thus can be advantageous on this aspect, since they can be used for long term without having any stern side effects and also contains antioxidant properties. Several herbal combinations are available that alone can be used by patients having mild to moderate symptoms. For the patients with severe symptoms of schizophrenia, the herbal medicines can be included with allopathic medicine as adjuvant therapy, so that therapeutic effect is maximize without increasing the side-effect load. In the present article text mining was done to extract out the information on all the essential herbal plants and their essential secondary metabolites. A library of these compounds has been created that can be used by researchers to formulate new and potential drug against the disorder.

Healing properties of Himalayan medicinal plants (Poster)

Nikita Goswami and R. Sarmah, University Institute of Biotechnology, Chandigarh University, Gharuan, Mohali, Punjab, Email: nikita.uibt@cumail.in

Plant plays a vital role for existence of life on earth. India has a rich biological diversity and subsequent to the dawn of the civilization, medicinal plants have been most important resource of mankind. Medicinal plants are found in different areas of India such as in tropical areas Aravallis and Himalayas, Western and Eastern Ghats, the Vindyas and Chota Nagpur plateau (Sharma and Kumar, 2013; Biradar, 2015).They hold high amount of biologically active phytochemical substances such as saponins, triterpenes and other secondary metabolites, which are integrated in alkaloids, glycosides, corticosteroids and essential oils. Indian system of medicines engage 80% of the material derived from the plants (Vaishnav *et al*., 2015).The Himalayan region is a complex geographical region with several local warming and cooling domains and slopes. The Soil over this region is mountainous, rust-coloured and rich in debris of decomposed leaves. The paper discusses about the various medicinal plants found in Himalayan region and its beneficial effects.

A proportion of medicinal plants found in Himalayan and Northern region which have medicinal properties are *Withania somnifera, Lavendula angustifolia, Terminalia arjuna, Celastrus paniculatus Willd* and *Terminalia chebula. Withania somnifera* Dunal have anti-oxidant properties, great restorative esteem, and cure neuro degenerative illnesses. *Lavendula angustifolia* is having antibacterial, antifungal, antispasmodic, antioxidant activities (Shellie *et al.*, 2002; Śmigielski *et al.,* 2008). *Terminalia arjuna* is helpful in treating ulcers, asthma, bronchitis, tumors, and hemorrhages. *Celastrus paniculatus Willd* is used as powerful brain tonic, helps in physical weakness and mental confusion. *Terminalia chebula* helps in curing asthma, sore throat, gout (Aneja and Joshi, 2009) and digestive issues. Medicinal plants as a potential source of therapeutic components have attained a significant role in health system all over the world not only in disease condition but also for maintaining proper health.

Effects of *Ginkgo biloba* extract on hypobaric hypoxia induced memory deficit and neurodeganaration in rats. (Oral)

Neetu Kushwah[1], Vishal Jain[2], Manisha[1],Dipti Prasad[1], Bhuvnesh Kumar[1,2], Nilofar Khan[1]. [1]Dept of Neurobiology, [2]Dept of Neurophysiology, Defence Institute of Physiology & Allied Sciences, DRDO, Lucknow Road, Timarpur, Delhi-110054. E-mail: nilofar.ashraf@gmail.com

A large number of stressors like hypoxia, ischemia, and aging can lead to oxidative stress including ROS production, lipid peroxidation and DNA damage. Oxidative stress may in turn lead to the pathogenesis of neurodegenerative disorders. Extract of *Ginkgo biloba* leaf (GBE) is among the most widely used traditional herbal medicines, and has been used to treat various diseases including atherosclerosis, diabetes, poor circulation, fatigue, vertigo, tinnitus, and cognitive disorder viz anxiety and depression. The present study is aimed to explore the possible protective effect of GBE on hypobaric hypoxia (HH) induced memory impairments in rats. Sprague-dawley rats were exposed to HH at an altitude of 25,000ft in animal decompression chamber for 14 days. Special memory assessment by Morris water maze was performed prior to and after hypoxic exposure. Results from the present study revealed that GBE significantly decreases path length and latency to reach the platform in the memory testing and increases the number of entries and platform crossing in the probe trial. GBE ameliorated the HH induced neuronal damage in hippocampus as evident from decreased number of fluorojade B positive neurons and caspase-3 positive neurons which were otherwise increased in 14 days of HH exposure. Hypoxic exposure also damages the neuronal morphology of the neurons in the cresyl violet staining however, GBE recovers the neuronal morphology. Thus, the results indicate that GBE has protective effect on HH-induced memory impairment and neurodegenaration.

Raising of salt tolerant saplings of *Jatropha curcas* employing *in vitro* techniques. (Poster)

Khurana N[1] and Sharma S[2]. [1-2] University Institute of Biotechnology, Chandigarh University, Gharuan (Punjab); E-mail: nishu.uibt@cumail.in

Jatropha curcas commonly known as “Physic nut” or “Nettlespurge” belonging to the family Euphorbiaceae can grow well in adverse climatic conditions because of its low moisture demands, fertility requirements and tolerance to high temperatures. The substitution of biodiesel produced from plantations on wastelands (e.g., Jatropha plantations in India) for conventional fuel has gained widespread attention (Frencis *et al*., 2005). Jatropha is a little known herbal drug of Unani medicines. It is a potential source of herbal drug in dental complaints. Raising of salt tolerant samples of *J. curcas* employing *in vitro* techniques by standardising the concentrations of hormones and salts (NaCl) was of preeminent concern. In present study auxillary buds and nodes were selected as ex plants. MS media in combination with citric acid, Indole Acetic Acid (25µl/l-100µl/l), 6-benzyl amino purine (25 µl/l-250 µl/l, were employed. Medium supplemented with different concentrations of adenine sulphate and in combination with glutamine were chosen for *in-vitro* growth. It was observed that MS media in combination with citric acid (0.01%) as well as IAA (25µl/L) and BAP (25µl/L) showed best survival and growth results in terms of axillary buds and nodes. Best rooting was observed when MS Basal media supplemented with salt (NaCl) at concentration of 0.03% and 0.04% was used. The outcomes were reproducible in varying concentrations of IAA, BAP, citric acid and NaCl. The present study was focused on the raising of salt tolerant samplings to produce salt tolerant saplings that can be cultivated in salt affected waste and barren land in India and execute the needs of alternative fuel as well.

Conservation of some selected rare medicinal orchid species through post harvest handling of pods, seeds and pollinia (Poster)

Manuj Awasthi[1] and Jaidev Chauhan[2]. [1]Department of Horticulture, Sardar Vallabh- bhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh-250110, India. [2]High Altitude Plant Physiology Research Centre, HNB Garhwal University, Srinagar Garhwal, Uttarakhand, India. E-mail: jaidevchauhan678@gmail.com

The use of post harvest handling plays an essential role in conservation of orchids since they play an important role in our biodiversity with about 25,000 species, orchids are the largest plant family on earth, At the same time, many orchid species are rare and endangered. In efforts to cryostore germplasm of Indian orchid species. The first step is to devise the handling methods for various explants of different orchid species so that materials can be safely transported from one research centre to another before long term storage in viable conditions. The experiments were conducted on pods of *Coelogyne nitida, Cymbidium iridioides and Thunia alba*. Pollinia of species *Cymbidium erythraeum*. Flowers of species of C*oelogyne ovalis, Cymbidium elegans* were used. It is intended to develop cryoprotocols for seeds and pollinia of diverse orchid species for which viability retention isessential. In this procedure for pods, flowers and pollinia were transported from Darjeelijng, Shillong and Imphal to cryolab at NBPGR in polybags. Material received within 3 days of harvest showed healthy condition. Healthy undamaged immature and mature pods, fully opened flowers and pollinia extracted from flowers after receiving at cryolab were processed fromcryostorage within one month of harvest seeds were found to retain high viability. Pollinia extracted from flowers on receiving did not show viability. However pollinia sent by mail enclosed in polypropylene cyrovials showed good viability on receipt at the processing laboratory.

Medicobotany of medicinal plants of Himalayan region in panchakarma therapy. (Oral)

[1]Nivedita Srivastava and [2]Rajan Kumar Gupta.[1]Navjivanam Hospital, Rishikesh, UK; [2]Centre of Advanced Study in Botany, Banaras Hindu University, Varanasi 221005 U.P. Email: rajankgupta1@rediffmail.com

Medicinal herbs are staying a comeback and "Herbal Renaissance" is happening all over the globe. The Ayurveda, Siddhartha, Unani and folk tribal medicines are major systems of Indigenous medicines. Among these systems, Ayurveda is most developed and widely practiced in India and medicinal herbs play the key role in Ayurvedic system of healing because these medicinal herbs and product which made up of the herbs today symbolize safety and without side effects in contrast to the synthetics that are regarded as unsafe to human and environment. So the blind dependence on synthetics is over and people are returning to the naturals with hope of safety and security. Over three quarters of the world population relies mainly on the medicinal herbs for health care. Panchkarma is a detoxifying process of Ayurveda that eliminates the toxins from the body. Different therapy curing diseases and revitalizing the human body. The use of various medicinal plants in this Ayurvedic process of Uttarakhand plays important role as a key ingredients of treatment procedure. Since these plants inherently possess specific therapeutic properties. The quantity and composition of specific medicinal plants used for an individual is determined by his body constitution and specific diseases to be cured. The present work is based on the practicing the Panchakarma therapy in the people of Himalayan region and returning back to the natural healing.

A brief perspective ofwood borer, *Z. conferta* Walker on *Aquilaria malaccensis* Lamk. (Oral)

Nizara D. Barthakur[1], R. Raja Rishi[2] and R. K. Borah[3], Rain Forest Research Institute, Jorhat[1,3] Assam and Institute of wood science and Technology, Bengaluru[2], Email:nizaradb@gmail.com.

Zeuzera conferta, is a lepidopteran borer belongs to the Family Cossidae, is found associated with the phenomena of agar wood production. The larva of *Z. conferta* makes a long zigzag tunnel in the trunk of agar tree *Aquilaria malaccensis* Lamk. In mature infected trees black oleoresin deposits are seen. The tree is famous for its black oeloresinous deposit and agar oil (the essential oil), which is the most expensive stabilizing agent, used in perfume industry. The Agar wood is very lucrative in market. People involved in agar tree plantation and agar wood collection believes that agar formation is primarily due to the insect attack. Traditionally it is found that presence of borer injury in the tree is considered as a good indication of agar formation in an agar tree. Such type of tree along with sufficient no of hole fetches high value in market. Agar traders believed that agar formation is primarily due to the insect borer attack. Agar wood is harvested by felling the tree and then splitting the tree to open. But external signs of the presence of agar oil are not always obvious. As a result, agar trees are often cut down indiscriminately in the search for those containing agar oil leads the species become endanger. Information on the bioecology of *Zeuzera conferta* and its role on agar formation is meagre Therefore research efforts needs to focused on the biology of *Z. conferta* and its use for possible infestation and agar production. The detailed photographic illustrated diagnostic feature with biology along review of fungal pathogen and future strategies to elucidate the role and mode of transmission of Pathogen associated with agar has been discussed.

Peak variation on the antioxidant potential of medicinal plant *Angelica glauca* of Himalayan region. (Poster)

Noopur Singh[1] and Praveen Kumar M[2], [1]HNB University, Srinagar, [2]Maya College of Agriculture and Technology, Selaqui, Dehradun- 248001(pkumarapm@gmail.com)

Seeds of choru (*Angelica glauca*) a medicinal plant used traditionally in early Indian household for medical purpose . It has a potent medicinal properties. Methanolic and Acetonic extracts were prepared from seeds of choru (*A. glauca*) for estimation of antioxidant activity. In this study, the effect of variation of altitude on the total B-carotene and DPPH content of seeds of *Angelica glauca* along with associated antioxidant potential was investigated. It was observed that the extracting solvent significantly affected the total antioxidant potential of extracts with higher antioxidant capacity had higher B-carotene contents also. It could be convincingly seen that solvent and altitudinal variations have profound effects on the B-carotene and DPPH content, antioxidant activity of all the samples of *Angelica glauca*. However, all the measured parameters of samples from high altitudes were relatively higher than those collected from lower altitudes. The outcome of this study also suggested that environmental temperature plays a significant effect on all the measured parameters.

Trans-Himalayan medicinal plants wealth of India (Oral)

OP Chaurasia, Defence Institute of High Altitude Research (DRDO), Leh–Ladakh, India. E mail:opchaurasia1998@gmail.com

The trans-Himalayan belt (Ladakh & Lahaul-Spiti) of India is a unique region of the world characterized by extreme temperature variation, low precipitation mostly in the form of snow, thin atmosphere with high UV-radiation, high wind velocity, sparse plant density, short growing season and fragile ecosystem. The trans-Himalayan plants exhibit characteristic features in terms of morphological, anatomical, physiological and reproductive to cope up with high altitude environments. Plant biodiversity play a vital role in day to day life of human beings. Man has started using plants for various purposes viz. food, medicine, feed, fodder, fuel, ornamental etc. since his origin on the earth. Like other parts of the Himalaya, Ladakh (J&K) and Lahaul-Spiti (HP) are also the treasure house of value medicinal plants which play major role in traditional system of medicines especially Sowa Rigpa System (Amchi system of medicine) since ages. Defence Institute of High Altitude Research of DRDO has carried out extensive ethno-medico-botanical survey of high altitude regions of trans-Himalaya, covering far flung and high passes past 20 years and collected approximately 1100 plant species of various uses based on ethno botanical information, out of them, approximately 500 species are of medicinal values. The widely used medicinal plants from Ladakh and Lahaul-Spiti are *Aconitum heterophllum* (Aconite), *Bergenia stracheiy* (Pashanbheda), *Capparisspinosa* (Caper bush), *Colchicum luteum, Dactylorhiza hatagirea* (Spotted heart orchid), *Ephedra gerardiana* (Ephedra), *Hippophae rhamnoides* (Seabuckthorn), *Hippophae salicifolia* (Seabuckthorn), *Hippophae tibetana* (Seabuckthorn), *Inula racemosa* (Pushkarmool), *Lycium ruthenicum* (Black Goji berry), *Meconopsis aculeaa* (Blue Poppy), *Origanum vulgare* (Oregano), *Podophyllum hexandrum* (Mayapple), *Rheum webbianum* (Rhubarb), *Rhodiola imbricata* (Arctic root), *Saussurea lappa* (Costus), *Thymus serpyllum* (Wild thyme), etc. Based on ethno-medico-botanical studies, it has been observed that most of trans-Himalayan Medicinal plants belong to Rare, Endangered & Threatened category. An Alpine Herbal Garden has been established within premises of DIHAR which will play vital role in propagation, cultivation conservation and sustainable utilization of trans-Himalayan medicinal plants wealth.

Response of some important medicinal plants to various soil treatments. (Poster)

Parul Bhatt Kotiyal[1], Ruchita Tiwari and Antrix Soni. [1]Scientist-D, Forest Ecology and Climate change Division, Forest Research Institute, Dehradun 248006. Uttarakhand. Email parulbhatt29@gmail.com

The quality of herb medicines is the comprehensive indicator reflecting certain cultivation technologies and ecological conditions under which the medicinal plants grow. Among which, soil serves as an essential medium for supporting plant growth and development, and thus, it has important influences on the growth, development and the medicinal quality of herb plants. The nutritional elements (e.g. N, P, K, Ca, and Mg etc.) of soil are required for the growth of medicinal plants. These elements are not only the important sources of materials for building up the structures of plant tissues, but also are actively involved in the metabolic activities within plants. The experiment was conducted at Forest Research Institute, Dehradun to study the growth parameters of the selected medicinal plant species *viz*,*Withania somnifera (Ashwagandha), Ocimum* × *africanum (*Lemon tulsi)Ocimum *tenuiflorum* (Kapoor tulsi) *Andrographis paniculata* (Kalmegh) under different treatments using soil "soilization" technique. In this technique commercially available sand made productive and fertile by applying various treatment combination SAND + COMPOST, SAND + COMPOST + CMC SAND + COMPOST + CMC + NPK, CONTROL (Sand) .With the results obtained, it was evident that the media with only sand was not suffice for the optimum growth of the vegetation. The selected medicinal plants viz, Ashwagandha, Lemon Tulsi, Kapur Tulsi, Kalmegh were planted for full three months i.e. March to May, the plants survived this period of continuous change in temperature. For comparison with the results of the above experiment, the following plant species with three replication were planted in the only sand media. In sharp contrast to the "soilized" sand, although the same methods of sowing and watering were used, plants only in the sand pots showed very little growth. As the sand does not possess the eco- mechanical attributes of soil. The yields of three species i.e. Ashwagandha, Lemon Tulsi, Kapur Tulsi were much higher by using soil "soilization" technique which was used in three other treatment pots. Only Kalmegh species deferred by failing to grow in the sand and the NPK rich media. Out of the four treatments, the best results were obtained in the Sand+CMC+ Compost media as it furnished the best results by using Completely Randomized Design (CRD) method.

Ethnomedicinal Plants used against liver and kidney troubles by the rural populace of Tehsil Paonta Sahib, District Sirmour, Himachal Pradesh (India). (Poster)

Parul Singhal[1,2]. [1]Uttarakhand State Council for Science and Technology (UCOST), Vigyan Dham, Dehradun. [2]Himachal Pradesh University, Summer Hill, Shimla. Corresponding Author Email: parul.singhal1436@gmail.com

The acquaintance on medicinal plants has been accumulated in the course of many centuries. The indigenous medicinal knowledge may have practical implications for developing new medicines. Ethno botany is the undeviating relationship of plants with inhabitants. Traditionally, native societies worldwide are dependent largely on plants for their sustenance and livelihood. Considerable amount of knowledge on the traditional uses of plants is available with the aboriginal people. Plants play a significant role in the most expedient and valuable manner in health care. Percentage of people suffering from liver and kidney problems is increasing day by day. Liver is one of vital organs of body. Kidneys also play a very important role in filtering blood and elimination of wastes through urine from our body. An ethno botanical survey was carried out to collect information on plants used against liver and kidney problems by the inhabitants of Tehsil Paonta Sahib. A total of 31 plant species belonging to 27 genera and 21 families (eg. *Ailanthus, Bryophyllum, Celastrus, Ficus, Pedalium, Solanum* sp. etc.) were reported to treat the problem in the region. Most of the plant species used were trees and herbs (38.71% each) followed by shrubs (12.91%), climbers (6.45%) and liana (3.22%). The present study was focused to explore the traditional medicinal plant wealth that is being used by the rural populace of the study area. The medicinal preparations include powder, decoction, juice, etc. The potential value of their traditional herbal practices for curing liver and kidney troubles needs to be popularized worldwide.

Targeting *Candida glabrata* biofilm using active components of medicinal and aromatic plants. (Poster)

Payal Gupta, Purusottam Mishra, Vikas Pruthi*. Department of Biotechnology, Indian Institiute of Technolgy Roorkee, Roorkee, Uttarakhand, India. E-mail: vikasfbs@gmail.com

Candidiasis is a recalcitrant and most common fungal infection in immunocompromised patients. The mortality by these infections increases when they turn up to form biofilm. The development of biofilm requires a coordinated gene expression that is regulated by a cellular communication known as quorum sensing (QS). This investigation aims to study the mechanism of action of active components of medicinal and aromatic plants; Cinnamaldehyde (CIN) and eugenol (EUG) on *Candida glabrata* biofilm. Transcriptional analysis of CIN treated *C. glabrata* cells exhibited 2.3 fold up regulation of *ERG10*. Interestingly on EUG treatment, *C. glabrataERG2, ERG3, ERG4, ERG10, ERG11* and *CDR1* genes gets 1.3, 2.7, 0.9, 2.0, 1.6 and 1.8 fold upregulated, respectively. The above results were further confirmed spectrophotometrically by measuring the ergosterol content in *C. glabrata* cell wall. Reactive oxygen species (ROS) generation studied using 2',7' –dichlorofluorescin diacetate and propidium iodide revealed that CIN treated biofilm exhibited high level of ROS generation and cell lysis as compared to EUG treated biofilm. The rate of release of intracellular content in CIN and EUG exposed cells was measured by taking absorbance (260 nm) of medium at different time interval. The results suggested that 4 h of incubation of cells with CIN and 8 h with EUG is sufficient to cause 90 % of cell lysis. The amount of cytochrome C in mitochondria and cytosol was quantified and its content was found to be significantly high in CIN and EUG treated sample as compared to control. This gives indirect evidence of apoptosis caused by CIN and EUG. Thus, the results of present study suggest that EUG and CIN show antifungal activity by targeting more than one physiological process. These results strengthen their candidacy for development of novel antifungal therapeutic.

Computational approach for studying the bioremediation process of arsenic by *Pseudomonas fluorescens*. (Poster)

Poonam, Devvret, Neema Tufchi, Kumud Pant, Anju Rani, Manu Pant. Graphic Era Deemed to be University, Dehradun, India. Email: devvret@gmail.com.

Numerous studies showed that the major pollutants present in the water bodies are heavy metals, pestisides, dyes, and other toxic contaminants. Removal of various inorganic pollutants (heavy metals) by a number of bacteria is an important means for solving the problem of pollution. *Pseudomonas fluorescens* is a gram negative halotolerant, arsenic oxidizing bacteria, containing genes for arsenite oxidation and arsenic resistance. Arsenic oxidase (AO) is a bacterial enzyme from *Pseudomonas fluorescence* can be used for the economic and ecofriendly removal of arsenic. To understand the activity of AO in elimination of arsenite, sequence analysis was carried out and homologs, orthologs, domains, family, and conserved residues were identified. The three dimensional structure of AO was generated using SWISS-MODEL an online homology modeling tool using template from *Escherichia coli* K12.The generated model was validated for the quality protein structure and further optimization using energy minimization approach was done. Molecular docking studies were performed to study the binding interaction of AO with arsenite. The study predicts and validates the 3D structure of *Pseudomonas fluorescence* arsenite oxidase and reports four active sites of Arg at position 5, 175, 222 and 370 respectively. The molecular docking studies suggested the formation of a stable complex and *in silico* site-directed mutagenesis revealed the importance of Arg at all the active sites which resulted in a decrease in stability of the complex when mutated. The study implicates *P. fluorescence* arsenite oxidase as a non-virulent protein for low cost and eco-friendlybioremediation of arsenite.

Screening for chemical composition and antifungal activity of essential oils against *Malassezia furfur*. (Poster)

Pragya Pandey[1], R K Upadhyay[1], Lokesh Kumar Tripathi[2,] [1]CSIR- Central Institute of Medicinal and Aromatic Plants, Pantnagar, U.S. Nagar, Uttarakhand and [2]Department of Biotechnology, , Bhimtal Campus Bhimtal, Kumaun University Nainital, Email ID:- kashu.pandey26@gmail.com

To evaluate the potential antifungal activity, selected essential oils of *Eucalyptus citriodora*, *Tagetes minuta*,*Melaleuca bracteata,* and*Callistemon citrinus* obtained by hydro-distillation were tested against *Malassezia furfur*. *M. furfur* causative agent of dandruff, metabolizes triglycerides present in sebum by the expression of lipase resulting in a lipid by product oleic acidcausing dermal inflammation and tissue damage. It is the most common secondary manifestation of seborrhoea on the scalp. The anti- Malassezia activity was determined by minimum inhibitory concentration ranging concentration from 24-2µl using broth micro diffusion method and the essential oil were analyzed by Gas chromatography- mass spectrometry (GC-MS). *In-vitro* activity assay confirmed the potential efficacy of *M. bracteata* which inhibits the growth of *M. furfur* by 59.07 ± 2.01% at 20µl/ml. Essential oil of *E. citriodora*, *T. minuta* shows effective response at 24 µl/ml. Lowest activity was obtained in *C. citrinus* with the growth percent inhibition 23.98 ± 1.57 at 24 µl/ml. GC analysis of essential oil identified the main constituent of *M. bracteata* as methyl eugenol. The essential oil of *C. citrinus* was found to be rich in 1,8-cineole, α-pinene and α-terpineol and the major components found in *E. citriodora* essential oil were citronellal, geraniol and β-citronellol. *T. minuta* contain β-Ocimene, tagetone, and dihydrotagetone. This study conclude that the essential oil of *Melaleuca bracteata* may be used as an alternative to the other chemical products. It also provides the information for further more studies to control the *Malassezia furfur*.

Synthesis of silver nanoparticles from *Berberis asiatica* using leaf extract. **(Poster)**

Preeti Dobhal, Saumya Agnihotri and Sushma Tamta. Plant Tissue Culture Laboratory, Department of Botany, D.S.B. Campus, Kumaun University, Nainital 263002, Email:- dobhalpreeti@ymail.com

Nanobiotechnology is the emerging discipline of research in contemporary material science. Generally particles with size less than 100nm are referred as nanoparticles. The emerging field of nanobiotechnology is at the initial stage of development due to lack of innovative techniques and yet has to be improved with the modern technologies. Though nanoparticles can be synthesized by using various physiochemical methods but green synthesis is more environmental friendly as compare to other methods. Plants and different plant products have been used in nanobiotechnology for synthesizing nanoparticles. Green synthesis of nanoparticles using Silver Nitrate has been increased as they are cheap and nontoxic. In the present work nanoparticle of medicinally important plant*Berberis asiatica* has been synthesized by using leaves extract. *B. asiatica* commonly known as Daruhaldi, Kingora, Kilmora, Tree Turmeric or Asian Berberryis also an important plant from Himalayas which is used in many medicine formulas. It is a deciduous shrub with various secondary metabolites present in it like benzylisoquinoline (berberin), a natural alkaloid. Itis used in the treatment of diseases like jaundice, diabetes, malarial fever, wound healing, gastrointestinal disorders, rheumatism, infections of eye and ear and various skin diseases and is reported to have anti-cancer, diuretic, stomachic, anticonvulsive, and stimulant properties. Due to important medicinal properties of this plant, nanoparticles of this plant can be used for many purposes for example increasing medicinal properties of this plant or other plants. Therefore this work was carried out for standardization of protocol for synthesis of nanopaticles from this plant. UV spectral analysis shows peak between 390-450nm which confirms the nanoparticle synthesis. Further experiments for qualitative analysis of AgNps of the plant are on progress.

ISSR and SCoT based genetic variability and active ingredient analysis of micropropagated plants of *Nardostachys jatamansi* (Valerianaceae). **(Oral)**

Priya P[1], Janhvi M. Rawat[2], Aakriti Bhandari[1], Ajay Thakur[1] and Anup Chandra[2], Chitti Babu CV[3]. [1]Tissue Culture Discipline, Genetics and Tree Improvement Division Forest Research Institute, Dehradun, Uttarakhand, India/ [2]Botany Division, Forest Research Institute, Dehradun, Uttarakhand, India/ [3]Department of Plant Biology and Biotechnology Presidency College, Chennai, Tamil Nadu, India. anushapriya19@gmail.com

Genetic variability and active ingredient analysis of micropropagated plants of *Nardostachys jatamansi* (D. Don) DC (Valerianaceae), have been carried out. Rhizomes were used as explant, and maximum shoot multiplication was observed on MS medium supplemented with 6-Benzylaminopurine 8.0 µM and Indole-3-acetic acid 0.1 µM. Roots were observed within 14 days in the MS medium supplemented with 0.5 µM IAA and 0.1 µM Naphthalene acetic acid (NAA) with an average production of 4.2 roots per shoot. Rooted plantlets were successfully hardened under greenhouse conditions and subsequently established in field, with a recorded survival rate of 81 % after 45 days. Twenty three Inter Simple Sequence Repeats (ISSR) and twenty Start Codon Targeted (SCoT) primers were used to assess the genetic variability of the tissue culture raised plants. The phytochemical analysis of tissue culture raised products showed higher secondary metabolite content as compared to the mother plant. The findings of the present investigation may be utilized for the conservation, commercial propagation and enhance the production of bioactive constituents through incorporating changes at genetic level of this high value, critically endangered medicinal herb of West Himalayas.

In silico screening of antioxidant compounds from aromatic plants used in Chyawanprash. (Poster)

Priyanka Sharma[1], Subhash Chandra[2], Sushma Tamta[1]. [1]Department of Botany, D.S.B. Campus, Kumaun University, Nainital, Uttarakhand, India and [2]Department of Botany, S.S.J Campus, Almora, Kumaun University, Nainital, Uttarakhand, India.Email id- scjnu@yahoo.co.in

Aromatic plants, also known as herbs and spices, have been used in traditional medicine. Several aromatic plants are used in the preparation of chyawanprash, namely such as *Aqualaria agallocha* (Agar), *Cinnamomum zeylanicum* (Dalchini) *Cinnamomum tamala* (Tejpat), *Cyperus rotundus* (Motha), *Elettaria cardamomum* (Elachi) and *Piper longum* (Pipali). They contain many biologically active compounds, having antimicrobial, antioxidant, antiparasitic, antiprotozoal, antifungal, and anti-inflammatory properties. Currently, the demand for these plants has increased because they are natural, eco-friendly and generally recognized as safe products. The phytochemicals of these aromatic plants may have the potential to become a new drug against human and animal diseases. The purpose of the study isto screen antioxidant compounds from these aromatic plants through the *in silico* techniques. In order to discover new antioxidant compounds, we have carried out virtual screening of a library of 150 phytochemicals from 6 aromatic plants against protein tyrosine kinase which is a well-known molecular target for discovery of antioxidant compounds. The result of molecular docking showed that 15 phytochemicals viz., Kobusone, Sesquiterpenoid, Naphthalene, Rotundone, Piperoleines B, trans-cinnamic Anhydride, Piperine, Alpha-cyperone, Beta-cyperone, Sitosterol, and 4-Flavanol, have excellent binding affinity (range between -6.3kcal/mol to -9.7kcal/mol) in comparison to reference ligand, α-Tocopherol (-6.2kcal/mol). All screened hit phytochemicals were evaluated further for drug-likeness and ADMET properties and the result showed that they are strong candidates as potential antioxidant drugs.

Anticandidal activity of green tea and identification of drug targets in ergosterol biosynthesis pathway (Poster)

Priyanka Sirari Khati, Ashish Thapliyal, Nishant Rai. Department of Biotechnology / Life Science, Graphic Era (Deemed To Be University), Dehradun. Email: siraripriyanka28@gmail.com

Candidiasis is a fungal infection caused by yeast-like fungal pathogens belonging to a genus Candida. The *candida* species are eukaryotic commensal organisms residing on the mucosa of mouth, oesophagus, gastrointestinal tracts & vagina. There are 17 different species of candida which cause candidiasis; in which we select two species namely- *candida albicans and candida glabrata*. *Candida albicans* is opportunistic pathogenic yeast that is a common member of the gut flora. *Candida Glabrata* is a haploid yeast of the genus Candida. Cell membrane of candida is made of Ergosterol. Ergosterol is the major product of sterol biosynthesis in fungi. The drugs that disrupt fungal cell membrane are Amphotericin, Fluconazole, Itraconazole, Caspofungin, Griseofulvin etc. These drugs cause Side effects if taken in high dosage. These side effects are the following-Itraconazole - headache, dizziness, rash, hair loss, vomiting, nausea. AmphotericinB-fever, shaking chills, hypotension, anorexia, nausea, vomiting, headache, and tachypnea are common 1 to 3 hours after starting an intravenous infusion. Caspofungin- Bloating or swelling of the face, arms, hands, lower legs, or feet. Griseofulvin-rash, numbness or tingling in your your mouth, stomach pain, diarrhea. Green tea is derived from the leaves of the plant *Camellia Sinensis* which is an angiosperm dicot plant. Teas contain bioactive compounds of which one third is contributed by polyphenols. Among natural polyphenols present actively in GT are the flavonoids commonly known as Catechins. Major catechins present in green tea are epicatechin, epigallocatechin gallate, epigallocatechins and epicatechin gallate. It has higher antioxidant activity that makes it more beneficial in protecting the body from oxidative damage. The interaction of Green tea Phytocompounds and ergosterol synthesizing proteins (ERG) of the Candida species can be assessed by in silico study using iGEMDOCK software by taking the following targets – ERG 26, ERG 6, ERG 25, and ERG 8. The phytocompounds taken in combination with

these targets are- Kaempferitin, Chlorogenic acid, Epigallocatechin gallate, Epicatechin gallate, respectively.

Medicinal plants of high altitude Pangong Wetland of Indian Trans Himalaya (Poster)

Puja Bhojak[1], Dipti Dey[2] and K. C. Sekar[1]G.B. Pant National Institute of Himalayan Environment & Sustainable Development, Kosi-Katarmal, Almora-23601[1], Wildlife Institute of India, Dehradun[2]. E-mail-pujabhojak007@gmail.com

Pangong high altitude wetland is a land locked lake situated in eastern part of Ladakh, at an altitude of 4281m asl and remains frozen for about three months during winter. There is no outlet to the lake and loss of water is only through evapotranspiration. High altitude wetlands identified as the home of several medicinal plants and source of income for local people. Amchi system of medicines is a complementary medicines system in leh-Ladakh. The medicinal plants species were collected in the summer season of 2016 and 2017 of Pangong Wetland. During the present study a total 99 species medicinal plants found in pangong wetland, of which 21 are placed in least concern threat categories as per the IUCN (2015). Asteraceae is the largest family represented by 21 species followed by Ranunculaceae (11), Fabaceae (11), Lamiaceae (7), Brassicaceae (6) etc. Leaves (42) are highly used, followed by flower (32), Root (18), Shoot (19), seeds (8) fruits (2) and whole plant of (13) species etc are used by amchi for curing various ailments. These plants parts are used for curing various diseases such as respiratory disorders, cardio vascular, bone and muscular, liver, digestive disorders, reproductive, urogenital disorder, General body ache, ophthalmic disorders, dental disorder, dermatological etc. High altitude medicinal plants are facing threat due to, growing impact of tourism, tourist camp, grazing presser, road cutting around the wetland, anthropogenic presser and medicinal plant extraction etc in pangong wetland. Therefore there is a need to conservation and management such as sustain utilization, education and awareness program and support strategic conservation frameworks.

Exploring drug-like property in Cannabinoids of*Cannabis sativa*: A Bioinformatics approach. (Poster)

Kumud Pant[1], Devvret[1], Shivangi Solanki[1], Pushpanjali Kumar[1], Poorva Rana[1], Mayank Basran[1], Rohan Mishra[1], Neema Tufchi[1]. [1]Department of Biotechnology, Graphic Era Deemed to be University Dehradun, Uttarakhand India – 248002. E-mail: devvret@geu.ac.in

Marijuana (*Cannabis Sativa* L.) is hemp belonging to family Cannabaceae. An annual, herbaceous, flowering plant belongs to central Asia and has been used for its medicinal properties from the ancient times. It is a heterogeneous combination of phytochemicals like Cannabinoids, alkaloids, terpenoids, stilbenoids and flavonoids. Earlier research proves that the cannabinoids have high therapeutic value. Due to its natural origin and natural properties it has been scientifically proven that marijuana has less adverse effects on Homo sapiens. Marijuana is the most popular adulterous drug and is consumed by millions of people worldwide. The plant has more than 500 compounds out of which 113 compounds are cannabinoids. In the study we have screened all the cannabinoids present in *Cannabis Sativa*. The compounds were downloaded from PubChem database. Molecular properties and bioactivity score was calculated using *Molinspiration*. Lipinski's rule of five i.e. was used as a reference for determining the drug-like properties of the phytocannabinoids. We predicted bioactivity scores for UDP-Glucuronosyltransferase (UGT) which is a known target of Cannabidiol. Docking analysis performed by iGemDock showed that cannabitriol (CBT) has best docking energy and can be further used as potential UGT inhibitor.

An ethnobotanical study of wild medicinal plants used by migratory shepherds: A tribal community of Western Himalaya (Poster)

Radha Chauhanand S. Puri,School of Biological and Enviromental Sciences, Shoolini University, Solan, Himachal Pradesh, E-mail: radhuchauhan7002@gmail.com

In the present study medicinal plants growing wild used by migratory shepherds of Kinnaur district, a tribal community of western Himalaya, were surveyed. The ethnobotanical survey was undertaken between July 2017 to October 2018. Questionnaire for the present survey, personal field visits and participatory observations were done to collect information about the use of various plants by shepherds. During the survey, 86 medicinal plants from wild were documented with their ethno-medicinal use. It was observed that plant and plant products play an important role in the life of migratory shepherds. The livelihood of shepherds was seen to be developed as the biodiversity of flora. Today ethnobotany has become increasingly valuable in the development of health care and conservation programs in different parts of the world. The awareness towards herbal medicines and products has been increasing in rural and urban settlement these days. This development leads to enhanced demand for Himalayan medicinal plants. The net result is over harvesting of Himalayan Medicinal plants. The silver line is that the migratory shepherds have started cultivation some of these medicinal plants in their farmland and thus aiding for their conservation. The information generated from the current study can be used as foundation for formulating management practices for the conservation and sustainable use of wild medicinal plant in the study area.

EMS induced cytomorphological variations in*Eclipta alba* (L.) Hassk (Poster)

Radha Mishra and G. Kumar. Plant Genetics Laboratory, Department of Botany, University of Allahabad, Allahabad-211002. Email- radhauniv2015@gmail.com

Eclipta alba (L.) Hassk. commonly known as Bhringraj is one of the most valuable medicinal plant belonging to family Asteraceae. As the dependency on medicines of plant origin is increasing worldwide, these plants need alteration of genetic makeup to obtain improved qualitative and quantitative traits. Induced mutagenesis using chemical mutagens may be helpful in accomplishing these objectives. Present study was conducted with aim to enhance genetic variability using different concentrations for variable treatment durations of Ethyl methane sulphonate (EMS). Mutagenic impact of EMS is assessed on cytology as well as morphology of the plant. Seeds of Bhringraj were treated with different concentrations of EMS viz; 0.1%,0.3% and 0.5% (w/v) for 5hrs. After treatment, these seeds were sown in pots along with control. Microsporogenic studies revealed normal cytology in control plants however cytology of EMS treated plants revealed introduction of different meiotic anomalies. The result deciphered that higher concentration and longer treatment duration are toxic both at morphological as well as cytogenetical levels where as at lower concentration significant morphological and chromosomal variations were induced. Diverse morphological variants were also obtained among plants growing in the field such as variation in plant height and leaf variants. Chromosomal aberrations such as stickiness, univalents, precocious movement, bridges and laggards were among the most profound abnormalities. This in-depth study gave ample evidence that EMS is highly effective in creating genetic variations as well as morphological alterations.

Effect of Gamma rays on induced morphological variants and chromosomal behaviour in *Artemisia annua* L. (Poster)

Rajani Singh, G. Kumar. Plant Genetics Laboratory, Department of Botany, University of Allahabad, Allahabad-211002. Email: singh.rajani1995@gmail.com

The low artemisinin content in *Artemisia* has caused this compound to be expensive among medicines. Several attempts have been made to increase its production by using different mutagens. Gamma rays have proved to be more economical and effective compared to other ionizing radiations because of their easy availability and power of penetration. The present study deals with the effect of gamma irradiation on meiotic cells of *Artemisia annua* L. For this the fresh seeds of *Artemisia* were irradiated with 5 variable doses viz. 100, 200, 300, 400 and 500 Gy respectively from ^{60}CO source at NBRI, Lucknow. Irradiated seeds along with control were sown in fields and young floral buds were fixed in carnoy's fixative and were transferred in 90% alcohol after 24hours for meiotic study. Meiotic cells were found to be quite normal in control. However, as a result of the treatment various chromosomal anomalies were induced such as stickiness, disturbed polarity, precocious movement, multivalents, laggards, bridges and unorientation etc. The disturbed polarity was found to be predominant abnormality in higher doses of gamma rays i.e. 500Gy. Result obtained shows that lower doses are beneficial for the plant. Different morphological variants were also screened out among plants growing in the field which may be utilised in enhancing qualitative and quantitative characteristics. [Keywords: *Artemisia annua L.,* chromosomal anomalies, Gamma rays]

Genetic profiling and bioactive constituents prospecting of synthetic autotetraploids of medicinally important *Tinospora cordifolia* Miers Hook. f. and Thoms. (Oral)

Rakesh Kr Thakur[1], Vijay Rani Rajpal[2], Upender Sharma[3] and Soom Nath Raina[1]. [1]Amity Institute of Biotechnology, Amity University, Noida, 201313, U.P. [2]Department of Botany, HansRaj College, University of Delhi, 110007, Delhi, [3] Natural Products Chemistry and Process Division, Institute of Himalayan Bioresource Technology, Palampur, 176061, H.P. E-mail: soomr@yahoo.com

Induction of autotetraploidy may lead to changes in many parameters including increase in 1, cell size and 2, secondary metabolites. It may also lead to extensive genomic changes in early generations of polyploids. *Tinosporacordifolia* commonly known as Giloe, is a diploid (2n=2x=26), dioecious, deciduous, climbing shrub found throughout the tropical and subtropical regions of India. The whole plant including stem, root and leaf is medicinally important. A variety of constituents have been isolated from *T*. *cordifolia*. *Tinospora cordifolia* has anticancer, antidiabetic, antioxidant, antipyretic, hepatoprotective, immunomodulator, anti-inflammatory, antistress, anti-malarial and neuroprotective activities. Autotetraploidy was successfully induced by colchicine treatment in several genetically diverse diploid *T*. *cordifolia* genotypes. The synthetic autotetraploids were analysed vis-à-vis diploid for morphological, genomic and phytochemical changes. Several DNA markers were used to ascertain the changes, if any, in the neoautotetraploids. HPLC analysis of eight well known marker compounds was carried out in the diploid and autotetraploid *T*. *cordifolia*. The results as above will be presented and discussed.

Thorny Cactus Pear – Food, Feed and Village Pharmacy. (Oral)

Ramesh C Gupta, Nagaland University, Kohima Campus, Meriema, Nagaland 797004, India. E-mail: rameshgupta1954@gmail.com

Cacti as a group interesting plants well adapted to xeric conditions and mostly have colourful flowers and fruits. We present research on its chemical constituents and it is interesting to note the presence of a number of amino acid of which sulphur containing amino acid taurine is in high concentration. With the presence of bioactive molecule like amino acids, phenols, vitamins and large number of minerals it is logical to think of its biological role. Its antioxidant activity and health improving capacity has been registered. Its protective spectrum is very wide which include; anticancer, antiviral, anti- inflammatory, anti- diabetic, anti-hyperlipidemic and hyper cholesterotmic. Prickly pear cactus has been also used to treat; ulcers, allergies, fatigue, rheumatism, anti uric and diuretic. With all this cactus plant is term as "village pharmacy". On the functional food and nutriceutical front, it is good source of fibre, juice and pulp is now part of specialize, ice cream, jelly, candy, etc. Taurine chemically; 2- amino ethane sulfonic acid; has convincing role in protective

effect of various organs dysfunctions. It is more or less now established that taurine protective actions are mediated through its antioxidant character or osmo-regulation, stabilization of cell membrane, as well as ions management. Cactus species are involved in “host defence” and also known as megavitamin or functional / nutriceutical agent.Role of taurine from cactus pear and its biological functions will be discussed.

Antioxidant and Hemolytic activity in the leaf extracts of *Psederanthemum bicolor (sims) Radik* (Oral)

Rajanna. L and B S Ramesh, Department of Botany, Bangalore University, J B Campus, Bengaluru-560056. Email: lrajannabot@gmail.com

Psederanthemum bicolor (sims) Radikis a member of the family Acanthaceae having both antioxidant and hemolytic potential. The dried powder of the leaves were extracted with Methanol, Chloroform and Ethyl acetate and tested for antioxidant activity. Antioxidant activity of these extracts were performed by using various assays like, DPPH and ABTS free radical scavenging assay using quercetin as standard. Total reducing power assay, Nitric oxide scavenging assay (NOS) and catalase activity were performed using Ascorbic acid, Curcumin and hydrogen peroxide as standards respectively. In DPPH, ABTS and total reducing power assay, methanol, chloroform and ethyl acetate extracts showed significant antioxidant activity having IC_{50} values such as 104.30,107.90,111,90µg /ml For ABTS, 116,40.111.70,79.06 µg/ml. For total reducing power assay Vitamin C/g were 336.67,746.67 and 553.33 mg respectively. In NOS assay, the methanol and chloroform extracts showed dose-dependent nitric oxide radical scavenging activity with respective IC 50 values Ethyl acetate and methanol extracts are having catalase activity. Hemolytic activity showed positive results for all the plant extracts tested for their hemolysis abilities.

Biofabrication of metal nanoparticles using plant extracts: their characterization, therapeutic importance and applications. (Oral)

Ravindra Shukla, Sandip K Chandraker, Mishrilal; Laboratory of Bio-resource Technology, Department of Botany, Indira Gandhi National Tribal University, Amarkantak (MP) 484887; Email: ravindra.shukla@igntu.ac.in

Green nanotechnology is an important field of modern research dealing with the use of medicinal plants and their phyto-constituents for synthesis, strategy and manipulation of nanoparticles like silver, gold, copper, calcium, iron, and zinc oxide. Phytosynthesis of nanoparticles is a rapid, cost effective and environment friendly approach exhibiting superiority over physical, chemical and microbial methods. Plant extracts contain wide range of biomolecules including carbohydrates, alkaloids, amino acids, terpenoids, phenolic compounds, essential oils, and enzymes which have their role as reducing and stabilizing agents. Synthesized particles exhibit a color change pattern upon synthesis and affirm its respective broad peak through UV–vis spectroscopy at certain wavelength due to surface Plasmon resonance. Fourier transform infrared spectroscopy (FT-IR) study confirms the responsible functional groups involved in capping and stabilization of nanoparticles. Dynamic light scattering (DLS), Zeta potential, X-ray diffraction (XRD) studies and scanning/ transmission electron microscopy reveal size and shape of particles, their stability, non-agglomeration and poly-dispersion. A variety of plant species and plant parts have been successfully extracted and utilized for AgNPs syntheses. The Phytomediated nanoparticles have been effectively controlling the various endemic diseases with less adverse effect. Nanoparticles are important in the field of pharmaceuticals for their strong antibacterial, antioxidant and anticancer activity. Phytogenic nanoparticles are useful in sensing free radicals like H2O2 and degradation of carcinogenic azo dyes from industrial effluents. The green synthesis of nanoparticles can be efficiently applied for future engineering and medical concerns.

Promoting the Lichen trade and conservation in Uttarakhand through facilitating precise species identification. (Poster)

Rekha Gahtori[1], Ashutosh Paliwal[1], Nidhi Negi[2], Rahul Anand[1], Garima Chand[2], Yogesh Joshi[4], Penny Joshi[2] and Santosh K. Upadhyay[1]* [1]Department of Biotechnology, Kumaun University Campus, Bhimtal, India-263136, [2]Department of Chemistry, D.S.B. campus, Kumaun University, Nainital, India-263101, [4]Department of Botany, University of Rajasthan, Jaipur, RajasthanEmail: rekhagahtori11@gmail.com

Lichens are unique group of plants that show close symbiotic association between fungus and an alga. The mountainous area in the state of Uttarakhand harbour rich diversity of lichens. Lichens have numerous industrial applications and are sources of many novel compounds of medicinal value. They are precious non-timber forest product collected from state of Uttarakhand and as per an estimate annually more than 20,000 tonnes of Lichen biomass is sold in designated local markets. However, despite tremendous potential of employment generation, the local community (mostly include lichen-collectors) is deprived of fair share of profits from lichen trade. It has been observed that due to their ignorance regarding precise species identification and lichen-biomass categorization, collectors usually fetch very poor value for their product. Additionally, the Uttarakhand Mountains also harbour many of the endemic and endangered/rare species of lichens. These species face consistent threat not only from changing environment, but also of illegal harvesting and biopiracy, due to their unique and precious secondary metabolites. Therefore, for better characterization of lichen biodiversity in Uttarakhand, we are using modern methods of identification including chemotaxonomy and DNA-barcoding. Additionally, we have been working towards creating a resource group for training lichen collectors and other people in community in precise lichen identification. This combinatorial approach of molecular characterization of lichens, as well as training local community with lichen-identification, would simultaneously help in conservation and sustainable use of lichen-biodiversity for the welfare of stakeholders.

Phytochemical screening of Ayurvedic head massage oil formulation from Jatamansi (*Nardostachys jatamansi*) and its clinical evaluation in mental stress as a risk factor in cancer. (Oral)

Sandeep Chavan[1], Bhagyashree Sardeshmukh[1], Vidya Gupta[1,2], Vineeta Deshmukh[1] Sadanand Sardeshmukh[1]. [1]Bharattiya Sanskriti Darshan Trust's Integrated Cancer Treatment and Research Centre, Wagholi, Pune, INDIA 412 207 [2]CSIR National Chemical Laboratory, Pashan, Pune, INDIA 411 016. E-mail: ictrcdrugresearch2016@gmail.com

Jatamansi (*Nardostachys jatamansi*) is an important aromatic mountainous shrub widely used by Ayurvedic practitioners from centuries. The Ayurvedic traditional methods of pharmaceutical preparations were evolved by implementing Ayurvedic concepts of pharmacology. Various internal formulations like tablets and external formulations like medicated oils are used for several ailments. *Jatamansi* is mentioned as intellect enhancing (*Medhya*), strengthening (*Balya*) drug and useful in skin disorders. Therefore, *Jatamansi* was used in the form of *Jatamansi* oil as an external treatment (head massage) in mental stress elevated conditions including cancer. A sesame oil base formulation prepared and standardized by traditional method of decoction and evaporation was developed. *Jatamansi* has several major phyto-constituents such as jatamansone, spirojatamol, valerenal, valerenic acid, nardol, humulene etc. A clinical study was initially conducted to assess the effect of *JatamansiTaila* on insomnia in 30 patients. It showed encouraging results in improving duration of sleep, interruptions in sleep, freshness after sleep and frequency of dreams during sleep ($P<0.01$). The cancer patients undergoing chemotherapy & radiation treatment are observed to have insomnia (n*idranasha*) and mental disturbance (*manodaurbalya*) as a side effect of the treatment and disease itself. Hence, *JatamansiTaila* was used as *Mastishkya* (various types of head massage i.e. *Shiropichu*, *Shirodhara* and *Shiro-abhyanga*) in cancer patients. These types of *Mastishkya* were clinically used in 198 Breast cancers, 30 Triple Negative Breast cancer, 50 oral cavity, 20 Ovarian, 35 Glioblastoma Multiforum, 4 Lung cancer with brain metastasis and 17 Prostate cancer patients. It was found that *Jatamansitaila* prepared by *Jatamansi* - a Medhya herb i.e. brain tonic as per Ayurvedic text, helps to relieve the mental stress considerably and improve the quality of life of cancer patients.

Green synthesis of Silver Nanoparticles using leaf extract of *Zanthoxylum armatum.* (Poster)

Saumya Agnihotri, Preeti Dobhal and Sushma Tamta. Plant Tissue Culture Laboratory, Department of Botany, D.S.B. Campus, Kumaun University, Nainital 263002. Email: smagnihotri83@gmail.com

Nanotechnology is the branch of science that conducts at the nanoscale, which is about 1 to 100nm. Now a day, it is used in various fields like medicine, pharmaceuticals, electronics and agriculture. Nanoparticles can be synthesized by using chemical, physical and biological approach. Chemicals used in synthesis of nanoparticles can be toxic and lead to non ecofriendly bioproducts. So the need of eco-friendly non-toxic synthetic protocols for synthesis of nanoparticles leads to developing interest in biological approach. Thus there is an increasing demand for "Green Nanotechnology". Plants provide a better platform for nanoparticle synthesis because they are free from toxic substances as well as provide natural capping agents. *Zanthoxylum armatum* (common name Prickly ash or Timur) is an important plant. Different plant parts of timur are used for curing toothache, stomachic, fever, abdominal pain and also used as carminative and anthelmintic. Gas chromatography–mass spectroscopy (GC–MS) based studies have revealed the presence of over 100 volatile compounds in the extracts of plant,22 different components and 25 constituents in essential oil of the seed of *Z. armatum*. As the plant is medicinally important, nanoparticles synthesized from this plant can be used to enhance medicinal properties of it. Therefore present study was conducted for standardizing the workable protocol for the synthesis of nanoparticles of the target plant species. For this leaf extract of the target species was prepared and further process was followed according to Jyoti et al (2016). After the synthesis of AgNPs, UV-Visile spectral analysis was performed. The peak was recorded at a wavelength of 390-450nm, which confirms the formation of AgNPs of selected plant species. Further experiments for qualitative analysis of AgNPs of target plant species are on progress.

Antibacterial potential of *Mangifera indica* against oral pathogen. (Poster)

Savita Petwal[1], Koushalya Danwal[2]. [1]Modern Institute of Technology, Rishikesh and [2]Dept.of life sciences, Uttarakhand Technical University, Dehradun. E-mail: savita.pandey27@gmail.com

Dental caries and other related oral problems have widely affected man populations all over the world. Due to the side effects associated with repeated use of antibiotics, in the recent years, there has been increased focus on plants (products) used in folk dental practice and ayurvedic remedies.The medicinal and aromatic plants represent enormous reservoir of potential microbiocidal compounds that are alternative to synthetic microbiocides. In the present investigation, the leaf, bark, kernel, root and stem samples of *Meliaa zedarach* (Mahanimb, denkan), *Mangifera indica*(mango tree), *Ficus racemosa* (gular), *Vitex nigundu(nigundu)* and *Mimosa pudica*(*lajawati*) were screened for antibacterial activities against **oral pathogen** namely *S. aureus, St. mutans, St. gordonii, St. oralis, L. caise* and *L. brevis*. The air dried powder of the leaves, bark, kernel, root and twig samples of mentioned plants were subjected to Soxhlet extraction at their relevant boiling point with using five solvent petroleum ether, chloroform, ethanol, 80% methanol and distilled water sequentially. Extracts were further dried, % yield were calculated and re-dissolved in 50 ml of pet. Ether, chloroform, ethanol, 80% methanol and D/w. Antibacterial activities of all the extracts against oral pathogens were determined by measuring zone of inhibition by disc diffusion method and minimum inhibitory concentration (MIC). The results evidently demonstrated highest antibacterial activity in ethanolic and methanolic extracts of twig and kernel samples of *Mangifera indica* against all the test bacterial cultures followed by *Vitex nigundu, Ficus racemosa, Melia azedarach*and *Mimosa pudica* extracts. Among all the tested solvents, ethanol and methanol extracts showed highest antibacterial activity for all the tested plant samples againsted most of the oral pathogens. Ethanolic and methanolic extracts of *M. indica* were further checked for phytochemical analysis and found to be rich in phenolics, flavonoids and tannins suggesting their involvement in bactericidal activities. Present study establishes ethanolic extracts as potential remedies against oral pathogens.

Endophytic fungal consortia at juvenile stages of *Aquilaria malaccensis* growth contributes Agarwood production (Oral)

Shiny C Thomas, Dwrbi Mochahari, Assam Don Bosco University, Tapesia Campus, Sonapur, Assam, 782402, E-mail: shinnyct@gmail.com

Aquilaria malaccensis is one of the plants where microbe-plant interaction plays a role in its secondary metabolites production or the oleoresin formation, most actively its essential oils which the aromatic perfumes are made from. The resin is produced by the biochemical processes that take place between the plant mechanism and the fungus present in the plant, either pathogenic or endophytic. The present study emphasises on the isolation of the endophytic fungi associated with *Aquilaria malaccensis* and to identify each of the fungus and to study the interaction between them and also their biological potentialities like the antibacterial activity by disc diffusion method in Luria Agar plates. The growth of the endophytic fungi and other non-endophytic fungi are compared in presence of *Aquilaria malaccensis* stem pieces in PDA plates. The study gives a clue that the resin production takes place in *Aquilaria malaccensis* is due to many biological processes. The initiation and regulation of agar resin production is the combined biochemical processes beginning from the early stages of growth of the plant and the resin production is visible only in the mature plant.

An ethnomedicinal study of Ghatkohka Buffer Range in Pench Tiger Reserve, Seoni (M.P). (Poster)

Shubhangee Waske[1]and M.K.Thakur[2,1]Department of Botany and Environmental Science, Govt. Science College, Jabalpur, M.P;[2] Govt.College, Panagar, Jabalpur (M.P.). E-mail: waskeshubhangee@gmail.com

An ethnomedicinal survey of the different parts of Ghatkohka buffer range in Pench tiger reserve of Seoni District was carried out during 2015-2018. This medicinal plant survey for folklore information was collected in the form of discussion (verbal communication). A list of medicinal plants used by local healers was compiled during this survey. The result of present study shows 54 plant species of 25 different families were used by local communities to cure different types of human diseases viz. diarrhoea, dysentery, edema, piles, wound, burning, liver tonic, nervous disorders, regulate menstrual etc. The present study also showed that these medicinal plants are used by local communities in the form of powder, juice and extracts. The source of medicine is root, stem, leaf, bark, fruits, seed and flower. People of the study area realize on ethnomedicines and in most problems they go to local traditional herbal healers for health care. These ethnomedicinal plants need a thorough phyto-chemical investigation including alkaloid extraction and isolation along with few clinical trials. The present study also highlight the information of some of the plant species have needed immediate attention for their conservation. The protected and reserved forest area is observed as the best conservation model for large number of endangered and rare plant species.

Medicinal and Aromatic plants as preferred food of *Ochotona roylei* from high altitudinal zones of Western Himalaya, Uttarakhand, India. (Poster)

Siddhant Bhardwaj[1], Devendra Singh[1] and S. N. Bahuguna[1]Department of Zoology and Biotechnology, Hemwati Nandan Bahuguna Garhwal University, Srinagar Garhwal - 246174 Uttarakhand, India. E-mail: profsnbahuguna@rediffmail.com

Ochotona roylei, a small herbivores mammal from high altitudinal zones of western Himalaya, sole representative of family Ochotonidae with a characteristic feature of having four incisors differentiating them from rodents having two incisors. Social and semi-fossorial herbivore mammals play an important role in grasslands throughout the world and the ecosystem engineering and tropic effects done by these mammals are useful for maintaining grassland biodiversity as a result they frequently plays the role of keystone

species in these ecosystems. They also influence the microhabitat and plant communities' composition. *Ochotona roylei* fulfill its foraging requirements by consuming ferns, grasses, aromatic plants and medicinal plants of high altitudinal zones. Food hoarding was also done by *Ochotona roylie* for food availability during harsh environmental conditions. Standard Quadrat method and focal sampling was done for identification and quantitative analysis of foraged plants. Cafeteria method was used for relative preference of foraged plants. A total of about 20 medicinal plant species were observed to be consumed by *Ochotona roylei*. Highest food preference was shown for *Rumex sps*. by *Ochotona roylei* with the Rodgers index value of about 8.20.

Screening and taxonomy of *Croton bonplandianum* in Garhwal Himalayan Uttarakhand, India (Poster)

Somya Sinha, Vaishali Chaudhry, Bipin Sati, Ashish Thapliyal*. Department of Biotechnology / Life Science, Graphic Era (Deemed To Be University), Dehradun. Email: somyasinha.bio@geu.ac.in

Uttarakhand is well known for its rich medicinal plant resources. *Croton bonplandianum* is a medicinal plant and grows well in wild. Due to its resemblance of the leaves and flower cymes to that of *Ocimum sanctum*(Tulsi), this plant is often called Ban Tulsi. It is a small annual herb, growing up to 1-2 ft tall. These plants play a vital role in primary health care system, ethno-medicine, as well as traditional Indian system of medicines, viz., Ayurveda, Unani, Siddha, and Naturopathy and even in Homeopathy and Allopathy. Popular uses include constipation, diabetes, digestive problems, dysentery, external wounds, fever, hypercholesterolemia, hypertension, inflammation, intestinal worms, pain, ulcers and weight-loss. Due to its slow rate of conventional multiplication, the full medicinal potential is not achieved but still the plant is very high in demand. In this study we have highlighted the economic values of this wild species, as it can grow well in wild without much care. This species can have huge economic benefit and our present study focuses on developing economically viable use of this wild medicinal plant.

Unravelling the insights on *E. globulus* seed extract for the treatment of urinary infections. (Poster)

Sonam Gupta[1], Purusottam Mishra[1] and Vikas Pruthi[1]. Department of Biotechnology, IIT Roorkee E-mail: guptasonam1710@gmail.com

Urinary tract infection(UTI) is an important disease predominantly affect the women and infants which are mainly caused by bacterial pathogens such as *Staphylococcus aureus*and *E. Coli.*In the present investigation, we have reported the antimicrobial potential of *Eucalyptus globulus* seed extract oil emulsion for the effective treatment of these urinary pathogens. Seed oil was extracted using Clevenger by water distillation method and its physico-chemical properties were studied using HP-TLC. DPPH assay suggested that extracted *E. globulus* seed extract oil emulsion are potent antioxidant compounds. Its antimicrobial potential was studied by agar well diffusion assay against *E. Coli*, *S. aureus* and *Pseudomonas aeruginosa*. Data revealed that as compared to the control extracted oil emulsion showed maximum zone of inhibition against *S. aureus* and *E. Coli.* From these results, it can be conferred that extracted *E. globulus* seed extract oil emulsion can be used for the preparation of antimicrobial disinfectants.

Docking studies of Lichen metabolites used against *S. Typhi* treatment: An Insilico approach. (Poster)

Sugam Gupta[1], Neema Tufchi[2], Devvret Verma[2], Himanshu Rai[3], Kumud Pant[2], Rajan Kumar Gupta[3], D. K. Upreti[4].
[1] Department of Environmental Sciences, Baba Farid Institute of Technology (BFIT), Dehradun, UK, India, [2]Department of Biotechnology, Graphic Era Deemed to be University, Dehradun, UK, India, [3]Centre for Advance Studies in Botany, Institute of Science, Banaras Hindu University, Varanasi, UP, India and [4]Lichenology Laboratory, CSIR-National Botanical Research Institute, Lucknow, UP, India. E-mail: sugam2606@gmail.com

Lichens are symbiotic association between mycobiot, phycobiont and/or cyanobiont. Lichen are known to be one of the potential plant having medicinal, industrial and commercial values. Lichens form an idea model to study its bioactive compounds. In the current study, the lichens species (*Everniastrum cirrhatum* and *Usnea longissimi*) having antimicrobial activities were selected and bioactive compounds of the species were retrieved from "An Annotated Checklist of Indian Lichens". Atranorin, protolichesterinic, usnic acid fumarprotocetraric acid and salazinic acid are the characteristic metabolites having anti- microbial properties. Typhoid fever is affecting approximately 21 million people and is one of the leading cause of death worldwide. *Salmonella enterica* serovar Typhi strains is an obligate parasite that has no known natural reservoir outside of humans. It produces and excretes a protein known as "invasin" which allows non-phagocytic cells to take up the bacterium due to which bacterium is able to live intracellularly. Multi drug resistant *S.* Typhi has been prevalent in India and the neighbouring countries since 1989 and there are no effective drugs available for the treatment of disease. The bioactive compounds of lichen were downloaded from PubChem database. The PyRx software was used for studying the binding energies of metabolites with the invasin target protein. Ciprofloxacin was used as a control drug which is used for the treatment of *S.* Typhi. The results showed that Salazinic acid showed maximum binding energy with invasin protein. Thus it is concluded that Salazinic acid can be effective against the virulent protein invasin of *S. typhi*.

Isolation and identification of fungi from selected orchid species to study the plant growth promoting activity. (Poster)

Sujit Shah[123], Khrisna Chand[1], Biru Bhadur Thapa[1], Bijaya Pant[1], Yogesh Souche[2], Rohit Sharma[2], Jyotsna Sharma[3].[1]Central Department of Botany, Tribhuvan University, 2642 KathmanduNepal; [2]National Centre for Microbial Resource-National Centre for Cell Science; NCMR-NCCS, Pune, India, [3]Texas Tech University, Department of Plant and Soil Science, Box 42122, Lubbock, TX 79409. Email. sujitaug16shah@gmail.com

Endophytes are microbes that make symbiosis with the host plant. They may be bacteria or fungi that colonize the host plant tissue to complete the part of its life cycle without harming the host plant. Such relationship is beneficial for both host plant and microbe. Endophytes have wide application in the field agriculture, horticulture, conservation and isolation of novel compounds. Orchid associates with endophytes throughout its life cycle. In this investigation, twelve different types of fungi were isolated in Potato Dextrose Media to study their characteristic features and growth. The identification of the fungi and iaa gene was done by molecular technique. The biochemical assay and chemical profiling of the fungal extract was done to investigate the presence of the metabolite that are directly or indirectly contribute to the plant growth and development. Root staining with DAPI and fungal colonization inside the root was observed. The co-culture assay was performed with established *in vitro* orchid plantlet. The growth pattern of in-vitro plant observed and recorded.

In vivo antidiabetic evaluation of *Olax acuminata* Benth. leaf extracts. (Poster)

Carey V. Rynjah[1], Sumarlin Snaitang[1], Ibapherlin E. Suchiang[1], Livingstone Kro[1], Donkupar Syiem[2], Suktilang Majaw[1]. [1]Department of Biotechnology & Bioinformatics, North-Eastern Hill University, Shillong, 793022, Meghalaya, India. [2]Department of Biochemistry, North-Eastern Hill University, Shillong, 793022, Meghalaya, India. E-mail: smajaw.nehu@gmail.com/smajaw@nehu.ac.in

This study examines the antidiabetic effects of aqueous extract (AE) of *Olax acuminata* leaf in normoglycemic and alloxan-induced diabetic mice (Swiss albino mice) under 24h and 14d treatment. In

24h study, hypoglycemic-, antihyperglycemic-effects including the glucose tolerance tests were evaluated and the result confirmed the ability of the extract (50, 250, 500 mg/kg b.w.) to reduce blood glucose level in both normoglycemic and diabetic mice. In 14d study, the effect of AE (50 mg/kg b.w.) was assessed on enzyme activities such as hexokinase (HK), phosphoenolpyruvate carboxykinase (PEPCK), glycogen synthase (GS) and acetyl coA carboxylase (ACC) in liver and kidney of diabetic mice. In addition, serum alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were assayed along with the histological studies on the above tissues. The results showed that 14d treatment of AE to diabetic mice improved the histological features and function of liver/kidney as the enzyme activities were found to be restored near to the normal control mice. Further, phytochemical screening of AE of *O. acuminata* leaf revealed the presence of comparatively higher saponins than flavonoids and terpenoids. The saponins (SE) was further extracted from AE of *O. acuminata* leafand quantitatively measured by spectrophotometer using ursolic acid as standard. The saponin content of SE was found to be 46.125 ± 0.9464 mg/g of dry weight. During 24h antidiabetic study, SE (50 mg/kg b.w.) administered to normoglycemic and diabetic mice exhibited hypoglycemic- and antihyperglycemic-effects. These findings show the antidiabetic potential of aqueous extract of *O. acuminata* leaf, likely mediated by the presence of phytochemicals such as saponins. Further investigations are however, required for identification of individual saponins in *O. acuminata* leaf and to establish the mechanism of action for their antidiabetic property.

Protective effects of periplogenin-3-*O*-D -glucopyranosyl (1 → 6) (1 → 4) - D - cymaropyranoside, isolated from *Lagenaria siceraria* in thyrotoxicosis and in hepatic lipid peroxidation in rats (Oral)

Sunanda Panda,School of Pharmacy, Devi Ahilya University, Indore, M.P. E. mail**:** spanda4@rediffmail.com

Periplogenin-3-O- D-glucopyranosyl (1→6)(1 → 4)- cymaropyranoside, was isolated from *Lagenaria siceraria* and its effects were evaluated in L-thyroxine (L-T_4)-induced thyrotoxicosis in rats. Administration of L-T_4 at 500 µg/kg body weights for 12 days increased the levels of serum thyroid hormones, the activity of 5-monodeiodinase-I (5'DI) and hepatic glucose-6-phosphatase (G-6Pase) as well as lipid peroxidation (LPO); with a parallel decrease in the activities of cellular antioxidants and the levels of serum lipids. However, administration of the isolated Periplogenin at a pre-standardized dose (5.0 mg/Kg) for 15 days ameliorated the L-T_4-induced alterations in the levels of thyroid hormones, hepatic LPO, G-6-Pase, 5'DI activity, and cellular levels of antioxidants and improved the status of different serum lipids, suggesting its antithyroidal and antioxidative potential. As compared to the standard antithyroid drug, propylthiouracil (PTU), periplogenin appeared to be more promising.

***In-vitro* and *In-vivo* Evaluation of Anticholelithiatic and Hypolipidemic Activities of Fruit and Kernel of Wild Apricot (*Prunus armeniaca* L.) on Mice fed with a Lithogenic Diet: A Developmental Strategy of Folk Medicine in The Scientific World. (Oral)**

Sunita Waila Tiwari, Archana N Sah. Department of Pharmaceutical Sciences, Faculty of Technology, Bhimtal Campus Bhimtal, Kumaun University Nainital, Uttarakhand-263136, India. E-mail: sunitawaila@hotmail.com

Prunus armeniaca L.(Wild Apricot or khubbani) belonging to family Rosaceae is an important medicinal plant with edible fruits, grown in North Eastern hills, also found in Nainital district of Kumaun region. In present study, the apricot kernels and fruits were evaluated for their anticholelithiatic activity as no satisfactory pharmacological treatment is yet available for cholelithiasis except cholelithotomy. *P. armeniaca* L.fruit and kernel extracts were prepared in ethanol (99%) and petroleum ether (70ºc) respectively. For *in-vitro* study, gall bladder stones (cholesterol and pigment stones) were collected from hospitals and treated with combination of fruit and kernel extracts in two doses (1 mg/ml and 2 mg/ml) and standard (Ursodiol, 2 mg/ml) for 4 weeks. It was found that dry weight of stones were reduced and amount of cholesterol released was increased in dose dependent manner. For *in-vivo* study, acute toxicity studies

were carried out using Wistar rats and both the extracts were found to be safe up to the dose of 2000 mg/kg. Cholelithiasis was induced in albino mice (25-35 gm) by feeding them a lithogenic diet (2% cholesterol and 0.5% cholic acid) for four weeks. Treatment groups were given fruit and kernel extracts in combination (total 400 mg/kg) and separately (200 mg/kg each). Experimental animals were analyzed for serum, bile and liver lipid parameters. Percent weight gain of mice, weight of isolated organs (liver and gallbladder) were measured. Cholesterol gallstones grading and histopathological analysis of isolated organs were also performed. FTIR (Fourier transform infrared spectroscopy) analysis was performed to investigate the composition and type of gallstones. The antilithogenic influence was found to be highest when apricot fruit and kernel extracts were given in combination as compared to their separate doses. The data obtained from the current study justified the therapeutic importance of *P.armeniaca* L. against cholelithiasis.

In vitro studies for conservation of _Berberis aristata_ DC. (Oral)

Sushma Tamta[1] and Latika Brijwal[2]. [1]Department of Botany, D.S.B. Campus, Kumaun University, Nainital 263002 and [2] Department of Entomology, Agriculture College, G.B.P.U&T, Pantnagar. E-mail:sushmatamta@gmail.com

Kilmora (*Berberis aristata*), an endangered, woody spiny shrub, is an important component in different medicinal formulations. Its natural regeneration mainly takes place through seeds but takes long time for germination in natural conditions. So *in vitro* attempts were made for its propagation by using different explants like- leaves, nodal segments etc. In addition to this, leaves and callus were also used to induce hairy roots. Protocols have been developed for *in vitro* regeneration and hairy root induction. Findings of this study will be helpful in lowering the pressure on natural populations, as these results could help fulfill the demand of pharmaceutical industries for the endangered native *B. aristata* plants.

Over production of flavonoids in _Oroxylum indicum_ under _in vitro_ conditions through elicitation. (Poster)

Swati Sinha, Kajal, Neema Bisht and Tapan K Nailwal.Departent of Biotechnology, Kumaun Univeristy. E-mail: tapannailwal@gmail.com

Oroxylum indicum (Bignoniaceae) commonly known as, Indian Trumpet flower, Shyonak, Midnight horror, tree of Damocles, broken bone tree and bat-pollinated (Chiropterous) is native to Indian sub-continent and has been extensively used by local tribes for medicinal purposes. It has been listed under rare and endangered plant in many states of India. *O. indicum* is used in many ayurvedic formulations like dashmool, amartarista, dantyadyarista, narayana taila, and chyavanaprasa. The evolving commercial importance of flavonoids and a need for renewable resources of valuable chemicals has lead to attempts in developing alternative systems for their production. Phytochemically, *O. indicum* contains flavonoids like baicalein, chrysin, oroxylin A, apigenin, hispidulin and scutellarin. In this study we have reported *in vitro* production of quercetin, baicalein and chrysin under the effect of two abiotic elicitors - Methyl Jasmonate and Salicylic acid. Three concentrations of the elicitors viz., 50µM, 100 µM and 200 µM were tested at different time interval of incubation. Methyl Jasmonate (MJ) was found better than salicylic acid (SA) under all applied concentrations for over production of flavonoids with one exception. Treatment of *Oroxylum indicum* with 100 µM of MJ for 10 days led to highest production of chrysin and Baicalein, while 100 µM of SA of 10 days led to highest production of quercetin. Production of Baicalein (has been reported to have anti-cancerous activity) under *in vitro* conditions was higher than that in wild type *Oroxylum indicum* on per gram fresh weight basis even without elicitation. From this study we can conclude that *in vitro* production of flavonoids under elicitation, from *Oroxylum indicum* provides a non-destructive approach of production as against, extraction of flavonoids from plants occurring in nature.

Allelopathic effect of some medicinal plant extracts on seed germination and seedling growth on food crops. (Poster)

Tanmay Mishra, Rashmi Singh, Narendra Kumar. Department of Botany and Pharmacognosy, CSIR-Central Institute of Medicinal and Aromatic Plants, Kukrail Picnic Spot Road, Lucknow-226015. E-mail: narendrakumar@cimap.res.in

Allelopathy can be considered as a component of biological control in which plants influences the growth and development of nearby plants through both inhibitory and stimulatory biochemical interactions. In medicinal plants, secondary metabolites might play an important role to find out the new agrochemicals and probably will enhance the process of novel natural herbicide development. These agrochemicals from medicinal plants could be considered as replacement for synthetic compounds in the crops. Therefore, the present study was carried out to explore the allelopathic effect of selected plants (*Parthenium hysterophorus, Lantana camera, Artemisia annua, Ocimum carnosum*) on *Brassica campestris* and *Hordeum vulgare*. The result showed that increasing the concentration of plant extract, cause reduction of seed germination and seedling growth. *Artemisia annua* exhibited significant inhibition in seed germination and seedling growth among other studied extracts of plant species. Different parameters i.e. germination percent, germination index, mean germination time, germination energy and seed vigour index were studied to optimize the effective inhibitory concentration of extracts. Various histological differentiation in treated and control plant species were also observed.

Identification of *Fusarium oxysporum* inhibitors by high throughput virtual screening of *Mentha piperita*. (Poster)

Tanuja Joshi[1], Tushar Joshi[2], Subhash Chandra[1]*. [1]Department of Botany, Kumaun University, S.S.J Campus, Almora, Uttarakhand, India and [2]Department of Biotechnology, Bhimtal campus, Kumaun University Uttarakhand, India. Email- scjnu@yahoo.co.in

Mentha piperita of the Labiatae familyis economically important aromatic and medicinal herb. Several scientific literatures have demonstrated that the oil of *M. piperita* have antimicrobial properties. A report has demonstrated that peppermint oil has very good fungicidal effects against several fungal pathogens including *Fusarium* sp. and may be used as a fungicide. In present work, we have computationallyscreened several potent antifungal phytochemicals from *M. piperita against Fusarium oxysporum*. For this we have conducted Virtual Screening against Isocitrate lyase (ICL) enzyme of *Fusarium oxysporum*.ICL is a crucial enzyme involved in the Glyoxylate pathway, essential for the virulence of a number of fungal pathogens including *F. oxysporum.* Therefore, ICL is attractive molecular target for the discovery of antifungal compounds. ICL inhibitors can be used to control the growth of this fungus. Although, several inhibitors of ICL have been identified, however, most of these inhibitors are not environment friendly. Hence there is still a need to discover natural specific inhibitor of ICL derived from plants that can be effective as they may be environmentally suitable with less toxicity.Firstly, Text mining methods were used to collect a 3D structural library of 80 phytochemicals from *M. piperita*then subjected to Molecular Docking (MD) followed by Drug-likeness and ADMET prediction.The results revel thattotal 56 phytochemicals have excellent binding potentialto ICL of *F. oxysporum as* compared to reference molecule.The binding energy ranges obtained from MD were between -7.3 kcal/mol kcal/mol to -3.2 kcal/mol as compared toreference ligand, 3-bromomopyruvate (-3.2 kcal/mol) as standard ICL inhibitor. The ADMET prediction of hits compounds shows their strong candidature as potential antifungal drug candidates.Therefore, we conclude that these phytochemicals can be used as an antifungal agent and they can be further used to develop more effective fungicide with fewer side effects.

Cordyceps sinensis: The progress from Chinese medicine to a promising therapeutic drug. (Poster)

TribhuwanChandra[1], Sunita Kumari Yadav[2] and Nitin Bhardwaj[3]. [1]Department of Zoology, Govt. Post Graduate College, Gopeshwar Chamoli, Uttarakhand, India, [2]Department of Zoology, Govt. Post Graduate College, Karanprayag, Chamoli, Uttarakhand, India [3]Department of Zoology, Daulat Ram College, Delhi University. E-mail:nitindna2001@gmail.com

The parasitic association of *Cordyceps sinensis* and caterpillar of ghost moth is a well-known medication used in traditional Chinese medicines for centuries. The presentation involves the structure and distribution of *C. sinensis* beside most recent enhancements in *C. sinensis* research, with respect to its bioactive chemical constituents, the pharmacological findings and the advancement in the developments of its commercial products in recent time. Significant findings: *C. sinensis* is commonly called winter worm summer grass in English and Yarsagumba in Nepalese. It is also called Himalayan Viagra for its aphrodisiac effect. The various bioactive molecules present in *C. sinensis* are cordycepin, cordycepic acid, a number of polysaccharides, minerals, proteins, ergo sterol and lipids. It has a potential role in treating immense number of diseases such as potency, insomnia, stress, fatigue, diabetes, hyperlipidemia, renal, respiratory, lung and heart diseases. The research advances of *C. sinensis* from traditional Chinese medicine to laboratory will be debated along with animal trial studies showing promising results. Several bioactive components of *C. sinensis* playing role in curing various diseases will be discussed. Since it is available in limited amount at a particular time of the year and has vast beneficial effects, it is illegally trafficked and due to excess harvesting and trading, it is at the verge of being classified as a rare species in the near future. *C. sinensis* has a potential to be a promising therapeutic drug. The future perspectives involving pharmacokinetics, pharmacodynamics and toxicity related studies need to be addressed. Also the excess harvesting of *C. sinensis* may lead to its extinction, therefore the conservation steps need to be engaged to preserve *C. sinensis.*

Preliminary phytochemical screening and salivary α- amylase inhibition activity of _Enicostemma axillare_ (Poster)

Gavit Ujwala[1], Patil Geeta[2] and Gavit Pankaj[1].[1]G. D. M. Arts, K.R.N. Commerce and M.D. Science College Jamner, Dist- Jalgaon. MH. India 424206. [2]Arts, Commerce and Science College Bodawad, Tal- Jamner, Dist- Jalgaon. MH India 424206. E-mail: pankajgavit@rediffmail.com

Medicinal plants have been of great interest due to their benefit as to health foods and drugs to prevent various diseases. Naturally the secondary metabolites of the plant provide defence mechanisms against pathogens, predators and for self protection against microbes and herbivory. The chemistry of natural products is an emerging area in drug development activity. The extract of leaf samples were used for the phytochemical analysis to find out the phytochemical constituents in the plants. The main objective of the research work was to check the presence or absence of the phytochemical constituents in plant and In vitro studies the α-amylase inhibition activity. The α-amylase has been used as an effective therapy for Type 2 diabetes is an endocrine disease normoglycemia to prevent later complication. Among glucose-lowering medication, α-amylase inhibitor delays the absorption of ingested carbohydrates, reducing the postprandial glucose and insulin peak. The phytochemical analysis of the plants is very important commercially and has great interest in pharmaceutical companies for the production of the new drugs for curing of various diseases. It is expected that the important phytochemical properties recognized by our study in the indigenous medicinal plant. The results suggested that *Enicostemma axillare* is a rich source of the phytochemical analysis of these medicinal plant showed that the flavonoids, terpenoids, reducing sugar, and alkaloids were found to be present in afore mentioned medicinal plant.

Traditional grains as nutraceuticals in modern markets (Oral)

Vartika Jain.Department of Botany, Government Meera Girls' College, Udaipur, Rajasthan, India.E-mail: vartikajain31@gmail.com

The term Nutraceutical was coined about three decades ago for plants or plant products having nutritional value with added health or medical benefits. Indigenous communities were consuming many of such plants in their daily diet regime traditionally without knowing that those plants could be called as modern day nutraceuticals. These include various grains of cereals, millets, and pseudocereals. An attempt was made to survey rural markets, bakery shops, grocery shops, urban food markets, food marts and super markets in Udaipur as well as online shopping websites to know about availability and types of products developed from these grains. There were 20 plant species whose grains are utilized to produce various nutraceuticals and out of 20, 11 are monocots from family Poaceae and rest 09 are dicot species. Many of these grains possess many potential health benefits such as lowering of blood pressure, cholesterol and obesity, prevention of cancer and cardiovascular diseases, reduction in tumor incidences, and supply of gastrointestinal bulk in form of rich dietary fibers. As there is growing awareness about nutrition and health-care, incorporation of these traditional ancient grains into modern diets in form of biscuits, pasta, chips, snacks, chocobars, foodles, noodles, spaghetti, bread, muffins, porridge, health-drinks etc. is a consumer friendly innovation to therapeutically benefit high-risk populations by enjoying delicious dietary modifications. The paper further highlights the noticeable shift in diets of urban rich communities by including healthy nutraceutical food in their daily diets in order to stay fit and gain long lives.

Cinnamaldehyde encapsulated gellan/PVA based electrospun nanofibers for eradicating *Candida* biofilm. (Oral)

Purusottam Mishra, Payal Gupta, Vikas Pruthi, Department of Biotechnology, Indian Instituite of Technolgy Roorkee, Roorkee, Uttarakhand, India. E-mail: vikasfbs@gmail.com

High cost, nephrotoxicity, bone marrow and liver dysfunctions are the significant challenges that need to be addressed while designing any novel anti-fungal therapeutic agents. Natural phytochemicals possess low cytotoxicity and minimal side effects as compared to the currently available anti-fungal drugs. In this study, Cinnamaldehyde (CA), an FDA approved phytoactive molecule present in essential oil of cinnamon with antimicrobial activity was evaluated for its anti-biofilm activities. Therapeutic application of CA is restricted due to its low water solubility, high volatility and irritant effect. Recently, synthesis of biomolecules encapsulated in electrospun nanofibers have emerged as an alternative strategy to overcome the above-mentioned hindrances. Here, we encapsulated CA with gellan (GA)/ poly vinyl alcohol (PVA) nanofibers by using electrospinning technique. The encapsulation, compatibility and physical state of CA nanofibers were evaluated by FTIR, XRD and TGA analysis. The average diameters of CA encapsulated GA/PVA nanofibers and GA/PVA nanofibers were recorded to be 106.04 ± 50.64 nm and 181.77 ± 48.78 nm, respectively. These nanofibers were evaluated for their anti-biofilm activity against *Candida* usingXTT (2, 3-bis (2- Methoxy-4-nitro-5-sulfophenyl) - 5-[(phenylamino)-carbonyl]-2H-tetrazolium salt) reduction assay. Data demonstrated that CA encapsulated GA/PVA nanofibers can effectively eradicate 40% and 22% of *C. glabrata* and *C. albicans* biofilm respectively. Sustain release of CA was examined to study the continuous decrease in cell count at different time intervals. FESEM micrographs depicted drop in adherence of *Candida* cells to the surface of CA encapsulated nanofibers as compared to the GA/PVA nanofibers. These fabricated nanofibers potentially could be used as novel wound dressing material and coatings on biomedical implants to inhibit fungal contaminations.

Biosynthesis of metal nanoparticles using herbal extracts and their applications (Poster)

Vinay Kumar [1] , Syed Mohsin Waheed[1] and Manu Pant[2]
[1]Department of Biotechnology, Graphic Era (Deemed to be University), Dehradun, Uttarakhand and
[2]Dept. of Life Sciences, Graphic Era (Deemed to be University), Dehradun, Uttarakhand. E-mail: kumarvinay7291@gmail.com

Metal nanoparticles have numerous applications in science and technology. They can be synthesised either by chemical, physical or biological methods. One of the biological methods adopted is the use of herbal extracts to synthesize metal nanoparticles. Phytocompounds present in herbal extracts have anti-oxidant

or reducing properties which can be utilized to (by reduction of metal ions) synthesize metal nanoparticles from their salts. This method is cost effective, eco-friendly, safer, and easier to use. The process of nanoparticle biosynthesis could be controlled to make nanoparticles of different shapes and sizes. The biosynthesized nanoparticles must be characterized and stabilized before they could be put to the desired use. The nanoparticles thus synthesized could be put to various applications such as imaging, diagnostics, therapeutics, and targeted drug delivery by functionalizing them. Functionalizing involves conjugation of nanoparticles with numerous other molecules or biomolecules to perform specific functions. Besides, nanoformulations using metal-nanoparticles have been in use for a long time in various branches of traditional medicine like, Ayurveda, Siddha and Unani medicines.

Traditional Knowledge on Healing Properties of Medicinal Plants in Kashmir Himalaya (Poster)

Zakir Hussain Khanday Department of Life Science, Singhania University, Rajasthan
E-mail: zkhanday@gmail.com

Traditional medical practitioners play an important role in the health care of millions of people in developing countries. Global estimates indicate that over ¾ of the 5 billion world population cannot afford the products of western pharmaceutical industry and have to rely upon the use of traditional medicines, which are mainly derived from plants. This fact is well compiled in WHO in an inventory of medicinal plants list of over 20,000 species. As a part of the strategy to reduce financial burden on developing countries which spent 40-50% of their total health budget on drugs, WHO currently encourages, recommends and promotes the inclusion of herbal drugs in national health care program because such drugs are easily available at a price within the reach of common man and as such are time-tested and considered to be much safer than the modern synthetic drugs. During the present ethno botanical survey of different inaccessible regions of Kashmir, the author found that the local knowledge on medicinal plants abounds and their use is an important link between the dwelling communities and their biodiversity of the area. The use of effective medicinal plants is, thus strength within a link. However these plants cannot meet all the health needs, but have been confidently used as home remedies.

Plant Species used by locals as ethno medicine in Garhwal Region of western Himalaya (India). (Poster)

Zoya Shah and Dhani Arya.Department of Botany, S.S.J. Campus Almora, Kumaun University Nainital, Uttarakhand (India).

Plants have played a key role in day-to-day life support system of human beings from time immemorial. The use of plant species of the Himalaya as medicine has been known for a long time.The present investigation was carried out in nine villages of Chamoli district of Garhwal Himalaya regarding mild and native ethno-medicinal plants which were used by locals in their own traditional health care system. This study reveals the status of ethno-medicinal plants and their importance preserved by locals of Garhwal region. During the study it was observed that 72 species of medicinal plants were being used in ethno medicine by locals with advice of Vaidhyas and experienced persons of the region since long time. Herbal medicine is still the mainstay of about 75% of the world population, especially in the under developed and developing countries, for primary health care because of better compatibility with the human body and lesser side effects. Hence the main purpose of this study was to document the indigenous knowledge of Vaidhyas and other experienced persons of the area regarding the use of ethno-medicinal plants, their conservation and imparting this knowledge with younger generation. Because, the indigenous knowledge of local flora are being eroded in younger generation, therefore the present study may help in fulfill this gap respectively.

Effect of Plant Growth Regulators (PGRs) on root formation in Top edge cuttings of *Nardostachys grandiflora* DC. (Poster)

Pradeep Dobhal, Vijay Kant Purohit, Bhagat Singh Mengwal, Mohan Chandra Nautiyal. High Altitude Plant Physiology Research Centre, H.N.B. Garhwal University (A Central University), Srinagar, Garhwal-246174. Email: vijaykantpurohit@rediffmail.com

Nardostachys grandiflora DC. (Jatamansi) is a small herbaceous species of family Caprifoliaceae, commonly known as Jatamansi, Indian nard or spikenard. It is a perennial, dwarf, hairy, rhizomatous medicinal herb and grows in steep, moist, rocky, undisturbed grassy slopes between 3000-5000 m asl in random forms in higher Himalayan region. It has a long history of use in ethno medicine, perfume, incense and modern medicine. The species has become endangered due to over exploitation for medicinal use, habitat degradation and other biotic interference in its distribution ranges. Initially the observations of experiment indicated that the large number of *N. grandiflora* plants can be obtained through using top edge cuttings without damaging the plants before senescence period therefore experiment was conducted at HAPPRC, Srinagar Garhwal (550 m asl). Top edge cuttings (7.11±1.69 cm L; 4.34±1.59 mm Dia.; 2.93±1.29g wt.) prepared from five year old plants growing at Tungnath nursery (3400 m asl). Four treatments viz., IAA, IBA, NAA, and BAP with different concentrations (50, 100, 500 and 1000 µM each) were tried to stimulate sprouting and rooting. The cuttings were dipped in different concentration of PGRs for 24 hours and planted in Styrofoam trays at greenhouse condition containing mixture of Soil, Sand, Farm Yard Manure (FYM), and Forest Litter (FL) at the ratio of 1:1:1:1:1.The cuttings were also treated with Bavastine through direct dip method and same cuttings were planted in Styrofoam trays containing mixture of soil as control. Experimental trails have been for development of reliable and most beneficial vegetative propagation through top edge cuttings method. After six month of plantation the present experiment represent that IBA (50µM) showed maximum percentage (53.33%) of rooting compared to other PGRs.

Spatial distribution, availability and threats on medicinal and aromatic plants of alpine region of Uttarakhand: Angelica galuca Edgew: a case study (Poster)

Naveen Chandra, Gajendra Bisht, Shashank Lingwal, Vineet Pal, M.P.S. Bisht
Uttarakhand Space Application Centre, Vasant Vihar Dehradun

The alpine and subalpine regions of Western Himalaya are one of the world richest treasuriesof Medicinal and Aromatic Plants and also houses many Rare, Endangered and Threatened (RETs) owing to its diverse topographic and climatic variation. **High altitudes of Uttarakhand are rich in plant diversity and around 701 species of the region are being utilised in different ethno-medicines.** In the recent past theavailability of these species in the regions has declined considerably due to unsustainableharvesting, habitat loss and excessive grazing pressure. There are 25 (RETs) reported fromalpine region of Uttarakhand. Present study deals with (i) Availability (ii) Spatial distribution& (iii) Threats on the RET species of the alpine region of Uttarakhand between 3000-5300melevation. Random sampling technique (10 plots in 1hectare area) and Rapid MappingExercise (4 plots at every 50m distance, total 40 plots in one transect) were used to assess theavailability of species. Landsat-8 data was used to delineate the spatial distribution of RETsby using various Ground Control Points (GCPs). Various herbarium records, literature &current field locations were also used for spatial distribution assessment. Potentialdistribution modelling was done for RETs by using MaxEnt modal with bioclimatic andvarious abiotic variables (slope, aspect, elevation, soil types etc.). Information on livestockpopulation, grazing period and exploitation by human beings were collected to assess thethreats. Among various RETs, Angelica glauca showed its highly suitable area about 332 km 2whereas less suitable area reported 764 km 2. The density ranges between 0.5-1.5 ind/m 2 .There are only 10 potential rich sites (Tungnath, Gidara, Devikund, NapalchuNala, Valley offlower, Mandani, Palang Gar, Phurkia, Rudranath, Khatling etc.) of Angelica in the alpineregion of the

state. The species has major threat, due to excess/unscientific exploitation.Whereas due to grazing by livestock the habitat is dwindling. For its cultivation, some effortsare being made by local communities in certain valleys, but these are insufficient to reducethe pressure in the natural habitats. Similarly, all the 25 RETs species are being assessed forthe alpine region of Uttarakhand.

QUALITATIVE, QUANTITATIVE PHYTOCHEMICAL ANALYSES AND ANTIOXIDANT ACTIVITY OF *RHODODENDRON ARBOREUM* FROM HIMACHAL PRADESH (Poster)

Pramod Rawat, Navin Kumar, Syed M. Waheed, *Rakesh* Kumar Bachheti, Nishant Rai * Graphic Era (Deemed to be University) Dehradun, Uttarakhand, India

A strong, well-functioning immune system is the foundation of good health. Immunity is the balanced state of obtaining sufficient biological defenses to fight infection or different unwanted biological invasions whereas having tolerance to avoid allergic reaction and autoimmune diseases. Different parts of Rhododendron arboreum is a source of high value phenolics and flavonoids which could be used in preventive medicines, nutraceuticals and have the capability of removing free radicals from human body and thus acting as anti-oxidants. In the present study, qualitative phytochemical investigation of *R. arboreum* leaves extract indicated the presence of phytosterols, alkaloids, carbohydrate, glycoside, sterols & steroids, terpenoids, and tannin. All the extracts showed remarkable DPPH free radical scavenging activity, ABTS free radical scavenging activity and FRAP ferric ion reducing antioxidant power using tolox as standard. The methanolic extract is subjected to TLC and column chromatography out of 15 only 07 fractions were collected and coded as *R. arboreum* methanolic fraction (RAM Fr1, Fr2, Fr3,) likewise. These fractions were analyzed by TLC using different solvents ratio along with standards (Sigma and Himedia). The result showed that retention factor of spot TMS-10 (Toluene: Methanol) (8:1, v/ v) is equivalent to ursolic acid and spot CMS-3 (Chloroform: Methanol) (11:3, v/v) is equivalent to kaempferol. The concentration of purified residue of TMS-10 was estimated in the range of 5.68 ±2.66 mg ursolic acid g^{-1} of extract and CMS-3 was estimated in the range of 66.8± 0.786 mg kaempferol g^{-1} of extract by HPLC. Identification of compounds (TMS-10 & CMS-3) by 1H NMR, C 13, IR, depth 135 and mass spectrometry confirmed TMS-10 as ursolic acid and CMS-3 as kaempferol. Hence, the *R. arboreum* have potential to develop them as effective natural anti oxidative and immunomodulator drugs which inhibit the oxidative mechanism and play a crucial role as health defensive factor.

Evaluating native plants of Western Himalayas for ornamental and medicinal uses (Oral)

Priyanka Thakur[1] and AK Joshi[2] Principal Floriculturist[1] and Associate Director [2]Regional Horticultural Research and Training Station Dhaulakuan, District Sirmour Dr Y.S. Parmar University of Horticulture and Forestry, Nauni(HP) 173230 Email address: priyanka.thakur@gmail.com

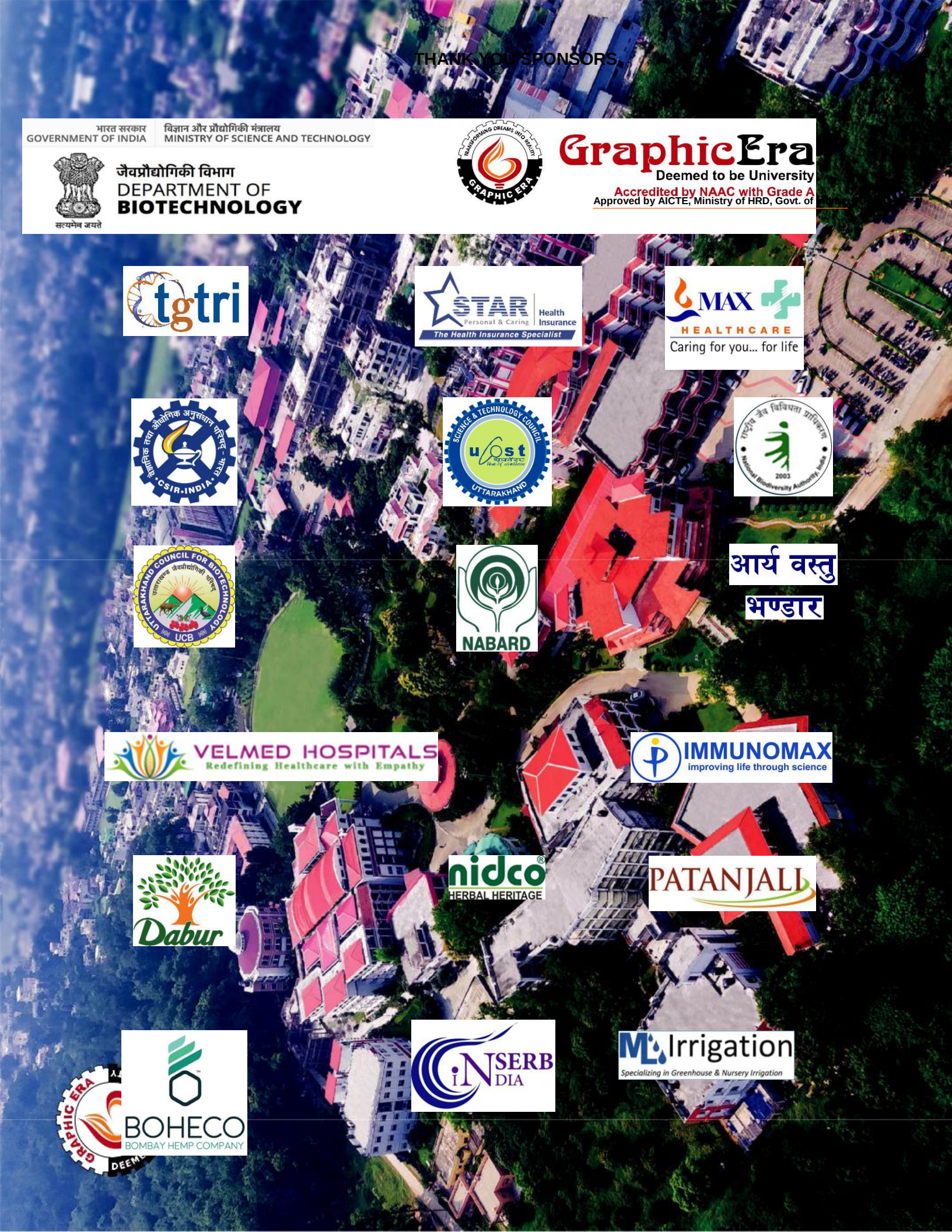
Western Himalayas, is the home of an amazing array of wild flower species, available at all the time of the year; beautifying a hollow in a rock, half hidden ferns in moist shady areas, covering blossoms or splendid splash of autumn colours over the trees. All over the world, people are literally 'going native' especially The Great Britain, Ireland, England, Scotland, Australia etc. Australia has domesticated their native flowers like Banksia, Kangaroo Paw (*Anigozanthos*), rice flower etc. In the present study, extensive explorative surveys were conducted in different agro-climatic zones of HP and Uttrakhand to collect native flowering plants for various ornamental and medicinal uses. *Barleria cristata* belonging to family Acanthaceae is a deciduous perennial shrub which can be used as border, pot plant, shrubbery and specimen shrub in gardens, and its dried capsules can be value added by painting for making dry flower baskets, besides medicinal plant (roots and leaves are used for the treatment of cough). An evergreen shrub *Jasminum humile* which is utilized for perfume and oil extraction can also be used for hegde, borders, avenue, loose flowers for venis and gajras etc. Likewise, *Reinwardtia indica, Cotoneaster macrophylla, Inula cappa, Indigofera pulchella, Daphne cannabina, Cocculus laurifolius* etc can be utilized for ornamental purposes like specimen, mass plantations, avenue, shrubbery borders, pot plants etc. Attractive ferns like *Cheilanthes albomarginata, Christella dentata, Polystichum sqarrosum, Pteridium aquilinum, Pteris cretica, Pteris vittata, Woodwardtia*

unigemmata. Flowers like *Anaphalis margaritacea, Ainsliaea aptera, Barleria cristata, Clematis gouriana, Cyperus alternifolius, Juncus thomsonii, Reinwardtia indica, Rosa brunonii, Salvia coccinea, Senecio chrysanthemoides, Spirea canescens, Thysanolaena maxima, Verbena bonariensis.* Ornamental twigs of *Betula utilis, Sapium insigne, Cotinus coggygria, Elaeagnus parviflora, Myrsine africana*; ornamental attractive seeds and fruits of *Abrus sprecatorius, Aesculus indica, Engelhardtia colbrookiana, Flemingia fruticulosa, Dioscorea deltoidea, Euonymus tingens, Hedera helix, Mallotus philippinensis, Nicandra physaloides, Prunus cerasoides, Pyracantha crenulata, Rosa webbiana* etc. Cones of conifers like *Abies pindrow, Cedrus deodara, Pinus roxburghii, Pinus wallichiana* etc. are used for making dry flower greeting cards, floral baskets and other value added items.

Indirect organogenesis of *Sida cordifolia* **(Poster)**

Nidhi. S[1], Mariadoss. A[1], Kalivani. T[1], Rajasekaran.C[1] Department of Biotechnology, School of Biosciences and Technology, Vellore Institute of Technology, Vellore, Tamil Nadu- 632 014 Email.:nidhisabade143@gmail.com

Sida cordifolia is a small herb which is found in the tropical and sub-tropical regions and belongs to family Malvaceae. It is commonly known as country mallow in English and Bala in Hindi. Traditionally it is used in the treatment of nasal congestion, chronic dysentery, asthma, gonorrhoea and other ailments related to respiratory system. The leaf extracts show anti-inflammatory, analgesic, hypoglycaemic and cardiovascular properties. It is also used in formulation of medicated oil for treating joint pain, swelling and massaging This plant is reported to contain considerable amounts of ephedrine, pseudoephedrine, vasicinol, vasicinone, and N-methyl tryptophan. Ephedrine is believed to stimulate the central nervous system and can enhance weight loss. Due to its numerous uses it is being extensively collected from its wild habitat. The objective of this study is to develop effective callogenesis protocol for *in vitro* propagation *Sidacordifolia*. Different plant parts like leaf, nodes, inter-nodes and roots are used as explants for callus induction.Among the different explants, leaf explants produced highest frequency of callogenesis in Murashige and Skoog (MS) medium supplemented with kinetin (Kn) 1mg/l and Naphthalene Acetic Acid (NAA) 0.5mg/l. Among the different combinations MS medium fortified with 1.5mg/l 6-benzylaminopurine (BA) and 0.1mg/l Indole Acetic acid (IAA) showed highest frequency (78%) of indirect shoot regeneration from callus. Thus, this protocol will provide an alternative effective *in vitro* propagation method for mass propagation of *Sidacordifolia* to meet the pharmaceutical industry demand without affecting the natural population.


THANK YOU SPONSORS
भारत सरकार
GOVERNMENT OF INDIA
विज्ञान और प्रौद्योगिकी मंत्रालय
MINISTRY OF SCIENCE AND TECHNOLOGY
जैवप्रौद्योगिकी विभाग
DEPARTMENT OF
BIOTECHNOLOGY
सत्यमेव जयते
GraphicEra
Deemed to be University
Accredited by NAAC with Grade A
Approved by AICTE, Ministry of HRD, Govt. of
tgtri
STAR
Personal & Caring
Health
Insurance
The Health Insurance Specialist
MAX
HEALTHCARE
Caring for you... for life
CSIR-INDIA
SCIENCE & TECHNOLOGY COUNCIL
ustost
UTTARAKHAND
2003
National Biodiversity Authority India
UTTARAKHAND COUNCIL FOR BIOTECHNOLOGY
UCB
NABARD
आर्य वस्तु
भण्डार
VELMED HOSPITALS
Redefining Healthcare with Empathy
IMMUNOMAX
improving life through science
Dabur
nidco
HERBAL HERITAGE
PATANJALI
BOHECO
BOMBAY HEMP COMPANY
iNSERB
DIA
Irrigation
Specializing in Greenhouse & Nursery Irrigation

Poster/ Oral Competition Awards			
Category	Winners	Awards*	Address
Poster	First prize- Ms. Arti Bisht	Certificate and $100	Govind Ballabh Pant Institute of Himalayan Environment and Development, Kosi Katarmal, Almora, Uttarakhand, India Mob: +91 8057713933
	Second Prize- Dr. Payal Gupta	Certificate and $75	Department of Biotechnology, Indian Institiute of Technolgy Roorkee, Roorkee, Uttarakhand, India Mob: +91 9760882930
	Third Prize- Dr. Amrita Srivastava	Certificate and $50	Department of Life Sciences, Central University of South Bihar,Panchanpur,Gaya, India Mob: +91 7905078443
Oral (O1)- Young Scientist	Mr. Rakesh Kumar Thakur	Certificate and $100	Rakesh Kr Thakur C/O Prof. S. N. Raina Amity Institute of Biotechnology Amity University,Sec 125 Noida,India Mob-+91 9810354666
Oral (O2)- Young Scientist	Dr. Mythily S.	Certificate and $100	Dr. Mythily S., Division of Biochemistry, School of Basic and Applied Sciences, Galgotias University, Greater Noida,India Mob. No: +91 9599863924

*Prize money- As discussed with Prof. Adelberg