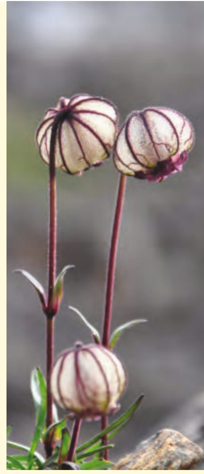
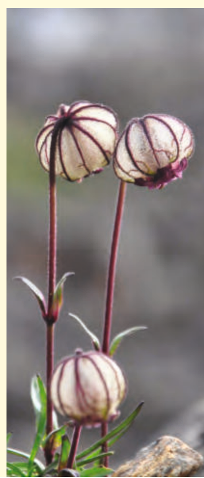


APSBBC 2023



XXXIII Annual Conference of Indian Association for Angiosperm Taxonomy
and
International Seminar on

Advances in Plant Systematics, Biogeography and Biodiversity Conservation

November 25-27, 2023

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XXXIII Annual Conference of Indian Association for Angiosperm Taxonomy
&
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ADVANCES IN PLANT SYSTEMATICS, BIOGEOGRAPHY AND BIODIVERSITY CONSERVATION (APSBBC- 2023)

November 25-27, 2023

Abstract Book

Organized by

Department of Botany, University of Calcutta

In collaboration with

Botanical Survey of India, Kolkata

Book of Abstracts

International Seminar on "Advances in Plant Systematics, Biogeography and Biodiversity Conservation (APSBBC-2023)"

25–27 November, 2023

Editors
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Dinesh Kumar Agrawala
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XXXIII Annual Conference of Indian Association for Angiosperm Taxonomy
&
International Seminar on

Advances in Plant Systematics, Biogeography and Biodiversity Conservation (APSBBC- 2023)

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MESSAGE

It is heartwarming to see the Indian Association for Angiosperm Taxonomy (IAAT) growing in leaps and bounds. The quality of taxonomic research in the country is improving day by day. The role of IAAT in the whole transformation is highly appreciable. The IAAT has given the much-required identity to the plant taxonomic fraternity. Thirty-three years after its establishment, taxonomists are meeting at Kolkata for the XXXIII Annual Conference of the Indian Association for Angiosperm Taxonomy & International Seminar on Advances in Plant Systematics, Biogeography and Biodiversity Conservation. Being the birthplace of modern Botany in the country, it is more than just a gathering of botanists; it is a botanical pilgrimage for most of us. Thanks to the Department of Botany, University of Calcutta, for making efforts to organise this event in collaboration with the Botanical Survey of India. This seminar is happening against the backdrop of breathtaking developments in Science and Technology, which will influence every walk of life, and the field of plant taxonomy is no exception. Hope, as a plant taxonomic community, we positively respond to these developments and grow with the rest of the scientific community. I believe this seminar will bring the members of the IAAT family much closer, leading to the discussions that eventually advance plant systematics at the global level. On behalf of the IAAT, I thank the University of Calcutta and the Botanical Survey of India for their efforts and wish them a grand success.

(M K Janarthanam)
President
IAAT

Prof. Santa Datta (De)
M.Sc., Ph.D.
Vice Chancellor
University of Calcutta

UNIVERSITY OF CALCUTTA

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07.11.2023

MESSAGE

It's wonderful to hear that the Department of Botany, University of Calcutta is preparing to publish the 'Abstract Volume' of the XXXIII Annual Conference of Indian Association for Angiosperm Taxonomy and International Seminar on "Advances in Plant Systematics, Biogeography and Biodiversity Conservation". Conservation of biodiversity is indeed a critical and pressing concern in the present era. The loss of biodiversity is a result of various factors, including environmental disasters and human activities such as deforestation, habitat destruction, pollution, and overexploitation of natural resources. To address these challenges, it is crucial for the global community to exchange ideas and implement strategies aimed at preventing further biodiversity loss and maintaining the ecological balance of our planet. Promoting the conservation of biodiversity involves a collaborative effort, and platforms like this are essential for facilitating the exchange of knowledge. Besides, this volume promises to serve as a platform for innovative scholarly works in various aspects like plant diversity, floristics, phytogeography, endemism, climate change, ethnobotany, etc. that showcase the integration of collective knowledge and research on interdisciplinary and trans-disciplinary ideas.

I would like to express my heartfelt appreciation for every individual who have played pivotal role in bringing this publication to fruition. Their dedication and hard work have undoubtedly contributed to the success of this endeavor.

I extend my sincere acknowledgment and best wishes for the continued success of this important publication. It is through efforts like these that we advance our understanding of plant science and its applications.

S. Datta (De) 07/11/2023
Vice Chancellor

The Indian Association for Angiosperm Taxonomy (IAAT)

(Established: 1991)

Prof. Santhosh Nampy
Secretary

Message

The Indian Association for Angiosperm Taxonomy, with over 900 life members, is the largest organization of taxonomists in India. Established in 1991 with Department of Botany, University of Calicut as its headquarters, IAAT welcomes anyone who is interested in advancing Angiosperm Taxonomy. The Annual Conference of the Association is held in different parts of the country each year and it gives me immense pleasure to announce that the Department of Botany of Calcutta University is hosting the XXXIII Annual Conference of IAAT from 25 to 27 November 2023 at Kolkata. A Symposium on ”Advances in Plant Systematics, Biogeography and Biodiversity Conservation (APSBBC-2023)” is being planned in conjunction with the Conference.

I congratulate the Department of Botany, Calcutta University for their dedication and thumping drive in organizing the Conference. I sincerely appreciate the hard work by Dr. Debabrata Maity in organizing the Conference and Symposium. I also congratulate his team for their meticulous effort in preparing an excellent book of abstracts. I am sure that three day Conference will provide an enlightening platform for all taxonomists to discuss the recent developments in the field of angiosperms and will serve a pivotal point in the student’s development as eminent scholars.

I wish everyone a rewarding academic experience and wonderful stay at Kolkata.

S. Nampy
Secretary
IAAT

UNIVERSITY OF CALCUTTA

Senate House, 87/1, College Street, Kolkata – 700 073

Prof. (Dr.) Debasis Das
Registrar

Phone : 033-2219-0092
E-Mail : registrar@caluniv.ac.in

I am delighted to hear about the upcoming XXXIII Annual Conference of Indian Association for Angiosperm Taxonomy and International Seminar on "Advances in Plant Systematics, Biogeography and Biodiversity Conservation" organized by the Department of Botany, University of Calcutta in collaboration with the Botanical Survey of India to be held at the Department of Botany, University of Calcutta, 35, Ballygunge Circular Road, Kolkata – 700 019, West Bengal, India and The Ramkrishna Mission Institute of Culture, Golpark, Kolkata 700 029, West Bengal, India from 25th to 27th of November 2023.

Seminars indeed provide a valuable platform for the exchange of knowledge within specific community and have the potential to foster lasting relationships among stakeholders. In today's world, seminars on plant science play a crucial role in advancing our understanding in this vital area.

Such events emphasize the importance of bringing academicians and experts together from different regions, both within the country and abroad, to facilitate the exchange of ideas, thereby enriching the academic and research community.

I wish the upcoming seminar a great success and extend my sincere gratitude to the organizers for taking this commendable initiative. I also warmly welcome the participants from different corners of India and abroad who will contribute to the success and knowledge exchange at this event. Such gatherings are crucial for the advancement of plant science and its applications.

Date: 30.10.2023

Place - Kolkata

Registrar

University of Calcutta

REGISTRAR
UNIVERSITY OF CALCUTTA

MESSAGE FROM DEAN OF SCIENCE, UNIVERSITY OF CALCUTTA

It gives me immense pleasure to write this welcome note for the 'Abstract volume' of the XXXIII Annual Conference of Indian Association for Angiosperm Taxonomy and International Seminar on "Advances in Plant Systematics, Biogeography and Biodiversity Conservation" organized by the Department of Botany, University of Calcutta at its Ballygunge Campus and The Ramkrishna Mission Institute of Culture, Golpark, Kolkata from 25–27 November, 2023.

This conference promises to be a significant event particularly for the plant taxonomists, bringing together participants from different parts of India and abroad to explore various aspects of plant systematic research. It provides a valuable platform for the exchange of knowledge and ideas, fostering collaboration and the advancement of plant science.

I would like to extend my heartfelt wishes for the success of the conference. May it prove to be a platform for fruitful discussions, sharing of scientific insights, and strengthening of research networks. Additionally, I would like to express my deep appreciation for the organizers for their dedicated efforts in ensuring the success of this grand event, which undoubtedly contributes to the promotion of botanical research and understanding in India and beyond.

Prof. Salil Kumar Biswas

ए.ए. माओ
निदेशक
A. A. Mao
Director

भारत सरकार
पर्यावरण वन एवं जलवायु परिवर्तन मंत्रालय
भारतीय वनस्पति सर्वेक्षण
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE
BOTANICAL SURVEY OF INDIA

सत्यमेव जयते

MESSAGE

It has been a privilege to write the congratulatory message for the efforts of the Department of Botany, University of Calcutta, in organizing the XXXIII Annual Conference of Indian Association for Angiosperm Taxonomy and an International Seminar on "Advances in Plant Systematics, Biogeography and Biodiversity Conservation" in collaboration with the Botanical Survey of India, Kolkata. The University of Calcutta, with its century-old tradition, has indeed made significant contributions to scientific research in India, particularly in the field of Botany. It's commendable that the department continues to adapt to global developments in scientific research and maintains high standards. At the same time, the Indian Association for Angiosperm Taxonomy (IAAT) has been providing an apt platform for disseminating and promoting the beautiful subject of plant taxonomy which help in capacity building and creating the next generation taxonomists. Undoubtedly, this event will serve as a platform for sharing knowledge, fostering interaction among researchers from various parts of the world, and providing opportunities for young students and researchers to learn from experts in the field. This exchange of ideas and information is essential for the advancement of science and the development of innovative solutions to various challenges. India's commitment to the Convention on Biological Diversity (CBD), achieving the targets under the Sustainable Development Goals, and National Biodiversity targets underscores the importance of conferences like this by bringing together experts and stakeholders to discuss and collaborate on biodiversity-related issues.

My best wishes for the grand success of this important international seminar which is befitting to the contemporary global challenge of combating climate change and loss of biological diversity.

(Ashiho Asosii Mao)

सी.जी.ओ कॉमप्लेक्स, तृतीय एम.एम.ओ भवन, ब्लॉक-एक (पाँचवा तल),डी एफ ब्लॉक, सेक्टर 1, साल्ट लेक सिटी, कोलकाता-700 064 फोन : 033-23344963
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From:
Head of the Department

Ref. No.: BOT./ *Dated* 06.11.2023

I take immense pride in hosting the XXXIII Annual Conference of Indian Association for Angiosperm Taxonomy and International Seminar on "Advances in Plant Systematics, Biogeography and Biodiversity Conservation" on 25-27 November 2023 in collaboration with Botanical Survey of India in this esteemed department. Its a pleasure for me to welcome you all in this occasion.

Taxonomy serves as the foundation of Plant Science. Plants are an important and inevitable component of our ecosystem and play an irreplaceable role in maintaining the ecological balance. The diversity of plants is a fascinating area of research and interest. Discovery of a new species not only adds up to the count but also to various other aspects of biology. However, unregulated urbanization and industrialization have led to environmental degradation over the years, which has impacted the plants in various ways that require immediate attention.

I feel this conference would be a great place to exchange ideas from the experts of this field and learn about the advances in plant taxonomy research from scientists all over the world. I sincerely hope that this three-day International Conference will enrich and awaken young minds. I extend my heartfelt gratitude to all the speakers, participants, delegates, students and organizers for coming together and making this conference a success.

RKundu

(Rita Kundu)

University of Calcutta
DEPARTMENT OF BOTANY

Dr. Debabrata Maity
Associate Professor

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Message from the Organizing Secretary

It's a matter of great pleasure for me that the Department of Botany, University of Calcutta has been trusted with the task of organizing the XXXIII Annual Conference of the Indian Association for Angiosperm Taxonomy (IAAT) and International Seminar on "Advances in Plant Systematics, Biogeography and Biodiversity Conservation (APSBBC-2023)" in collaboration with Botanical Survey of India, Kolkata, which is scheduled to be held during 25th to 27thNovember, 2023.

It is really an honour for the Department to host a galaxy of eminent taxonomists and botanists of India and abroad during the Seminar. This academic event will provide a great learning opportunity to popularize the plant taxonomy and allied branches for the progress of botanical sciences and its linkages with societal development.

This Seminar aims to provide scientific platform to brainstorm on the research frontiers in angiosperm taxonomy under different themes, such as 'Floristics, Plant Diversity and Conservation', 'Biosystematics and Phylogeny', 'Nomenclature, Revision and Monograph', 'Phytogeography, Endemism, Climate Change and Plant-Animal Interaction', 'Indigenous Traditional Knowledge and Bioprospection', 'Digitization and Database'. The deliberations during the event will be helpful for the students, research scholars, teachers, scientists and other stake holders by sharing and exchanging their research ideas, expertise, and knowledge. The scientific interaction among the participating academicians and the researchers as well as the students from universities, research institutes and organizations across the country will promote cross-fertilization of ideas and knowledge, and expected to go a long way in inculcating the state-of-the-art research culture.

My warm wishes and sincere thoughts on this momentous occasion to the younger researchers as well as eminent professors of different universities and the scientists of different institutions and organizations for their participation and august presence in this Seminar.

I heartily welcome all the esteemed participants including our Hon'ble Vice-Chancellor, Hon'ble Registrar, Hon'ble Dean of Science, my colleagues at the Department, students, research scholars and the administrative staff to this three-days Seminar and pray for successful accomplishment of the objectives of this scientific event.

Wishing this International Seminar a grand success.

(Debabrata Maity)
Organizing Secretary

Dated : 20-11-2023

UNIVERSITY OF CALCUTTA

The University of Calcutta (informally known as Calcutta University; abbreviated as CU) is a public collegiate State Research University located in Kolkata, West Bengal, India. It was established on 24 January in the year 1857. It is considered as the oldest multidisciplinary and European-style Institution in Asia. The University has topped among India's best Universities several times and has been enlisted as one of the best State Research University every single year. Though at the time of establishment, the University had a catchment area, ranging from Lahore to Myanmar, at present, its jurisdiction is limited to a few districts of West Bengal. As of 2023, 154 colleges and 21 institutes and centres are affiliated to CU. The University has a total of 14 campuses spread over the city of Kolkata and its suburbs. Within India, it is recognized as a "Five-Star University" and accredited an "A+" grade by the National Assessment and Accreditation Council (NAAC). The University of Calcutta was awarded with the status of "Centre with Potential for Excellence in Particular Area" and "University with potential for excellence" by the University th Grants Commission (UGC). The University ranked 4 in the Indian University Ranking 2021 list, released by the National Institutional Ranking Framework of the Ministry of Education of the Government of India. Its alumni and faculty include several heads of State and Government, social reformers, prominent artists, the only Indian Academy award winner and Dirac medal winner, many Fellows of the Royal Society and three Nobel laureates as of 2022. The University has the highest number of students who have cleared the National Eligibility Test. The University of Calcutta is a member of the United Nations Academic Impact.

DEPARTMENT OF BOTANY, UNIVERSITY OF CALCUTTA
&
CALCUTTA UNIVERSITY HERBARIUM (CUH)

Mr. C.C. Calder, the then Superintendent of Royal Botanic Garden, Calcutta established the Department of Botany, University of Calcutta in 1913. Afterwards, Prof. Shankar Puroshattam Agharkar, Prof. Paul Johannes Brühl, Dr. K.P. Biswas, Prof. H.C. Ganguly, Prof. P.N. Bhaduri, Prof. P.C. Sarbadhikari, Prof. J.C. Sengupta, Prof. I. Banerjee, Prof. A. K. Sharma carried out the legacy of this century old department. The Department is well recognized for the excellence in teaching and research in major areas of Plant Sciences in general. Department maintains 'Arun Kumar Sharma Botanic Garden' and 'Kalipada Biswas Arboretum'. It is a treasure of plant wealth, conservatory of rare, endangered species.

Calcutta University Herbarium (CUH) was established in the Department by Prof. Agharkar in 1920. The foundation of CUH is based on the specimens from Europe collected by Prof. Agharkar. The century-old CUH is a botanical treasure, contains more than 30,000 specimens of all plant groups collected from different parts of the globe (75 countries). The herbarium holds hundreds of type specimens belonging to Algae, Fungi, Liverworts, Seed plants and Fossils. The type specimens are mostly from Argentina, Bolivia, Brazil, Columbia, Ecuador, Indonesia (Sumatra), Malaysia, Peru, Portugal, USA and Venezuela in addition to India. A representative collection of mosses was purchased from Vienna and was added to CUH by Professor Brühl. This is one of the best collections of mosses in India. The exsiccatae, Mugula's Cryptogams, and Hupke Herbarium Cecidologicum were also added to this herbarium by him. Throughout its journey CUH has already proved itself as one of the best taxonomy research centre in the country.

INDIAN ASSOCIATION FOR ANGIOSPERM TAXONOMY (IAAT)

Indian Association for Angiosperm Taxonomy (IAAT) was established in 1990. With nearly 1000 life members, it is the largest taxonomic association in India. This is the only Association recognized by the International Association for Plant Taxonomy (IAPT) as its affiliate. It is the endeavor of IAAT to promote Angiosperm Taxonomy by offering a platform for scientific deliberations, not only among Indian taxonomists, but also those from all over the world. The Association also publishes the journal "Rheedea" featuring original research contributions, proceedings and other scholarly works. The Association runs a library named after Late Prof. V.V. Sivarajan at the Calicut University with a collection of over 2000 books. Two gold medals (Y.D. Tiagi and V.V. Sivarajan Gold Medals) are awarded every year to distinguished life members of the Association for their valuable contributions to the field of Angiosperm Taxonomy. To encourage the young researchers a number of awards have also been instituted in different disciplines.

CONTENTS

KEYNOTE LECTURES

KEYNOTE LECTURE 1

Phylogenomics of Cucurbitaceae

Hanno Schaefer

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Germany
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With about 1000 species and important crops like cucumber, melon, and pumpkin, the gourd family has long been in the focus of plant systematists around the world and DNA sequence data has become available for most species. While phylogenies based on limited numbers of DNA regions have given us a good general understanding of genus circumscriptions and relationships in Cucurbitaceae, the huge amounts of genomic data accumulated in recent years revealed significant gene tree conflict indicating a strong role of reticulate evolution in the family.

In the framework of the Plant and Fungal Tree of Life (PaFToL) project of Royal Botanic Gardens Kew, we sequenced a total of 125 Cucurbitales samples, 118 for target capture and seven for whole genome shotgun sequencing, representing all 102 genera currently accepted in the order and found that conflicting results of earlier phylogenetic studies, e.g. regarding the genera Trichosanthes and Indofevillea, can be reconciled when accounting for the gene tree conflict in the group.In order to analyze the large amounts of data in the most efficient way, we developed a new analysis pipeline for all kind of genomic data, CAPTUS, implemented in Python 3 and freely available and maintained through GitHub (https://github.com/edgardomortiz/Captus), which might help to make genomic data more accessible to biologists without expert bioinformatics knowledge. Our resultssupport all currently accepted tribes and most of the genus circumscriptions but makes us question some of the relationships within the tribes in Cucurbitaceae and between the families in the order Cucurbitales.Based on the new evidence, we suggest younger evolutionary ages than previously thoughtfor many genera leading to revised scenarios for the biogeographic history of some of the lineages, including those found in India.

Looking at specific genera, for Zehneria, one of the most diverse clades in the family for which we have obtained an almost complete species sampling, we infer a rate of at least 20 long-distance dispersal events per million years, probably as a result of frequent bird dispersal. For the large genus Cucumis, the new genomic data reveal multiple overlooked species, mainly in Africa. For the genus Thladiantha, a clade of about 30 species mostly restricted to China, a complex evolutionary history with conflicting signals from nuclear versus plastid genomes indicates a history of frequent hybridization despite their specialized oil-bee pollinators.We are able to place for the first time the presumably extinct genus Khmeriosicyos from Cambodia, which groups with the morphologically similar Southeast Asian Borneosicyos and Solena.

In contrast to the impressive amount of genomic data available, there is still a lack of ecological knowledge for most species, including distribution data and information on pollinators and seed dispersal agents. Jungle genomics approaches using cheap single molecule DNA sequencing with Oxford Nanopore devices under field conditions can deliver quick and reliable species identifications, which helps to focus the collection of ecological data for the most relevant plant individuals and can speed up the process of discovering and naming new species of Cucurbitaceae. In combination with citizen science approaches like our "Cucurbits of the world" project on the iNaturalist platform (www.inaturalist.org/projects/cucurbits-of-the-world), this makes participation in taxonomy and systematics research of Cucurbitaceae easier and more democratic andwill ultimately results in a much better understanding of these important plant species.

KEYNOTE LECTURE 2

Plant Taxonomy and Applied Botany

C. R. Babu

Centre for Environmental Management of Degraded Ecosystems
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Taxonomy is a dynamic science and the knowledge generated by taxonomists has wider applications in addressing contemporary environmental issues including climate change, food security and health care than the taxonomists perceive. One category of taxonomists practice hard core traditional or classical taxonomy and generate knowledge that has been the basis for identification service, inventorization and classification of plant resources. The second category of taxonomists undertake experimental work to circumscribe and delimit species in species complexes / problematic taxa and also elucidate the evolutionary/ phylogeny relationship among the taxa and the data generated is used for refinement of classification. The third category of taxonomists develop taxonomic data basis on digital platforms for wider access to utilize the taxonomic knowledge. All the three categories of taxonomists are important for advancement of taxonomic knowledge.

There is a fourth category of taxonomists who utilize taxonomic knowledge for addressing not only the 21st centaury environmental challenges including climate change but also food security and health care. For example: (i) restoration of degraded or local extinct ecosystems to their natural states, (ii) recreation of lost natural heritage that lead to environmental sustainability and enhanced climate resilience of urban centres, (iii) use of nature based solutions like constructed wetlands in the treatment of waste water for recycling and (iv) bioremediation of contaminated soils, surface and ground water with spent wash of distilleries and other industrial effluents cannot be achieved without taxonomic knowledge. In all these applications, identification and selection of appropriate species form the basis of development of technologies, which are illustrated in the presentation.

KEYNOTE LECTURE 3

Exploring the floristic diversity in India and harnessing the potential

A.A. Mao

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E-mail: aamao2008@gmail.com

India is one of the 17 megadiversity countries in the world with incredible richness in floristic diversity. It shares 2.4 % of the total geographic area in the earth and contribute to a staggering 11.2% of the total plant species described so far. The Indian region has been considered a one of the centres of origin of flowering plants as well as the crop diversity and the country shares its territory with four global biodiversity hots spots (The Western Ghats, The Himalayas, Indo-Burma Region and Sundaland). The topography, climate and other edaphic factors are responsible for the high species diversity and with 24.62 % forest cover, India is fast emerging as a carbon neutral country. The high Himalayan ranges in the north, together with the north-east India is the meeting point of three important phytogeographic realm i.e., Indo-Burma, Indo-Malaya and Indo-China, thereby sharing the floristic elements common to these areas. At the same time, the diverse peninsular region with western and eastern ghats and the deccan peninsula harbour more endemic species.

The ancient India represents one of the oldest human civilizations in the world where the multipurpose use of plant products has been recorded. Indian plants were formally studied during the prehistoric period, went through the mediaeval period and the present day phylogenomics. Right from the Van Rheede's 'Hortus Malabaricus'(17th century), through the Linnaeus' 'Species Plantarum' (18th century), J.D. Hooker's 'Flora of British India' (19th century), Engler's Pflanzenfamilien (early 20th century) and todays modern flora, the Indian Flora have witnessed optimum dynamism of plant taxonomy and nomenclature. With the modern sophistication in characterisation and analysis, new taxonomic concepts are being unfolded every day.

From the erstwhile British India, J.D. Hooker had documented 14,312 species of flowering plants, of which 10,200 species were from the present political boundary of India. Presently, as per the latest estimate, 22,108 species of flowering plants have been recorded from India which forms more than 100% increase in number of species found in India. Of course, there may be possible duplication and/or synonyms prevailing in this list. This staggering increase can be attributed to the facts like, (i) constant discovery of new species and records due to more thorough survey with more geographic coverage in unexplored areas;(ii) more understanding of taxonomic characters/concepts resulting in merging or splitting of species.

The latest estimate of plant diversity in India stands 55,387 (Angiosperms- 22108; Gymnosperms- 83; Pteridophytes- 1319; Bryophytes- 2819; Lichen and Lichencolous fungi- 3044; Fungi- 15701; Algae- 9035 and Microbes- 1278). Botanical Survey of India has been working relentlessly and developed excellence in plant taxonomic research in the country. BSI has been consolidating all the new discoveries/records of plants from India every year in the form of 'Plant Discoveries' and advising the Government of India for making policies related to floristic research, documentation and conservation.

Biodiversity adds more value when its potential is harnessed for the utility of mankind. The multifarious utility of Indian plants has been understood and documented since the ancient period. As plants are the primary basis for existence and sustenance of life on planet earth, every species is important in one way or the other. For the existence of humanity, it is important to understand the floristic wealth of a region which also indicates the climatic and environmental wellbeing of the region. The diversity and importance of floristic wealth of India has been presented here.

KEYNOTE LECTURE 4

Species diversity and evolution of *Taxus*

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Species diversity is the most basic dimension of biodiversity conservation in a changing world. However, ongoing taxonomic debate is commonplace in many plants. *Taxus* L. is the most diverse genus within Taxaceae. It has acquired great medical significance as the source of taxol, a natural antitumour agent with high potentialfor cancer treatments. However, morphological characters tend to vary greatly within species and often with overlap among species, leading to ongoing taxonomic controversy. By combing morphological, genetic and geographic distribution evidence, we clarified there are 16 lineages showing allopatric distributions worldwide, except *T. mairei* in the Sino-Himalayan region. The evolutionary history of yew was characterized by repeated intercontinental migrations and recurring hybridizations. Moreover, population genetic/ genomic analysis suggest that the speciation of the *Taxus* species are driven by geological and climatically factors in the Himalaya and Hengduan Mountains. Our results shed important insights into the conservation and utility of *Taxus* germplasm. The integrative approach used here set an exemplar to tack with other taxonomy and evolutionary intricate plant taxa.

KEYNOTE LECTURE 5

Biodiversity conservation and world climate

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Over a period of millions of years biodiversity has developed but unfortunately due to different causes including anthropogenic activities and climate change biodiversity is being destroyed in minutes. Many researches focused on the potential impacts of climate change on the plant diversity, its life history, land transformation, threats to plant diversity, potential vulnerability of plant diversity, on the future of biodiversity etc., but very little has emphasized the effect of changing species composition and diversity on local and regional climate. Here focus will be given on how the changed species composition is affecting the climate. It has been observed that the changing species composition and population structures of the forest ecosystems are adversely affecting the climate. Soil organic carbon and respiration have been found to be affected by the rhizospheres of different plant species. Several studies were carried out to determine the amount of C stocked and CO2 released due to soil respiration in the soil of deciduous Sal forests of Bangladesh, and of Bangladesh Sundarbans. Attempts were also made to estimate the C stock of major mangrove species Bangladesh Sundarbans. Remote Sensing and Geographic Information Systems have been used to explain changes in forest cover and species composition of Bangladesh Sundarbans over a long period of time. It has been found that the community structure of Rajespur Sal forest (Cumilla district) has been changed where the forest once dominated Shorea robusta is being replaced by Grewia nervosa. Rhizosphere soil samples of S. robusta and G. nervosa from different locations were collected. The amount of C stocked (30 cm depth) in Cumilla and Gazipur Sal forests ranged from 529.21 to 836.84 ton/ha and 175.42 to 1066.92 ton/ha respectively. The amount of stocked C in bulk soil were 624.03 ton/ha. The amount of CO2 released by soil respiration of Cumilla Sal forest ranged from 21.01 to 39.05 mg CO2/g soil and from 25.10 to 30.98 mg CO2/g soil in Gazipur. The amount of CO2 respired by bulk soil ranged from 5.05 to 5.16 mg CO2/g soil. Soil respiration was also higher in the rhizosphere soils than the bulk soils. It has been found that deciduous forest managed properly inceasing C stock of soil but change in forest structure resulting in more emission of CO2 from the soil and condequently decreasing the C stock. Comparison of the Landsat images of two Ranges namely Nalianala (Khulna) and Chandpai outof four Ranges from Bangladesh Sundarbans during 1989, 2000 and 2010 revealed that there wasa decreasing tendency of dominance of Heritiera fomes in these two Ranges but Bruguiera sexangula, Excoecaria agallocha and Sonneratia apetala showed an increasing tendency. Overall, 3% decreased in total tree cover in 2010 from that of 1989 was noted.

Increased salinity has beenfound to be main factor attributing the changes in the tree composition and cover. The changes in the tree composition and physiography of the two Ranges between 2000 - 1989 were also found to be considerable. The changed species composition result in less carbon dioxide sequestration by Bangladesh Sundarbans. The studies revealed that in the ten dominant mangrove species in overall SMF, total carbon dioxide sequestration was as follows: *Heritiera fomes* (300.044 t/ha), *Excoecaria agallocha* (46.803 t/ha), *Avicennia officinalis* (38.686 t/ha), *Ceriops decandra* (10.2 t/ha), *Xylocarpus moluccensis* (4.033 t/ha), *Cynometra ramiflora* (2.385 t/ha), *Tamarix dioica* (1.073 t/ha), *Bruguiera gymnorrhiza* (0.542 t/ha), *Aegiceras corniculata* (0.425 t/ha) and *Aglaia cuculata* (0.064 t/ha). Considering the land area of Bangladesh Sundarbans of about 4143 Km2, the total CO2 sequestered (above ground and below ground) in overall Bangladesh Sundarbans was 192.87 Megaton. The upper layer of soil sequestered about 7.225 Mton CO2 and lower layer sequestered about 6.514 Mton CO2. The soil respiration rates were almost similar in the three ecological zones of Bangladesh Sundarban where the values were 27.63±4.16 mg CO2/g soil, 28.19±5.02 mg CO2/g soil and 27.81±4.38 mg CO2/g soil in the oligohaline zone, mesohaline zone and polyhaline zone, respectively. It is clear from these studies that the capacity of forest plan species and soil in sequestering carbon dioxide is decreasing with the changing species composition which may result in a positive feedback in the climate change. So, the conservatio diversity of forests is not only essential to get the continued benefits from these forests, but also for the stability of climate. A long-term detailed studies is needed to have a complete picture of the scenario.

KEYNOTE LECTURE 6

Systematics and biogeography of Urticaceae

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Urticaceae consists of approximately 54 generawith more than 2000 species, and is widely distributed in tropicalregions but less common in temperate regions, with by far thelargest concentration of genera and species in tropical Asia. This family has important economic and medicinal value, a full understanding of relationshipswithin this family would help to understand how these ecologicalassemblages evolved, and also to detect potential new sources ofmedicinal compounds. However, the infra-familial classification of Urticaceae has been controversialfor more than one century,and relationships within it remain poorly known. In this talk, I will introduce some of my studies on the systematics of Urticaceae in the last 10 years based on different molecular markers and research methods. We presented the first densely sampled molecular phylogeny of Urticaceae, and showed that Urticaceae including Cecropiaceae was monophyletic, Urticaceae can be divided into four well-supported

clades; previously erected tribes or subfamilies were broadly supported, with some additions andalterations; the monophyly of many genera was supported, whereas *Boehmeria, Pellionia, Pouzolzia*and *Urera* were clearly polyphyletic, while *Urtica* and *Pilea* each had a small genus nested within them; relationships between genera were clarified, mostly with substantial support.

In addition, I will present an in-depth study of the biogeography of Urticaceae Integrated multiple lines of evidence includingphylogenetic, molecular-dating, biogeographical, ecological, seed biology and oceanographic data, wefound that Urticaceae originated in Eurasia ~69 Ma, followed by e”92 LDD events between landmasses. Under experimental conditions, it was demonstrated that seeds of many Urticaceae floated for >220 days, and remained viable after ten months in seawater, long enough for most detected LDD events, according to oceanographic current modeling. Ecological trait analyses indicated that preferences for disturbed habitats might facilitate LDD. Nearly half of all LDD events involved dioecious taxa, so population establishment in dioecious Urticaceae requires multiple seeds, or for occasional selfing to be possible. This work clearly shows that seawater LDD played an important role in shaping the geographic distributions of Urticaceae, providing empirical evidence for Darwin’s transoceanic dispersal hypothesis.

INVITED LECTURES

INVITED LECTURE 1

Joseph Dalton Hooker and Indian Flora: Present Status With Future Challenges- are Paper Floras Still Relevant?

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Joseph Dalton Hooker, the closest friend of Charles Darwin, was 32 years old when he visited India. Perhaps Hooker had been the first man of science to publicly defend Darwin's ideas and Theory of Evolution, once they became public.

Over a two year period from 1848-1850, he travelled widely in the eastern part of India and described over 3,000 species of plants. After Hooker returned to England he went on to write with help of his numerous collaborators, over a 25 year period, the seven volume Flora of the British India- the first exhaustive account of the plants of the region. The first part of the first volume was printed and published in England in May 1872. For the convenience of the users four different kinds of fonts were used throughout the Flora to distinguish each kind of text from the other making reading and recognising the relevant part an easy task.

After more than 150 years of the appearance of the first volume of J. D. Hooker and his colleagues' monumental work on the Flora of British India (published during 1872-1897), It is time to reflect on our journey so far in this important field since independence and my own personal journey since 1980.

It is also time to reflect on the impact of Institution and capacity building exercise in both national research labs and academia since 1952 on taxonomic research in Independent India, and computer revolution in all sphere of our social and scientific endeavours, the public access to internet and web based technologies and major thrust on Digital India since 2014. Though the basic principles of Plant Taxonomy remain more or less unaltered, this century has also witnessed paradigm shift in how plant taxonomy is practised with revolutionary changes in phylogenetic plant classification, International Code of Botanical Nomenclature (now known as ICN International Code of Nomenclature for Algae, Fungi and Plants). Nevertheless expectations from and challenges faced by plant systematists have also multiplied. Progress and crisis in biodiversity related sciences, environment and climate change have endangered food security and added fuel to the fire and need to be seriously reflected upon. The science of Taxonomy forms the fundamental basis of our understanding of biodiversity and its evolutionary history, as well as plays a vital role in conservation studies, ecological assessment and restoration, sustainable ecosystem management, and effect of climate change on plant distribution and phenology.

The taxonomic knowledge need to be constantly updated with increasing available evidence and discovery of new taxa and additional distribution records, as supported by fresh field collections. Therefore, the printed flora model of taxonomic information is not able to keep pace with the needs of the wider stakeholders and end-users of taxonomic information. All the major Floras of the world, including New Flora of India and Checklist of Flora of India, Plants of Himalayan Region and some state floras like Flora of Kerala are available in e-Flora format. There need to be a national portal to take care of the fast changing technologies in this field.

Stable and integrated dynamic e-Flora model at all geographical levels with built in safeguards will be the best option for India.

The future of Plant Taxonomy in India appears very bright as young taxonomists are doing impressive research in the field. There is need to revive the Capacity building at National level on the lines of earlier successful scheme of the MOEFCC, and career opportunities for young researchers who now seem to be more interested in phylogenetics.

INVITED LECTURE 2

Role of molecular markers to study bamboo taxonomy, flower diversity and beyond

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Critical identification and taxonomic classification of bamboos are mainly dependent on reproductive characters. However, due to the unusually long sexual cycle and unavailability of reproductive stages, the systematics have remained as an outstanding problem for a long time. In the present investigation, two species-specific sequence characterized amplified regions (SCAR) have been identified for the two commercially important bamboo species, *Bambusa balcooa* and *B. tulda*. Species-specificity of the two markers was confirmed through Southern hybridization. The species-specific SCAR fragments were named as 'Balco$_{836}$' for *B. balcooa* and 'Tuldo$_{609}$' for *B. tulda*. The species-specific 'Balco$_{836}$' was amplified from genomic DNAs isolated from 80 individuals belonging to 16 populations of *B. balcooa*. Similarly, the presence of 'Tuldo$_{609}$' was noted in all the 80 individuals representing 16 populations of *B. tulda* assessed. Such method may be employed to identify more species/genotype specific markers for other bamboo species/genotypes of commercial importance such as high fibre yield or cellulose contents.

Another important aspect of bamboo diversity is the variability with respect to timing (1-120 years), nature (spikelet vs. pseudo-spikelet) and magnitude (sporadic vs. gregarious) of flowering across species and populations. Particularly, sudden onset of flowering followed by death of bamboo vegetation (monocarpy) has enormous impact on forest ecology. Our study has already identified and characterized important photoperiod and clock genes such as *LATE ELONGATED HYPOCOTYL* (*LHY*), *TIMING OF CAB EXPRESSION1* (*TOC1*), *ZEITLUPE* (*ZTL*), *GIGANTEA* (*GI*), *CONSTANS A* (*COA*), *CONSTANS B* (*COB*), *FLOWERING LOCUS T1, 2, 3, 4* (*FT1, 2, 3, 4*), *FD1* and *FD2* from *Bambusa tulda*. This information may be useful in future to develop genetic tool to predict flowering time of a bamboo population.

INVITED LECTURE 3

Revisiting the Taxonomy of Smilacaceae in the Indian Subcontinent Using Morphological and Molecular Tools

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Due to its rich diversity and historical taxonomic ambiguities, the family Smilacaceae presents a compelling case for revision in the context of the Indian Subcontinent. This study employs a multidisciplinary approach, integrating morphological analysis with molecular tools, to revisit the taxonomy of Smilacaceae in the Indian Subcontinent. *Smilax* is the sole genus of the family, represented by 36 taxa in the Indian subcontinent. The taxonomy of the genus has been challenging due to its dioecious nature and substantial inter and intra-specific variations. They are popularly known as 'Sarsaparilla' and have tremendous potential to provide various therapeutic compounds such as anti-inflammatory, antifungal, antipruritic, antiseptic, diuretic, etc. Nonetheless, a comprehensive taxonomic revision has not been available for Indian Smilacaceae, which creates difficulties in proper species identification. Earlier studies predicted that more than 40% of the *Smilax* species could be treated as synonyms. Many of the species have limited distribution, making it challenging to meet the increasing demand in the crude drug market; therefore, adulteration or substitution in the market samples is suspected. The present work aims to develop DNA Super-barcodes for selected *Smilax* species for their accurate identification and delimitation. The study also intends to investigate the pattern of inter/intraspecific morphological evolution in different Indian *Smilax* species and decipher the phylogenetic relationships among them. Previous studies have found Indian *Smilax* pivotal in connecting the species in East Asia, Southeast Asia, and Africa. Therefore, studying the phytogeography of Himalayan *Smilax* could help provide a better understanding of the temporal origins and biogeographic processes underlying the formation of disjunctive distribution patterns of the species. With the goal of clarifying and streamlining the nomenclature of *Smilax* species and resolving long-standing taxonomic ambiguities, we conducted a critical morphological analysis of the taxa belonging to *Smilax* in the Indian subcontinent. We devised a key to identify *Smilax* species in the Indian subcontinent based on vegetative charscters alone, allowing for year-round identification, even without reproductive parts. Moreover, we prepared an updated checklist of Smilacaceae in the Indian Subcontinent. Additionally, *S. turbans*, a long-lost species, was rediscovered in Arunachal Pradesh after a gap of 95 years. The foundation of our taxonomic reassessment is the morphological analysis of freshly collected materials, herbarium specimens gathered from diverse regions, and a thorough literature survey.

These morphological data have been supplemented by DNA sequencing-based molecular analyses. The molecular data-derived phylogenetic insights enable us to evaluate the evolutionary relationships among Smilacaceae taxa in the Indian Subcontinent. Our research also aims to resolve long-standing taxonomic discrepancies, synthesize synonyms, and develop a more comprehensive framework for the identification and classification of Smilacaceae in the Indian Subcontinent. In this context, *Smilax aspericaulis* and *S. quadrumbellata* are synonymized under *S. odoratissima* and *S. zeylanica*, respectively. The typification of six *Smilax* names is also addressed. In conclusion, this study aims to bridge the gap between traditional and molecule-based taxonomy, providing a more nuanced understanding of the diversity of Smilacaceae in the Indian Subcontinent. By reconsidering the taxonomy of this ecologically and economically significant plant family, we hope to advance both botanical knowledge and regional conservation efforts.

INVITED LECTURE 4

Reinstatement of *Zehneria tridactyla* (Hook.f.) R.Fern. & A. Fern. with insight from Morphological and Molecular systematic study

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Zehneria thwaitesii (Schweinfurth) Jeffrey has been investigated through molecular phylogenetic studies on a broader geographic scale. In its present delineation, this species ranges from India to southern Tropical Africa, with numerous names assigned to different areas within this range.

However, molecular phylogenetic analyses reveal that the Indian plants represent an evolutionary lineage distinct from the African, a distinction already recognized by Hooker in 1871. Hooker considered *Melothria tridactyla* Hooker (originating from African countries such as Sudan, Mozambique, Angola, and Congo) to be distinct from the plants found in Ceylon. The characteristic features of *Z. thwaitesii* are unambiguously linked to the latter island, firmly associating the name with that specific lineage. When incorporated into a larger *Zehneria* genus, the oldest available name for the African plants is *Z. tridactyla* (Hooker) Fernandes & Fernandes (equivalent to M. *tridactyla* Hooker), for which we designated a lectotype.

INVITED LECTURE 5

Genus *Sida* L. (Malvaceae) in India

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The family Malvaceae is known as 'Mallow family' characterized by its alternate leaves, well-developed and prominent stipules, actinomorphic corolla, distinct and attractive petals united with staminal column at the base, monadelphous stamens, echinate pollen grains, superior ovary and schizocarpic, capsular or baccatefruits. Family Malvaceae (*s. l.*) contains *ca* 249 genera and 5400 species, distributed mostly in the tropical and subtropical regions of the World.

The genus *Sida* L. has great importance in most of the traditional systems of medicine popularly known as *bala, atibala, mahabala*etc.Most of the species of genus are heliophilous, weedy growing in exposed waste lands. Sometimes, they also occur as undergrowth's in semi-deciduous and deciduous forests, plantation and in partially shaded habitats.

Taxonomically, the genus is one of the most difficult groups displaying wide range of morphological variability. The genus *Sida* (Malvaceae) is revised for India based on field observation, literature survey and extensive herbarium studies. The genus is represented by 23 species under six sections in India.A taxonomic treatment of *Sida* in India is presented here with morphological descriptions, geographic distribution, notes, illustrations and identification key for the species.

INVITED LECTURE 6

Systematics of *Lepidagathis* Willd. (Acanthaceae: Barlerieae) in India

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Acanthaceae are the most diverse group of flowering plant family with a rich diversity in the taxonomy, morphological and ecological variations, and geographical range. The most recent estimates on the total species diversity in the family show that there are around 4900 species belonging to 206 genera in the world (Manzitto-Tripp *et al.*, 2022; POWO, 2023). The members of the family are predominantly concentrated in the tropical and subtropical regions of the Old World and New World. The family is classified into four subfamilies, namely Nelsonioideae (*c*. 175 species), Avicennioideae (*c*. 8 species), Thunbergioideae (*c*. 260 species), and Acanthoideae (*c*. 4450 species).

Acanthoideae are the most diverse subfamily among others with a synapomorphic character i.e. presence of capsules with retinacula. The subfamily includes eight tribes: Acantheae (15 genera and *c*. 550 species), Andrographideae (8 genera and *c*. 130 species), Barlerieae (13 genera and *c*. 500 species), Justiceae (100 genera and *c*. 2000 species), Nueracantheae (1 genus and *c* 33 species), Physacantheae (1 genus and *c*. 3 species), Ruellieae (37 genera and *c*. 1200 species), and Whitfieldeae (8 genera and *c*. 33 species). The tribe Barlerieae is diagnosed as having corolla with quincuncial aestivation, two or four fertile stamens, mostly 3-colporate or 3-porate pollen grains, fusiform or rostrate capsules that are rarely stipitate, 4 ovules developing into 1 to 4 fertile seeds. Among the 13 genera, *Barleria* Nees (paleotropical) with 303 accepted species and *Lepidagathis* Willd. (pantropical) with 151 accepted species that are widespread.

Carl Ludwig Willdenow (1800) established the genus *Lepidagathis* Willd. based on specimens collected by Jacob Theodor Klein from Madras Presidency with the species *L. cristata* Willd. as its type. *Lepidagathis* is characterised (includes *Lophostachys* Pohl and *Teliostachya* Nees) by having densely secund spikes (sometimes compounded into dense heads) or many-flowered thyrses with flowers in dense whorls at each node,

usually conspicuous bracts and bracteoles which are often similar to calyx lobes in shape and size, unequally 5-lobed calyx lobes (2+2+1 configuration), of which the anterior lobes are often partially fused, posterior lobe broadest and lateral lobes narrowest, corolla distinctly bilabiate (although posterior pair of lobes is fused) with quincuncial aestivation, stamens are included, not exserted beyond the corolla lobes and seeds are covered with long hygroscopic trichomes (Darbyshire *et al.*, 2010;

Manzitto-Tripp *et al*., 2021). In India, the genus is represented by 33 species and seven varieties, of which 23 species and one variety are endemic.

The detailed morphological diversity and variations of habit, inflorescence, calyx, corolla, androecium, pollen grains, gynoecium, capsule, and seeds will be discussed along with a few novelties, nomenclatural issues and ecology of the Indian *Lepidagathis* based on the findings of the on-going SERB funded major research project.

INVITED LECTURE 7

Conservation Assessment of Endemic Species of Leguminosae: subfamily Detarioideae of Western Ghats, India

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Western Ghats region of India with its exceptionally high level of biological diversity and endemism is globally recognised as one of the biodiversity hotspot and UNESCO natural heritage site, has about 135 species and 45 varieties of legumes recorded as endemic. A critical taxonomic study of these endemic taxa based on all known collections represented in various herbaria and freshly collected specimens and field observations made during 2016 and 2021 and published literature has resulted in identifying 88 species and 13 varieties belonging to 35 genera as exclusively or strictly endemic to Western Ghats. The subfamily Detarioideae is represented by 18 genera (8 introduced) and 40 species (including 19 species introduced and cultivated) in India. Twelve species and 2 varieties belonging to 3 genera viz., *Cynometra* L., *Humboldtia* Vahl and *Proria* Griseb. were assessed for conservation status following IUCN Red List criteria and categories and assigned Red List status. Out of 4 species of *Cynometra* assessed for conservation status, one (*C. sampathkumaraniana* Sanjappa et al.) as Critically Endangered and 3 (*C. beddomei* Prain, *C. bourdillonii* Gamble and *C. travancorica* Bedd.) as Endangered; 7 species of *Humboldtia* assessed, one species (*H. sanjappae* Sasidh. & Sujanapal) and 2 varieties (*H. brunonis* var. *raktapushpa* Udayan et al., *H.unijuga* var *trijuga* J.Joseph & V. Chandras.) as Critically Endangered ; 4 species (*H.bourdillonii* Prain, *H.decurrens* Bedd. ex Oliv., *H.unijuga* Bedd., *H.vahliana* Wight) as endangered and one (*H. ponmudiana*), a recently described as Data Deficient; one species of *Prioria* (*P. pinnata* (Roxb. ex DC.) Bretler) as enadangered. All the species are small to large trees occurring in evergreen and semievergreen forest habitats. Most of the species assessed here have been accorded in situ protection as they are distributed in protected areas (Wildlife Sanctuaries, National Parks, Tiger Reserves, Elephant corridors/reserves, Natural Heritage sites, Reserve Forests and Biosphere Reserves) with a few extending outside protected forest areas. All species of Humboldtia, Cynometra and Prioria are also conserved ex situ in Botanical and Zoo Gardens. Some of these species are threatened by habitat degradation, expansion of roads, encroachment for plantation and other agricultural crops, spreading of invasive alien species. It is also observed that no forests exist in old collection sites of a few of these assessed species indicating their total eradication in some habitats. Earlier reports show species like *Cynometra beddomei,C. travancorica, Humboldtia unijuga, H.vahliana,* and *Prioria pinnata* yield valuable timber used in making furniture and in construction. One of them, *Prioria pinnata* is widely and illegally tapped for resin-like copaiba balsam used in pharmaceutical and varnish industries.

INVITED LECTURE 8

Taxonomic Data Synthesis: Building baseline for Biodiversity Science

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Currently, the twin crises of biodiversity loss and climate change have emerged as formidable global environmental challenges. The ongoing climate change is posing severe risks to the global biodiversity, such as driving drastic declines in species diversity, changes in the species composition, shifts in distribution and disruption of life-supporting ecosystem services. With the recent adoption of Kunming-Montreal Global Biodiversity Framework, there is urgent requirement to have robust scientific baseline data available on the status, trends and threats of biodiversity at regional, national and global scales. This will help in better assessment and monitoring, and guide policy formulation towards effective conservation, restoration and sustainable use of biodiversity. Recently, with the help of emerging data-analytical and technological tools, the quantitative syntheses (e.g., systematic reviews, meta-analyses) have received huge research attention in almost all the scientific disciplines. Taxonomy, that deals with the discovery, description, nomenclature and classification of world's biota, forms the bedrock of biodiversity science. Being a data-intensive discipline, the taxonomy (and the taxonomists) should be at the forefront of synthesizing baseline data on biodiversity science. It is in this context that the present talk will discuss the recent taxonomic data synthesis studies conducted at sub-national, national and supra-national scales. The talk will highlight, how the taxonomic synthesis data can help in understanding macroecological, biogeographic, evolutionary and conservation aspects of biodiversity. Based on the insights gained, the use of best practices in taxonomic data synthesis for biodiversity science, particularly related to data collection, curation, integration and analysis will be showcased. Finally, current knowledge gaps in plant biodiversity and future opportunities in the taxonomic data synthesis in India will be highlighted.

INVITED LECTURE 9

Therapeutic Use of Succulent Herbs: An Emerging Healthcare System

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The contemporary healthcare systems use only the dry parts of the medicinal plants or their extracts. The analytical systems for validation of the health benefit reports of the plants are designed to get knowledge about the active compounds of the plant parts, then synthesis of these compounds artificially to market them as some medicines. But the succulent part of any medicinal plant contains the highest number and quantity of the effective phyto-constituents and all of them work together to exert the effects beneficial to our health. There may be internal interactions like potentiation or control of activities of some phyto-constituents by others inside the succulent plant parts. During the entire evolutionary period, all the living entities are accustomed to such total effects of the plant parts. That may be the reason acting behind the toxic effects shown by most of the isolated phytochemicals of any plant at their possible therapeutic doses. The succulent parts of the effective medicinal plants can be used directly for healthcare purposes. To strengthen the disease-preventive ability and modulation of the body's immunity power, exclusion of the disease-provoking practices and inclusion of some beneficial practices in the lifestyle is necessary. Regular intake of some succulent plant parts, most of which have been used by human communities for thousands of years as edible fruits, vegetables, spices, etc., can keep the health status in good condition. To combat specific diseases, some other succulent plant parts may be used. For control of the infective diseases caused by bacteria and viruses as well as diseases like diabetes, cancers, etc., such plants are identified and listed with various details related to their use as succulent biomedicines. As the ancient problems of regional and seasonal availability of plants can be overcome now by effective use of the cold chain, the bio-preservative added, bio-encapsulated succulent biomedicines can be prepared and transported throughout the globe up to the patients or consumers. The main features of that novel healthcare system are discussed along with the search for possible mechanisms of activities of this type of plant medicine.

INVITED LECTURE 10

Paradigm Shift in Ethnobiological Research

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The field of ethnobiology and, in particular, ethnomedicine, has attracted significant attention and interest recently, especially since Professor Youyou Tu was awarded the 2015 Nobel Prize in Physiology or Medicine for her pivotal contribution to the discovery of the anti-malarial drug Artemisinin, derived from a traditional Chinese anti-fever medicine. This discovery highlights the potential of ethnobiological knowledge and traditional medicine for novel drug discovery. Ethnobiology is now a rapidly growing field of research, gaining professional, student, and public interest around the world.Early in the development of Ethnobiology, only the collections and descriptions were the prominent methods of research. Presently ethnobiological methodologyis becoming more experimental, more technological, and more participatory.

Unfortunately, despite their obvious importance, ethno-biologists have long drawn a measure of scorn from other fields of biologists who widely perceive ethnobiological work as a rather imprecise area of research. The truth is that the role of a true ethnobiologist has all too often been misunderstood by other biologists and few who are not directly involved, have any real concept of the rigor involved in the proper execution of ethnobiological works.

Ethnobiology has often been criticized for focusing on just list-making and lacking methodological rigor. The ethnobiological science is intrinsically interdisciplinary, making it susceptible to charges of being vague and imprecise. Western science and biomedicine still consider ‘ethnobiology’ as “primitive” and inferior. However, some criticism of the methods and philosophical approach of ethnobiology is certainly justifiable. As several others have pointed out there is a lack of methodological rigor in ethnobotanical research. Many researchers have argued that the traditional subjectivity of ethnobiology does not form the basis of true science. Like all other areas of scientific research, more objective criteria must be used in ethnobiological research. Methodological contributions are essential in any branch of science and many researchers have shown concern with respect to a perceived lack of methodological advances in contemporary ethnobiology. Partly in response to the long-standing perception of ethnobiology as not being “scientific,” there is now a strong movement to change the traditional compilation style approaches in ethnobiology, by developing methods that allow researchers to quantitatively describe and analyze the patterns in what they study i.e.quantitative ethnobiology. The term ‘quantitative ethnobiology’ is defined as the ‘application of quantitative techniques to the direct analysis of contemporary plant/ animal use data’.

The term quantitative ethnobotany was used for the first time by Balée (1987) in an article published in a Brazilian journal. Since then, the term ‘quantitative ethnobotany’ or ‘Quantitative Ethnobiology’ has been increasingly used by other workers in this field. This new era of ‘ethnobiological technique’ started with Trotter and Logan (1986) when they used the ‘Informant Consensus’ method for the first time to evaluate the relationship between the effectiveness of medicinal plants quoted and their respective biological activity. Later Phillips and Gentry (1993) developed the concept of ‘Use Value’ for assessing the relative importance of plants quoted during ethnobotanical investigations at Tambopata, Peru. All the known quantitative ethnobiological techniques are generally grouped into three principal categories: (i) Total uses/ Aggregation of uses, (ii) subjective allocation, and (iii) informant consensus. However, some workers like Turner (1988), Hoffman and Gallaher (2007) are in favour of using an all-inclusive term for these indices as ‘Relative Cultural Importance (RCI).

All the available quantitative ethnobiological techniques are not equally important or suitable for testing a particular or specific hypothesis. Every technique has some positive side and some weaknesses and limitations. So, the researchers should be careful before selecting quantitative ethnobiological techniques for assessing the research hypothesis/ question. However, “Quantification can provide ‘proof’ for validation of essentially qualitative evidence, but is not an end in itself” (Hoffman and Gallaher, 2007). For the final validation of ethnomedicinal information, qualitative analysis is a must. It includes phytochemicals/biomolecules screening, *in vitro* screening of phytochemicals/ biomolecules for efficacy and safety, *in vivo* assay methods in pre-clinical animal models for various diseases for disease amelioration scoring, metabolic and systemic effect of materials as well as effective and safe dose range determination. All these activities require up-to-date molecular biological techniques and protocols. So, achieving expertise in both quantitative and qualitative analysis is essential for success in ethnobiological research.

INVITED LECTURE 11

The sub-Himalayan MPCAs': diverse flora including medicinal plants and ecological magnitude

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The Indian Traditional medicine system has been broadened with the view of their applications based on region and community specific medicinal plants. Medicinal Plants Conservation Areas (MPCAs) areas are the virgin forest patch of about few hectors (>200) selected for conserving distinctive populations or diversity of medicinal plants in their wild natural ecosystem. The MPCAs are *in-situ* conservation initiative to protect diversity of wild medicinal plant populations in their own natural habitat where the conventional forestry administration operations are kept to minimum. Considered as a pioneering *in-situ* conservation effort, currently a network of 106 – 108 MPCAs are operational across 11 – 12 states in India mainly in the areas of Himalaya, North-East India and Western Ghats, covering different bio-geographic regions. Three MPCAs (North Rajabhatkhawa MPCA, Sursuti MPCA and North Sevoke) of sub-Himalayan region of West Bengal were studied and recorded the occurrence of a rich flora. To study the ecological study, nested quadrates were plotted and diversity status were estimated. Present study represented by 626 species of 397 genera belonging to 102 families, which include Pteridophyte and Angiosperms. Around 38 (34 %) of endemic species are acknowledged to be exclusively endemic to the Darjeeling foothills and adjoining area of Terai and Duars region of West Bengal. Around 77 IUCN threatened species and 89 species of exotic species were recorded. Concentration of dominance were determined by calculated Simpson index and the result showing significant values for all the three MPCAs. Species richness for same vegetation were measured using Menhinick and Margalef Index and calculated values were appeared to be very high. The present data is indicating a heterogeneous assemblage of herbs, shrubs, climbers and trees in The MPCAs. Protection required from anthropogenic and natural threats.

INVITED LECTURE 12

Taxonomy of Indian Barleria (Acanthaceae): an integrative approach

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Barleria L. (Acanthaceae) is a genus of herbs and shrubsthat is represented by ca. 300 species. It ismainly distributed in the Old World. In India, the genus comprises 30 species, of which 18 are endemic to the Indian subcontinent. Showy flowers and foliage make some of the species potential ornamentals that can be brought into horticultural trade. Moreover, the species are a source of some medicinally important chemical principles, viz. Iridoid glycosides, Prioniside, Verbascosides, etc. In the present communication I elaborate the integrated taxonomic approach we have used to understand *Barleria* species. We studied the stem anatomy of 28 species and recorded the presence of inter- and intraxylary phloem. Cytogenetical data revealed that the Indian speciesexhibited two basic chromosome numbers, i.e. x = 10 and 11. Pollen grains were found to betri-brevicolporate with honey-combed tectum. The taxonomy of the genus has been resolved in India except for some species complexes such as *B.buxifolia, B.mysorensis, B. cristata, B. involucrata, B. elata* and *B. prionitis.* I discuss the taxonomic gapswhich once bridged can help in realizing the full ornamental and medicinal potential of this genus. I also cite some examples to emphasize that multidisciplinary alliance in taxonomic studies has a pivotal role to play in the bioprospecting and sustainable utilization of the rich plant resources of the country.

INVITED LECTURE 13

Applications of embryological studies in solving taxonomic riddles

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Embryological data have been successfully used at all levels of the hierarchy. Embryological characters have considerable correlative significance and it allows one to work with a wide array of characters for each taxon of angiosperms. As reproductive organs are comparatively less prone to climatic variability and do not display much ecotypic variations, the embryological characters provide many features that are complex and, when properly applied along with evidence from other data sources, offer good indications of relationships at various taxonomic level. The level of the ploidy may bring about considerable differences in external morphology, but not in the embryological characters. Despite its evident systematic value and increasing need, however, information on embryological characters is still lacking for a majority of taxa. The analysis of embryological characters in comparative studies, often lacks in depth study. Thus, the potential value of embryology in the solution of disputed taxonomic problems has not yet been fully realized.

There is need for more embryological information as only a small fraction of the total number of species of angiosperms are studied. Comparative embryological data are ontogenetic data which can help significantly in the resolution of difficulties in determining homologies. They can also provide independent (and quite different) evaluations of relationships hypothesized via use of other characters.The contributions of embryology to systematics may be regarded as significant as those offered by other disciplines. However, the pathway to these contributions has been a difficult one. According late Professor P. Maheshwari “It takes many years of laborious and painstaking research to study (the embryology of) even a few representatives of a family”. Our recent embryological studies on *Corokia* (Argophyllaceae) and *Bischofia* (Phyllanthaceae) have revealed interesting features for resolving systematic position of the two genera.

INVITED LECTURE 14

Botany subject is taught everywhere in curricula but Botanist's role is restricted in Education, Research, Productivity sector and Policy making for better resourceful India: Whom to blame?

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Sun is the central and star of solar family. Earth, as a living planet, receives its energy to run the bio-geochemical cycles and to produce the non-renewable resources to promote and evolve the diverse life and made it habitable. Earth's environment has been built-up over millennia for the organisms to evolve. Ecology is the subject primarily helps to understand how life adopts eco-physiologically, anatomically, morphologically and environmentally through natural selection and evolution. Human understanding of diversity of life and its complexity, connectivity (linkages of various kinds) between biotic and abiotic environments was understood by the study of biogeography and biodiversity while botanists and zoologists playing their pivotal role. Intelligently and rightly humans carved out based on ground reality the subjects like Botany and Zoology to know the basic structure of life and how life cycles of the living organisms are run? It was realized that all organisms are not just plants and animals in the web-of-life.There appeared R.H. Whittaker's classification of five kingdoms of life accordingly. The *Plantae* are primary among these by their presence in ecologically diverse environments, eukaryotic, autotrophic and being the producers. Naturally, the centre of the Life sciences is Botany, apply so since most of the biomass of planet Earth (*ca.* 98%) belongs to plants. It is because of their tremendous productive ability through photosynthesis (the organic carbon fixed and oxygen released), using water, the elixir of life. Plants, being the primary producers not only feed the herbivores directly or indirectly through food chain, the fuel being the energy. Plants are factories synthesizing millions of micro- and macromolecules which have great potential as therapeutic agents which the human's, their crops, pet animals and the other life are relieved off their suffering caused by the category of life called *pathogens*. Although the role of botanists was realized with his needs and deeds to start with uses as food plants, medicinal plants (pharmaceuticals), simple experimental materials (green pea for genetics; *Arabidopsis*, etc.), ethnobotany, phytochemistry, biogeography, ecology, breeding crops for better productivity, nutraceuticals, floriculture, apiculture, ornmental and what not? But, with the advances in science towards commerce (corporate-driven) as means and economics at the centre with no ethics (in the interests of politicians), gradually uprooted the fundamental subjects with their priorities. Botany and Botanist became the worst victims as a consequence. Playing unduly and saying unethically that botanycannot provide jobs, slowly and steadily the subject was displaced giving undue

room for subjects which are projected as great job providers (though Microbiology, Biotechnology, etc. not subject of their own but interdisciplinary and largely meant for applied research with limited teaching or job opportunities); these subjects were first inserted as special papers and then offered as full-time courses at the expense of Botany while the UGC and its board members hardly with any core botanists included (at the helm of affairs) helped to either covert the botany posts or send them on deputation while the teaching of botany and/or required research suffered. The shameful and painful aspect is that the students of botany cannot write their NET or SLET [UGC or CSIR) exams in their subject called Botany. Life Sciences subject is not Botany. FNAs from Botany have a responsibility in reclaiming botany as clear and primary subject to be allowed to write exams for selecting research fellows or government jobs. It is great injustice to botany subject when the other compatriots write their exams in their respective subjects. ICAR through UPSC used to employ at least Economic Botanists decades back and they eliminated the opportunity by prescribing Agriculture subject as the primary requirement. Why Botanical Survey of India recruits Agriculture-background graduates? Botanical Survey is for plants in nature, not in agriculture or gardens. Field botanists are not appointed as members of National Biodiversity Board or majority of State Biodiversity Boards. State Forest Departments are largely rehabilitated by retired forest officer instead of appointing young field botanists as research fellows in their projects. More so, the funding agencies are doing injustice by hardly financing primary botanical research of its due share. Part of the problems is with botanists at the helm of affairs and with those being converted/transformed from Botany to other expertise (simply forgetting the fact that they are successful because they were principally botanists or deliberately to favour their brainchild by diverting/awarding the funds to institution where botanist are not employed…..molecular research is not botany! It is unfortunate that the greatest injustice has been done to botanists and Forest Ecosystem Conservation in the recruitment of Indian Forest Service personnel. The personnel with basic knowledge of plants, animals, ecology and geology are supposed to be 90% but in reality they constitute less than10%. It is a clear lack of vision and honesty of purpose by policy makers! Asking a botanist to come with impact factor publications is ridiculous. It is just like dismissing leaves of plants as not productive but fruits are! Or else, 'a' and 'z' in English alphabet are not comparable: 'a' is not inferior and 'z' is not a superior letter!! It is like saying plants are not as important as animals!!! It is foolish to use the same scale academic measurements to basic and applied subjects. It is seen that Biotechnology and Crop Improvement research is done without field botanists and plant anatomists, thereby true productively with rich nutrients are lost. It is a stark reality that quality and quantify are exclusive. The Lecturer further discusses the problems of classroom teaching, syllabus framing, paper-setting, integrated research, article writing, editing of botany books or articles which are increasingly becoming problematic. The analysis offers that there is a dire need to bring change in the mindset of educational policy makers and dedicate ourselves to fight the onslaught on subject of botany and save it for better understanding of plant life, nature and extent of our indigenous plant resources, germplasm and productivity of agro- and natural ecosystem towards well-being of our lives. One should feel proud to be botanist for his potential and productive role in nation-building and down-trending hunger index. There is an urgent need to strengthen the hands of a botanist by one and all.

INVITED LECTURE 15

Who conserve the Biodiversity ?

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Man started wondering about the huge biodiversity seen around him. Towards him there are three things he has to perform with the biodiversity. They are know, use and conserve for future. Since the origin of the first man we started to use it. Since the age of Theophrastus we started to know it and only since the time of realizing that the biodiversity around us is facing extinction faster than the natural rate. Huge numbers of taxonomists around the world are on the unending process of discovering new species day by day almost for the last twenty centauries. Many new geographical areas are presently under the process of biological exploration. The idea of protection and conservation came very late to the mind of human as he knows that the same reason that lead the organisms including plants and animals to extinction will lead us also to extinction. There are agriculturists and pharmacy people to use these organisms in very successful ways. There are large number of taxonomists and microbiologists to know the magnitude of biodiversity including plants, animals and microorganisms. But for the last aspect of biodiversity, i.e., conservation, who are in the forefront and who will take the responsibility? There is a list of people to whom we can finger for this sake. The environmentalists, nature lovers, forest departments, green tribunal, courts, governments, local administrative bodies like Panchayaths, etc. or we plant taxonomists who recognize the biology of the species and biotic potential of the area? Are we doing our duty as a return of many things from the plants that contributed to the growth of ours? Do we have any concern about the existence of the taxa we studied? Are we ready to work with the forest department and other organizations to conserve these species? We are scientists and researchers. But we reached these levels only because of these organisms. And finally the question still remains unanswered: who will conserve these biodiversity and nature.

INVITED LECTURE 16

Understanding the problematic taxonomy of the Indo-West Pacific *Avicennia* based on morphology and adaptive strategy

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The Indo-West Pacific biogeographical region harbours five species and three infraspecific taxa of *Avicennia*. The morphological characters such as bark type, leaf shape, flower size, position of the stigma in relation to the stamens, length of the stigma and fruit shape have been used to distinguish the species. However, the high degree of variation in these structures often blurs the species boundary, which had led to several proposals for new taxa in the past. In addition, *A. officinalis*, which has been reported from Australasia, is morphologically distinct from the same species from India.

The most variable species is *Avicennia marina*, which is represented by three varieties. Although the varieties are geographically separated from each other, the morphological uniqueness is not very clear. Taxonomists could not distinguish *A. marina* in India before independence due to its morphological similarity with *A. alba* and *A. officinalis*. Moreover, the varieties of A. marina reported from India are not unique enough to be considered a variety. To understand the morphological uniqueness of *Avicennia* species, the morphological characters of three *Avicennia* species from India, previously used in taxonomy, were studied. The leaf shape and fruit shapes of the three species were analysed using a geometric morphometric approach. Principal component analysis of the geometric variables shows overlap between the species. The linear discriminant analysis, which considers the geometric variables of leaf and fruit shape as predictors and the species, bark types, stigma types and stigma positions as response variables, cannot provide a 100% correct classification. Further morphological analyses of the hypocotyl hairs, the shape of apical cell of capitate hairs and density of the salt glands on the dorsal leaf surface can differentiate the species. The rate of salt secretion from the leaves is also clearly different in the three *Avicennia* species. This indicates that although the species do not differ clearly by morphology, they do differ in their adaptive strategy.

INVITED LECTURE 17

Traditional Knowledge of Tribal Botany in Arunachal Pradesh (India) with emphasis on Tangsa Community

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Arunachal Pradesh is the remotest and easternmost North-east Indian state with over 90 % forest cover. The entire population of the state has been recorded as Scheduled Tribe and 26 distinct tribes and at least 110 subtribes have been officially recognised so far. They are living in different areas and practices unique long-earned traditional cultures for survival. Some tribes live in very small areas like Apatani tribe live in Ziro Valley of Lower Subansiri district, Wancho in Patkai Hills of Longding district, Tangsa in Changlang district and Nocte in Tirap district.

Though Christian missionaries invaded deeply in these societies but the larger proportion of the population even today believe in their traditional religions. Animism is prevailing in most of the areas. Sun, Moon, Soil, etc. are the main sources of their inspiration and are traditionally worshipped by them. They do believe in many spirits and deities. Recently a new religion, *Rangfrah*, is increasing its impact very fast specially in Changlang and other nearby districts. However, *Donyi-Polo* (Sun & Moon) is the major religion in other parts of the state.

Different tribe regularly organize their own festivals in different seasons of the year. These traditional festivals are mostly linked to different seasons, harvests, expression of heroic past, etc. Use of different plants in their festivals is also significant, e.g. leafy twigs of *Saurauia armata* is must in different festivals of Adi community or the *Ridin* fibre used as religious protective thread (as in Adi and Galo) or for blessings (as in Tangsa) are collected from different plants by many communities.

They are mainly non-vegetarians and eats most of the animals including any type of birds, mutton, beef, pork, buff, insects, etc. Mithun (*Bos frontalis*), the semi-domesticated animal, is very much integrated in their culture. The weight of a mature Mithun may be over 800 kg. Meat of Mithun is served during festivals and celebrations along with local drink *Apong*or *Chhyang*. Traditions among the Monpa people in high altitude places like Tawang is different matching with the ambient chilling climate.

They mostly prefer boiled preparations. Large leaves of *Lai Patta* (*Brassica juncea*) are the most preferred vegetable. Use of naturally growing aromatic plants is their much favourites and includes *Zanthoxylum rhetsa, Zanthoxylum aromaticum,* and *Houttuynia cordata*. Innumerable other wild plants they collect from the natural habitat and consume. They are having many special preparations too! Apatani people in Ziro Vally prepare the famous '*Pikey-pila*' that is a preparation of mostly soft bamboo-shoot and dried-smoked pork. The amount of vegetable they collect from the nature is sufficient to their regular requirement. However, now-a-days some people don't have time to collect plants from vegetation so they procure different vegetable from local markets. Many of these wild vegetables and edible fruits are now regularly marketed in town areas.

Lower parts of Arunachal Pradesh are traversed by numerous hilly streams where they use plants for stupefying fishes. In addition, fishing and hunting, equipments are mostly made of bamboos. In fact, bamboos have great role in their life, from food to utensils, making houses and its ornamentation, etc.

Tangsa is one small tribal community, with many sub-tribes, living mainly in the Patkai Hill region of Changlang district of Arunachal Pradesh where they settled sometimes in early 13th century and migrated out from adjacent Myanmar. Folklores reveal their migration from Mongolia, through the Yunnan Province of South-West China and then through Myanmar. They do not use any script for writing. Richer people generally live on upper areas of hills and others used land for cultivation in lower valleys. They produce a special type of roasted tea in bamboo. This *Phalap* is consumed almost by all except children. They take tea in bamboo cups (*Phalap-phaloq*) and in bottle-gourd shells (*Kaitao*).

Their prop-houses are generally constructed 1.2 – 1.8 m above the ground. Floors and walls are mostly made with locally available wood and/or bamboo, and thatched with leaves of *Salacca secunda* and *Livistona jenkinsiana*. Bamboos play great roll in their life. While the main pillars of the houses are made up of timbers, the skeleton, walls, and floors are with different forms of bamboos.

These people, including Tangsa tribe, mostly depend on local forest-resources for their survival. For food they use numerous wild and naturally growing plants which include leafy twigs, tubers, rhizomes, bulbs, inflorescence, flowers, ripe and green fruits, and seeds. When someone becomesick, they collect medicinal herbs, prepare their own traditional medicines for a wide range of diseases. Even today they never or rarely visit a hospital to treat their ailments. Most of the vessels for domestic uses are made of the fruit-shell of *Lagenaria siceraria* (bottle-gourd), cooking utensils with wood or bamboo, bamboo-water pipes, etc. The use of *Phrynium pubinerve* leaves for packing and offering food is a must. For similar other purposes leaves of *Macaranga india, Macaranga denticulate, Mallotustetracoccus*. and *Amomumdealbatum* are also used. So, for their livelihood requirement they are completely dependent on naturally occurring forest products mostly available in their surrounding vegetation. Though they are mostly animist, but in every religious ritual they use different type of plants. In wedding ceremony, the grains of *Setaria italica* are carried by the bride while leaving her father's house as they believe that in doing so, she will be highly productive and that her children will grow like the numerous seedlings of this foxtail-millet.

This shows that the traditional knowledge of Tangsa community is good enough for their normal survival in the forested habitat.

But, not only Tangsa, present generation from most of these traditional communities are coming out *en-masse* taking higher education, thanks to Ramakrishna Mission and Christian Missionaries, taking up research, participating in administration (All India administrative/ forest and other services) and even going abroad for their better understanding of global science and culture. The contribution of Arunachal University, established on 4th February 1984, now the Rajiv Gandhi University (Central), becomes the main flag carrier for their upliftment. Now, some other government and private institutes are also contributing immensely towards the academic upliftment of these people who were previously completely forest-dwellers and even head-hunters!

INVITED LECTURE 18

Sacred Groves: from the Perspectives of Conservation and Human Centric Culture and Development

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‘Sacred Groves’ are considered to be one of the best management methods for *in situ* conservation of our bio-wealth. In India, many of the endemic plant and animal taxa across different groups as well as many microbes are reported to be specifically conserved in sacred groves. This tradition of ethnic peoples is playing major role in the environment management, maintenance of medicinal resource stock and gene resources for peoples.

India is the richest country in terms of number of Sacred Groves. As per the ENVIS report there are about 13720 sacred groves in India, out of which more than 5000 sacred groves are found in Himachal Pradesh alone. At least, 2808 sacred groves are recorded from Maharashtra. Currently, the number of sacred groves varies as some sacred groves are newly discovered and some others are vanished. In India, almost all states have sacred groves and known by different names, like ‘*Devarai’* in Maharashtra, ‘*Devban’* in Himachal Pradesh, ‘*Dev-Van*’ in Chhattisgarh, ‘*Gudi’* in Assam, ‘*Kadu’* in Karnataka, ‘*Jaheera’* in Orissa, ‘*Kovilkadu’* in Tamil Nadu, etc.Although, the concept of sacred grove is Indian, the existence of them is felt across the world, mainly in Asia and Africa. Sacred groves or ‘Forests protected on religious grounds’ are found in India, Thailand, Korea, Russia, East Africa, Kenya and Ghana.

Sacred groves are not only a means of protection of nature, plants and animals; but also reveal a clear picture of evolution, spiritual and physical changes of human life. One can easily observe these changes through sacred groves, that’s why sacred groves have a unique importance in human life. The study of human genealogy in anthropology shows that at different stages of human evolution; different concepts of behaviour and social systems existed and it has been displayed in all these periods. Humans have remained as an integral part of nature. We can see the reflection of how it goes from indivisibility to divisibility. These change overs are unfolded by sacred grove to us.

The relationship of human and sacred groves is revealed through a detail study of sacred groves in Maharashtra state is considered to reveal the bio-wealth and human relationships with sacred groves with a case study of Pune District with about 237 sacred groves with the objectives to study, nature of deity, state of sacred grove, bio-wealth, ownership, and socio-economic aspects of sacred groves.

INVITED LECTURE 19

Plant Taxonomy in 21st Century: challenges and perspectives

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As we are nearing to the first quarter of the twenty-first century, the demand for taxonomy is greater than ever before. The global imperative for the conservation of biodiversity has brought into sharp focus both the need for and the needs of taxonomic research. Although experts today frequently, and rightly, stress how comparatively little we know about the diversity of organisms with which we share our planet, we should not lose sight of the enormous progress that has been made in cataloguing, describing and understanding the Earth's plants, animals and microbes. In spite of its immense contribution, in the last quarter of the twentieth century, systematics and taxonomy have lost its core role both in the biological curriculum and in the biologist's world-view. The problem was that the expansion of modern biological sciences demands more and more taxonomic data which could not be met with conventional taxonomists. In addition, taxonomy as then practised was essentially a 'cheap' science as it costs much less to buy dissecting microscopes, chemicals, herbarium cabinets etc. than to fund molecular biology laboratories, with DNA sequences, centrifuges and thermal cyclers. Of course, we know that cheap does not mean low quality, but it perhaps led to a view that the subject did not need the same support as some of the newer biological disciplines required.

Wounded by this relentless attrition, and in particular the accusation of being a descriptive enterprise, taxonomy responded with a philosophical makeover. The phylogenetic systematics pioneered most notably by Willi Hennig in the 1950s and 1960s provided a conceptual framework and set of workable tools to enable organisms to be classified in a consistent manner that explicitly took account of evolutionary relationships. Analytical techniques have largely kept pace with data generation, and for taxonomists working on living organisms there is no question but that molecular techniques will remain central to understanding evolutionary relationships.

The phylogenetic revolution in taxonomy has brought major benefits, though there has also been a downside. Taxonomy is more than just phylogeny; it also involves the definition and description of species, and the organization of knowledge in a manner that can be used by the wider community. In the past 25 years this field of the subject has been perceived as less 'cutting edge' and therefore less fundable. It has disappeared from many universities whose hiring strategy faithfully follows research funding and even some major museums and herbaria have rowed back on their commitment to this core part of taxonomy. A second downside has been the development of a certain brand of hardliners that see the whole field through a distorting prism of pure phylogenetics. This kind of phylogenetics advocates radical change in the way we perform taxonomy, which may ultimatelyalienate both end-users and funders. There is currently a ferment of ideas and suggestions about how taxonomy should advance, and though it is far from clear how the science will emerge from this period, there seems little doubt that the taxonomy in 2050 will be different from what we practiced today.

Taxonomy has had a turbulent time over the past last half of 20th century (Godfray and Knapp, 2004). Before this period any student of biology would have spent much of their time learning the tools and techniques needed to document and describe the world's flora and fauna. Every accessible nook and cranny of the living world was explored by an array of trained naturalists that organized this corpus of knowledge according to a series of rules and protocols. As our knowledge of the natural world grew, so did the world-view of the biological sciences. Sub-disciplines like physiology, genetics, ecology and evolutionary biology were emerged from the foundation laid by taxonomists, and inevitably taxonomy lost its core role in the biological curriculum. Taxonomic research became passé and conceptually forcing taxonomy to become a 'hypothesis-driven science' which was insufficient to save it from a perception of mediocrity held by some outsiders. Wounded by the relentless attrition that taxonomy was essentially descriptive, this most pervasive of biological disciplines has until recently languished in relative obscurity. The impending biodiversity crisis, coupled with the need for sustainable management of the worlds dwindling natural resources has brought an unprecedented focus on the significance of taxonomy. It is as relevant to the needs of fundamental and applied biology today as it ever was. What has changed is the climate in which taxonomists work and a demand for taxonomic data that is outstripping supply. Slowly, there is evidence that new opportunities are granted for taxonomy along with new challenges for the 21st century.

The survival of the subject depends upon the three main areas such as the science of taxonomy, technological developments and the socio-political environment. The tax in defining and parameterising the mode and tempo of evolutionary change in organisms and the processes of speciation. These strengths will remain at the core of the subject, enhanced rather than replaced by new developments. Incorporating taxonomic outputs into forecasting and modelling the impact of environmental change on biodiversity will be a growth area. Therefore, the taxonomy will require integrating knowledge of natural ecosystems with human systems and social impacts, not only for its survival but also to contribute the understanding of evolution of species, expansion and extinction in a given evolutionary time scale.

The role of taxonomy as an information science will increase greatly, most likely as a primarily web-based science on future. The tools for the management of information will be central to taxonomic work. The specimens, or vouchers, will remain a critical part of taxonomic science as hypotheses are based on them, but concept of 'specimens' will include surrogates such as digital images, bioacoustic data, molecular sequences etc. The current approaches to taxon description will need to be radically reviewed as the approach is inadequate to meet needs by using existing nomenclatural and publication tools. Formal description might only be used in taxa or instances where a name is essential. Emerging biodiversity informatics techniques can associate different kinds of information with unique identifiers that do not require a formal name. These changes need to be led from within taxonomy. An ecosystem approach based on metagenomics will need to be incorporated into the portfolio of approaches to describing life on earth, particularly for the micro world.

The taxonomists, with many new practical and theoretical tools becoming available, will increasingly need to be broadly based and to keep abreast of technological developments. The ability to integrate different types of data will be critical as it will offer flexibility, such as transferring skills from one taxon to another. Taxonomists will increase their capacity to interact both within and outside taxonomy, and ready to be hired in relative fields such as ecology, conservation, environment etc. As in the case for many areas of science, the future availability of expertise will be shaped by available funding and an ability to contribute to the major scientific issues of the day. Currently the number of full-time taxonomists is declining, as universities and other organisations continue to reduce positions. There will be a continuing need to train students in taxonomy, focusing on exploring and understanding biodiversity. The training of taxonomists is likely to be undertaken by specialised institutions, but with this comes the risk of a narrow perspective. It will be essential to engage the emerging cadres of students produced by bioinformatics, computer science, and ecological training schemes to face with the major challenges and opportunities of taxonomy.

The community of taxonomic data users and collaborators will broadentheir disciplines provided taxonomic information and new tools are made more readily available. Customisation of taxonomic information will be essential for practicing the discipline in developed and developing countries. However, the way in which information is provided may well change, using a just-in-time approach, on demand from users, rather than the current just-in-case approach, determined by suppliers. The maintenance of up-to-date information, and therefore rapid response to new information and mediated taxonomic judgment, will be vital to ensure user friendly.

i). The needs of users, especially the field-based rapid biodiversity assessments, will be a major driving force in the development of the subject.

ii). The compliance with an increasingly complex framework of international laws and regulations will be essential to ensure continued access to biodiversity samples as well as to collaborators. Information Technology will track source and use of samples for equitable sharing of benefit as per CBD protocol.

iii). Virtual research environments and collections will increasingly enable the public use of taxonomy as human populations become more urbanised and their primary contact with Nature.

iv). The user base will access taxonomic information through the internet, requiring online diagnostic services based on morphological data (automated analyses of digital images), sequence data (automated assignment of specimens to taxa via sequence) and other modes namely chemistry, bioacoustics etc.

The taxonomy faces exciting challenges and opportunities in the future to meet the demand for an ever more profound understanding of the diversity of life on this planet and the impact of increasingly destructive human activity including climate change, factors that are predicted to have an enormous negative influence on the diversity and distribution of biodiversity. The overall importance of the taxonomy in the science of 21st century is summarized.

i). Pivotal to the development of taxonomy are the rapidly expanding fields of high throughput DNA sequencing, automated digital data-gathering and biodiversity informatics. Incorporating these technologies will be critical to the science of taxonomy.

i). Scientific collaborators and users of taxonomy will require new ways of working and interacting with taxonomists. It is essential that taxonomists and their users respond to this need. Taxonomists integrated into interdisciplinary teams will be an essential way of working.

ii) Although an ever-expanding repertoire of theoretical and practical tools is available to taxonomists, there will have to be substantial, even radical, changes in how taxonomy is done and its supporting infrastructure operated, to exploit these opportunities to the full.

iii) To measure the impact of taxonomy, new evaluation metrics will be developed that more effectively recognise taxonomic contributions to knowledge and world science. It will be essential that the intellectual content of synthetic taxonomic publications, especially floras, faunas and revisions, is recognised and hence are more valued.

In short, the taxonomy will have the inherent capacity to absorb and synthesize data from other branches of modern sciences for serving the humanity and there by the taxonomy is not only as old as human history but also as young as any other new disciplines.

INVITED LECTURE 20

Preliminary appraisal of the diversity of Kalliad Laterite Areas of northern Kerala, South India

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Laterite was first described by Francis H. Buchanan in 1807 from Angadippuram village in the Malappuram district of Kerala; and hence Kerala is known as the 'type locality' of laterite in Earth Science literature. The western coast of India is characterized by hard crusts of laterite, extending from Kerala to Maharashtra. Broad, flat to moderately sloping lateritic areas are common in the midland regions of the northern districts of Kerala, from Malappuram to Kasaragod. The edaphic and climatic conditions of laterite 'hillocks' create extremely harsh physical conditions for life forms and have given rise to specialized plant communities with several endemic and habitat-specific species. Floristic surveys conducted in the laterite areas of Kalliad in the Kannur district of Kerala, South India resulted in the documentation of about 400 species of flowering plants under *c.* 80 families, of which about 20 percent are endemic. Associated fauna includes species of birds (123 species), butterflies (157), dragon flies (24 species), damselflies (21 species), frogs (20 species), caecilians, moths, bees, reptiles, spiders, ants, mammals and many more. The plateau consists of a complex of microhabitats resulting from differences in geographic terrain, soil cover, soil physical and chemical parameters and microclimate; and are inhabited by diverse forms of plants and associated fauna. Mass flowering of ephemeral plants such as species of *Utricularia* L., *Eriocaulon* L. and *Lindernia* All. furnish the plateau with varied hues in the early monsoon months. Grasses and sedges are dominant in the late monsoon and post monsoon periods, and are associated with few species of perennial xerophytes. Various anthropogenic activities such as mining for laterite bricks, construction activities, destructive tourism and consequent invasion of exotic species cause threats to these fragile habitats, leading to the loss of micro ecosystems and associated treasure of biodiversity. Short lived habitat-specific herbaceous species, most of which are endemic and belonging to various threat categories are at high risk, as they are unable to survive outside their natural microhabitats.

INVITED LECTURE 21

Phytodiversity Studies and Establishment of Conservation Sites in Arid Zones of Karnataka

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The state of Karnataka covers an area of over 1,92,000 Km^2, and several of its mountainous regions are covered with dense forests. The Arid-zone in Karnataka is distinct in many respects. It is mainly an inland plateau of varying height covering a large area of 92,353 Km^2. This zone embraces eighteen drier, 'maidan' districts viz. Bagalkot, Bangalore (Rural), Bellary, Bidar, Bijapur, Chikballapura, Chitradurga, Davenageri, Gadag, Gulbarga, Haveri, Kolar, Koppal, Mandya, Raichur, Ramanagaram, Yadgir and Tumkur. These districts lie between 12° 45' -18° 25' N latitude and 74° 59' - 78° 35' E longitude. The total forest area in this region accounts to only 7 % of the total geographical area. Major soil types in the region are black clay, red loams, red, sandy loams, clay lateritic and black soil. The forest ranges between 300-900 m altitudes (msl), receive 500-700 mm of rainfall. The pioneering work of Sir J.D. Hooker and his associates (l872-97) is very limited. This was followed by the publication of a number of provincial/regional floras. Buchanan Hamilton (1807) seems to be the pioneer in Mysore area. The vegetation of the region falls in to Southern tropical dry deciduous forests and Southern tropical thorn forests. The forests here are characterized by having small trees with patchy, open distribution. The struggle here is against the inhospitable physical surroundings and not merely between the floristic constituents. The species occurring here are mostly prickly or spiny and characteristically drought resistant. They assume xerophytic nature. According to Champion and Seth (1968) the vegetation ofArid zone of Karnataka generally falls into (i) Southern tropical dry deciduous forests and (ii) Southern tropical thorn forests. However, it is not always possible to delimit these two types as they gradually merge into each other. To safeguard long-term conservation of Arid Zone Biodiversity sites in the state, this study is aimed to establish representative field gene-banks and develop a biodiversity park a place with educational and research value for botanical studies and research. The biodiversity rich areas of approximately 100 - 200 ha each was selected. The major emphasis was given to ensure full protection from biotic pressures and develop them as "harvest free zones". Inthese areas along with scientifically collected and documented herbariums were served as a unique repository of botanical knowledge related to arid zone of the state. During survey, plant species were identified with the help of floras, photographs were taken as supportive documents of the species which had complete vegetative appearance and collected herbarium specimenand develop a data sheet. The check list of species for which identification process has completed and few unknown species will be identified with filed verification. The botanical survey was carried out in different seasons to

prepare site wise check list of available species. Herbarium specimens were collected, identified and pasted with labels. The specimens are deposited in the Department of Botany, Karnataka Science College, Dharwad. More than 3000 species has been authenticated. Maximum number of species was identified in Donimalai of Bellary District and Sherebikanahalli of Gulburga district respectively. Highest number of medicinal plants was found in Jogimatti of Chitradurga and Malebennur of Davanagere. The IUCNlatest version 3.1 has been considered for threatened status. Maximum number of species have identified under Fabaceae followed by Astraceae and Euphorbiaceaefamily. Most of the medicinal plants produce phenolic compoundsand secondary metabolites like tannins are due to stress created by high temperature and scarcity of water.

INVITED LECTURE 22

Botanical Illustrations: A Fading Art In Taxonomy

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Botanical illustrations are detailed and accurate depictions of plant species, typically created for scientific and educational purposes. These illustrations aim to visually represent the various parts of a plant, including its flowers, leaves, stems, roots, and seeds, with precision and clarity. Botanical illustrators use a combination of artistic skill and scientific knowledge to create these drawings or paintings. The history of botanical illustrations in India is rich and diverse, spanning centuries and reflecting the country's deep connection with its rich flora. India has a long tradition of depicting plants in various art forms. Ancient Indian manuscripts featured drawings of medicinal plants. During the Mughal era, botanical illustrations became more systematic. The Mughal botanical illustrations often combined artistic elements with scientific observation.

The British colonial period saw increased botanical exploration and documentation. British botanists and illustrators, such as William Roxburgh, contributed significantly to the field. The 19thand 20thcenturies saw an increase in scientific publications featuring botanical illustrations.Notable works include Roxburgh's *Plants of the Coast of Coromandel* (1795–1819), *Illustrations of Indian botany*and *Icones Plantarum Indiae Orientalis* (1840-1853) by Robert Wight. In contemporary times, botanical illustration in India continues to thrive. Throughout its history, botanical illustration has evolved from traditional artistic depictions to a more scientific and systematic approach. With technological advancements, digital illustrations and photographs are now common in scientific publications, while traditional hand-drawn illustrations maintain their significance. The fusion of artistic skills with scientific precision has contributed to a valuable legacy of botanical documentation all over the world.

Botanical illustrations were once a crucial component of taxonomy, aiding in the identification and classification of plant species. However, with the advancements in technology, particularly the widespread use of high-resolution photography and digital imaging, the role of traditional botanical illustrations has diminished. Photography allows for accurate and detailed representation of plants, often surpassing the level of detail achievable through hand-drawn illustrations. Additionally, digital photographs can be easily shared, disseminated, and stored, making them more practical for modern taxonomic research. However, there is still value in botanical illustrations, especially for capturing specific details or nuances that may be challenging to convey through photography alone. While not as prevalent in taxonomy works, botanical art continues to thrive as a form of creative expression and appreciation for the beauty of plant life.

INVITED LECTURE 23

Species delimitation in Angiosperms: Challenges and opportunities

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Currently several new species of angiosperms are being described from India, however, taxonomic status of many of them is questionable. It is satisfaction and pleasure to describe a new species but, in the process, novelties are described solely on the basis of some minor variations without required field experience, proper understanding of species concept and variations within species. Now we rarely come across publication of new infraspecific categories which are almost forgotten by present-day taxonomists. Many of the new species are described on the basis of minor variation ignoring ecotypes wherein these variations are genetically fixed but populations are not reproductively isolated and they are interfertile producing fully fertile hybrids. Indeed, documentation of variations is major job of taxonomists, but question is at what taxonomic level variations should be documented. In determining whether a form should be ranked as a species or a variety, the opinion of naturalists having sound judgement and wide experience seems the only guide to follow. This sentence was used by Ernst Mayr (1982) to illustrate that Darwin didn't understand the true nature of species. Species is a concept and the species concept varies from person to person. Although no one definition of species has yet satisfied all naturalists; yet every naturalist knows vaguely what he means when he speaks of a species and this hails from extensive observations and experience. Similarly, old protologues sometimes are of little value in determination and delimitation of species in absence of type specimens or poorly preserved types. Taxonomists need to have vast field experience and understanding of biosystematic categories, morphological and population concept of species, infraspecific categories as well as variations within species.

In spite of difficulties, there are good opportunities to discover and describe novelties in nature. Extensive field work, consistent careful observations on selected group results into identification of good taxonomic characters in delimiting species and discovery of novelties. This is my own lifetime experience with flowering plants. The lecture illustrates challenges and opportunities in the discovery of new species with some selected suitable examples from India.

INVITED LECTURE 24

eSRF-CARE: A Comprehensive Framework for Advancing Climate Resilience through Biosystematics-Informed Restoration Ecology

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Addressing the intricate challenges posed by climate change on global ecosystems necessitates a paradigm shift in restoration practices. The prevailing gap in effectively integrating biosystematics into restoration ecology has resulted in suboptimal resilience and functionality of restored ecosystems. We propose the Enhanced Systematic Resilience Framework for Climate-Adapted Ecosystem Restoration (eSRF-CARE) as an interdisciplinary solution, aiming to bridge this gap. By incorporating advanced biosystematics, highlighting the indispensable role of plant-microbe interactions, and elucidating the phage-bacterium-plant tripartite relationship, eSRF-CARE embarks on a mission to restore and rejuvenate degraded ecosystems, enhancing their resilience and functionality. Aligned with the international mandate of protecting 30% of Earth's terrestrial and marine habitats by 2030, as advocated by the Convention on Biological Diversity's Post-2020 Global Biodiversity Framework, eSRF-CARE is poised to make a significant impact. Its strategies span across plant-microbe mediated ecosystem resilience, comprehensive biodiversity conservation, and the promotion of sustainable agricultural and forestry practices, collectively fostering the development of climate-adapted ecosystems.In India's context, the framework is synergistic with national endeavors such as the Green India Mission and the National Action Plan on Climate Change, offering a holistic and resilient roadmap for ecosystem restoration. At its core, eSRF-CARE is committed to cultivating the next generation of 'Ecological Systematists'—professionals adept in marrying biosystematics with pragmatic restoration ecology. This integration not only prepares them to confront the complexities of climate change and ecosystem degradation but also instills a robust foundation for data-driven decision-making, leveraging advanced technologies for biodiversity monitoring. By galvanizing a global community of practitioners, eSRF-CARE stands as a beacon for sustainable development, biodiversity conservation, and the fortification of climate resilience, ensuring the prosperity of ecosystems and human societies alike.

MEDAL AND ENDOWMENT LECTURES

Y. D. TIAGI MEDAL AWARD LECTURE

My pleasurable journey into the taxonomy

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This medal and talk of mine is dedicated to my Guru Dr. V. N. Naik, the great taxonomist of India, who transformed my life and became my guide, friend, philosopher and a part of my family who would have been the happy and proud person today.

I have no hesitationin telling you that myjourney is withsome happy accidents the first accident was when I was forced to elect Botany Special at my graduation. This was followed by some other accidents.

Studies for my doctoral degree started in 1972 under the guidance of Dr. V. N. Naik as apart-time researcher, worked for 9 years and was awardedthe degree in 1982. The thesis entitled 'Flora of Northern Hills of Aurangabad District' isof 780 pages without any graphs illustrations or photographs and is typed on a typewriter. As many as 1020 species are reported from this dry region. The important contributions are: 1. Diagnostic dichotomous keys whichmake it easy to come to correct conclusions. 2. Detailed description of taxa. 3. As many as 380 critical notes. 4. More than 50 new records to region and state. 5. Three new taxa (one species and two varieties now elevated to specific status by others.)

The research activity was resumedin the year 1990 when visited Rijksherbarium, Netherlands and Kew Herbarium Kew. There Dr. Kalkman and Dr. R. M. Polhill encouraged me to undertake studies on the genus Alysicarpus. Dr. Polhill provided funds to attend the 3rd International Legume Conference. Findings on relationships and probable evolution of the genus were submitted attheconference in 1992.

During this, Dr. V. N. Naik got a grant to publish "Flora of Marathwada" and several expeditions in the region were undertaken mainly for photography. I also got an invitation to contribute to the ILDIS project to compile data in the tribe Desmodeae of South Asia in NBRI Lucknow.

Ultimately "Flora of Marathwada" was published in year 1998in which my contribution was Layout, photo plates and part of Fabaceae and Mimosaceae. Legumes of South Asia was published in the year 2003. My contribution to the database and checklist is on tribe desmodeae. In the year 2006a major project by DBT entitled "Conservation of Abutilon Randee and Erinocarpus nimonii, two critically endangered species from theWestern Ghats" was sanctioned. Under this a tissue culture lab was developed In Dr. B. A. M. University Botany Dept.

and protocols of tissue culture were established for both species. Besides this, various aspects like seed dormancy, soil microbiology, variability, seed structure, vegetative propagation etc. were studied. Insitu conservation of 300 and 550 individuals respectively at 5 localities was successfully undertaken.

In year 2008 the Herbarium of Botany dept. Dr. B. A. M. University Aurangabad was renovated and got international recognitionand an acronym **BAMU.**

In the year 2003, I was recognised as a Ph.D. guide. One of my students Arvind Dhabe started working on Genus Alysicarpus followed by Ravi Patil and lastly by Shantanu Chavan. Compilation of the data of the 3 theses and further studies and confirmatory expeditions were made to meet out scanty data and doubtful specimens.Ultimately my first book on the genus entitled “Genus Alysicarpus Desv. Fabaceae in India” was published in 2017. In 2022, my second book on the genus entitled “Revision of Genus Alysicarpus Neck. Ex Desv. (Fabaceae) for India, a monographic approach” was published by Nova Science Publisher New York.

Through these books, contributions made to the knowledge of the genus are presented, some of these are:

1. Morphological variations and taxonomic significance of stipels, stipules,and primary and secondary bracts.

2. Probable evolution of inflorescence of the genus.

3. Three distinct types of inflorescences are described.

4. Unique self-pollination with the help of standard petals was discovered and described. This is the unique feature of the genus.

5. Three types of pods and 4 types of pod ornamentations are described.

6. Seedcoat morphology and anatomy for all taxa described.

7. Testa topography for all taxa described. More than half of taxa have duplex teste topography, a unique feature of the genus.1.Nutritive value as fodder crop was known only for 3 species. The nutritive value of all 17 species is documented.

2.Extensive chemical data of 22 taxa is presented especially on chemicals having taxonomic values, like saponins, glycones, aglycons, flavones, phenolics etc.

3.A new classification of the genus (after Prain 1897) is proposed.

4.Relationships of species and the probable evolution within the genus proposed.

I sincerely believe that this genus is a gold mine for the young generation. Vast data and taxa are yet to be unearthed. Application of modern techniques along with a keen understanding of the taxonomy of the genus and extensive fieldwork will never disappoint you. I am sure you will find that the findings presented in my two books are a small fraction of what you will unearth. Hope today some of you will get interested in the genus and will start working.It is impossible to mention all the persons whom I would like to thank for their contribution during this journey but deserves mention are all my classmates, my teachers andtaxonomists like my guru Dr V. N. Naik, Dr. R. M. Polhill, Prof. Pai, Prof. M. Baboo, Prof. S. R. Yadav, Dr. M. Sanjappa, Prof. Janardanan.There are many more stalwarts and friends in IAAT who blessed, appreciated and encouraged me in my journey in the field of taxonomy. I really want to thank them all along with all the IAATians.

Lastly, I sincerely thank the committee who found me worthy of awarding this prestigious medal.

PROF. V. V. SIVARAJAN GOLD MEDAL AWARD LECTURE

Kachchh: A semiarid paradise of India

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Field studies in Indian Botany is a question yet to be solved in many areas, an up-to-date information on the taxonomy and distribution of Indian plants requires the efforts of all. The flora of Gujarat is indeed in need of precise and critical study as most of the plant communities are affected by the environmental factors having a considerable influence on the growth and distribution of the vegetation at a particular area. The Arid and semi-arid regions are very important as the problems they pose in number of countries are much different than other region including the salinity. Arid and semi-arid regions have very peculiar type of climatic conditions, i.e., extreme heat in summer, very poor rainfall, and extreme cold in winter. The vegetation of such regions is quite distinct both in quality and quantity as compared to the adjoining areas where, extreme climatic conditions do not exist. The systematic study of such areas will provide useful information regarding diversity of plant species growing there and their adaptions to prevailing extreme climatic conditions.

Kachchh peninsula is an ancient land possessed of great antiquity which takes its name from its geographical characteristics and topographical features resembling a tortoise (Kachchh). Thus, the mainland of Kachchh is almost encircled by either saline water or Swampy marshes or by the vast low lying fallow low land and saline sandy tracts of the ranns. The land of Kachchh is unique and rich in its phytodiversity including the presence of inland mangroves in greater rann due to its wide and extreme environmental and geographical conditions which acts as strong drivers. Kachchh is divided into three major regions Great ran of Kachchh, little ran of Kachchh and Southern region with sparse forest vegetation dominated by thorny scrubs.

Though botanical studies for the district have initiated in 1880s. Afterword the area remained neglected for number of years. Subsequent research studies on the flora of kachchh have been made by so many researchers covering the area from various angles. It gives an overview of the gross diversity in numbers, it suffers from the lack of information on the variability existent at phytodiversity level. Katchchh district falls under arid to semiarid climate which is demarcated by the xerophytes or majority of annual plant species and classified under "Northern Tropical Thorn Forest. Total of 988 species are recorded under the flora of Kachchh district. The thorn forest and Savannah are two dominant habitats in Kachchh. These vegetation types exist in the form of a

mosaic in hilly tract and plain area. Hilly tract supports rich mixed thorn forest, mostly dominated by *Euphorbia* scrubs and *Acacia* forests which classified based on the floristic composition of each habitat and plain area supports mainly grassland and saline scrub. In addition to floristic richness, land also deals wild Ass sanctuary with phytogeographical aspects of the kachchh flora, its endemicity, exotic angiosperms, and threatened angiosperms.

Grasslands the mother's magic plays an important role of food supply for all the living organism in the area. The stark landscape of *Banni*comes as a surprise to many.*Banni,* the largest and finest stretch of grassland in India and the second largest in Asia, is located on the northern border of Kachchh district at the westernmost end of Gujarat State and forms an important ecosystem in Kachchh supporting a diverse array of wild floral and faunal species including certain threatened species.

Comparative studies of old and present observations with the recent findings indicate that the plants which had been recorded as very common are rare and endangered now. Endemic and threatened plants represent a small but important part of the flora of Kachchh. They are very susceptible to the environmental change. The causes of such environmental change are biotic and abiotic activities including anthropogenic pressure; such as land clearing, cutting, lopping, overgrazing, the development of man-made forests of *P. julieflora*and industrial pollution. Past and present floristic data reveals that phytogeographically the area is more akin to Sind (Pakistan) and N W Rajasthan than any another part of Indian sub-continent. The flora also depicts the dominance of western elements than Indo-Malayan which is quite commonly recorded in Indian flora. Very many RET plants are enumerated in various reports by numerous earlier workers. The number display a discrepancy from 22-30 rare and endangered plants from different habitats. The number always varies as per the specific area of the second largest district in India. These recorded RET plants of the district can be classified into four categories.

Strictly endemic; Widely distributed in semiarid region of India; Plants found in tropical African nations and extended their distribution and Plants becoming rare due to anthropogenic activity.

PROF. KAMESWARA RAO ENDOWMENT LECTURE

Experimental studies on eco-evo-developmental dynamics of floral nectaries

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Floral nectar is the key pollination reward in the majority of angiosperms. It is exuded from the floral nectaries (FN) as a blend of sugars with a range of metabolites, and presented in variable amounts and viscosities. This sugary concoction offers a strong evolutionary selection on floral foragers by acting as a filter to engage suitable pollinators. The others may harness it only by illegitimate means, often referred to as nectar robbing. This arrangement has ecological and genetic consequences on gene flow and fitness of plants. The net fitness is defined by what all is included in a foraging guild of a plant. Despite its importance in facilitating mutualism between plants and pollinators, there is paucity of information on the eco-evolutionary and developmental dynamics of FN. My research group has looked into these aspects through experimental approaches combining field-observations with *in-silico* and molecular tools. Unlike the other floral organs, the developmental position of FN is highly variable across the flowering plants, but conserved among the eudicots. A phylogenetic analysis has indicated its acrocentripetal developmental trend, with positions ranging from sepals in basal angiosperms to inner whorls of the flowers among the core eudicots. These differences suggest respective floral organ gene networks at play. So far, only one gene namely, *CRABS CLAW* (*CRC*) from *Arabidopsis thaliana*, has been implicated in FN development. Our detailed investigation amongst the diversely-pollinated and sequenced genomes of Solanaceae (Asterid), directed to look for the homologues, indicated one ancestral segmental-duplication event specific to the family. The event resulted in two homologues of *CRC* (*CRCa* & *CRCb*) falling in two separate clades. The family also displays variability in types of FN ranging from the ancestral lobed (Schizanthoideae and Petunieae) to annular (Capsiceae, Physalinae and Withaninae) types. The zygomorphic floral form, associated with butterfly, bird, bat, and moth pollination, tends to have lobed nectary while the actinomorphic forms are associated with bee pollination or annular nectary disc. Microsynteny analysis shows that genomic segments of the paralogues underwent species or lineage-specific changes which possibly resulted in differential retention of the two paralogues across Solanaceae. These findings have provided us the foundation to perform expression analysis of *CRC a/b* paralogues to establish their possible developmental role in FN specification, and explore the possibility of concerted evolution through repeated gain and loss of function across angiosperms.

PROF. A. K. PANDEY AWARD FOR REVISIONARY STUDIES

Taxonomic revisions in Indian Orchidaceae: Subtribe Goodyerinae, genus *Calanthe* and *Gastrochilus*

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Orchids, one of the most fascinating plants existing in the nature are one of the widely distributed groups of flowering plants on the earth. The family Orchidaceaeis one of the largest families of flowering plants in the worldwith about 28,484 accepted taxa (Govaertset al., 2017) distributed under 736 genera (Chase et al., 2015). In India, the family is represented by 1263 taxa under 155 genera, of which 308 taxa are endemic (Singh et al., 2019). Though several taxonomic works on Indian orchids were attempted earlier, only a few endeavours were made to undertake taxonomic revision on Indian orchids. The revisionary studies on the subtribe Goodyerinae Ridl., genus *Calanthe* R. Br. and *Gastrochilus* D. Donwere undertaken to provide detailed taxonomic account of the members of these groups with correct identification, updated nomenclature, detailed citation and description with photographs/ photo-plate/illustrations, distribution, phenology, conservation status, potential uses and other available information. Theserevisionary studies enabled documentation of 75 species, 1 variety under 13 genera in Goodyerinae, 23 species in *Calanthe*, and 18 species, 1 variety in *Gastrochilus*from India. The major outcomes of these studies includes description of 4 new species, 4 new combinations, 8 new records for India, 1 new record for China, exclusion of 5 species from India, 16 new synonyms, reinstatement of 4 species, typification of 24 names and rediscovery of 2 species. The comprehensive revisionary accounts on these groups can help the researchers, general public, policy makers, management authorities, foresters to developbetterconcept on the identifying features and also to record the diversity, distribution, threats to different taxa.These taxonomic revisions will lead to formulate conservation strategies for the threatened taxa and aid in conserving the Biological Diversity of our country. The results may also facilitate to develop novel breedsin providing information on the scope of potential utilization of various taxa of Indian orchids.

PROF. SANTHOSH NAMPY IAAT YOUNG SCIENTIST AWARD

SNA-0P-01

Contribution to the Flora of Sikkim

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Sikkim exhibits unique geo-climatic conditions due to its geographical position, altitude, topographic factors as well as for the Indian monsoonal climate. All these factors together favor the growth and sustainability of a rich biodiversity in Sikkim. Being the second smallest state of India, it occupies nearly 0.2% of the total geographical land masses of the country, however, it shares nearly 31% flowering plants of India. Sikkim is also known as the naturalist's paradise for its wide array of species composition starting from the primitive representatives to a highly advanced group of plants. The state harbours more than 6000 species of flowering plants, about 480 species of pteridophytes, 506 species of bryophytes and nearly 306 species of algae. Besides it shelters 93 strict endemic taxa and nearly 142 East Himalayan endemic taxa. On the other hand as Sikkim is a part of the '*Himalayan Hotspot*', it receives considerable threats to its biodiversity. A thorough investigation on the flora of the state Sikkim since 2016 to till date results in record of several novelties from the region. In this study, four species and one subspecies have been described as new to science. Besides, three species and one subspecies have been rediscovered after more than 100 years from India. *Primula munroi* subsp. *schizocalyx* is a strict endemic to the state Sikkim and therefore, the scope of the rediscovery is global. New distributional records for 12 species have been claimed from the state [India: 2 spp., Himalaya: 1 sp., Eastern Himalayan Region (India): 1 sp. and Sikkim: 8 spp.]. Moreover, recircumscription of two taxa, viz. *Saxifraga umbellulata* f. *pectinata* and *Gagea serotina* var. *parva* has also been accomplished. *Gagea serotina* (L.) Ker.-Gawl. var. *parva* (C.Marquand & Airy Shaw) D. Maity, M. Midday & J. Ghosh has been published as new combination and new status (*comb. et stat. nov.*).

Additionally, during the entire tenure of the research work new synonymy for three taxa and typifications of 22 names has been completed. Furthermore, non-conventional uses of three species by the tribal communities of the Sikkim have been documented.

After rigorous study and extensive effort, contribution has been made to illustrate the floral diversity of the state and the taxonomic account of 41 families has been contributed in the book, "*Flora of Sikkim (a comprehensive account of angiosperms with identification keys)*".

SNA-0P-02

The genus *Sonerila* Roxb. (Melastomataceae) in India

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Sonerila Roxb., an incredibly diverse and taxonomically complex Old-World genus of the family Melastomataceae (tribe Sonerileae) comprising around 180 taxa. The genus is distributed across Sri Lanka, India, Nepal, Bhutan, South China, Taiwan, Indo-China and the Malay Archipelago. It is the largest genus in the Indian Sonerileae with 49 species and one variety, and exhibits a high percentage of endemism. The greatest diversity of *Sonerila* in India occurs in the Western Ghats, where 43 species and one variety are found with 86% of endemics. It includes caulescent and acaulescent herbs, and many produce tubers. Members of the genus are easily recognized by generally trimerous flowers, mostly uniparous (scorpioid) cymes, and a 3-locular, inferior ovary. The genus thrives in shady habitats and displays an array of morphological diversity. As a part of ongoing systematic studies, *Sonerila* in India is revised based on field studies and herbarium specimens and data. The present work highlighted the taxonomy of Indian *Sonerila* with a revisionary account including key for the identification, illustrated taxonomic account, notes on infraspecific variations, habitat, ecology, distribution, endemism and conservation status assessment. Six species was found new to science. Taxonomic problems relevant to the study were also resolved resulting in subsequent synonymy, typification and reinstatement of names.

SNA-0P-03

Pollen flora of Lachen Valley, Sikkim

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Lachen Valley, a small and biodiversity enriched section of North Sikkim with diverse flora, is located along the river Lachen Chu with an area of about 565 sq. km. About 230 angiosperm taxa comprising of endemic, RET, medicinal and economically important plants are recorded in Lachen. Located in the temperate region, the lower height of the valley receives moderate monsoon rainfall (nearly 200-500 cm) and consists of mixed broad-leaved evergreen plants. The upper elevation remains snowy mostly during winters. Under present investigation pollen morphology of 56 herb, 44 arboreal and 7 vine species among the total 230 angiosperms present in Lachen has been examined thoroughly. The studied 107 species are stretched in 36 families and 80 genera. The present study is being aimed on a keen observation of pollen flora with the help of pollen morphological analyses. Besides, pollen load and pollen viability assessment have also been performed. Every pollen character has been analysed critically with the help of both Light Microscopy (LM) and Scanning Electron Microscopy (SEM). Standard parameters have been taken into account for describing the pollen grains. Among the 107 species studied, pollen grains of only one family (Ericaceae) along with its ten species are tetrads while the rest 35 families along with their 103 species are monads. The pollen shapes are widely variable generally from sub-prolate (38 taxa) to oblate–spheroidal (6 taxa) with intermediary traces of prolate-spheroidal (29 taxa), spheroidal (18 taxa) and prolate (16 taxa). Most of the pollen grains are small-sized (62 species). Medium-sized pollen grains are moderate (42 species) and large pollen grains are found in three species. The NPC digitisation categories of pollen have been

found to be from inaperturate to spiraperturate, zono to panto, mostly furrowed, compound to rarely flattened, simple aperturate. Pollen load count is being ranged from ca. 1,050 (*Geranium nepalense*) to ca. 32,690 (*Capsella bursa-pastoris*) and pollen viability (PV) percentage are found moderate (45.57%-98.27%). Among the studied taxa 92% (98 taxa) are homomorphic and 8% (9 taxa) are heteromorphic. Pioneer report has been recorded for pollen aperture heteromorphism in single species *Capsella bursa-pastoris* (Brassicaceae). Amidst 107 species, 8 are psilate and the rest 99 are with differently ornamented exine. Out of the total 36 families studied, 17 are eurypalynous and 19 stenopalynous. A key to the species with pollen traits has been prepared.

The pollen flora has been structured for palynotaxonomical study as an aid to the systematics of the flora and also resolving taxonomic ambiguities whenever present. Besides, these data can also be useful in forensics, reconstruction of palaeoclimate and

vegetation, quantification of the aeroallergenicity, creation of apiaries with subsidiary honey-based industries and biodiversity conservation through pollen cryopreservation. Besides, the data can also be used in breeding programmes, pollen-pollinator interaction study, seed setting and germination.

DR. A. K. PRADEEP YOUNG RESEARCHER AWARD

AKPR-OP-01

Ethnobotanical use of wild fruit plants with special reference to the Kani tribe of Peppara wild life Sanctuary, Kerala, India

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The present study focuses on the ethnobotanical utilization of wild fruit plants, specifically examining the practices of the Kani tribe residing in the Peppara Wildlife Sanctuary located in the southern Western Ghats, Kerala, India. Peppara Wild Life Sanctuary as a whole is a repository of native fruit plants that are traditionally consumed. The indigenous people of the Kani tribe have an extensive knowledge of wild fruit plants. Wild fruits have a wide variety of uses, including those for food, forage, medicine, offertory, fish poisoning, condiment, source of dye or ink, hygiene and other needs. The study area was frequently visited, and ethnobotanical information such as local name, uses, time of harvesting method of preparation etc. was gathered using semi-structured questionnaires in the local language so as to extract valuable age old informations from the inhabitance and tribal practitioners in the settlement area especially of Village leader, 'MoottuKani' .The information gatherd were documented the standard format and analysed data to avail the results viz. Use value (UV) fidelity level (FL), family use value (FUVs) etc. The documentation of these valuable germplasm will undoubtedly provide benefits in terms of ensuring food and medical security of the nation. Information was recorded from 164 respondents, ranging in age from 20 to 90 years. The present study reveals that, the tribes use 38 species from 18 angiosperm families. It includes 6 threatened taxa listed in the Red Data Book by the IUCN.

AKPR-OP-02

Impatiens L. (Balsaminaceae) of Western Himalaya with a rediscovery and a new addition to the flora of India

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Impatiens is one of the largest and diverse genera of angiosperms with more than 1000 species known globally and about 35 species are known from the Western Himalaya, half of which are endemic and one third of these endemics are only known from the century old herbarium records with incomplete short descriptions. Our extensive explorations in the Himachal Pradesh state from 2018-23 lead to the rediscovery of rare Western Himalayan endemic species *Impatiens violoides* Edgew. ex Hook. f. after 189 years and finding of *Impatiens lemannii* subsp. *kurramensis* Grey-Wilson a poorly known taxon, which forms to be a new addition for the flora of India. Based on the observations of living material we provide augmented description of both these little-known taxa along with information on their global distribution, ecology and detailed photographs including floral dissections. Moreover, the current taxonomic status of genus *Impatiens* in Western Himalayas is discussed briefly.

AKPR-OP-03

Foliar architecture and pollen morphology of the family heliotropiaceae schrad. And their systematic relevance

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The classification of the order Boraginales has changed dramatically over time. Due to its broadly drawn limits and lack of consensus, the order faces some debate both at familial and infra-familial levels. The systematic position of the family Boraginaceae s.l. remains highly problematic and controversial. Recent studies support the recognition of eleven, easily recognizable families, namely the Boraginaceae s.str., Codonaceae, Coldeniaceae, Cordiaceae, Ehretiaceae, Heliotropiaceae, Hoplestigmataceae, Hydrophyllaceae, Lennoaceae, Namaceae, and Wellstediaceae. The family Heliotropiaceae comprises four genera, *Heliotropium* L. (incl. *Tournefortia* L.), *Euploca* Nutt., *Ixorhea* Fenzl and *Myriopus* small. with ca 450 species mostly along the warm tropics and temperate regions. In India, the family is represented by two genera *Heliotropium* L. (incl. *Tournefortia* L.) and *Euploca* Nutt. Heliotropiaceae is characterized by annual or perennial herbs; pentamerous, bisexual flowers; scorpioid cymes; stamens epipetalous; gynoecium bicarpellate, ovary 4-locular, style terminal with a conical stigmatic head having a basal ring-shaped stigma and a sterile apex, disc present at the base of ovary; fruit dry or fleshy, usually four seeded. The present work evaluates the systematic relevance of morphological, anatomical, and palynological diversity within the family.

AKPR-OP-04

Ethnobotanical study of some medicinal plants used by the Rabha tribe of Udalguri District, Assam, India

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Ethnomedicinal plants used by Rabha tribe residing in Udalguri district of Assam were studied. The present study evaluates 59 plant species belongs to 58 genera and 35 families used in various traditional medicine. Among them the most of the plants are used to cure gastrointestinal disorders, Dysentery, diarrhea, Jaundice, Constipation, piles etc. Observation on growth form of ethnomedicinal plants revealed that herbs were most frequently used in preparation of traditional medicines. The use value calculated was ranges from 0.05 to 0.66. Highest UV was calculated 0.66 in *Kalanchoe pinnata* (Lam.) Pers. and least UV calculated 0.05 in both *Moringa olifera* Lam. and *Lasia spinosa* (L.) Thwaites. The plants with lowest fidelity level index was calculated 40% in both *Ageratum conyzoides* L. and *Neolamarckia cadamba* (Roxb.)Bosser and the plants with highest FL index was calculated in *Mentha arvensis* L. (94.4%) followed by *Lasia spinosa* (L.) Thwaites (94.1%) and *Saraca asoca* (Roxb.) W.J.de Wilde (91.6%) which indicates their effectiveness in treatment of respective disorders.

AKPR-OP-05

Distribution and Ecology of *Coelachne madayensis,* a tiny Grass of Southern Western Ghats, India

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Coelachne R.Br. is a genus of small grasses of the subfamily Micrairoideae of the family Poaceae. It comprises 12 species extending their distribution from tropical East Africa, eastward to Japan and northern parts of Australia. In India, the genus is represented by four species and one variety, of which two species and one variety are endemic. The tiniest grass of the genus *C. madayensis* Pramod & Pradeep, was recently described from the shallow seasonal pools of a lateritic plateau of Northern Kerala, South India (Pramod *et al.,* 2012). The coastal plains parallel to the southern Western Ghats are characterized by ferricretes rich in aluminum, forming plateaus and hilltop carapaces. The peculiar harsh microhabitats of these hillocks provide a home for *C. madayensis* and other endemic, habitat-specific species. The grass is found growing in the shallow seasonal pools and adjoining wet areas on the low altitude lateritic plateaus. They start sprouting after the first shower of the southwest monsoon in June, and take about one-month time to complete life cycle. The present study provides information on additional locations other than the type locality, its habitat ecology, and morphological data through comprehensive field visits across northern Kerala. A distribution map is prepared using information gathered from the field. Conservation status of the species was evaluated based on the IUCN Red List Categories and Criteria Version 15.1. (IUCN 2022). Additionally, the threats faced by the microhabitats of the endemic grass are also discussed.

AKPR-OP-06

Resolving the identity of some species in the genus *Bupleurum* L. (Apiaceae) in India using Morpho-Anatomical features

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Bupleurum L., known as Chai Hu or Hare's ear is a perennial herbaceous genus in the carrot family Apiaceae. They are used as medicine in Chinese pharmacopoeia and in European pharmacopoeia, so they are considered as an important plant throughout the world.About 190 species are reported from Eurasia, North Africa, South Africa and North America, making this genus the second largest in diversity within the family Apiaceae. In India, the genus is represented by 21 species distributed in Himalayan ranges. Comparing with the other genus in the Apiaceae, this genus is characterised by having simple leaves and an umbel of yellow or dark purple flowers. Hence the taxonomic identification from the rest genera is simple and identification within the genus is difficult. So, this work focuses on the taxonomic identification of some complex species in this genus distributed in India based on their morpho-anatomical features.

AKPR-OP-07

Bark factors affecting the distribution of epiphytic mosses communities along elevation gradient in Fambonglho Wildlife Sanctuary

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In the growth and behaviour of the plants, substratum plays an important role. All bark of angiospermous trees were invariably hard and has markedly rough textured. In present study total of 5 plots was set each comprising of 10 trees having diameter ≥ 15 cm. As a result, 50 phorophytes i.e., host trees were analysed for their bark characteristics irrespective of their different altitude gradient. All tree's bark that was collected in November, June, and August as winter, pre monsoon, and monsoon samples studied found to have different range of acidity and moisture content. The nutrient contents (organic C, N, Ca, K, P) of bark samples were also analysed. The texture, colour, hardness, and softness of bark were noted by visual observation during the field survey. In all, 46 epiphytic mosses were collected and identified. All the chemicals except calcium showed mixed pattern of range. In general moisture content and texture of bark are important for epiphytic mosses. The majority of epiphytic mosses were recorded from shady moist places suggesting that these mosses communities demand high humidity for their growth and survival.

AKPR-OP-08

Taxonomic Diversity and Conservation of Gingers in Odisha

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Gingers are overvalued due to their high economic and medicinal importance in tropical countries. The state Odisha is blessed with rich diversity of Gingers due to its favorable climatic conditions and edaphic factors. However, the up-to-date taxonomic status and potential utilization of Gingers is still lacking in Odisha. The present study focused on the inventorisation, collection and conservation of the ginger germplasm resources of Odisha. About 26 species under 8 genera of gingers were growing in different parts of the state. The recorded taxa were *Alpinia* comprising 2 species, *Amomum* (1 sp.), *Boesenbergia* (1 sp.), *Curcuma* (9 sp.), *Globba* (3 sp.), *Hedychium* (3 sp.), *Kaempferia* (2 sp.) and *Zingiber* (5 sp.). The enumeration of the plants with field photographs, botanical name, vernacular names, use categories, flowering & fruiting time were recorded. Among the use category, maximum gingers species were used for medicinal purposes (96%) followed by ornamental (25%), Food (21%) and cultural significance (10%). Out of the 26 ginger species of Odisha, 22 species were found growing in the wild and 4 of them were cultivated. The cultivated species were *Curcuma angustifolia* Roxb., *Curcuma amada* Roxb., *Curcuma longa* L. and *Zingiber officinale* Rosc. The unsustainable utilization of wild gingers such as, *Curcuma montana* Roxb., *Zingiber capitatum* Roxb.*, Zingiber montanum* (J. Koenig) Link ex A.Dietr., *Zingiber zerumbet* (L.) Roscoe ex Sm. may lead to local extinction and needs conservation prioritization. The collected fresh germplasm were planted in the Botanical Garden, MSCB University, Baripada campus for ex-situ conservation, research and educational activities. The present taxonomic study on gingers will help researchers, scientists and biotechnologists in bioprospecting and adding value for sustainable production and utilization of gingers in Odisha.

AKPR-OP-09

Phytochemical evaluation of an underutilized wild edible zinger of Assam

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Zingiberaceae family members are noted to have numerous medicinal plants that are unexplored because they are mostly present in wild state. Rhizomes are common wild edible plant part of Zingiberaceae members that has been utilized by the tribal and rural inhabitants from time immemorial in their dietary habits for its beneficial effects. *Boesenbergia rotunda* (L.) Mansf commonly known as "Chinese keys" or "Fingerroot". Proximate composition analysis of *B. rotunda* showed 73.5% of high carbohydrate content in comparison to moisture, ash, fat, protein and fibre. It was found that high carbohydrate content species have high energy content. Phytochemistry analysis showed specifically the presence of secondary metabolites such as phenols, flavonoids, terpenoids etc. The species showed antioxidant activity of IC_{50} value 25.50 µg/ml against the standard ascorbic acid. Positive correlation was found among total phenolic content, total flavonoid content and antioxidant activity. Presence of alcohol, alkane, alkene and nitro compound as functional group was observed in FTIR spectroscopy. GCMS analysis of dried rhizome powder of the species showed anticancer, antioxidant, anticoagulant activities etc.

AKPR-OP-10

Krummholz vegetation and its associated herbaceous floral diversity in Northwest Himalaya, India

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The Indian Himalayan region harbors about half of the plant species recorded in India. The diversity is nowhere so prolific as in the Himalayas, which represent the richest heritage sites of the Indian subcontinent. Throughout Western Himalaya, the topography, altitude, and climatic conditions vary widely which led to the effective creation of a diversified flora. Knowledge of high altitude Krummholz vegetationof WHabove timberline is very fragmentary and many potentially interesting species are poorly known. This vegetation type is characterized by the growth of trees and shrubs that are twisted, stunted, and often have a prostrate or low, creeping form. *Trillium govanianum*, *Polygonatum geminiflorum*, *Angelica archangelica*, *Allium wallichii* etc. are the dominant herbs of the vegetation. Plants of this type of vegetation are acting as buffer to the diversity. The present communication gives an account on much ignored vegetation of the alpine area of WH and associated herbaceous flora in the absence of any such previous attempt.This type ofcommunity can be ecologically important as they provide protectionto palatable species from herbivores.It also plays a crucial ecological role in alpine ecosystems by providing shelter and food for various wildlife species. In the studied transect based on collections made from 2019–2023 a total of 68 taxa belonging to 53 genera and28 familieswere recorded. Habitat study indicates that 52 species are restricted to the habitat and remaining species are common with other vegetation.

AKPR-OP-11

Prey spectra of the endemic carnivorous *Utricularia sainthomia* (Lentibulariaceae) from Kerala

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The genus *Utricularia* L. of the Lentibulariaceae family, also known as bladderworts, includes about 250 species worldwide and 42 species under 7 sections in India, mainly distributed in the Western Ghats and the Northeast India. Carnivorous plants typically grow in nutrient-poor, wet, or aquatic habitats, and derive nutrients from animal carcasses. For the digestion and absorption of prey, carnivorous plants have highly specialised structures called traps. Remarkably, there isn't much information available on the captured prey. The present study focuses on a detailed survey of the prey spectra in the trapsof the endemic species *U. sainthomia* P. Biju, Josekutty, Janarth. & Augustine, collected from three different locations in Kannur and Kasargod districts of Kerala. 50 traps from each location were collected, fixed in FAA and examined under a compound microscope. Bladder content showed the presence of various zooplankton and phytoplankton.

AKPR-OP-12

Pollen character elucidation of some rare and endemic species of the Genus *Lasianthus* Jack from Southern-Western Ghats, India

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Lasianthus Jack is an evergreen shrub belonging to the family Rubiaceae with over 180 species. Its ecological niche is confined to evergreen forests at higher altitudinal ranges, rarely in semi-evergreen forests. These tropical species are marked with high endemism and shows high species diversity in tropical Asia. Pollen morphology of 10 species of *Lasianthus* endemic to Southern-Western Ghats was analyzed with light microscopy (LM) and scanning electron microscopy (SEM). The study revealed that, their pollen grains are small to medium in size, triangular or tetrangular in outline with diverse pollen morphology, particularly in aperture and exine ornamentation. The apertures are usually 3–4 zonoaperturate, pororate. The exine is usually perforate. The resulted data were found to be informative and helpful in the delimitation of taxa at the species level, which is extremely difficult.

AKPR-OP-13

An investigation of the morphological diversity of autorotating dispersal units of the flowering plants of South India

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Autorotation is the continuous rotation of an object brought about merely through the action of aerodynamic forces. This phenomenon can be seen variously in nature; but autorotation shown by the dispersal units of sedentary life forms such as plants are spectacular and intriguing. It is one of the efficient physical mechanisms in plants that enable to slow down the descent rate by creating lifting forces due to the autorotational flight, helping in long-distance dispersal of diaspores. As a result of the ability of the plant to perceive and regulate its architecture, as well as the evolution of morphology in response to the changing surroundings, these autorotating diaspores display remarkable morphological variations. During a study on the winged diaspores of the flowering plants of South India, a total of 79 species were recorded, that produce autorotating diaspores with well-defined morphological adaptations. The present study aimed to analyze this morphological diversity, the reasons behind their variations, and the impact of morphological variations on the autorotation and dispersal of diaspores. Based on the variations in the number of wings, the studied diaspores are categorized into six morphological types, each with distinct wing morphology, texture, and configuration. The diaspores are fruits, seeds, or infructescences with wings developed from the ovary wall, integument, perianth whorls, or bracts. Detailed studies of selected diaspores from each category reveal that the diversity of autorotating diaspores is attributed to differences in the nature of origin, pattern of development, and the ultimate configuration of the wings. This leads to changes in the action of aerodynamic forces during fall, ultimately resulting in changes in the descent rate, terminal velocity, and direction of autorotation. This indicates that morphological variations among the autorotating dispersal units are important for their effective establishment in new habitats; illustrating amazingly the relationship with the environment.

SM. & MR. ALMEIDA AWARD IN PLANT NOMENCLATURE

SMA-OP-01

Unravelling the nomenclatural history of *Isodon japonicus* and *Isodon glaucocalyx* (Lamiaceae)

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The *Isodon* genus encompasses 108 species and is primarily found in tropical and subtropical regions across Asia. Notably, the Hengduan Mountains region stands out as an area with a remarkable abundance of species diversity within this genus. The present study revealed the need for solving the nomenclature problem associated with *Isodon japonicus and Isodon glaucocalyx*. *Scutellaria japonica* Burm.f. (1768), the basionym of *Isodon japonicus* was misidentified by Bentham (1832) as *Plectranthus coetsa*. Based on this treatment the *Plectranthus coetsa* is treated as *Plectranthus japonicus* in some Indian botanical literature. The inclusion of *Scutellaria japonica* as a synonym of *P. glaucocalyx* var. *japonicus* Maxim. (1875) later, due to the priority of publication, *I. glaucocalyx* is treated as a variety of *Isodon japonicus* when both are different.

SMA-OP-02

Typification of Indian *Gentiana* L. (Gentianaceae) revisited

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Typification, the second of the six principles of Code, is considered as an important aspect of plant nomenclature that prescribes the type for the name of a taxon, and also ensures clarity and stability in nomenclature. As a part of the ongoing revisionary study on the genus *Gentiana* in the Eastern Himalaya of India, it has been aimed to reevaluate the status of names and update the classification and taxonomy of every taxon within the group through suitable taxonomic justification, extensive literature survey and consultation of original material deposited in different herbaria across the globe.

Since the initiation of this revisionary study, extensive efforts have been made to reveal and resolve the complex nomenclatural issues exist in the plant group through careful examination of the type, protologue and other pertinent literature of every name in conformity with the Shenzhen Code. Till now, lectotype has been designated for about 20 names in *Gentiana*, and in a few cases the holotype of names has been affirmed.

Furthermore, an effort has been made to clarify the authentic designation of lectotype for the name *Gentiana phyllocalyx* C.B. Clarke, which was earlier typified by various authors differently. Similarly, in the present study, the designation of lectotype for the name *Gentiana crassuloides* Bureau & Franch. by Yu & al. (2014) was rejected as it was not based on original material and the correct type has been assigned with the original material traced at P. The present study highlights the importance of implication of typification in revisionary studies as well as choosing the correct type of the name to establish stability in nomenclature.

SMA-OP-03

Resolving the taxonomic status of some species of the genus *Dipcadi* from India

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In India, the genus *Dipcadi* Medik is represented by 14 species and 2 varieties. Our study reveals that Indian species belonging to this genus is delimited mainly based on overlapping morphological characters which has led to complexities in species identification. This paper, therefore, attempts to resolve the status of doubtful! taxa namely, *D. janae-shrirangii* Chandore, Borude, Bhalekar, Madhav & Gosavi, *D. krishnadevarayae* B.R.P. Rao and *D. maharashtrense* Deb & Dasgupta based on field observation, morphometry, anatomy and ecological studies. In addition to the field study, approximately 200 herbarium specimens of Indian *Dipcadi* were also examined for the said purpose. The herbarium studies have led to neotypification of *D. saxorum* Blatt. and lectotypification of *D. ursulae* Blatt.

DR. R. S. RAO AWARD

RSR-OP-01

Traditional Remedies of Muthuvan Tribes of Chinnar Wildlife Sanctuary, Kerala, India

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Muthuvan tribe is considered to be one of the earliest inhabitants of the Western Ghats. They are believed to have migrated from Tamil Nadu and settled in the evergreen forests of the Western Ghats a thousand years ago. Traditionally, the Muthuvan are nomadic agriculturists, hunters and trappers.This study focus on to document the traditional knowledge of the potential plants used by the Muthuvan tribal community and to prepare an extensive data exclusively based on the ethnic uses of plants with special emphasis on food and herbal medicine.The study area was frequently visited and recordedethnobotanical data such as local name, useful part, uses, mode of preparation etc.were collected through semi-structured questionnaires in their local language and discussion with the help of village heads known as 'Kani', local villagers and tribal practitioners around the inhabiting area. The data generated were analysed and calculated the use value (UV), Informant census factor (ICF), Fidelity level (FL), Family use value (FUVs), Consensus value for plant parts (CPP), relative importance (RI) etc. Information was received from 82 respondents ranging at the age group of 20 to 90 years. The majority of plant materials are consumed raw, and useful plant components include roots and tubers, leafy vegetables, fruits and seeds, among others. Medicinal practitioners use to treat cough, cold, fever, skin diseases, headaches, stomach aches, teethaches and diarrhoea. The number of Therapeutic plants used by the Muthuvan community and the knowledge on these herbals as per the local folk traditional system are of great importance in the changing pattern of life style and depletion of biodiversity in the global scenario.

RSR-OP-02

Tree diversity assessment of Forts from Northern Western Ghats

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Forts are one of the micro hotspots within the Western Ghat. Their unique topography and bioclimatic conditions resulted into enormous plant wealth, which consist of many endemic and RET plant species. In present study we have done Tree assessments of six forts from Kolhapur district, nested in Northern Western Ghats, by using Line Transect method. Out of six forts, 3 forts are having human settlement. Total 45 transects were laid in study area, and total 90 tree species were encountered. The statistical analysis of data was done in excel and Past Software (ver. 4.11). Highest Simpson and Shannon index value is seen in Panhala Fort, while lowest in Pavangad. Highest Dominance index is observed in Pavangad and lowest in Panhala. Species Importance Value (SIV) is calculated for each species. *Pongamia pinnata* (L.) Pierre shows highest SIV followed by *Syzygium cumini* (L.) Skeels and *Acacia auriculiformis* A.Cunn. ex Benth. In forts, where human settlement is present, monotonous vegetation of selected species can be seen, which increase SIV of particular species e.g., *Pongamia pinnata* (L.) Pierre, *Acacia auriculiformis* A.Cunn. ex Benth., *Eucalyptus tereticornis* Sm. and *Gliricidia sepium* (Jacq.) Kunth. While forts without human settlement dominated by indigenous species like *Syzygium cumini* (L.) Skeels, *Lagerstroemia microcarpa* Wight, *Ixora brachiata* Roxb.etc. and shows higher SIV.

RSR-OP-03

Mapping the Range of *Ceropegia odorata* Nimmo ex Hook.f. and *Ceropegia vincaefolia* Hook. In Western Ghats, India

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This study documents the distribution by mapping the range of *Ceropegia odorata* Nimmo ex Hook.f. and *Ceropegia vincaefolia* Hook. in the diverse landscape of Western Ghats, India. These species have highly specific environmental preferences and are found in limited microhabitats, with small populations that are potentially at risk of extinction due to environmental stressors or human activities. By utilizing a combination of field survey, herbarium data and GIS technology extent of occurrence (EOO) and area of occupancy (AOO) of both species in India were determined using the aerographic method (AM) and cartographic method (CM), with AM providing the most reliable estimates. The study also provides detailed descriptions, colour photographs, and herbarium specimens for validation. The findings highlight the need for conservation efforts to protect these species and their habitats.

RSR-OP-04

Alpine Cushions: Micro-Refuges of Plant Diversity in the Himalayan Highlands

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Cushion plant species in alpine regions buffer environmental extremes by increasing soil resources and facilitating favourable biotic and abiotic conditions. These ecosystem regulating services are crucial for the survival of plant species beyond their preferred habitat and contribute to higher levels of species richness and phylogenetic diversity within the alpine regions. Here, we investigated how the cushion plant species facilitated associated plant species along the elevational gradients in alpine areas of Kashmir Himalaya. We used these cushion species to assess the impact of the entire plant community on taxonomic species richness and phylogenetic diversity. We also investigated whether the effects of the cushion plant community varied across various spatial scales, different cushion types, and along the elevational gradient. The results indicated a variety of cushion effects on overall species richness and phylogenetic diversity depending on the cushion identity. We recorded generally positive effects of the cushions, which promoted whole-community species richness and phylogenetic diversity in the study region. Our results suggest that the cushions function as micro-refugia by facilitating less stress-tolerant species of severe environments in the alpine ecosystems. We also analysed the phylogenetic structure of the cushion communities at each elevational belt, measured by net related index and net nearest taxon index. Both these indices of phylogenetic diversity indicated that the species growing within cushion and non-cushion plots tended to show phylogenetic overdispersion and clustering respectively. Moreover, cushions tended to show phylogenetic overdispersion at each elevational belt while as non-cushion plots show phylogenetic clustering at each elevational belt. Overall, the findings suggest that the environmental filtering, niche conservatism, and interspecific competition determine phylogenetic structure in the cushion communities of alpine ecosystems in the Himalayan highlands.

RSR-OP-05

Invasion Dynamics of Major Invasive Alien Plant Species from Thiruvananthapuram District, Kerala, India

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Invasion is emerging as a greatest threat to plant diversity, conservation and management. Invasive Alien Plant Species (IAPS) alters individual plant performances and species composition leading towards ecological and edaphological changes and gradually impacts the structural and functional dynamism of ecosystem. The IAPS shows dominancy over indigenous lifeforms through high reproductive and aggressive characteristics leading towards local or regional displacement or extinction of flora. India is documented with 1600 IAPS among which 93 is present in Kerala. Thiruvananthapuram district, the southernmost province of Kerala, with 21% of forest cover is having an invasion record of 70 IAPS from different terrestrial ecosystems. The present study involves qualitative and quantitative floristic analysis of major IAPS invading various terrestrial ecosystems from different geographical regions of the district and comparing their invasion dynamics with respect to ecological and edaphological factors. Based on the occurrence data and relative growth analysis we have selected 10 dominant IAPS spreading in various ecosystems and analyzed their characteristics and invasion pattern. Among which *Alternanthera bettzickiana* (Regel) G. Nicholson, *Chromolaena odorata* (L.) R.M.King & H. Rob., *Mikania micrantha* Kunth, *Pennisetum polystachyon* Schult., *Pueraria phaseoloides* (Roxb.) Benth. are seen as common invaders from different ecological and climatic conditions. The characteristic advantages of these IAPS in terms of residence time, lifeform, reproductive and dispersal strategies favored their establishment and spread. The dominance of IAPS is majorly dependent on diversity and stability of ecosystem. Disturbed ecosystems are having high chances of invasion. Thus, the degree of invasion is directly proportional to anthropogenic disturbances and inversely proportional to biotic stability.

RSR-OP-06

Distribution of invasive alien plant species along the banks of the Sasthamcotta Lake (Ramsar Site) in Kollam, Kerala

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Invasive Alien species are the second biggest threat to biodiversity after habitat destruction and are a major cost to the economic wellbeing of the planet. They cause enormous and often irreversible harm to biodiversity around the world by displacing native and useful species and changing ecosystems. Overgrowth of these species cause extinction or decline of many species and continue to pose a huge threat to many more. The Sasthamcotta lake, categorized as a Ramsar wetland, is the largest fresh water lake in Kerala, India on the South of the West Coast. It meets the drinking water needs of half million people of the Kollam district. Rich plant diversity in the banks of lake gives aesthetic beauty to the lake along with richness of water. In the present study, invasive alien plant species occurring along the banks of lake were compiled based on the literature survey, field observation and discussion with local people. Invasive alien species were divided into three categories- naturalized, interfering and noxious. Self-replacing plant populations by recruitment through seeds and capable of independent growth were categorized as naturalized. Alien and native plants which impacted agriculture adversely especially on the disturbed sites were taken as noxious. The adverse impact of noxious species was in the form of competition for space with tillage or forage crops and harbouring of pests or disease vectors, harmful to crops and native species. The habit, nativity and the impact of invasive plant species on forest, grassland and agricultural communities were noticed to prepare a catalogue of this region. A total of 58 invasive alien plant species of the terrestrial vegetation of Sasthamcotta lake side have been documented. Habit wise analysis shows that 57% of species are herbs, 19% are shrubs and 21% are climbers. The four dominant families contributed 75% of the invasive alien flora of terrestrial vegetation of Sasthamcotta lake side. The present catalogue of invasive exotic species is likely to serve as basic information for future research towards conservation of native plant species of the region.

RSR-OP-07

Ethnic food culture focusing on leafy vegetables by Gowda Saraswatha Brahmin community of Alappuzha district, Kerala

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Food and medicine are the major concern in the evolutionary history of human beings. Through empirical methods, the food materials and food habits have been developed in the due course of time. Leafy vegetables form a major part of food component anywhere in the world due to its easy availability, deliciousness and nutrient content. The present study is focused on Gowda Saraswatha Brahmin community of Alappuzha district, Kerala. Informations were gathered from the user based on a semi-structured questionnaire and followed by interview. A total of 40 households from 5 selected Gramapanchayaths and Municipalities of Alappuzha district were visited during the survey. The results revealed that altogether there are 32 species consumed as leafy vegetables falling under 28 genera and 17 families. Life form analysis showed that there are 21 herbs, 1 shrub, 3 trees, 6 climbers and 1 creeper. There are10species wherein only leaf lamina is used and in certain cases along with itspetiole; and 20species are used as a whole, except roots. It has found that Araceae (25.01%) forms the major component of the leafy vegetables for consumption followed by Cucurbitaceae (12.50%) and Amaranthaceae (9.38%).It was noted that even though some species are easily available from the homesteads or way sides, most of them are rare at present due to the alterations of habitat. Moreover, because of the changing lifestyle, less attention is paid to the age old traditional food habit or even neglected, especially the younger generation. This is the major hurdle in the transfer of valuable information on the edibility of locally available food resources in and around any area, and which is cost effective too. In the present global scenario of climate change, local greens form a strong alternative for the prevailing food habit. It acts as a ‘green reserve’ to overcome food crisis and ensure food security as indigenous and wild foods are vital for achieving the 2030 Sustainable Development Goals (SDGs) of United Nations.

RSR-OP-08

Tree Diversity in Haveri District, Karnataka State, India

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The Haveri district is known as gateway of Northern districts of Karnataka and is situated in the central part of Karnataka state, covering total area of 4848 km^2. The survey was conducted from November 2020-April 2023 it resulted an account of 193 tree species belonging to 47 families and 145 genera. Out of 193 species; 76 are cultivated and 117 are wild in which seven are endemic species. The dominated families are Fabaceae (44), Moraceae (14), Bignoniaceae (10), Malvaceae and Rubiaceae represented by 9 species each. In case numbers of species are highest in the genera *Ficus* (12), *Terminalia* (7) and *Albizia* and *Senegalia* (4). Threat status was assessed by referring IUCN Red Data List, indicating that, 3 species are data deficient (DD), 3 are near threatened (NT), 7 are vulnerable (VU) and 93 are least concern (LC). Analysis of utilization was noticed, they are medicinal (55), timber (50), ornamental (37), edible fruits (36), sacred plants (11), fencing (6), dye yielding (5), green manure (5), fodder (4) and fuel (2). The present work compiled on primary information was gathered from stakeholders of Haveri District. It will serve as baseline data and helpful to the forest department, future floristic studies in sustainable utilization of biodiversity.

RSR-OP-09

Understanding the Distribution and Endemism of genus C*rinum* L. in India: an Ecological Niche Model based Conservation Initiative

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The assessment of the distribution patterns of any taxa is crucial. It is imperative to effectively conserve and utilize plant genetic resources by understanding phytogeographical distribution, diversity, and endemism. Species endemic to some geographical regions create a unique conservation challenge. Understanding the area and pattern of endemism is crucial to developing conservation strategies. Translocation to suitable habitats with the help of Ecological Niche Modelling mitigates the threat of endemism. The genus *Crinum* L. is the largest in the family Amaryllidaceae, with 111 taxa. It is distributed throughout the tropics and warm temperate regions and thrives in a wide range of habitats, from marshes to deserts. In India, 12 species have been reported; eight of them are endemic. The present study is an overview and critical assessment of the distribution, diversity, and endemism of the genus *Crinum* in India based on field exploration, examination of herbarium records, and literature. In addition, the study prepared ENM models for three endemic *Crinum* species and predicted the habitat for suitable translocation. Species richness and diversity analyses were conducted utilising the DIVA-GIS programme, employing the Jackknife-2 estimator for richness and the Shannon index for diversity. Areas of endemism were identified using Parsimony Analysis of Endemicity (PAE). The distribution maps were prepared using QGIS-3.28.4. Ecological niche models were developed with the help of Maxent. Most of the Crinum members in India are confined to the Western Ghats, followed by the Northeast region. The highest species diversity was found in Maharashtra. The results of the PAE analysis show two areas of endemism: the Western Ghats and the Eastern Himalayas. The ecological niche modelling of *C. malabaricum, C. woodrowii,* and *C. amoenum* indicates plenty of suitable regions for these species. Translocation of these species to suitable habitats in these suggested areas can help resolve the threats endemism poses.

RSR-OP-10

Role of Sacred Grove in Plant Conservation

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In India sacred grove is one of the traditional conservation concepts. These are the one of the best examples of unique tradition of conservation of natural resources. In the recent context of deforestation, environmental pollution and tremendous uses of natural resource, sacred groves offer a very good model of conservation of biodiversity conservation. Sacred groves are most important reservoirs of biodiversity which are preserving unique species of plants and animals. In other words sacred groves are small pockets of vegetations which is conserved from thousands of years under religious ground. It is a natural plant museum and paradise for plant taxonomists. In the present study the floristic diversity of sacred grove called as Kedarguda which is located in Hadgaon taluka of Nanded district from Marathwada region of Maharashtra State have been reported.

RSR-OP-11

Floral diversity of Paderu Forest division of Andhra Pradesh

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The study site is located in the North Coastal Eastern Ghats of Paderu division of Vishakhapatnam district in Andhra Pradesh. For study a total of 15 plots were laid out randomly in the division and each plot was of 0.1 hectare (31.62 m X 31.62 m) and the total study area covered the 1.5 hectare in the different compartments in different beats and different forest types such as scrub forest, open forest, reserved forest and dense forest. Laid out the 0.1 hectare for tree species, 3 m X 3 m for shrubs, saplings, climbers and 1 m X 1 m for herbs, grasses and seedlings was laid out as nested quadrats at North east and South west side direction. There were total 30 tree species and total 174 individuals are found in the total study area. The top 3 species based on the IVI values are, *Pterocarpus marsupium* (97.24), *Grevillea robusta* (94.14), *Syzygium cumini* (77.97) belongs to family Fabaceae, Proteaceae, Myrtaceae respectively. In 3 m X 3 m nested quadrat there were total 90 individuals found in study area of 0.027 ha of land in that 2 climbers, 16 saplings and 7 shrubs were there. Top 3 species based on the IVI value are *Lantana camara* (141.11), *Woodfordia fruticosa* (55.56), *Cassia fistula* (38.89) belongs to family Verbenaceae, Lythraceae, Leguminosae respectively. 1 m X 1 m was studied for Herbs, Grasses, and Seedlings. There were total 1393 individuals found in study area of 0.003 ha. There were 14 grasses, 26 herbs and 8 seedlings. The top 3 species based on the IVI value are, *Sida acuta* (108.760), *Ageratum conyzoides* (105.31), *Mesosphaerum suaveolens* (70.33) belongs to family Malvaceae, Asteraceae, Lamiaceae respectively.

RSR-OP-12

Reproductive adaptations in *Goniothalamus keralensis*, an endemic Annonaceae of the southern Western Ghats

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Goniothalamus keralensis ESS Kumar *et. al*. (Annonaceae), is a large shrub endemic to Kerala, southern Western Ghats. It is reported only from Idukki district and prefer to riparian habitats. Two populations were located falling under different altitudinal gradations. As part of reproductive biological aspects and conservation of this species, the floral morphology and reproductive adaptations were studied. For this, floral morphology and detailed reproductive events were recorded. It was observed that flower buds initiated in mid – October and continues up to January. A flower bud took 45 to 50 days to attain maturity. Flowers are large and borne on leaf axils or/and are cauliflorous. They are solitary and possess trimerous calyx with two whorls of petals. Inner petals are fused apically and form pollination chamber, a rendezvous place. Outer petals compressed against the apertures between inner petals on lower side resulted in effective pollinator trapping mechanism. Flowers are bisexual and protogynous. Flowers pass through characteristic pistillate and staminate stages. The flowers possess floral scents, mainly volatile ethyl acetate, which attracts pollinators. Floral thermogenesis was also recorded during the late pistillate stage. Small beetles of family Nitidulidae are prominently found to visit flowers and are involved in pollination. Implications of floral morphology and adaptations with respect to reproduction of *G. keralensis* are discussed.

RSR-OP-13

Germination study and Conservation of *Piliostigma foveolatum* Dalzell.: An Endemic plant species from Western Ghats, India

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Genus *Bauhinia* subdivided into four subgenera. Subgenus *Piliostigma* represents two species in India.*Piliostigma foveolatum* and *Piliostigma malabaricum*, *Piliostigma foveolatum* dalzell. an endemic plant species from Northern Western Ghats, India. The species is distributed in semi-evergreen forests between 450 and 1000 m. Gujarat, Maharashtra and Karnataka. A thorough field survey spanning from 2021-23 in western region Nashik district which encompassed (Trymbakeshwar subdivision of Nashik district) aimed to elucidate the distribution patterns of the *P. foveolatum.* Employing a methodology centered on individual counts, each systematically surveyed all conceivable habitats.A total 26 individuals were meticulously documented. Notably the survey revealed a marked gender imbalanced within the population, with a lower prevalence of female plantsobserved among the population. These findings suggest a notably confined distribution range for this species and have significant implications for conservation strategies. The limited presence of female plants suggests potential reproductive challenges within the population. The species exhibits a notably low seed germination rate because of the presence of a tough outer covering on the seed and exhibit physical dormancy. Additionally, the pods are tough on the outside and fibrous on the inside, and they do not naturally split open. These characteristics pose a significant obstacle to the seeds and absorption of water. To facilitate germination and overcome dormancy, seeds need pre-treatments.The study encompasses various methods for breaking dormancy.Recognizing and mitigating factors affecting seed germination is a pivotal consideration for the conservation of this species. This insight provides valuable information for conservation efforts and underscores the need for further research to comprehensively understand the ecological dynamics surrounding and reasons behind rarity of *P. foveolatum* species. Finally, the grown seedlings will be reintroduced to their natural habitat and monitored.These findings will also helpful for mass propagation of the species and serve as a foundation for future studies.

RSR-OP-14

Optimization of Biofuel Production by Molecular Characterization of Ligninase Enzyme isolated from Wood Rot Fungi in Pushpagiri and BrahmagiriHills, Karnataka by using RAPD Molecular Markers

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Wood rot fungi are one of the major degraders in the biosphere that help in degrading most of the plant origin polymers like cellulose, hemicellulose and lignin. Lignin is the second most abundant aromatic compound found in plant cell that holds up cellulose and hemicellulose. There is a lot of emphasis that is being put on the fungal degradation of lignin using wood and other lignocellulosic as a renewable source in the production of chemicals, paper products, feeds and fuels and the use of fungi as one of the most potent sources of degrading organisms. In the present study, screening for lignin degrading enzymes were done with 132 isolates and the maximum enzyme producing strains of 10 wood rot fungi samples were taken for molecular characterization using RAPD molecular markers. Isolation of genomic DNA of the 10 wood rot fungi samples was done using phenol-chloroform method and quantified on agarose gel. The obtained genomic DNA was further subjected to characterization using RAPD-PCR method with 06 random primers OPA2, OPA5, OPA7, OPA8, OPD3 and OPC2. The amplified PCR products were analyzed by Agarose Gel Electrophoresis and was observed under UV Transilluminator. Analysis of the base pairs of the bands was done by Bio-Rad Gel Doc system. A total of 172 fragments were generated in the 10 isolates with 6 primers. Dendrogram analysis of the gels were done which gave a close relation of each DNA samples. The results indicate that some strains were genetically more similar and few diverse. The current study shows samples 30, 40, 41, 113 and 124 are genetically closely related.

RSR-OP-15

Diversity of Wild Orchids at Kali Tiger Reserve Forest, Karnataka, India

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Orchidaceae is one of the most diversified family in monocots, having the most beautiful flowers in the world. The orchid diversity from Kali Tiger Reserve Forest (KTRF) is located in Uttar Kannada District, Karnataka state, India. Kali Tiger Reserve Forest comprises various types of habitats including evergreen, semi-evergreen, moist deciduous forests (with rich leaf litter humus), riparian, hilltop grasslands and lateritic plateaus. Therefore, this place has been surveyed from 2020 to 2023, revealing the census of about 86 orchids which includes 50 species of epiphytes, 31 species of terrestrial, 3 species of mycoheterotrophic and the remaining 2 have both terrestrial and epiphytic habits. All orchids are adopted and survived based on their altitude ranges from 300 to 900 m and nature of habitats. The epiphytic and terrestrial orchid distributions have been evaluated at an altitude of 600 – 900 m. The objective on the Orchid diversity and altitude ranges of the different habits with habitats had shown a comprehensive keynote on orchid distribution in the KTRF region.

RSR-OP-16

Endemic Flowering Plants from Plateaus of Satmala Ranges, Maharashtra, India

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Rock outcrop/Plateaus are naturally occurring landforms where open rock surface visible over large area. Two types of rock outcrops/plateaus seen on Northern Western Ghats i.e. lateritic plateaus & basaltic plateaus. Mostly, basaltic plateaus were found in Pune, Nashik & Ahmednagar districts of Maharashtra. The present floristic study was carried out on basaltic plateaus from remote area Nashik district. These plateaus are part of Satmala Hill range which is an integral part of Northern Western Ghats. Studied plateaus were dry for 08-10 monthswhile moist only for 02-04 months in a year. Average rainfall on these plateaus is 800 to 1000 mm. The climate of these plateaus is dry throughout the year except during the south west monsoon season.In spite of adverse climatic conditions, these plateaus harbour many endemic & RET category plants. It is may be due the diverse microhabitats were present on these plateaus which support the more endemism. The present paper gives a checklist of endemic plants reported from study area with their locality, microhabitat preference & life form type. Voucher specimens were collected from study area and herbariums were prepared.

PROF. K. S. MANILAL AWARD

KSMA-OP-01

Taxonomic Revision of *Leea* L. (Leeoideae: Vitaceae) in India

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The tropical genus *Leea* L. comprises 38 species worldwide, distributed entirely in the old-world tropics, mainly restricted in the Indo-Malayan region extended to Northern and Eastern Australia and some parts of Africa and Madagascar. The highest species richness and endemism can be found in Malaysia with 25 endemics. In India, the genus is known to have 16 species with two endemics, mainly distributed in the Northeast India, Peninsular India and Andaman and Nicobar Islands. *Leea* was earlier recognised at the rank of family, but is now accepted under the subfamily LeeoideaeBurmeister of Vitaceae. They are mostly shrubs, trees or creeping herbs, and some species possess prickles on theirstems. *Leea* is distinguished by the presence of a conspicuous petiolar stipule, well-developed floral disc, syngenecious stamens, one ovule in each locule and ruminate endosperm. This genus is taxonomically difficult because of its uniform vegetative and floral features and almost similar habitat preferences. As a result, species delimitation in this genus is often quite challenging. The widely distributed species have several synomyms, and selection of correct names is often quite problematic. The present paperincludes the taxonomic revision of the genus *Leea* in India, discussing its diversity, including taxonomic key, illustrations, photo plates, distribution map and conservation assessment. Nomenclatural problems relevant to taxonomic studies were also discussed.

KSMA-OP-02

Morphological and Palynological study of Selected *Persicaria* Species

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Pollen morphology of *Persicaria* was studied globally by various workers but very few work had been done from India. India is rich in diversity of polygonaceae. The identification of *Persicaria* species is based on leaf shape, size, tomentose, ochrae, flower colour and seed type. In recent years due to hybridization and variation, accurate identification of *Persicaria* species is quite challenging, but with the help of palynological and morphological evidences now the classification makes more convenient. The present investigation shows detailed morphological and palynological study of selected *Persicaria* species from Maharashtra by using Light Microscope and SEM by following Acetolysis method. In present work the study of morphological characters such as leaf shape, size, ochrea structure, flower colour and inflorescence type are considered. In palynological study we have examined pollen morphology, exine structure, and ornamentation. This detailed study of pollen grains and morphological characters may help to solve taxonomic confines among *Persicaria* genus.

KSMA-OP-03

A glance through the Monocot diversity of Idukki district, Kerala

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Survey and documentation of the floristic wealth of a region is a prerequisite for planning the proper utilisation of its potential plant resources on one hand and to conserve the depleting genetic resources on the other. Idukki is the largest district of Kerala and is part of the floristically rich Western Ghats. The area is unique in providing an abundance of habitats that attribute rich vegetation and diverse biota with a high level of plant diversity. Monocots are much diverse and one of the major groups of flowering plants in Idukki district. In this study, 595 species belonging to 211 genera under 33 families of flowering plants were reported. Three new species: *Eriocaulon vamanae* Dani & Nampy, *Burmannia munnarensis* Dani & Nampy and *Ariopsis idukkiana* Dani, Nampy & Vishnu were described, and *Burmannia indica* was rediscovered after 110 years. Poaceae (185), Orchidaceae (127), Cyperaceae (99), Commelinaceae (41), and Zingiberaceae (27) are the dominant families. The present paper discusses the taxonomy, diversity, endemism and conservation of monocotyledons in Idukki district.

KSMA-OP-04

Passiflora vesicaria var. *vesicaria* (Passifloraceae) section Dysosmia: a new record for India

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Passiflora vesicaria L. var. *vesicaria* (Passifloraceae)collectedfrom northern region of state of Maharashtra, India,is reported here as a new record for flora of India.It belongs to section Dysosmia, with characteristic fruit changing to orange - yellow after maturity unlike *P. foetida* where it is green. Taxonomic treatment, detailed Morphological description, geographic distribution and color photographs are discussed here to facilitate easy identification.

KSMA-OP-05

Taxonomic study of the Family Asteraceae in Kamrup (Rural) District of Assam, India

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A taxonomic study on the family Asteraceae was conducted in Kamrup (Rural) district of Assam with a view to explore the species of the family during the period from February, 2022 to January, 2023. A total of 34 species under 28 genera were collected for taxonomic enumeration. Only the species found available in natural habitat were taken into consideration excluding the cultivated ones. Study was accomplished according to classical taxonomic method including specimen collection, preservation and identification, dissection, drawing and description of each part of the plant body. Species were identified by consulting the Botany Herbarium (GUBH) of the Department of Botany, Gauhati University, Guwahati and after thorough consultation of the Flora of Assam (vol.3) and the Flora of British India.

KSMA-OP-06

Assesment of The Plant Diversity of Kerang-Jhachu-Bamzey Valley, Sikkim

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The Kerang-Jhachu-Bamzey (KJB) Valley is situated in the extreme north of the state Sikkim and shares international boundary with China. The KJB valley, a part of the '*Himalaya Hotspot*', is located in the East Himalaya Bio-geographic Province. This valley covers an area of about 400 km^2 and is extraordinarily rich in biodiversity. Extensive field surveys have been conducted on almost every corner of the valley and a considerable number of specimens have been collected. BSHC, CAL and CUH have also been consulted for earlier collections to illustrate the floristic diversity of the valley. It is estimated that about 465 species (+10 infraspecific taxa) of seed plants belonging to 199 genera under 61 families are growing within the territory of KJB valley. Among them 459 species (+10 infraspecific taxa) belong to 196 genera under 58 families of angiosperms and six species of gymnosperms belong to three genera under three families have been recorded. Dicotyledons is the most dominant plant group in the valley and includes 410 species (+eight infraspecific taxa) under 174 genera belonging to 49 families, whereas the Monocotyledons is represented by 49 species and two infraspecific taxa under 22 genera and nine families. Asteraceae is the most dominant family among the Dicotyledons (66 species +two infraspecific taxa) and *Saxifraga* is the dominant genus with 22 species. Poaceae is the dominant family in Monocotyledons with 17 species (+one infraspecific taxon) and *Carex* is the dominant genus in this group with nine species. The valley shelters two carnivorous plants, *Drosera peltata* Thunb. (Droseraceae) and *Pinguicula alpina* L. (Lentibulariaceae) and three root parasitic plants, namely *Thesium himalense* Royle ex Edgew. (Santalaceae, hemiparasite), *Thesium jarmilae* Hendrych (hemiparasite) and *Xylanche himalaica* (Hook.f. & Thomson) Beck (Orobanchaceae, obligate). During this study two species have been described as new to science, one species each has been added to the flora of India as well as to the state Sikkim. Lectotypification and holotype affirmation has been done for one name, and moreover, three names have been synonymised. One species has been rediscovered after more than a century from Sikkim as well as from India. Importantly, during the present study one new combination has been proposed with taxonomic justifications. This region is also the home of six narrow endemics and 10 East Himalayan endemic plants. KJB Valley shelters six RET plants. Significantly, the valley encompasses several pioneer medicinal plants. Besides, several non-conventional promising medicinal plants are also recorded inside the valley. New non-conventional medicinal uses of two species have been documented. The study is also aimed at the population status assessment of all endemics, and selected RET and medicinally important species through extensive field surveys following IUCN guidelines. A total of 16 species were targeted for this purpose. The additional habitats within the valley are identified, recorded with proper care and mapped which will help to design the conservation strategies. The aim of the study is to illustrate the floristic diversity of KJB valley along with proposal for conservation of this important biodiversity landscape.

KSMA-OP-07

Chloroxylon Dc. (Rutaceae): An Addition to the Flora of Uttar Pradesh, India

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The genus *Chloroxylon* DC. of the family Rutaceae is reported as a new addition to the Flora of Uttar Pradesh, India, from Anpara, Sonbhadra district. *Chloroxylon swietenia* DC. is native to South India and Sri Lanka. This tree now has cited under IUCN Red List Category as a vulnerable species. This is due to the timber exploitation and whole part of this tree has been used as the traditional system of medicine. Enumeration of the taxa along with the brief description up to date citation, phenology, ecology and photoplate is provided for easy identification.

KSMA-OP-08

Contributions to the Grass Flora of North Sikkim

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Snuggled in the Himalayas and endowed with exceptional natural resources, Sikkim is exceptionally rich in floristic diversity. Poaceae, the second highest species rich family in Sikkim, contribute immensely to the state flora with about 416 species under 130 genera. Among the four districts of the state, North district is the largest having around 4,226 km^2 area and Mangan as its headquarter. Mount Khangchendzonga, the third highest peak in the world is situated amongst the north-south spur of the Great Himalayan Range in this district. The district share subtropical climate in lower foothills to high alpine snow-capped mountain peaks in the extreme North West corner. This wide variable physiography provides a wide array of climatic variations and exceptional richness in grass flora. The major representation has been recorded in temperate forest (about 89 species) followed by subtropical (about 50 species) and alpine (about 50 species) regime. The members of this family often determine the character of the vegetation type particularly the high Himalayan pasture (e.g. *Deschampsia cespitosa* (L.) P.Beauv. dominated forest and *Phleum alpinum* dominated forest).

Under the present investigation, the grass flora of North Sikkim district has been extensively studied since 2019. Until now, around 180 species under 47 genera are recorded for North Sikkim. *Poa* L. with 20 species dominates the terrain followed by *Festuca* Tourn. ex L. with 9 species and *Agrostis* L. with 7 species. Among the recorded species major representatives are under Pooideae (about 115 species) followed by Panicoideae (about 50 species) and Bambusoideae (about 15 species). The present survey results in many additions and exclusions of grass elements from this region. The most notable contribution is the description of a new species *Arundinella sikkimensis sp. nov.* (Arundinellae). Besides, 3 species have been claimed for new distribution records. Notably, during the study five species are excluded from the state flora for the time being due to lack of supportive specimens. Moreover, three narrow endemic species to this north district of the state are recorded including the newly described species.

The details of morphological traits, phenological data and habitat information are provided. Besides, illustrations of each species, both line drawings and microphotographs of spikelet parts and field images of most of the representatives have been incorporated for correct identification and easy recognition. Additionally, key to the genera, key to the species and infraspecies taxa are also incorporated.

KSMA-OP-9

Floristic diversity of Overa-Aru Wildlife Sanctuary in Kashmir Himalaya

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Protected areas are one of the prime repositories to conserve biodiversity and furnish life-supporting ecosystem services. The Overa-Aru wildlife sanctuary is one of the largest protected areas in terms of area in Kashmir Himalaya, however little is known about its biodiversity. Here we present an integrative study on floristic diversity of this sanctuary.In terms of taxonomic composition, a total of 397 taxa (392 species, 1 subspecies, 3 varieties and 1 forma) belonging to 254 genera in 76 families are recorded from the sanctuary. A new species, *Swertia pahalgamensis* has been described from the sanctuary. In addition, the utilization of plants in the sanctuary for precious ecosystem provisioning services such as fuel, fodder, medicine, and the community perception of these services have been studied. Hopefully, this comprehensive study will be immensely useful in guiding suitable conservation strategies and management decisions of this protected area in the region, with lessons for elsewhere.

KSMA-OP-10

Taxonomic revision of the subtribe Anthistiriinae (Poaceae: Andropogoneae) in South India

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Andropogoneae is known as the most challenging tribe in the family Poaceae due to its diversity and complexity in the nature of spikelets as well as due to its evolutionary trends. This tribe is characterized by the presence of pointed callus which is obliquely applied to the internode tip, instead of blunt and sunk into it. As per various classifications, Andropogoneae is subdivided into several subtribes. Anthistiriinae is one of the important and interesting subtribe among them. This subtribe has great importance in Indian scenario by its endemism. It is known to have 12 genera worldwide, among them, 5 occurs in south India. These five south Indian genera include *Heteropogon*, *Iseilema*, *Parahyparrhenia*, *Pseudanthistiria* and *Themeda*. The present paper deals the taxonomic revision of these 5 genera in South India. Detailed morphology, illustrations, taxonomic key for identification, nomenclature and notes on distribution are provided. The study recognized 17 species of 5 genera as occurring in South India of which 7 are endemic to India and Sri Lanka.

PROF. T. R. SAHU AWARD

TRSA-OP-01

Diversity, Distribution and Ethnomedicinal uses of the genus *Clematis* L. (Ranunculaceae) from Darjeeling Himalaya regions of West Bengal, India

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Darjeeling derives its name from *Darjyu Lyang* meaning land of God or heaven earth. It is also said to be named after *Dorjee Ling*, the Buddhist monastery that once stood on the observatory hill of present Chowrasta. The word *Dorjee* also means the Celesiastical scepture of double headed thunderbolt of the Lamaist faith and a common emblem associated with priestly power. The regions have been divided into two Districts *viz*., Darjeeling and Kalimpong. The region is rich in biodiversity due to the varied topography and climatic condition ranging from small valley to mountainous region at different altitudes. Darjeelingis an important constituent of Eastern Himalaya, and a well-known place of tourist interest for its amazing floristic diversity resources. The genus *Clematis* is one of the large genera belongs to family Ranunculaceae and consisting of about 355 species worldwide with the main concentration in Southern China. India is represented by 32 species of which 30% are endemic. Several species of *Clematis* are used as ornamental flowers and their aerial parts are used as medicines for various diseases as diurectic, antimalarial, antidote in snake bites, antidysentry, fever, eye infections, gonorrheal symptoms chronic skin disorders, gout and varicosity in Europe and Eastern Asia. This group is complex in classification due to the variable morphological characters among the members. The present paper deals with nine species of *Clematis* L. from Darjeeling Himalaya of West Bengal, India, *viz*., *Clematis Montana* Buch.-Ham. *ex* DC., *Clematis tongluensis* (Bruhl) Tamura, *Clematis napaulensis* DC., *Clematis connata* DC., *Clematis gouriana* DC., *Clematis smilacifolia* Wall., *Clematis acuminata* DC., *Clematis buchananiana* DC. and *Clematis grewiflora* DC. with their diversity, local and general distribution, ethnomedicinal uses, flowering and fruiting months.

TRSA-OP-02

Evaluation of *in-vitro* anti-oxidant and anti-diabetic properties of *Premna herbacea* Roxb. based on the traditional knowledge system of Bodo Tribes of Assam

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The Baksa district of Assam is dominated by Bodo tribes who have their origin from Tibeto-Burman region and is one of the oldest communities of Assam. The ethnic tribal communities from the fringe villages of Baksa district relies predominantly on herbal medicine or natural remedies for ailments of body's disorder like fever, intestinal worms, cold, cough, jaundice, hypertension, diabetes, etc. The present study recorded 129 medicinal plant species belong to 58 families and 110 genera with 43 dicot, 13 monocot and 2 pteridophytic families with their traditional health care practices by the Bodo peoples.

Premna herbacea Roxb. is a traditional herbal medicineusedby Bodo Tribes of Assam to treat diabetes mellitus. They consume it as decoction for medicine and local household uses this plant as saag (vegetable) in their day today life. It is commonly known as Kheraidafni (Bodo), and Matiakaldap (Assamese). The specimen was collected from the Holtugaon Reserve Forest under Manas National Park. The local people collect it from the forest under the provision of NTFPs, to sustain their livelihood. The specimen was deposited in the Gauhati University Botanical Herbariumwith Accession No. GUBH18205.

The methanolic extract of *Premna herbacea* Roxb. was studied foralpha-amylase andalpha-glucosidase inhibition. The plant extract was examinedfor phytoconstituents and antioxidant activities by using free radical DPPH, ABTS scavenging ability, estimation of total phenolic content and flavonoidcontent. The study revealed that the extract is potent source of total phenolics, flavonoid and exhibit potent radical scavenging activityusing DPPH and ABTS as substrate. The methanol extract exhibited significant á-amylase and á-glucosidase inhibitory activities when compared with standard acarbose drug. The isoverbascoside isolated from *P. herbacea* showed enhanced insulin signalling via AKT/AMPK pathway in differentiated L6 cells. Thus, it could be concluded that due the presence of antioxidant components the plantextract has well prospective for the management of hyperglycaemia, diabetes and the related condition ofoxidative stress.

TRSA-OP-03

Traditional medicinal Uses, phytochemistry and GC-MS analysis on leaves of *Vitex negundo*: An anti-typhoidal plant of Ranchi district, Jharkhand, India

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Indigenous population use plants as an important healthcare resource or remedy for different diseases. They have developed this traditional knowledge over several years of observations, trial and error, inference and inheritance. *Vitex negundo* (family: Verbenaceae) is a widely used plant in folk medicine, namely for the treatment of jaundice, malaria, typhoid, headache, wounds, body ache, toothache, asthma, eye pain, reduce inflammatory swellings of joints in rheumatic attacks etc. The personal interviews conducted with local tribal healers and herbal practitioners of Ranchi district, Jharkhand, India. The survey reported a total of 18 plant species belonging to 16 families used for the treatment of typhoid disease. The dominant family having highest number of species were Acanthaceae and Verbenaceae (2 species). This study aimed to perform the preliminary phytochemical and GC-MS analysis of *Vitex negundo* which is responsible for its pharmacological properties. The extract was subjected to qualitative phytochemical screening using standard procedures. Results show that eleven of twelve phytochemicals screened for were present. They are alkaloids, flavonoids, saponins, steroids, phenols, tannins, carbohydrates, glycosides, proteins, terpenoids and phlobatannins but anthocyanins was not detected. The GC-MS analysis of the *Vitex negundo* leaves ethanol extract revealed that Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl) ethyl ester was the major compound, with an area of 31.42%. The diversity of phytochemicals found present suggests that *Vitex negundo* may serve as a source of useful drugs. Thus, our results encourage the potential use of *Vitex negundo* as a medicinal product.

PROF. S.R. YADAV AWARD

SRY-PP-01

Dynamics of Extra Floral Nectar Production: A Case Study of *Albizia lebbeck* (L.) Benth. (Caesalpinioideae DC.)

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Extrafloral nectaries (EFNs) are specialized structures that produce nectar without participating in the process of pollination. EFNs exhibit remarkable diversity within the family Fabaceae. In this study, we present an examination of EFNs in *Albizia lebbeck*, focusing on two critical factors: spatial differentiation (in grazed and undisturbed environments) and temporal variations (across different time periods). In *A. lebbeck* EFNs are prominently located on the petioles, rachis apex and inter-nodal regions of leaflets. As EFNs mature, they change their shape from oval to a flattened structure, accompanied by changes in coloration. Anatomically, EFNs are distinguishable into a protective outer cuticularized epidermis underlain by secretory, subsecretory and vascular zones. Two bundles from the petiole vasculature are responsible for the continuous supply of nectar to the secretory and sub-secretory zones during the nectaries active stages. Chemical analysis of the nectar indicates the presence of high glucose and amino acids, attracting a diverse range of insects, which were categorized as nectar feeders, predators and camouflagers (phytophagous or phytophagous with nesting behaviour). EFNs play a crucial role in plant defense by attracting natural enemies, primarily ants that act as herbivore predators. This mutualistic relationship is triggered in response to herbivore damage, establishing an ecologically significant ant-plant mutualism. Our study also reveals a diurnal pattern, with increased insect visits during morning and evening hours corresponding to higher nectar quantities and sugar concentrations. This emphasizes the importance of plant-ant mutualism in devising strategies for biological pest management through natural predator recruitment, even in plant species lacking EFNs, suggesting the potential for genetic manipulation. The presence of ants around EFNs indirectly benefits plant and human interests by improving soil aeration, ultimately enhancing plant productivity.

SRY-PP-02

Indigenous knowledge of Padel Village, Taluka Devgad, Dist. Sindhudurg, Maharashtra

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Padel (Devgad taluka, Sindhudurg district, Maharashtra) is a small village of 1314.55 hec. area. There are 15 wadis with a total population of 3500 inhabitants belonging to Hindu-Kunbi. India has a rich treasury of ethnobotanical knowledge which is inherited from generation to generation since ancient times. Today, the traditional knowledge amongst the younger generation is becoming poor as more and more people are settling in cities for a better lifestyle. Thus, we felt the need of recording the ethnobotanical information from local people, before they were completely lost. As a part of the work, an ethnobotanical survey was conducted (in Padel Village) to collect information about plants used by people. Information presented in this work was gathered from people in the age group between 18 and 70. The survey exploration revealed some of the lesser-known medical uses of plants. These medicinal plants are used in the form of juice, extract, and powder, to treat ailments. The indigenous knowledge available to these people plays an important role in quickly and properly identifying natural resources. The information thus collected is analyzed and some points with respect to the conservation of the habitat and species are discussed.

SRY-PP-03

Documentation of sustainable fishing practices and biodiversity conservation: Insights from the Oldest Fishing Community (*Rapankars)* at Killenivati - Vengurla Maharashtra

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Fishing communities have played a crucial role in shaping the dynamics of marine ecosystems for centuries. There is an increasing need for traditional fisheries practices to be incorporated into formal fisheries management practices. Present study aimed to document the traditional knowledge and sustainable practices of the oldest fishing community known as *Rapankars*, located in Sindhudurg district in Killenivati -Vengurla village of Maharashtra. Artisanal fisheries sector provides food, employment, livelihood support and socio-economic benefits to the village economy. Data was collected through document analysis (between June and September 2023), field observation and questionnaire-based interviews. Study recorded use of plants such as *Mangifera indica* (Mango), *Lannea coromandelica* (Moi), *Bombax ceiba* (Savari), *Calophyllum inophyllum* (Undal), and *Anacardium occidentale* (cashew) in crafting the canoe and dyeing nets, ban on fishing for certain period of year, sustainable fishing to conserve environment. Taboos and cultural practices such as performing rituals to 'sea gods' help to manage the fish stocks. It is concluded that Killenivati village has the oldest fishing community that serves as a compelling example of climate friendly fishing technology with their traditional knowledge and sustainable practices. It is a need of the hour to equip fishers with alternative livelihood jobs in order to reduce the pressure on the fishery resources. National policy can be framed to integrate traditional management practices into formal fisheries management plans.

SRY-PP-04

Morphological diversity of Pollinarium in the Subfamily Asclepiadoideae (Apocynaceae *s.l.*) of Assam

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Palynological data provides significant information for taxonomic implication and delimitation of a taxa. Likewise, the Pollinium (pl. Pollinia); a coherent mass of pollen grains serves as an important taxonomic attribute to solve the taxonomic dilemma particularly in the members of Orchidaceae (Monocotyledons) and Apocynaceae (Dicotyledons). Subfamily Asclepiadoideae of Apocynaceae *s.l.* is quite unique for its well developed pollinia with translator apparatus and the corpusculum forming the complex pollen containing structure; the Pollinarium. Morphological diversity of Pollinarium in ten species of the sub family Asclepiadoideae has been studied. The present study represents *Calotropis gigantea* bears largest pollinia as well as corposculum and *Gymnema acuminata* shows smallest pollinia, while *Cosmostigma cordatum* bears longest caudicle among the selected taxa. These characters can be an important tool to assess the phylogeny in the members of the subfamily Asclepiadoideae.

SRY-PP-05

Chemical ecology-A case study of *Goniothalamus cardiopetalous* (Dalzell) Hook. f. & Thomson (Annonaceae) in the Western Ghats

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The genus *Goniothalamus* belongs to the family Annonaceae, and it comprises 134 species that are found in the rainforest and are slender treelets or shrubs. *Goniothalamus cardipopetalus* is primarily endemic to India and distributed in the Western Ghats. It is important to note that a floral aperture is developing during the pre-receptive phase of the flowering stage. The flower petal colour changes from pale green to pale yellow to pink during the flower anthesis, and the floral apertures are visible between the outer and inner petals during the flower anthesis. These apertures are used by pollinators to enter the flower. Most of the *Goniothalamus* flowers are highly fragrant with a pleasant fruity smell, and the Head-space gas chromatography-mass spectrometry (HS-GC-MS) analysis of the floral headspace volatiles revealed ethyl acetate as the major component. The relative amounts of the volatiles were calculated using peak areas, which were normalised as percentages. In addition, 30 minor constituents were also identified in the floral headspace volatiles, and interestingly, a gradual variation was noted in the floral headspace volatiles during different development stages. Fluorescence pigments are guiding pigments for pollinators to facilitate effective pollination, and *G. cardiopetalous* flowers showed characteristic fluorescence at 365 nm and 254 nm. *Carpophylus dimidiatus* have been identified as the major floral visitors to *G. cardiopetalus.* The chemical and ecological interaction between the *G. cardiopetalous* flower and the floral visitor is to be investigated in detail based on the volatiles and visual cues.

SRY-PP-06

The subtribe Conyzinae (Asteraceae) in India

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The family Asteraceae, also referred to as Compositae is one of the oldest known and largest families of flowering plants with c. 24,000 species (excluding apomictic microspecies), and with estimation of total number reaching 30,000 under 1600–1700 genera, 43 tribes and 12 subfamilies. The family has distribution around the globe, except Antarctica. In India, the family comprises of 1172 infrageneric taxa belonging to 193 genera. The subtribe Conyzinae under the tribe Astereae of the family Asteraceae includes *Erigeron* L., New World *Conyza* Less., the North American genus *Aphanostephus* DC., and several small groups of South American species sometimes segregated as the genera *Apopyros* G.L. Nesom, *Darwiniothamnus* Harling, *Hysterionica* Willd., *Leptostelma* D. Don., and *Neja* D. Don. *Erigeron* is the only genus of Conyzinae with species native to regions outside the New World. In India, the subtribe is represented by 2 genera, i.e., *Conyza* (9 species, 1 variety) and *Erigeron* (22 species, 2 varieties). The genus *Conyza* is represented by more than 150 species worldwide, whereas *Erigeron* has cosmopolitan distribution with c. 500 species, predominantly in North America.Both the genera are found at 500–4800 m elevational range. Morphological boundaries between some taxa of*Conyza* and *Erigeron* are not clear. Significant variations have been found in the features of phyllaries, ray florets, tubular florets, style branches, cypsela etc.which make them very difficult to distinguish from their closely allied taxa.Morphologically *Conyza* differs from *Erigeron* in reduced ligule length of ray ûorets and lessnumber of hermaphroditic disc ûorets than the female ray ûorets; while most species of *Erigeron* have conspicuous rays and numerous disc ûorets. The revisionary study of the subtribe Conyzinae, supplemented by molecular data, has been attempted in Indian context to resolve identity crisis of different members under the subtribe and to understand their phylogenetic relationships.

SRY-PP-07

Study of compatibility system and floral visitor's role in Oleaceae Hoffmanns. & Link from West Bengal, India

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The compatibility system in pollination is a process that allows or forbids the fertilization of a flower by pollen from another flower. There are two types of compatibility systems; self-incompatibility (SI) and self-compatibility (SC). In flowering plants, self-incompatibility is a widespread mechanism which prevents inbreeding and invites outcrossing. To acquire successful cross pollination, self-incompatible plants adapt themselves a variety of ways to attract floral visitors. Pollination by biotic vectors, particularly entomophilous pollination, is regarded as a vital component of ecosystem services and alsocrucial for food production, and economic stability on a global scale. Members of Oleaceae have a diverse range of habits, habitats and floral traits. The mode of pollination in this family is still controversial. Oleaceae membersplay a significant economic role due to their aromaticity, essential oil contents, medicinal properties andwood production ability. Here, we examinedthe probable compatibility statusof collected few Oleaceae members and also aimed to find out the relationship status between the selected floral traits and pollen traits with regard to floral visitors. The present work makes compelling evidencefor the existence of the relation and also illustrates its significance to the ecosystem.The adaptive traits of the studied taxa were also included here. The most frequent visitors to the flowers were butterflies, followed by moths and bees.

SRY-PP-08

Phenotypic plasticity in *Ledebouria hyacinthina* Roth from India

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The genus *Ledebouria* is described by Roth from India and represented by three species, namely, *L. hyacinthina* Roth, *Ledebouria hyderabadensis* M.V. Ramana, Prasanna & Venu and *Ledebouria karnatakensis* Punekar & Lakshmin. It grows in different habitats namely open lands, high and low altitude plateau in Maharashtra. Based on the evidences from field work and herbarium specimens, observations are made on phenotypic plasticity of *Ledebouria hyacinthina.* Comment is also made on the status of existing species in India.

SRY-PP-09

Study of salt management strategies in the mangrove species *Bruguiera gymnorhiza* (L.) Savigny and *Ceriops decandra* (Griff.) W. Theob. under hydroponic system

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Bruguiera gymnorhiza (L.) Savigny and *Ceriops decandra* (Griff.) W. Theob. are two important true mangroves in the mangrove ecosystems of the Indo-West Pacific mangrove biogeographic region. These two species are non-recretohalophytes, i.e. they do not have salt glands for salt exclusion. Leaf succulence in mangroves is an important adaptive evolution to dilute salt in the mesophyll cells. In addition, salt exclusion at the root through the mechanism of ultrafiltration is considered a strategy to slow down salt accumulation in the mesophyll cells. *B. gymnorhiza* and *C. decandra* are categorised as 'salt excluders' because both have effective ultrafiltration mechanisms. Seedlings of these species were grown in a hydroponic system providing brackish water as a substrate to test their ability to filter salts. The salinity of the brackish water in the hydroponics of these two species was measured at 30-day intervals. The amount of salt absorbed from the substrate was calculated and compared. The seedlings were grown for up to four months. The data obtained showed that *B. gymnorhiza* is a more efficient salt excluder than *C. decandra*. The experiment demonstrates that *B. gymnorhiza* is more adaptable in saline habitats than *C. decandra* in terms of salt filtering ability. Therefore, the increase in salinity in mangrove ecosystems caused by climate change may pose a greater threat to the latter species than to the former. This data may be useful to develop strategies for the conservation of mangrove species in the climate change scenario.

SRY-PP-10

Comparative Analysis of Riparian Angiosperm Floristic Diversity in the Dudhganga River and 14 other Rivers

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Riparian ecosystems are the dynamic zones connecting land and water along riverbanks.Theyare critical for biodiversity conservation and ecosystem health. This research paper contains a comparative analysis of riparian plant diversity, with a specific focus on angiosperms, in the Dudhganga River, located in Kolhapur district of Maharashtra, India and based on the review of literature on 14 other rivers.Our study reveals remarkable insights into the floristic diversity of these rivers. The Dudhganga River, nestled within a biodiverse context, showcases a notable diversity of angiosperms, comprising 67 tree species from 25 angiosperm families. While modest in comparison, this diversity underscores the ecological importance of the Dudhganga River as a unique habitat.Our comparative analysis highlights the Sabarmati River in Gujarat, India, as the standout among the studied rivers. It boasts the highest angiosperm diversity, with an impressive 542 species from 384 genera belonging to 144 angiosperm families. This remarkable diversity in the Sabarmati River reflects its rich ecological tapestry and underscores its significance as a biodiversity hotspot. This research emphasizes the importance of preserving and conserving riparian habitats and advocates for holistic approaches to protect and manage these vital ecosystems. By recognizing the unique angiosperm diversity of the Dudhganga River, in addition to highlighting the exceptional richness of the Sabarmati along with 13 other Rivers, this study contributes to our understanding of riparian ecology and urges the conservation of these critical ecosystems, even in the face of ongoing environmental challenges.

SRY-PP-11

Floral biology and pollination of *Muntingia calabura* L. (Muntingiaceae), an economically important species in India

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The present study deals with the floral biology, bee flower interaction and pollination of *Muntingia calabura* L. belonging to Muntingiaceae, which is the sole species in the genus *Muntingia* having economic importance. It is a small tree around 7–15 meters in height with slightly drooping branches. Plants have open, bowl shaped, hermaphrodite, actinomorphic, complete white flowers, approximately 2–2.5 cm in diameter. Flower is composed of five sepals (1.1 cm long) and five white petals (1.5 cm long, 0.2 cm in wide). Both sepals and petals are free. The odoriferous flower emits a mild sweet scent. There are usually numerous stamens (average 82) with yellow anthers and each stamen is 0.3–0.5cm long. Anthers are dorsifixed and dehisced longitudinally. A single flower produced 34058.67±495.16, tricolpate pollen grains. Pollen-ovule ratio was 3405.8:1. The fruits are green in the young stage but after maturation it becomes reddish to brown. Flowering period ranges throughout the year. Pollen viability test as observed on acetocarmine (97.18±0.16%) and 2,3,5-triphenyl tetrazolium chloride (72.11±0.46%) was higher in the morning and after that it losses its viability gradually. Flowers open in the early morning (5.00 to 5.30 hrs.). After the flower opening an array of flower visitors like *Apis dorsata* F., *Eristalinus* sp., *Polistes* sp., *Vespa* sp., *Xylocopa* sp. etc., were found to visit the flower regularly and play vital role in pollination. Among different flower visitors, *A. dorsata* showed highest visitation frequency (5 flowers/min) followed by *Eristalinus* sp. (3–4 flowers/min) and *Polistes* sp., (2 flowers/min), while a lowest visitation frequency was observed in *Xylocopa* sp. (1 flower/5 min). The information generated so, will enable conservationists to design appropriate strategies for its long-term survival and sustenance in nature.

SRY-PP-12

Palynological Studies in some species of Tribe *Merremieae* (Convolvulaceae) from India

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Family Convolvulaceae is one of the most diverse families among the angiosperms and graceful due to variable-colored attractive flowers. Among the 12 tribes in the family Convolvulaceae Merremieae is one of them. Pollen characters are the key characters in family Convolvulaceae. In the family pollen grains are divided into two unranked groups viz., Psiloconiae (pollen without spines) and Echinoconiae (pollen with spines). Hallier was the first worker to use the pollen morphology as taxonomic character in classification of family Convolvulaceae. Hallier f. segregated the genus *Merremia* from *Ipomoea* based on non-spinulose pollens in *Merremia*. Recently Simose & Staple provided a new generic classification of tribe Merremieae on the basis of morphological and molecular evidences. Authors have split genus *Merremia* into following genera viz., *Camonea* Raf., *Daustinia* Buril & A. R. Simose, *Distimake* Raf., and *Merremia*. Hence now the tribe Merremieae possess nine genera like *Camonea*, *Daustinia*, *Decalobanthus*, *Distimake*, *Hewittia*, *Hyalocystis*, *Operculina*, *Remirema* and *Xenostegia*. In present piece of work pollen grains of 15 species are studied from the Indian Merremieae.On the basis of pollen morphology, all 15 species can be divided into five major typesi.e. Tricolpate, 5-6 Colpate, 12- rugate type, Pantoporate type and 9-12 Colpate type. Tricolpate pollens are mostly reported in *Merremia hederacea, M. emarginata, Operculina turpethum*, *O. petaloidea* and *Distimake aegyptius, D. dissectus*, *Camonea umbellata, C. pilosa* and *Distimake vitifolius* showed presence of 5-6 colpate, whereas 12-Rugate type is present only in *D. tuberosus.* Pantoporate type is present in *Xenostegia tridentata*, while 9-12 colpate pollen present in *D. rhyncorhiza.* During this investigation it has been observed that, the delimitation of all species of the tribe Merremieae also support the pollen morphology and in present study authors have studied the pollen morphology of some additional species of the tribe.

SRY-PP-13

Convolvulus sagittatus (Convolvulaceae): A New Record for India

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Convolvulus L. is one of the large genera of family Convolvulaceae which has about 190 species worldwide and in previous literature eleven species are reported in India. The genus *Convolvulus* is mainly distributed on all main landmasses of world but most diverse in areas with Mediterranean climate and in semi-desert region. It mostly inhabited in the dry, stoney and sandy habitats. During our field visit at Nilgiri hills of Tamil Nadu State, authors found interesting specimen of the genus *Convolvulus.* After morphological examination of the specimen, previous literature studies and herbarium consultation authors concluded that the specimen is *Convolvulus sagitattus* Thunb. The present species is characterised by, twining habit, leaves sagittate at the base, corolla white to pale pink and seeds rugose ornamentation. It is previously reported from South Algeria, Ethiopia, South Tropical & South Africa and South West Arabian Peninsula. As this is the first report to the Indian flora, authors have provided a detailed taxonomic account including description, illustrations and photographs for easy identification of species in the field.

SRY-PP-14

The Comprehensive Study of Assessing the threats to Riparian vegetation of the Panchganga River

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Riparian zones are diverse from the surrounding uplands because their soils and vegetation are designed by the presence of water. The study area includes river Panchgangain the Kolhapur district of Maharashtra, India. Panchganga river starts from Prayag Chikhali (16°43'04.1"N 74°12'24.2"E) in Kolhapur and meets Krishna rivernear Nrusinhawadi, (16°41'50.7"N 74°36'33.8"E) Kurundwad. The river flows from two highly populated and industrially developed urban cities namely Kolhapur and Ichalakaranji. The entire waste from these cities is discharged into river through streams. Due to these multiple natural and anthropogenic activities along with pollution of river water, also affecting riparian ecosystem. The present study includes exploration of entire Panchganga river and various aspects have been studied and recorded all the localities by using GPS waypoints. The study resulted in finding total 82 adverse sites like soil extraction points, soil erosion points, destruction sites and Polluted areas which provides a valuable data source for planning, management and restoration of river ecosystem.

SRY-PP-15

Phytolith morphotypes of some selected species under the genus *Eleocharis* R. Br. (Eleocharideae, Cyperaceae) and their taxonomic significance

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Eleocharis R. Br. is a cosmopolitan genus of Cyperaceae that comprises of c. 297 species worldwide and c. 18 species from India. Robert Brown established the genus *Eleocharis* as distinct from *Scirpus* L. by highlighting its unique features *i.e.* a solitary spike (uni-spicate) without bracts, absence of blades, hollow culm, and a persistent stylopodium that connects to the ovary and placed under the tribe Scirpeae Kunth ex Dumort. Along with the members of Poaceae, different taxa of Cyperaceae are major silicon accumulators and also reported to produce diverse phytolith morphotypes. Recent morphological and molecular phylogeny-based studies on the genus *Eleocharis* changed its tribal position from Scirpeae to Eleocharideae Goetghebeur. The present study deals with detailed phytolith morphotypes of five species of *Eleocharis* namely, *E. acutangula* (Roxb.) Schult., *E. dulcis* (Burm. f.) Trin. ex Hensch., recently described *E. neglecta* Borude, Chandore, Gholave & S.R. Yadav, *E. retroflexa* (Poir.) Urb. and *E. tetraquetra* Nees belonging to three series of *Eleocharis i.e.* Mutatae, Tenuissimae, and Multicaules. In addition to the other morphological and anatomical data, phytolith morphology-based characters also provide here valuable additional insights for the genus *Eleocharis*, even at the species level. The present investigation is also focused on *in-situ* localization of the observed phytoliths in the studied species of *Eleocharis*. Here, ACUTE, ARCUATE ENTIRE, BLOCKY, CAVATE, CONICAL, DENDRITIC, ELONGATE, FAVOSE, GENICULATE, RONDEL, STOMATAL COMPLEX, TABULAR, TRACHEARY and VELLOATE types are revealed as major phytolith morphotypes. In addition to these morphotypes, silicified STEGMATA like phytolith (cells) was strictly signified for *E. dulcis*, *E. neglecta,* and *E. tetraquetra* and probably the first-time report in Cyperaceae. Moreover, the entire epidermal margin with stomata was observed in *E. retroflexa*. Whereas, crenate epidermal margin with associated stomata was observed in *E. tetraquetra* and *E. neglecta*. Besides, *E. dulcis* and *E. acutangula* were signified by sinuate-crenate type epidermal margins with stomata. Additionally, morphometric analysis of major phytolith morphotypes emerges as taxonomically significant tool and helps to discern closely related species.

SRY-PP-16

Plateau vegetation of Padel Village, Taluka Devgad, Dist. Sindhudurg, Maharashtra

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Padel (1314.55 hectares) in Devgad taluka, Sindhudurg district of Maharashtra is a small village. It exhibits Mangrove vegetation, cultivation field, Plateaus (sadas) and Sacred Groves and forest land. Lateritic plateau (locally known as Sada) is a distinct geographical feature of Northern Western Ghats, India. Uniqueness of this Plateau vegetation is they can grow in lack of substrate, extreme climatic conditions, low water retention. Angiosperm diversity in the plateau area shows adaptation towards nature. The present work deals with the floristic analysis, and taxonomy of plants documented from these Plateaus in Padel village. The information gathered during this study will be used to plan habitat conservation measures as well as the assessment of threatened and economically important species.

SRY-PP-17

Diversity, Distribution and Endemism of the family Melastomataceae in Idukki district, Kerala

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Melastomataceae are among the top ten families of the flowering plants consisting about 170 genera and *c.* 5100 species worldwide. They are a monophyletic group and have always been considered as the core family of the Myrtales. The family comprises of herbs, shrubs, trees, or woody climbers and is widely distributed in tropical and subtropical regions. As part of the documentation of angiosperms in Idukki district, the diversity and distribution of Melastomataceae members have been extensively studied. Idukki is the second largest district in Kerala with an area of 4358 sq. km., representing 11.2 % of the total area of the state. The district is covered by dense tropical forests, plantations, scrublands and grasslands and situated mostly in the lofty hills of the southern Western Ghats. The present study documented 35 species of Melastomataceae belonging to six genera from Idukki district, of which 32 are endemic to South India, including six species endemics to Kerala. *Memecylon idukkianum* and *Sonerila roxburghi* are exclusively endemic to the study area. *Miconia crenata* is the only invasive species recorded. Endemism pattern highlights an urgent need for their conservation. The diversity, distribution, and endemism of the family Melastomataceae in Idukki district are discussed in this paper.

FR. ANTONY MUKKATH- PROF. K. S. MANILAL AWARD

FAMKSM-OP-01

Molecular Taxonomic Studies on *Danthonidium*, a Monotypic Grass Genus of the Western Ghats

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In India, there are around 30 monotypic grass genera, the majority of which are highly restricted in their distribution. *Danthonidium* C.E.Hubb. is a monotypic grass genus with the species *Danthonidium gammiei* (Bhide) C.E.Hubb. This grass is reported from the Western Ghats of Maharashtra, Karnataka, and Kerala to date. The genus shows peculiar taxonomic characters such as one flowered spikelets, inverse position of glume and prolongation of rachilla beyond the floret; and thus, remains distinct from the allied genera. However, there has always been debate over its elevation at the suprageneric rank. The morphology-based taxonomy places the genus within Arundinoideae, a subfamily that is considered a heterogeneous group for many misfit grass genera. In contradiction to this, Soreng *et al.* (2022) placed the genus under *incertae sedis* within the subfamily Danthinioideae in the phylogenetic classification of Poaceae considering its unresolved ancestry. While analyzing the literature, it was noted that there was no molecular data available for *Danthonidium* to date. The inclusion of the genus within Danthonioideae was based on a sheer possibility. In this article, the taxonomic placement of *D. gammiei* is discussed based on morphological and molecular data.

FAMKSM-OP-02

Systematic significance of molecular data and flower colourvariations in *Clitoria ternatea* at the intraspecific level

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Clitoria ternatea belonging to the family Leguminosae comprises of two varieties namely, *C. ternatea* var. *ternatea* (Papilionaceous form) *a*nd *C. ternatea* var. *pleniflora* (Non- papilionaceous form). The varieties are classified based on varied floral colour and symmetry. In light of this, the proposed study was carried out in the seven morphotypes of *C. ternatea* exhibiting different flower colour and symmetry. The study aims to ascertain whether flower colour is driven by genetic or environmental variablesby comparing molecular data obtained using ISSR and SCoT markers to the morphological data analyzed. The morphological characterization statistically analyzed both qualitative and quantitative characters of the different morphotypes.

Morphological dataanalysis separated the varieties solely on the basis of symmetry. Close relationships were shown by *C. ternatea* var. *pleniflora* f. *leucopetala* (Double white) and *C. ternatea* var. *pleniflora* f. *plenifora* Fantz (Double blue). Futhermore, *C. ternatea* var. *ternatea* f. *albiflora* (Voight) Fantz (Single white) and *C. ternatea* var. *ternatea* (Single violet) showed a similar symmetry. But the ISSR markers differentiated the morphotypes on the basis of floral colour and symmetry and revealed a close relationship between the morphotype Single white and single violet based on their symmetry. However, the close relationship between *C. ternatea* var. *ternatea* f. *ternatea* L. (Single blue) and *C. ternatea* var. *pleniflora* f. *plenifora* Fantz (Double blue)could be explained by the flower colour. SCoT markers also showed a relationship between the morphotype Double white and double blue based on similar symmetry. The morphotype Single white and single violet, likewise displayed a close connection.The molecular data set adds essential detail and support for the classification of the varieties, complementing the morphological variations.However, SCOT markers provided a betteranalogy with the morphological phylogenic data in comparison to the ISSR marker studies. The study established that genetic influences are responsible for flower symmetry and colour variation rather than environmental factors.

FAMKSM-OP-03

Molecular Systematics, Character Evolution, and Biogeography of the Genus *Pogostemon*

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The genus *Pogostemon* Desf. (Lamiaceae) encompasses around 90 species distributed primarily along South and Southeast Asia to China, with the highest species diversity and endemism in the Indian subcontinent. *Pogostemon* can be distinguished from other Lamiaceae members by the presence of exserted stamens adorned with moniliform hairs. Nonetheless, within the genus, two distinct morphological groups exist, one characterized by the presence of moniliform hairs on the stamens and the other lacking this feature. Despite this distinction, the evolutionary history of these staminal characteristics remains unexplored. The objective of this study is to elucidate the evolutionary history of these staminal traits while also conducting ancestral trait reconstructions for various other morphological, micromorphological, and palynological features. Additionally, the research reevaluates existing sectional classifications within the genus and outlinesthe most suitable sectional treatment by incorporating morphological and micromorphological data into a phylogenetic tree constructed using four chloroplast markers (*trnH-psbA* IGS, *rps16*, *trnL-F* IGS, *trnL* intron). The phylogenetic reconstructionsare employed to trace the systematic significance of each character, as well as to infer the biogeographic origin of major clades by ancestral area reconstruction and molecular dating techniques. The methodology adopted encompasses a broad range of tools and techniques, including field exploration, light microscopy(stereo and compound), Scanning Electron Microscopy, DNA isolation, PCR, Sanger's sequencing, and bioinformatictoolsfor principal component analysis, phylogenetic reconstruction, character evolution analysis, ancestral state reconstruction, molecular dating and ancestral area reconstruction (FastTree, RaxML, IQTree, MrBayes, BEAST, RASP, Phytools, BioGeoBEARS, etc.). This comprehensive approach aims to provide a better understanding of the evolutionary history, taxonomy, and biogeographic patterns of the genus, utilizing a diverse array of scientific methods and computational tools.

FAMKSM-OP-04

Petal Anatomical Stidies in Some Species of Genus *Justicia* L. (Acanthaceae) From Marathwada Region

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The Acanthaceae is a flowering plant family with taxonomic diversity, morphological and ecological, and geographical ranges potentially more than 4900 (Taxon-2022) species worldwide so it placed among top 12 family in Angiosperms. *Justicia* L. have well-known medicinal plant valued in pharmacology from family Acanthaceae. On global scale Acanthaceae is a flowering plant family with taxonomic diversity, morphological and ecological variations and geographical ranges. This diversity is parsed among 191 genera recognized with *Justicia L.* Species (~1000). Included among these *Justicia L.* genera is the species rich genus for which evaluated the current microanatomical studies for intra-species classification. *Justicia* L. grossly polyphyletic and most taxonomically complex and difficult group in Acanthaceae. The tricolporate, hexasuedocolpate pollen and rugula is present in upper lip hypothesized to be synapomorphic for Justicieae include *Justicia* L. (ca.700sp; Danial,2011,2016). The microanatomical study has been carried out from the petals of different species from the above genus shown variation in capitate trichomes in *J. betonica* L. *J. procumbense* L. shown : peltate glandular (multicellular terminal – 8 cells), capitate glandular (short stalk – unicellular terminal) sparsely scattered on the abaxial epidermal surface, simple multicellular or simple uniseriate , cell wall and stomata. *J. procumbens* L. showing peltate glandular (short stalked terminal multicellular, 4 cells) & sinuous anticlinal cell walls. *J. adhatoda* L. Our hopes that the present study will be serve to benefits future research on systematics of Justicia L.

FAMKSM-OP-05

Revisiting *Utricularia* section *Oligocista* (*Utricularia* L., Lentibulariaceae) based on morphological and molecular evidences

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The carnivorous genus *Utricularia* L. comprises about 250 species distributed worldwide and diversified in the Neotropics (Ellison & Adamec, 2018). The genus is represented by 42 species under seven sections, and the section *Oligocista* is the largest with 22 species. The Western Ghats harbouring 21 species is a centre of diversity of the terrestrial bladderworts while, the remaining one is distributed in Northeast India. The species in this section are mostly terrestrials or sub-aquatics, characterized by 1–3-nerved linear–spathulate leaves with basal traps, basifixed scales bracts and bracteoles, accrescent calyx lobes and gibbous corolla with diverging spur. Species delineation is crucial within this section due to inter- and intra-specific variations and hybridization. Moreover, there are 12 (54 %) endemics in India, whose interrelationships and evolution are not studied yet. Based on extensive field trips across India during the past five years (2018-2023) and consulting specimens in major herbaria in India and virtual herbaria online, variations at the infra-specific level were studied. Upon critical examination of morphological data and molecular phylogenetic analysis, the hypothesis that the sect. *Oligocista*, currently circumscribed as paraphyletic is tested. Maximum Likelihood and Bayesian analysis were performed for phylogenetic analysis and the phylogenetic position of all the taxa were analysed with a well resolved tree.

FAMKSM-OP-06

Karyotype variability in Indian *Dipcadi* Medik. (Asparagaceae) and its bearing on species delimitation

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Dipcadi Medik. (Asparagaceae), a bulbous monocot is mainly confined to the Old World. Species of the genus are found in Africa, the Indian subcontinent, the Middle East and some parts of Europe. In the present investigation, we studied the karyotypes of 23 accessions of *Dipcadi* from India. The variation in diploid chromosome number ($2n$) indicated the presence of three series with $2n$ = 12, 20 and 22 chromosomes.Karyotypes were bimodal and trimodal. *D. concanense, D. goaense, D. janae-shrirangii, D. reidii, D. saxorum,* and populations from Ankai fort, Delhi, Gautala and Mhaismalhad $2n$ = 12chromosomes whereas *D. coimbatorensis, D. krishnadevarayae, D. montanum* var. *madrasicum, D. ursulae*, *D. ursulae* var. *longiracemosum,*andpopulations from Ajara, Badami, Belgaum, Dapoli, Dolkhamb, Halkarni, Rantale and Yercaud had $2n$ = 20 chromosomes. *D. erythraeum* had $2n$ = 22 chromosomes. The mean chromosome length (MCL) varied from 3.64 ± 0.55 ìm (*D. ursulae* var. *longiracemosum*) to 5.67±1.30 ìm (*D. janae-shrirangii*). The total length of the haploid complement (THL) was the highest in *D. erythraeum* (48.91ìm) and the lowest in populations of Delhi (24.76 ìm). We also discuss the utility of karyotypesin species delimitation.

FAMKSM-OP-07

Tree flora of Indian Himalaya Region: Taxonomic and Phylogenetic diversity

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In an era of the Post-2020 global biodiversity framework, understanding the geographic patterns of taxonomic and phylogenetic diversity spanning across broad biogeographic scales is urgently required to inform policymaking and guide conservation strategies. However, despite massive efforts to document global biodiversity to furnishbaseline data, there still remain large knowledge shortfalls that affect our understanding of the biodiversity patterns and impede effective conservation strategies. Here, we present a consolidated native tree database of the Indian Himalayan Region (IHR) – home to two global biodiversity hotspots – collated from acomprehensive data synthesis. A total of 1689 native tree species belonging to 529 genera in 128 families across the IHR are documented. Using this novel database, the geographic patterns of taxonomic and phylogenetic diversity, distribution, and drivers of the native tree flora of IHR are described.The results show a considerable variation in the taxonomicand phylogenetic diversity of tree species among the provinces of IHR. Based on the nearest taxon index (NTI), phylogenetic clustering (NTI> 0) was mostly found in the western Himalayan provinces, while phylogenetic dispersion (NTI< 0) was observed in the eastern Himalayan provinces. Different sets of bioclimatic drivers explained the variation in tree species richness, standardized effect size of phylogenetic diversity, and nearest taxon index. Overall, our study showcases a model for understanding the patterns of taxonomic and phylogenetic diversity of tree flora in this biodiversity-rich region with significant insights on evolutionary, ecological and biogeographic processes, and has wide conservation and policy implications.

FAMKSM-OP-08

Phytolith profiles of the genus *Carex* L. (Cyperaceae) and their taxonomic significance

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Carex L. is the largest and mega-diverse genus of the family Cyperaceae, species of which are distributed all over the world. The genus is also considered as an ancestral genus of the family based on embryo morphology. Along with other genera of Cyperaceae, *Carex* is also a major Silica accumulator and silico-phytolith producer. According to POWO (2023), Indian subcontinent harbors 222 species of the genus of which more than 175 species are distributed in India alone (including EHM, WHM, ASSAM, IND). Species are mostly distributed in the hilly regions and some of them are restricted in distribution probably due to their specific habitat requirements. Previously, C.B. Clarke divided the genus *Carex* into two subgenera, *Vignea* (P. Beauv ex T. Lestib.) Peterm. and *Eucarex* Peterm. based on morphological characters. In very recent molecular phylogeny and morphological studies, the genus *Carex* was divided into six subgenera: *Siderosticta* Franch. ex Ohwi., *Carex* L. *Euthyceras* Peterm., *Psyllophoras* (Degl.) Peterm., *Uncinia* Pers. and *Vignea* (P.Beauv ex T. Lestib.) Peterm. Present study deals with the phytolith morphotypes and elemental composition of silico-phytoliths from aerial parts of eight species of *Carex* to validate their taxonomic significance. Altogether, fifty eight phytolith morphotypes were observed and recorded from these studied species of *Carex*. The major phytolith morphotypes observed in the present study are ACICULAR (hair), ELONGATE, FUSIFORM, ORBICULAR, TABULAR, TOWER and TRACHEARY, and ELONGATE ARTICULATED and ELONGATE BULBOUS margins in the epidermal long cells, which are considered as key characters for the genus. The Elongate bulbous morphotype with smooth to wavy surface ornamentation is first time reported here in the genus *Carex*. Present study also reveals that conical morphotype with its different sub-morphotypes show taxonomic significance. Scanning Electron Microscopy-Energy Dispersive X-ray (SEM-EDX) analysis of the extracted silico-phytolith morphotypes revealed that soil geochemistry controls phytolith elemental composition (17 elements detected). The highest weight percentage (Wt%) values were reflected in SEM-EDX spectroscopy for Carbon (C), Oxygen (O), and Silicon (Si) in the phytolith. Rest of the elements was detected in comparatively lesser or trace amount.

FAMKSM-OP-09

Study on leaf anatomy of the tribe Rhizophoreae (Rhizophoraceae) in systematic and adaptive-strategic contexts

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The tribe Rhizophoreae is a monophyletic group within the family Rhizophoraceae. The tribe consists of nine true mangrove species within four genera in Sundarban. The anatomical features of the leaves of the tribe Rhizophoreae are poorly elucidated in systematic and adaptive strategic contexts. In the present study, the thickness of the cuticle, epidermis and different tissue layers of the leaves of the nine species of Rhizophoreae and one non-mangrove species of Rhizophoraceae were acquired from thin sections of the mid-lamina. The thickness data were first transformed and then coded using the gap coding method. Phylogenetic analysis was carried out following a molecular phylogenetic framework of the family. The result shows that (1) in the *Bruguiera* sub-clade the allocation of the hypodermal layer (the colourless water storage tissue layer of the leaf) is reduced, while the palisade and spongy layers are increased; (2) in the *Ceriops-Kandelia* sub-clade, a lower palisade layer is present; and (3) in the *Rhizophora* sub-clade, the allocation of the upper hypodermis layer is maximised. An efficient ultrafiltration mechanism in the *Bruguiera* may lead to a slow accumulation of salts in the mesophyll tissue, reducing the allocation in the hypodermis layer. To maintain normal photosynthetic activity in the mesophyll tissue under high solar radiation, the lower palisade layer evolved in the common ancestor of the *Ceriops-Kandelia* sub-clade. The maximized allocation on the upper hypodermal layer in the *Rhizophora* sub-clade might indicate its highest salt tolerance.

PROF. M. SABU AWARD

MSA-OP-01

Determination of Bioactive Components of *Phyllanthus amarus* Schumach. & Thonn and *Phyllanthus maderaspatensis* L.by GC-MS and its Antimicrobial Activity

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Phyllanthus amarus Schum. & Thonn. and *Phyllanthus maderaspatensis* L are globally distributed herbs known for its several therapeutic potentials. *P.amarus* and *P maderaspatensis* has a long history of use in the traditional system of medicine for over 2000 years owing to its wide array of secondary metabolites that confer significant medicinal attributes. The present study was carried out to determine the phytochemical screening and antimicrobial activity of ethanol extracts. Extracts of *P.amarus and P. maderaspatensis L.* were studied for its antibacterial activity by well plate method against selected strains. Preliminary phytochemical screening of extracts of *P. amarus and P.maderaspatensis L.* revealed the presence of alkaloids, proteins, phenolic compounds, saponins, amino acids, flavonoids and tannins. Extracts were subjected to GC-MS analysis which shows presence of phytochemicals viz palmitic acid, 2,6-dihexadecanoate, 1-methylethyl ester, methanesulfonic acid, ethyl ester, tetradecanoic acid, polyphenols, eupalitin, Epicatechin etc. Extract of plants of *P.amarus* and P. maderaspantasis exhibited significant antimicrobial activity against microbes like *Alternaria, Bacillus, Curvularia and Escherichia.*

MSA-OP-02

Integrated Taxonomic Approaches: Resolving Problem of Heterogenous Plant

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An integrated taxonomic approach using a number of independent lines of evidence is needed to disentangle the complex systematic relationships among heterogeneous group of plants. Only morphological and anatomical studies are not enough to solve the taxonomic problems in plant systematics where still number of heterogeneous plant taxon dealing with the problem of correct description and assigning them into correct position of classification. Different new, advance, interdisciplinary approaches in the field of plant description are required to solve latest problems. The chemical relationship of plant groups can be proven a very helpful evidence to solve the taxonomic problem in the field of plant systematics. The present study deals with the study of phytochemicals using the advance techniques like High Performance Liquid chromatography. The work specially deals with the heterogeneous plant group and plants, trying to prove as solid evidence in resolving the problem of heterogeneous plant.

MSA-OP-03

Navigating Taxonomic Crossroads: A Comparative Analysis of Takhtajan's System of Angiosperm Classification (2009) and APG IV (2016)

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Over the past two and a half decades, the Angiosperm Phylogeny Group (APG) classification has played a key role in angiosperm systematics, with the latest version being APG IV (2016). However, disagreements over classification methodology raise concerns about APG's future influence. This dilemma prompts global plant systematists to consider alternatives like Takhtajan's System of Angiosperm Classification (2009). In this study, a comparative analysis featuring user-friendly guidelines with ready to locate tables to be discussed in detail in the paper, outlining supraordinal and ordinal groups of angiosperms in both APG IV (2016) and Takhtajan (2009) - is made to encourage a shift towards Takhtajan's system (2009) unless APG resolves its uncertainties in angiosperm classification methodologies.

MSA-OP-04

Floristic inventory of Ankasamudra Bird Conservation reserve: A wetland of Kalyana Karnataka, India.

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The first Bird conservation reserve in the Kalyana Karnataka is the Ankasamudra Bird conservation reserve. The current paper describes the vegetation composition and its contribution to the Sanctuary as a bird habitat. An extensive floristic survey has been carried out from April 2023 to September 2023. Total 124 plants species & 25% alien species were recorded from the study area. Among trees, the tank is dominated by *Acacia nilotica (L.)* which serves breeding & roosting ground for the water birds. The aquatic system is facing threat from proliferation of *Typha angustifolia* Bory & Chaub. and *Eichhornia crassipes* (Mart.) Solms. Strategic eradication of invasive plant species and the plantation of native species in the sanctuary are needed for better management.

MSA-OP-05

Are infraspecific variations a basis of evolution? : A Case study of *Curcuma inodora* Blatt. populations

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Taxonomic identification of species is difficult and displays certain systematic problems due to morphological variations at the infraspecific level. Literally the word 'infra' means 'within' or 'part of something'**.** Genus *Curcuma* L. (Zingiberaceae) comprising of 120 species is distributed throughout South and South-East Asia, with few species extending to China, Australia and South Pacific.; 40 species being recorded from India. *Curcuma inodora* Blatt. a common herb of Melghat at higher elevations which is commonly known as 'Jangali Halad'. In Melghat area populations of this species are found to show many distinct variations in aerial as well as underground characters.

Populations study of *Curcuma inodora* are conducting for last 13 years. Major variations found are spike position, length of spike; shape, size and colour of bracts; length of leaf stalk and shape of root tubers. Of these distinct variants were selected for case study. Like morphological, molecular studies were also carried out. Cluster analysis of 50 morphological characters was done by UPGMA using PAST software. In present study inflorescence position variation of three types was observed in *C. inodora*. Great bract colour variation was observed in the populations growing in Melghat. A colour range from dark red- rusty brown to violet to purple to pink and white was observed. Molecular genetic fingerprint of twelve variants of one species were developed using ISSR and RAPD marker to elucidate the genetic diversity and relatedness. Dendrogram was constructed based on UPGMA by using MEGA software. Cluster analysis of ISSR and RAPD data placed twelve variants of *C. indora* distinct subclusters indicating the relatedness and also the genetic distance pointing out clear polymorphism within the species. Population variations are interesting from evolutionary point of view, these can be said as stocks of future evolutionary lines.

Creation of infraspecific variations and divergence among the population is main source of speciation. The apparent basis for speciation is geographic isolation, reduction in gene flow and reproductive isolation. Our work suggests that infraspecifc variation (such as plasticity, or variation governed by developmental switches) might lead to incipient speciation and eventual divergence either in allopatry or sympatry. Infraspecific differences in the form of alternative phenotypes can contribute to the evolution of

reproductive isolation. Evolutionary potential of *C.inodora* population is quite obvious it is therefore suggested that these populations growing should be conserved with atmost care to save the future evolutionary lines.

MSA-OP-06

The genus *Syzygium* Gaertner (Myrtaceae) in Assam, India

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The genus *Syzygium* Gaertner belongs to the family Myrtaceae under the order Myrtales. It is one of the largest genera of Myrtaceae with more than 1,200 species occurring from Africa to Hawaiian Islands and from India to Australia and New Zealand. The genus is represented by *ca*. 84 species from India while *ca*. 34 species are recorded from north-eastern India. The present study includes a consolidated and comprehensive account on the taxonomy of the genus *Syzygium* occurring in Assam. A total number of 15 *Syzygium* species were studied and documented from the region. Additionally, after conducting widespread field surveys followed by critical consultation with the existing literature and herbarium specimens, interesting distributional notes on 16 lesser known *Syzygium* species were also inferred during the present study. The study also resulted in the discovery of a new species, *S. namborense* D. Dey, N. Devi & J. Sarma from the Nambor Reserve Forest of Golaghat district and from the Rongkhang Reserve Forest, Karbi Anglong district of Assam. Lectotypes for two names in the Indian *Syzygium* viz. *S. reticulatum* and *S. ramosissimum* have also been designated. An amplification of the original protologue for *S. polypetalum*, a lesser known chasmophytic jambolan species of Assam was also conducted in the study. The study also includes the first ever photographic documentation of the endemic tree species viz. *S. assamicum*. The occurrence of another lesser known shrub species, *S. cyanophyllum* hitherto known only from Assam, was also recorded from the state of Meghalaya (Jaintia Hills). *S. diospyrifolium* has also been recollected from Assam after a gap of 109 years near Bherjan – Borajan– Podumoni Wildlife Sanctuary, Tinsukia.

MSA-OP-07

An Investigation on process of fermentation of "Shidol": A traditional fish product of North East India

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Fermentation of fish, apart from being preservation method, helps in developing suitable physicochemical characteristics responsible for favorable dietary property including altered vitamin contents, better digestibility and longer shelf-life.

Shidol is a pasty, solid, fermented fish product indigenous to the North East India, particularly in Assam, Tripura and Manipur. It is known for its strong flavor. During fermentation process, the shape of the fish remains unchanged but texture becomes a bit softer due to little disintegration near belly and caudal portions. The colour of best quality product is dull white which gradually turns into light brownish to deep brownish on continuous exposure to air.

Shidol is a popular dietary item and is relished by various ethnic tribes of North East India and Bengali community of Assam and Tripura. **Shidol** is believed to have many health benefits including curing of malaria, as it contains volatile fatty acids, essential amino acids and their derivatives.

In the present study, an investigation has been carried out in important locations of N.E. India regarding the indigenous process of fermentation and preservation of this popular product and an attempt has been also made to procure information regarding various modes of consumption as a dietary item and health benefits associated with it.

MSA-OP-08

Effectiveness of CTC Tea Wastes as fish feed on Mrigal Carp (*Cirrhina mrigala*)

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Tea waste is an essential byproduct of crush, tear and curl (CTC) tea processing. Tea gardens of North Bengal cumulatively produce around 15 million kg of Factory Tea Waste (CTC-FTW) annually. This pollutes soil, water and air. Beside this, minor commercial / domestic consumption of CTC tea also produce a huge quantity of waste, called domestic tea waste (CTC-DTW). In the present study, potential use of CTC-FTW and CTC-DTW as fish feed have been evaluated. Fingerlings Mrigal carp (*Cirrhina mrigala*) (N = 270) were grouped into different treatment and fed with different ratios of CTC-FTW plus conventional oil-cake (OC) and CTC-DTW plus OC for 180 days. After the treatment, gross growth rates were measured and healths of fishes were determined by liver function tests (LFTs) and hematological parameters. The fishes, provided with upto 50% CTC-FTW and CTC-DTW along with OC, demonstrate significantly better growth parameters as well as healthier LFT and hematological profile compared to the control group. The presence of different elementsin the major components of the feed formulations were also evaluated and it was found that Iron, Copper, Zinc, Manganese, Cobalt, Chromium and Silicon are present in FTW, DTW and OC, which are significantly important in the growth and development of fishes. Among these Iron, Cobalt, Copper and Silicon shows more or less similar results in FTW, DTW and OC, whereas Manganese content drastically decreases in OC in comparison to FTW and DTW. In case of Chromium, it was only observed in FTW and DTW. The antioxidant properties viz. DPPH, $ABTS^+$, Nitric oxide, Hydroxyl radical scavenging activities and FRAP assay were also conducted and the results shows FTW having higher amount of antioxidant properties followed by DTW and OC. The nutritional components like sugar and protein contents were also found to be higher in FTW and DTW than the OC. Our preliminary results suggest that, FTW and DTW may be used as a supplementary or alternative food for Mrigal carp fishes.

MSA-OP-09

Taxonomic Paradox behind Subtribe Ambrosiinae Less.: A Case Study on *Xanthium* and *Ambrosia*

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Ambrosiinae Less. is a subtribe of Heliantheae tribe belonging Asteroideae subfamily of Asteraceae. 8 genera worldwide comprise this subtribe. Originally presented as an independent tribe, this was later combined with the Heliantheae tribe. Heliantheae tribe members typically have heterogamous heads (disciform or radiate), multiseriate involucres, syngenesious black anthers, and fruit cypsela. However, a thorough examination of the morphological and palynological traits of the genera *Xanthium* and *Ambrosia* reveals a number of contentious traits that are absent when compared to the Helianthae tribe. Either the above genera should be promoted to a higher taxon of tribe, or the distinguishing traits of the tribe should be re-delimited.

MSA-OP-10

Diversity and Endemism of selected taxa of *Coleus* and *Pogostemon* in Western Ghats

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The Mint family, Lamiaceae is the sixth largest plant family consisting of about 236 genera and 7173 species worldwide. Plants belonging to this family are mostly aromatic having advanced gamopetalous flowers, quadrangular stem and bilabiate corolla. Diversity of Lamiaceae plants adds beauty and aroma to the species richness in Western Ghats. Among the family Lamiaceae the genera *Coleus* Lour. and *Pogostemon* Desf. in Western Ghats is remarkable with much rare and endemic taxa. The genus *Coleus* is characterized by declinate stamens held in the boat-shaped lower lip of the corolla and *Pogostemon* with flowers having exerted stamens bearing monoliform hairs. In Western Ghats these genera *Coleus* and *Pogostemon* are represented by 34 species with 20 endemics and 21 species with 7 endemics respectively. The extensive survey, and assessment of species diversity based on field exploration and plant collection in Western Ghats helped in preparation of a detailed taxonomic account of these genera with descriptions, photographs, ecology, phenology, distribution and keys for identification. The present study report includes new species, resurrection, typification, and distributional records in Western Ghats. The collected plants were conserved in Calicut University Botanical Garden, Kerala.

MSA-OP-11

Eco-Reproductive Dynamics and Preservation Efforts for *Guilandina bonduc* L.: A Vital Ethno-Medicinal Plant of Tripura

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*Guilandina bonduc*is an extremely rare perennial lianas for Tripura and is restricted to West Tripura andthe Dhalai District of Tripura. This study focused on the reproductive ecology of the plant from flower production through seed germination to identify possible weak points that might contribute to its rarity and impede its conservation. Flowering starts in mid-June and continues till the second week of March. Opening of flower takes place between 5.00 am-7.00 am while anthesis occurs between 6.00 am –7.30 am. Andromonoecious condition was observed in *G.bonduc*. Floral visitors such as butterflies, beetles, and bees are visited almost daily. Among them, *Apisindica*, *Apisdorsata*, *Xylocopa* sp. and *Bombus* sp.weremost frequent. Most plants produced a large mean number of flowers and ovules (2249.6and 4049.28, respectively), but relatively few of these formed fruits and seeds (667.85 and 868.21, respectively). In decreasing importance, ovules in fruits were lost to predation, seed abortion, and lack of fertilization. The percentages of these fates differed among sites and years. Excluding pollinators by bagging flowers reduced fruit set but seed set per fruit and seed mass were unaffected. Germination was affected by scarification, temperature, soil acidity and moisture availability. About 11% of seeds are damaged due to dispersal. Thehard seed coat (over 80% at one site) has a negative effect on population growth. Conservation of this species could benefit from improved fruit set and decreased population.

MSA-OP-12

Phytogeography, diversity and regeneration status of tree species in Similipal Biosphere Reserve, Odisha, India

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The plant diversity of India is more diverse than any country in the eastern hemisphere due to its varied topography, climate and edaphic factors. Similarly, the state of Odisha in Eastern India is rich in diversity and inhabited mixture of north and south Indian flora. Odisha is the meeting ground of for the Himalayan and South India floristic elements. In this context, Similipal Biosphere Reserve (SBR), Odisha has a major role in the migration of flora of the Indian flora. Therefore, we have studied the phytogeography, diversity and regeneration status of tree species in SBR for their conservation and management. A total of 240 tree species phytogeographical affinities were analysed by comparing with different countries of the globe. The results revealed that SBR has strong affinity with Sri-Lanka (46.66%) and Myanmar (45.83%) followed by China, Malaysia, Thailand, Australia and Africa. Several trees and orchids have also affinity with Himalayan vegetation distributed in both the areas. Quantitative tree species diversity and regeneration status was studies in major three forest types of SBR, namely Dry Deciduous Forests (DDF), Moist Deciduous Forests (MDF) and Semi-evergreen forests (SEF). Random sample plots were laid for studying the diversity and distribution pattern of tree, sapling, and seedling stages of the tree species.The regeneration potential of tree species was poor in DDF (39%) where as it was fair in SEF (43%) and MDF (49%). Most of the dominant tree species at each forest type performed good regeneration. The species such as *Ehretia laevis* Roxb.,*Bridelia retusa* (L.) A.Juss., *Mitragyna parviflora* (Roxb.) Korth., *Terminalia tomentosa* Wight &Arn., *Terminaliachebula*Retz., *Terminaliabellirica*(Gaertn.) Roxb.etc. had either no regeneration or poor regeneration potential need immediate attention for conservation measures.Thephytogeographical affinity of SBR supports the migration, establishment and naturalization of flora from/to SBR. Thishypothesis needs further study for biogeographical mapping of Indian sub-continent.

MSA-OP-13

The genus *Scleria* Berg. (Cyperaceae) in Peninsular India and Rest of Maharashtra

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About 24 taxa of Scleria *s.1.*, occurring in Peninsular India and Rest of Maharashtra have been critically studied on morphological ground. With reference to these taxa, the present paper is the first attempt in India to focus on the generic limit of Scleria Berg. *Diplacrum* R. Br. and *Sphaenopus* Boeck. The separation of these genera is based on very narrow distinction of one or two characters.

Three groups of cyperlogist divided opinions in accepting generic and infrageneric delimitation of these genera. Some cyperlogist accept *Scleria* and *Diplacrum* as two distinct genera merging *Sphaeropus* in the latter genus, while others take *Scleria* in broad sence, treating the former two infragenerically as its Sections. Boeckeler alone considers three distinct genera. Observations based on different taxa of the study regions clearly reveal continuity of characters in these genera. Hence, it is provisionally accepted that a single genus *Scleria* be better treated with broad generic limit merging other two genera in it.

MSA-OP-14

Taxonomic Studies of *Corchorus* L. (Tilioideae) Malvaceae from Maharashtra

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The *Corchorus* established by Linnaeus (1753) based on one type species *C.olitorius* L. It represents ca 100 species worldwide which is distributed warmer parts of tropical and subtropical regions of the world. The others were found wild in nature, but most of them are now extinct or in endemic condition. However, being an extremely variable genus, its natural distribution, genetic and evolutionary relationships, as well as center of origin are poorly documented, virtually controversial and yet to be resolved. Wild *Corchorus* L. taxa are mostly distributed in the tropical and subtropical regions of Africa, America (including Brazil, Mexico, Bolivia, Venezuela, and West Indies), Australia, China, Taiwan, India, Myanmar, Bangladesh, Nepal, Sri Lanka, Japan, Indonesia, Thailand, Malaysia, and Philippines (Kundu, 1951). Roxburgh (1832) accounts 6 species and Bentham and Hooker (1874) accounts 8 species and *C.pumilus* Ham. doubtful species for the India. The Preliminary study of genus *Corchorus* L. in India was under taken by Chakravarty (1950), enumerating 8 species. Later on Pardeshi (1982) added one new species *C. velutinus* Pardeshi, but Singh and Vishwanathan (1991) changed the name of same species as *C. deccanensis* H. B. Singh and M. V. Viswan. Daniel and Chandrabose in Sharma and Sanjappa (1993), as parts of floristic, Flora of India recorded 8 species and one excluded (*C.deccanensis* H.B. Singh and M. V. Viswan.) due to absence of herbarium specimens in Central National Herbarium, Calcutta. Monumental work of this regions Cooke (1958) reported about 7 species for the flora of presidency of Bombay. Almeida, (1996) recorded 8 species in Maharashtra; Singh et.al. (2000) accounts 9 species for Maharashtra. Present paper deals with distribution, morphology, dermatology, Anatomy of root, Stem, Leaves, petiole and Maceration studies which will be help to delimit the *Corchorus* L. from Maharashtra State and extended distribution of C. Corchorus urticifolius Wight & Arn for flora of Gujrat.

MSA-OP-15

Taxonomic revision of the genus *Ophiorrhiza* L. (Rubiaceae) in India

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Rubiaceae, one of the largest angiosperm families, consist of over 13,000 plants, widely occurring in many parts of the world, especially in the moist tropical regions. The genus *Ophiorrhiza,* a notably species-rich, taxonomically complicated genus within the family Rubiaceae (tribe: Ophiorrhizeae), comprises of 327 taxa. Deb & Mondal (1997) revised the genus in Indian subcontinent and reported 46 taxa form India. Since Deb & & Mondal (1997), several new synonyms, new taxa, and possibly extinct species are rediscovered from India. Since Deb & Mondal (1997), few new synonyms, new taxa, and the rediscovery of possibly extinct species from India. Currently the genus consists of 51 taxa in India, mainly distributed in northeastern states and Western Ghats with 26 endemic taxa. Among them, 27 taxa are distributed in southern India and Northern & NE India with 24 taxa. The present study brought out six new taxa, of which three from North-East India, two from Western Ghats and one from Andaman and Nicobar Islands. Moreover, three possibly extinct species were also rediscovered from Western Ghats, in which two after more than a century and another after 78 years. Further, two taxa new to India one to southern India were also reported.

GENERAL PAPER PRESENTATION

THEME 1: FLORISTICS, PLANT DIVERSITY AND CONSERVATION [ORAL]

T-1-OP-01

Taxonomy and diversity of the genus *Senecio* L. in Maharashtra, India

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Senecio L., a diverse and widespread genus with about 1250 species in world belongs to the tribe Senecioneae of the Asteraceae. It has a goodrepresentation in India, with a total of 47 species and 6 varieties. Of these, 21 are exclusively endemic to the country. Indian species are mostly distributed in the Himalayan and the Western Ghats region. In Maharashtra, six *Senecio* species have been identified and all are endemicto the country. Thesespecies, namely *S. belgaumensis* (Wight) C.B.Clarke, *S. bombayensis* N.P.Balakr., *S. dalzellii* C.B.Clarke, *S. edgeworthii* Hook.f., *S. gibsonii* Hook.f. and *S. hewrensis* (Dalzell) Hook.f., display notable variation in leaf morphology, indumentum, size and count of ray florets, pappus structure and cypselae. In the present study we discuss the morphology and geographical distribution of these species.

T-1-OP-02

Woody Flora of Jammu and Kashmir, India

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Woody flora, as a biodiversity surrogate, can help in rapid assessment and monitoring of biodiversity in a particular region. The present paper provides an updated checklist of the woody flora of the Jammu and Kashmir, India, including both native and alien species. In the checklist, each species is provided with its current valid scientific name, family, collector(s) and collection number, common synonym(s), wild/cultivatedstatus, and growth-form.The woody flora of the study region comprises 745 species, belonging to 362 genera in 106 families. It includes 362 species which are exclusively wild-growing, 320 species are cultivated for different purposes, and 63 species are cultivated and also grow in the wild as well. In terms of growth form, the trees, shrubs, sub-shrubs, and woody climbers are represented by 290, 346, 38, and 71 species, respectively. Thesubtropical Jammu and temperate Kashmircontribute 561 and 384species, respectively to the total woody flora.Hopefully, the checklist will form the scientific baseline to guide the conservation and sustainable use of arboreal plant diversity in this Himalayan region.

T-1-OP-03

Study of Pollen diversity in Seven Species of *Solanum* L.

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The aim of this research work is to analyse carbohydrates, lipid, protein and amino acid of pollen present in seven different species of *Solanum* L. i.e., *S. erianthum*, *S. indicum*, *S. macranthum*, *S. melongena*, *S. sisymbriifolium*, *S. torvum* and *S. xanthocarpum*. The pollen grains were collected from plants growing in Santiniketan, Sriniketan, Prantik and Bolpur of Birbhum district. The flowering season, anthesis time, pollen morphology, pollen protein profile were studied and total carbohydrates, proteins, lipids, amino acids, DNA were estimated using standard methods. The flowering season and anthesis time vary among the studied species. The size of pollen grains varies between 17 x 16 µm to 68 x 72 µm. The total content of carbohydrates, lipids and proteins were highest in *S. xanthocarpum* whereas total free amino acid and DNA was highest in *S. erianthum*. The *S. macranthum* reported lowest amount of total lipids, proteins and free amino acids among all species. The proline present in all species ranging 0.59-3.00 mg/g, an essential amino acid for pollen germination. The SDS- PAGE of pollen protein revealed 44 major polypeptide bands of different molecular weight ranging from 19 kDa to 135 kDa and variation in polypeptide bands observed from 7 to 13. A dendrogram was drawn and found that. *S. macranthum*, showed less similarity with other species and it placed alone in a separate cluster.

T-1-OP-04

Morphogenetic and phytochemical diversity of *Abutilon* species in North-Western India

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Constant anthropogenic activities and changing environmental conditions have a direct impact on the vegetation of any area. Plants are constantly subjected to selection through preferable plantations, pollution tolerance and escapism. This process may either enhance the rate of evolution or lead to complete elimination of genotypes as well thereby leading to complete loss of certain species or sometimes even emergence of new ones in the same area. The present study was undertaken to explore the diversity of species of *Abutilon*, a wild medicinally important genus of the region, which is of common occurrence. Variations in the environment are often reflected in the as marked variations in the phytochemical constituents of plants which may enhance or even decrease the efficacy of the medicines derived from such plants. The investigations revealed that North-western India is home to 6+1 species of *Abutilon*. Cytologically the genus presented variation in the earlier reported chromosome numbers thereby indicating the underlying changes in genome. These included new chromosome count for *A. ramosum* (n=8) and presence of B chromosomes in *A. indicum*. Further the presence of *A. theophrasti* in the region is a matter of concern as the species had not been reported earlier in any regional flora. The investigations also brought forth occurrence of a tentative new species in the region with four populations being identified from areas under intensive infrastructural development. Molecular data was used to understand the interspecific genetic relationships between the various species found in the region. The phytochemical profiling of the accessions was also done to understand the variability in the flavonoid, fatty acid content and phenol content among the species of *Abutilon*.

T-1-OP-05

Ex situ conservation of *Syzygium stocksii* (Duthie) Gamble: An Endangered Tree Species

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Syzygium stocksii (Duthie) Gamble is a species belongs to the family Myrtaceae and it is rare and endemic species to India. This species was described by Duthie in 1879 as a *Eugenia stocksii* from evergreen forest of Konkan region based on plant collection of Stocks. After that no one has collected this plant species from Konkan region (Cooke, 1905); therefore, it is placed in endangered category of IUCN red data list (IUCN, 2022-1). Recently we have collected this species from Konkan region after a long gap of 150 years and attempts were made to conservation of this species by using conventional methods.

T-1-OP-06

A comparative leaf anatomical study of some halophytes and glycophytes of Apocynaceae

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The saline habitat of Sundarban harbours at least nine species of the family Apocynaceae. To grow in the saline environment, the plants evolved various morpho-anatomical features. These traits are poorly known for members of the Apocynaceae. We investigated the leaf anatomy of *Filaysonia obovata* Wall., *Pentatropis capensis* (L.f) Bullock, *Sarcolobus carinatus* Wall. and *S. globosus* Wall. We also studied the leaf anatomy of *Hemidesmus indicus* (L.) R. Br. and *Oxystelma esculentum* (L.f.) R. Br., two glycophytes of this family, to understand adaptive evolution in Apocynaceae under salinity. The allocation to leaf cuticle, epidermis and tissue layers was measured. The stomatal index and frequency from the abaxial leaf surface were also determined. The result shows that the allocation to cuticle, hypodermis layer (water storage region) and total leaf thickness is higher in halophytes than in glycophytes. The highest leaf thickness was observed in *Filaysonia obovata*. The hypodermis layer contributes more than 20% of the total leaf thickness. In *S. globosus*, the hypodermis layer contributes less than 10%. This indicates that the former species is better adapted to saline soils than the latter. In contrast to the halophytes, the glycophytes have no hypodermal layer. By increasing the allocation to the hypodermis layer, the halophytes increase their safety in saline conditions, while the galycophytes cannot. This study suggests that the hypodermis layer is an important functional trait for salt tolerance.

T-1-OP-07

Floristic and Phytosociological Study of Susunia Hill, Bankura, West Bengal, India

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The present paper embodies the analysis of floristic composition and assessment of the distribution status of different plant groups like herbs, shrubs, climbers and trees of the Susunia Hill of Bankura district, West Bengal, India. Multiple field surveys during 2021 to 2023 have been performed in different forested sites of Susunia hill in different seasons to record its floristic composition. A total of 90 taxa have been recorded which belong to 35 dicot families, 73 dicot genera, 83 dicot species and 3 monocot families, 4 monocot genera, 5 monocot species along with 2 species of pteridophytes under 2 genera and 2 families. Dominating dicot families are Fabaceae, Rubiaceae, Malvaceae and Acanthaceae. Both Fabaceae and Rubiaceae represented by 9 plant species. Habitually the recorded species belong to four categories which are herbs of 29 species, shrubs with 4 species, trees 47 species, and climbers contain 10 species. Phytosociological studies of Sushunia Hill have also been carried out during the survey period to know the present status of plant species in forest floor of the hill. IVI of 26 tree species have been estimated. *Shorea robusta* Gaertn.f. recorded with highest IVI value of 223.69. *Soymida febrifuga* and *Butea monosperma* have been identified as the next dominant species with IVI values of 21.912 and 20.44, respectively. Trees with very poor IVI value recorded between 2.08 - 5.92 are*: Cleistanthus collinus*, *Terminalia bellirica*, *Adina cordifolia, Cochlospermum religiosum, Flacourtia jungomas.* The present study highlights the present status and floristic composition of the plant species grown in the forest of Susunia Hill and it will help in framing the conservation strategy of plant resources of the area.

T-1-OP-08

Diversity and threats of the Genus *Nymphoides* Seguier in the Lateritic plateaus of Northern Kerala, India

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The aquatic genus *Nymphoides* Seguier is widely distributed in the wetlands of tropical and temperate regions of both the old and new worlds (Sivarajan et al.1989). In Northern kerala, the *Nymphoides* Seguier shows more diversity in the seasonal ponds on the lateritic plateaus. The present study listed out six taxa from the seasonal ponds of lateritic plateaus. The genus includes both dioecious and bisexual species. The bisexual species are *N. indica* (L.) Kuntze., *N. parvifolia* Kuntze, *Nymphoides balakrishnanii* Biju, Josekutty, Haneef & Augustine J. and *Nymphoides palyii* Biju, Josekutty, Haneef & Augustine J. The dioecious species *Nymphoides krishnakesara* is represented by two varieties, the *Nymphoides krishnakesara* var. *krishnakesara* K. T. Joseph & Sivar. and *Nymphoides krishnakesara* var. *bispinosa* Biju, Josekutty, Haneef & Augustine J. The genus *Nymphoides* Seguier is now facing serious threats extinction due to rapid habitat destruction due the different anthropogenic activities. The protection of lateritic plateaus is inevitable for conservation of these rare species of the genus *Nymphoides* Seguier.

T-1-OP-09

Biodiversity-rich sacred grove in Eastern tribal belt of Gujarat state: Mahakali Mandir

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A sacred grove is a forest patch that has religious importance for the local community and is protected by them. It has been a tradition followed by indigenous people since ancient times to conserve natural habitats like ponds, small streams, and forests by believing these patches as ancestral spirit's abode and marking them as divine thus in-situ conservation is achieved. They become important for their belief that it is home to their diety and thus cannot be disturbed or harmed. The present study is on the Sacred Grove which falls in in Fatatalav village of Vijaynagar taluka in Sabarkantha district. The study area falls in the Aravalli hilly range. This place is being taken care of by the local priest of the village and worshiped by local communities residing in its vicinity.

Tribal people have a tradition of offering a terracotta horse-shaped figure known as 'ghodo'. A small seasonal stream is located nearby. The main tree in this shrine is *Ficus benghalensis*. A preliminary survey was conducted by frequent visits. The total area covered under this area is 2 Sq. km. During the floristic enumeration, more than 85 plant species have been reported. Apart from this angiosperm, the grove also supports various bryophytes and sellaginella, pteridophytes. Among the reported higher plant species, few are conservation significant.

T-1-OP-10

Climbing attributes of lianas: a case study in northeastern India

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Lianas are woody vines which after germination in the ground climb to the tree canopy to get access to well-lit areas of the forests. Relying upon host arboreal species and other means of vertical supports, they ascend to the canopy by various climbing mechanisms. Their structural morphology and twinning mechanisms add to the complexity of the vertical structures of the forests. Climbing generally takes place through their special adaptive features *viz*. stem twining, tendrils, thorns, hooks, spines, etc. Studies on the diversity and climbing patterns of lianas were carried out in northeastern India particularly in Assam (Barak Valley), Manipur and Tripura. A huge diversity of lianas with high infestation rate on trees and curious climbing patterns was recorded from the region due to the prevalence of tropical forests in the study area. The study enumerated 27 species of lianas from southern part of Assam (Barak Valley), 62 spp. from Tripura and 88 spp. from Manipur. Stem twinner was found as the most dominant form followed by tendril climber. Mostly, lianas associated with large trees were found to have stem twinning mechanisms; whereas, tendril climbers were found to have preferential growth on smaller trees possibly due to advantages of enfolding and coiling around smaller branches of trees for further upward movement. Here, climbing patterns of lianas in the region are presented.

T-1-OP-11

Regeneration status of trees species along the elevation gradient in Sainj Wild Life Sanctuary, Western Himalaya

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Trees are the most important element of any forest community as they are the most influential in determining the forest resources and physical structure and in providing shelter to almost all other forest organisms. The existence of a tree species in any forest community is maintained by its regeneration potential under diverse environmental conditions, and thus assessment of regeneration status is important to portray the existing forest composition as well as to predict possible forest composition in near future. Sainj Wild Life Sanctuary (SWLS), located in the Kullu district of Himachal Pradesh, is a botanically unexplored territory in Western Himalaya. The present study has been carried out in the SWLS to assess the regeneration potential of tree species at different elevations. To fulfill the purpose, the study area has been divided into five elevation zones, viz. A1 (~1800–2200 m amsl), A2 (2201–2600 m amsl), A3 (2601–3000 m amsl), A4 (3001–3400 m amsl), and A5 (>3400 m amsl) mainly based on the vegetation composition and structure. The densities of seedlings, saplings, and adult individuals of the forest-forming trees have been assessed in each elevation zone to understand their population structure and regeneration patterns. The highest tree species richness is observed at the lowest elevation zone (A1), while the lowest species richness is recorded at the highest elevation zone (A5). The densities of trees (adult), saplings and seedlings range 7–356 ind./ha, 3–101 ind./ha and 2–124 ind./ha respectively. The total basal cover of trees (adult), sapling and seedlings vary from 0.478–76.01 m^2/ha, 0.011–0.385 m^2/ ha and 0.001–0.027 m^2/ha respectively. Overall, the forest shows ‘fair’ regeneration status in each elevation zone except the highest elevation zone (A5) in which forest shows ‘poor’ regeneration status. However, poor or no regeneration of some forest-forming species (e.g. *Aesculus indica*, *Populus ciliata*, *Picea smithiana*, *Abies pindrow*, *Pinus wallichiana*, *Quercus floribunda*) in different elevation zones predicts elimination of these tree species from that elevation zone or a huge species compositional change in that area in near future.

T-1-OP-12

Floristic composition and species diversity patterns in the treeline ecotone of Kashmir Himalaya

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Globally, the treelines at higher elevations in mountains are reported to be advancing up-slope in response to recent climate warming. However, little is known about the treeline advancement in the Himalaya due to paucity of baseline biodiversity data with which to compare, thus making their assessment and monitoring challenging. To fill this knowledge gap, the present study documented floristic composition and species diversity patterns of two treeline ecotone sites in Kashmir Himalaya. At each site, we conducted field sampling by laying ten 20-m^2 plots for trees, and two nested subplots of 5-m^2 for shrubs and five 1-m^2 for herbs along the elevation gradient (2600-3600 m). We recorded 123 plant species belonging to 39 families from the two treeline sites. We observed a considerable difference in floristic composition and species distribution along the treeline ecotones in the study area. Majority of the plant species recorded were perennial herbs. We observed a significant association of growth forms with the particular plots along the treeline ecotones. At both the sites, we recorded highest species richness at the actual treeline which was correlated well with the functional traits, thus indicating convergence of floristic and functional diversity at this transition zone between tree-dominated subalpine forests and herb-dominated alpine meadows. With rapid climate change reported in mountains in recent times, our study provides precious floristic baseline data that will facilitate assessment and monitoring of the Himalayan treelines.

T-1-OP-13

The genus *Eragrostis* Wolf (Poaceae: Chloridoideae) in Telangana State, India

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Eragrostis Wolf, the largest grass genus comprising approximately 423 species in the tribe Eragrostideae (subfamily Chloridoideae, family Poaceae). The genus is a morphologically highly variable and taxonomically complicated due its ploidy levels, is widely distributed in tropical, subtropical, and warm temperate regions of the world. In India, the genus is represented by 48 taxa belonging to 43 species and 5 varieties and distributed from sea level to 2800 m elevations in diverse ecological environments, of these 5 species and 4 varieties are endemic to the country. *Eragrostis* species often grow on sandy, clay, rocky slopes, gravel soils etc. Few species of *Eragrostis* are commonly used as forage grasses and the majority are good soil binder. To increase the Tiger population in the state of Telangana, a number of grasslands have been developed by the forest department in arid and semi-arid regions of various protected areas/forest divisions in the state, in which majority of *Eragrostis* species were used for successful development of grasslands. Thus, to understand the ecology of *Eragrostis* species, field explorations have been conducted in diverse habitats of the state during 2017-2022. Present taxonomic studies on the genus *Eragrostis* revealed that a total 23 species in Telangana state, of which four species recently added to the flora of Telangana including a new report (*Eragrostis barrelieri* Daveau) to the grass flora of India. The detailed taxonomic studies of all 23 species including new additions with photographs, ecology, distribution, variation within the species is discussed in the present communication.

T-1-OP-14

Diversity of low altitude grasslands of Western Ghats- A case study

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The low altitude grasslands of Western Ghats has rich and unique diversity. They are located between 700m a.s.l and 1500m a.s.l along windward side and form an important ecosystem of the Western Ghats. Even though considered inferior to the evergreen rain forests, they form an important vegetation and has peculiar significance in the ecology of the area. The area is characterised by the presence of shallow soil layer with abundant granite and lateritic rocks and has several microclimatic habitats including the marshes, rocky cliffs, lateritic stones and slopes. The current study carried at Paithalmala of Southern Western Gats reveals the existence of 160 species of flowering plants including 60 species of grasses and several epiphytic balsams and orchids. Several endemics including RET species, medicinal plants are found in the area. The plants are well adapted to survive the extreme summers and hazards like wildfires. The perennial grass species form an excellent support to soil, and thereby maintains the geomorphology of the area. The low altitude grasslands has significant role in the conservation of water and form an important source of water for the people living around the hills. The area is currently subject to a number of threats including intense tourism, constructions, monoculture plantations and climate changes. So necessary steps are needed to conserve these pristine environment for the coming generations.

T-1-OP-15

An overview of Genus *Tripogon* (Poaceae) from Maharashtra (India)

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Genus *Tripogon* is represented by 51 species throughout world. In India, the genus is represented by 24 species and two varieties. Among them nine species and one variety were reported from Maharashtra. During survey and collection of grasses from Maharashtra we have collected 2 species as a recollection, which were less known from Maharashtra and nobody reported in the last 50 years. Also collected an interesting species of *Tripogon* which we discussed in present communication.

T-1-OP-16

Diversity of *Cyperus* Species in Birbhum district , West Bengal, India

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This study presents a systematic assessment of the species of Cyperus of Cyperaceae family. After intensive study of the plants from Birbhum district 23 numbers of Cyperus plant species are collected and documented as important members of the Flora of Birbhum district, West Bengal, India. Collected species members of the Genus Cyperus are *Cyperus cephalotes, Cyperus platystylis , Cyperus difformis , Cyperus iria , Cyperus hyalinus ,Cyperus laevigatus, Cyperus rotundus, Cyperus exaltatus, Cyperus cuspidatus , Cyperus castaneus, Cyperus involucratus , Cyperus distans ,Cyperus haspan,Cyperus monoceohalous , Cyperus umbellatus, Cyperus brevifolius , Cyperus flavidus , Cyperus triceps , Cyperus nutans, Cyperus diffusus, Cyperus sanguinolentus, Cyperus pumilus , Cyperus digitatus.* Some members of the genus have medicinally as well as socio-economic importance. *Cyperus cuspidatus, Cyperus castaneus* are very rare occurrence species in the district.

T-1-OP-17

Ex-situ conservation of some indigenous medicinal plants through seeds, seedlings and saplings in the campus of Bejoy Narayan Mahavidyalaya, Itachuna, Hooghly

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India has a very long, safe, and continuous usage of many herbal drugs as evidenced by Ayurveda, Yoga, Unani, Siddha, Homeopathy, and Neuropathy except Allopathy. More than 70% of Indians, 1.1 billion population still use this non-allopathic system of medicine (Vaidya and Devasangayam, 2007). Out of 20,000 medicinal plants listed by WHO globally, India's contribution is 15-20%. In India, about 2,000 drugs are of plant origin.

Medicinal plants do not have a separate morphological identity, growth pattern and habitat except for their therapeutic value in the concerned organs or whole plants from which drugs extracted. Though many works on medicinal plants have been recorded in West Bengal but none of them are based on seedling taxonomy although well identified natural seedlings are suitable for *ex-situ* conservation. Seedlings of indigenous medicinal plants under natural habitats are facing biotic and abiotic threats for survival.

Considering the above fact, a strategy for *ex-situ* conservation of the indigenous medicinal plants at the campus of Bejoy Narayan Mahavidyalaya, Itachuna, Hooghly has been taken with financial assistance from West Bengal Biodiversity Board.The proposed land for conservation are laid out by cleaning, ploughing, brick-made blocks, etc. Seeds of medicinal plants are sown among properly tagged blocks. After several times irrigations most of the seeds are germinated. Again, in the rainy season, seedlings of some natural habitats of South Bengal are planted on these blocks. A few seedlings/ saplings have also been purchased from local nursery.

In some seed beds, seeds of indigenous medicinal trees like *Barringtonia acutangula, Cassia fistula*, *Holarrhena antidysenterica, Strychnos nux-vomica, Sapindus emarginatus,* etc. are sown to raise seedlings for dissemination to students and local people as well as plantation at the vacant land of our college campus. We also have made a vermicompost plant for the cultivation of some high-value indigenous medicinal/ or vegetable crops through an organic process. The so established medicinal herbs/ or shrubs are properly tagged by display of boards having medicinal values to aware the students of local colleges and schools to establish a **biodiversity conservation-education center** in our college campus.

T-1-OP-18

Reproductive Phenology And Foraging of *Ficus Benghalensis* L.

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The reproductive phenology and forage were carried out in *Ficus benghalensis* L. species at Oothumalai hill, Southern Eastern Ghats, in Tamil Nadu. The reproductive phenology was seasonal were occurred in summer (April to June) and winter (November to January). The phenological phase lasted for 50 to 60 days in each season. *Ficus benghalensis* L. had syconium initiated, while species in leafless stages. Developing phase of syconium was considerably longer in the winter than summer season. In the phenological events on the twigs counts on inflorescence (flower), fruiting was made for two consecutive annual cycles. The syconia development and colour changes in external appearance by light brown colour, brown colour, red colour and cherry red colour take place for 30 days. The cherry red colour Syconia is the mature become soft and fleshy and attractive to dispersers. After maturation of syconia the pollination was completed within a week and set to seed formation.

Foraging observation was made between 6am-4pm in a day. Foraging visitors were observed in the first phenological phase (winter season -November to January) 11 birds and one animal was recorded. In the second phenological phase (summer season -April to June) 12 birds and two animals were noted. The nutritional potential of various stages syconia (young, unripe and ripe) was evaluated and mineral contents of these fruits were high in ripe mature syconia. The study revealed knowledge about reproductive phenology and foraging birds and animals of the plant species.

T-1-OP-19

Diversity and Occurrence of Two New Species of *Luisia* Gaud. (Orchidaceae) from Mainpat Plateau of Surguja District, Chhattisgarh, India

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The Mainpat plateau covers 407 km^2 and has an elevation range of 558.15 m to 1085 m above sea level. It is located between latitudes 22^{0}81'9''N and longitudes 83^{0}28'2''E. Between July 2022 and April 2023, extensive field surveys of orchids were carried out throughout the Mainpat plateau. *Luisa* Gaud conducted this study. In the Mainpat plateau area of the Surguja District in Chhattisgarh, India, four species *Luisia trichorrhiza, Luisia zeylanica*, *L. primulina,* and *L. trichorrhiza* var. *trichorrhiza were* found. The two species, *L. primulina* and *L. trichorrhiza* var. *trichorrhiza,* are new to the Chhattisgarh orchid flora. The research represents *Luisia* Gaud's taxonomy-based investigation. Orchid diversity and distribution in the area include flowering times, associated hosts, altitudinal range, and collection location (occurrence).

T-1-OP-20

Upright Stratification of Vascular Epiphytes in Chapramari Wildlife Sanctuary, West Bengal, India

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Vascular epiphyte makes a significant contribution to tropical and sub-tropical diversity. In this study vertical distribution of vascular epiphytes and its presence of significance is analysed within the Chapramari Wildlife Sanctuary. Ten dominant tree species were selected upon which VAE (Vascular epiphytic assemblage) were studied by using binocular and rope climbing methods. For diversity analysis, quadrate method is used in the preferred ten host species. In total 1057, individual epiphytes representing 59 species of 10 families were sampled. Trees were separated over heights, DBH, and Vertical distribution according to zonation pattern confirmed by Detrended correspondence Analysis (DCA). Orchids and ferns are the dominant vegetation in the study area. However, Aroids and other angiosperms are less predominant.

T-1-OP-21

Floristic diversity and phytogeographical affinity of Chakratirtha forest, Hadagarh Wildlife Sanctuary, Odisha

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Flora has been a part of human life from ancient period and floristic analysis insights the basic information on plant species. The present study aimed to document the floristic composition and study the phytogeographical affinity of plant species in Chakratirtha forest of Hadagarh Wildlife Sanctuary, Odisha. The study encountered a total of 184 species belonging to 62 families and 104 genera. The plant species habit-wise analysis revealed that trees were dominant life form (55.76%) followed by climbers (13.46%), herbs (15.38%) and shrubs (15.38 %). The well represented families were Fabaceae contributing 13 species, Rubiaceae 8 species, Moraceae 7 species, Acanthaceae, Apocynaceae, Asteraceae, Euphorbiaceae, Malvaceae contributing 5 species each and Ebenaceae (3 species). As per the species composition, forest was dominated by deciduous trees and few numbers of evergreen tree species. According to Raunkiaer plant life-form, phanerophytes holds more species than the other categories. The phytogeographical affinities revealed that flora of Chakratirtha has strong affinity with Sri Lanka and Myanmar followed by Thailand, China, Malaysia, Africa and Australia. The present study baseline information will be helpful for conservation and sustainable utilization of the plant resources of the protected area.

T-1-OP-22

Effect of hormonal supplements in standardized basal medium for efficient PLBs formation in an endangered orchid *Vanda bensonii* for conservation

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The horticulturally and medicinally potent *Vanda bensonii*, is a conservation prioritized orchid species. The present study optimized the requirements of basal medium and hormonal combination for asymbiotic seed germination, and protocorm like body formation (PLBs). The seeds were set after four months of manual pollination which were cultured on KC medium, MS and ½ MS medium supplemented with 2% peptone. It was observed that KC medium containing 2% peptone recorded the highest frequency of asymbiotic seed germination in compare to other. The protocorm like bodies (PLBs) formed in three months old culture were transferred to different basal medium to identify most suitable medium for PLB formation. Necrosis of protocorms was observed in most of the treatments except KC basal media which shows the highest rate of proliferation. Half strength MS basal media, Vacin & Went basal media and Lindemann orchid basal media shows moderate growth whereas 100% necrosis was recorded in Gamborg's basal media, Mitra basal orchid media, MS basal media. The KC medium containing 2% peptone is standard for further proliferation and *in vitro* propagation. In the second phase of experiment protocorms were transferred in 2% peptone supplemented KC medium along with different combinations of Auxin (IAA, NAA) and Cytokinin (BAP, Kinetin, 2iPA) maintaining 10 hours photoperiod at 22°C culture conditions. It has been observed after three months that KC medium having IAA 2mg l^{-1}/ BAP 1mg l^{-1} shows the highest proliferation rate than other combinations of auxin and cytokinin. Whereas all combinations of NAA+kinetin resulted necrosis. The study confirmed that standardization of basal medium is important for efficient PLB's formation, further micropropagation and conservation of *Vandabensonii*.

T-1-OP-23

Conservation of *Oxystelma esculentum* (L. f.) Sm. Through Stem Cuttings

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Oxystelma esculentum (L. f.) Sm. (Apocynaceae) is a very rare climber. It is used as a remedy for various diseases and microbial infections. However, habitat degradation and loss of associated species are two major reasons behind the rarity of *O. esculentum* (L. f.) Sm. in the wild. Therefore, conservation practices were undertaken by multiplying this rare climber through stem cuttings. The saplings, raised from the stem cuttings, were planted in the wild habitats and donated to local herbal healers to create awareness. As the plant is used locally to increase lactation in domestic animals, saplings were donated to marginal farmers rearing lactating cows, buffaloes, and goats.

T-1-OP-24

Taxonomic delimitation and phytochemical evaluation of vegetable Amaranths

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Leafy vegetables are the key ingredients of a balanced human diet, in the hot humid tropical low-land of Africa and Asia, especially in the Indian tropics. It provides the cheapest, and most reliable sources of vitamins, minerals, fibres and essential amino acids and antioxidants. Vegetable amaranths are considered as the most popular vegetables in India. Mild spinach-like flavour, high yield, ability to grow in hot weather and high nutritive value are the reasons for their popularity. Wide morphological variability with overlapping characters, presence of a large number of morphotypes, landraces, crop-wild relatives, synonyms, subspecies and varieties have created disputes in taxonomic delimitation and proper identification of taxa. *A. tricolor* and *A. blitum* are two most popular leafy vegetables in India, enriched with many land races, morphotypes and crop-wild relatives. Two species complexes or aggregates i.e., *Tricolor*-complex and *Blitum*-complex have been introduced to resolve the taxonomic ambiguity also to ease the identification process. Both the complexes included crop-wild relatives, as well as common cultivated forms. Along with nutrient factors, anti-nutrients like oxalates are also abundant in leafy vegetables which reduce the bioavailability of nutrients in the body. The nutrient factors of the conventional vegetables are well documented but those of the crop-wild relatives, land races are yet to be screened properly. There is a need for screening of all existing germplasm of vegetable Amaranths including crop-wild relatives, morphotypes and landraces to identify them in terms of nutrient, antioxidant and antinutrient content. An array of important phytochemical components has been identified in the organic leaf extracts of vegetable Amaranths through GC-MS analysis which proved that the crop-wild relatives are not only palatable but equal or even better nutrient-rich in some cases specially in terms of antioxidant content.

T-1-OP-25

Host tree specificity of epiphytic polypodiaceae

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Members of Polypodiaceae are mostly epiphytic. The present study focuses on the host tree specificity and composition of epiphytic Polypodiaceous fern in Darjeeling eastern Himalaya. The region comprises of five vegetation zones and each zone has specific host canopies that shelter the Polypodiaceous fern taxa. In the tropical forest some of the dominant hosts are *Shorea robusta* and *Lagerstroemia parviflora* and the epiphytic Polypods in these hosts include *Drynaria quercifolia*, *Pyrrosia lanceolata* and *Microsorum punctatum*. Towards the sub-tropical zone trees like *Tetrameles nudiflora*, *Ficus benghalensis*, *Duabanga grandiflora* shelters *Lepisorus sublinearis*, *Pyrrosia costata*, *P. heteractis* etc. In sub-temperate forests *Engelhardia spicata, Saurauia napaulensis, Ficus neriifolia, F. auriculata* holds epiphytic polypods like *Loxogramme involuta, L. porcata* and *Drynaria propinqua.* In the upper hill forests of temperate region, *Symplocos glomerata*, *Quercus lamellosa*, *Alnus nepalensis*, *Magnolia campbellii*, *Lithocarpus pachyphyllus*, *Cryptomeria japonica* are the specific hosts for species like *Arthromeris wallichiana*, *Lepisorus nudus, L. contortus*, *Goniophlebium amoenum*, *G. argutum*, *Pichisermollodes ebenipes*, *Selliguea oxyloba*. Towards the higher tier, the species richness shows a sharp decline in sub-alpine zones where few species like *Arthromeris himalovata* and *Lepisorus loriformis* grow on host trees like *Rhododendron falconeri*, *Rhododendron grande*, *Acer campbellii.* Host tree diameter, bark texture and branching pattern had the greatest influence on species diversity. It is observed that maximum numbers of species occur in the host tree with larger CBH (circumference at breast height) with rough bark, storing humus and water as compared to the host tree with smaller CBH with smooth bark texture.

T-1-OP-26

The diversity of the genus *Ficus* L. (Moraceae) in Northeast India

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Ficus L. belonging to the Family Moraceae is one of the dominant genus comprising of c. 735 taxa in the world (Berg & Corner, 2005) and 115 taxa (*c*. **89** spp. and **26** infraspecific taxa) occur in India (Chaudhary *et al*., 2012). In Northeast India, it is represented by 67 taxa including 13 infraspecific taxa based on the literature and field surveys. Based on the morphological features and distributional pattern (Berg & Corner, 2005), the genus *Ficus* is classified into 6 subgenera, 19 sections and 27 subsections. Of these, 11 sections and 12 subsections occur in the Northeast India up to 3048 m asl. The maximum diversity is in Assam with 58 taxa, followed by Meghalaya (54 taxa), Arunachal Pradesh (50 taxa), Sikkim (40 taxa), Mizoram (35 taxa), Tripura (30 taxa), Manipur (27) and minimum in Nagaland with 24 taxa. This genus comprises mainly trees, shrubs and epiphytes, and a few climbers (*F. hederacea*), creepers (*F. pumila*), rheophytes (*F. squamosa*), and lithophytes (*F. hederacea*). *Ficus benghalensis* being the India's national tree is culturally important with religious significance in the Vedas and also economically valuable. Some species are used as a source of traditional medicines, vegetables and edible fruits because of the presence of essential minerals. Hence, this paper highlights the diversity, distribution, altitudinal variation, phenology, and economic importance of the genus *Ficus*.

T-1-OP-27

Flora of Susunia Hill, West Bengal

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Susunia hill is the most famous hill of Southern West Bengal. The hill is situated at a distance of 20 kilometers north-west of the district headquarter town Bankura. The said hill occupies an area of about 9 square kilometers only but gained its importance being a well known site for religious, historical, Geological and adventure sports like rock climbing. The plant diversity of the said hill is not yet explored extensively. Though, Sanyal (1994) and a few other workers reported some plants from this hill. The present study was aimed at preparing the flora of the hill. Though during the study basic ecological data are also recorded. Till date a number of 364 species of Angiosperms and 14 species of Pteridophytes are collected from the hill and identified, which includes 1 species reported by previous workers too. Among the plant species collected in the present study, 2 species are new report for the state of west Bengal where as 12 species of Angiosperms and 14 species of Pteridophytes are new addition to the flora of concerned Bankura district. The vegetation is basically dry-deciduous in nature which is evident from dominance of annual herbaceous plants as well as deciduous shrubs and trees. Among other ecological parameters, population pressure and subsequent detrimental effect on the rich flora of this small hill due to increasing number of tourists throughout the year is clearly visible and effectively recorded for few species of angiosperms.

T-1-OP-28

Botanical Garden – from Idea to Reality: A case study with reference to its role in Awareness Generation and Species Conservation

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Botanical garden is a collection of living plants. Major objective of the garden is to maintain extensive collection of well labelled plants. It is one of the important cultural resources which offer the city dweller part of the natural environment and a mental escape from psychological pressure.

This Botanical Garden, being discussed here, is developed in around 2000 m^2 area inside the educational institute in the heart of the city, Mumbai. It houses approximately 375 species of plants. It has around 200 species of well labelled medicinal, aromatic and other economically important plant species. Other sections in the garden are aquatic garden, Ferns, Special section for visually impaired persons.

This paper deals with the role of this garden in science education, awareness generation on Indian Knowledge System and conservation of endemic and threatened species.

T-1-OP-29

Some lesser-known plants of Gujarat from Dahod district

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Dahod is the easternmost district of Gujarat, sharing a boundary with the states of Rajasthan and Madhya Pradesh, with diverse habitat *i.e.,* grasslands, savannas, wetlands, dry deciduous hilly forests. Previous studies on the floristic diversity of Gujarat depicted a very narrow distribution of some taxa within the state. Hence in the present study such rare species have been reported for the first time from Dahod district, Central Gujarat. These species are documented and its local and global distribution is discussed here. Such information of distributional range extension will play vital role in the conservation and management planning of important species.

T-1-OP-30

Morphotaxonomic Studies of Diversity of Genus *Eragrostis* of Family Poaceae of Nagpur Division, Maharashtra

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Nagpur division is the part of vidarbha it includes about 6 districts. Survey of grasses biodiversity of study area conducted during 2014-2018, reported 168 species belonging to 70 genera. *Eragrostis*is the largest genus of study area. It has 13 species which belong to subfamily pooideae. The aim of our study is morphotaxonomic revision of family poaceae and details of macro and micro morphology of some important grasses.

T-1-OP-31

Ethnoflorestic Diversity and Conservation Strategies of Sacred Groves in Karur District, Tamil Nadu

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Sacred groves are small patches of forest that are severely endangered but communally protected as most have a profound religious significance to the indigenous community guarding them. It serves as the conservation pockets of local biodiversity such as ethnobotanically and commercially important plant species. Sacred groves are considered to be repository of many important folklore medicinal plant species including endangered and endemic categories. An ethnoflorestic survey was carried out in five sacred groves of Karur district during the period of July 2022 - June 2023 to assess and documented the medicinal properties of plants from elderly people, traditional healer and rural communities through personal interviews and group discussions. From this study, about 86 plant species belonging to 50 genera under 40 families were recorded, majority of medicinal plant species are found in Asteraceae, followed by Asclepiadaceae, Euphorbiaceae, Apocynaceae, Solanaceae, Boraginaceae, Scrophulariaceae, Acanthaceae, Amaranthaceae, Moraceae, Loganiaceae, Rutaceae, Combretaceae, Rubiaceae, Malvaceae, Sterculiaceae, Verbenceae, Lamiaceae, Meliaceae, Cucurbitaceae, Passifloraceae, Lauraceae, Lilliaceae, Cyperceae and Poaceae. The identified plant species were used for treating various human ailments like stomach ulcer, headache, throat infections, healing of wounds, body pain, poison bite, nervous problem, skin disease, cough, fever, dysentery, rheumatism, mumps, sugar problem and leprosy etc. Sacred grove remains unexpected and no comprehensive studies of their ecology and ethnobotanical issues. So the conservation of medicinal plant diversity and protection of sacred groves is most important for the future generation.

THEME 1: FLORISTICS, PLANT DIVERSITY AND CONSERVATION [POSTER]

T-1-PP-01

Foliar Morphology and Micromorphlogical study of the species *Dendrocnide sinuata* (Blume) Chew

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The Urticaceae family encompasses a diverse array of plant genera, with *Dendrocnide* standing out as a notable genus. Comprising mostly woody species, *Dendrocnide* is renowned for its striking features, including brightly-coloured fruits and the notorious stinging hairs capable of delivering painful, even lethal stings. However, *Dendrocnide*'s taxonomy and phylogeny remain understudied. This study delves into the micromorphological characteristics of *Dendrocnide sinuata* (Blume) Chew, shedding light on its unique leaf structure and function. The findings reveal distinct features, including irregular-shaped abaxial epidermal cells, pentagonal adaxial epidermal cells, and hypo-stomatic leaf arrangement with random stomatal orientation. Stinging trichomes on the abaxial surface, non-glandular trichomes on veins, and glandular dots contribute to leaf defence mechanisms, water regulation, and potential interactions with pollinators and seed dispersers. Notably this research represents a pioneering effort, as previous work primarily examined trichome morphology in different species within the genus. The comprehensive analysis presented here advances our understanding of *Dendrocnide sinuata* and highlights its adaptation to environmental condition. There is no significant work on the adaptations to environmental conditions. Moreover, present work emphasizes the need for further investigation into foliar morphology, micromorphology, and histology under varying habitat conditions, which could yield valuable insights and potentially innovative approaches, such as bio-weapons, for defence purposes.

T-1-PP-02

Floral diversity and Biological Spectrum of some grassland communities of Sadar Sub-division Mayurbhanj, Odisha

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The floristic composition and life-form spectrum of ten grassland communities of Sadar subdivision Mayurbhanj in Odisha was studied during June 2022 to June 2023. The study area i.e. ten different blocks were situated in between the latitude $21^0$42’41.59" to $22^0$10’04.96" N and longitude $86^0$33’11.09" to $87^0$02’54.10" E. A data matrix was prepared in the presence (1)/ absence (0) of species to estimate the species richness of various growth-forms and life-forms for the particular study sites. Present study revealed that the floristic diversity of Sadar subdivision in Mayurbhanj district comprised of 115 species where (51 Grasses and 64 Non-Grasses) belongs to 77 genera and 23 families. Among all the families Poaceae occupies a greater number of species (i.e. 51 species) followed by Cyperaceae (20 species), Fabaceae (7 species), Asteraceae (6 species), Amaranthaceae (4 species), the species belongs to families Rubiaceae, Euphorbiaceae and Malvaceae contribute (3 species), Convolvulaceae, Commelinaceae, Lamiaceae (2 species), while the remaining 12 families represented single species each. The Life-form classes of Sadar subdivision was compare with Raunkier’s Normal spectrum and the Phyto spectrum of present study indicates “Thero-Hemicryptophytic” types of Phyto climate. This variation in Life-form and species composition in the grassland community might be due to geographical distribution, climatic conditions and biotic interference of the locality.

T-1-PP-03

Grasses of Andhra Pradesh

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Andhra Pradesh is situated in the middle portion of the Eastern half of the Indian Peninsula, and it lies between the latitudes 12°–19° N and longitudes 77°–84° E. It is bordered by Telangana to the North-West, Chhattisgarh to the North, Odisha to the North-East, Tamil Nadu to the South, Karnataka to the West, and the Bay of Bengal towards the East. Total geographical area of the state is *c.*1162,975 km^2 with 974 km coastline along the Bay of Bengal. Geographically, the whole state can be divided into the Coastal Plains, the Eastern Ghats, and the Western plains. Predominant forest types are 1. Tropical semi-evergreen forests, 2. Tropical moist deciduous forests, 3. Southern dry deciduous forests, 4. Northern mixed dry deciduous forests, 5. Dry savannah forests, 6. Tropical dry evergreen forests, and 7. Tropical dry evergreen scrubs. In addition, coastal vegetation is also predominant *viz.*, estuarine vegetation the family Poaceae comprise 1391 species belonging to 242 genera in India. Of these 327 taxa under 82 genera are endemic to India (Nagaraju & al., 2023). During the field tours conducted while working on Grasses of Andhra Pradesh, 423 field numbers were collected of which, 356 field numbers were identified using revisionary works and regional/state floras. Specimens were processed as per the standard herbarium techniques. Present study resulted in inventorying 334 taxa under 114 genera. Of these, the genus *Eragrostis* is largest with 25 taxa followed by *Chrysopogon* with 13 taxa. 3 species are strictly endemic to Andhra Pradesh namely *Iseilema venkateswarlui, Lophopogon prasannae* and *Tripogon trifidus* var. *tirumalae*.

T-1-PP-04

Pollen morphologcial study of Linderniaceae members from Eastern Himalaya

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Linderniaceae is one of the recently established angiosperm family and shows more or less pantropical distribution. Although, a widely distributed family, there are no Light microscopic pollen morphological study on Linderniaceae. Here we studied pollen morphology of 16 taxa of four different genera under the light microscope. Fresh and dried pollens were studied under light microscope following the acetolysis methods suggested by Erdtman (1952, 1969) and Halbritter et al. (2018). Pollen grain type, shape, outline, size, length of the polar axis (P) and equatorial diameter (E), P/E ratio, and exine thickness were documented for 16 taxa of four genera. Pollens were monads, isopolar and radially symmetric. The mean P value varied from 13.96 ìm in *L. procumbens* to 27.36ìm in *T. violacea*. The mean E value varied from 13.63 ìm in *L. procumbens* to 24.02 ìm in *T. violacea*. Pollen grains of Linderniaceae shows more or less similar types of characters, which varies qualitatively and quantitatively in different genera. *Torenia* shows highest exine thickness values varied from. 1.36 – 1.79 ìm. Rest three genera show lesser exine thickness and distinguishable by their polar outline type, i.e., Circular in *Bonnaya*, Lobate in *Lindernia*, Triangular in *Vandellia*.

T-1-PP-05

Morphoanatomical and Molecular Characterisation of *Annona squamosa* L. Accessions from Kerala

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Annona squamosa L. commonly known as sugar apple is a multipurpose tree. The fruits are consumed widely and the fruits contain vitamin C and minerals such as calcium, phosphorous and potassium. All parts of *A. squamosa*, including the bark, leaves, and roots, have hepatoprotective, neuroprotective, antibacterial, antifungal, anti-inflammatory, anti-cancer, anti-ulcer, antidiabetic, antidiarrheal, antiplatelet, and antioxidant properties with the leaves being especially potent in these areas. Coumarins, tannins, cardiac glycosides, flavonoids, sugars, and saponins are only a few of the phytochemicals found in *A. squamosa* leaves.

The plant is often grown in tropical and subtropical regions. Within this species, various cultivars are available but the seed propagation with cross pollination by nitidulid beetles results in considerable variability. It is necessary to evaluate the natural variability and the diversity should be conserved *ex situ* and *in situ* to utilize for further hybridization programmes. In the present investigation, diversity among 30 sugar apple genotypes, which were collected from various parts of Kerala were compared based on their morpho-anatomical characters. Among them morphologically different 18 genotypes were studied for diversity at molecular level using RAPD -ISSR markers.

The 8 random primers yielded a total of 52 scorable markers, of which 32 were polymorphic. 14 ISSR primer pairs produced scorable and clear-cut bands and a total of 48 alleles were detected from these 14 primer pairs of which, 34 alleles were polymorphic. The number of alleles generated from each primer pair ranged from 3 to 7. The overall size of the PCR products amplified from these 14 primer pairs ranged from 10 to 180 bp. RAPD -ISSR analysis revealed that 4 genotypes *i.e.,* collections from Palakkad (KPAS-03), Kasargod (KKAS-07), Idukki (KIAS-05) and Kollam (KQAS-02)- were divergent and the rest of sixteen genotypes were almost similar to each other and these 16 genotypes were categorised into three distinct groups.

The results have shown that there is considerable diversity amongst the *Annona squamosa* L. genotypes collected from different locations. ISSR markers have proved to be suitable for characterizing sugar apple varieties. The genotypes KPAS-03, KIAS-05, KQAS-02 and KKAS-07 can be conserved based on true genetic diversity.

T-1-PP-06

Floristic Composition of Agartala, Tripura, India

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Floristic survey of Agartala and surrounding areas in the year 2021-22 recorded a total of 332 species under 252 genera and 83 families. There were 77 dicot and 10 monocot families. The Tree species were distributed over 45 families representing 95 genera and 121 species. The herb species were distribured over 49 families representing 119 genera and 161 species. The shrub species were distributed over 20 families representing 35genera 46 species. Among herbs major contributing families are Asteraceae, Acanthaceae, Apocynaceae, Brassicaceae, Cyperaceae, Poaceae, Polygonaceae, Lamiaceae, Scrophulariaceae. Major contributing families among the tree species are Caesalpiniaceae, Euphorbiaceae, Myrtaceae and among the shrub species the major contribuing families are Caesalpiniaceae, Rubiaceae, Euphorbiaceae. The dominating tree species within different study areas are *Acacia auriculiformis, Artocarpus heterophyllus, Azadirachta indica, Cassia siamea, Cassia fistula, Cocos nucifera, Delonix regia, Eucalyptus citriodora, Mangifera indica, Psidiam guajava, Samania saman, Shorea robusta* and different species of *Albizzia, Terminalia, Syzygium,* and *Ficus etc*. Among the herb the dominating species are *Ageratum conyzoides, Acalypha indica, Croton bonplandianum, Heliotropiun indicum, Mimosa pudica, Mikania cordata, Parthenium hysterophorus* and different species of *Amaranrhus, Chenopodium, Brassica, Polygonum, Cyperus* and *Poaceae*. Among the shrub species most common members are *Ipomoea fistulosa, Ricinus communis, Lantana camara etc.*

T-1-PP-07

Floristic study of the family Asteraceae in Barpeta district of Assam

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The present investigation focuses on the family Asteraceae, also known as the Compositae, in the Barpeta district of Assam, emphasizing the floristics and morphological aspects of various species. The diverse species of the family includes *Ageratum conyzoides, Blumea lacera, Tridax procumbens, Mikania micrantha, Youngia japonica, Parthenium hysterophorus, Eclipta prostrata, Chromolaena odorata, Bidens pilosa, Gamochaeta purpurea, Gamochaeta malvinensis, Synedrella nodiflora, Acmella calva, Acmella paniculata, Cotula hemisphaerica, Sonchus arvensis, Sonchus oleraceus, Cyanthillium cinereum, Grangea maderaspatana, Gnaphalium polycaulon, Gnaphalium uliginosum, Melampodium divaricatum, Xanthium strumarium, Cosmos sulphureus, Erigeron canadensis, Erigeron bonariensis, Crassocephalum crepidioides, Sphaeranthus indicus, Sphagneticola trilobata, Elephantopus scaber,* and *Blumea densiflora.*The study delves into the common taxonomic features of the recorded species in general and unique features in particular. Notably, the Asteraceae family exhibits a wide array of inflorescence types, including racemose, head or capitula, globose, compound capitulum, and spike or cone-like inflorescences. Furthermore, the study examines the distinction between disc florets and ray florets, highlighting the diversity within homogamous and heterogamous heads. The presence of pappus structures on the calyx for fruit dispersal is also explored. The Asteraceae family, with its gamopetalous corolla, syngenesious stamens, bicarpellary ovary, and unique fruit and seed characteristics, emerges as a highly evolved and polyphyletic group. It is characterized by its distinctive capitulum inflorescence and the remarkable plan of its florets. Understanding the floristics and botanical features of the species contributes to our appreciation of the remarkable diversity within the family Asteraceae in the Barpeta district of Assam. Furthermore, the Asteraceae, one of the largest plant families globally, holds immense ethnopharmacological potential.

T-1-PP-08

In-vitro conservative effort of medicinal, ornamental *Geodorum densiflorum* (Lam.) Schltr. endemic and endangered orchid from Eastern Ghats of Andhra Pradesh through seedling culture

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The *Geodorum densiflorum* is an endemic and endangered medicinal orchid found in the Eastern Ghats of Andhra Pradesh. Due to its medicinal and ornamental significance, the goal of the current investigation was to boost seedling recruitment through in-vitro propagation, which is crucial for population growth, persistence, conservation and survival. For accelerated propagation, asymbiotic *in-vitro* germination of seeds is appropriate procedure. To evaluate seed germination, PLB formation, and SPS development, terrestrial orchid media were utilized in addition to MS media. The combination of chosen medium with activated charcoal, coconut water of distinct volume and PGRs was kept up for further growth. BAP, IAA, TDZ, and IBA, are utilized in combination as PGRs. The best results for seed germination were noted in weeks, and achieved in MS-AC medium at 88.4%, MO medium at 86%, and BM2 medium at 73.6%. The activated charcoal media showed the best results for seed germination. The following ratios had a positive impact on distinctiveness and growth. Rhizome distinction and SPSs development have been noticed in MS-AC media with + BAP (1.5mg/l) + IAA(0.9 mg/l)+TDZ(1.2mg/l)+IBA(2mg/l), MO media with BAP (2.5mg/l) + IAA(1.2mg/l) +TDZ (0.6mg/l) + IBA(2mg/l) and BM2 media BAP (2.0mg/l) + IAA(0.9 mg/l) + TDZ(0.9mg/l) + IBA(2mg/l). For the formation of PLBs, MS-AC media had the highest proportion with PGRs fortified media (86.6%), followed by MO media (81.4%), and BM2-AC media (73.8%). As of this study, the shortest amount of time for the seed germination, PLB formation, rhizome development, SPSs development were MS-AC(4.2±0.15wks), MS-AC (18.2±0.3 wks), and MS-AC(26.4±0.2 wks), weeks respectively. MO(4.6±0.3wks), MO(19.4±0.2 wks), and MO(28.4±0.15wks), correspondingly. BM2-AC (5.2±0.17 wks), BM2-AC (20.5±0.17wks), BM2-AC (30.2±0.17 wks).

T-1-PP-09

Floristic study on Kolleru Lake of Andhra Pradesh, India

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Kolleru lake is a large fresh water lake in Andhra Pradesh situated between the Krishna river on the west and the Godavari river on the east. The lake has an area of about 904 km^2 at +10 counter level, of which 260 km^2 is in the kaikaluru and Gudivada taluks of Krishna district and the rest in Eluru, Bhimavaram and Tadepalligudem taluks of the west Godavari district. The area lies between longitudes $81^0$40’ and $80^0$20’ in the east and latitudes 17^0 25’ and $16^0$28’ to the North. Geologically, it is believed to be of recent origin formed by excessive silting of the Krishna and Godavari rivers, of an earlier lagoon separating it completely from the sea. The field trips conducted last 2 years and intensively explored covering of all seasons for the collection, identification and taking plants images for e-Herbaria**.** A total of more 255 specimens were collected from the Kolleru Lake and made herbaria by following standard methodology. Out of the total 255 specimens collected 200 specimens were studied morphologically by following recent literature. The present study reveals that the Angiosperm flora comprises 150 taxa under 85 genera, 55 families respectively.The important plants like *Alternanthera paronychioides*, *Andrographis paniculata*, *Bixa octandra*, *Centella asiatica*, *Ceratophyllum demersum*, *Hemidesmus indica, Ludwigia adscendens, Nymphoides hydrophylla, Oxystelma esculantum, Passislora foetida, Phyla nodiflora, Polygonum plebeiem, Typha angustata.* The study area totally unexplored and expecting rich in floristic diversity, endemism and implications discussed here to know the floristic wealth of Kolleru Lake.

T-1-PP-10

Medicinal Plant Diversity in Sacred Groves of Alappuzha District, Kerala

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Sacred Groves represent relic untouched forests patches protected by assigning them as abode of Gods and Goddesses. They serve as a source of several medicinal plant species and managed as part of local cultural tradition. Around 14000 Sacred Groves have been reported from all over India, which act as reservoir of flora and fauna, amid rural and urban settings. They are considered as one of the land use systems with ecological and socio-cultural importance in the region. Studies conducted in the State have already established the fact that well conserved sacred groves are providing unparalleled ecological attributes. The present study was carried out in 146 sacred groves in 5 Taluks of Alappuzh district, Kerala. Floristic studies of these sacred groves recorded 74 medicinal plant species belonging to 58 genera and 33 families. Among the 74 species, 36 are herbs, 12 are trees, 21 are shrubs and 5 are climbers. These plants species are used in different medical systems such as Traditional, Folk, Ayurveda, Siddha, Unani and Homeopathy. The dominant medicinal plants recorded are *Vateria indica, Alstonia scholaris*, *Garcinia gummi-gutta*, *Mimosops elengi*, *Geophila repense*, *Hydnocarpus pentandra*, *Cinnamomum verum*, *Acacia caesia*, *Persea macrantha*, *Leea indica*, *Asparagus racemosus*, *Saraca asoca*, *Strychnos colubrina*, *S. nux-vomica* etc. The presence of rare and threatened species such as *Myristica malabarica*, *Gloriosa superba, Gymnacranthera canarica* etc. increases the value of Sacred Groves in terms of conservation. Also the environmental services provided by the sacred groves are priceless in terms of carbon sequestration, biodiversity, water and soil conservation. Moreover, due to its religious aspects, many of the rare and endemic plants are well cared and ensure their very survival. Therefore, this is the time for conservation of such vital assemblage of vegetation that act as 'Green Spots' of biodiversity with the help of local communities before it is vanished.

T-1-PP-11

Morpho Taxonomic Study of Wild Members of Poaceae from Buldhana District, Maharashtra, India

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The family Poaceae is one of the most economically important group of Angiospermic plant. A plant specimens of this family commonly known as Grass. It is widely used for food, fodder, as well as making musical instrument like flute. Rice and Wheat are the major food crop belonging to this family. Flower of the grasses are small and minute, hence this group of plants are neglected. So it is necessary to study and explored this family.

During present study visited to the different areas of Buldhana district i.e. Malkapur, Nandura, Jalgao jamod and Khamgaon Talukas; 45 specimens of different grasses have been collected. During collection field diary has been maintained. Field characters such as density, frequency, height, habitat, etc. were recorded. After collection specimens were dried with the help of plant presser. After drying specimens were mounted on herbarium sheets by stiching. After preparation of herbarium all specimens were observed under stereoscopic binocular microscope. Spikelets were dissected, glumes, lemmas, palea were observed; specimens were identified with the help of standard floras i.e. Grasses of Maharashtra by Dr. G. G. Potdar et al., Grasses of Marathawada by Dr. B. W. Patunkar, Flora of Marathawada by Dr. V. N. Naik, Flora of British India by Hooker, and all available literature. After identification all the specimens were discribed on the basis of actual specimens, during description all the vegetative as well as floral characters were covered.

T-1-PP-12

Preliminary account angiosperms of Chatra District, Jharkhand, India

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The Chatra district of Jharkhand state lies between the parallel of 23^0 38'and 24^0 27' N latitude and 84^0 26' and 85^0 25' E longitude. It is bounded on the east by Hazaribagh, west by Palamu district, south by Latehar district of Jharkhand and north by Gaya district of Bihar. This district covers area of 3706 sq. km. The river in Chatra district are Mohana, Barki, Chako, Damodar and Garhi. Chatra district major area is covers by forest about 60.4% of total geographical area and 29.2% of total Jharkhand and have one wildlife sanctuary. Major soil of this district is red laterite acidic soil. Seasonal vegetation shows a remarkable feature which changes with the advancement of the season. Up to date nomenclature, brief description, phenology and ecology of each taxon has been discussed in the paper. The specimens with their field numbers are kept in Duthie Herbarium (DUTHIE), Department of Botany, University of Allahabad, Prayagraj.

T-1-PP-13

Maharashtra Nature Park – A Journey from a Land Fill Site to a Green Lung & its Role in Species Conservation and Generating Public Awareness

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Mumbai is a densely packed urban city with less than 15% green cover. Maharashtra Nature Park (MNP), spread over 33-acre area on Sion Dharavi Road, Sion, provides a much-needed area of nature. It is a man-made forest developed on a former dumping ground with the objectives of nature conservation, education and public-awareness kept in mind. Managing a garbage dumping ground is a problem all over the world and MNP offers a wonderful solution to it.

The park is adjacent to the natural ecosystem of Tiwar by the Mithi River basin. It has a biodiversity of more than 400 species of flora and over 100 species of fauna. The park has a wooded area, divided in various other zones and a nursery area. It serves as a recreation cum education center for all visitors. It conducts various events and trails by experts which helps the public understand and interact with nature. It acts as one of the important catchment area in the heart of the city.

This paper deals with the role of MNP as green lung in the heart of the city, species conservation as well as its contribution to public awareness.

T-1-PP-14

Morphogenetic diversity of some Monocots from North-West India

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North-Western regions of India, especially the regions of Punjab and Haryana are under intensive agriculture which has led to loss of biodiversity of many wild endemic species in the region. The other areas or states of the region are also under stress due to spurt in anthropogenic activity because of increased infrastructural and recreational requirements. The present studies were thus undertaken to evaluate the morphogenetic diversity of some monocot members upon exposure to such stress may afford certain cytological changes for better adaptation or evolution of the plant species. During present investigations a total of seventy-nine population belonging to ten species of seven genera were studied in details. Divergent chromosome numbers could be detected in thirteen populations of six species. Presence of n=14 for *Costus pictus* is being reported for the first time at world level in the present studies. Presence of B-chromosome in *Alisma plantago-aquatica* (n=14+0-11B), *Murdannia nudiflora* (n=10+0-1B), *Tinantia erecta* (n=32+0-1B) and *Tradescantia pallida* (n=12+0-1B) are the first reports at world level. Within India the investigations have brought forth varied chromosome number reports for *Tinantia erecta* (n=32 and 34) and *Cyanotis cristata* (n=12+0-1B).

T-1-PP-15

Distribution and morphological diversity of the genus *Anaphalis* DC. (Asteraceae) in India

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The genus *Anaphalis* DC. belongs to the tribe *Gnaphalieae* of the family Asteraceae and comprises of c.110 accepted species worldwide. It represents the largest genus in the tribe *Gnaphalieae* with major distribution in Asia, North and South America. In India, there is significant species diversity with 42 taxa (37 species and 5 varieties) which are widely distributed from Western to Eastern Himalayas to Peninsular India usually at elevation ranging from 2000 to 4500 m. The genus is represented by c. 12 endemic species in India with highest number in Western Ghats, followed by Himalayan region. With such species diversity, *Anaphalis* show a high level of variation in its morphological characters. Further, several taxa under the genus are with high phenotypic plasticity and often it is very difficult to distinguish them from their allied taxa. Even sometimes, some members of *Anaphalis* are wrongly identified at generic level due to their very close morphological similarities with some species of *Gnaphalium* L., *Helichrysum* Mill., *Leontopodium* R. Br. ex Cass. and *Pseudognaphalium* Kirp. The objectives of this poster are to present the distributional and morphological diversity of the different taxa under *Anaphalis*. These are the preliminary observations in connection with the revisionary study of the tribes *Coreopsideae* and *Gnaphalieae* in Indian context which was initiated from June 2023 under 'Flora of India' research scheme of the Botanical Survey of India with aim to prepare the state of knowledge on the systematics of the members under the two tribes, supplemented by molecular data. Also, here we have tried to shade some light on the economic and medicinal potential of this genus based on literature review.

T-1-PP-16

Changing Diversity in the Family Cyperaceae of Uttar Pradesh, India

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The family Cyperaceae is commonly known as 'sedge' family. It is fourth largest family of angiosperms of Uttar Pradesh with 113 species and 17 genera (Sinha et al. 2016). The paper deals with the changes in the family Cyperaceae of Uttar Pradesh, observed during recent survey conducted by authors. The changes including addition, disappearance and reducing species diversity in the state. A number of species, those were collected by earlier workers but could not be recollected from same or different locality by the authors. Some of the species become rare in Uttar Pradesh are *Abildgaardia ovata* (Burm. f.) Kral., *Bolboschoenus glaucus* (Lam.) S. G. Sm., *Bulbostylis barbata* (Rottb.) C. B. Clarke., *Bulbostylis densa* (Wall.) Hand.-Mazz., *Carex fedia* Nees. R. Wight, *Courtoisina cyperoides* (Roxb.) Sojak., *Cyperus alopecuroides* Rottb., *Cyperus alternifolius* L. Mant., *Cyperus haspan* L., *Cyperus niveus* Retz., *Cyperus paniceus* (Rottb.) Boeckeler., *Cyperus richrdii* Steud., *Eleocharis atropurpurea* (Retz.) J. Presl & C. Presl., *Eleocharis dulcis* (Burm. F.) Trin. ex Hensch., *Eleocharis ovata* (Roth) Roem. & Schult., *Erioscirpus comosus* (Wall.) Palla., *Schoenoplectiella latriflora* (J. F. Gmel.) Lye., *Schoenoplectiella mucronatus* (L.) Jung & H. K. Choi., *Fuirena cuspidata* (Roth) Kunth., *Schoenoplectiella roylei* (Nees) Lye. The details data of these findings and the factors responsible for the changes have been discussed in paper.

T-1-PP-17

The genus *Pleione* D. Don (Orchidaceae) in India – a synopsis and assessment

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Pleione D. Don [ORCHIDACEAE-EPIDENDROIDEAE-ARETHUSEAE-COELOGYNIINAE] with its vibrantly colored flowers, is the genus of the Himalayan Mountains adapting to variety of habitats, mostly in lightly shaded places. The genus was established in 1825 by David Don based on two Himalayan species, *P. praecox* and *P. humilis*, both previously figured and described by Sir James Smith as species of *Epidendrum*. Subsequently it was long treated by J. Lindley 1821, 1830), J.D. Hooker (1890) and King & Pantling (1898) as a section under *Coelogyne* Lindl. Much later in 1903, Rolfe resurrected the genus by distinguishing it from *Coelogyne* in having much different annual pseudobulbs, peculiar inflorescence and a very distinct labellum. The genus comprises of 39 species distributed in the Himalayas in India, Tibet, Nepal, Bhutan, China, Myanmar, Thailand, Laos, Vietnam, and Taiwan (Govaerts, 2023). In India, the genus is represented by nine species viz. *P. arunachalensis* Hareesh & al., *P. grandiflora* (Rolfe) Rolfe, *P. hookeriana* (Lindl.) Rollisson, *P. humilis* (Sm.) D. Don, *P. lagenaria* Lindl. & Paxton, *P. maculata* (Lindl.) Lindl. & Paxton, *P. praecox* (Sm.) D. Don, *P. saxicola* Tang & F.T. Wang ex S.C. Chen and *P. scopulorum* W.W. Sm. distributed in the Himalayas and in north eastern part of the country. Among the nine species occurring in India, *P. arunachalensis* is endemic to the country. Recorded distribution shows that Eastern Himalaya and North-East India are abode for more diverse species of *Pleione*, representing all 9 species, while the North-West Himalaya harbours 4 species.

The genus has been studied thoroughly in Indian perspective under the Himalayan Research Fellowship Scheme of National Mission on Himalayan Studies. All the species have been studied in respect to their taxonomy, distribution and threat status assessment as per IUCN guidelines. The genus is epiphytic in India, growing on the branches, tree trunks and rocks or rocky slopes in montane forests and woods. Most of the species are leafless and dormant during the winter season. The plants are left with only pseudobulbs to surpass low temperature and even frost or a cover of snow. As spring approaches, weather ameliorates, lateral shoots come up to flourish and flower. *Pleione* is thus a challenge to the workers as the plants are found to flower in both conditions, while having leaf or leafless, with a varying numbered leaves from one to two in same species. Some species like *P. maculata* with huge range of variations in its labellum, *P. praecox* in its albino form, *P. lagenaria* having its natural hybrids creates confusion, misleading workers to form new species. This study resolves such cases like the identity crisis of *P.*

saxicola and *P. arunachalensis*. Furthermore, species of *Pleione* are exploited for ornamental purpose. They are compatible for production of excellent hybrids with more self-life and beauty. Although, distributed with greater density, the species of Pleione have narrow range of occurrence which makes them threatened. Being epiphytes, the habitat is always vulnerable. Two important stages in the life cycle i.e. pollination and seed germination are vector dependent.

This study deals in solving the problems of Indian *Pleione* that results in placing the genus distinct from its other related genera, understanding each species reported from India and resolving anomalies and complexities along with suggestions of sustainable utilization of natural resource.

T-1-PP-18

Botanical Motifs in Warli Art form of Maharashtra, South India

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This probing study explored plant motifs used in Warli paintings. Warli art is an indigenous artform practiced in Maharashtra, in the western peninsula of India. Traditionally, in the past, the artform was used as a medium by the community to communicate and transfer knowledge to future generations. Through a series of interviews with local Warli artists and an examination of their sketches and older Warli art collections, the plant imagery depicted was explored to identify their visual correspondence to real plants. The plant species represented by the motifs were identified by their vernacular name and morphological keys visible in Warli paintings. The extensive botanical presence in Warli art is explained by the several uses that plants have within the daily and ritual lives of the Warli community, such as in rites and daily practices as resources for food and medicine. A total of twelve botanical motifs are identified to the species level. This research can help to trace the evolution of individual plant motifs over a period of time, and also to transfer knowledge of plants, its identification skills, cultural importance to future generations.

T-1-PP-19

Exotic and Invasive Angiosperms of West Bengal

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Biological invasion, ranked as the second most significant threat to biodiversity according to the CBD in 1992, stands out as a paramount environmental concern. This is mainly attributed to the capacity of exotic plants for rapid growth, extensive biomass production, and exceptional reproductive efficiency when compared to the native plants of that region. A plant is said to be exotic, when the presence of that particular plant in a given area is due to intentional or accidental introduction by human activities or by any other physical or environmental factor. The detrimental impacts of alien plant species on native biodiversity, ecosystem functionality, economic stability, and even human health have been extensively documented, firmly establishing them as a pivotal element within the broader context of global environmental change. In this present investigation, exotic plants are categories as Cultivated, Naturalized, and Invasive which are documented through an exhaustive review of various floristic publications and inclusive field surveys conducted across different regions of West Bengal. This documentation encompasses over 850 angiosperms, out of which near about 40 plants are classified as invasive which are characterized on the basis of their reproductive capabilities, human involvement, and sustainability. The nativity status, life form, habitat information of the exotic species was also documented. Fabaceae and Asteraceae emerge as the predominant families among exotic angiosperms plants which belong to 116 families. This comprehensive list is envisioned to serve as a valuable and indispensable resource for future studies about the formulation of effective management strategies of invasive species and the conservation of native biodiversity.

T-1-PP-20

A Floristic Inventory of Koppal Fort, Karnataka, India

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Present work was carried out to explore the plant survey of Koppal Fort, Koppal District and got collected total 101 plant species exhibiting under 51 families of lower and higher plants were identified in the current study, Lichens 05, Mushrooms 05, Bryophytes 03, Pteridophytes 05, Monocot 11, Dicots 72. These all group of plants were recorded from different location of locations, positions at Koppal fort the rocks and fort walls, Slope, landscape and ponds of Koppal fort. The discrepancy in the florastic diversity of fort may be due to the topography of the soil and the climaticconditions of the region. It is observed that the number of plants was highest in the rainy season and lower in the summer season. It is intersecting to note the family Amaranthaceae occupies top position among the families. The most attractive was epilithophytes i.e., *Actinopteris radiata*, Ficus racemose. It's very interestingly focused and collected rare and endangered plants *Ophioglossum*2-species at high altitude of Koppal Fort. Therefore, it is suggested that still there is need of more and more work or exploration of Koppal Fort with different seasons.

T-1-PP-21

Exploring relationships between plant diversity and NTFP marketing and - A case study of Purulia District of West Bengal

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Forest resources not only produce timber raw materials but also produce different types of minor forest product as a cash crop which help the rural people. Minor forest products such as leaves, wild fruit, medicinal tree bark, and edible flowers, fuel woods were collected by the villagers from the nearest forest patch and supplied to local market. The marketing of minor forest products plays a necessary role in improving the livelihood of poor villagers by enhancing their source of income. The present study deals with the marketing of NTFP products by the tribal people of Bersa village in the Purulia District of West Bengal. A total of 25 tree species belonging to 16 families were recorded in the forest patch Bersa forest beat. The tribal people of this village are fully dependent on this forest, which indicates the importance of the local ecosystem and also highlights the tree diversity of the forest. This specific tree diversity supports and enhances the income source of forest fringe villagers. On the basis of IVI analysis of tree species suggest most dominant Sal-associated Forest in this area supply minor forest products mainly fresh leaves, green plate, green bowl, seeds, etc. These are eco-friendly easily available forest products. Most of people buy Sal and associated products for various festivals and traditional purposes. Nowadays many of these tree species of the forest patch are now risk due to over-exploitation and the collection of forest products unsustainably which does not permit the regeneration process. After Phyto-analysis it will be justified that sustainable utilization and conservation of Sal-associated Forest in this area is very necessary because it has a crucial impact on the socio-economic and employment status of poor villagers.

T-1-PP-22

In vitro micropropagation of *Phaius tankervilleae*, a terrestrial orchid of Arunachal Pradesh

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Phaius tankervilleae (Banks) Blume is a terrestrial sympodial orchid native to Arunachal Pradesh, thriving in dense moist tropical forests at 1000 to 2000 m altitude. It holds economic significance in floriculture, natural dye production and traditional medicine. Due to low seed germination (5%) in natural conditions and various anthropogenic activities, it faces a threat to its survival. For *in vitro* asymbiotic seed germination, protocorm formation, and seedling development, Murashige and Skoog (MS) and ½ strength MS proved to be comparatively better basal media than ¼ strength MS, Knudson C, Vacin and Went and Heller medium though embryo swelling occurred after 7 weeks of culture on all of them. Peptone proved to be the better organic additives than Coconut water and Yeast extract which on supplementation @2 g/l to MS and ½ MS provided early swelling of seeds (4 weeks of culture) together with high seed germination (51%) and protocorm formation (45%). Healthy seedlings were initially hardened on autoclaved brick pieces, charcoal pieces, decayed wood, and leaf litter at a 1:1:1:1 ratio with tap water. Subsequently, after 7 weeks, seedlings were transplanted into a Community Potting Mix (CPM) consisting of garden soil, brick pieces, charcoal pieces, decayed wood, and leaf litter at a 1:1:1:1:1 ratio with mosses on top for acclimatization. After 3 months of acclimatization, the survivability of seedlings was 71%. This study demonstrates that *in vitro* micropropagation holds promise for the mass production and conservation of *P. tankervilleae*.

THEME 2: Biosystematics and Phylogeny [ORAL]

T-2-OP-01

Taxonomy, Phytogeography, Molecular Phylogeny and Uses of Indian Himalayan Taxa of *Daphne* (Thymeleaeceae)

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Daphne, a member of the Thymelaeaceae family, is a small group of shrubby plants found primarily in subtropical and temperate parts of the world, with a few species being found in alpinehabitats. Of *ca*. 95 species in the world, six species and one variety are reported from India, distributed from Himalayn region.*Daphne* species grow slowly as understorey shrubs in Indian Himalayan region. Highest probability of occurrence is between 2100 m and 2800, sometimes found in alpine regions. They generally favor sites, with Quercus, Rhododendron, Hemlock (*Tsuga dumosa*), or fir (Abies species), and are also found to a lesser extent in upper mixed broad-leaved forests. The distribution pattern, morphological characters are elaborated in the paper. *Daphne bholua* is used to treat fever and as anthelminthic as well as to treat respiratory disorders.The inner fibrous bark of these species is commonly used for the manufacture of handmade paper. Handmade paper is used to make greeting cards, stationery products (notebooks, printing paper, envelops), lampshades, wrapping papers, boxes and bags, thankas (traditional Tibetan painting), wallpapers, Christmas cards, and exported to several countries.

Phylogenetic relationships of the Indian *Daphne* were investigated based on nuclear (ITS) and plastid (*rbc*L and *trn*L-F) regions. A total of 20 sequences representing five of the six species reported from India, collected from Eastern Himalaya, were newly generated for the present study. The phylogenies generated from individual and combined datasets using ML and Bayesian analyses were consistent and strongly supported the monophyly of the Indian species of the genus *Daphne*. Combined analyses revealed two major well-supported cladeswithall Indian species, viz., *D. bholua* var. *bholua, D. bholua* var. *glacialis, D. retusa, D. sureil* and *D. tangutica* are grouped togetherform a monophyletic group.Ancestral state reconstructions were done using the evolutionary significance features, viz. presence or absence of indumentum on calyx and colour of the calyx occurrence of species. This study supports the independent species status of *D. retusa* and *D. tangutica*andthe narrow endemic species, *D. thanguensis*.

T-2-OP-02

Study of Aluminum Accumulation in Some Members of Family Rubiaceace, Found in the District of Ranchi, Jharkhand

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Aluminum is the 3rd most abundant metal on earth soil, yet it is not listed as one of the nutrients required for plant growth and development. Our state Jharkhand is rich in aluminum, lateritic soil and mega bauxite reserves (It supports two giant aluminum plants, Renukoot and Muri). Several studies have shown that Aluminum is a reason for poor development of roots in acidic soil, leading to poor plant growth. In the Jharkhand's acidic soil more aluminum is washed into soil moisture which inhibits the growth of plants. However, some plants have the tendency to accumulate this metal more than 1000 ppm in their tissues, and they are referred to as hyperaccumulators.

Some studies suggest that members of family Rubiaceae have aluminum accumulating characteristics which can be taken into consideration as Chemo-Taxonomic marker when studying relationship between taxa. In our present study, 12 different genera were considered for Aluminum testing. They belong to the three sub-families Rubioideae, Cinchonoideae and Ixoroideae of family Rubiaceae found in Ranchi, Jharkhand and were studied for the same using Histochemical tests. The findings revealed that one member from each sub-families tested positive for Aluminum - *Haldina, Mussenda* and *Spermacoce*. In future course, more plants and more techniques including electron microscopy will be incorporated for making the work more extensive.

T-2-OP-03

On the current taxonomic status of the genus *Aster* L. (*sensu lato)* in India

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The genus *Aster* is the type of the family Asteraceae. The family is one of the largest families of flowering plants comprising of c. 24,000 species (excluding apomictic microspecies), with estimates of total number reaching 30,000 species distributed around the globe except for Antarctica (Funk & al., 2009). In India, the family comprises 1172 infrageneric taxa belonging to 193 genera (Karthikeyan & al., 2020), whereas the genus *Aster* sensu lato is represented by 26 species, 3 subspecies, 4 varieties and 1 forma (Karthikeyan & al., 2020). Majority of the species of Indian *Aster* s.l. are found in high-elevation areas of Western and Eastern Himalayas. While working on Indian *Aster* under SERB-Core Research Grant scheme (CRG/2021/000790) we have observed high morphological variation in the habits, vegetative as well as floral characters among the members of the genus. The generic circumscription of *Aster* are challenging for the taxonomists. Some studies (Li & al., 2012; Korolyuk & al., 2015) indicated that the genus *Aster* s.l. was polyphyletic which resulted in describing several new genera, resurrecting old genera, and raising infrageneric taxa to generic rank. According to Nesom (2020), *Aster* s.s. represents only three species, viz. *Aster amellus* L., *A. indamellus* Grierson and *A. aitchisonii* Boiss. However, the *Aster* s.s. concept is not universally accepted yet and some related genera are found to be nested within the *Aster* clade in the phylogenetic tree. Further, for many split-genera the generic delimitation is not very much clear or convincing. The morpho-molecular study on Indian *Aster* s.l. supplemented by SEM study of cypsela will demonstrate the present taxonomic status of different members of the genus found in the country.

T-2-OP-04

ITS based characterization of some genera belonging to family Fabaceae from Satpura Hilly Ranges of Central India and Western Ghats of Maharashtra

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Flower evolution frequently modifies the androecium, ensuing in either stamen loss or shifting of stamon function from pollen production to alternating function. For which the ten species from family Fabaceae were collected from Satpura Hilly Ranges of Central India and Western Ghats of Maharashtra. The phylogenetic tree was constructed after amplification and sequencing of ITS region by using MEGA X software. The phylogenetic tree shows its origin of divergence 1.20 and separates tree in to two clades. The clade I further divided into two subclades. The subclade I of clade I indicated by the species *Aeschynomene indica* and *Tephrosia pumila*. *Alysicarpous glumaceus* and *Tephosia purpurea* in another cluster forming clade II. Likewise clade II divides the species in to two sub cluster. It is highly notified that the Sub-cluster I represents the species *Aeschynomene americana*, *Alysicarpus monilifer* and *Zornia diphylla*. Sub-clade II with *Smithia conferta*, *Smithia bigemina* and *Tephrosia villosa* were out-grouped.

T-2-OP-05

A note on the occurrence, taxonomy, and genetic resource potential of *Sesamum laciniatum*, an endemic wild relative of sesame from Peninsular India

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Sesame (*Sesamum indicum* L.), belongs to the family Pedaliaceae is an important oilseed crop that had originated from the Indian subcontinent. Wild relatives offer immense potential for improvement of this crop, therefore basic studies gain importance in recent years. *Sesamum laciniatum* J.G.Klein ex Willd. is an Indian endemic species first published in Species Plantarum (ed. 4) in the year 1800 based on the herbarium collection from the Hyderabad area. Recent studies involving several field trips across its distributional range, and herbarium consultation in reputed herbaria in India as well as the world, indicated that this taxon is distributed between that geographical range lying between the latitude of 10.51 to 23.25° N and longitude of 69 to 80° E, broadly spanning over Western Ghats, Eastern Ghats, Deccan Plateau, in the states of Kerala, Tamil Nadu, Karnataka, Telangana, Andhra Pradesh, Maharashtra, and Gujarat. This species is locally abundant in dry barren rocky grounds, exposed gravelly grounds, open scrub forests, and lateritic outcrops, from 100-750 m above MSL. Although this species was recently synonymized with the coastal strand species, *S. prostratum* by Dorothea Bedigian, our detailed comparative studies of both the taxa on the morphological characters of taxonomic value (esp. pertaining to stem, lamina, calyx, capsule, and seed), seed micromorphological characters using SEM images, and molecular studies using SSR markers had convincingly distinguished both the taxa, which is further supported by mutually exclusive habitat preferences. Wide hybridization of sesame with these two taxa (*lacinatum* -16 crosses; *prostratum* - 8) further revealed the significant difference in the F_1 hybrids developed with these two taxa in terms of growth rate, growth habit, canopy, and other morphological features. *Sesamum laciniatum* is known for traits of breeder's interest such as resistance to root rot, tolerance to salinity, and not fully dehiscent capsules, besides ornamental value. This presentation details about its ecogeography, taxonomic distinction from close ally, and genetic resource potential.

T-2-OP-06

Metabarcoding of the Diet of spotted deer (*Axis axis* Erxleben) to understand the grazing patterns in Madras Christian College Campus, Chennai

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DNA barcoding, a tool that obtains species-specific DNA signaturesbased on the simplepremise within small stretches of the organism's genome. It canprovide a "biological barcode" to identify any organism at the species level.It isbelieved that DNA barcoding, will provide a "universal key" that will allowthe identification of a species by running unknown DNA sequences through a DNA barcodedatabase such as BOLD, NCBI etc... Further, "barcoding", has helped clarify taxonomic position of an'Apparent species complex' by revealing several cryptic species within a 'single' speciesdescribed through conventional taxonomy.This study aims to understand the grazing preferences of Spotted Deer within the MCC campus by analysing the pellets using a Meta-barcoding approach. DNA markers havegreater fidelity to unravel the diets even if the plant materials have been processed throughthe gut. This study has been identifiedthe niches (foraging grounds) for spotted deer, hence the demarcation can bederived to avoid niche overlaps and animal conflicts within the campus.

T-2-OP-07

Micro-morphological and Anatomical Characterization of *Gymnema* R.Br. species from Maharashtra to distinguish at vegetative stage

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Genus *Gymnema* R.Br. belongs to family Apocynaceae: Asclepiadoideae. Genus *Gymnema*was proposed by Robert Brown (1810) on the type specimens of *G. lactiferum* (L.) R.Br. (*Asclepiaslacifera* L.). The generic name *Gymnema* is derived from 'Gymnos' means naked and 'nema' means filament, referring to staminal corona absent. Genus *Gymnema*R.Br.represented with 52 accepted species. These species are widely distributed in Asia, Africa and Australia. In India, genus is represented by14 species and two varieties. In Maharashtra, it is represented by six species viz., *Gymnema cuspidatum* (Thunb)Kuntze; *G.latifolium* Wall. ex Wight; *G. montanum* Hook.f.; *G. sylvestre*(Retz.) R.Br. ex Sm.; *G. inodora* (Lour.) Decne. (syn. *G.tingens* (Roxb.) Wight & Arn.); *G.elegans* (Wight &Arn.) Decne. Recently,*G. khandalense*Santapau and *G.kollimalayanum* A. Ramachandran & M.B. Viswan both the species considered as a new synonyms of *G.latifolium* Wall. ex Wight (Meve& Alejandro, 2013). Therefore, in this paper four species of Gymnemaare compared for micro-morphological and anatomical characters are applied to identify in the vegetative stage.

T-2-OP-08

Nodal and Petiolar Anatomy of 10 Species of Indian Members of Verbenaceae and their Systematic Relevance

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A comparative study on nodal and petiolar anatomy was undertaken for 10 Indian members of Verbenaceae collected from different states of India. Work is done to assess anatomical variations that can be useful for the identification of species and to evaluate their significance in the taxonomy of this family. The nodal configuration is unilacunar uni-traced, two- traced or sometimes three-traced. Large or small number of sclerenchymatous patches along with numerous sclereids are found which surround the vascular tissue at nodal region and sometimes also extended into the petiole. The number of vascular bundles and their respective arrangement at three different regions of the petiole viz., proximal, middle and distal show considerable variations among the studied different species as well as within the same species. The largest vascular bundle possesses different shapes like crescent, semi-lunar and sometimes ring shaped located towards centre. Lateral vascular bundles are small and varies in number. In some species accessory vascular bundles also occurs in the petiole. Some species possess stone cells either in pith or in the cortical cortical region of petiole. As additional feature both glandular and non-glandular, unicellular or multicellular trichomes are present over the epidermis. Different types of calcium oxalate crystals like druses, prismatic and styloids are notably found within the cell. A statistical analysis was performed followed by UPGMA and PCA analysis to establish species correlation. The aim of this anatomical study is to understand the anatomical features of nodes and petioles of these studied species and to establish a systematic relevance of these characters with the taxonomy of the family Verbenaceae.

THEME 2: Biosystematics and Phylogeny [POSTER]

T-2-PP-01

Jasmonic acid foliar spray effects of on plant anatomical characteristics in *Cymbopogon flexosus* (Nees ex Stad)

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Cymbopogon flexosus (Nees ex Stad) commonly known as Lemon grass or Malbar grass, which is one of the perennial grass belongs to the family Gramineae. This grass species is very well known for its aromatic essential oil/volatile oil. The volatile oil was present in leaf lamina to occur rows of cells present just below the bands of the bulliform cells. Volatile oil, which was one of the secondary metabolites which is not responsible for the development of plant but mainly perform role in plant defence. Secondary metabolites can enhance by using elicitors like Jasmonic acid (JA) and its methyl ester, methyl jasmonate are well known signaling molecules that play an important role in eliciting the biosynthesis of secondary metabolites in plant cells. In present study different concentrations of (50µM, 100µM and 200µM) of Jasmonic acid used and treatment of that given to the plant at regular intervals. After each interval plants are harvested and processed for anatomical and micromorphological analysis. Anatomical studies reveled that after forth interval at 200 µM concentration plant showed characteristic variations than the controlled plant. Variations like increase in density of sclerenchyma tissue, number of stomata increase and degradation in chlorophyll pigmentation. In summary, the study suggests that the treatment of *Cymbopogon flexuosus* with Jasmonic acid (JA) at various concentrations induces specific anatomical changes in the plant. The results indicate that Jasmonic acid might play a role in modifying the plant's anatomical and micromorphological characteristics, possibly as part of a defense mechanism triggered by secondary metabolite synthesis.

T-2-PP-02

Micromorphological study of Cyperaceae flora of Nepal with emphasis on nut morphology

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Value of the micromorphological characters as a practical guide in the study of Cyperaceae is indisputable. Micromorphological characteristics of 10 taxa of family Cyperaceae from lowland Nepal were investigated using stereo zoom microscope to ascertain the taxonomic utility of the characters particularly focusing on nut morphology in differentiating closely related genera and species. The studied taxa included representatives of genera *Abildgaardia* Vahl, *Actinoscirpus* (Ohwi) R.W. Haines & Lye, *Bolboschoenus* (Asch.) Palla, *Bulbostylis* Kunth, *Carex* L., *Cyperus* L., *Eleocharis* R. Br., *Fimbristylis* Vahl, *Schoenoplectiella* Lye and *Scleria* P.J. Bergius. The nuts display considerable diversity in shape, size, color, surface and these characters are useful to delimit the taxa. During the floristic study in Kanchanpur district, about 4 species were recorded new for the flora of Nepal, which were confirmed through micromorphological study. The nut diversity of the studied species is illustrated by giving adequate photographs that were taken during the study.

T-2-PP-03

Leaf architecture of some selected species of the genus *Rubus* L. from Eastern Himalaya

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Rubus L. is one of the diverse genera within Rosaceae, consisting of approximately 700 species. Mostly distributed in the temperate regions of Northern hemisphere and few in Southern hemisphere. In India, the genus represents about 75 species and the maximum diversity found in the Eastern Himalayan region at altitude ranging 300–3500m. The genus *Rubus* divided into 12 sub-division ie. *Anoplobatus, Chamaebatus, Chamaemorus, Comaropsis, Cylactis, Diemenicus, Dalibardastrum, Idaeobatus, Lampobatus, Malachobatus, Micranthobatus, Orobatus* on the basis of leaf simple or pinnately or palmately compound, prickle, number of leaflets, stipule adnate or free etc. The term "leaf architecture" was defined by Hickey to denote the placement and form of those elements constituting the outward expression and leaf structure, as well as venation pattern, marginal configuration, leaf shape and gland position, etc. The veins and veinlets which form the vasculature, called the 'venation', is an important feature of mature leaves. Venation patterns are important characteristics used to determine many controversies in plant taxonomy. venation, epidermal outgrowth, stomata and epidermal cells also provide taxonomically important diagnostic characters, such as the presence or absence of stomata on the adaxial or abaxial leaf surface and arrangement of epidermal cells adjacent to the guard cells.

T-2-PP-04

A molecular phylogeny of the genus *Drimia* in India based on molecular systematic study

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The evolutionary history of the medicinally important bulbous geophyte *Drimia* Jacq. (Asparagaceae: Scilloideae: Urgineeae) (alternatively Hyacinthaceae subfamily Urgineoideae sensu APG II) has long been considered as a matter of debate in the monocot systematics. The genus comprises approximately 110 bulbous geophytic species distributed in Africa, Madagascar, the Mediterranean basin and Asia. The majority of the species (~93) are native to Africa. Currently, a total of eight species of the genus *Drimia* have been recognized in India, however, the taxonomic delimitation among them is ill-defined till date. In the present study, a comprehensive phylogenetic relationship among Indian species of this genus has been inferred for the first time based on chloroplast DNA *trn*L intron, *rps*16-*trn*K intergenic spacer, *atp*B-*rbc*L intergenic spacer and ribosomal DNA ITS1-5.8S-ITS2 sequences, leaf morphology, anatomy, stomatal characteristics and pollen exine ornamentations. The present findings revealed the monophyletic origin of the Indian members of *Drimia* and grouped them into two possible lineages (clade- I and II). The phylogenetic tree based on cpDNA concatenated sequences further resolved the clade-I into two distinct subclades (I and II) and clarified the intraspecies relationship among the studied members. The present study suggested a strong relationship between the molecular phylogeny and the morphological characteristics of the species studied. A possible trend of evolution of two important traits: 'type of palisade cells' in leaf and 'pollen exine patterns' among the members of *Drimia* in India was also suggested. In conclusion, the present research work demonstrates an explicit phylogenetic relationship among seven Indian species of *Drimia* on the basis of both molecular and leaf morpho-anatomical characters for the first time.

T-2-PP-05

Rp-Hplc Based Phytochemical Screening of Systematically Related Four Species of *Carex* L. Under the Sections *Polystachae* Tuckerman and *Indicae* Tuckerman (Cyperaceae Juss.)

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Cyperaceae Juss., also popularly known as sedges, is the third largest family among Monocotyledons, under the order Poales. This family comprises of 89 genera c. 5570 species worldwide, except Antarctica. Among the genera, *Carex* L. is the largest one with c. 2000 species, sometimes hard to identify by traditional morphological methods, especially which form species complex. This problem can be resolved by using chemotaxonomic approach and by detection of taxon specific polyphenols in the species complexes. This group of phytochemical is the most important bioactive component, having numerous pharmacological properties. There is no such record of phytochemical screening on *Carex* from India till date except in very few specified cases, which leads us to explore this field. For the present study, four members of the sedge family from two species complexes, covering two sections *i.e. Polystachae* and *Indicae* from West Bengal, India has been taken. Among them, *C. filicina* Ness and *C. cruciata* Wahlenberg belong to the section *Indicae,* and *C. myosurus* Nees and *C. spiculata* Boott belong to the section *Polystachae*. Successive soxhlet extraction revealed constantly higher extractive yield in hydro-methanol solvent for all the four studied species. RP-HPLC analysis of these extracts compared with nine polyphenol standards, showing variation in the qualitative and quantitative data. This qualitative data was used to prepare a data matrix which was further employed in cluster analysis. The variation in the presence and absence of the detected polyphenols among the studied taxa were helpful in clustering the species into different groups. Though, being member of the same section, *C. cruciata* and *C. filicina* were phytochemically distant from each other. Also, *C. myosurus* and *C. spiculata* were separated from each other because of Caffeic acid and Rosmarinic acid. Interestingly, *C. filicina* and *C. myosurus* showed maximum similarity and were grouped together based on their polyohenol composition, despite of representing different species complexes. Study concludes that polyphenolic compounds are useful to separate the species pairs of the same complex.

THEME 3: Nomenclature, Revision and Monograph [ORAL]

T-3-OP-01

Systematics of *Lepidagathis cristata* (Acanthaceae: Barlerieae) complex in India

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Lepidagathis Willd. (Acanthaceae: Barlerieae) is distributed throughout the pantropical regions, with 151 accepted species globally (POWO, 2023). It is represented by 33 species and seven varieties in India, of which 23 species and one variety are endemic to the country. Carl Ludwig Willdenow (1800) established the genus *Lepidagathis* Willd. based on specimens collected by Jacob Theodor Klein from Tamil Nadu with the species *L. cristata* Willd. as its type. Since then, various workers have added several species that are morphologically similar to the type (*L. cristata*) of the genus from India. The present paper aims to throw light on their taxonomic identity and interrelationships between the species, misidentifications, erroneous nomenclatural citations, typifications, new synonyms, resurrection of species and geographical distribution based on a thorough review of all the earlier literature, examination of herbarium specimens housed in Indian and foreign herbaria (images), detailed study of freshly collected specimens across India, for micro- and macro-morphological characters and molecular phylogeny based on chloroplast and nuclear genomic markers.

T-3-OP-02

Vascular Flora of Ladakh (Trans-Himalaya), India: An Updated Checklist

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In addressing the challenges of biodiversity conservation, the taxonomic documentation of floristic diversity needs priority, particularly in data-deficient regions of the world. In this study, we present a comprehensive and updated taxonomic checklist on the vascular flora of Ladakh, a region located in the remote Indian Trans-Himalaya. The checklist, based on field surveys over the last decade, herbarium studies, and a rigorous review of literature, records 1810 taxa (1702 species and 108 infra-specific taxa) belonging to 530 genera in 91 families from the region. The angiosperms are represented by 1772 taxa belonging to 508 genera in 77 families. The dicots contributed 1413 taxa (1320 species and 93 infra-specific taxa), while the monocots contributed 359 taxa (345 species and 14 infra-specific taxa) to the checklist. Likewise, the gymnosperms are represented by 11 taxa, and the pteridophytes (ferns) by 27 taxa. The family Asteraceae contributes the largest number of 277 taxa, followed by Poaceae with 221 taxa. The flora in the region is dominated by 1667 herbs, followed by 101 shrubs, 34 trees and 8 climbers. In terms of lifespan, there are 1370 perennials followed by 411 annuals and 29 biennials. The checklist will not only serve as a useful reference for researchers, policymakers, and other stakeholders but is an important tool for guiding conservation efforts and sustainable use of the unique and valuable plant resources in the Trans-Himalayan region of Ladakh.

T-3-OP-03

Studies in the genus *Bulbophyllum* Thouars in India

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The genus *Bulbophyllum* was first described by Louis-Marie Aubert du Petit-Thouars in his book in 1822. In this work, he included eighteen species of *Bulbophyllum*, with *B*. *nutans* (Thouars) Thouars as the type species. The genus name is derived from the ancient Greek words 'bolbos', meaning "a fleshy, usually underground stem or bud," and 'phyllon', meaning "leaf," referring to the pseudobulbs on top of which the leaves grow. *Bulbophyllum* is the largest genus of the family Orchidaceae, and there is a considerable amount of heterogeneity among the infrageneric taxa of the genus.

The genus *Bulbophyllum* as understood presently, has included many new or resurrected genera such as *Acrochaene*, *Mastigion*, *Jejosephia*, *Rhytionanthos*, *Trias*, *Ione*, *Sunipia*, *Cirrhopetalum*, etc. As evident from the high number of species within this group, a great degree of variation is prevailing in the vegetative and floral characters. The remarkable taxonomic characters used in this group to differentiate infrageneric ranks include the distance of pseudobulbs on the rhizome, the relative size of pseudobulbs compared to the plant, the number, shape, and texture of leaves, the presence or absence of leaves during flowering, the position of the inflorescence on the rhizome, the number and arrangement of flowers, the relative length of the dorsal sepal compared to the lateral sepals, the degree of union of sepals, the margin and venation of floral parts (especially petals), the mobility, shape, size, and ornamentation of the labellum, and the nature of pollinia, stelidia, anther etc. In India, 137 taxa of *Bulbophyllum* have been reported to date (S.K. Singh *et al*., "Orchids of India," 2019), with few later additions from different parts of the country, estimated to be around 140 (±5). The genus exhibits a high degree of endemism, with 34 species being endemic to the country, as estimated through literature and herbarium surveys. *Bulbophyllum* comprises nearly 2200 species globally and is widely distributed worldwide.

The genus is being studied thoroughly in Indian perspective under the NMHS fellowship scheme of Government of India. Extensive field trips have been conducted in different parts of the Himalayas, resulting in the collection and documentation of a considerable number of species. Some interesting findings include – the first record of *Bulbophyllum nodosum* from Sikkim with resolving its typification and identity conflict with the allied *Bulbophyllum helenae*. This endemic species has also been assessed as 'Endangered' as per the IUCN guidelines. Two species *Bulbophyllum dickasonii* and *Bulbophyllum proboscideum* were found as erroneously recorded from India and therefore excluded from Flora of India. Two species names have been re-circumscribed, and their taxonomic status has been ascertained. Typification of 11 names has been done. The distribution pattern of endemic species has been analysed. The present communication is aimed in presenting the brief synopsis of the genus *Bulbophyllum* found in India.

T-3-OP-04

Synopsis of genus *Tainia* Lindl. (Orchidaceae) in India

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The genus *Tainia* (Orchidaceae Epidendroideae Collabieae) was established by Carl (Karl) Ludwig von Blume (1825) in Bijdragen tot de Flora van Nederlandsch Indie with *Tainia speciosa* as the type species. The genus is represented by rhizomatous terrestrial or epiphytic orchids with cylindrical pseudobulbs, terminal inflorescence on specialized leafless shoots, flowers with spurless labellum (Pridgeon *et al.* 2005, Pearce & Cribb 2002). Genus *Tania* is closely allied to *Ania* Lindl. Dressler (1981, 1993), Seidenfaden (1986, 1992), Pridgeon *et al.* (2005), Chen and Wood (2009) had treated *Ania* as a synonym under *Tainia* whereas Ridley (1907), Schlechter (1915), Senghas (1984) considered *Ania* and *Tainia* as separate genera. Turner (1992) attempted to revise the genera *Ania* and *Tainia* separately based on the vegetative as well as reproductive characters. Li *et al.* (2014), confirmed the separate status of *Tainia* and *Ania* through a molecular phylogenetic study. Overall, *Tainia* is differentiated from *Ania* in having pseudobulbs mostly cylindrical with one internode, swollen at base; petiole non articulate; terminal inflorescence on specialized shoots and labellum without a spur.

The genus *Tainia* comprises 32 taxa including 2 subspecies and 1 variety globally and is distributed in South-East Asia, Australia and Pacific Islands (Turner 1992, Govaerts *et al.* 2022). *Singh et al.* 2019 listed five species of *Tainia* [*Tainia bicornis* (Lindl.) Rchb.f.; *Tainia latifolia* (Lindl.) Rchb.f.; *Tainia megalantha* (Tang & F.T. Wang) Srivastava & Bhattacharjee; *Tainia minor* Hook.f. and *Tainia wrayana* (Hook.f.) J.J. Smith] as distributed in India. Revisionary studies on the genus had been carried out by the authors as a part of NMHS funded project on systematic studies on the Himalayan Orchids. As a result, *Tainia wrayana* as recorded from India has been identified as *Tainia megalantha* & an interesting epiphytic species was discovered and described as *Tainia epiphytica* S. Sarkar *et al.* (2023). All the species of *Tainia* in India are often traded as horticultural curiosities. The genus has been studied for its taxonomy, distribution, phenology, and conservation aspects in Indian perspective. The threat status was also assessed for all the species as per IUCN guidelines. Results of this study have been presented here.

THEME 3: Nomenclature, Revision and Monograph [POSTER]

T-3-PP-01

Fruit Morphology of the Genus *Dioscorea* in India

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In India the family Dioscoreaceae R.Br. is only represented by the genus *Dioscorea* L. The diversity of the genus *Dioscorea* in India is considerable (Hoque 2020) and evidently Prain and Burkill (1936, 1938) made the most important contribution to the taxonomy of the genus from East Asia including Indian subcontinent. In the recent revisionary work (Hoque 2020), 33 species and four varieties under *Dioscorea* has been recognized for India.The studies on the genus *Dioscorea* had been done for many of the academic aspects mostly the descriptive morphology for the benefit of identity. Various morphological characters of fruits may be used to correlate the different characters and helpful in the classification system.

The fruits of *Dioscorea* is regarded as capsule by almost all the authors, but as the fruit arises from the inferior ovary, here ithas been termed as diplotegia. The fruits of Dioscorea is always triwinged, with almost all loculicidal dehiscence. Rachis of infructescence varies with the range of stout, slender, erect, pendulous, branched, unbranched, glabrous or hairy. The number and arrangement of fruits on the rachis may be of different types viz. Numerous, clustered, overlapping, fewer, lax and non-overlapping. Fruits are usually stipitate but rarely sessile in *D. melanophyma.* The stipe may be glabrous (*D. alata*, *D. bulbifera* etc.) or hairy (D. *pentaphylla*, *D. tomentosa*etc). All left twining Indian species, *viz.D. arachidna*, *D. bulbifera*, *D. cumingii*, *D. deltoidea*, *D. esculenta*, *D. hispida*, *D. kamoonensis*, *D. melanophyma*, *D. pentaphylla*, *D. prazeri*, *D. scortechinii* and *D. tomentosa*contain recurvedfruits, but all right twining species are with non-recurved fruits. The Diplotegia are always triwinged. It is broader than long in *D. alata*, *D. belophylla* etc.,but longer than broad in *D. hispida*, *D. kamoonensis*, *D. melanophyma* etc. In case of all simple-leaved species, the fruits are usually wider than length except in *D. bulbifera*whereas in case of all compound-leaved species (e.g. *D. pentaphylla*, *D. arachidna*, *D. cumingii*, *D. hispida*, *D. kamoonensis*, *D. melanophyma*, *D. scortechinii*, *D. tomentosa*) the fruitsare longer than breadth. The shape of diplotegia is quite variable. It can be ovate, oblong-rectangular, transversely elliptic, obcordate or rounded. It is ovate in *D. alata*, *D. b-elophylla*, *D. laurifolia*, *D. lepcharum*, *D. orbiculata*, *D. pubera*, *D. serpenticol a*and *D. wightii*; oblong-rectangular in *D. tomentosa*, *D. scortechinii*, *D. pentaphylla*, *D. melanophyma*, *D. hispida*, *D. cumingii*, *D. bulbifera*and *D. arachidna*; transversely elliptic in *D. aculeata*, *D. esculenta*, *D. listeri*, *D. spicata*and, *D. wattii*; obcordate in *D. decipiens*, *D. deltoidea*, *D. glabra*, *D. hamiltoni*, *D. orbiculata*, *D. spicata*, *D. trinervia* and *D. wightii*; rounded only in *D. vexans.*The apex of the fruits are also variable among different species. It is emarginate in *D. alata*, *D. esculenta*, *D. glabra*, *D. hamiltoni* and *D. spicata*; retuse in

D. belophylla, *D. lepcharum*, *D. pentaphylla*, *D. serpenticola*, *D. trinervia*, *D. vexans* and *D. wightii*; cleft in *D. decipiens* and *D. pubera*; rounded in *D. hispida*, *D. melanophyma*, *D. tomentos a*and *D. kamoonensis*; truncate in *D. cumingii*, *D. deltoidea*, *D. listeri*, *D. melanophyma*, *D. orbiculata*, *D. pentaphylla*, *D. scortechinii*and *D. wattii*; obtuse in *D. arachidna* andacute in *D. bulbifera*. Base of the diplotegia is also much variable. It is obtuse in *D. alata* and *D. laurifolia*, alternate in *D. aculeata*, retuse in *D. arachidna* and *D. cumingii*; cordate in *D. pubera* and *D. serpenticola*; truncate in *D. decipiens*, *D. esculenta*, *D. glabra*, *D. lepcharum*, *D. listeri*, *D. scortechinii*, *D. spicata*, *D. trinervia* and *D. wattii*; rounded in *D. deltoidea*, *D. hamiltoni*, *D. hispida*, *D. kamoonensis*, *D. melanophyma*, *D. orbiculata*, *D. pentaphylla*and *D. tomentosa;* and cuneate in *D. vexans* and *D. wightii*. Fruit surface is usually glabrous, but it is sparsely hairy in some species like *D. pentaphylla*, *D. scortechinii*, *D. arachidna*, *D. cumingii*, *D. decipiens*, *D. esculenta*, *D. hispida*, *D. kamoonensis*, *D. listeri*, *D. melanophyma* and *D. orbiculata*; densely hairy only in two species, *viz. D. pubera* and *D. tomentosa*. Diplotegiacolour changes on drying and the color change is variable amongst the studied species. Fruit surface turns black in *D. pentaphylla*; yellow in *D. hispida*; reddish in *D. hamiltoni*; brown spotted in *D. pubera* and *D. decipiens*; and yellowish with red spots in *D. bulbifera*. Fruit dehiscence is loculicidal or septifragal, from apex to base. Dehiscence may be with rib separation as found in *D. wattii*, *D. serpenticola*, *D. listeri*, *D. scortechinii* and *D. cumingii* or without any rib separation as in all the remaining species. Largest known fruit among the Indian *Dioscorea* species are found in *D. wattii* (5 × 7cm) (among broader than long); *D. hispida*, *D. scortechinii* and *D. cumingii* (5 × 2cm) (among longer than broad). Diplotegia wings showing variable characters like very hard, medium hard and membraneous. The wing is almost woody in *D. wattii*, *D. hispida*, *D. esculenta* and *D. listeria*; it is medium hard in *D. pubera*, *D. tomentosa*, *D. oppositifolia*, *D. scortechinii*, *D. decipiens*, *D. belophylla*, *D. glabra* and *D. trinervia*; whereas it is membranous in *D. prazeri*, *D. hamiltoni*, *D. bulbifera*, *D. pentaphylla*, *D. deltoidea*, *D. lepcharum*, *D. melanophyma* and *D. kamoonensis*. Wing margin of fruit (diplotegia) is usually convex or semi-rounded but it is parallel in *D. scortechinii*, *D. hispida* and *D. cumingii*. Margin with membranous border is found only in *D. hamiltoni* and *D. prazeri*. Fruit (diplotegia) apex bears macrescentperianth cup with a neck as noticed in *D. hamiltoni* and *D. lepcharum*, however without neck is observed in *D. prazeri*, *D. deltoidea* and *D. esculenta*. The persistent perianth cup is situated at a notch as in *D. hamiltoni* and *D. alata*, but sometimes it is not within a notch as found in *D. prazeri* and *D. deltoidea*. Fruits are without any persistent perianth cup is seen in *D. listeri* and *D. wattii*.

T-3-PP-02

Taxonomic revision of the genera *Heracleum* L., *Pimpinella* L., *Pleurospermum* Hoffm., *Physospermopsis* H.Wolff, *Pternopetalum* Franch. and *Sinocarum* H.Wolff of Apiaceae in India

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The family Apiaceae commonly known as the celery, carrot or parsley family named after the type genus *Apium*. It is one of the largest angiosperm family possess 446 genera and 3800 species globally with well-known economically important plants. First consolidated account of the family Apiaceae given by C.B. Clarke for Indian subcontinent, where he mentioned 188 species under 39 genera. Later various worker like Gamble, Haines, Chatterjee and Wolff contributed a lot. After independence a revised account on Apiaceae for India made by Mukherjee & Constance. An updated revised account on the family recorded 283 taxa belong to 71 genera in Indiaby Mukherjee *et al*.

All the six genera considered as a part of the revisionary work to give an updated account, resolve nomenclatural ambiguities and species complex. Importantly the Indian taxa are merely represented by old collections made in the early 20th century by different taxonomists. Besides, some of the species are with complex nomenclatural ambiguities needed to be properly encountered to resolve the issues. Several taxonomists around the globe have worked on the molecular phylogeny of the members of Apiaceae to establish the infrageneric classification as well as the inter- and intra-specific relationship by using different molecular markers. Under these circumstances, an extensive revisionary study on above said genera involving integrated data from both morphology and molecular taxonomy. Thus, this study will throw light on the taxonomy, species delimitation, nomenclature, diversity, endemism and phylogeny of the members of the genus in India.

Heracleum L about 90 species in the world. The native range of this genus is Temp. Northern Hemisphere, NW. Africa, Eritrea to Malawi. In India represented by 22 taxa mainly distributed in Himalayas with few endemics in Maharashtra. *Pimpinella* L is an old world genus represented by c. 158 species in the world and in India 29 taxa so far reported. *Pleurospermum* Hoffm. is an Eurasian genus with complex generic circumscription represented by 22 taxa in India. The species complex to be studied with the help of modern tools. *Physospermopsis*, *Pternopetalum* and *Sinocarum* are mostly colonize in eastern Himalaya in India represented by about 7 taxa each except *Sinocarum* which represented about 10 taxa.

T-3-PP-03

Studies on the genus *Papilionanthe* Schltr. (Orchidaceae) in India

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The genus *Papilionanthe* Schltr. (Orchidaceae-Vandoideae-Vandeae) was established by Schlechter on 1915 based on *Papilionanthe teres* (Roxb.) Schltr. (a" *Dendrobium teres* Roxb.). It is represented by 12 species globally which are collectively distributed in India, China, Southeast Asia, and the Malay Archipelago. In India, the genus is represented by five species, *Papilionanthe subulata* (Willd.) Garay, *Papilionanthe teres* (Roxb.) Schltr., *Papilionanthe uniflora* (Lindl.) Garay and *Papilionanthe vandarum* (Rchb.f.) Garay which are mostly distributed in subtropical forest (900–2100 m amsl) in the country. However, *P. teres* is quite cosmopolitan in distribution and are found at elevations as low as 100 m. The genus can be identified by its characteristic terete stems and leaves. Flowers are often showy with the lateral lobes of labellum either parallel or hugging the column.

The showy flowers of *P. teres* have led it to become one of the most favourite ornamentals of many Indian homegardens. Its therapeutic properties are reported treat dislocated bones. However, its widespread distribution has also led to the existence of some misidentified herbarium records which are confused with related species. Therefore, it is important to identify the species of *Papilionanthe* correctly to resolve the taxonomic doubts. Present communication intends to characterise the distinct morphology of these species and provide a detailed taxonomic account of the genus *Papilionanthe* in India highlighting its distribution along with the IUCN Red List assessment of each species.

T-3-PP-04

Taxonomic studies of the genus *Panisea* (Lindl.) Lindl. (Orchidaceae) in India

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The name *Panisea* [Orchidaceae-Epidendroideae-Arethuseae-Coelogyninae] was used by Lindley (1830) as a section under the genus *Coelogyne,* with one species, *Coelogyne parviflora* Lindl. (= *Panisea demissa* (D.Don) Pfiz.), a plant collected by Wallich from Nepal. Later, he has treated it as separate genus in 1854 in 'Folia Orchidacea' and listed it with four species. There have been different views on the circumscription of the genus and its relationship with *Coelogyne* Lindl. and other genera like *Bulleyia* Schltr., *Dickasonia* L.O. Williams, *Neogyna* Rchb.f., *Otochilus* Lindl., and *Pholidota* Lindl. The genus is characterized by relatively smaller habit, conduplicate leaves, one to few-flowered racemes, undifferentiated sepals and petals, entire labellum with sigmoidly curved at base, apically winged column. The genus is represented by 11 species globally, distributed throughout the South-east Asian countries like India, Bhutan, Nepal, Malaysia, Myanmar, China, Thailand and Indo-China. In India, the genus comprises 5 epiphytic species [*viz. P. apiculata* Lindl., *P. demissa* (D.Don) Pfitzer., *P. panchaseensis* Subedi, *P. tricallosa* Rolfe, *P. uniflora* (Lindl.) Lindl.] and inhabit the sub-tropical and temperate broad-leaved forests of Northeast India, Sikkim, Tamil Nadu and West Bengal. During the revisionary work on the Indian species of *Panisea*, four species could be studied in live condition at different parts of Eastern Himalaya and Northeast India. Taxonomic complexity prevails between *P. tricallosa* and *P. uniflora* due to their close morphological similarities. Revisionary studies on the genus have been completed for India based on live and authentic specimens. The results of this study are intended to be presented here.

T-3-PP-05

Study on morphology and nomenclature of the species *Cyperus paniceus* (Rottb.) Boeckeler (Cyperaceae) and comparison with its allied and sympatric species *Cyperus cyperoides* (L.) Kuntze

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Kyllinga panicea Rottb. (a” *C. paniceus* (Rottb.) Boeckeler) was for the first time described by Rottböll based on the collections of Köinig and Froskahl. This species is distributed in India, Arab, China, Jawa and Seychelles. In India, the species is reported to be distributed in Karnataka, Kerala and West Bengal. A total of thirteen synonyms are so far traced under this species name of which eleven are heterotypic synonyms. Morphologically this species is very similar to *C. cyperoides* (L.) Kuntze. In the present treatment, authors considered 34 morphological and micro-morphological characters of both the vegetative and reproductive morphology to show the range of variation of the species as well presented the comparative account of the species with its closely allied *C. cyperoides*. Morphologically, this species recognizes from *C. cyperoides* by several characters like the number of spikes in *C. paniceus* is less than *C. cyperoides*.Outer ray, culm, and prophyll lengths in the species are generally smaller than *C. cyperoides.* Whereas, both the species shared some characteristics like tristrichously arranged lateral spikes in the inflorescence, nutlet micro-morphology and uni-floret spikelets. Type status of the names is also discussed here in this presentation.

THEME 4: PHYTOGEOGRAPHY, ENDEMISM, CLIMATE CHANGE AND PLANT-ANIMAL INTERACTION [ORAL]

T-4-OP-01

Endemic plants of Megamalai Wildlife Sanctuary, Western Ghats, Tamil Nadu, India

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India, one of the 18 extremely diverse and top 10 species-rich countries of the World, is estimated to have 18,043 Angiosperm plant species, including 4303 endemic taxa. The Western Ghats, one of the global biodiversity hotspots, harbourmore endemic taxa (2116) than rest of India. The Megamalai Wildlife Sanctuary (WLS) covers 269.11 km^2 (26,910.82 ha.) and falls in part of Madurai and Theni districts of Tamil Nadu. In Tamil language, the term Megamalai denotes cloud-covered mountains, '*megha'* meaning cloud and '*malai'* referring to hill. Among the locals, it is also known as *Patchakumachi* (*Patcha*- green, *kumachi*-jungle).This sanctuary is surrounded by Periyar Tiger Reserve inSouth-West, Srivilliputtur Grizzled Squirrel Sanctuary in South and South-East; Madurai in East; Cumbam plains in North and North-East and Theni-Periyakulam plainsinWest. The Sanctuary ranges from 300 to 2000 M above sea level. Most of the sanctuary area have been converted to monocultureplantations like tea, cardamom, coffee, pepper, etc., however the sanctuary supports various types of vegetation viz., wet evergreen, montane, high altitude grasslands, southern tropical west coast semi-evergreen, southern tropical moist mixed deciduous, southern tropical secondary moist mixed deciduous, southern tropical dry mixed deciduous, southern dry deciduous, southern tropical carnatic umbrella thorn, southern tropical scrub, etc,. The Sanctuary is also beingtype locality for many narrow endemic plant species including *Ardisia blatterii*, *Litsea megamalayana, Impatiens tamilnadense, Impatiensmegamalayana*, *Ixora ravikumarii, Ceropegia megamalayana* and *Elytranthe pseudopsilantha.* Based on intensive and extensive survey (2016-2020) covering all the season in Megamalai WLS, 1290 taxa including 5 new species (*Eugenia megamalayana* Murugan & Arum., *Eugenia pachakumachiana* Arum. & Murugan, *Grewia lakshminarasimhanii* Arum., Murugan, Arisdason & R.Manik. *Syzygium lakshmananii* Murugan & Arum., and *Tripogon jayachandranii* Arum. & Murugan, have been collected and documented.This area is a unique home forseveral rare and endemic plants, which were categorized into endemic to the Indo-Sri Lanka(156spp.); endemic to India (31spp.); endemic to Western Ghats (216 spp.); endemic to Tamil Nadu state (24 spp.), and strict endemics to Megamalai Wildlife Sanctuary (25 spp.). Some endemic species were disjunctly distributed among districts, states, ghats, climatic regimes and bioregions.

T-4-OP-02

Mixed-effects allometric model for estimation of aboveground biomass in the forests of Darjeeling eastern Himalaya, India

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Forests of Darjeeling eastern Himalaya are dense, diverse, and rich depository of rare and endemic species and play a significant ecological role in conserving and managing natural resources, as well as harbouring substantial stocks of carbon in the form of biomass. Quantification of forest aboveground biomass (AGB) is crucial for both applied forestry and research implications. Therefore, the work focuses on developing the most suitable allometric equation and validating and comparing its accuracy. We applied a non-destructive sampling method based on forest inventory data. Biomass models were developed using a linear mixed-effects modelling approach. Five different forms of models were tested and the best-fit model was chosen based on the model efficiency and the Akaike Information Criterion (AIC). Model 4 was found to be the best-fit for the study area and in comparison to previously published pan-tropical and regional models, the model developed in this study expressed the highest R^2 value of 0.999. The developed allometric model not only provides an accurate estimate of AGB but is significantly applicable to similar vegetation types at both regional and national levels. The findings provide an insight to the policy makers, forest managers and REDD+ organizations regarding sustainable forestry activities as well as forest carbon management for climate change mitigation.

T-4-OP-03

Investigating Moth-mediated Pollination pattern through palynological approaches in the Eastern Himalaya

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The most essential activity that all plants go through, pollination, is what gives an ecosystem's vegetation its foundation. In recent years, research on nocturnal insect (mainly moth) angiosperm pollination has been largely abandoned in favor of diurnal pollinators. The diversity of angiosperms is extremely abundant in the eastern Himalayan region. Major angiosperm (eudicot) orders like the Fables, Rosales, Ericales, Brassicales, Asterales, etc. dominate this large region. The majority of these family's floral traits and pollen morphological traits (exine ornamentations, pollen walls, etc.) favor nighttime insect-driven pollination. Echinate, microechinate, reticulate, and stirate pollen exine ornamentations are significant primarily for lepidoptera (moths and butterflies) driven pollination. In addition to these features, several moth proboscisdes-specific structures and sporopollenin based attachments structures like viscin thread and pollenkitt also have important role in lepidoptera driven pollination. In this study, two types of moth interaction i.e. Sphingophily and Phalaenophily (pollination by hovering moths and settling moths) along with these parameters have been considered to generate the preliminary plant-pollinator pollen transfer network model. Alongside with interaction network model, a comparative pollen spectrum, related to availability of pollen samples in surface soils and moth proboscides of survey regions presents a clearer concept about role moths in formation of vegetation of this region. So, these interaction network models along with palynological approaches have been given a preliminary and basic idea related to the importance and significance of moth in various ecosystems of eastern Himalaya. On the other hand, this interaction study will enhance more advance research in pollination biology and conservation of crop and fruit plants in future.

T-4-OP-04

Botanic Gardens as Suitable Sites for Plant Phenological Studies: Insights from Kashmir Himalaya

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Phenology – the timing of seasonal events of an organism's life cycle – has globally emerged as a prominent bioindicator to monitor the response of vegetation to climate change. Worldover, botanic gardens serve as rich repositories of live plant collections, and have recently emerged as the suitable sites for phenological research. In this study, we monitored plant phenology of 250 species in the year 2022 in two botanical gardens – low-altitude Kashmir University Botanic Garden (1600 m) and high-altitude Gulmarg Botanic Garden (2600 m)–in Kashmir Himalaya. The study aimed to answer the research questions, whether different climatic variables impacts the phenology of plants, and how altitude acts as a proxy to the climate change in phenological research. We followed the globally standardized protocols of PhenObs (www.idiv.de/phenobs) and USA-National Phenology Network (www.usanpn.org) for monitoring the vegetative and reproductive phenophases of plant species in the two botanic gardens. Our results revealed a high intraspecific variation in the timing of phenological events between the two gardens. The onset of initial vegetative and reproductive phases was delayed by several weeks while the start and end of senescence was preponed by one month among the species growing at the high-altitude garden. Based on the novel insights gained from our study, current knowledge gaps and future direction for this fast-emerging research area of contemporary concern with relevance for taxonomy in general and botanic gardens in particular is highlighted.

T-4-OP-05

Ecological studies on *Lindernia madayiparensis* (Linderniaceae), an endemic species from the lateritic hillocks of northern Kerala, South India

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Seasonal pools on the lateritic hillocks form a peculiar micro ecosystem for numerous endemic, threatened and rare plant species. *Lindernia madayiparensis* Ratheesh, Sunil & Nandakumar is an emergent aquatic herb inhabiting the seasonal pools of lateritic plateaus. The species was described from a seasonal pool on the Madayippara lateritic plateau of Kannur district, northern Kerala (Ratheesh Narayanan *et al.*, 2012) at an altitude of about 50 masl. The species has extended its distribution to lateritic hillocks of neighboring district also. An extensive field survey was conducted across the lateritic plateaus of northern Kerala for gathering ecological data and collection of specimens of *Lindernia madayiparensis*. The collected specimens were subjected to morphological studies using CSM2 stereomicroscope (Labomed, India) and anatomical studies using Vision 2000 microscope (Labomed, India). The species was seen growing associated with other species such as *Eriocaulon cuspidatum* Dalzell, *E. reductum* Ruhland, *Rotala malampuzhensis* R.V.Nair, *R. malabarica* K. T. Joseph & Sivar., *R. rosea* C.D.K.Cook, *Oryza rufipogon* Griff., *Dopatrium junceum* (Roxb.) Benth. and *Blyxa octandra* (Roxb.) Planch. ex Thwaites. The uniqueness of *Lindernia madayiparensis* with respect to its morphology and anatomy as a consequence of its ecology is discussed in this paper. The vegetation of the seasonal pool is highly influenced by the physicochemical features such as temperature, turbidity, hardness, pH and nutrients of water and soil nutrients.

T-4-OP-06

Seasonal variations in Grassland Flora of Vagamon Hills of Southwestern Ghats

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The Vagamon is a famous hill station and tourist destination covering 15000 hectors of land in southwestern ghats and is located in the borders of Kottayam and Idukki districts of Kerala. Vagamon has of different types ecosystems supported by microclimatic conditions. The grass lands of rocky slope are predominant among them, characterized by seasonal change in its plant diversity. There four different seasons in this area:- monsoon season (June-September), Post monsoon season (October-November), Winter season (December-February), and Dry summer (March-May) and there is a seasonal variation in flora. In the present study, the vegetation of the grass lands of rocky slopes of Vagamon is monitored in four seasons of the year. It was found that a total of 77 grass species are growing in this area, mostly in monsoon season. 7 orchids found growing in the winter season when grasses subside. 49 other species also found to be growing including 1 species Drosera, 3 species of Utricularia, 7 species of Eriocaulon, and 3 species of orchids. It was also found that there is significant variation in the floral diversity of grass lands where tourist resorts and roads have been constructed, indicating impact of tourism activities on native grass land flora. This change in floral composition of grass lands can be used as an indicator of damage caused by tourist activities.

T-4-OP-07

Introduction of fodder plants for elephants of Dalma Wild Life Sanctuary to minimize human-elephant conflicts

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Elephant (*Elephas maximus*) from Dalma Wild Life Sanctuary, Jharkhand show migrating movement to densely populated village areas of nearby Purulia district of West Bengal due to some fodder preference or plant species of these areas. During this movement there are the major losses of agricultural crops and other properties including sometimes resultant conflict as injuries, casualties, etc. A list of fodder plants are suggested that can be profusely grown for elephant feed such as *Shorea robusta* (Sal), *Bambusa vulgaris* (Bamboo), *Phyllanthus emblica* (Amla), *Terminalia arjuna* (Arjun), *T. chebula* (Hartaki), *T. bellirica* (Bahera), *Syzygium cumini* (Black jamun), and *Dillenia indica* (Chalta), etc. If the food resources are amply available to fulfil their requirement the migration will be ultimately least towards population habitat or in villages and thus human-elephant conflict of Dalma Wild Life Sanctuary, Jharkhand and Purulia, West Bengal can be minimized.

T-4-OP-08

Role of Great Hornbill in the seed dispersal and germination of *Litsea oleoides* (Meisner) Hook. f. (Lauraceae), an endemic species of the Western Ghats of South India

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The genus *Litsea* Lam. (Lauraceae) comprises about 400 species distributed in tropical and subtropical Asia, Australasia, and America. In India there are about 45 species of which 18 species endemic to South India, (Bhuniya *et.al,* 2010). The fruits of many *Litsea* species along the Western Ghats are relished by Hornbills, and hence they play a significant role in the seed dispersal of *Litsea* species in hornbill habitats. One such species is *Litsea oleoides* (Meisner) Hook. f. endemic to Southern Western Ghats. It is a medium to large sized evergreen tree 10-30 m tall, with buttressed trunk. Leaves are sub-opposite to alternate, younger leaves pinkish red, flowers unisexual. Fruits are berries, depressed globose or hemispherical, 3.8"4 cm long, pale green to dark green when young and turn to red with white spots when mature. Their brightly coloured large fruit attracts several frugivores. The Great Hornbill is one among them which is considered near threatened (IUCN 2000). They prefer large seeded fruits for their diet and swallow the fruit and regurgitate the seed intact. *Litsea oleoides* is one of the diets of Great Hornbill. The present study was to establish the potential role of hornbill as an important dispersing agent and germination success of the seed of *Litsea oleoides* in the Vazhachal Sholayar part of Southern Western Ghats where the Great Hornbills are found at lower elevation. The detailed taxonomy, fruit, and seed morphology of *Litsea oleoides* were done. The phytosociological studies were done at selected locations in the study area to understand the community composition of species and the niche occupancy. The germination experiments *ex situ* (nursery in the rainforest field station) conditions showed that the species showed high germination rate in hornbill regurgitated seed than the controlled seeds. The regeneration plot studies around the nest tree showed more regeneration of saplings than around the parent tree. Study showed that the Great Hornbill plays a crucial role in the seed dispersal and germination of *Litsea oleoides*. So, it is essential to conserve the habitat of Great Hornbill for the existence of the species.

T-4-OP-9

Endemic flowering plants from Ratnagiri district (Maharashtra)

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A endemic plant are those plant that are found in a particular geographical region and nowhere else in the world. Ratnagiri district is a district in the state of Maharashtra, India. The district bounded by the arabian sea to the west, Sindhudurg district to South, Riagad district to the North & East side is Ghats regions. This district is part of Konkan regions. During our floristic studies of Ratnagiri district, we have collected 48 endemic plants belonging to 25 families.We have prepared a checklist and taxonomic account of all collected endemic plants from Ratnagiri area. In this study the family Acanthaceaeis dominant family with seven taxa & family Orchidaceae with five taxa. The dominant genus is *Barleria* L. with three taxa.

T-4-OP-10

Melissopalynological studies from Anuppur district, Madhya Pradesh

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Melissopalynology, the study of pollen grains in honey, can reveal valuable information about the pollen and nectar sources that bees use to produce honey. This information can be used to determine the geographical and botanical origin of the honey. The aim of the present investigation was to identify the plant taxa visited by bees during nectar collection and incorporated into honey samples. The honey samples were collected from wild in Anuppur District, Madhya Pradesh of Central India, to identify the important source plants in the region. Pollen-analytical examinations were conducted on five honey samples collected from different localities of Anuppur. Analysis of 05 squeezed honey samples revealed a diversity of 20 pollen morphotypes belonging to 15 different plant families. The palyno-assemblage of most honey samples mainly consist of pollen from summer blooming plants such as *Syzigium*, *Schleichera*, *Terminalia*, *Lannea*, *Lagerstroemia*, and Anacardiaceae members, indicating the occurrence of a tropical moist deciduous forest in the region with high monsoonal conditions (core monsoon zone).

T-4-OP-11

Iron Pulsing restores the perturbed micronutrient balance under elevated atmospheric CO_2

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The current environmental scenario impacts both the quality and quantity of our food. Excessive greenhouse gas emission has culminated in global climatic shifts and irregularities that have not only jolted the agricultural yield but also the nutritional quality of it. Studies predict that by 2050 global atmospheric CO_2 concentrations could reach 550 parts per million. Such elevated CO_2 levels can apparently be beneficial for yield increment in some crops owing to higher levels of carbon assimilation but concomitantly reduce the mineral accumulation (especially micronutrients like Fe and Zn) that is not only concerning for plants but also for human health. Iron Pulsing (IP) is a seed invigoration technique where rice seeds are supplemented with iron salts during germination. The present study investigates whether IP can rescue the nutritional impairment caused due to increased CO_2 levels. IP-treated rice seedlings grown in phytotrons under ambient (400 ppm) and elevated CO_2 (950-1000 ppm) and their morphological parameters and nutritional status were evaluated. The results indicate that IP can be beneficial in restoring the micronutrient imbalance under elevated CO_2 (eCO_2) conditions. Besides, the growth-promoting efficacy of IP was also persistent under eCO_2 conditions. Thus, IP can be a propitious approach to mitigate micronutrient malnutrition in plants due to increased atmospheric CO_2.

T-4-OP-12

Present Climate change and Patterns of Biodiversity

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Climate change refers to any change in climate over time, whether due to natural variability or as a result of human activity. Now it has been well recognized that Earth's energy flux is not in balance. Earth's surface was getting warmer affecting the elements of climate system. The climate itself was changing. By 1995 it became evident that the main culprit was Carbon Dioxide emissions produced by the burning of fossil fuels. If the emissions continue to grow at current rates it is almost certain that atmosphere levels of carbon dioxide will double from pre industrial levels during current century and it is quite possible that levels will triple by the year 2100. As a result of this Earth has been suffering from 'FEVER' and we have to act sincerely to cure it .Climate change has become the prime issue which is threatening the sustainability of world's environment. It has also affected the livability, health and economy of the globe. The forth assessment report of the Intergovernmental Panel on Climate Change (IPCC) stated that "continued GHG emissions at or above current rates would cause further warming and induce change in the global climate system during 21st century, that would very likely be larger then those observed during the 20th century. Predictions are there that that climate change will bring about increase in temperature s across the world which will ultimately lead to changes in average temperatures and rainfall patterns. It will have profound impacts on phenology, pollination patterns. Crop flowering, productivity and leaf fall .It will cause the risk of extinction of species. It is estimated that 15-37 % of wild plant diversity will be lost by 2050 due to climate change. We must remember that tropics and subtropics are more affected and may face problem of decreased food production. India and other developing countries would be among the most seriously affected by climate change.

Therefore there is an urgent need for creating bibliographic information in searchable databases. This will reduce the time spent in data gathering and support the provision of information on climate change to public and policy makers. Let us return to our natural ecosystem rather than a new arrangement may be termed as **'human –dominated techno -ecosystem'**

THEME 4: PHYTOGEOGRAPHY, ENDEMISM, CLIMATE CHANGE AND PLANTANIMAL INTERACTION [POSTER]

T-4-PP-01

Trait based prediction of seed dispersal mechanism and dispersal agents in Tropical Forests - a case study in woody species of Kolli Hills, Southern Eastern Ghats

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Ecological traits are adaptive features that are coevolved in plant and animal communities. Studies on those traits are crucial to perceiving the adaptive features of the plant community to the environment. Seed dispersal is one of the fundamental life processes for all plant species to disseminate and survive. Fruit diversity is directly proportionate to seed dispersal mechanism and dispersing agents, which determines the faunal community of the region. With this background, a study was conducted to investigation the following hypothesis *"How fruit traits facilitate to understand the seed dispersal mechanism and dispersing agent"*. Present study was conducted in the Kolli hills, one of the southern Eastern Ghats hill ranges of Tamil Nadu. It is an undulated chain of hill ranges that covers a total area of 503 km^2 with an elevation ranging from 180 to 1415 MASL. Different forest types ranging from Semi-evergreen to Southern thorn forest have been reported from Kolli hills. A total of 579 woody taxa of the tropical forests community of Kolli hills were analysed. Fruit traits such as fruit type, fruit size and fruit color were analysed to understand the seed dispersal mechanism and types of dispersing agent. Tropical forests of Kollimalai harbour nearly 55% of fleshy fruits (Berry and Drupe) and remaining 45% are dry fruits (capsule, pod, achene and samara). It indicates a large number of fruits are dispersed by frugivorous animals and nearly an equal number of fruits are dispersed by self-mode of dispersal. An analysis of fleshy fruits bearing (302) taxa of Kollimalai results, about 87% of the fruits are small (*c.*1cm across) and medium sized (>1–2 cm across). It indicates that the fruits are largely dispersed by small and medium size beaked frugivorous birds. Rest of the 13% are large size (>2 cm across) fruits which could be possibly dispersed by means of other mammals and large birds. Fruit color analysis of fleshy fruit taxa reveal that fruits with black (81 taxa), red (76 taxa) and yellow (85 taxa) colors are almost equal in numbers and rest of the 60 taxa contain cream color fruits. Tropical forests of Kollimalai harbours 28% of yellow fruits followed by 27% black, 25% red and 20% cream colored fruits. Black and red colored fruits are commonly preferred choice by birds (Balasubramanian 1996; Khan & Ahsan, 2015). The diversity of the fruit color in Kollimalai, points out that the birds also prefer the yellow color fruits.

T-4-PP-02

Climate change and the role of dehydrin PpDHNA from Physcomitrium patens in plant stress mitigation

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Plants use a diverse set of proteins to mitigate various abiotic stresses. Increase in global temperature has emerged as a threat to world food security, which has caused major morphological and physiological alterations in plants leading to lesser production and even early death of plants.The intrinsically disordered protein dehydrin is an important member of this repertoire of proteins, characterized by a canonical amphipathic K-segment. It can also contain other stress-mitigating noncanonical segments—a likely reflection of the extremely diverse nature of abiotic stress encountered by plants. Among plants, the poikilohydric mosses have no inbuilt mechanism to prevent desiccation and therefore are likely to contain unique noncanonical stress responsive motifs in their dehydrins. Here we report the recurring occurrence of a novel amphipathic helix-forming segment (D-segment: EGuuD(R/K) AKDAu, where u represents a hydrophobic residue) in Physcomitrella patens dehydrin (PpDHNA), a poikilohydric moss. NMR and CD spectroscopic experiments demonstrated the helix-forming tendency of the D-segment, with the shuffled D-segment as control. PpDHNA activity was shown to be size as well as D-segment dependent from in vitro, in vivo, and in planta studies using PpDHNA and various deletion mutants. Bimolecular fluorescence complementation studies showed that D-segment-mediated PpDHNA self-association is a requirement for stress abatement. The Dsegment was also found to occur in two rehydrin proteins from Syntrichia ruralis, another poikilohydric plant like P. patens. Multiple occurrences of the D-segment in poikilohydric plant dehydrins/rehydrins, along with the experimental demonstration of the role of D-segment in stress abatement, implies that the D-segment mediates unique resurrection strategies, which may be employed by plant dehydrins that are capable of mitigating extreme stress.

T-4-PP-03

Short notes on the endemic theory and distribution of endemic vascular plants from the coastal districts of Tamil Nadu and Pondicherry, Southern India

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Last two and half decades of intensive botanical survey in protected (hillocks, reserve forest) and unprotected (sacred groves, unclassified vegetation) sites along the 13 coastal districts of Tamil Nadu and Puducherry district, Union Territory of Pondicherry. About 127 sites were studied, most of them were belonged to Tropical Dry Evergreen Forest, in which 107 endemic taxa were documented. Among them 19 are trees, 18 shrubs, 9 climbers and 61 herbs. Distribution of these endemic species were critically studied and categorized into endemic to the country, peninsular India, southern India, Eastern and Western Ghats, to the state and district level. Interestingly the study found that some endemic species were disjunctly distributed in between districts (12), states (16), ghats (25), climatic regimes (26) and bioregions (19). The remaining 9 species are narrow endemic. Based on distribution and theories of endemism, there are 97 species are considered as relics or epibiotic endemics as per the geographer's point of view which are extensively distributed in Cretaceous and Tertiary periods. The second theory or age and area hypothesis believes that the endemic are recent and youthful forms in course of gradual extinction. There are 10 species recorded in the second theory from this area. According to IUCN criteria only six species are assessed; known from published sources about 10 species are variously categorized as rare or endangered or threatened and the remaining species were listed as 'not evaluated' or 'data deficient'.

T-4-PP-04

ROS mediated Programmed cell death in Tobacco BY-2 cells upon exposure to fungal toxin

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Cytotoxicity and Reactive oxygen species (ROS) generation are mechanisms by which the mycotoxins mediate toxicity in plants. Plant ROS signaling network, composed of reactive species, antioxidant enzymes and ROS-producing enzymes, is responsible for maintaining ROS levels under tight control. In response to stress stimuli, ROS levels can increase dramatically and result in oxidative stress. However, the exact mechanism underling the plant–toxin interactions and the successive events that lead to PCD are still unclear. In the present study, tobacco BY-2 cells were exposed to different concentration of toxin extracted from *Colletotrichum gloeosporioides* (CG-toxin) and *C. capsici* (CC-toxin). Toxin treated tobacco BY-2 cells showed decreased cell survivability. Both the toxins induced oxidative bursts and programmed cell death in tobacco BY-2 cell cultures. The antioxidant enzymes (CAT, SOD and GPX) and other compounds studied like lipoxygenases (LPO), appeared to be highly induced in both treatments. Reduction of cellular viability by both the toxin was correlated with increases of ROS generation and MDA formation in concentration dependent manner. Among the different cell death cascades, autophagy was significantly unregulated, especially in lower to median toxin concentrations (25- 100 ppm). It is expected as autophagy plays a critical role in the adaptation of plants to oxidative stress, and pathogen invasion. Different genes involved in the regulation of autophagy and antioxidant enzymes were also unregulated in toxin treated BY-2 cells. Collectively, the present study highlight the complexity of the signaling network of tobacco BY-2 cells and provide information for the understanding of the physiological, molecular, and biochemical responses to fungal toxin induced toxicity.

T-4-PP-05

Seed priming an emerging tool in ameliorating heavy metal stress in plant

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Plants often encounter to different natural and man-made abiotic stresses, like temperature, salinity, drought and heavy metals (HMs), which is now a grave global threat to growth and yield of crop plants. HMs, both in bulk and nano forms, alter fundamental and crucial processes of plants.Theycan hamper multiple developmental processes like seed germination to grain maturity of a cultivatedplant by affecting different physicochemical process, photosynthesis and antioxidant defence responses by overproducing ROS. To mitigate HM-induced toxicity various approaches such as molecular breeding, transgenic manipulation and biotechnological interventions have proved to be effective, but theirapplications are limited to laboratory and they are less popular amongst farmers. In that context, seed priming techniques have gained popularity being very effective against heavy metal stress, with the added advantage of being very easy to apply. Seed priming is a process of controlled induction of physiochemical processes of plant cells by treatment with natural and synthetic compoundsbefore seed sowing. In this experiment, seed priming with inorganic salts (NaCl and KNO_3), plant growth regulators (IAA and GA) and engineered nanoparticles (Al_2O_3 and CeO_2) showed very promising results in terms of enhanced seed germination, seedling vigour, viability and overall growth in onion (*Allium cepa*). Robust seedlings that emerged from primed seeds showed quick and uniform germination rates, as well as, fast and effective cellular defence against HM stress. Amongthepriming agents used, 4mg $L^{-1}CeO_2$-NPtreatment wasmost effective in eliciting HMs stress tolerance. This study explored seed priming approach as a useful tool for better management against HMs stress in plants.

T-4-PP-06

Cytotoxic effects of Cobalt oxide nano-particle in onion Bhima Cultivars

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In recent times environmental pollution is one the most worrisome issues, working in concert with climate change. Myriad anthropogenic utilities have introduced the additional menace of nano-particles in soil and water. Different types of hazardous chemicals and heavy metalsin bulk and nano formsleach into the cultivated fields where they are taken up by the crops, and ingress into the food-chains. Cobalt oxide nanoparticle (Co_3O_4 NP) is one of the frequent engineered metal nanoparticles that has been found in polluted water. The aim of this work was to test the effect of Co_3O_4 NP exposure on five different Bhima onion varieties.Characterization of the commercially acquired nano-powder revealed a particle size of<50nm. The DLS and Zeta potential data indicated that this nanoparticle was highly stable in de-ionized water, while the XRD pattern showed sharp peak confirming its crystalline structure. Co_3O_4 NP proved to be a potently cytotoxic agent. TTC assay showed a dose-dependent decreasein cell viability with increasing concentrations of this ENP in exposed tissues. This nanoparticle also showed clastogenic activity,with decrease in Mitotic Indexand increased aberration frequency. Flow cytometry indicated that the cell cycle was affected with alternation of G0/G1 and G2/M phases with changes in treatment concentration and cultivar variation. The present experiment proved that ingress of Co_3O_4 NP in water and soil pose a high risk of its introduction into food chains with possible bioaccumulation in plants and eventual transmission to humans. Thus, proper disposal of Co_3O_4 NP and other remedial strategies have to be devised and implemented to contain its damages.

T-4-PP-07

Using MaxEnt model to predict the distribution of *Ficus* trees in Kolkata for conservation planning

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The members of the genus *Ficus* are considered as keystone species. *Ficus* trees are extremely important for the survival of many avian species in urban regions. In order to conserve the *Ficus* trees in an urban setting, knowledge of their distribution is critical. In this study, we recorded the locations of *Ficus* trees in Kolkata based on three urbanization categories. The locations of *Ficus* trees in Kolkata in high, medium and low urban areas were recorded. We used Maximum Entropy model to predict the distribution of a species. We used locations of 2099 *Ficus* trees and raster environmental layers for average temperature and precipitation to predict the distribution of different species of *Ficus* in the study area. Understanding the interaction of environmental variables dictating tree distribution may facilitate habitat restoration, and will assist planning decisions for persistence of *Ficus* trees.

T-4-PP-08

Enumeration of strictendemic plants of Himachal Pradesh (India)

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Indian state of Himachal Pradesh located in North-western part of the country, lies between 30°222 N and 33°122 N latitude and 75°472 E and 79°042 E longitude with ranges between 230 –6813masl. Thegreat altitudinal variationand varied climatic conditions which is hot and humid in southern part and cool, chilled in the northern and eastern part of the State, supports a unique and vivid floral diversity and endemism within the state.

India being a country with diverse flora, has 21984 species of angiosperms, 82 species of gymnosperms (Mao et al., 2022). About 4303 species and infraspecific taxa of angiosperms and 12 gymnosperms are endemic to India (Singh et al., 2015), which is approximately 20% of the known angiospermic and gymnospermic flora of the country. In India, Western Himalayan regionis one of the biogeographic regions immensely rich in species diversity and endemism and it comes under Himalayan Biodiversity Hotspot. There are about 297 endemic species in Western Himalaya (Singh et al., 2015). The current study lists 21 species point endemic to the state of Himachal Pradesh. These plants belong to different climatic habitats and altitudinal zones. Habit, altitude and phenological data of each species is analysed in the present study.

THEME 5: INDIGENOUS TRADITIONAL KNOWLEDGE AND BIOPROSPECTION [ORAL]

T-5-OP-01

Phytochemical Analysis from Some Species of *Leucas* R.Br.

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Plants of genus *Leucas* L. (Lamiaceae) are widely distributed throughout Asia, Africa, and India. Genus *Leucas* L.with about 41 species found in India and 12 species are found in Marathwada is an Asian genus with separation from its close relatives in Africa based on phylogenetic evidence. Present study represents the only comprehensive phytochemical investigation on some species of Leucas specially in Marathwada. A variety of phytoconstituents have been isolated from *L. cephalotes*, *L. martinicensis* and *L. stricta*. Phytochemical investigation shows the presence of lignans, flavonoids, coumarins, steroids, terpenes, fatty acids, phenol, phytosterol and tannins. The result of the study could be useful for identification and preparation of monograph of the plant.

T-5-OP-02

Medicinal Capacity of Some Angiosperm Families

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In India the tropical trees are rich in tannins and other polyphenols scavenge free radicals and prevent a number of predators and tropical diseases. The plant antioxidants seem to have a significant contribution in evolution and taxonomy.

The transition from woody to herbaceous forms is often accompanied by loss of proanthocyanidins. Alkaloids are toxic and low in antioxidant capacity whereas phenolics are good antioxidants. The flavonoids with other compounds and morphological structures act together for defense, pollination and dispersal and better adapted in high altitude for radio protective capacity. Essential molecules (monoterpenes, diterpenes, resin) characteristic in many families are antioxidants; the temperate coniferous and tropical *sal* forests mentioned as health resorts in ancient Indian literature.

Leaf and flower extracts of 200 plants belonging to 30 angiosperm families were screened for their *in vitro* antioxidant activity against 2, 2-diphenyl-1-picrylhydrazyl radicals and total antioxidant capacity equivalent to gallic acid.

Good activity was observed among the studied members in Euphorbiaceae, Lythraceae, Myrtaceae, Rosaceae, Rubiaceae and Zingiberaceae; moderate in Apiaceae, Caesalpiniaceae, Fabaceae, Lamiaceae, Magnoliaceae, Malvaceae, Moraceae, Nymphaeaceae, Sapotaceae, Verbenaceae, Liliaceae whereas activity was much variable in others. The studied tannin-rich tree members of the genera *Terminalia*, *Syzygium*, *Acacia*, *Lagerstroemia*, *Phyllanthus* belonging to different families exhibited high antioxidant capacity. Organic acid qualitative profile allowed the distinction of the families and genera *Phyllanthus* spp., *Citrus* spp., *Hibiscus* spp. and *Rumex* spp. Quantitative profile distinguished the varieties in *Mangifera indica*, *Tamarindus indica* and *Syzygium cumini*.

T-5-OP-03

Plants to Pills: Are drug combinations the future of cancer therapeutics?

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Combination of more than one drug(s) with different mode of actions is how researchers are attempting to avert drug resistance and concurrent cancer relapse—the primary reason behind cancer mortality. More than one drug(s) will allow targeting of multiple pathways to shut down all the possible escape routes of the cancer cells. This study reports *Tiliacora racemosa* from Menispermaceae with striking anticancer potential in cervical cancer cells with an excellent prospect in sensitizing SiHa cells to doxorubicin through combination therapy. The plant extract acted through oxidative stress-mediated double-stranded DNA damage leading to ATM-Chk2 kinase pathway mediated G2/M arrest through cyclin B1 inhibition. Both extrinsic and intrinsic apoptotic cascades were triggeredin a caspase-dependent manner, along with modulation of heat shock proteins and apoptosis inhibitors. Such anticancer potential of *Tiliacora racemosa* was accredited to its plethora of bisbenzylisoquinoline alkaloids, chiefly tiliacorinine-2-N'-oxide. Subsequently, *Tiliacora* also showed goodpotential in combination therapy with the partner drug from homeopathic repository—*Thuja occidentalis*. *Thuja* drug contains thujone as the bioactive component and can individually block growth and proliferation of SiHa cells by apoptotic and autophagic cell death. Although *Tiliacora* extract individually sensitized SiHa cells to doxorubicin, while *Thuja* drug failed, combinatory formulation between *Tiliacora* plant extract and *Thuja* drug showed the most robust sensitization effect to doxorubicin drug. Since, resistance to doxorubicin is a frequent trouble in current days, and doxorubicin causes tremendous side effects, *Tiliacora racemosa* and the framed drug formulation could reduce cancer recurrences and help us achieve global realm cancer-free one day.

T-5-OP-04

Ethnobotanical knowledge and bioprospecting of natural products: The Indian scenario

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Traditional knowledge about utilization and sustainable management of plant resources are the integral part of Ethnobotany. This discipline of Science highlights the age-old relationship between people in a culture and plants in an environment. Ethnobotanical knowledge plays a vital role in bioprospecting of phytoresources for development of natural products such as pharmaceuticals, nutraceuticals, biopesticides, cosmetics, etc. Present paper illustrates the importance of folk knowledge in bioprospecting of plant resources in the global as well as Indian perspective and also embodies a thorough discussion on uses of statistical quantitative indices to identify the ethnobotanical information prospective for drug discovery. It has been noticed that most of the information or leads coming from the traditional herbal knowledge exhibit positive result in bioprospecting of novel products. For this reason, scientists rely mostly upon the ethnobotanical information for development of natural products. Taking the leads from traditional herbal knowledge, many novel natural products including drugs have been designed across the world by the consorted efforts of the scientists from the disciplines of Ethnobotany, Chemistry, Pharmacology and Medicine. Ethnobotanists have been employing various statistical indices for management, conservation and sustainable utilization of plant resources at local as well as regional level. The quantitative approach in ethnobotany has also been tested as effective tool in selection of ethnobotanical claims as promising candidate for bioprospecting and new drug discovery. All those aspects including free prior informed consent, benefit sharing and intellectual property right have been discussed in this paper at a greater length. After a critical analysis, some major lacunae have been identified in present day research on bioprospecting and ethnobotany from India. Finally, some recommendations have been made for future plan and improvement of ethnobotanical research in India.

T-5-OP-05

Green synthesis of Zinc Nanoparticles on the Leaf Part of *Memecylon talbotianum* D. Brandis (Melastomataceae) and its Larvicidal Activity

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A rapid, green, and easy strategy for the biosynthesis of Zinc nanoparticles using the leaf of *Memecylon talbotianum* D. Brandis (Melastomataceae) the structures of synthesized nanoparticles were characterized by using UV-visible absorbance spectroscopy (UV), Fourier-transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), scanning electron microscope (SEM) to determine the phase and morphology of Nanoparticles (NPs). The elements or chemical components are estimated by using GCMS for further applications by various solvents to imply an antioxidant activity for comprising the free radical scavenging and provision with larvicidal activity to know their potential as a promising tool in vector control strategies for combining mosquito-borne diseases.

T-5-OP-06

A few Combination Drugs used by the Local People of Jispa of Lahaul-Spiti District, Himachal Pradesh, India

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India has one of the World's oldest medical systems known as Ayurveda. The Tibetan medical system is based upon Indian Buddhist literature and Ayurveda and continues to be practiced in Tibet, India, Nepal, Bhutan, Ladakh, Siberia, China and Mongolia and more recently in parts of Europe and North America. A whole Tibetan group and the followers of His Holiness, The Dalai Lama, had come from Tibet and settled Dharamshala of Kangra District in Himachal Pradesh. With this migration the Tibetan culture has also come here and blended with Indian one. With a history going back approximately 2,500 years, the Tibetan Medicine is known as Sowa Rigpa in Tibetan Language.

In this paper, a few Combination Drugs, with their composition and uses, are mentioned by interviewing the local Tibetan Doctor (called "Amchi") Chhewang Somphel, at Jispa of Lahaul-Spiti District, Himachal Pradesh, India.

Tibetan medicine teaches and practices to heal negative thinking that can poison our mind and life. By healing the mental poison one can lead a healthy life.

T-5-OP-07

Sugar signaling acts as a proxy for cytokinin signaling for de novo meristem formation during nodule organogenesis

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Department of Biochemistry, University of Calcutta, Kolkata 7000019, IndiaSymbiosis between plants and diazotrophs require formation of a *de novo* meristem for endocytic accommodation of symbionts, a process that is tightly regulated by plant hormones cytokinin and auxin. Cytokinin signaling through CRE1 receptor causes auxin accumulation by regulating its transport or biosynthesis to initiate cell division for nodule organogenesis. Accordingly CRE1 mutant (*cre1*) is unable to undertake symbiosis and our objective was to strategize and restore functional symbiosis in *cre1* for understanding the downstream events. First and foremost, we show that sucrose as well as turanose (non-metabolizable sucrose) treatment can recover functional symbiosis in *cre1* indicating the importance of downstream sugar signaling in symbiosis. An auxin conjugate hydrolase *MtIAR33* was highly upregulated by sugar signaling leading to IAA-asp to IAA conversion. Overexpression of *MtIAR33* could also restore symbiosis in *cre1* indicating deconjugation of auxin conjugates to be a potential pathway of auxin accumulation during nodule organogenesis. Additionally sugar signaling significantly upregulated an auxin responsive homeobox transcription factor WOX5 well known for its role in meristem maintenance. Intriguingly overexpression of *MtWOX5* from *Medicago* having indeterminate nodule meristem failed to rescue *cre1* but *AhWOX5* from *Arachis* having determinate meristem could completely rescue *cre1*. We probed into the mechanism of this differential response and uncovered a striking molecular basis for how these homologous proteins have diverged in these two legumes. We have shown that MtWOX5 function as a repressor whereas AhWOX5 acts as an activator and swapping a single amino acid is sufficient to convert MtWOX5 to AhWOX5 function and vice versa.

T-5-OP-08

Traditional uses and Bioactivity Studies of the Endemic Flowering Plants of Western Ghats

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The Western Ghats, a remarkable mountain range celebrated for its exceptional biodiversity and high levels of endemism, is one of the world's pivotal biodiversity hotspots. Spanning an area of 1,64,280 Km² running parallel to the western coast of the peninsular Indiaand stretching across six states from North to South, this region harbours a wealth of unique flowering plants. However, existing literature on the endemic flora of the Western Ghats is fragmented, lacking a comprehensive assessment of the appropriate utilization of these distinctive plants found nowhere else. The objective of the study is toanalysereported traditional uses and methodical bioactivity studies on the endemic flowering plant species of the Western Ghats. A thorough literature-based survey of traditional uses and bioactivity studiesof the endemic flowering plant species of the Western Ghats was conducted. Data were gathered fromflora, Scopus journals and Google Scholar and other databases. Total number of flowering plantsfrom Western Ghats are more than 1400, of whichtraditional knowledge are recordedfor less than 200 species. Scientific studies (including preliminary) reported confirmingthis traditional knowledge are less than 100. These data show that uses of only c. 10% of the Western Ghats endemic plants are known.

This study sheds light on the traditional knowledge and potential applications of Western Ghats' unique flora and provide information needed for planning subsequent studies on the biological treasure trove that still unexplored.

T-5-OP-09

Phytochemical Screening of *Amorphophallus paeonifolius var. campanulatus* (Decne.) Sivad. Using by HR-LCMS Technique

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Amorphophallus campanulatus, widely known as elephant foot yam and suran.It is cultivated crops and used as vegetable.Their corms are edible in times of food scarcity, usually after peeling, slicing and repeated washing and boiling in water to remove toxic and irritating substances. Their corms are mainly cultivated in home gardens or collected from the wild and consumed locally, and is available in local markets.Most of the cormsare planted in home gardens by small holders and intercropped with numerous other crops. In, Kokan region,Plantis often planted under Betel Palm, Coconut, Banana and Cashew Nut. *Amorphophallus campanulatus* (Family-Araceae) is a cultivated crop used as vegetable. The leaves and their corms are used for kitchens and many home remedies.The corms are dry, acrid, pungent incerses both appetite and taste; digestive, anthelmintic and aphrodisiac; useful in vitiated conditions of vata and kapha, elephantiasis, inflammations, haemorrhoids, abdominal pain, asthma, piles, dysentery, splenopathy, amenorrhoea, seminal weakness, fatifue, anemia and general debility. The genus is represented 213 species Worldwide; In India 21 species and from Maharashtra 10 species have been studied.The isolation of individual phytochemical constituents may proceed to find a novel drug. In present investigation HR-LCMS of *Amorphophallus campanulatus*is studied.

T-5-OP-10

Indigenous Medicinal Plants Propagation Through Herbal Garden In Rie Ncert, Bhubanewsar

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The Indian Traditional System of Medicine is one of the oldest systems of medical practice in the world and has played an essential role in providing health care service to human civilization, right from its inception. India has the exclusive distinction of its own recognized traditional medicine; Ayurveda, Yoga, Unani, Siddha, and Homoeopathy (AYUSH). The basic treatment approach of all these systems is holistic and the pharmacological modalities are based on natural products of plant origin. Medicinal plant-based drugs have the added advantage of being simple, effective, and offering a broad spectrum of activity with well-documented prophylactic or curative actions. Conservation of medicinal plants involves the sustainable utilization of medicinal plant resources that is in such a way that they satisfy the needs of today's generation without hindering the ability of tomorrow's generations to satisfy their own needs. The medicinal plant Ashwagandha, Giloe, Ginger, Cinnamom, Tulsi, Black pepper, Blak cumin, Amla, Turmeric, Garlic, and Flax seeds have been traditionally used as herbal remedies. This paper will discuss on recently established botanic garden in Regional Institute of Education, Bhubaneswar with an objectivity of conservation, propagation of medicinal plants collected from the various places of conservation repository in Odisha state Govt forest Nurseries for Outdoor science Education to both the pre-service students and in-service training programmes of NCERT. We are using deferent strategies used in conservation of medicinal plants in view of recent trends in agro-technology and Micro-propagation techniques. We are maintaining 60 varieties deferent medicinal plants which includes *Plumbago zylanica*, *Alove vera, Saraca ashoka*, *Stevia*, *Elaeocarpus*. *Rauvolfia serpentine*. Withania sominefera, Chlorophytum borivilianum, *Rosmarinus officinalis, Tinospra cardifolia, Santalum album Linn, Swertia Chirata Syn, Bacopa monnierie (L) pennel, Bacopa monnierie (L) pennel, Typhonium trilobatum, Cissus quadrangularis and Gymnema sylvestre*. These indigenous medicinal plants were collected from various plant nurseries in and around the Bhubanesar for propagation and conservation. The Nursery based techniques and polypot were transplanted with the collected saplings and propagated through cuttings, seedlings and seed bed with transplantion. Among various agro techniques applied for conservation and propagation, most efficiently propagated species lemon grass, *Tenospora cordifolia*, Satavari fallowed by *Gymnema sylvistris*. During the course of studies on skill based approach, skill enhancement course was initited based on the CBCS credit system, successfully completed more than 3 bathes and at present 4th batch is going to complete in the current academic year 2023-24. Pre-service students involved very actively in propagation, conservation and preservation of these medicinal plants for their investigatory projects etc.

T-5-OP-11

Phytochemical screening, GC-MS analysis and antibacterial activity of *Coldenia procumbens* (L.)

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Coldenia procumbens (L.) is an annual herb, common weed in India. It belongs to the family Boraginaceae. In India, the fresh leaves of Creeping *Coldenia* ground up are applied to rheumatic swellings. The dried powder of leaves of *C. procumbens* was extracted with different solvents (Ethanol, Chloroform and Acetone) and it was used for the analysis of phytochemical present in the leaf sample. In the quantitative and qualitative test, all the three solvent extracts showed the presence of flavonoids, tannins, saponins and phenolic compounds followed by alkaloids. Among the three solvent ethanolic extracts showed the high percentage of compounds then the other two solvent extracts. FTIR analysis revealed the various functional groups found in the leaves such as, alcohols, phenols, alkanes, alkynes, alkyl halides, aldehydes, carboxylic acids, aromatics, nitro compounds and amines. GC-MS analysis of ethanolic extract of *C. procumbens* was showed thirty components present in the leaves. The highest peak area (%) was obtained by Dibromoschizandrin (11.24 %) and 2-Hexadecen-1-ol, 3,7,11,15-tetramethyl-,[R-[R*,R*-(E)]]- (CAS) (8.62%), whereas, lowest peak area was obtained by 9-Octadecenoic acid (Z)-, ethyl ester (1.02) and ACETYL TRI-N-BUTYL CITRATE (1.02). Leaves extracted with three different solvents like ethanol, chloroform and acetone were used to test the antibacterial efficacy. The ethanol extract showed a higher degree of zone of inhibition against *Klebsiella pneumonia* and *E.coli*.

T-5-OP-12

Ethnobotanical survey and preliminary phytochemical screening of *Posakumura*: a nun charted ethnic food of Assam

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India is a land of diverse ethnicity and thus houses a plethora of ethnic foods. The eight sister states of North East India cater to a large number of indigenous tribes and one such state is Assam. Assam has an enormous reserve of ethnic food and beverages having distinct flavours, one of the ethnic foods is Posa kumura (a form prepared from matured fruit of *Benincasa hispida* (Thunb). Cogn. However, being not so popular food product till date the there is no written document to provide an evidence of the origin of Posa kumura even in the historical chronicles and manuscripts called Buranjis and books on Assamese cuisines. This article aims to document the contemporary process of making Posa kumura by means of both online and offline survey through a semi-structured questionnaire along with the consumption pattern. Attempts have also been made to carry out the preliminary phytochemical analysis of Posa kumura. The findings revealed that of the 918 respondents (559 male, 358 female and 01 transgender) from 35 districts of Assam, 372 consumes Posa kumura in various forms. Of the 372 people who consume, 75.81% opined that the matured *Benincasa hispida* is paced in shade for varying periods of time ranging from one month to over a year for conversion into the popular food, Posa kumura. Though the production process reported is similar, it is different in terms of how people intend to consume. Frying of Posa kumura with onion (49%) was found to be the most favoured mode of consumption followed by curry preparation (27%) with local fish, dry (6%) and pitha (a rice preparation in Assam) (6%). The age-old health benefits claimed by the consumer of Posa kumura includes improved digestion, controls diabetes, promotes weight loss, enriches skin texture etc. The preliminary phytochemical analysis revealed the presence of carbohydrates, reducing sugars, alkaloids, flavonoids, amino acids, phytosterols, saponins, coumarins. However, phenolics, tannins, phlobatannins, triterpenoids, lignins, quinones, anthraquinones, resins, fixed oils and fats were absent. Besides, Posa kumura also enhances milk production and helps prevent foot and mouth disease of cows. Thus, it can be inferred that the functional ingredients of this food lead to improvement in health in a holistic way.

T-5-OP-13

Bioprospecting *Hyophila involuta* (Hook.) A. Jaeger for potential antibacterial activity

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Bryophytes including mosses, hornworts and liverworts are cryptogamic plants occupying a wide range of ecosystem and plays a remarkable role in maintaining the ecosystem. They have been neglected as a study material for a long time due to their small size and identification problems. Recent investigations on the phytochemistry of mosses revealed the presence of remarkable and distinctive biologically active substances. *Hyophila involuta* (Hook.) A. Jaeger, commonly known as cement mosses are traditionally used in Indian medicine to cure cuts and burns. The present work set out to analyze the bioactive phytochemicals in *Hyophila involuta* and to examine the range of its antibacterial activity. The GC-MS analysis of the ethanol extract of *Hyophila involuta* revealed the presence of Squalene followed by 1, 2-Benzenedicarboxylic acid, Hexadecanoic acid, ethyl ester etc. showing several biological properties. The antibacterial potential of ethanol, acetone and petroleum ether extracts were tested by agar well diffusion assay against - *Escherichia coli, Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* (ESKAPEE pathogens recommended by WHO), responsible for nosocomial infections and exhibits multidrug resistance. The obtained results imparts a preliminary as well as significant information regarding the antibacterial potentiality of screened extracts. Thus novel therapeutic protocols for inhibiting the growth of ESKAPEE pathogenic bacteria, causing infectious diseases can be developed.

T-5-OP-14

Ethnomedicinal importance of *Tinospora cordifolia* used by the tribals of Eastern ghats of North Coastal Andhra Pradesh

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The paper deals with the ethnomedicinal importance of *Tinospora cordifolia* (Willd.) Miers ex Hook. *f.* & Thoms. belongs to the family Menispermaceae is used to cure appetite, asthma, cancer, cold, cough, diabetes, dyspepsia, fever, galactagogue, headache, heart pain, high blood pressure, helminthiasis, jaundice, leucoderma, malaria, paralysis, snake bite, stomachache, ulcers, ureter stones and ward off evil spirits by the tribal people of North Coastal Andhra Pradesh. It is endemic to India and distributed throughout the tropical and subtropical zones at an altitude of 600 m.

In Andhra Pradesh, 10 communities *viz.*, *Bodo Gadaba, Chenchu, Dongria Khond, Bondo Porja, Gutob Gadaba, Khond Porja, Konda Reddi, Konda Savara, Kutia Khond* and *Parengi Porja* are recognized as PVTGs and except *Chenchu* and *Konda Reddi* the rest are present in the study area. It falls in between 81p 51' and 84p 46' of Eastern longitude and 17p 45' and 19p 40' Northern latitude with a total area of 10,860 sq. km. covering 23 mandals of Srikakulam, Vizianagaram and Visakhapatnam districts with 4002 scheduled villages with a total population of 42,88,113 of which the tribes are 6,18,500 (14.42%) and the Primitive and Vulnerable Tribal Groups (PVTGs) constitutes 1,76,324 (4.11%) as per 2011 census. Though there are publications on ethnomedicine for various diseases on PVTGs exclusive publications on headache were not present necessitating the present study.

T-5-OP-15

Ethnobotanical Knowledge of Tribes of Sidhaeswaran Hills, Salem District, Tamil Nadu

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A survey was carried out on ethnobotanical plants used by *Malayali* tribes of Sidhaswaran hills, Salem District, Tamil Nadu, India. Using standard method, periodical field survey was conducted in the study area and about 153 plant species belongs to 62 families were documented. The surveyed plant species are alphabetically arranged with binomial name, vernacular name, family, parts of the plants used, usage and in case of medicinal plants, the medicinal values along with their dosage forms also documented.

Among the enumerated angiosperms species, 148 species are dicotyledons and 5 species are monocotyledons and about 77 plant species belonging to 72 families are having therapeutic values. About 27 plants species are used by the native residents of the study area for non-medicinal purposes such as ornamental plants, hair care plants, ritual plants, fuel wood plants, live fences etc. About 11 plant species are used for house constructions purposes and 15 plant species are used as edibles. About 48 plant species belonging to 31 families are used for magical purposes namely superstitious belief and protect from bad evils. Apart from the above categories 25 plant species are under cultivation.

From the study it is concluded that the ethnobotanical knowledge of the native residents of the Sidhaeswaran Hills, Salem District, Tamil Nadu, is similar to that of *Malayali* tribes of Eastern Ghats of Tamil Nadu.

T-5-OP-16

Role of healing plants in sustainable livelihood of the tribals of Bankura, West Bengal

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The tribal community of Bankura district are mainly forest dwellers and rely solely on the natural resources to treat against different diseases. Theseindigenous people hold an exorbitant knowledge regarding the uses of the medicinal plants to satiate the agony of the people in their own communities. Various research works have been conducted worldwide in search of the important medicinal plants. Keeping this in mind the present study mainly aims to undertake a statistical approach to validate the ethnomedicinal data of various wild plants recognized as medicinal by the different ethnic community and to conserve this eroding knowledge through written documentation and also to compare the various knowledge amongst these prominent tribal communities residing in the study site. The study was conducted from 2016 to 2022 in 42 villages involving 11 medicine men and 36 knowledge holders. The data were collected by a semi-structured questionnaire and group discussions and analysed by Fidelity Level (FL%), Informant Consensus Factor (ICF), Use value (UV), and Formulation Scoring (FS). The medicine men cited 67 plants to treat 6 different categories of diseases, namely gynecological problems, stomach problems, pains, poisonous bite, fever with cough and cold and respiratory problems. Frequently used plant parts were leaves (28.34%) followed by roots (15%) and oral administration mode were more frequent. Plants with highest fidelity representsthese plants are used in a repetitive manner by a large and the highest ICF value shows the agreement amongst the different traditional healers regarding the treatment strategy. The identification of the overutilized plants throws a light towards pharmaceutical research that may mark the beginning of a new era of medicines and sustainable conservation of these important plant resources.

T-5-OP-17

Blepharis integrifolia (L.f.) E. Mey. & Drege ex Schinz: An important nutritional and antioxidant supplement

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Blepharis integrifolia (L.f.) E. Mey. & Drege ex Schinz belonging to family Acanthaceae is commonly known by its marathi name 'Hadsan'. This plant is sold in local markets of Marathwada region as wild vegetable. Whole plant of *Blepharis integrifolia* is widely consumed as vegetable by tribal and rural people for strengthening the bones and also used to prepared *laddus* as tonic. This plant is used traditionally to treat bone fractures, skin diseases, urinary discharges and allergies. The present research paper deals with the evaluation of the nutritional, phytochemical and antioxidant potential of *Blepharis integrifolia.* The qualitative phytochemical screening of plant shows the presence of bioactive compounds like Alkaloids, Flavonoids, Simple Phenolics, Steroids and Saponins proves its medicinal value. Nutritional analysis shows the good concentration of carbohydrates, starch, reducing and non-reducing sugars, total fat, crude fibers and protein which proves its dietary value. DPPH radical scavenging activity of Methanol extract of *Blepharis integrifolia* was proved to the best DPPH radical scavenger at 400ìg/ml concentration among all tested extracts. Presence of lycopene, anthocyanin and chlorophyll pigments also supports its antioxidant properties.

T-5-OP-18

Ethnomedicinal Survey of the Hirpora Wildlife Sanctuary, Kashmir Himalaya, India

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In the contemporary world, the public health care system is increasingly moving towards herbal remedies, as their use for treatment of various human diseases seldom have side effects. This has led to recent resurgence towards herbal medicines resulting in the exponential growth of herbal-based medicines and food industry. Hirpora wildlife sanctuary, which lies in the lap of Pir Panjal Range of Kashmir Himalaya, harbours a rich diversity of prized medicinal plants. In view of this, the present study provides a detailed account on ethnomedicinal uses of 56 plant species by tribal communities and adjacent villagers. In the present study, each medicinal plant has been provided with its scientific name, local name, altitudinal range, part(s) used, method of usage and mode of preparation.

T-5-OP-19

Variation in Andrographolide Content in Selected *Andrographis* Species

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Genus Andrographis belongs to the family Acanthaceae. Genus Andrographis is a rich source of medicinally important phytochemicals, particularly diterpenoids and flavonoids. Many diterpenoids, flavonoids, and their glucosides besides some xanthones have been isolated from the Andrographis species by various investigators. The principal bitter compoundis andrographolide which is diterpenoid. The present study shows variation in andrographolide content with respect to the stem, leaf, and roots of selected Andrographis species. The present study includesthe estimation of the amount of Andrographolide from selected species which can be further utilized for pharmacological applications like antibacterial, antiviral, anti-inflammatory, anticancer and hepatoprotective capabilities.

T-5-OP-20

Ethno-medicinal Treatment and Management of Skin diseases by the Rural People of Purulia District, West Bengal, India.

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Skin diseases have become increasingly prevalent over the past few decades, posing significant challenges to global health-care systems. The burden of these diseases on healthcare resources is considerable, and effective measures must be taken to address this growing issue. Purulia, a poverty-stricken district, has a high prevalence of various skin disorders, including carbuncle, eczema, furunculosis, alopecia, melanosis, tinea, itching, keratolysis exfoliativa, and miliaria. Although modern allopathic medicine can cure most diseases successfully, rural communities have limited access to its benefits. Most of these impoverished rural people rely on their traditional knowledge to address their skin conditions. To investigate traditional medical knowledge about skin diseases in Purulia district, a three-year survey was conducted. During the field survey, 22 ethnomedicinal formulations with 28 plants and 6 animal products were documented for the mentioned diseases. According to quantitative ethnobiological data analyses, the plants *Vitex negundo, Solanum sisymbrifolium*, and *Cocos nucifera* are the most important for treating specific skin diseases. The animals *Calotes versicolor* and *Hemidactylus brookii* are also important in treating these diseases. Scientific validations of these medicinal plants and animals could provide important clues for more cost-effective and potentially more effective treatments for certain skin diseases.

T-5-OP-21

Phytochemical Composition on Stem Part of *Memcylon talbotianum* D. Brandis (Melastomataceae) and Its Antimicrobial Activity.

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The ethnomedicinal plant *Memecylon talbotianum* D. Brandis (Melastomataceae) is used to investigate the phytochemicals present in the stem part using two solvents which are moderate and high polarity-based Acetone and Methanol respectively. The various chemical components are estimated by using GCMS, and even with the help of screening secondary metabolites with standard protocols, Flavonoids, Saponins, Tannins, Phenols, Proteins, Cardiac glycosides, Terpenoids, Carbohydrates and Quinonewhich deliberate the strong presence promote the application based on antimicrobial studies (Bacteria and Fungi) and imply the technique of drugs and disease resistance from various disease host strains. Even the antioxidant activity methods comprise the free radical scavenger presence.

T-5-OP-22

Green synthesis of silver nanoparticles from *Pleurolobus gangeticus* root extract and their antiurolithiatic and cytoprotective role on oxalate injured renal epithelial cells

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The green synthesis of nanoparticles and their specific role in the field of medicine are getting humongous attention worldwide. Their eco friendly and non toxic behaviour gives them such immense priority in the field of medicines. In our study, we explored the antiurolithiatic potential of green synthesized Ag nanoparticles from the root extract of *Pleurolobus gangeticus* (L.) J. St.- Hil. Ex H. Ohashi & K. Ohashi. (PG) on oxalate-induced injury to renal tubular epithelial cells. The extract obtained from *P. gangeticus* successfully reduced silver ions and synthesized silver nanoparticles (AgNPs). The PG derived AgNPs were characterized using UV-Visible Spectroscopy (UV-Vis), Fourier Transform Infrared Spectroscopy (FT-IR), X-ray Diffraction analysis (XRD), Dynamic Light Scattering (DLS) and Scanning Electron Microscopy (SEM). The results revealed that the synthesized silver nanoparticles are rod shaped in structure ranging between 100 and 150 nm in size with a poly dispersive index value of 0.214. The AgNPs showed potent cytoprotective effects on oxalate-induced Madin-Darby Canine Kidney (MDCK) renal epithelial cells in a dose dependent manner via reducing the reactive oxygen species (ROS) generation in the cells. Overall, our findings suggest the role of PG derived AgNPs as a potent source of antiurolithiatic agents and open a wide range of possibilities in the use of silver nanosystems for the treatment of urolithiasis.

T-5-OP-23

Phytochemical Analysis, Antioxidant Activity and Antimicrobial Activity on leaf part of *Amarphophallus paeonifolius* (Dennst.) Nicolson.

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The elephant foot yam, *Amarphophallus paeonifolius* (Dennst.) Nicolson. Is a highly medicinal plant which the tuber mediated plant using leaf Part to evaluate the Phytochemicals (Flavonoids, Tannins, Phenols, Quinons, Protein and Carbohydrates) present with non-polar solvent Petroleum ether and High polar solvent Methanol respectively. The elements or chemical components are estimated using GCMS for further application. The antimicrobial activity to evaluate disease drug resistance against pathogens or contaminants (Bacteria and fungi) and the antioxidant activity to conclude free radicals scavenging activity.

T-5-OP-24

Nutritional and antimicrobial potential for bioprospecting of two noxious invasive alien plants in Mizoram, a part of Indo-Burma Biodiversity Hotspot in India

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The nutritional and antimicrobial properties of two invasive Alien Plant species (IAPs) namely *Ageratina adenophora* and *Chromolaena odorata* was explored during 2018-2021 being a part of the study "Ecological Investigations to understand causes and consequences of invasion in Tripura & Mizoram". These two species were used by the local inhabitants in Mizoram for fodder and antimicrobial purposes. The proximate composition, mineral and Vitamin content were investigated following standard analysis protocols to explore the nutritional properties. Results revealed high protein (1.19-12.70%, dry plant material), carbohydrate (1.55-26.79%, dry plant material) and ash (6.93–12.14%) but low crude fat content (1.12–3.64%) in these IAPs. Highest Vitamin-C content was observed in *A. adenophora* (28.15 mg/ 100 g dry plant material). The phytate content was least in (0.06% ± 0.001%) in *C. odorata*. Tannin was detected highest in *A. adenophora* (3.82% ± 0.164%). Highly invaded *A. adenophora* contained mineral in the following order Ca> Zn > K > Mg > Na > Fe > Mn > Cu. The methanol extract of *A. adenophora* exhibited positive antifungal potential against the test plant pathogenic fungi whereas petroleum ether extract of *A. adenophora* and *C. odorata* exhibited significant antibacterial potential against both Gram-positive and Gram-negative test bacteria. The results also revealed the solvent extracts of the studied invasive alien plants exhibited almost similar or more effectiveness with that of commonly used synthetic antifungals like Bavistin and broad-spectrum antibiotics like Gentamicin. Investigating the minimum inhibitory concentration of the plant extracts revealed their effectiveness even at minor concentrations. As an outcome of the study, it can be concluded that these two IAPs possess good nutritional value and exhibited high antimicrobial potential. Results of these study recommend their potential use as antimicrobial and food or feed additive in Mizoram as a bioprospecting resource.

T-5-OP-25

Ethno-Veterinary knowledge of the Pastoral Community of Kachchh region in Gujarat state-India

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The present investigation deals with the Indigenous Traditional Knowledge associated with the pastoral communities of the Kachchh district of Gujarat state. During the present study, a total of 35 higher plant species were reported as ethnoveterinary important in which parts of various tree species (n=14) are most known for medicinal purposes followed by herbs (n=8). Leaves, oil, stem bark and decoction of *Murraya koenigii* (locally called mitho limdo) has a wide spectrum of medicinal use *i.e.,* 12 diseases are cured by it. While the plant parts of *Capparis decidua* (Kerad), *Acacia nilotica* (Deshi baval), and *Cucumis callosus* (kotimbda) are useful in curing six types of diseases. Mastitis (Inflammation of udder and tit) is the most found disease in such regions and cure by the gum of *Commiphora wightii*, which is recorded as conservation significance species of the arid and semi-arid tract of India.

T-5-OP-26

GCMS profiling and antibacterial assay of *Hydnocarpus pentandrus* (Buch.-Ham) Oken, a vulnerable tree species endemic to Southern Western Ghats

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Ethnobotanical research across diverse communities has pointed out the importance of medicinal plants in supporting community well-being. Many plant-derived products were prevalent in these practices, and pharmacognostic compounds have been subsequently identified from them. Chaulmoogra oil, the seed oil of *Hydnocarpus spp.,* is used in ethnobotanical and modern medicine to treat severe skin diseases. Chaulmoogra oil owes its medicinal properties to the presence of cyclopentenyl fatty acids, including chaulmoogric acid and hydnocarpic acid, which exhibit anti-leprotic and antimicrobial activity. It has proven effective in treating leprosy and has shown high inhibitory activity against *Mycobacterium leprae*. This study focuses on *Hydnocarpus pentandru*s, a tree species endemic to the Southern Western Ghats and a major source of chaulmoogra oil. The species faces extensive utilization and destruction, particularly due to over exploitation for medical purposes. Due to its hard seed coat and prolonged dormancy, the species has a low seed germination rate. This extensive seed collection threatens its remaining population, classifying it as “vulnerable” according to IUCN criteria A2cd. In an effort to explore alternative sources of cyclopentenyl fatty acids beyond seed oil, this study conducted GCMS profiling of ethanolic extracts from different parts of *H. pentandrus*. The results revealed the presence of both chaulmoogric acid and hydnocarpic acid in the leaves. Additionally, the GCMS analysis of the bark identified novel compounds like heneicosane. The plant extracts are tested for antibacterial activities against *Mycobacterium smegmatis* and S*taphylococcus aureus*. Both the bacteria strains showed to have a noticeable zone of inhibition against the leaf extract. Further studies in this area will help to plot an efficient method for the utilization of this oil without harming the natural population.

T-5-OP-27

Spectrophotometric quantification of total phenolic and flavonoid content of Selected Traditional Medicinal Plants in Bodla Block, Kabirdham District, (C.G.) India

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The aim of the present work was to determine the total phenolic content (TPC), and total flavonoid content (TFC) in selected 10 Medicinal Plants such as *Cassia fistula* L., *Psidium guajava* L., *Careya arborea* Roxb., *Syzygium cumini* (L.) Skeels, *Vitex negundo* L., *Aegle marmelos* (L.) Corrêa, *Terminalia chebula* Retz., *Madhuca longifolia* (J.Koenig ex L.) J.F.Macbr., *Shorea robusta* Gaertn., *Cordia macleodii* Hook.f. & Thomson etc. The total phenolic content (TPC) was estimated spectrophotometrically using Folin Ciocalteu method. Total flavonoid content (TFC) was measured by aluminium chloride assay. The results showed *Syzygium cumini* (belonging to the family Myrtaceae) is the richest source of phenolics (total Phenolic content: 80.08 mg GAE/g and *Shorea robusta* (belonging to the family Dipterocarpaceae) is the richest total flavonoid content: 80.83 QE/g). The lowest Total phenolic and flavonoid content was noticed in *Aegle marmelos* (belonging to the familyRutaceae) (total Phenolic content: 2.33 mg GAE/g) and the lowest total flavonoid content (0.83 mg QE/g). The result of the study highlighted a potent phenol and flavonoid in the plant extract and thus can be used to explore new drugs.

T-5-OP-28

Cytotoxic activity of ZnO NPs synthesized from aqueous extract of *Oldenlandia corymbosa* L. inhibits cell proliferation and induces cell apoptosis in human Brest cancer cell lines (T-47D)

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In the present study, zinc oxide nanoparticles (ZnO NPs) synthesized by simple and eco-friendly method using *Oldenlandia corymbosa* (OC)extract was studied *in vitro*. The characterization of ZnO NPs was done by UV-Visible spectroscopy, Fourier transform infrared (FTIR) spectroscopy, Energy dispersive X-ray (EDX) analysis and Scanning electron microscope (SEM) analysis. The formation of ZnO NPs and reduction of zinc ions was observed by changing its color from light yellow to dark brown within 15 minutes. The UV-Visible spectroscopy showed maxima absorption peak at 400 nm indicating mainly its formation. The FTIR analysis was monitored to identify functional groups and biomolecules in the OC extract as responsible for the capping and stabilization of ZnO NPs. The EDS analysis was used to determine the elemental composition of nanoparticles. The crystalline size of the ZnONPs was confirmed by X-Ray diffraction analysis, which was found to be 41.02 nm. The surface morphology and size of the ZnONPs was determined using SEM analysis. The prepared ZnO NPs.

T-5-OP-29

Traditional foods and methods of preserving vegetables by Monpa tribe in Tawang district of Arunachal Pradesh, India

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People of Monpa tribe living in high altitude areas of Tawang district in Arunachal Pradesh (India). Their cuisine is the reflection of region's culture and geography. The diversity of food they prepare are rich and using ingredients from their high-altitude environment. These not only showcase the resourcefulness of Monpa people but also express how they sustain through their unique way of life. Their traditional foods include a variety of dishes, such as *Zan Guthuk, Puta, Khaze, Ashumthukpa, Ashumzan, Ashumtoh, Morgubaktsa,* etc. The primary sources of their food are locally cultivatedas well as wild plants and domesticated animals. Wild vegetables like Fiddlehead (*Kukuling*, *Diplazium esculentum*), Water dropwort (*shungru*, *Oenanthe javanica*), *Dambe hru* (*Elastostema sessile*), *Mreptang* (*Houttunynia cordata*) and *Tseplum* (algae), etc. are commonly consumed by them. Monpas preserve almost all vegetables they cultivate for winter using age-old technique of sun-drying. They rear animals like Yak, cattle, sheep, goat, pig, chicken, etc. from which they get meat, milk, cheese (*Mar*), and paneer (*Chur*).They use *Mar* and *Chur*in almost all dishes.

During festivals and celebrations, they prepare their preferred traditional foods as each such item signifies something of life. They prepare different type of alcoholic drinks and served differentially as per their traditions.

Many foods are prepared from barley and finger-millets. The flour is used to eat as *Zan chang*. It is also eaten by Monks and Nuns in monasteries as breakfast.

T-5-OP-30

Antispermatogenic effect of *Ruellia tuberosa* L. Roots on Albino Rats

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The most ancient form of treatment known to mankind is use of herbal medicine. More than 80% of the world's population in poor and developing countries depend on traditional plant-based medicines for their primary healthcare needs. India is first among the countries to adopt an official family planning programme, as early as 1952. However, fifty years later this has not prevented the population touching one billion mark. Approximately 48.2% of couples of 18 to 49 years of age practice family planning methods in India; female sterilization accounting for 34.2% while, male sterilization declining from 3.4% in 1992-93 to 1.9% in 1998-99 to less than 1 percent (0.3%) during 2019-20 in India. *Ruellia tuberosa* L. of Acanthaceae, a native of America was introduced as garden plant in India. Now it has naturalized and grows as garden weed. Aqueous tuberous root extract of *R. tuberosa* administered orally at the dose of 50 mg/kg, 100 mg/kg and 150 mg/kg body weight respectively for 21 days to fertile male rats before taking the sperm count resulted in significant decreased sperm count. The results suggest that the aqueous extract of *R. tuberosa* produces antispermatogenic effect in male albino rats. Treatment with *R. tuberosa* tuber extract significantly reduced sperm density from 27.63 million/ml in control to 23.88 million/ml, 17.10 million/ml and 12.65 million/ml showing gradual increase in average antispermatogenic activity (13.52%), (38.08%) and (54.20%) in groups treated with the tubers. About 54% antispermatogenic activity makes *R. tuberosa* a strong candidate to be worked out further to develop male contraceptive.

T-5-OP-31

Chemo preventive and Neuroprotective effect of Letrozole isolated from *Glycosmis pentaphylla* (Retz.) DC. (Rutaceae)

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Glycosmis pentaphylla (Retz.) DC. is an ethnomedicinal plant belonging to the family Rutaceae. The plant has also demonstrated a huge range of pharmacological effects like antioxidant, anti-inflammatory, antidiabetic etc. Previous studies reported the use of this plant as a neuroprotectant. But, a scientific proof for the same has not been conducted at molecularlevel. Therefore, the present work was aimed to explore the role of *G. pentaphylla* in neuro-oncology and neuroprotection. Bioactivityguided separation of leaf ethanolic column fraction resulted in the isolation of a dibenzonitro compound called Letrozole. Further neuroprotective and neuro-oncology studies were done onLetrozole. Initially MTT and LDH assays were conducted on Letrozole and the toxicity dose was fixed as 20 and 30 ìg/mL. Further, using flow cytometry, the distribution of cells at different stages of cell cycle were obtained. Effect of Letrozole on different genes involved in replication (Cyclin D1, PCNA), Neuronal specific marker differentiation (NF 200, MAP 2 and Neu N), Heat shock (Hsp 70 and Mortalin) and cell survival (NF êâ, pAKT-1, c-fos and c-jun) were also done. The translational level regulation was determined using Western blot analysis. For neuroprotection the transcriptional and translational level studies were conducted using genes like ApoE4 and BACE 1. Also, DCFHDA and NBT assays were conducted. Finally, autophagy was determined using LC 3 detection method. The results of the study showed that, even though both doses of Letrozole could effect the expression of genes, a more prominent effect was observed for a higher dose of 30 ìg/mL. Thus, the present study is a proof in support of the ability of Letrozole in both neuroprotection and neuro-oncology.

T-5-OP-32

Pharmacognostic studies on *Tragia cannabina* L.f. leaves

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Tragia cannabina L. f. is common, found in hedges around fields and along roadsides. Its leaves are used medicinally in traditional systems of health care. The leaves are commonly used on toothache and dysentery in Vidarbha region by Banjara tribe. The anatomical and phytochemical study was carried out for leaves. Trilacunar three trace nodes is most common feature for Euphorbiaceae. Presence of stinging hairs also reported earlier in some tribes of the family. Phytochemical analysis was done to test 16 types of bioactive molecules. Present investigation showed the presence of alkaloids, simple phenolic, flavonoids, steroids and cadenolides with digitoxose. Different ash values were estimated and ash analysis was done to study the mineral profile. Qualitative as well as quantitative analysis was carried out for Sodium, Potassium, Phosphorus, Iron, Magnesium, Aluminum, Copper and Zinc.

T-5-OP-33

Medicinal Plant Conservation Area (MPCA) as tool for Biodiversity Conservation and Socio-Economic Development in West Bengal

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Abstract

MPCAs in West Bengal were established for In-situ conservation of the genetic diversity of highly traded and threatened medicinal plants of the state. Phytosociological analysis of the 7 MPCAs (Bonnie Camp, Garpanchkot, Dhotrey, Tonglu, North Rajabhatkhawa, North Sevoke and Sursuti) established since 2007 had Shannons diversity index ranging from 1.91 to 3.68 for trees, 2.27 to 3.52 for shrubs and 2.49 to 4.32 for herbs. The number of plants unique to the MPCAs ranged from 11% to 71%. A total of 1270 medicinal plants belonging to 167 families were recorded from the 7 MPCA's of which 40 were threatened such as *Gynocardia odorata, Machilus glaucescens, Mesua ferra, Steroospermum colais, Xylocarpus granatum* and others. Many species from the MPCA were of first record from the State. Many of these threatened species were found to have a viable population in the MPCA's. Forest communities living in the neighbourhood of the MPCA's traded 30-40 medicinal plants for their livelihood some of which also had genepool in the MPCA's. Hence, long term monitoring of the MPCA's that are ecologically and taxonomically rich ecosystems can address many sustainable development goals (SDGs) to mitigate poverty and climate change. The need for regeneration and micropropagation of the threatened traded medicinal plants is an immediate requirement for reducing the pressure of extraction of such plants from the wild. Awarness programs among the neighbouring communities regarding the importance of the MPCA and SDGs is a prerequisite for intellectual, ecological, social and economic development of the State.

THEME 5: INDIGENOUS TRADITIONAL KNOWLEDGE AND BIOPROSPECTION [POSTER]

T-5-PP-01

Exploration of ethno-medicinal herbs and their practices by indigenous people of Purulia District of West Bengal

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The present study was performed in Purulia district of West Bengal, India. At the study site, a total of twenty herbaceous medicinal plants were documented. Between April 2022 and April 2023, intensive field surveys were conducted in the research areas. Native knowledge of wild medicinal plants was obtained on field trips through questionnaires, discussions, and in-person interviews. In accordance with their correct nomenclature, plants were organized according to their botanical name, family, common name, parts used and diseases treated. The Zingiberaceae family was the most prevalent in the current study, For a longer period of time, the rural residents of Purulia district have used native flora for primary healthcare and the treatment of various diseases. However, there was little information about traditional knowledge of medicinal plants documented. Rural people asserted that younger generations are less interested in traditional knowledge of medicinal herbs as a result of societal development. Therefore, it is crucial to document ethnomedicinal plants before they are no longer available and go extinct. In order to effectively conserve plants and traditional knowledge for the future, this ethnobotanical database will be helpful to scientists, naturalists and chemists.

T-5-PP-02

Green synthesised algal nanoparticles and their application in wastewater remediation

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Water is the most vital life sustaining element on earth. According to WHO, over 2 billion people live in water-stressed countries, which is predicted to be exacerbated in future. Due to rapid industrialization, urbanization, untreated agricultural and municipal sewagerunoff,water quality has steadily deteriorated over time. Effluents frommining, tannery, textile and electroplating industries contain significant amounts of heavy metals i.e.,Cr, Pb, Co, Cd, Hg,As, Zn, Ni, Fe.Being highly toxic,they can impose severe threat to terrestrial and aquatic biome. Therefore, feasible wastewater remediation strategies are an immediate necessity. Traditional methods are ineffective to an extentfor beingenergy exclusive, costly, and non-eco-friendly. Use of nanoparticles (NP)for wastewater remediation has gained attention of researchers due to their large surface to volume ratios, higher reactivity, greater sensitivity and reusability. Green synthesis of NP utilising algae culturesis a preferable choice due to fast and abundant growth, easy handing and high stress tolerance of algae. Algal capped and stabilized metallic NP is widely considered as a less toxic, cost effective, eco-friendly method of fabrication. Many algal genera have been explored till date. Research works on NP synthesisusing green algae i.e., *Chlorella, Chlorococcum*, Cyanobacterial algae i.e.,*Spirulina, Lyngbya*and marine algae i.e., *Ulva, Sargassum*have shown promising results in terms of heavy metal, synthetic dye removal and other water remediation parameters such as BOD, COD, Chloride, TDS. Extensive research on different algal genera for NP synthesis and detailed studies on mode of action of algal NP in wastewater remediation and effective separation method after remediation will be helpful for its mass application.

T-5-PP-03

Quantitative study on the ethnomedicinal plants used to alleviate gastrointestinal disorders by the tea garden workers of Darjeeling Hills

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Gastrointestinal (GI) disorder as the name suggests, it is any kind of deformities or abnormalities in the function of our digestive tract from mouth to anus. Prolonged and untreated conditions may lead to severe diseases such as ulcers, cancers in colon and rectum. Despite the availability of modern treatment for this ailment, the tea garden workers of Darjeeling Hills belonging to different ethnic communities like *Lepcha, Sherpa, Kirat, Mangar, Newar, Sunar, Khas, Limboo, Tamang*, and other still prefer ethnomedicinal formulation to treat various infirmities including gastrointestinal disorders. The present study was conducted to document the indigenous knowledge of the local people to cure GI disorders. Frequent ethnobotanical survey was conducted in randomly selected tea gardens of Darjeeling hills. A semi-structured interview was conducted by using open ended questionnaire considering the consent from the informants. A total number of 27 informants participated in the interview. This study revealed the use of 35 plant species belonging to 33 genera and 27 families against gastrointestinal disorder. Zingiberaceae was the frequently used family with highest family use value (FUV=3.5) followed by Asteraceae, Myrtaceae, Leguminosae, Costaceae, Apocynaceae all with FUV=2. The highest frequency of citation (FC) and relative frequency of citation (RFC) were recorded for *Curcuma caesia* Roxb. (FC 21.42 and RFC 0.78). The recorded informant consensus factor for gastrointestinal disorder was 0.31. This information encourages further pharmacological research which may be the lead to new drug discovery.

T-5-PP-04

The Prevalent Family in Home Gardens of the Tripuri and Reang Communities of Tripura: Leguminosae

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This paper explores the prevalence of the Leguminosae family in the home gardens of the Tripuri and Reang communities of Tripura. Home gardens are essential components of agricultural systems, contributing significantly to food security, medicine, biodiversity conservation, and cultural heritage. The Leguminosae family, known for its ecological and economic importance, is examined in the context of these indigenous communities' home garden practices.

Through field surveys and data analysis, we identify the prominence of Leguminosae species within the flora of home gardens. Factors influencing the choice and cultivation of Leguminosae plants in these communities are discussed, shedding light on their cultural significance, nutritional value, and sustainable farming practices. This study highlights the role of Leguminosae in enhancing the resilience and biodiversity of home gardens among the Tripuri and Reang communities and underscores its potential for broader implications in agroecosystems and biodiversity conservation.

T-5-PP-05

PROXIMATE, MINERAL AND ANTI-NUTRITIONAL COMPOSITION OF OKRA GERMPLASM FROM KOLHAPUR DISTRICT

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Bhendi or Okra, scientifically called *Abelmoschus esculentus* belonging to the family Malvaceae, is commonly known as "lady's finger". The Mucilage from stem of the Okra plant is considered to be important during Jaggery production. It is a good clarifying agent during Jaggery production. From this point of view, it is necessary to check the nutritional quality of the Okra mucilage. In the present study proximate analysis, mineral composition, and Anti-nutritional factors in the mucilage are studied. From different locations in Kolhapur district total 55 accessions of *Abelmoschus esculentus* were collected. Mucilage from the stems of each accession was extracted by the method of Nair and Fahsa (2013). The proximate and mineral composition of Okra accessions weredetermined using standard methods of Association of Official Analytical Chemists. In present paper, the detailed estimates of proximate, mineral and anti-nutritional composition of 55 accessions of Okra are given.Therefore, an increase in the production and use of thesenutrient-richindigenous Okra accessions will help to solve the problems associated with Jaggery production.

T-5-PP-06

Pharmacognostic studies on *Kaempferia scaposa* (Nimmo) Benth

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Kaempferia scaposa is an aromatic, rhizomatous perennial herb endemic to Western Ghats. The plant has been widely used, especially in the main and tuberous parts of the rhizome, which are rich in essential oils. The sweet scented rhizome is used in the treatment of rheumatism, inflammation, Headache, sore eyes, sore throat, cough, asthma, etc. The present study aimed to evaluate the pharmacognostic studies for macroscopic, microscopic and phytochemical studies of leaf and rhizome of *K. scaposa.* The quantitative phytochemical screening was done using Acid-Base Fractionation method. Also, some pharmacological activities of the phytochemicals from rhizome extract were analysed.

T-5-PP-07

An Ethnobotanical investigation on Plant medicines used by People of Fringe Villages of Manas National park, Assam (India)

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Ethnobotany is the study of plant utilization by the indigenous communities. These communities seem to live in harmony with nature which is rendered by their traditional knowledge (TK). The TK of medicinal plants helped them to remain protected from a wide range of illnesses. However, with time and the advancement of synthetic drugs, this knowledge is gradually fading.

The study was aimed to document the use of plants for the prevention and control of various human diseases by traditional healers in the fringe villages of Manas National Park (MNP). A survey was conducted to collect data on medicinal plants from among the 20 indigenous healers through face-to-face interviews. The information was compiled in a table through the UR (Use report). The scientific name of the plants was verified using https://wfoplantlist.org/plant-list.

A total of 42 plant species having medicinal properties belonging to 42 genera and 30 families have been reported in the present study. The highest use has been found in the families of Asteraceae, Malvaceae, Fabaceae, and Lamiaceae. The leaves were the most used parts accounting for 53% of the total and were usually used by extracting the juice. The indigenous communities of MNP are closely associated with the nature and well-versed with the uses of plants. They have gained this knowledge from their ancestors who in turn have acquired this by trial and error and left a rich legacy of the use of plants. The medicinal plants are mainly used in their crude form and thus they must be systematically assessed and tested to detect and identify the bioactive compounds involved in their mechanism of action. This information can be further used in synthesis of the novel drugs.

T-5-PP-08

Assessing the Medicinal Plant Wealth of Sacred Groves of Dakshin Dinajpur: A Quantitative approach

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The Dakshin Dinajpur district is home to sacred groves, natural sanctuaries teeming with rich ethnomedicinal plant diversity and a haven for various forms of life. Indigenous communities have been preserving these groves for generations, guided by their beliefs and folklore practices, and have accumulated a wealth of knowledge about herbal ethnic medicines. This study aims to delve into the traditional medicinal practices associated with significant plants among different indigenous communities residing in villages centered sacred groves across the district. We selected 15 ethnomedicinally enriched sacred groves for this study, gathering ethnomedicinal data from 179 informants. We then conducted a quantitative analysis using various statistical indices, including Use Value, Informant Consensus Factor, Fidelity Level, and Relative Frequency of Citation. To further validate our findings, we employed in-silico network pharmacological investigations.Our study documented a total of 105 ethnobotanical plant species, representing 93 genera and 47 families. Among these, the Fabaceae family emerged as the most dominant. The informants' reports covered a spectrum of 16 distinct disease clusters. Notably, *Cuscuta reflexa* Roxb. *Heliotropium indicum* L. and *Cynodon dactylon* (L.) Pers. were identified as the most widely recognized and used medicinal plants. Collecting such invaluable firsthand knowledge about ancient traditional practices has the potential to significantly contribute to future pharmacological studies, potentially paving the way for novel approaches to modern therapeutics.

T-5-PP-09

Evaluation of antioxidant activity in *Strobilanthes* Blume species by DPPH and ABTS radical scavenging capacity assay

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In Ayurveda, *Strobilanthes ciliata* Nees, and other species of *Strobilanthes* are used as a major ingredient in formulation of drug 'Sahachara'. The local adivasi, traditional healers use the plant parts of *Strobilanthes* species for the treatment of inflammatory disorders and various other ailments from ages. Antioxidants play vital roles in reducing or inhibiting the free radical damaging oxidizing agents. The two most common assays of radical scavenging 1,1-diphenyl-2-picrylhydrazyl (DPPH) and 2,2'-azino-bis-3-ethylbenzthiazoline-6-sulphonic acid (ABTS) were used to evaluate the antioxidant activity in the methanolic leaf and stem extracts of five *Strobilanthes* Blume species viz. *S. callosa* Nees, *S. ciliata* Nees, *S. integrifolia* Kuntze, *S. ixiocephala* Benth, *S. heyneana* Nees. L-ascorbic acid and Butylated hydroxytoluene (BHT) were used as reference standards in expressing antioxidant activities. The result shows that both leaf and stem extracts of *Strobilanthes* species possesses antioxidant activity and maximum percentage of inhibition was increased with the increase in the concentration i.e. 320 ug/ml. With respect to IC_{50} value DPPH assay showed highest antioxidant activity in *S. ciliata* leaf with 115.84 ug/ml as compared to L-ascorbic acid 107.99 ug/ml while, ABTS exhibited highest antioxidant activity in the *S. callosa* leaf 143.67 ug/ml as compared to BHT with IC_{50} value 139.54 ug/ml. In both assays, the antioxidant activity was seen lowest in *S. integrifolia* leaf (ABTS) and stem (DPPH). Phytochemical analysis of both these species *S. ciliata* and *S. callosa* are closely related with the presence of phytochemicals which are contributing significantly to antioxidant properties and hence, can be responsible for the highest antioxidant activity.

T-5-PP-10

Agro-morphological insights into diversity of indigenous turmeric cultivars using Neural Networking

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Curcuma longa (L.), commonly known as turmeric, is considered one of the most important commercial plants in India, our country being its largest global producer and exporter. In addition to innumerable traditional uses of turmeric, the main active constituent curcumin is known for its myriad medicinal uses. This study involves a novel approach of assessment of agro-morphological diversity of indigenous turmeric accessions, using twenty-seven cultivarscollected fromIndian Institute of Spices Research, Calicut, Kerala. The quantitative characters recorded were height, number of leaves, leaf length, leaf breadth, petiole length, sheath length, number of primary and secondary rhizomes, diameter of the rhizomes, weight of rhizomes andcurcumin content. Correlational analysis of these parameters was represented as a heatmap, that displayed relative strength of the inter-relationshipsamong them.The clustering pattern generated was supported by Principal Component Analysis (PCA). Cumulative data analysis based on variability showed the cultivars segregating in tofour clusterswhile the statistical multivariate analysis depicted that variation of curcumin content was highly dependable on parameters like height of the plant, leaf size and rhizome traits. The variation existing among the cultivars can be attributed to the vegetative propagation of turmeric germplasm.This investigation also employsNeural Networking using SPSS (version 27) which produced a complex web-like architecture depicting the impact of all the twelve quantitative parameters on the amount of curcumin present. The presented approach of studying diversity among turmeric cultivars using multivariate statistical analysis and neural networking is a simple, rapid and cost-effective method. Moreover, it will be a resourceful contribution for identifying those traits impacting curcumin production, so that researchers can work on manipulating these traits further, for an increased and stable curcumin content. Knowledge on the agro-morphological diversity of turmeric can be used in future breeding programs and management of sustainable bioprospecting for increased bio-resources like curcumin content and other valuable by-products for commercialization and overall benefits of the society.

T-5-PP-11

Androgrpholide- an efficient bioactive compound

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Androgrphis paniculata (Burm.F) Nees commonly known as the "King of Bitters" is an herbaceous plant belonging to the family Acantheceae and is found throughout the tropical and sub tropical Asia, South East Asia and India. In India, *A. paniculata* is known as 'Kalmegh'. The chief chemical constituent obtained from this plant is androgrpholide which is a labden di-terpenoid lactone exhibits a wide range of pharmacological activities such as anti inflammatory anti bacterial, antivirus and is used in the treatment cardio vascular – cerebro vascular diseases and protection of the liver and gall bladder. In addition to this activity andrographolide was also reported to attenuate postprandial hyperglycemia by inhibiting *á*-glucosidase and *á*-amylase enzyme activities. In biological system andrographolide can interact with many inter-intra cellular constituent as a bipolar compound thus ensuing many biological responses. Androgrpholide found to inhibit the proliferation of various cell lines including leukemia, breast cancer, lung cancer and melanoma cell. It is also used in the treatment of snake bite and is found to be more or less effective than the anti snake venom generally used .The objective of this review is to summarized current knowledge of the biological effects of andrographolide. This article reviews the application, anti-inflammatory mechanism and molecular targets of andrographolides in different inflammatory disease including respiratory, digestive, immune, cardiovascular and tumor system diseases and describe its toxicity and explain its safety. This future direction of androgrpholide research is also introduces as in the recent research that indicate its potential clinical application.

T-5-PP-12

The importance of wild edible plant and macrofungi diversity to attain food security for the tribes of eastern India - a quantitative ethnobotanical approach towards bioprospection

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Inventorization and promotion of traditionally used local flora can be a better option to gain a wide range of alternative edible resources and multiple nutritional benefits. A perusal of literature highlighted the poor nutritional status of the tribal community living in eastern India and pointed out the potential lack of information regarding locally available wild edible resources. Present study aimed to document detailed information on wild edibles of eastern India, evaluate their cultural significance, and understand their role in achieving food security for the local tribes. Traditional knowledge of wild edibles was collected using a semi-structured questionnaire. Standard protocols were followed for collecting data. The collected data were analyzed using specific statistical tools like Relative frequency of citation (RFC), and Cultural food significance index (CFSI) to identify the most cited and culturally significant species. Jaccard similarity index (JI) was used to check the similarity of food plant use in different localities and adjoining areas of the laterite region in eastern India. A total of 2,603 citations were made by the 153 participants for 83 types of wild edibles spread across 48 families. Among the 83 species, 65 species were angiosperms, three species were pteridophytes and the rest 15 were from fungal groups. The RFC value ranged from 0.04 to 0.76, and *Madhuca longifolia* (L.) J.F.Macbr. was identified as the most frequently cited species (FC = 116; RFC = 0.76). The Cultural food significance index (CFSI) value varied from 0.2to 844, and thirteen wild edibles like *Colocasia esculenta* (L.) Schott, *Enydra fluctuans* Lour., *Marsilea vestita* Hook. & Grev., *Termitomyces heimii* Natarajan, etc. were identified as culturally most important in the locality.

Present study concludes that the local flora and macrofungi diversity is a treasure trove for fulfilling human hunger and gaining enough nutritional benefit. Scientific and sustainable utilization of these wild edibles can be a wise step to attain multiple health benefits and food security for the tribal community of eastern India. Moreover, culturally accepted species can be opted as a good source for bioprospecting nutraceuticals.

T-5-PP-13

ETHNOBOTANY OF GARHWA DISTRICT, JHARKHAND

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India has indigenous system of Medicine based on use of wide biodiversity of medicinal plants.Jharkhand state is one of the hotspot of biodiversity of medicinal plants in eastern India. The area of Garhwa district is about 4044 Sq. Km. andcovers nearly 29. 2 % area under forest. The present study is concentrates on the Garhwadistrict of Jharkhand, has primarily tribes, rural and most of the population resides in village.Tribal population of the district is still thriving for the livelihood in the forest areas.Present investigation of indigenous knowledge on medicinal uses of most commonly occurring plant species in Garhwa district. The available biodiversity was found to be frequently used in treatment of gynecological and physiological problems like gonorrhea, leucorrhoea, vomiting, diarrhea, dysentery, diabetes, bone fracture, malaria, typhoid, fever, cough, cold, snake and scorpion bite, rheumatism etc. in human and in case of different infectious disease and wounds of animal. The mode of administration varied from decoction, extract, infusion, powder, paste and poultice to combination with other plants. All collected and identified plant specimens were deposited in Duthie herbarium (DUTHIE), Department of Botany, University of Allahabad, Prayagraj.

THEME 6: DIGITIZATION AND DATABASE [ORAL]

T-6-OP-01

Method of Chhyang production and its social implications for the people of Monpa tribe in subalpine Arunachal Pradesh (India)

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The traditional brewing methods of *chhyang* and the role of different types of *Chhyang* in the Monpa tribal community living in the Tawang district of Arunachal Pradesh in North-East India which is almost inseparable from their regular social life. They speak in their own Monpa language. Production and consumption of *chhyang* is a traditional heritage for them. Three main types of *Chhyang* (= Chang/ Chhang) prepared by Monpa people are Arah, Bangchang and Singchang. As a basic material or source of starch, they mostly use grains of *Eleusine coracana* (L.) Gaertn., *Oryza sativa* L., *Hordeum vulgare* L., *Zea mays* L., and seeds of *Amaranthus caudatus* L. They have their own instrumentation for fermentation and distillation necessary for *chhyang* production. The method of starter preparation is also important and it include the use of some plants.

The *chhyang* is almost omnipresent in all festivals and other social programs of Monpa people. So they need to produce huge quantities of *chhyang* and for this they grow all these crops locally mostly on subtropical to sub-alpine hills.

T-6-OP-02

Use of Herbarium Data in Global Environmental Change Research: Opportunities and Challenges

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In an age of Anthropocene, world is experiencing rapid environmental changes, notably the current crises of climate change and biodiversity loss. The recent warming trends in climate are causing drastic changes in the natural environment, including significant impacts on biodiversity. Exploring how species respond to ongoing climate change is urgent for conservation of biodiversity and, therefore, is currently a frontier areain global environmental change research. Worldover, herbaria – the premier centres of taxonomic research – are reorienting their roles to become relevant in contemporary times. Herbaria, because of their temporal dimension, provide long-term plant data critical for tracking ecological and evolutionary changes under ongoing global change. Here, we showcase how herbaria can provide precious information about long-term effects on plants from the major drivers of global change: habitat change, shifts in phenology, redistribution and extinction risks. By presenting a model phenological study of an early spring-flowering geophyte *Sternbergia vernalis*, distribution modelling and niche dynamics of treeline *Betula utilis*, and distributional shifts of some endemic alpine species in the Himalaya over time and space, the scope of integrating herbarium data sources in global change research will be highlighted. Additionally, we will provide a snapshot of how herbarium data so far has been used in global change research, discuss future opportunities and challenges posed by the nature of these data, and suggest future direction for a systematic use of these 'windows into the past' for global environmental change research and beyond.

T-6-OP-03

Endemic Tree Flora of India: Diversity, Distribution and Threat Status

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Endemic species with restricted geographical ranges experience relatively a higher risk of extinction than widely distributed species, and therefore successful conservation strategies of the endemic species require scientific knowledge of their diversity, distribution and threat status. Here we present the endemic tree flora of India, a comprehensive database assembled from an empirical synthesis of 313 studies published over the last one and a half century (1872-2022). The database comprises 737 endemic species belonging to 246 genera and 73 families, which represents about 20% of the total tree flora of India. The database enhances the number of endemic tree species in India by additional 100 species, in comparison to those previously recorded in Global Tree Search (GTS) for the country. The results reveal that distribution of the endemic tree species varied greatly across the different regions in India, with southern and eastern parts harbouring the highest endemic tree diversity. Similarly, biome distribution patterns revealed that the wet tropical biome harbours the highest proportion of endemic tree species (64.5%), followed by the seasonally dry tropical biome (26.38%). Furthermore, there are currently 222 endemic tree species that fall under different IUCN threat categories with 41 as Critically Endangered, 98 Endangered, 66 Vulnerable and 17 Near Threatened. In an era of twin crises of global climate change and biodiversity loss, our extensive data synthesis on the endemic tree species of India has huge policy and management implications in guiding area-based biodiversity conservation and designing ecosystem restoration protocols.

T-6-OP-04

Recent trends and breakthroughs in Myrtaceae-based research: A bibliometric analysis

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One of the largest and most economically significant flowering plant families in the world, the Myrtaceae, comprises 5500 different taxa. The present study focused on recent trends in Myrtaceae-based research. We employed bibliometrix, an R package, and VOS viewer for comprehensive science mapping analysis by using the metadata downloaded from the Web of Science Core Collection database and Scopus using the search string"Myrtaceae". A total of about 6790 documents, including research articles, proceedings papers and conference papers, were retrieved from the Web of Science and Scopus published during the period from 1993 to 2022. The downloaded data were from 1341 different sources by 16284 authors representing 116 countries. Based on the research articles published during the period from 1993 to 2022 indicate that there is an observable increase in research outputs over the years and the most relevant author, journal and country were Sobral M (104 articles), Journal of Essential Oil Research (264 articles) and Brazil respectively. The results also revealed the nature of the collaboration network among researchers and the trend topics in Myrtaceae-based research. This study will help the researchers who are working on the family Myrtaceae in different research aspects and convey much valuable information to the scientific world for future works.

T-6-OP-05

Cucumis callosus (Rottl.) CognUnderutilized Vegetable and It's Biological Activity

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This study aimed to identify the phytochemical composition of *Cucumis callosus* and investigated its potential pharmacological properties using hot extraction method. The results showed that *C. callosus* containedvarious phytochemical compounds such as alkaloids, tannins, phenolic compounds. The presence of these phytochemicals suggested that *C. callosus*could have various pharmacological activities such as anti-inflammatory, antibacterial and antioxidant properties. *C. callosus* extracts have shown inhibitory effects on protein denaturation, which is a key factor in the pathogenesis of several chronic diseases such as arthritis. In addition, *C. callosus* extracts have demonstrated significant alpha-amylase inhibitory activity, which could be useful in the management of diabetes. Furthermore, *C. callosus* extracts have shown potential anthelmintic activity against various intestinal parasites, which could be useful in the treatment of parasitic infections. Moreover, *C. callosus* extracts have exhibited antibacterial activity against several bacterial strains, which could be beneficial in the treatment of bacterial infections. Overall, present bioactive compounds in *C. callosus* it may be new natural medicines for various disease and conditions. However, further studies are needed to fully understand the mechanisms of action and safety profile of *C. callosus* extracts.

THEME 6: DIGITIZATION AND DATABASE [POSTER]

T-6-PP-01

Recent Trends in New Species' Discovery

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Taxonomists are continuously exploring new areas and examining the past herbarium and fresh plant material, and as a result the new species are being incessantly discovered. To assess the progress in this area of taxonomic research, it becomes important to understand the trends in new species' discovery. In particular, it is crucial to understand what, how and where species are discovered. Here we undertook a quantitative review of new species discoveries published from 2011-2020 to investigate the trends in new species' discovery of plants, fungi, lichens and bacteria. We initially retrieved 4976 relevant research articles, out of which 1030 articles were excluded due to lack of required information, and finally 3946 articles were retained for data extraction. Our results reveal that, worldwide, a total of 6098 species and 82 subspecies belonging to 2155 genera and 710 families have been described during the study period. About 80% of species' discoveries are primarilybased on morphological characters. Furthermore, there were only 351 species for which IUCN conservation status was given, which includes 158 Critically Endangered followed by 96 Endangered. Globally, the highest number of new species' discovery are reported from Brazil, followed by China. Based on the insights gained from this study, we identify the data gaps and highlight the best practices in new species' discovery, that will guide future research direction. In an era of global environmental change, the findings from our study can help in identifying the taxa, areas and tools that merit priority in the taxonomic discovery, documentation and conservation of biodiversity.

T-6-PP-02

The Potential Role of Artificial Intelligence and Machine Learning in Aiding Automated identification and Characterization of Plant Species

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Artificial Intelligence (AI) is playing significant role in different fields of plant biology such as plant breeding and crop improvement, plant pathology and disease management, plant genomics, climate change and conservational biology. However, its role in the field of plant taxonomical research, specifically in identifying and classifying plant species, is a lesser-known yet equally important application. This emerging technology could be a potential tool, offering solutions to some of the most complex challenges in plant taxonomy.Traditionally, the identification and classification of plant species have been laborious tasks, requiring expert knowledge and extensive fieldwork. One has to collect specimens, meticulously observe their physical characteristics, and compare them with existing records. This process is very time-consuming and also prone to human error. Moreover, the vast number of plant species worldwidemakes the task even more challenging.With the ability to analyze large amounts of data quickly and accurately, AI can significantly enhance the process of plant identification and classification. Machine learning, a subset of AI, can be trained to recognize patterns and make predictions based on previous data. For example, machine learning algorithms can be trained to identify plant species based on images of their leaves, flowers, or other parts and genus specific characteristics can be categorized to classify different plant species using neural network. AI can detect subtle differences in shape, color, and texture that may be overlooked by humans. This ability can significantly improve the accuracy of plant identification and classification. With the advancement and improvement of this technique, it is likely to revolutionize the field of plant taxonomy research and reshape our understanding of the plant kingdom.

STUDENTS' POSTER

SPP-01

Production of Volatile Organic Compounds as Mediator of Plant-Plant Interaction under Stress Conditions

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Volatile organic compound (VOCs) are the most abundant and structurally diverse plant secondary metabolites. They play a key role in plant lifespan by direct and indirect plant defenses and mediating various interaction between plant and their environment. Neighbouring plants constantly monitor and respond to the VOCs with great sensitivity. This response results in plant fitness and reduce future plant damage by inducing their own defense. The activation of the regulatory or transcriptional machinery is induced which can be seen in neighboring plants as defense mechanism. The functions of VOCs as mediators of plant interactions of community and individual levels, highlighting the complexities of plant receiver feedback to various abiotic and biotic stress.

SPP-02

Assessment of the Woody Species Diversity in the Bethuadahari Wildlife Sanctuary, Nadia,West Bengal

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Tropical forests are vital in regulating the rates of climate change as well as providing various ecological services like species conservation, water and air regulation, maintain carbon and nutrient cycles, microclimate cooling, pollution removal, prevention of soil erosion, etc. Bethuadahari Wildlife Sanctuary, a tropical forest in the lower Gangetic plain, is located in Nadia district of West Bengal covering about 67 hectares area. Till date, comprehensive data on the woody species (trees and shrubs) diversity of the forest is unavailable. In this context, the present attempt has been undertaken to document the diversity of the woody species occurring within the sanctuary. All total 38 woody species have been recorded from the sanctuary, of which 34 species are trees and 4 species are shrubs. Among the 38 woody species, dicotyledons are represented by 34 species, while 4 species, viz. *Bambusa balcooa* Roxb. (Bambusaceae), *Borassus flabellifer* L. (Arecaceae), *Cocos nucifera* L. (Arecaceae) and *Phoenix sylvestris* (L.) Roxb. are monocotyledons. Fabaceae reveals as the most dominant family with 7 species followed by Moraceae (5 species) and Rutaceae (4 species). *Ficus* is the most dominant genera (4 species) followed by *Albizia* and *Polyalthia* (2 species each). There are another 29 genera represented by single species only. As the woody plants forms the main forest structure and characteristics, and provides habitat for other forest organisms the present study will be useful for sustainable utilization, management and conservation of the forests.

SPP-03

Performance of elite germplasm of wheat against spot blotch disease resistance under terminal heat stress

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The present study was conducted with 104 genotype of wheat to select most promising genotype, resistant against spot blotch and heat stress based on several morphological, physiological and biochemical parameters.

Wheat spot blotch disease (caused by fungus *Bipolaris sorokiniana*), along with terminal heat stress can cause severe yield loss. In Eastern Gangetic Plains (EGP) region of India, wheat is late sown. As a result, wheat encounters both problems of spot blotch and terminal heat stress in this region. The most effective method of control is using resistant variety which is very less available.

In this experiment, 104 wheat germplasm were collected from national and international sources and were late sown for their exposure to the terminal heat stress. Physiological characters like SPAD, NDVI, Canopy temperature (CT), Canopy temperature depression, Grain yield, Test weight, lodging behavior were studied and Correlation study shows SPAD, NDVI, CT had significant correlation with the AUDPC and grain yield. Stem solidness character which is a heritable character was negatively correlated with the lodging. Enzyme activity of ROS such as- Ascorbate Peroxidase, Peroxidase, Catalase and SOD were conducted in selected genotype.

Change in root and shoot growth under heat stress were studied and root damage under heat stress was also checked by Evans blue staining method under laboratory condition, which showed that resistant genotype had more root and shoot growth and less root damage. The expression of resistant genes for heat shock protein was conducted in selected genotype after applying abiotic stress. As a result, expression of HSP70, HSP90, Catalase and GADPH gene showed upregulation in resistant genotype in compare to susceptible one.

SPP-04

Toxic effects of some vegetable extracts (cauliflower, spinach and radish) containing heavy metals from Dhapa area, Kolkata

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Dhapa, Kolkata is situated in the Eastern Metropolitan Bypass (EM Bypass) area considered as the waste disposal site along the southern boundary of Kolkata-Basanti Highway. Within this area five villages, namely Bainchtala, Arupota, Durgapur, Sahebabad and Khanaberia, were under study where there are the extensive cultivation of some vegetables mannured by the waste and watering by the sewage water or the water from shallow ponds.

The vegetables are mostly of 3–4 months duration of life span, mostly taken the entire solid waste as well as sewage water by which contaminated with uncontrolled toxic, mineral-rich leached out elements which are harmful to human being. Several studies had already been done on the heavy metal contents of these vegetables and their respective effects on toxicity to human being including several serious diseases. The toxic metals, beyond the level, are traced as Cu, Pb, Ni, Zn, Cr, and Mn, etc. in different edible parts of the plants as cauliflower, spinach and radish, commonly consumed by the local habitants. The higher concentration of uptake of heavy metals and their respective effects are here discussed on the basis of health risk assessment of these metals. So, the sediments of heavy metals in Dhapa can be considered as the potential sources of toxicity in the vegetables grown as well as consumed by the local people. The grown vegetables should be avoided or the cultivation of the vegetables should be banned in these areas as they are responsible for serious toxic effects to human being.

SPP-05

Ongoing organic process of waste management and wise use of East Kolkata Wetlands: The Kidney of Kolkata

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The East Kolkata Wetlands (EKW), one of the Ramsar Sites comprising with a large number of water bodies, is consisting of area of 12,800 hectares, having 254 sewage fed fisheries, small agricultural plots and solid waste farm. This wetland also includes efficient and eco-friendly system of solid waste and sewer treatment system for Kolkata. So, it serves as a "Natural Kidney" for removing around 237 kg of BOD per day from the receiving of 250 million gallons of anthropogenic waste water of a day.

EKW is a valuable water bodies that can enhance the environmental security maintaining the ecological health due to its integrated and comprehensive management plan. It is also maintaining the ecosystem conservation, sustainable resource management and livelihood improvement along with public awareness to conserve this wetland.

SPP-06

Diversity of Vascular Plants in the Chintamani Kar Bird Sanctuary, South 24-Pargana, West Bengal, India

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Chintamani Kar Bird Sanctuary is located in the South 24-Pargana district of West Bengal. This sanctuary is famous for the great diversity of birds. In the present study, diversity of vascular plants growing within the sanctuary has been documented. A total of 130 species of vascular plants belonging to 114 genera and 62 families have been recorded from the study area. Among the 129 species, six species belongs to pteridophytes and 123 species belongs to angiosperms. Of the total 123 species of angiosperms, 92 species are dicotyledons and 31 species are monocotyledons. Growth form analysis reveals that there are 36 species of trees, 20 species of shrubs and 54 species of herbs. Besides, the sanctuary also shelters 19 climber species. The present study will be helpful for understanding forest composition and will be useful for sustainable utilization, management and conservation.

SPP-07

Impact of heavy metal nanoparticles derived on plant metabolism

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Engineered Nanoparticles are highly beneficial for human use in the modern world, finding applications across a wide range of fields due to their structuresand versatile properties. These nanoparticles are characterized by size of less than 100 nm and are usedin various commercially available products such as food packaging, fertilizers, cosmetics, pharmaceuticals, etc. However, there isn't any stringent regulation regarding their disposal and more often than not these are carelessly discarded in nature. These particles directly or indirectly get entry into the plant body from soil or water, and are easily taken up inside the cells. They interact with the plant systems at molecular and cellular levels, though such interactions can be both beneficial and detrimental to the organism, depending on the nanoparticle concentration. Recent researches have shown that uptake of nanoparticles have significant effects on different key physiological processes such as plant growth, nutrient uptake, photosynthesis and stress response. Heavy metals such as Si, Zn, As, Ag, etc., are known to incite toxic symptoms in plants at higher concentrations, though at low concentrations many of these are key micronutrients. Nanoparticles derived from heavy metals may be much more harmful to plant metabolism, than their bulk forms are. It is because of their unique properties such as their minuscule size, greater surface area and tunable surface chemistry. Also, the plant surface anatomy favours deposition and ingress of the nanoparticles through cell surface barriers. Despite the involvement of engineered nanoparticles in our daily lives, we cannot ignore the fact that accumulation of these particles in the environment can cause adverse effects to the ecosystem. The impact of nanoparticles derived from heavy metals on plant physiology is a complex and emerging area of research. Understanding these impacts is crucial for harnessing the positive potential of applications of nanoparticles in fields like agriculture and for mitigating the adverse effects on plants exposed to heavy metal nanoparticles from anthropogenic sources.

SPP-08

Green repellent: our ultimate protector

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Due to the environment and human health concerns of synthetic repellents, essential oils as natural alternatives have received increased attention. Instead of those synthetic products, natural products possess good efficacy and are environmental friendly. Essential oils from different plant species have been widely used for their repellent properties as a valuable natural resource.

The essential oils whose repellent activities have been demonstrated, as well as the importance of the synergistic effects among their components are the main focus of this review. Essential oils are volatile mixtures of hydrocarbons with a diversity of functional groups, and their repellent activity has been linked to the presence of monoterpenes, diterpenes, sesquiterpenes and phenylpropanoids. Among the plant families with promising essential oils used as repellents, *Cymbopogon* spp., *Ocimum* spp. and *Eucalyptus* spp. are the most cited. Individual compounds present in these mixtures with high repellent activity include á-pinene, limonene, citronellol, citronellal, camphor and thymol. The practice of green technology through present generations by reducing pollution, waste, and natural resource depletion can build environmental sustainability. It includes biodiversity protection and conservation, and the development of sustainable communities.

Finally, although from an economical point of view synthetic chemicals are still more frequently used as repellents than essential oils, these natural products have the potential to provide efficient, and safer repellents for humans and also for the environment.

SPP-09

Spatial distribution of invasive alien plants in global perspective

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An Invasive alien plants species (IAPS) is defined as a plant that is non-native, show a tendency to spread out of control and has negative effects on our environment, economy & human health. The globalization of invasive plants has broken down the geographic and biological barriers that previously maintained biodiversity within distinct biomes. This homogenization has significantly impacted native flora across regions. Invasive alien plants species (IAPS) are considered to be the major operators of biodiversity loss. The term “invasive” refers to the most aggressive plant species that grow and reproduce rapidly, causing major changes to the areas where they become settled. The invasiveness is dependent on some key factors like regional climate, microclimate, site, past disturbance patterns, and individual species characteristics. Invasive plants spread successfully because they produce large quantities of seeds, easily grow in disturbed soil, often have deep root systems that disturb the root growth of nearby plants or may produce chemicals in leaves or roots that inhibit the growth of plants around them. Allelopathy is a potential mechanism of invasive plants that grow widely and inhibit the growth of native species. The main focus of our presentation is to figure out some major invasive alien plant species and their adverse effect on biodiversity and other resources in global scenario. Here, we have presented fourteen chief invasive plants and their impacts. Species like *Parthenium hysterophorus, Lantana camara, Mikania micrantha, Eichhornia crassipes*, *Chromolaena odorata, Ageratina adenophora* are commonly native to North & South American tropics and extensively invasive to India, Australia & parts of Africa and Asia causing significant livestock production losses.

SPP-10

Genome editing and its implications on climate resilient crops

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Several environmental factors like temperature, soil conditions, water content directly effect the growth and development of plants. Climate change poses a severe threat to our agronomic crops, their growth and productivity which lead to decrease in their nutritional value. The primary cause of climate change is the increase of greenhouse gases in the atmosphere. Anthropogenic activities for centuries have led to emission of greenhouse gasses like CO2, CH4, CFC, SO2 etc. Abiotic stresses such as drought, salinity, temperature hamper the crop productivity. The use of gene editing techniques to produce gene modifications at precise genomic locations are applied as a method to cope up from the effects of climate change on agriculture. Here, we discuss how CRISPR (Clustered Regularly Interspaced Short Palindromic Repeat)/Cas (CRISPR associated protein) systems are applied to achieve such gene edits. CRISPR/Cas technologies enable precise and accurate genetic modification of crops without the incorporation of foreign DNA, and they increase the speed of crop improvement, thereby revolutionizing genome editing due to it's simplicity, cost-effectiveness, versatility and efficiency. In this review we highlight how the current applications of these techniques has facilitated the agronomically important crops to better adapt and combat against the deleterious effects of climate change.

SPP-11

Pollen Morphology of Mangroves of Sundarbans (India): A Review

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Sundarbans, a UNESCO 'World Heritage Site', is the world's largest adjoining mangrove ecosystem stretching from India to Bangladesh and consists of hundreds of islands intersected by a network of tidal rivers, creeks and estuaries. The Sundarban mangrove forests in India are located in the north-east coast of Bay of Bengal within the districts South 24-Parganas and North 24-Parganas of West Bengal. Till date, a total of 31 species of mangroves belonging to 23 genera and 17 families are reported from this area. In the present study, an effort has been made to review the pollen morphology of 20 mangrove species occurring within the Sundarban area. Pollen grains of most of species are monad type and radially symmetrical. Most of the pollen grains are with tri-zonocolporate apertures. Pollen shapes are greatly variable in species as prolate, subprolate, perprolate, prolate-spheroidal, spheroidal, oblate-spheroidal, oblate and sub-oblate. However, *Nypa fruticans* Wurmb (Arecaceae) is exceptionally characterized with monosulcate and bilaterally symmetrical pollen grains. Majority of the pollen grains exhibit reticulate ornamentation. Besides, pollen grains with punctuate, psilate, micro-reticulate, echinate, foveolate, verrucate and granulate ornamentation are also common in these mangrove species. The present study pictures the pollen morphology of the important mangrove species of Sundarbans and will be helpful for taxonomists, researchers and students in characterization and identification of the mangrove species of occurring within the area.

SPP-12

Artificial Intelligence for enhancing plant taxonomy, diversity and conservation

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In the last few years, the integration of Artificial Intelligence (AI) into plant science has brought a shift towards transformative world. The poster explores the development and influence of AI- based plant tools, highlighting their critical role in advancing the field of plant identification for taxonomy, biodiversity and conservation. These tools use deep learning, a subset of algorithm based machine learning, such as real-time computer visuals to identify plant species rapidly and accurately. AI-powered tools have revolutionized biodiversity research thereby contributing to a comprehensive understanding of ecological systems and facilitating conservation efforts. Through real-time species identification, researchers and conservationists can make informed decisions to protect threatened and endangered species and their habitats. Furthermore, AI-driven tools aids in ecological studies by enabling the rapid analysis of plant composition in ecosystems, thereby analyze the impacts of climate change, habitat loss, and invasive species leading to more effective management and preservation strategies. Additionally, advancements in technology have necessitated the development of more effective approach to fulfill the demands for species identification that could accelerate taxonomic research. In conclusion, AI-based technology offers multipurpose benefits by providing valuable insights that are crucial in addressing environmental challenges and promoting sustainable coexistence of humanity and the plant world.

SPP-13

Nutritional profile of a few types of microgreens

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The heavy dependence of basic human nutrition on agricultural production has been highlighted as a result of rapid population growth and environmental degradation over the past twenty years. Increasing food and agricultural productivity has simultaneously imposed external expenses and consequences upon the financial resources, ecological system, and human health by excessive water use, soil occupation, fertilizers, pesticides, herbicides, and food waste treatment. In the current scenario, improvement in public awareness about the healthy lifestyle framework has prompted the search for novel food sources that are beneficial to human health. Functional foods and nutraceuticals which are rich in essential nutrients are gaining importance due to their positive effects on human health starting from the reduction in the risk of chronic diseases to basic nutrition.

Sprouts and microgreens are a new approach for functional foods with various advantages from the sustainability perspective, inclusive of eliminating the use of herbicides and pesticides, reducing the generation of food waste, and reaching a 10-fold increase in health-promoting phytochemicals compared to commercial adult plants. Microgreens are newly sprouted, rootless immature plants that are harvested after the development of cotyledon leaves or seed leaves. Despite the size microgreens are emerging specialty food products and gaining popularity as they are serving as dense sources of nutrients. Depending upon the variety of seed sown, microgreens are harvested between 7 to 21 days after sowing. Microgreens are generally consumed raw and can also satisfy the specific needs of the so-called ‘raw foodiests’. They are considered functional foods that contain health-promoting or disease-preventing properties that are additional to their normal nutritional values. These greens can be a promising way to fight against Food security with their short growing season. Microgreens can provide higher amounts of phytonutrients (ascorbic acid, â-carotene, á-tocopherol, and phylloquinone) and minerals (Ca, Mg, Fe, Mn, Zn, Se, and Mo). Such immature leafy vegetables started as a food trend tied to high-end restaurants and their demand for an inheritance, locally collected, and unique offerings.

SPP-14

Taxonomic investigation of some grasses of West Bengal

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Grasses are one of the most diverse and widely distributed groups of plants with both economical and ecological significance. It served as the source of food for the early civilization like, *Oryza sativa*, *Triticum aestivum* and *Zea mays*, etc. Poaceae is the third largest families of flowering plants followed byAsteraceae and Orchidaceae, with its about 11,300 species in the world, especially found in the tropical and north temperate and sub-arid regions including the Australia and North America. The members of the family Poaceae are widespread and found to grow in all the possible types of climatic conditions as well as in habitats starting from plain land to high Himalayan Mountains, except the Antarctica. In India, the family is represented by about 1200 species belonging to 298 genera out of which West Bengal shelters 172 species in its wide array of habitats. During this study an extensive effort has been made to collect, document and to identify the grasses from different parts of West Bengal with the special reference to the Hilly areas. A comprehensive data along with their identification keys to the genera as well as species wherever necessary has been provided for 29 species belonging to two subfamilies and six tribes.

SPP-15

Eco-floristic diversity of Biharinath hillock, Bankura: A Preliminary Survey

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Biharinath is a hillock located at the far northern border of Bankura district of the state of West Bengal which is one of the few isolated hillocks at the eastern part of the Chhotanagpur plateau. The hillock is 452 meters in height and characterized by stiff slopes on northern, eastern and southern sides and a deep gully on western side. The flora of this hill is more or less still unexplored except a few reports by Sanyal, 1994. However, no individual flora of any of the hillocks of the district is presented till date. As the flora of the hillocks is visibly much different from the flora of the surrounding plain land, it is significant to record the flora of the hillocks separately. In the present study, till now a total of 163 different plant species were collected and identified which includes 156 species of angiosperms and 7 of species of pteridophytes. Habit classification of the recorded species along with their level of dominance and richness are calculated. The species recorded so far shows the flora is dominated by deciduous trees and annual herbs.


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