



Higher Education
Department

**SOUVENIR CUM BOOK OF ABSTRACTS OF
47TH ANNUAL CONFERENCE
OF
ORISSA BOTANICAL SOCIETY
&
NATIONAL CONFERENCE
On
Research Approaches for Sustainable Growth of
Plants and Microbes in Present Climatic Condition**

28th & 29th December, 2024



Organised by

**P.G. Department of Botany
Fakir Mohan University
Vyasa Vihar, Balasore -756089**

SOUVENIR CUM BOOK OF ABSTRACTS OF

47TH ANNUAL CONFERENCE

OF ORISSA BOTANICAL SOCIETY

&

NATIONAL CONFERENCE ON

Research Approaches for Sustainable Growth of Plants and Microbes in

Present Climatic Condition

(28th & 29th December, 2024)

Organized by

P. G. Department of Botany

Fakir Mohan University, Balasore, Odisha

&

Sponsored by



Fakir Mohan University, Balasore



Higher Education Department
Government of Odisha

**Souvenir cum Book of Abstracts of
47th Annual Conference of Orissa Botanical Society
&
National Conference on
Research Approaches for Sustainable Growth of Plants and Microbes in Present
Climatic Condition**

Chief Editor

Prof. Anil Kumar Biswal & Prof. Ranindra Kumar Nayak

Editorial Board Members:

Dr. Arpita Banerjee

Dr. Rajashree Das

Dr. Biswajit Patra

Ms. Adyasha Panda

Cover Design:

Ms. Adyasha Panda

ISBN No. 978-93-341-6238-7

©Published by:

Dr. Mihir Tanay Das, Organizing Secretary, OBS-2024

Coordinator, P.G. Department of Botany

Assistant Professor, P.G. Dept. of Environmental Science

Fakir Mohan University, Balasore, Odisha

EXECUTIVE COMMITTEE

Chief Patron: Prof. Santosh Kumar Tripathy, Vice Chancellor, F.M. University, Balasore

Patron: Prof. Bhaskar Behera, Chairman, PG Council, F.M. University, Balasore

Convener: Prof. Ranindra Kumar Nayak, Professor, Dept. of Environmental Science, F.M. University, Balasore

Co-convener: Prof. Anil Kumar Biswal, Adjunct Professor, Dept. of Botany, F.M. University, Balasore

Organizing Secretary: Dr. Mihir Tanay Das, Asst Professor, Coordinator, Dept. of Botany, F.M. University, Balasore

ORISSA BOTANICAL SOCIETY (OBS) OFFICIALS

Prof. B. B. Mishra, President OBS & President, Odisha Bigyan Academy

Prof. A. B. Das, Vice-President OBS & CSIR-Emeritus Scientist, Utkal University, Bhubaneswar

Dr. S. Mohanty, Secretary, OBS & Assoc. Professor, Dept. of Biotechnology, R D Women's University, Bhubaneswar

NATIONAL ADVISORY COMMITTEE

Prof. R. C. Mohanty, Former UGC & CSIR Emeritus Professor, Dept. of Botany, Utkal University, Bhubaneswar

Prof. S. P. Adhikary, Former Vice-Chancellor, F M University, Balasore

Prof. P.K. Chand, Former Vice-Chancellor, MSCB University, Baripada

Prof. A. N. Mishra, Former Vice-Chancellor, Khallikote University, Berhampur

Prof. U. B. Mohapatra, Vice Chancellor, Rajendra University, Bolangir

Prof. Kashinath Bhattacharya, Professor, Visva Bharati, West Bengal

Prof. Indu Shekhar Thakur, Former Professor, JNU, New Delhi

Prof. Pinaki Sar, Professor, IIT, Kharagpur, West Bengal

Prof. K.B Satapathy, Emeritus Professor, CUTM, Bhubaneswar

Prof. P. K. Mohapatra, Professor, Ravenshaw University, Cuttack

Prof. C. C. Rath, Professor, R. D. Women's University, Bhubaneswar

Prof. Ekamber Kariali, Professor, Sambalpur University

Dr. C. Pradhan, Associate Professor, Utkal University, Bhubaneswar

Dr. S. K. Das, Institute of Life Sciences, Bhubaneswar

Dr. N. R. Nayak, Principal Scientist, RPRC, Bhubaneswar

Dr. B. P. Nayak, Director, Neologics Bio, San Diego, California, USA

Dr. S. Pattnaik, Scientist, University of Kentucky, Lexington, USA

LOCAL ADVISORY COMMITTEE

Prof. S. K. Dey, Professor, Env. Science, FMU

Prof. A. K. Bastia, Adjunct Professor, Microbiology, FMU

Prof. B.P. Dash, Adjunct Professor, Zoology, FMU

Dr. P. C. Mishra, Head, Env. Science, FMU

Dr. B. B. Patnaik, Head, Biotechnology, FMU

Prof. S. K. Agrawalla, Head, Physics, FMU

Prof. T. Swain, Head, Chemistry, FMU

Dr. A. R. Routray, Head, I&CT, FMU

Prof. M. Mishra, Head, Geography, FMU

Dr. R. Das, Head, Geology, FMU

Dr. E. Pandit, Coordinator, Applied Microbiology, FMU

Dr. N. R. Rout, Dean of Students Welfare, FMU

Prof. P. K. Parhi, Director, R & D, FMU

Mrs. Kukumina Das, Registrar, FMU

Mr. Karan Soren, CoF, FMU

LOCAL ORGANIZING COMMITTEE

Dr. S. Mahalik, Asst Prof. Biotech

Dr. P. Kumari, Asst Prof. Biotech

Dr. A.A. Pradhan, Asst Prof. Geol.

Dr. A. Banerjee, Asst Prof. Botany

Dr. B. Patra, Asst Prof. Botany

Dr. R. Das, Asst Prof. Botany

Ms. A. Panda, Asst Prof. Botany

Dr. S. Jena, Asst Prof. Microbiol.

Dr. S. Nayak, Asst Prof. Microbiol

Dr. N. Kar, Asst Prof. Zool.

Dr. M. Bhattacharya, Asst Prof. Zool.

Dr. N. Mohapatra, Asst Prof. Zool.

Ms. S.S. Rout, Asst Prof. Zool.

Ms. P. Pradhan, Asst Prof. Zool.

Mr. B. Mohanty, Asst Prof. Env Sc.

Ms. S. Hansdah, Asst Prof. Env Sc.

Dr. D. Jena, Asst Prof. Chem.

Mr. A. K. Bej, Asst Prof. Chem.

47th Annual Conference of *Orissa Botanical Society (OBS)*.
&
National Conference on Research approaches for sustainable growth of plants and microbes in
present climatic condition
December 28-29, 2024

Scientific Programme

Day I: December 28, 2024 – Pre-Lunch Sessions

Time	Venue and Programme		
08:30 AM - 10:30 AM	Registration at PG Council Building, Ground Floor And Breakfast at the Food Court		
10:30 AM - 12:00 PM	PG Council Conference Hall (First Floor) Plenary Session I Session Chair: Prof. Rama Chandra Mohanty, Former UGC & CSIR Emeritus Professor, Dept. of Botany, Utkal University, Bhubaneswar Invited Lecture I: Prof. Partha Pritam Baruah, Former Head, Department of Botany, Gauhati University, Guwahati, Assam Invited Lecture II: Prof. Swati Bhattacharya, Senior Professor, Division of Plant Biology, Bose Institute, Kolkata, West Bengal Invited Lecture III: Dr. Soumit Kumar Behera, Senior Principal Scientist, CSIR-National Botanical Research Institute, Lucknow Rapporteur: Dr. Elsa Pandit, Associate Professor, Dept of Bioscience and Biotechnology, Fakir Mohan University		
12:00 PM - 12:15 PM	Tea Break		
12:15 PM - 02:00 PM	PG Council Conference Hall (First Floor) Technical Session I Session Sub Theme: Bioprospecting of Bioresources using Biotechnological approaches for Sustainable Development. Session Chair: Prof. P. K. Chand, Former Vice Chancellor, Maharaja SriRam Chandra Bhanj Deo University, Baripada Invited Speaker 1: Dr. N. K. Dhal, Principal Chief Scientist, IMMT, Bhubaneswar Invited Speaker 2: Dr. D. P. Barik, Ravenshaw University, Cuttack	PG Council Mini Conference Hall (Ground Floor) OBS Competitions Sarojini G. Panigrahi Young Scientist Competition (For presenters below 32 years) Session Chair: Prof. P. K Mohapatra, Professor, Dept. of Botany, Ravenshaw University Prof. Chandi Charan Ratha, Professor, Dept. of Life Sciences, Ramadevi University, Bhubaneswar	Poster Presentation Venue: Poster Session

	Invited Speaker 3: Dr. K. K. Sahoo, <i>Ravenshaw University, Cuttack</i> Short Oral 1: Shibani Mohapatra, <i>Siksha ‘O’ Anusandhan deemed to be University, Bhubaneswar</i> Short Oral 2: Jeevan Ranjan Dash, <i>OUAT, Bhubaneswar,</i> Short Oral 3: Smrutirekha Mishra, <i>Ravenshaw University, Cuttack</i> Short Oral 4: Manas Ranjan Mohanta, <i>Dharanidhar University, Keonjhar</i> Short Oral 5: Sandhyarani Kuanr, <i>Netaji Subhash Chandra Bose Govt.College, Sambalpur</i> Rapporteur: Dr. Subhashree Mahalik, Asst Professor, Dept. of Bioscience and Biotechnology, Fakir Mohan University, Balasore	Dr. B. P. Choudhary Memorial Competition Session Chair: <table><tr><td>Prof. A. K. Bastia <i>Adjunct Professor, Dept. of Microbiology, Fakir Mohan University</i></td><td>Prof. P. C. Panda <i>Professor, Dept. of Biotechnology, SOA Deemed to be University, Bhubaneswar</i></td></tr></table>	Prof. A. K. Bastia <i>Adjunct Professor, Dept. of Microbiology, Fakir Mohan University</i>	Prof. P. C. Panda <i>Professor, Dept. of Biotechnology, SOA Deemed to be University, Bhubaneswar</i>	
Prof. A. K. Bastia <i>Adjunct Professor, Dept. of Microbiology, Fakir Mohan University</i>	Prof. P. C. Panda <i>Professor, Dept. of Biotechnology, SOA Deemed to be University, Bhubaneswar</i>				
02:00 PM - 03:00 PM	Lunch Break				

Day I: December 28, 2024 – Post-Lunch Session
Annual Meeting of OBS and Key Note Address

Time	Programme
03:00 PM- 03:15 AM	Welcome and Invitation of the Guests to the Dais
	Inauguration of the Conference by Watering of Sapling
	Salutation to University Anthem
	Greeting the guests with saplings
	Prof. Bibhuti Bhusan Mishra, President, OBS, to preside over the meeting
03:15 PM -03:25 PM	About the Conference and Welcome Address by Prof. Ranindra Kumar Nayak, Convener, OBS-FMU-2024 <i>Professor, Dept. of Env. Science, F. M. University, Balasore</i>
03:25 PM - 03:35 PM	Introduction of the Guests by Prof. Anil Kumar Biswal, Co-Convenor, OBS-FMU-2024 <i>Adjunct Professor, Dept. of Botany, F. M. University, Balasore</i>
03:35 PM - 03:45 PM	Annual Report by Prof. Sujata Mohanty <i>Secretary, Orissa Botanical Society</i>
03:45 PM – 03:50 PM	Release of the Souvenir cum Abstract Book of the Conference by the Chief Guest
	Release of the OBS Journal “Plant Science Research” by the Guest of Honour”
03:50 PM – 04:05 PM	Presentation of OBS Awards and Felicitation of the Winners

04:05 PM - 04:15 PM	Address by Prof. Kashinath Bhattacharya, Guest of Honour, OBS-FMU-2024 <i>Professor, Department of Botany, Visva Bharati, West Bengal</i>
04:15 PM - 04: 25 PM	Address by Prof. Santosh Kumar Tripathy, Chief Guest, OBS-FMU-2024 <i>Vice Chancellor, F. M. University, Balasore</i>
04:25 PM - 04:35 PM	Felicitation of the Guests
04:35 PM - 04:40 PM	Address by Prof. Bibhuti Bhusan Mishra <i>President, Orissa Botanical Society</i>
04:40 PM -04:45 PM	Thanks note by Dr. Mihir Tanay Das, Organizing Secretary—OBS-FMU-2024, <i>Coordinator, Dept of Botany and Assistant Professor of Env. Science, F. M. University, Balasore</i>
04:45 PM - 05:00 PM	Tea Break
05:00 PM -05:15 PM	Presidential Address by Prof. Bibhuti Bhusan Mishra <i>President, Orissa Botanical Society</i>
05:15 PM - 05:45 PM	Keynote Address by Prof. Kashinath Bhattacharya, <i>Retd. Professor, Department of Botany, Visva Bharati, West Bengal</i>
05:45 PM - 07:45 PM	Cultural Programme
08:00 PM onwards	Dinner

Day II: December 29, 2024 – Pre-Lunch Sessions

Time	Venue and Programme	Venue and Programme
10:00 AM - 11:30 AM	PG Council Conference Hall (First Floor) Technical Session II <u>Session Sub Theme:</u> Climate Change, Plant-Microbe Interactions and Sustainable Agriculture Session Chair: Prof. K. B Satpathy, Former Professor, Dept. of Botany, Utkal University Invited Speaker 1: Dr. Sitaram Panda, Scientist D, Deccan Regional Centre, BSI, Hyderabad Invited Speaker 2: Dr. Sudam Charan Sahu, Asst. Professor, Dept of Botany MSCB University, Baripada Short Oral 1: Abhishek Mohanta, Banaras Hindu University, Varanasi Short Oral 2: Debasish Mahapatro, State Pollution Control Board, Odisha, Bhubaneswar Short Oral 3: Ghanashyam Behera, Maa Manikeshwari University, Manikya Vihar, Bhawanipatna	PG Council Mini Conference Hall (Ground Floor) Technical Session III <u>Session Sub Theme:</u> Exploring Microbial Diversity and Antimicrobial Solutions in the Face of Climate Change Session Chair: Prof. Shantilata Sahoo, Former Professor, Dept. of Botany, Utkal University Invited Speaker 1: Prof. H. N. Thatoi, Professor, Siksha 'O' Anusandhan Deemed to be University, Bhubaneswar Invited Speaker 2: Dr. Gatha Mohanty, Associate Professor, Institute of Dental Science, SOA, Bhubaneswar Short Oral 1: Swarna Kumar Dash, Maharaja Sri Ram Chandra Bhanj Deo University Short Oral 2: Barsha Bhushan Swain, Ravenshaw University, Cuttack Short Oral 3: Soumya Swarup Panda, Siksha 'O' Anusandhan deemed to be University, Bhubaneswar

	Short Oral 4: Keshari Prasad Mohanty, <i>Ravenshaw University, Cuttack</i> Short Oral 5: Ananya Nayak, Siksha 'O' <i>Anusandhan deemed to be University,</i> <i>Bhubaneswar</i> Rapporteur: Dr. Hrusikesh Nayak, Asst Professor <i>in Botany, Dept of Higher Education,</i> <i>Bhubaneswar</i>	Short Oral 4: Subhrakanta Jena, <i>Fakir Mohan University, Balasore</i> Rapporteur: Dr. Umabati Sahu, Asst. Professor, <i>Dept of Botany, Fakir Mohan (Autonomous)</i> <i>College</i>
11:30 AM - 11:45 AM	Tea Break	
11:45 AM – 01:30 PM	PG Council Conference Hall (First Floor) <u>OBS Competition</u> Smt. Priyambada Mishra Memorial Award Competition (For M.Sc. Students) Session Chair: Dr. Bharat Bhusan Pattanayak, Asso. Professor <i>and HoD, Dept of Bioscience and Biotechnology,</i> <i>Fakir Mohan University</i>	PG Council Mini Conference Hall (Ground Floor) <u>General Body meeting of OBS</u>
01:30 PM - 02:30 PM	Lunch	

Day II: December 29, 2024 – Post-Lunch Sessions

Time	Venue and Programme
03:00 PM- 04:00 PM	PG Council Conference Hall (First Floor) OBS Valedictory and Award Ceremony
04:00 PM – 05:00 PM	High Tea
04:30 PM- 06:30 PM	Visit to Professor Gopinath Panigrahi Botanic Garden, Professor Bhabani Prasad Choudhury Non-Timber Forest Product (NTFP) Museum, etc. depending on availability of time.



“Weeds are flowers too, once you get to know them.”

— A. A. Milne

FAKIR MOHAN UNIVERSITY

ଫକୀରମୋହନ ବିଶ୍ୱବିଦ୍ୟାଳୟ

Prof. Sanosh Kumar Tripathy
Vice Chancellor



Vyasa Vihar, Nuapadhi
Balasore-756089, Odisha, India
Ph: +91-6782-275768 Fax: +91-6782-275768
E-mail : vcfmuniversity@gmail.com
Website : www.fmuniversity.nic.in



Message

I am happy to learn that the PG Department of Botany, Fakir Mohan University is going to organize 47th Annual Conference of Odisha Botanical Society and National conference on Research approaches for sustainable growth of plants and microbes in present climatic condition during 28-29 December, 2024.

The global climate change continues to present unprecedented challenges, particularly to agricultural productivity and environmental sustainability. The future of food security, biodiversity, and ecosystem health hinges on our ability to adapt and develop strategies that mitigate the adverse effects of climate change while promoting resilience in plant and microbial communities. Our institution is committed to advancing scientific knowledge through interdisciplinary research that can help build a more sustainable and climate-resilient future. We recognize that the successful growth of plants and microbes in the face of changing climatic conditions requires a multifaceted approach. As climate change is a global issue, it is essential for researchers, policymakers, and industry stakeholders to work together across borders. Our institution is committed to fostering collaborations with international research networks, government agencies, and local communities to share knowledge, resources, and technologies that will drive sustainable solutions for plant and microbial growth under changing climatic conditions. The idea of organizing the present conference is timely and I congratulate the organizers for conducting such an important event I am sure the outcome of the conference will be fruitful.

I wish a grand success for the conference.

Prof. Santosh Kumar Tripathy
Vice Chancellor
Fakir Mohan University



ODISHA BIGYAN ACADEMY

(ODISHA SCIENCE ACADEMY)

Science & Technology Department, Government of Odisha, India



Message

It gives me immense pleasure to know that the Department of Botany, Fakir Mohan University, Balasore is going to organize the 47th Annual Conference of the Orissa Botanical Society (OBS) and a National Seminar on the theme 'Research approaches for sustainable growth of plants and microbes in present climatic conditions' on 28th and 29th December, 2024. The theme of the conference is time based and needs deliberation at this hour when climate change has become a great challenge to the society. Climate change largely have adverse effect on soil microbial diversity and growth of plants leading to decrease in productivity. Time necessitates new research approach in plant science and application of microbes for climate resilience growth and sustainability mitigating climate change. The organizers are also publishing a souvenir on the occasion of the

National Seminar. I am confident the seminar will come out with a road map to combat environmental issues for sustainable development.

I congratulate the organizers for such a noble endeavor and wish the 47th Annual Conference of the Orissa Botanical Society and the National Seminar a grand success.

Bibhuti Bhusan Mishra

(BIBHUTI BHUSAN MISHRA)

FAKIR MOHAN UNIVERSITY

ଫାକିରମୋହନ ବିଶ୍ୱବିଦ୍ୟାଳୟ

Prof. Bhaskar Behera
Chairman,
Post-Graduate Council



Vyasa Vihar, Nuapadhi
Balasore-756089, Odisha, India
Ph : +91-6782-275859
E-mail : pgcouncilfmu@gmail.com
Website : www.fmuniversity.nic.in



Message

I am delighted to learn that the PG Department of Botany, Fakir Mohan University, is organizing the 47th Annual Conference of the Odisha Botanical Society and a National Conference on "Research Approaches for Sustainable Growth of Plants and Microbes in Present Climatic Conditions" during 28–29 December 2024. This is undoubtedly a commendable initiative.

I am confident that the conference will provide valuable insights into addressing critical issues such as increasing urbanization, urban agriculture, and vertical farming—emerging solutions to ensure food security. These approaches hold great potential in mitigating the challenges posed by unpredictable weather patterns and reducing dependency on traditional agriculture.

I extend my heartfelt congratulations to the Coordinator, the Department, and all the faculty members for their enthusiasm and efforts in organizing this conference. I also wish the event great success.

Prof. Bhaskar Behera
Chairman, P.G. Council
Fakir Mohan University

FAKIR MOHAN UNIVERSITY

ଫକୀରମୋହନ ବିଶ୍ୱବିଦ୍ୟାଳୟ

Prof. Ranindra Kumar Nayak

Convener, OBS-FMU-2024

Professor

P.G. Dept of Environmental Science



Vyasa Vihar, Nuapadhi

Balasore-756089, Odisha, India

E-mail : ranindra1968@gmail.com

Website : www.fmuniversity.nic.in

Message



It gives me immense pleasure to organize the 47th Annual Conference of Orissa Botanical Society and National conference on Research approaches for sustainable growth of plants and microbes in present climatic condition during 28-29 December, 2024. On behalf of the University, it is my pleasure to welcome all the scientists, academicians, young researchers, business delegates and students from all over the country to attend this conference.

As we face an era of rapid climate change, it has become imperative to address the challenges posed to ecosystems, agricultural systems, and environmental sustainability. The impacts of climate change manifested in rising temperatures, altered precipitation patterns, extreme weather events, and shifting ecosystems are affecting the growth and productivity of plants and microbes worldwide. To mitigate these challenges and ensure food security, environmental health, and biodiversity, it is crucial to explore and implement innovative, sustainable research approaches. The role of research in advancing our understanding of how plants and microbes interact with their changing environments is at the heart of finding solutions. As the organisers of this important research initiative, we are committed for promoting interdisciplinary and cutting-edge scientific exploration that addresses the complexities of these challenges. Our collective efforts will not only enhance agricultural productivity but also contribute to broader environmental sustainability.

We are looking forward for an excellent meeting with great scientists and academicians from different parts of the country for sharing new information in this conference.

Welcome and enjoy the conference

RK Nayak

Prof. Ranindra Kumar Nayak

Convener, OBS-FMU-2024

Professor, Department of Environmental Science

Fakir Mohan University, Odisha

From the Editors ...

It is with immense pride and enthusiasm that we welcome you to the “47th Annual Conference of the Orissa Botanical Society” *and the* “National Conference on Research Approaches for Sustainable Growth of Plants and Microbes in Present Climatic Conditions”. This event brings together a vibrant community of researchers, academicians, and students dedicated to advancing our understanding of plant and microbial sciences amidst the challenges posed by a rapidly changing climate.

The theme of this year’s conference, "Research Approaches for Sustainable Growth of Plants and Microbes in Present Climatic Conditions," is a timely reminder of the pressing need for innovative and sustainable solutions in the fields of botany and microbiology. Climate change continues to pose significant threats to biodiversity, agriculture, and ecosystems. In this context, the role of plants and microbial communities in mitigating these impacts and promoting sustainability has gained unprecedented attention.

With the ongoing global environmental shifts, our collective research efforts hold the potential to address issues such as biodiversity conservation, sustainable agriculture, and ecosystem resilience. We are proud to present a program that showcases cutting-edge research and fosters meaningful discussions. From keynote addresses by eminent scientists to technical sessions covering a diverse range of topics, this conference aims to serve as a platform for exchanging knowledge, inspiring collaboration, and shaping the future of botanical and microbial sciences.

We extend our heartfelt gratitude to all the authors who have contributed their academic and research findings to the conference, participants, and organizing committee members who have worked tirelessly to make this event a success. Their dedication and enthusiasm are the driving forces behind this conference’s success. We sincerely thank all the dignitaries who will deliver valuable lectures. We express our sincere gratitude to Prof. Santosh Kumar Tripathy, Vice-Chancellor, Fakir Mohan University, Balasore for his encouragement, support and guidance in organizing this Conference. We are also thankful to Fakir Mohan University and Odisha State Higher Education Council (OSHEC), Govt. of Odisha, for their financial support to organize the Conference.

We wish all participants a fruitful and enriching experience

Warm regards,
The Editorial Team

ABOUT FAKIR MOHAN UNIVERSITY



Fakir Mohan University (FMU) is a state university located in Balasore, Odisha, India. Established in 1999, the university is named after Fakir Mohan Senapati, a prominent Odia writer and social reformer often regarded as the father of modern Odia literature. The University was established by the Government of Odisha under Section 32 of the Odisha Universities Act, 1989 (Act 5 of 1989) and it was notified vide the Government's Notification No. 973, dated 3rd July, 1999. It has been duly recognized by the UGC under section 2(f) of the UGC Act as well as under section 12(B). The University has been recognized by the Association of Indian Universities. The University is accredited by National Assessment & Accreditation Council (NAAC), Bangalore with "A" grade (grade point of 3.18 out of 4) effective from 22nd September, 2023, and it also has a National Institutional Ranking Framework (NIRF) rank within the band 150-200 (University Category) and 51-100 (State Public University Category) for the year 2024. At present the University operates from two campuses: the old campus near Remuna Golei (Januganj) and the new campus at Nuapadhi, both located in Balasore. The serene environment of the Nuapadhi campus, surrounded by greenery, offers an ideal atmosphere for academic pursuits.

FMU has 26 post graduate departments offering postgraduation across various disciplines. The university also offers M.Phil and Ph.D. programs in several subjects. It has 96 colleges and 14 professional colleges, including 2 autonomous college and 1 medical college, affiliated to it. FMU provides modern infrastructure, a library with digital resources, and e-learning platforms like iLMS. It has a dedicated training and placement cell offering career counselling, soft skills training, and job placement assistance. The university also organizes seminars, workshops etc. to promote academic collaboration and innovation. FMU boasts facilities like a centralized computer lab, biosciences and environmental science labs, a central library with internet access, and sports amenities, including a cricket field and gym. There are also hostels for boys and girls, staff quarters, HRDC centre and a guest house. Institutional distinctiveness includes lab to land

research initiatives on Dhaan-Paan-Mina, Sahityaghara, Galleries in the name of various writers, lightning awareness programs, museums, etc. Best practices of the University include Back to School, Each One Teach One, Achi Jadi Dia Nahin Jadi Nia, Clean and Green Campus initiatives and many more. Recently, it has been a hub for academic and research activities, such as hosting the Odisha Research Conclave 2024.

ABOUT P.G. DEPARTMENT OF BOTANY, FAKIR MOHAN UNIVERSITY

The Department of Botany started during the academic session 2018-2019 with M. Sc. Course in Botany in regular mode. The Department also offers Ph. D. programme in Botany following the UGC guideline. Since its inception, the department has achieved remarkable milestones with its innovative approach towards conservation, education, and research. Besides regular PG teaching, the faculty members are engaged in research in the areas of plant stress physiology, plant taxonomy, Ethno-botany, bio-resource management etc. Within its short span of existence, the Department has succeeded to establish a Botanic Garden having many Rare, Endemic and Threatened (RET) taxa, an Herbarium and a Non-timber Forest Products (NTFPs) Museum in the University premises.



GOPINATH PANIGRAHI BOTANIC GARDEN



Fakir Mohan University has established a Botanic Garden in its premises, designed for display, conservation and propagation of diversity of plant species of the region which simultaneously felicitates further research and education. The Garden has been named after Dr. Gopinath Panigrahi (27 February 1924 – 23 December 2004) who

is a worthy son of the soil. He has earned high esteem worldwide through his immense contribution in the field of Botany, more specifically in plant taxonomy and cytogenetics. He was born in the village Baikunthapur, Basudebpur

block, Bhadrak district (Undivided Balasore District), Odisha, India and obtained a Ph.D. in 1954 from the University of Leeds, England,

where he adopted Cytogenetics as specialized branch. Dr. Panigrahi has acted as Joint Director, Botanical Survey of India (BSI), Howrah, and Regional Botanist/Indian Liaison Officer at Royal Botanic Gardens, Kew,



England, United Kingdom (UK). He was elected as Fellow of the Linnean Society, London (FLS), in 1973. He has reported some new taxa such as *Tragus roxburghii* Panigr. as a new sp. *Brachycaulos* and *Parahemionitis* as two new genera and Tectariaceae as a new family; to be cited as few of his remarkable contributions in the field of plant taxonomy. The University Garden has been divided into several plots like Rare, Endemic and Threatened taxa (RET) study centre (At present the garden houses as many as 46 RET species collected from all over the state, Silviculture Experimental Plot and Medicinal plant knowledge centre, Miyawaki forest, a lily pool for display of diverse aquatic plants.



PROFESSOR BHABANI PRASAD CHOUDHURY NON-TIMBER FOREST PRODUCTS (NTFP) MUSEUM

The Botany Dept. has taken steps for collection and display of various Non-Timber Forest Products of the region by setting up a dedicated museum. The museum is named after Professor Bhabani Prasad Choudhury who is one of the pioneering plant taxonomists in the state of Odisha. NTFPs are natural resources derived from forests that are not-timber-based. Odisha, a state in eastern India, is rich in biodiversity and hosts a variety of Non-Timber Forest Products (NTFPs) due to its diverse ecosystems, including forests, wetlands, and coastal

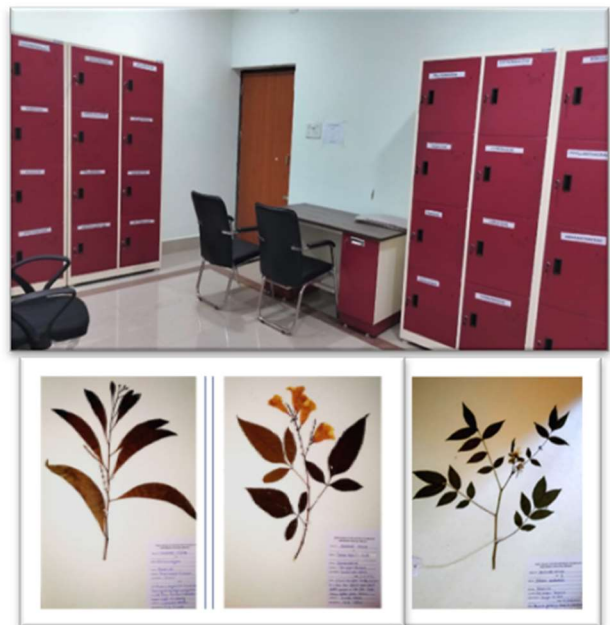


areas. NTFPs can be categorized under medicinal plant parts, natural dyes, fibres tannins, essential oils, latex, edible fruits and nuts, spices and condiments, gums and resins, cane and bamboo, leaves and flowers etc. At present the museum houses more than 100 NTFP entries for display under various sections.



FAKIR MOHAN UNIVERSITY CENTRAL HERBARIUM COLLECTION

Herbarium helps to document the plant diversity of a particular geographic area. It provides useful information regarding the flora of the particular region. Department of Botany of the University has established a Central Herbarium in the University campus which helps the students in identifying the flora of the region. Students and teachers of the Department are actively involved in collection and preservation of samples for preparing Herbarium.



CONTENT

Sl. No.	Title and Author's name	Page No.
i	About Fakir Mohan University	
ii	About P.G. Department of Botany	
SOUVENIR ARTICLES		
1.	Advantages being an OBS Member <i>Prof. R.C. Mohanty</i>	1
2.	Conservation and bioprospecting of mangroves in Odisha <i>Prof. Ranindra Kumar Nayak</i>	2
3.	Microbial diversity and their bioprospecting in changing climatic condition <i>Biswajit Patra & Mihir Tanay Das</i>	6
KEYNOTE & INVITED LECTURES		
4.	Plant Survival Mechanisms with reference to Sustainable Conservation in India <i>Kashinath Bhattacharya</i>	10
5.	Algal diversity in Himalayan Protected Areas: silent spectators towards climate change <i>Partha Pratim Baruah, Hima Mani Kalita and Debahooti Baruah</i>	11
6.	Estimating forest carbon fluxes in Similipal Biosphere Reserve, India using eddy covariance measurements <i>Soumit K. Behera</i>	11
7.	Impact of Atmospheric Biopollutants on Human Health: Monitoring, Assessment and management <i>Swati Gupta Bhattacharya</i>	12
8.	Hairy root culture in different medicinal plants using <i>Agrobacterium rhizogenes</i> <i>Durga Prasad Barik</i>	13
9.	Development of an efficient universal nutrient formulation for hydroponic cultivation of diverse groups of economically important plants <i>Khirod Kumar Sahoo</i>	14
10.	Inventorizing Plant Genetic Resources Associated with Divine Deities and Religious Practices in Odisha <i>Kunja Bihari Satapathy</i>	14
11.	Exploration of natural resources for better livelihood <i>N.K. Dhal, S.K. Kabi and D. Mishra</i>	15
12.	Understanding forest carbon pools: a potential strategy for climate change mitigation <i>Sudam Charan Sahu</i>	16
13.	Acharya Jagadish Chandra Bose Indian Botanic Garden (AJCBIG): A milestone in plant introduction and ex-situ conservation in India <i>S.P. Panda</i>	17
14.	Coastal Microbial diversity and Resilience of Climate change in Mangroves <i>H.N.Thatoi¹ and R.R.Mishra²</i>	18
15.	Quorum Sensing: The microbial diversity and their communication in Human Oral environment. <i>Gatha Mohanty</i>	18

ABSTRACTS FOR SAROGINI G. PANIGRAHI MEMORIAL AWARD

- | | | |
|-----|---|----|
| 16. | In Silico Techniques Unveil the Antioxidant Potential of Phytocompounds of <i>Plumeria</i> species via Xanthine oxidase inhibition
<i>Geetashree Gyanadarshinee Sahoo</i> | 20 |
| 17. | <i>Leonotis nepetifolia</i> Leaf Essential Oil: A Novel Modulator of Inflammation and Oxidative Stress in LPS-Induced RAW 264.7 Cells through TLR4/NF-κB/MAPK Signaling Pathways
<i>Omprakash Mohanta</i> | 21 |
| 18. | Bulked Segregant RNA Sequencing (BSR-Seq) Combined with SNP Genotyping Towards Mapping and Characterization of a Purple Blotch Resistance Gene in Onion (<i>Allium cepa</i> L.)
<i>Jayashree Sahoo, Raj Kumar Joshi</i> | 21 |

ABSTRACTS FOR SHORT ORAL PRESENTATIONS

- | | | |
|-----|---|----|
| 19. | Adapting Rice Cultivation to Climate Change: Enhancing Submergence Tolerance, Bacterial Blight Resistance, and Yield in Swarna through Gene Pyramiding and MAB Techniques
<i>Shibani Mohapatra¹, Sharat Kumar Pradhan²</i> | 22 |
| 20. | Potent antioxidant and anti-inflammatory effect of hesperidin in arsenic trioxide induced cardiotoxicity in rat
<i>Gayatri Khuntia¹, Jeevan Ranjan Dash^{1*}, Biswadeep Jena², Uma Kanta Mishra³, Subash Chandra Parija¹</i> | 23 |
| 21. | Comparative analysis of imidacloprid and thiamethoxam toxicity on the photosystem performance of <i>Synechocystis</i> sp. PCC 6803
<i>Smrutirekha Mishra and P. K. Mohapatra</i> | 23 |
| 22. | Sal (<i>Shorea robusta</i> Gaertn.) For India's net zero goals: insights from population ecology, phenology, and environmental adaptability
<i>Manas Ranjan Mohanta^{1*}, Sudam Charan Sahu², Sriyakankhsi Dutta¹, Lochan Kumar Sethy¹</i> | 24 |
| 23. | Introgression of SUB1 (sub1) QTL in mega rice cultivars increases ethylene production cause the loss of grain-filling under stagnant flooding
<i>Sandhyarani Kuanr¹, R.K. Sarkar² and P.K. Mohapatra³</i> | 25 |
| 24. | Optimizing light regimes for neutral lipid accumulation in <i>Dunaliella salina</i>: A study on physiological status and carbon allocation
<i>Abhishek Mohanta^{1,2}, Nitesh Prasad¹, Riyazat Khadim¹, R.K. Asthana^{1*}</i> | 25 |
| 25. | Present Status of Sea Grass of Chilika: A Coastal Wetland of International Importance
<i>¹Debasish Mahapatra, ¹Sangeeta Mishra and ²Bitu Mohanty</i> | 26 |
| 26. | Diversity and distribution of invasive alien plant species in Kalahandi district of Odisha, India
<i>Ghanashyam Behera¹, Mr. Nihar Ranjan Nayak², Alok Ranjan Sahu^{2*}</i> | 27 |
| 27. | Ethnobotanical study of medicinal hydrophytes used by peoples of bhadra district of Odisha
<i>Keshari Prasad Mohanty</i> | 27 |
| 28. | Elucidating anti-inflammatory mechanisms of <i>Zingiber</i> essential oil phytocompounds: A Network pharmacology and Molecular Dynamics Perspective
<i>Ananya Nayak</i> | 28 |
| 29. | Isolation & identification of endophytic bacteria from Fish Tail Sword Fern
<i>¹Swarna Kumar Dash, ²Nivedita Nayak, ²Bhagyajyoti Baral, ¹Bishnupriya Hansdah, ²Santilata Sahoo</i> | 28 |
| 30. | Enriched <i>Anabaena</i> sp. PCC 7119 strain causes enhanced degradation of the organophosphorus insecticide chlorpyrifos
<i>Barsha Bhushan Swain and Pradipta Kumar Mohapatra</i> | 29 |

31.	Chemical composition, antioxidant, antimicrobial and tyrosinase inhibitory activities of the leaf essential oils of <i>Syzygium schmidii</i>(Myrtaceae)	30
	<i>Soumya Swarup Panda and Pratap Chandra Panda*</i>	
32.	Studies on ethnobotanical value, phytochemical detection and antibacterial activity of medicinal plants of Udala, Mayurbhanj, Odisha	31
	<i>Subhrakanta Jena^{1*}, Jagatjit Nayak², Omprakash Satpathy and Hemanta Kumar Sahu³</i>	

ABSTRACTS FOR POSTER PRESENTATIONS

33.	Comprehensive quantification of protein content in millets	32
	<i>Bhagyajyoti Baral¹, Swarna Kumar Dash¹, Hrusikesh Nayak², Niranjana Mohapatra³, Santilata Sahoo¹</i>	
34.	Plant use values and phytosociological indicators: Implications for conservation in Kandhamal district of Odisha, India.	33
	<i>A. Dash¹, R. K. Mishra² and A. K. Biswal³</i>	
35.	Studies on Fungi Associated with Post-Harvest Decay of Carrot (<i>Daucus carota</i> L.) and Radish (<i>Raphanus sativus</i> L.) in Odisha, India	34
	<i>Akhtari Khatoon¹ Kunja Bihari Satapathy^{2*} and Ashirbad Mohapatra³</i>	
36.	<i>Nyctanthes arbor-tristis</i> Linn.: A possible candidate for the malaria vector control	34
	<i>Mamatabala Pani¹ & Aparna Das^{2*}</i>	
37.	Morphological study, ethnomedicinal uses and analysis of secondary metabolites present in some selected Mangroves and their associates in Dhamra Estuary, Bhadrak District, Odisha	35
	<i>Abinash Sahoo¹ and Ranindra Kumar Nayak^{1,2}</i>	
38.	Chemical profiling and antioxidant activity of <i>Vitex pinnata</i>	36
	<i>Alaka Mohanty, Sujata Mohanty*</i>	
39.	Role of osmolytes in enhancing tolerance during salinity stress in crops	36
	<i>Ananya Nayak*, Arpita Banerjee</i>	
40.	Genetic diversity studies and cluster analysis of doubled haploid lines derived from B × R hybrid based on agro-morphological traits	37
	<i>Anindita Mishra^{1,2}, Nihar Ranjan Singh², Ram Lakhan Verma¹, Sanghamitra Samantaray¹</i>	
41.	How chlorophyll works as a bio indicator in biotic stress in plants	38
	<i>Ankita Kindo*, Arpita Banerjee</i>	
42.	Impact of <i>Burkholderia cepacia</i> inoculation and organic amendments on growth and physiology of <i>Crotalaria juncea</i> L. grown on bauxite mine spoil	39
	<i>Ankita Tripathy and Bandana Kullu*</i>	
43.	Encapsulation of Anthocyanins from Jamun Pomace Extract	39
	<i>Aparna Panda, Minati Mohapatra, N.R.Sahoo, U.S. Pal</i>	
44.	Preliminary Hairy Root Induction in <i>Lawsonia inermis</i> Using In-Vivo Explants: An Assessment of Key Parameters for Transformation	40
	<i>Aryaputri Bedaprabha, Bhaswatimayee Mahakur, Durga Prasad Barik*</i>	
45.	Approaches employing biotechnology to preserve biodiversity and promote sustainable development agriculture	41
	<i>B Jyotirmayee, Ipsita Priyadarsini Samal, Sameer Jena and Gyanranjan Mahalik*</i>	
46.	Genetic variations in <i>dirigent</i> gene (<i>DIR</i>) paralogs associated with combined Nitrogen and Phosphorus deficient conditions in rice (<i>Oryza sativa</i> L.) at seedling stage.	41
	<i>Baishnab Charan Muduli^{1,2}, Parameswaran Chidambaramathan^{1*}, Chinmay Pradhan², Sabarinathan Selvaraj¹, Sanghamitra Samantaray¹</i>	

47.	Selenium priming enhances antioxidant defense against oxidative stress induced by <i>Fusarium nudum</i> in <i>Cajanus cajan</i>	42
	<i>Beda Saurav Behera, Punam Kumari</i>	
48.	Studies on Diversity and Distribution of Aquatic Plants in Khorda district of Odisha, India & Bio-evaluation of therapeutic Potential of <i>Hydrilla verticillata</i> (L.f.) Royle.	43
	<i>Bhagyeswari Behera and Kunjabihari Satapathy</i>	
49.	In vitro propagation and conservation of <i>Gloriosa superba</i> L.: An endangered species From Similipal Biosphere Reserve, Orissa.	44
	<i>B. Mahapatra and B.P. Hansdah</i>	
50.	Phytoremediation Potential of Medicinal Plants: A Sustainable Approach to Environmental Cleanup	44
	<i>Bimal Kumar Ghose and Ranindra Kumar Nayak</i>	
51.	Phytochelatin- A marvel in metal induced stress tolerance in plants	45
	<i>Binayak Acharya^{*1}, Arpita Banerjee¹</i>	
52.	In vitro shoot multiplication and plant regeneration of <i>Drimia indica</i> (Roxb) Jessop, an endangered medicinal plant from Odisha with cytological analysis	46
	<i>Binod Kumar Mahapatra^{1,2*}, Chinmay Pradhan¹, Anath Bandhu Das¹</i>	
53.	Taxonomic Enumeration of Coalfield Algae of Talcher, Angul, Odisha, India	46
	<i>Biswajita Pradhan^{1,2}, and Sunita Nahak¹</i>	
54.	Reviving Coastal Ecosystems: The Critical Role of Mangroves in Marine Conservation	47
	<i>Chandrasekhar Bhoi</i>	
55.	Phytochemical characterisation of Tulsi varieties and their therapeutic application	47
	<i>Chinmaya Kumar Sahu, Biswajit Patra</i>	
56.	Submergence sustainability through foliar NSi and SA in Black rice landrace after reaeration	48
	<i>Chinmaya Swarup Pattanaik and Nandita Jena</i>	
57.	Stress Memory in Plants	49
	<i>Chinmayee Behera*, Arpita Banerjee</i>	
58.	Hydroponics vegetative growth analysis of Scented and Non-scented landraces of Dhenkanal District of Odisha	50
	<i>Chinmayee Sahoo^{1*}, Geetismita Pal², Abhilipsa Rout², Sumitra Rout², Sourav Ranjan Mohapatra², Silpalipi Rout², Soumya Ranjan Nayak².</i>	
59.	Investigations on modulation of ferroptosis by quercetin and its neuroprotective effect in cerebral ischemia-reperfusion injury of mice	50
	<i>Jasasmita Parida, Pratap Chandra Panda and Nirmal Singh*</i>	
60.	Innovative Soilless Hydroponic Saffron (<i>Crocus sativus</i> L.) Cultivation Technology: A High Yield Approach to Sustainable Saffron Production	51
	<i>Sahoo D^{1*}, Sahoo S^{1**}, Muduli N^{1***} and Sahoo KK^{1*}</i>	
61.	Phytotoxicity of dimethoate and malathion on <i>Solanum lycopersicum</i> L.	52
	<i>Debajyoti Behera¹, Anil Kumar Sahoo¹, Kalpana Panigrahi¹, Santi Lata Sahoo², Padan Kumar Jena¹ and Jyoti Ranjan Rout^{1*}</i>	
62.	Carbon footprint evaluation for sustainable food processing system development	52
	<i>Debashree Pradhan, Aparna Das and Santilata Sahoo</i>	
63.	Phytochemistry and biological activities of <i>Bruguiera gymnorrhiza</i>	53
	<i>Deepak Kumar Patra</i>	
64.	Potential of <i>Lathyrus sativus</i> L. for sustainable agriculture in present climatic condition	54
	<i>Devirani Mallick, Surjendu Kumar Dey*</i>	

65.	Indigenous rice varieties from Odisha	54
	<i>Dibyaranjan Shaw* and Arpita Banerjee</i>	
66.	Ethnomedicinal Uses and FTIR Analysis of <i>Murrayakoenigii</i> (L.) Spreng.	55
	<i>Diptimayee Rout¹ and Ranindra Kumar Nayak²</i>	
67.	A review on opportunities for blue carbon strategies in Odisha	56
	<i>DS Soumya Ranjan*, Arpita Banerjee, Adyasha Panda, Rajashree Das, Biswajit Patra, Anil Kumar Biswal, Mihir Tanay Das</i>	
68.	Harnessing Beneficial Microbes for Sustainable Agriculture and Eco-Friendly Development.	57
	<i>Elina Das, Aparna Das, Santilata Sahoo</i>	
69.	Exploiting phytochemicals to target and modulate the nonsense-mediated decay pathway for anticancer therapies	57
	<i>Gagan Kumar Panigrahi, Sanjoy Majumder, Rutupurna Das and Kunja Bihari Satapathy*</i>	
70.	GA3 Application for Enhancing Finger Millet Productivity and Nutrition	58
	<i>Ganesh Kejriwal¹ and Dr. Deepali Dash²</i>	
71.	Diversity and Distribution of Invasive Alien Weed species in Rice fields of Bhadrak district of Odisha	59
	<i>Gouri Sankar Jaga Prakash Jena¹, Prasanna Kumar Mishra² and Kunja Bihari Satapathy³</i>	
72.	Conservation of medicinal plants cultivated in institute herbal garden through bio-technology	60
	<i>Gyanarasm Swain and Ch. A. Ramulu</i>	
73.	Allelopathic effect of <i>Mangifera indica</i> leaves aqueous extract on seed germination, seedling vigour and biochemical content of Mustard (<i>Brassica nigra</i>).	61
	<i>Ipsita Das¹ & Umabati Sahu^{2*}</i>	
74.	Role of allelopathy for sustainable weed management	61
	<i>Ipsita Priyadarsini Samal, Gyanranjan Mahalik*</i>	
75.	A Comprehensive Study on Ethnomedicinal Plants Used for Treating Skin Diseases in the Tribal Communities of Kandhamal District, Odisha	62
	<i>Jhilli Pradhan¹, Sagarika Nayak¹, Birendra Kumar Bindhani^{2*}</i>	
76.	Species authentication in <i>Ipomoea</i> L. based on matK and rpoB conserved regions	62
	<i>Kamalakanta Satapathy, Subhadarshani Dhall, Laxmikanta Acharya*</i>	
77.	Exploring the Bioactive Potential of <i>Lyngbya aestuarii</i>: Isolation, Characterization, and Antimicrobial Activity of Secondary Metabolites from a Mangrove-isolated Cyanobacterium	63
	<i>Karisma Dash, Pranabjeet Behera, Gayatri Nag, Bhabatarini Panda*</i>	
78.	Chemical and biological characterisation of orange peel and their effect on skin disease	64
	<i>Kripaline Devi, Biswajit Patra</i>	
79.	Identification of bacterial blight resistance in rice using molecular markers	64
	<i>Krishna Rani, Anshuman Khandual, Arup Kumar Mukherjee</i>	
80.	Eco-Efficient Microalgal Cultivation: Synergizing Aquaculture Wastewater Treatment with Valuable Biomass Generation	65
	<i>Kumar Avishek¹, Debaraj Parida^{2*}, Sk. Riyazat Khadim²</i>	
81.	Precision farming to improve crop productivity	65
	<i>Laba Hembram, Aparna Das, Santilata Sahoo</i>	
82.	Encapsulation Technology and Synthetic Seeds: A New Era in Crop Propagation	66
	<i>Lopamudra Dash^{1*}, Adyasha Panda²</i>	

83.	Evaluation of Different Hosts for the Mass Rearing of Peach Fruit Fly, <i>Bactrocera zonata</i> Saunders (Tephritidae: Diptera)	67
	<i>M. K. Jena¹, S. R. Patel² and Satikanta Sahoo³</i>	
84.	Identification, phytochemical and antimicrobial assessment of some potential ethno medicinal plants of forest fringe areas of Similipal Biosphere Reserve, Mayurbhanj: A review	67
	<i>Mahasweta Mohanta^{1,2} and Ranindra Kumar Nayak^{2,3}</i>	
85.	Microbial Diversity of Forest Floors: Potential Bioresource for Benefit Flow to Local Communities under the Biological Diversity Act 2002 (Amendment 2023)	68
	<i>Madhusmita Ghana, Soumya Sephalika Swain, Omprakash Mohanty, Shubhransu Nayak*</i>	
86.	Cyanobacteria as a Sustainable Solution: Improving Rice Performance under Salinity Stress	69
	<i>Madhusmita Nayak¹, Jagneshwar Dandapat²</i>	
87.	Non-Timber Forest Product (N.T.F.P.) in Odisha: Boon or Bane?	70
	<i>Manoranjan Pattanayak¹, Anil Kumar Biswal²</i>	
88.	Healing the Planet: Strategies for Ecological Restoration and Conservation	71
	<i>Malay Panigrahi^{1*}, Adyasha Panda²</i>	
89.	Fungal pathogens as biocontrol agents: advancements in agricultural pest management	71
	<i>Minakshi Agrawal and Debaraj Parida</i>	
90.	Plant diversity and soil elemental composition of Gangadeviforest of Puri district, Odisha	72
	<i>¹Menaka Nayak, ²Biswajit Patra, ¹Soumya Ranjan Dash</i>	
91.	BioControl Method: A Sustainable Way to Control Algal Blooms.	73
	<i>Minati Desinayak¹, Prasanta Kumar Samataray²</i>	
92.	A review on Kitchen waste composting: An approach for sustainable growth of plants and biofuel production	74
	<i>Mukti Prasad Rath* and Dr. Manna Milián</i>	
93.	SOX9 promotes the cisplatin resistance in NSCLC by regulating EMT and β-catenin	75
	<i>Munmun Panda</i>	
94.	Impact of compost prepared from different biowaste on seed germination and plant growth of <i>Luffa acutangula</i> (L.) Roxb.	75
	<i>N Bijaya Laxmi Swain</i>	
95.	Insilico discovery of dehydroquinase synthase inhibitor for anti-<i>Mycobacterium tuberculosis</i> approach	76
	<i>Nikhil Ranjan Behera¹, Binata Nayak², Pranab Kishor Mohapatra³, Bidyasagar Lenka⁴</i>	
96.	Volatile Organic Compound as Natural Pesticide	76
	<i>Nikitarani Behera</i>	
97.	Indigenous Leafy Vegetables: An Alternative Food Supplement of the Coastline Belts of Balasore District of Odisha, India	77
	<i>Niquehat Noor¹ and Kunja Bihari Satapathy²</i>	
98.	<i>Anisomeles indica</i> leaf essential oil attenuates oxidative stress in LPS-Stimulated RAW 264.7 cells by inhibiting ROS and related mediators	78
	<i>Omprakash Mohanta and Pratap Chandra Panda*</i>	
99.	Unravelling <i>Drimys indica</i>'s (Roxb.) Jessop cellular secrets: A Cytological and Phytochemical investigation in Odisha ecotypes	78
	<i>Padmaja Patel*, Chinmay Pradhan and Anath Bandhu Das</i>	
100.	<i>Cannabis sativa</i>: A Greenshield Initiative	79
	<i>Pooja Rout</i>	

101.	Biological diversity, ethnobotanical significance and conservation status of Figs (<i>Ficus</i> species) in Odisha, India	80
	<i>Prabhat Kumar Das & Pratap Chandra Panda</i>	
102.	Integrating Botanic Gardens into Science Education: A NEP 2020 Perspective	80
	<i>Prabhat Kumar Das* and Samarendra Narayan Mallick**</i>	
103.	Plant science innovations in ensuring food security and alleviating poverty in India	81
	<i>Prabin Panigrahi</i>	
104.	Identification of phytoconstituents and in-vitro evaluation of antimicrobial effect of methanolic leaf extract of <i>Polyalthia suberosa</i>	82
	<i>Prachita Das¹, Sasmita Mohanty^{1*}</i>	
105.	Medicinal carnivorous plant: A source of future drugs	83
	<i>Pragati Das*, Dr. Rajashree Das</i>	
106.	Biochemical characterization of selected subaerial algae sourced from Similipal Biosphere Reserve, Odisha	83
	<i>Prajna Paramita Bhuyan¹, Bishnupriya Hansdah¹ and Akshaya Kumar Bastia²</i>	
107.	Role of Plant growth promoting microbes for sustainable agriculture	84
	<i>Pranab Behera¹ & Ranindra Kumar Nayak²</i>	
108.	Study of aromatic medicinal plants in Birajakshetra, Jajpur district, Odisha	85
	<i>Priti Priyadarsini Puan¹ and Satikanta Sahoo²</i>	
109.	Characterization of Indigenous Phytocompounds for Cell Cycle Arrest in Cultured Glioma Cells	85
	<i>Priya Ranjan Debata^{1*}, Sunitee Hansdah¹, Shubhasmita Mohapatra¹, and Anil Kumar Biswal²</i>	
110.	Diversity of Corticolous Lichens in Kalahandi District of Odisha in Relation to Phorophytes and Habitat Fragmentation	86
	<i>Ramakanta Mishra¹ and Kunja Bihari Satapathy²</i>	
111.	Application of Artificial Intelligence and Machine Learning in Plant Research	86
	<i>Priyadarsini Dash</i>	
112.	Ethnomedicinal plants and their uses against gastrointestinal disorders in Balasore district of Odisha, India	87
	<i>Ranjitabala Mohapatra¹ and Kunja Bihari Satapathy^{2*}</i>	
113.	Algal diversity evaluation of Bhitarkanika: A comparative study of pre and post monsoon Phycodiversity	88
	<i>Reshma Rani Dash¹, Dr. Binata Naik² and Dr. Sangeeta Mishra³</i>	
114.	Effect of artificial ripening of banana using calcium carbide and their nutritional quality	89
	<i>Rupali Tripathy, Biswajit Patra</i>	
115.	Designing future crops for sustainable agriculture	90
	<i>Rutuparna Barik</i>	
116.	Some ethno- medicinal plants for the treatment of common health problems in Mayurbhanj district	90
	<i>Rupamanjari Behera</i>	
117.	Biochemical analysis of <i>Terminalia arjuna</i> (Roxb. Ex DC.) Wight & Arn. with reference to wild and cultivated condition.	91
	<i>S. Murmu, N. Mandal, B.P. Hansdah.</i>	
118.	Urban greening with avenue trees along the roadside: an approach for air-pollution management in developing countries	92
	<i>S.S. Ram</i>	

119.	Sustainability of Plant Biodiversity and Restoration of Microbial Flora through Organic Farming-A case study	92
	<i>Sabita Rani Mishra¹ and Arun K. Rath²</i>	
120.	Seasonal variation of dust deposition on plant leaves and its effect on morphological and physiological changes of plants	93
	<i>Sabitri Marndi¹, Biswajit Patra²</i>	
121.	A review on medicinal properties and nutritive value of <i>Moringa oleifera</i> Lam. Flowers	94
	<i>*Sagarika Priyadarshini, Arpita Banarjee</i>	
122.	Desiccation tolerant Pteridophytes of Odisha: Imperative resources in developing strategies to drought and desiccation pressure	94
	<i>¹Sailaja Nandan Ray, ²Prasad Kumar Dash, ¹Subhani Rath</i>	
123.	Traditional knowledge on anti-venom plants used by the tribal of Koraput, Odisha	95
	<i>Sameer Jena¹, Sudhansu Sekhar Dash² and Gyanranjan Mahalik^{1*}</i>	
124.	Phytochemical screening and antibacterial activity analysis of <i>Cordia macleodii</i> (Griff.) Hook. F. & Thomson leaves	96
	<i>Sandeep Kumar Mohanta and Durga Prasad Barik*</i>	
125.	Ethno medicinal uses of Dongoriakandha of Niyamagiri Hills, Odisha, India.	97
	<i>Sangeeta Das, Swarnalata Pattanaik, A.leelaveni</i>	
126.	Beneficial Plant Microbes Interaction for Agricultural and Environmental Sustainability: A Review	97
	<i>Dr. Sanjeeb Kumar Das^{1*}, Binapani Pattanaik²</i>	
127.	An Empirical Study of Valuation of Economic of Benefits of Anasagar Lake in Ajmer, Rajasthan - A Case study	98
	<i>Sanjeeb Kumar Das*</i>	
128.	Investigating Sustainable Development Approaches in the Similipal Biosphere Reserve.	99
	<i>Saraswati Majhi, Prasanta Kumar Samantaray</i>	
129.	A review on drugs discovery from traditional phytotherapy	100
	<i>Saroj Kumar Behera*, Anil Kumar Biswal</i>	
130.	Chlorophyll a key bio indicator of abiotic stress in plants	100
	<i>Sasmita Mohanty*, Arpita Banerjee</i>	
131.	A Diversity, Distribution and Therapeutic Potential of Zingiberaceae of Odisha: A Review	101
	<i>Sasmita Rana^a, Rajashree Das^{a b*}, Anil Kumar Biswal^a</i>	
132.	Ethnomedicinal plants used to cure gynecological disorders by the tribals of Bargarh district, Odisha, India	102
	<i>Satikanta Sahoo¹ and Dayanidhi Bagartee²</i>	
133.	Study of Pollution remediation aquatic plants in the industrial area of Jajpur District of Odisha	103
	<i>*Satikanta Sahoo¹, R. K. Nayak², D. Bagartee³, B.K. Sahoo⁴, P. Santi⁵ and M.K. Jena⁶</i>	
134.	Mangrove ecosystems & adverse climatic conditions in Odisha: Systematic approach is need of the hour.	104
	<i>Satyajit Mahatab, Uday Chand Basak</i>	
135.	Study of Photosystem II Activity during the Leaf Development in a Threatened Medicinal Tree	105
	<i>Shasmita^{1,2}, Barsha Bhushan Swain¹, Smrutirekha Mishra¹, Debasish Mohapatra¹, Soumendra Kumar Naik¹, Pradipta Kumar Mohapatra¹</i>	

136.	Essential oil extraction from various plant species of Fakir Mohan University campus	105
	<i>Shubhalaxmi Panigrahi, Biswajit Patra</i>	
137.	Declaration of Biodiversity Heritage Sites: a new in-situ approach for conservation plant genetic resources in Odisha	106
	¹ S. Rath, ² S.S. Hansda, ¹ A Mishra, ¹ S.R. Mohanty, ¹ A.K. Jena, ¹ R.S. Sahoo, ¹ S. Malik, ¹ B. Mohanty and ¹ P.K. Dash	
138.	Role of Physicochemical Parameter on Microalgal Diversity of Kuakhai River Bhubaneswar, Odisha	106
	<i>Soumya Ranjan Dash</i>	
139.	Study on the Antibacterial Potential and Phytochemical Analysis of <i>Thespesia populnea</i>(L.) Sol. ex Corr. used in the Treatment of Diarrhoea and Dysentery.	107
	<i>Somani Jethi¹ and Kunja Bihari Satapathy².</i>	
140.	Bio-control of Plant Pathogens by Native <i>Trichoderma atroviride</i> isolated from Maize Landrace of Odisha	108
	<i>Soumya Sephalika Swain^{1,2}, Bhabatarini Panda^{1*}, Madhusmita Ghana², Om Prakash Mohanty², Shubhansu Nayak^{2*}</i>	
141.	Ethnomedicinal Plants used by Mankidia Tribes of Similipal Biosphere Reserve, Odisha, India: A Review	109
	<i>Subhasmita Behera¹, Umabati Sahu²</i>	
142.	Mushroom Diversity of Keonjhar District in the State of Odisha, India	109
	<i>Suchismita Acharya¹ and Kunja Bihari Satapathy²</i>	
143.	Ascorbic acid mitigates chromium toxicity and boosts growth and bioactive compounds in wheat seedlings	110
	<i>Sudeshna Khatua* and Surjendu Kumar Dey</i>	
144.	A comprehensive study of diversity and distribution of Chroococcales algae from Similipal Biosphere Reserve, Odisha	111
	<i>S. Behera^{1*}, S. Bhakta², E. Sahu³, A.K. Bastia¹</i>	
145.	CRISPR/Cas9 Technology and its Application in Plants	111
	<i>Sudhir kumar Sethy</i>	
146.	An impact of invasive plant species on ecosystem and biodiversity	112
	<i>Sudipta Supriya Swain</i>	
147.	Botanical Extracts Combatting Spoilage Bacteria in Non Food Products: A Step Towards a Sustainable Future	113
	<i>Sujogya Kumar Panda^{1,2*}</i>	
148.	Effect of pH on growth and biochemical parameters of <i>Chlamydomonas reinhardtii</i> P. A. Dangeard	113
	<i>Supriya Devi</i>	
149.	Phytoremediation: A solar driven green technology	114
	<i>Suvendu Kumar Mishra*, Anil Kumar Biswal, Biswajit Patra, Arpita Banerjee, Rajashree Das, Adyasha Panda, Mihir Tanay Das.</i>	
150.	Role of plant-based nanoparticles in agriculture for abiotic stress tolerance: A review	114
	<i>Swagat Kumar Barik^{*1}, Umabati Sahu² & Arpita Banerjee³</i>	
151.	MutMapping for trait improvement in popular rice (<i>Oryza sativa</i> L) landraces of Odisha	115
	<i>Swagatika Baral^{1,2}, Parameswaran C¹, Sanghamitra Samantaray¹</i>	
152.	Hidden Dangers in Herbal Medicines: Toxicity and Contaminants	116
	<i>Swapnanjali Nayak</i>	

153.	Indigenous Knowledge and Socioeconomic Importance of Wild Edible Fruit plants of Soro block in Balasore district of Odisha	116
	<i>Trupti Khamari^{a,b} and Ranindra Kumar Nayak^{b,c,*}</i>	
154.	Physiological and Biochemical Responses of Rice to Melatonin under Drought Stress	117
	<i>Ujala Rashmi Sahu¹ and Deepali Dash²</i>	
155.	Glowing plant can light up the night sky: The beauty of bioluminescence	118
	<i>Unnati Pallai^{1*} & Adyasha Panda²</i>	
156.	Microbial Bioremediation of Environmental Pollutants: A Slant towards a Sustainable Technology.	118
	<i>Naba Krushna Panda</i>	
157.	Ethnobotanical uses and antibacterial activity of some mangroves in Inchudi Sea Beach along Balasore district of Odisha	119
	<i>Adarsha Pradhan^a and Ranindra Kumar Nayak^{ab}</i>	
158.	Taxonomy of Family Acanthaceae with special reference to Coastal Districts of Odisha, India	120
	<i>Nabin Kishore Jena^{1,2} and Ranindra Kumar Nayak²</i>	
159.	A Preliminary Report on Mangroves in the Accredited Land at Chudamani, Bhadrak	120
	<i>Astha Mohanty^{a*}</i>	
160.	Ethnomedicinal Plants Used By Mankidia Tribes Of Similipal Biosphere Reserve, Odisha, India: A Review.	121
	<i>Sanjay Soren^a, Rajashree Das^{a*}</i>	
161.	Unlocking the potential of <i>Spirulina</i> in Sustainable Food Production: A Nutritious and Environmentally Friendly Solution	122
	<i>Suchismita Behera^a, Rajashree Das^{a*}</i>	
162.	Bio herbicide acts as an eco-friendly tool for sustainable weed management: A Review.	123
	<i>Suchismita Sing^a, Rajashree Das^{a*}</i>	
163.	Harnessing medicinal plants for diabetes management in the era of Modern challenges	123
	<i>Monalisa Chaudhury</i>	
164.	Traditional Medicinal Knowledge and Phytochemical Potential of Selected Plant Species in Kuldiha Wildlife Sanctuary, Odisha	124
	<i>Priyanka Kar¹, Ranindra Kumar Nayak^{*1,2}, Pankaj Kumar Parhi³</i>	
165.	Indigenous Knowledge and Ethnobotanical Studies of Medicinal Plants of Kuldiha Wildlife Sanctuary	125
	<i>Sanjay Kumar Behera^a and Ranindra Kumar Nayak^{ab,*}</i>	
166.	<i>Oxalis corniculata</i>: A Versatile Traditional Remedy	125
	<i>Rojita Mishra[*], Satpal Singh Bisht</i>	
167.	Potential impact of climate change on soil properties w.r.t. sustainable agricultural practices	126
	<i>R.K. Mishra</i>	
168.	Traditional uses and phytochemical analysis of potential medicinal plants in Keonjhar District of Odisha	127
	<i>Debasish Patra^a and Ranindra Kumar Nayak^{ab}</i>	
169.	Phosphate Solubilization Potential of Rhizosphere Fungi Isolated from rice field	128
	<i>Pallavi Dehury, Rojali Maharana[*], Sourav Kumar Rout and Ipsita Pati</i>	
170.	Bacterial solubilization of mineral phosphates isolated from rhizospheric soil	128
	<i>Rachita Tarai, Rojali Maharana[*], Sourav Kumar Rout and Pallavi Jali</i>	

171.	Insectivorous medicinal plant <i>Drosera</i> ecology conservation through techniques of tissue culture and sustainable biotechnology as related to the environment.	129
	<i>Sushil Pradhan</i>	
172.	Molecular breeding approach for Development of Rice Lines with QTLs for Phosphorus uptake efficiency, Deeper rooting, and Yield under drought stress in Upland ecology	130
	<i>Sourav Surav Yadav¹, Soumya Abhilipsa Satpathy¹, Abhijit Parida¹, Namrata Nayak¹, Satyabrata Moahnta¹, Sharat Kumar Pradhan² and Elssa Pandit^{1*}</i>	
173.	<i>In-silico</i> analysis of divergence pattern of indigenous Macrophomina isolates collected from sesame in eastern India.	131
	<i>¹Ashutosh Nanda, ²Nirakar Ranasingh, ³Curie Parhi and ¹Elssa Pandit*</i>	
174.	Marker-trait association study for the detection of genomic regions controlling deeper rooting trait in <i>indica</i> rice (<i>Oryza sativa</i> L.)	131
	<i>Soumya Abhilipsa Satpathy¹, Sourav Surav Yadav¹, Swati Behera¹, Sanjib Kumar Singh², Sharat Kumar Pradhan³ and Elssa Pandit^{1*}</i>	
175.	Sustainable Utilization of Chicken Waste: Developing Nutrient-Rich Hydrolysates for Biotechnological Applications	132
	<i>Susmita Gharai¹ and Gargee Mohanty^{2*}</i>	
176.	Ethnomedicinal Use of Potential Medicinal Plants in Malyagiri Hill Ranges of Odisha	133
	<i>Manoj Kumar Pradhan^a and Ranindra Kumar Nayak^b</i>	
ABSTRACTS FOR SMT. PRIYAMBADA MISHRA MEMORIAL AWARD COMPETITION		
177.	Artificial photosynthesis, a promising trend for future	134
	<i>Smaraki Pattnaik</i>	
178.	Phytoremediation: The Nature's Mercy	134
	<i>Samina Khatun</i>	
179.	Biotechnological approaches for biodiversity conservation and development of climate resilient plant	135
	<i>Devi Prasanna Dash</i>	
180.	Vertical Farming in Urban Environment: A View of Architectural Integration and Food Security	135
	<i>Ananya Mohanty</i>	
181.	Disruptions in plant-microbe symbiosis induced by climatic variability	136
	<i>Chinmayee Dhall</i>	
182.	Promoting sustainable agriculture through climate smart practices	137
	<i>Dibyapranaya Tripathy</i>	
183.	Bioinnovation: PGPB based solution for crop improvement	138
	<i>Jyotirmayee Behera</i>	
184.	<i>Azolla</i> biofertilizer is an effective replacement for urea fertilizer and vegetable crops	139
	<i>Nupur Mishra</i>	
185.	Bioprospecting of plants and microbes	140
	<i>Partha Sarathi Rout</i>	
186.	Cultural gastronomy: an exploration of sustainable food choices and global challenges	141
	<i>Preeti Prada Udayasingh</i>	
187.	The role of cyanobacteria in sustainable and climate resilient agriculture	142
	<i>Priyadarshini Jena</i>	
188.	Mangrove and resilience of coastal ecosystem	143
	<i>Priyambada Swain</i>	

189.	Sustainable food production and demand	144
	<i>Sarbeswar Pujari</i>	
190.	Opportunities and solutions for sustainable food production	145
	<i>Sonalika Nayak</i>	
191.	Role of society in the production of sustainable food through organic farming	146
	<i>Subhashree Behera</i>	
192.	AI in agriculture - the future farming	146
	<i>Sudipa Pradhan</i>	
193.	Phycoremediation: An Eco-Friendly Approach to Solve Water Pollution Problems	147
	<i>Sudipta Mishra</i>	
194.	Phosphate solubilising bacteria: mechanisms and their role in phosphate solubilisation	148
	<i>Archit Amlan Behera</i>	
195.	In vitro solubilisation of inorganic phosphate by phosphate solubilising fungus: Overview, mechanisms and applications	149
	<i>Anshuman Swain</i>	
196.	Drought and salt stress mitigation in crop plants using stress-tolerant microorganisms: A futuristic approach towards sustainable agriculture	150
	<i>Ranjit Sumar Swain</i>	

SOUVENIR ARTICLES

Advantages being an OBS Member

Prof. Rama Chandra Mohanty

Past President, Orissa Botanical Society

Email: mohantyr62@gmail.com

Now less than three years remains to celebrate the society's "golden jubilee" and we are gathering this year in the annual meeting at Fakir Mohan University, Balasore, Odisha to be presided over by our president Professor Bibhuti Bhusan Mishra. The seed which we planted in 1977 (officially 1979) flanked by giant pioneers like Prof. Pran Krishna Parija, the first Vice Chancellor of the premier university of the state and Professor Bidyadhar Padhi, Founder, HOD of Botany, Vani Vihar, has now blossomed into a mighty banyan tree with a thick trunk supported by extensive prop roots and dense canopy. No attempt neither ever cyclone nor tsunami has blemished it, rather made strong to stronger.

Few of us know its genesis. Half a thousand friends are presently connected to enjoy the cohesion and its prospective growth. The society (registered as Orissa Botanical Society) tends to reach out the registered plant lovers all over the state and also some of the neighbouring states. As a result, the then toddler is gradually turning a behemoth to amuse and encourage for more and more activities of the society.

Maturity in its portals over the past about half a century period leads in several ramifications accumulating through mutual interaction to exchange ideas, recognition in old and new fields of research, knowledge sharing, as models proposed by young scientists in the context of current research, original work in taxonomy, plant physiology and biochemistry, algology/ microbiology / environmental science and conservation of biodiversity.

Besides, dashing posters of cutting-edge research and kudos in student's session add to the glamour of the gathering in the midst of exhibition and invited lectures. Our meetings are tentacling at different reputed institutions of the state to spread knowledge on regular basis. Dedicated to boosting of students and teacher's research in eastern India, its excellence spills over to other parts of the country to become exemplary for sister societies.

This year the vast lush green campus developed on a barren land would attract a huge gathering of plant lovers in Fakir Mohan University, Balasore. Who else can enjoy and appreciate the beauty of the campus, more than us, thanks to the affectionate call from none other than its incredible architect the Vice chancellor honourable Professor Santosh Kumar Tripathy, who claims that Utkal always remains in his heart. The botanical assembly not only for living within greenery, also to interact in environment-based themes of a national seminar coupled with several scholarly deliberations. Ofcourse, I am sure, sandwich of Balasorian flavor and hot cakes made up of varied local flour are waiting for us here.

Members of the society would be living in a warm environment throughout the two winter days presenting their novel research finding and feeling charm in the midst of FMU cultural extravaganza in evening. We headway this way holistically year after year and proudly out smart any other society as an identified pace-setting association of the state.

We get to see many familiar faces, old students, classmates, friends, well wishers, passionate learners, the amazing leader beloved Vice Chancellor and above all dear students to share our experiences. The botany legacy is carried by because the journey filled with new knowledge turn us educated with a proof of our mission a living testament of basic education. Again, it will guide to plan and prepare a roadmap for the future making happy and spirited.

Our host the "The Fakir Mohan University, Odisha" may be small and new but justify NAAC A+ ranking a big heart that it has with a fabulous leading capability touches us. The British economist E.F. Schumacher is right and relevant saying "Small is beautiful".

Conservation and bioprospecting of mangroves in Odisha

Prof. Ranindra Kumar Nayak

Covener, 47th Annual Conference of OBS & National Conference

Department of Environmental Science, Fakir Mohan University, Balasore-756089

Email: ranindra1968@gmail.com

Introduction

Mangroves are a peculiar group of salt tolerant plants which grow in the estuarine regions in the tropical and subtropical areas of the world. They play an important role in the protection of the coastal environment as they check the intensity of tropical cyclones, soil erosion, encroachment of sea towards land etc. These are also rich sources of timber, fuel, and tannin. etc. Besides these, mangrove forests provide a congenial habitat for fish, prawns, and some wild flora and fauna. Mangroves have enormous bioprospecting potential for nutraceuticals, antioxidants, antiviral, and antibacterials, mosquito repellants, larvicides, antidiabetics, anticancer substances, nanoparticles etc. These are distributed in some restricted regions of the world. Mangroves of India constitute 7% of the world's mangroves covering an area of 6740 sq. km. (Anonymous, 1987).

The state of Odisha in India is lying between 26° 00' N latitude and 94° 20' E longitude. It extends over an area of 155,707 sq. km accounting for about 4.87% of the total area of India. The coastal areas of Odisha are interrupted by several rivers and rivulets, the Mahanadi, Brahmani, Baitarani, Budhabalanga, Rusikulya and Subarnarekha. Chilika, the largest brackish water lake located in the east coast, deserves special mention. All are mixed with the Bay of Bengal forming deltas, which have thick mangrove forests (Panda et. al.2013). According to the report of Forest Survey of India (2001), 219 km² of area is under mangrove vegetation cover along the coastline of the state. Five districts of the state of Odisha viz. Balasore, Bhadrak, Jagatsinghpur, Kendrapara and Puri have mangrove distribution along their coasts. The highest area covered by mangroves is in Kendrapara district (192 km²), followed by Bhadrak (19 km²), Jagatsinghpur (5 km²), Balasore (3 km²) (Anonymous, 2001).

Past floristic studies conducted by many workers such as Haines (1921-25), Mooney (1950), Rao and Banerjee (1967, 1982), Banerjee (1987) Rao *et al* (1970), Choudhury *et al* (1991), Subudhi *et al* (1992), Choudhury (1994) reveal that the mangroves in the state of Odisha were much rich in the remote past. However, the vegetation has been depleted at an alarming rate due to the operation of severe biotic

pressures which include the establishment of ports, urbanization, piscicultures, settlement of immigrants, and conversion of mangrove forests into paddy fields. As a result, the present vegetation is found to be present in denuded condition. This has intensified the rate of tropical cyclones and other environmental hazards such as floods, soil erosion, encroachment of sea towards land etc. As such, the conservation and management of this ecosystem is an urgent need of the hour.

Present status of mangroves in Odisha coast

Floristic studies conducted in different regions of Odisha coast reveal that mangrove vegetation is extant in denuded condition due to the operation of various biotic factors. The status of mangroves is alarming in different locations of the Mahanadi delta (Nayak and Choudhury, 2001; 2002). Intensive floristic studies conducted in different regions of Mahanadi delta reveals that, 46 species of Mangroves and their associates are found to be present in different locations of this region. (Nayak, 2002). The mode of distribution and the number of species varies from place to place which has been discussed below.

The mangroves of Paradeep in Jagatsinghpur district of Odisha have been depleted at an alarming rate due to the establishment of Paradeep Port, Paradeep Phosphates Ltd. These industrial activities have accelerated the rate of urbanization and population explosion which have led to the clearing of mangrove vegetation for such activities. The vegetation is represented by some patches of mangrove species and their associates viz. *Acanthus ilicifolius* L., *Phoenix paludosa* Roxb., *Tamarix troupii* Hole, *Avicennia officinalis* L., *Rhizophora apiculata* Bl., *Rhizophora mucronata* Poir, *Kandelia candel* (L.) Druce etc (Nayak, 2005; 2003). These species are found to be present along with some other species of mangroves and their associates like *Hibiscus tiliaceus* L., *Clerodendrum inerme* (L.) Gaertn, *Acrostichum aurium* L., *Ipomea pes-caprae* (L.) R. Br., *Caesalpinia crista* L. etc. Of these, few tree species like *Avicennia officinalis* L., *Rhizophora apiculata* Bl., and *Rhizophora mucronata* Poir. etc. act as a protective measure to check the rate of tropical cyclones. However, this vegetation is not sufficient to check the rate of tropical cyclones.

The status of mangrove vegetation in Jambu in Kendrapara District of Odisha Island is much alarming due to severe anthropogenic pressures because of the settlement of immigrants. As a result, the present vegetation is represented by few species of mangroves and their associates such as *Heritiera fomes* Buch. -Ham., *Acanthus ilicifolius* L., *Phoenix paludosa* Roxb., *Hibiscus tiliaceus* L., *Tamarix troupii* Hole., *Porteresia coarctata* (Roxb.) Tateoka, *Ipomoea pes-caprae* (L.) R. Br. etc.

Mangrove vegetation of Batighar in Kendrapara district of Odisha is extant in luxuriant condition. The dominant elements are represented by some tree species like *Rhizophora apiculata* Bl., *Rhizophora mucronata* Poir, *Kandelia candel* (L.) Druce, *Sonneratia apetala* Buch.-Ham. etc. These species are extant along the side of the creeks and canals. These are much gregarious and act as a protective measure to check the rate of tropical cyclones.

Mangrove vegetation of Hukitola island in Kendrapara district of Odisha is extant in better condition as it is less interfered by biotic pressures due to geographical isolation. The dominant elements extant in this area include *Avicennia alba* Bl., *Aegialities rotundifolia* Roxb., *Lumnitzera racemosa* Willd., *Rhizophora apiculata* Bl., *Rhizophora mucronata* Poir, *Hibiscus tiliaceus* L., *Thespesia populnea* (L.) Sol. ex Correa,

Tamarix troupii Hole etc. Hukitola island is an idea site of *in situ* conservation of mangrove species and their associates(Nayak,2018).

Mangroves of Jatadhar Muhan in Jagatsinghpur district of Odisha are also present in much denuded condition as most of the areas have been converted into paddy fields in this area. The mangrove vegetation is represented by some species like *Acanthus ilicifolius* L., *Acrostichum aureum* L., and *Caesalpinia bonduc* (L.)Roxb. , *Caesalpinia crista* L., *Avicinnia alba* Bl. *Kandelia candel* (L.) Druce, *Porteresia coarctata* (Roxb.)Tateoka are extant in denuded condition representing the remnants of the past vegetation.

Mangroves of Devi estuary are extant in luxuriant condition in some areas of this region. Dominant species present in this area include *Avicinnia alba* Bl., *Sonneratia apetela* Buch-Ham., *Rhizophora apiculata* Bl., *Rhizophora mucronata* Poir, *Ceriops tagal*(Perr.) C.B.Rob., *Kandelia candel* (L.)Druce, *Phoenix paludosa* Roxb., *Dalbergia spinosa* Roxb. Etc.

The status of mangroves is much better in Bhitarkanika. Being a National park it is well protected. This National park is home to Saltwater crocodiles, Indian python, King cobra , deer and many other species of flora and fauna. This area has also been designated as a Ramsar site.

The status of mangroves of Dhamra estuary in Bhadrak district of Odisha is subjected to much biotic pressure due to pisciculture and the establishment of Dhamra port. Still, it harbours a good patch of mangrove vegetation (Sahoo and Nayak, 2024).

The status of mangrove vegetation of Sartha estuary in Balasore district of Odisha is alarming because of sand inundation. As a result, the mangrove vegetation is being depleted which is a serious threat to the conservation of Biodiversity.

Necessity for the conservation of mangroves

Fioristic survey reveals that the mangrove vegetation is extant in denuded condition in different areas of Odisha coast. This has intensified the rate of various environmental hazards mentioned earlier. It is evident from the devastations caused by the last Super cyclone of October, 1999 which was accompanied with high velocity of wind and unusual rise of seawater from the Bay of Bengal that has washed away many lives of human beings, cattle and other animals. Large number of gigantic trees have also been uprooted from different parts of the state of Orissa. It is to be mentioned here that, the Bhitarkanika area was better protected from the Super cyclone due to thick mangrove vegetation. As such, *in situ* conservation and management of the existing mangrove vegetation is an urgent need of the hour.

Bioprospecting potential of mangroves

Mangroves have enormous bioprospecting potential for nutraceuticals, antioxidants, antiviral, and antibacterials, mosquito repellants, larvicides, antidiabetics, anticancer substances, nanoparticles etc. Phytochemical analysis of leaves of mangroves of Dhamra estuary reveals the presence of various secondary metabolites such as alkaloids, flavonoids, glycosides, phenols, tannins, saponins, Proteins, Terpenoids, Resins and Reducing sugar which have much medicinal value(Sahoo and Nayak,2024). Quantitative estimation of these Phytochemicals will be much useful for the preparation of new drugs in the herbal drug

industry. Further research is needed to explore the therapeutic applications of these compounds and to ensure the sustainable management of mangrove ecosystems. Quantitative estimation of the phytochemicals will also be useful to assess the action of the drugs obtained from the particular parts of the medicinal plants against a specific disease. Further studies are needed to understand the mechanisms of action of these compounds and to develop effective and sustainable applications in healthcare and other fields.

Conclusion

From the above discussion it is evident that mangroves in the Odisha coast have been depleted at an alarming rate due to the operation of various biotic factors cited earlier. Conservation of the existing vegetation and restoration of mangroves in the degraded lands should be done on an urgent basis. Extensive plantations of some species of mangroves and their associates which are better adapted in this region such as *Avicennia alba* Bl., *Avicennia officinalis* L., *Rhizophora apiculata* Bl., *Rhizophora mucronata* Poir, *Kandelia candel* (L.) Druce, *Excoecaria agallocha* L., *Sonneratia apetala* Buch.-Ham, *Phoenix paludosa* Roxb. should be done to restore the past vegetation of this region. The successful plantation of *Rhizophora apiculata* Bl. in the south of Ho Chi Minh city of Vietnam which is extant in most luxuriant conditions is a bright example of mangrove regeneration in denuded areas. Steps should be taken by the State as well as the Central Government for the *in situ* conservation, artificial regeneration and rehabilitation of mangrove vegetation in different regions of Odisha coast. This should be done by the direct involvement of the local people as well as voluntary agencies. Seminars, symposia, work shops, and advertisement in the mass media should be done at regular intervals to generate public awareness among the common people. Stringent measures should be taken to check deforestation activities in the mangrove forests extant in this region. Intensive as well as extensive floristic and phytosociological studies should be carried out to get more reliable information about the present status of individual species of mangroves and their associates in different areas of the Odisha coast. Further studies on the phytochemical analysis and antimicrobial study of different parts of mangroves and their associates will reveal their bioprospecting potential for application in the herbal drug industry.

References

1. Anonymous (2001). State of the Forest Report. Forest Survey of India, Ministry of Environment and Forest, Govt. of India, New Delhi. India
2. Anonymous (1987). *Mangroves in India: Status report*. Government of India Ministry of Env. Env. & Forests, New Delhi.
3. Banerjee, L.K. (1987). Comparative study on mangroves of Sundarbans and that of the Mahanadi delta in Eastern India. *J. Econ. Tax. Bot.* 9(1): 119-131.
4. Choudhury, B.P. (1994). A Comparative study of mangrove vegetation in Bhitarkanika and Paradeep area in the state of Orissa: 33-41 in *Forest, Wildlife, Environment*. Andhra University, Visakhapatnam (Ed. M.V. Subba Rao)
5. Choudhury, B.P., A.K. Biswal and Subudhi, H.N. (1991). Mangroves of Orissa and aspects of their conservation. *Rheedea* 1: (1 & 2) 62-67.
6. Haines, H.H. (1921-1925). *The Botany of Bihar and Orissa* (1-6), London.

7. Mooney, H.F. (1950). *Supplement to the Botany of Bihar and Orissa*. Catholic Press, Ranchi.
8. Nayak, R.K.(2002). *Ecofloristic Studies in the Mahanadi Delta with special reference to Mangroves and their associates*. Ph.D. Thesis.Utkal University.Bhubaneswar, India.
9. Nayak,R.K.(2005).Conservation and regeneration of Mangroves in Paradeep and its adjoining region in the East Coast of India.*GEOBIOS*.32(2-3):219-220.
10. Nayak,R.K.(2018).Present status and Conservation of Mangroves in and around Hukitola Island. *Trends in Plant Systematics*. (Ed.Viswanathan,M.B.). Department of Botany,Bharathidasan University,Tiruchirappalli,Tamil Nadu:195-199(ISBN 978-93-5300-462-0).
11. Nayak, R.K. (2023). Impact of urbanization on the Mangroves of Paradeep in Mahanadi
12. Delta.pp.87-92. *Proc. Odisha Environment Congress 2023. Focal Theme: Environment and Urbanisation*.22-23 Dec, 2023(ISBN 978-81-938885-5-2).
13. Nayak, R.K. and Choudhury, B.P. (2001) Mangroves of Mahanadi delta and their conservation. *Plant Science Research*. 23 (1&2): 21-24.
14. Nayak and Choudhury, B.P.(2002).Status of Mangroves of Mahanadi Delta: Past, Present and Prospects for future. *Assian Jr. Microbiol. Biotech. Env. Sc.* 4(1):94-97.
15. Panda, S.P., Subudhi, H.N.& Patra, H.K. (2013). Mangrove forests of river estuaries of Odisha, India. *International Journal of Biodiversity and Conservation*. Vol.5(8).446-454.
16. Rao, T.A. and L.K. Banerjee (1967). Some new records for Orissa state. *J. Bomb. Nat. Hist. Soc.* 64: 583-584.
17. Rao, T.A., L.K. Banerjee and Mukherjee, A.K. (1970). Some interesting plant records from Orissa Coast. *J. Bomb. Nat. Hist. Soc.* 66. 659-660.
18. Rao, T.A. and Banerjee, L.K. (1982). Tidal Mangroves of the Mahanadi Delta, Utkal Coast, India. *Proc. Seminar. Res. Devt. & Env. in Eastern Ghats*, Waltair, pp 219-226.
19. Sahoo, A and Nayak, R.K. (2024). Phytochemical analysis of leaf extracts of mangroves and their associates in Dhamra estuary, Bhadrak, Odisha. *Journal of Pharmacognosy and Phytochemistry*.13 (4):428-433.
20. Subudhi, H.N., B.P. Choudhury and Acharya, B.C. (1992). Potential Medicinal Plants from Mahanadi delta in the state of Orissa. *J. Econ. Tax. Bot.* 16: 479-487.

Microbial diversity and their bioprospecting in changing climatic condition

Biswajit Patra² & Mihir Tanay Das¹

¹P.G. Department of Environmental Science, Fakir Mohan University, Odisha

²P.G. Department of Botany, Fakir Mohan University, Odisha

Microorganisms are the most diverse and abundant organisms essential for biogeochemical cycles and the functioning of ecosystems. They have also been considered the most profitable sources of bioactive natural products for over a century. Therefore, microbial diversity is crucial for the sustainability of ecosystem function and biotechnological applications of microbial natural resources, particularly for health-related advances. In this regard, polar and subpolar habitats, including microbial symbioses, are paramount for maintaining biodiversity and community composition, as global climate change can dramatically affect these extreme and unique environments. In recent decades, the emergence of genomic technologies has provided insights into understanding the diversity, function, adaptation and evolution of microorganisms and microbial communities in diverse global environments. Genome-resolved metagenomic studies have

significantly expanded the family tree of life by providing a clear representation of the phylogenetic diversity of microorganisms. Therefore, more comprehensive studies of microbial biodiversity in coastal habitats could help model the impacts of global climate change on these vulnerable ecosystems and provide new sources for bioprospecting.

Due to the extreme physicochemical conditions of polar environments, bioactive secondary metabolites produced by polar microorganisms can exhibit enormous scaffold diversity and structural complexity. Modern methodologies based on omics technology could be used for more microbial ecology-oriented investigations, such as exploring underexplored areas and studying the function of communities in ecosystem dynamics. Notably, contemporary sequencing and post-run analysis techniques apply to various targets, allowing observations to be made on both prokaryotes and eukaryotes.

Impact of Climate Change on Microbial Diversity

Ecology aims to understand the generation and maintenance of biodiversity over time and space, where climate strongly conditions the structure and interactions inside communities, as well as their functionalities. Thus, the impact of climate change on the ecosystems' inhabitants, including microorganisms, is expected to be significant and complex, although its quantification seems challenging. Among all the environmental factors affected by climate change (e.g., alterations in precipitation patterns, drought stress and changes in radiation), global warming has a pervasive influence on the variation in soil microbial diversity, playing a primary role in shaping microbial diversity compared to other proposed environmental drivers by increasing the temperature in the surface soil and decreasing its moisture. It is important to note from the outset that the effects of climate change on microbial communities in both terrestrial and aquatic environments are complex and, at times, even contradictory, with both deterministic and stochastic influences. On one hand, it has been widely reported that changes in temperature have an impact on microbial biodiversity at various levels (e.g., geographical range, phenology, distribution or abundance). Microbial metabolism, population growth rate and species number increase exponentially with increasing temperature. In fact, bacterial and fungal diversity tends to decrease with increasing global latitude as temperatures decline. However, variations in temperature can affect microbial biodiversity through several mechanisms. First, the most commonly reported mechanism is that increasing temperature leads to higher rates of metabolism, resulting in increased population doubling times as well as the rates of ecological and evolutionary processes, including mutation, speciation and interactions (e.g., parasitism, predation, competition or mutualism among others). On the other hand, higher temperatures lead to an increase in the number of plant species, and this higher plant diversity allocates nutrients to belowground ecosystems, as there is a well-known correlation between microbial taxa richness and plant species diversity. This shift in nutrient allocation could lead to changes in plant–microbe interactions, particularly affecting populations of plant growth-promoting rhizobacteria (PGPR) that rely on rhizodeposition.

Agriculture and Soil Microbiome

One of the most important worldwide primary sectors is agriculture, which relies on food production. However, the variation in soil microbial communities influenced by climatic change affects the

physiology, temperature sensitivity or plant growth rate, which jeopardizes the final yields and compromises the future of this sector. The relationships among microorganisms, atmospheric gases and crops showcase an intricate feedback system. Discrepancies have been observed between short-term laboratory studies and long-term field experiments on how climate change affects soil communities and nutritional balances. These differences may be caused by several factors, including variations in environmental conditions, differences in experimental designs and the complexity of soil ecosystems. In addition, temperature and soil humidity play a critical role in microbial-soil abundance, diversity and metabolic functionality, since climatic factors greatly modify the type and quantity of some plant species that predominate in a landscape. Thus, owing to the relationship between soil microbial biodiversity and the presence of certain plant species, this vegetal redistribution also affects soil microbial communities in a continuous feedback system.

Fishing and Marine Microbiome

Marine animals are mainly ectotherms, and, as a result, they are particularly sensitive to changes in water temperature, which highlights the effect of global warming on this fauna. Over the past few decades, there has been a significant increase in temperature in the European seas, with warming rates four to seven times higher than the global average. This accelerated warming has important implications for marine life because it can disrupt migration patterns, reproductive cycles, food availability and species distribution.

Microbial diversity of Mangrove ecosystem

Biodiversity can be defined as the variability of life at the genetic, species and ecosystem levels of organization. The mangrove ecosystem provides a unique environment harboring diverse groups of microorganisms. All microbial forms, such as bacteria, fungi, cyanobacteria, microalgae, macroalgae and fungus-like protists, have been reported in this ecosystem. The common bacterial groups of the mangroves are sulfate-reducing (*Desulfovibrio*, *Desulfotomaculum*, *Desulfosarcina*, *Desulfococcus* sp., etc.), N₂-fixing (*Azospirillum*, *Azotobacter*, *Rhizobium*, *Clostridium*, *Klebsiella* sp., etc.), phosphate-solubilizing (*Bacillus*, *Paenibacillus*, *Xanthobacter*), photosynthetic-anoxygenic and methanogenic (*Methanococcoides methylutens* sp., etc.) bacteria. In addition, various groups of fungi, such as ligninolytic, cellulolytic, pectinolytic, amylolytic and proteolytic fungi as well as actinomycetes are present in mangrove ecosystems. Actinomycetes have been looked upon as potential sources of bioactive compounds and are the richest sources of secondary metabolites. The mangrove ecosystem is a largely unexplored source of actinomycetes with the potential to produce biologically active secondary metabolites. Among microbes, bacterial populations in mangroves are many fold greater than those of fungi. Microbially generated detritus in mangrove ecosystems acts as the major substrate for bacterial growth in mangroves. The bacteria may act as primary decomposers that utilize dissolved organic substances at low concentration and assimilate dissolved inorganic substances like nitrate and phosphate. Bacteria with different ecological roles have been reported from mangrove ecosystems. Muddy mangrove soils have a strong capacity to absorb nitrates and phosphates carried by the tides. Most of the inorganic phosphate present in the sediment is bound to calcium, iron and aluminium ions as insoluble phosphates. Fungi and inorganic phosphate-

solubilizing bacteria present in the mangrove rhizosphere participate in releasing soluble phosphate into pore water. Certain bacteria exhibit high phosphatase activity, capable of solubilizing phosphate. Very little information is available about phosphate-solubilizing bacterial diversity and their activity in Indian mangroves. However, some studies related to phosphate-solubilizing bacterial activity have been done in the Vellar estuary at Parangipettai on the south eastern coast of India. Mangrove ecosystems provide large quantities of organic matter to adjacent coastal waters in the form of detritus, which serves as a nutrient source and is the base of an extensive food web. The diverse microbial communities living in mangrove ecosystems continuously transform nutrients from dead mangrove vegetation into sources of nitrogen, phosphorus and other nutrients that can be used by mangrove plants. Mangrove microorganisms have a diverse range of enzymatic activity and are capable of catalyzing various biochemical reactions with novel enzymes. Especially, halophilic microorganisms possess many hydrolytic enzymes (amylases, nucleases, phosphatases, and proteases) and are capable of functioning under conditions that lead to precipitation or denaturation of most proteins.

Conclusion

A number of past reviews have focused the attention of researchers on this tremendous treasure of mangrove microbial diversity but there is still a long way to go. Interdisciplinary research and collaborative endeavors are required amongst scientists, microbiologists and biotechnologists to provide innovative approaches to study the microbial diversity and explore the biotechnological potential of this unique ecosystem. Recent developments in molecular techniques will help to explore a good percentage of the microbial community that can be exploited for the welfare of the mankind.

Bibliography

1. Chen, Jianwei, Yangyang Jia, Ying Sun, Kun Liu, Changhao Zhou, Chuan Liu, Denghui Li et al. "Global marine microbial diversity and its potential in bioprospecting." *Nature* 633, no. 8029 (2024): 371-379.
2. Zhivkoplías, Erik, Jean-Baptiste Jouffray, Paul Dunshirn, Agnes Pranindita, and Robert Blasiak. "Growing prominence of deep-sea life in marine bioprospecting." *Nature Sustainability* 7, no. 8 (2024): 1027-1037.
3. Sekurova, Olga N., Olha Schneider, and Sergey B. Zotchev. "Novel bioactive natural products from bacteria via bioprospecting, genome mining and metabolic engineering." *Microbial biotechnology* 12, no. 5 (2019): 828-844.

KEYNOTE LECTURE

Plant Survival Mechanisms with reference to Sustainable Conservation in India

Kashinath Bhattacharya

Former Professor & Head, Department of Botany, Visva-Bharati University, Santiniketan, West Bengal

Email: kashinathbhat23@gmail.com

Selection pressure acts as a force driving the evolution of organisms toward increased prevalence of beneficial traits. Organisms develop various strategies to survive adverse environmental conditions. Plants, in particular, are often exposed to abiotic stresses such as high salinity, drought, and cold. In response, plants undergo widespread changes in gene expression, adjusting both transcriptional and post-transcriptional activities. Recent research has identified key components that help plants survive biotic and abiotic stresses.

Glutaredoxins (GRXs) are glutathione-dependent enzymes involved in redox homeostasis and the oxidative stress response. GRX genes are classified into three types: CPYC and CGFS, which are found across all prokaryotes and eukaryotes, and CC-type GRXs, which are specific to land plants, especially angiosperms. Heat shock proteins (HSPs) are a group of proteins induced by stress factors like temperature, pressure, or toxins. Their expression correlates with the accumulation of unfolded polypeptide chains, indicating a protective role. HSPs act as chaperones, aiding in the proper folding of nascent proteins by binding to exposed hydrophobic residues. In response to high salinity stress, plants use various genes. The glycosyltransferase *Qua1* modulates Ca^{2+} levels, and the zinc finger protein *AtZFP1*, when overexpressed, promotes salt tolerance by regulating ion transport proteins. Additionally, some ion-independent genes are critical for salt tolerance, such as glutathione S-transferase (GST) in *Arabidopsis*, which enhances resistance to salinity. Epigenetics studies are heritable changes in gene expression or cellular phenotype without altering DNA sequences. Mechanisms like DNA methylation and histone modification regulate gene expression without changing the genetic code.

The Rio Summit of 1992 led to two key treaties: (1) a commitment to reduce greenhouse gas emissions by 20% by 2005, and (2) the conservation and management of biodiversity through Agenda 21. Interestingly, ancient Indian civilization recognized the significance of nature, with sustainable practices rooted in texts like the Vedas, Jain and Buddhist scriptures, Manusmriti, and Kautilya's *Arthashastra*. These early principles of environmental sustainability align closely with modern ecological laws, highlighting India's deep historical connection to environmental conservation, as reflected in the country's environmental acts and laws, which echo Kautilya's teachings.

INVITED LECTURES

Algal diversity in Himalayan Protected Areas: silent spectators towards climate change

*Partha Pratim Baruah**, Hima Mani Kalita and Debahooti Baruah

Department of Botany, Gauhati University, Guwahati-781014, Assam

*Email: ppbaruah@gauhati.ac.in

Protected areas (PAs) are often referred as sites for conservation or in other words, nature reserves that always provide essential service in maintaining and managing many endangered or threatened organisms throughout the world including Himalaya. The entire Himalayan region which is now considered as one of the prime biodiversity hotspot is a home to complex mountain ecosystems, hilly terrains, and valleys that are characterized by significant topographic to climatic variations. Each of the major ecosystems that make up the Himalayan hotspot houses to a distinct collection of flora and wildlife that have adapted to the particular ecological conditions of the area. It also provides shelter to an astounding variety of algal species and as a good source of oxygen and nutrients for fish and other aquatic organisms, these algae play a major role in growth and evolution of aquatic ecosystems or water bird habitats of any protected areas. Some species are identified as indicators of specific fish varieties too. Algae respond quickly to environmental changes due to its short generation time and hence, can be considered as environmental monitoring tool which sometimes include the assessment of toxicity in water surface inside any protected zone due their microscopic size and great power of multiplication in suitable environment within a short span of time. As an example, sensitivity towards natural and anthropogenic disturbances and fast responses towards environmental changes make diatoms a valuable biological tool to measure environmental toxicants too. Further, surprise appearance of some harmful algae like, *Microcystis* species in sanctuaries is also a matter of concern. Therefore, research on these algae species is crucial for ecological management and monitoring in the water bodies of any Protected Area in general and in Himalaya in particular.

Estimating forest carbon fluxes in Similipal Biosphere Reserve, India using eddy covariance measurements

*Soumit K. Behera**

Plant Ecology and Climate Change Science Division, CSIR - National Botanical Research Institute, Lucknow-226001, India

*Email: soumitkbehera@gmail.com

Tropical forests play disproportionately important role in carbon sequestration and storage, with complex regulation mechanism by local environment (microclimate) and community structure. Similipal Biosphere Reserve situated in the northern part of Orissa's Mayurbhanj district plays a crucial role in the water and carbon cycle at regional vis-à-vis global scale. Yet very few field-based data on related processes exist for Similipal Biosphere Reserve. The forest is predominantly moist mixed deciduous forest with tropical semievergreen forest in areas with suitable microclimatic conditions and sporadic patches of dry deciduous

forests and grasslands. In the wake of global change, there is a need for a better understanding of the current and future response of the forest biome in this complex landscape. A new long-term effort has been set up by installation of an Eddy Covariance (EC) flux tower at Kachudhan, Pithabata South Wildlife Range in the core area of Similipal Biosphere Reserve for continuous measurement of exchange of CO₂, H₂O and energy between the vegetation surface and the atmosphere, empowering researchers to advance scientific understanding on forest carbon dynamics and net ecosystem exchange (NEE). The eddy covariance (EC) is one of the most effective methods to directly measure the surface mass and energy fluxes within atmospheric boundary layers at the regional scale. This study will be first of its type for Similipal Biosphere Reserve to measure forest carbon sequestration and predict climate change impact on forest carbon dynamics.

Impact of Atmospheric Biopollutants on Human Health: Monitoring, Assessment and management

Swati Gupta Bhattacharya

Former Professor & Head, Division of Plant Biology, Bose Institute (Main Campus), Kolkata- 700009

Email: swatigb29@gmail.com

Respiratory allergies and asthma have become major health problems worldwide, with India being no exception. Currently, approximately 20-25% of the Indian population is sensitised to various types of allergens, which originate from pollen grains, fungal spores, food, insects, and house dust mites. Hospitalisation data from different parts of the country indicate a sharp increase in the prevalence of IgE-mediated atopic diseases in recent decades. India, with its diverse climates, vegetation, and food habits, has been reported to harbour a broad range of such allergens.

The fundamental principle of allergen research is to identify the precise causative factor (protein/glycoprotein) of the pollen/spore allergens. Thus, the identification and characterisation of allergenic proteins or glycoproteins from pollen/spore are crucial for (a) evaluating the significance of allergic sensitisation, (b) prescribing appropriate medication, and (c) assessing the effectiveness of allergen elimination programmes (management). Although there are several reports on prevalent allergens from various parts of the country, these are mostly based on preliminary detection and identification. However, only a few of these allergen molecules have been characterised using molecular techniques such as recombinant technology and structural biology. This paper provides a comprehensive review of the biochemical, immunological, and molecular information on various pollen/spore allergens, as well as allergen-specific immunotherapy, testified from India.

Hairy root culture in different medicinal plants using *Agrobacterium rhizogenes*

Durga Prasad Barik

Department of Botany and Biotechnology, Ravenshaw University, Cuttack – 753003 Odisha, India.

Email: dpbarik@ravenshawuniversity.ac.in

Hairy root culture is a novel source of useful secondary metabolite production due to its rapid growth without hormones, biochemical and genetic stability. Hence the development of large quantities of hairy roots by *in-vitro* conditions to avoid the destruction of root harvesting from several important medicinal plant species. Hairy roots caused by root inducing plasmid explants of *Rhizobium rhizogenes* (formerly *Agrobacterium rhizogenes*), T-DNA transmit in plant cells and express along with plant genome. The different strains would be responsible for building hairy roots. This topic aims to explain the methods of culture through various strains of *R. Rhizogenes* hairy root propagation of medicinal plants, further secondary development of metabolites by this form of induction and highlights the possibilities provided by hairy roots in terms of viability and perspectives.

Vitex negundo L. is an aromatic, woody, blooming shrub in the Verbenaceae family which can grow into a small tree. Traditionally, *V. Negundo* root has been used to cure diabetes, colic, boils, leprosy, and rheumatism. Keeping the importance of its roots in mind, an attempt has been taken for development of a protocol for efficient hairy root proliferation system. The *Agrobacterium rhizogenes* strains (MTCC 532 and MTCC 2364) were used for hairy root induction. For *A. rhizogenes* infection, both *in vitro* and *in vivo* leaves as well as internodes were used as explant. *In vitro* leaves and internodal explants were obtained by the inoculation of matured nodal segments on the optimum medium [MS + 2.0 mg/L N6-Benzylaminopurine (BAP)] with c.a. 91.6% shoot regeneration and an average of 8.1 shoots per explants. *In vitro* leaf showed best hairy root induction followed by *in vitro* internode on ½ MS medium augmented with acetosyringone. Highest transformation efficiency was achieved using MTCC 2364 strain, while no transformation was observed in MTCC 532 strain. Different factors affecting transformation including co-cultivation period, infection time and optical density (O.D.) value were standardized. The highest efficacy, 88.8% hairy root induction was observed in *in vitro* leaves infected by MTCC 2364 for 60 minutes infection time with an O.D. value of 0.29 maintained over a 44-48 hours of co-cultivation period. The prescribed protocol may be used as a reference for development of industrial scale hairy root production for bioactive compound located in root of *V. negundo*.

Paederia foetida L. is one of the important medicinal plants of tremendous medicinal importance. This study aims to extract essential secondary metabolites from the roots of *Paederia foetida* for the design and manufacture of drugs without the plant being uprooted. Thus helps in the conservation of the plant species. We used the previously established plant tissue culture protocol as a pre-requisite for the development of hairy roots in *Paederia foetida* L. in this paper. Via the research aid of two *Agrobacterium rhizogenes*, MTCC 2364 and MTCC 532 wild type strains. *In vivo* and *in vitro* leaves and internodes were used as explants and to infection techniques viz, injecting and dipping for 15, 30 & 45 minutes were implemented. Highest result was recorded in *in vivo* internodal explant with 30 min dipping but 15 min and 45 mins dipping showed less response. Hairy roots induction in medicinal plants can provide the

supplement to the pharmaceutical companies without disturbing or uprooting the plants, which will lead to the conservation of medicinal plants.

Development of an efficient universal nutrient formulation for hydroponic cultivation of diverse groups of economically important plants

Khirod Kumar Sahoo¹

¹Assistant Professor, Department of Botany, Ravenshaw University, Cuttack- 753003

¹Email- khirod555@gmail.com

Hydroponics technology is a worldwide promising method for cultivation of many plants. Despite of rising demand, strawberry plants are not grown universally, likely due to variations in weather conditions across regions, available of infectious soil pathogen and insufficient knowledge of soilless hydroponic cultivation. The current research aims to establish an efficient nutrient medium that enhances the growth and yield of diverse variety of economically important plants using soilless hydroponic cultivation methods. A universal low-cost Nutrient formulation for Hydroponic plant cultivation technology was established. The effect of Nutrient formulation on the growth and productivity of 44 numbers of diverse plant species were checked. Out of which, 12 numbers were flowering plants, 05-vegetable, 03-leafy vegetable, 08-spice, 12-medicinal, 02-cereals and 02-fruited plants. Interestingly, 95% of the Hydroponic-cultivated plants showed better growth, high productivity and maintain enriched nutritional quality as compared to conventional soil-cultivated plants. This may be due to effective nutrient uptake and better physiological status of the plants under Hydroponic condition. The above R&D activity can be linked with the industry and institution in a collaborative approach for successful implementation of Hydroponic plant cultivation technology in the commercial level. The studies concluded that the novel nutrient formulation in hydroponic is most effective in terms of growth, nutrient uptake, physiology, and productivity of the plants. The result of this study gives an alternative to the farmers for cultivation of economically important plants in soilless hydroponic conditions. Hence; this universal medium can be helpful for common farmers for mass scale cultivation of different types of commercially important plants at limited area for sustainable development.

Acknowledgement: PI- Dr. Khirod Kumar Sahoo sincerely acknowledge the Department of Science and Technology, Government of Odisha for providing funds to carry out the Research project on 'Hydroponics'.

Inventorying Plant Genetic Resources Associated with Divine Deities and Religious Practices in Odisha

Kunja Bihari Satapathy

Department of Botany, Centurion University of Technology and Management, Odisha, India

Email: kbs_bot@rediffmail.com

Odisha also referred as 'Land of Jagannath' is well known for rich plant wealth, tribal diversity and cultural heritage. The people of this state have deep faith in their deities, rituals and ceremonies and involve several

plants in their socio-cultural life. The present-day inhabitants and priests of different temples of Odisha have been maintaining the age-old practice of offering of plants to the deities in form of leaves, flowers, fruits etc., as well as specific floral objects during daily rituals and festive occasions. The present investigation highlights traditional uses of plant wealth in various rituals and ceremonies among the rural communities of the state. Resources survey also documented the plants and plant parts used in worshipping and associated with divine deities and other religious practices in Odisha. The extensive and intensive field visits were organized in various villages of the state to observe their rituals and ceremonies. The present communication also focusses on documentation and enumeration of the medico-botanical relevance of plants worshipped and used in rituals of Lord Jagannath at Puri, Odisha. The recorded plant species were collected, taxonomically identified and preserved in the form of herbarium for future reference. During field study, a total of 48 plant species under 41 genera of 25 families were recorded, among which 18 plant species were found to be growing in wild condition and remaining 30 species were observed in cultivated areas. Highest number of plant species belonged to the Poaceae family (7 spp.) followed by Apocynaceae (5 spp.), Lamiaceae, Malvaceae, Oleaceae and Solanaceae (with 3 spp. each). The inhabitants of the study area use almost all plant parts as well as whole plant in worship of their deities and at various rituals in festivals, ceremonies and cremation. They believe in the supernatural power of some plant species and use them to keep away evil spirits. It was noted that *Tagetes erecta* L. is the most useful species and cultivated in gardens of almost all Hindu families. The worship of plants, offering of fruits, flowers, leaves etc. to the temple deities, routine use of certain floristic objects at festivals and rituals revealed that how could the religious people have been contributed to the protection and conservation of these plant resources. However, it is sad to note that the precious pharmaceutical potential of these sacred plants is not properly understood either by the priests or by the common users. Thus, indexing such plants with correct botanical names, local names and their local medicinal uses in an inventory is imperative.

Exploration of natural resources for better livelihood

N.K. Dhal, S.K. Kabi and D. Mishra

Bioremediation Laboratory, Environment and Sustainability Department,
CSIR-Institute of Minerals and Materials Technology, Bhubaneswar- 751 013, Odisha

E-mail: nkdhal@immt.res.in

Exploration and documentation helps us to understand the demand and supply of resources, value additions to local resources in terms of process development, technology transfer, and effective management for sustainable utilization of natural resources. Bioresources are sources of major economic of the world and provide livelihood opportunity of local people. Bioresources are often viewed as key assets driving development and wealth creation. During the exploration of Flora of Odisha project, we got an opportunity to survey different forest pockets of Odisha and interacted with most of the tribal people. Odisha's indigenous populations have a wealth of ethnobotanical knowledge since they have a strong bond with the local natural resources. Because it provides the limited habitats for numerous useful medicinal plant species, this plays a significant role in the evolution of traditional medicines, including Ayurveda.

During interaction, pharmaceutical products from traditional medicine, clinical trials based on ethnic leads, plant parts used in traditional medicine, species identified for industrial uses, medicinal plants with commercial importance, case study on sabai grass, minor forest products, forest as food producing habitats etc. were documented. Species identified for commercial importance ones, are used by a no of pharmacies for a no of compounds, tinctures and extracts. Given the vast amount of indigenous knowledge on the use of medicinal plants, proper preservation measures should be implemented which is need of the hour.

Understanding forest carbon pools: a potential strategy for climate change mitigation

Sudam Charan Sahu

Department of Botany, Mahaaja Sriram Chanda Bhanja Deo University, Baripada-757003 (Odisha)

Email: sudamsahu.bdk@gmail.com

Forest ecosystem plays a vital role in carbon emission and removals through ecological processes. Forests are the second largest carbon sink next to World's ocean. Tropical forests are not only the store house of biodiversity but also a potential accumulator of carbon. There is a continuous increase in carbon dioxide (CO₂) levels in the atmosphere, currently at 420 ppm (<https://www.co2.earth/> / 2023) resulting as a major contributor to global warming and climate change. The potential of carbon storage in different pools of forest ecosystems plays an important role in mitigating the adverse effects of climate change.

Reducing Emissions from Deforestation and forest Degradation (REDD+) is the most recent programme of the United Nations Framework Convention on Climate Change (UNFCCC) that aims towards enhancement of terrestrial carbon stock through integrated forest management processes (UNFCCC 2018). In this scenario, it becomes important to maintain a periodic inventory of carbon stocks and fluxes for forests as baseline scenario. Such an exercise is further supported by the need for information about status of forest carbon density, which is an indicator of ecosystem productivity and associated ecosystem services. Further, the information on carbon fluxes from forests is required for national greenhouse gas inventory preparation and communication under UNFCCC processes. Moreover, conservation of carbon stocks and flux monitoring and management are part of mitigation strategy.

Understanding the different carbon pools and its relationship with forest structural attributes is essential to achieve sustainable conservation of forest ecosystems and their carbon storage. Key factors such as basal area, species richness, stand density, species diversity, edaphic factors etc., affect the forest ecosystem carbon stocks. However, little is known about their inter-relationship in different forest types of India. Although studies on carbon stock estimation in tropical forests are available in Western Ghats and Northern parts of India, it is very rare in Eastern Ghats of India. This information will be helpful for planning and managing the carbon stocks in different tropical forests and conservation of biodiversity.

Acharya Jagadish Chandra Bose Indian Botanic Garden (AJCBIBG): A milestone in plant introduction and ex-situ conservation in India

S.P. Panda

Botanical Survey of India, Deccan Regional Centre, Hyderabad-500001

Email: situ.1979@gmail.com

The Acharya Jagadish Chandra Bose Indian Botanic Garden (AJCBIBG) previously known as Indian Botanic Garden, Howrah, has a special position among all the botanic gardens as it is witnessed as the centre of plant introduction and *ex-situ* conservation of many RET species collected from different parts of the globe since time immemorial. Presently Acharya Jagadish Chandra Bose Indian Botanic Garden is taken as a centre of conservation of plant resources from their extinction. This garden serves as a living repository of plants of a country and also of selected exotic species, and a "safe abode" for the rare and endemic plants. As a result it houses the germplasm collection of selected economic, ornamental and medicinal plants and their wild progenitors. The garden also act to promote educational programmes in order to generate awareness about the value of trees and other curious, beautiful, interesting plants with delightful landscaping and display. This garden also organizes flower, foliage and plant shows etc.; exchange of viable seeds, seedlings and other propagules as well. As a whole, it acts as a data bank of information and documentation on holdings in the botanic garden. Presently, the garden with an area of 273 acres and being a living repository of 1377 species of plants possesses 25 divisions and 24 interconnected lakes. The garden is a unique place of learning & rich array of curiosity and occupies matchless attractions like the 'Great Banyan Tree', a living wonder in the plant kingdom; the Large Palm House containing rich collection of palms including *Lodoicea maldivica* (J.F.Gmel.) Pers. (the Double Coconut palm); Branching palm [*Hyphaene thebaica* (L.) Mart.] introduced from Egypt; the century Palm (*Corypha utan* Lam.); the Giant Water Lily (*Victoria amazonica* (Poepp.) J.C. Sowerby and *V. cruziana* A.D. Orb.; the queen of flowering trees (*Amherstia nobilis* Wall.); the mountain rose or Venezuelan rose (*Brownea* sp.); the Baobab tree or Kalpavriksh (*Adansonia digitata* L.); the Rosogolla tree (*Chrysohyllum cainito* L.); the Cannon ball tree (*Couroupita guianensis* Aubl.); the African Sausage tree (*Kigelia africana* (Lam.) Benth.); the mad tree [*Pterigota alata* (Roxb.) R. Br. var. *irregularis*] and the 'Candle Stick Tree' (*Parmentiera cereifera* Seem.) etc., are a few to mention.

AJCBIBG, Howrah also played a significant role in introducing, multiplying and distributing many commercially important plants from various parts of the world. Introduction of some of the notable species directly influenced the welfare of people and economic development of the country. Tea (*Camellia sinensis* var. *assamica* (J.W. Mast.) Kitam.), Cinchona (*Cinchona pubescens* Vahl.), Rubber (*Hevea brasiliensis* (Willd. ex A. Juss.) Mull.Arg.), Mahagony etc. were first introduced in the garden and subsequently transferred to other parts. The garden has served as a platform for acclimatization and distribution of a number of economic and ornamental plants of Agri- Horticultural importance of Indian and foreign origin. Some of the important species are *Amherstia nobilis* Wall. (the Queen of flowering trees) introduced from Burma in 1826 by Nathaniel Wallich; *Allamanda* sp. in 1803 by W. Hamilton; *Bougainvillea* sp. in 1803 by W. Hamilton; Garden Croton in 1798 by C. Smith; Australian pine in 1798; *Crescentia cujete* L. (Calabash tree) in 1795 by

W. Hamilton; *Lodoicea maldivica* (J.F.Gmel.) Pers. (the Double Cocunut) in 1874 by Sir George King; Passion flower in 1797; Chinese rose in 1794 by William Roxburgh; *Victoria amazonica* (Poepp.) J.C. Sowerby (the Giant Water lily) in 1873 by Sir George King. The foregoing examples are only a few of them. A large number of economic and spice species like Cardamom, Cinchona, Cinnamon, Coffee, Cotton, Indigo, Nutmeg, Pepper, Clove, Sugarcane, Potato, Sago, Teak etc., and other species used as forage, fodder, oil, fruit, fibre, timber and ornamental plants were first introduced into this historic Garden. Multiplication of most of the introduced species carried out in the Garden itself and distributed to different parts of the country for commercial cultivation.

Coastal Microbial diversity and Resilience of Climate change in Mangroves

H.N.Thato¹ and R.R.Mishra²

1. Centre for Industrial Biotechnology Research, Campus-II, Kalinganagar, Siksha 'O' Anusandhan Deemed to be University, Bhubaneswar-751003
2. Department of Biotechnology, MITS School of Biotechnology, Bhubaneswar-751024, Odisha, India

Mangroves forests found in the tropical and subtropical regions of the world are a part of the "blue carbon" sink. They act as a connection between the terrestrial and marine ecosystems, providing habitat to countless organisms. Among these, microorganisms (e.g., bacteria, archaea, fungi, phytoplankton, and protozoa) play a crucial role in nutrient cycling, decomposing organic matter, and making nutrients available to plants. Besides nutrient recycling, the mangrove microorganisms contribute to carbon sequestration by breaking down organic matter and storing carbon in sediments. Microorganisms in mangroves can also suppress pathogens, reducing disease outbreaks and maintaining ecosystem health. By understanding the importance of microbial diversity in mangroves and the impacts of climate change, we can develop effective conservation and management strategies to promote the resilience of these critical ecosystems. Therefore, the conservation of mangrove ecosystems is necessary for protecting them from the changing environment—a step toward preserving the globe for better living.

Quorum Sensing: The microbial diversity and their communication in Human Oral environment.

Gatha Mohanty

BDS, MDS (Periodontics and Oral Implantology)

Associate Professor, Institute of Dental Sciences, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar.

Bacteria live unicellularly in conventional view of prokaryotic existence. They respond to external stimuli limited to the detection of chemical and physical signals of environmental origin. This view of bacteriology is now recognized to be overly simplistic, as bacteria can communicate with each other. The bacterial cell-to-cell signalling systems were initially described as mechanisms through which bacteria

regulate gene expression via cell density and, therefore, they have been collectively termed quorum sensing(QS).

Quorum sensing (QS) is a critical mechanism of intercellular communication that enables bacteria to monitor their population density and coordinate group behavior. This process involves the production, release, and detection of small signaling molecules known as Autoinducers. When the concentration of these autoinducers reaches a certain threshold, it triggers a cascade of gene expression changes that lead to collective behaviours, such as biofilm formation, secretion of virulence factors, and bioluminescence.

There are two main types of quorum sensing systems: Gram-positive and Gram-negative bacteria. In Gram-negative bacteria, the most well-studied QS system involves acyl-homoserine lactones (AHLs) as autoinducers. In contrast, Gram-positive bacteria typically use peptide-based signaling molecules. The complexity of these systems allows for a diverse range of responses depending on the species and environmental conditions.

Quorum sensing is not only crucial for bacterial survival but also plays a significant role in pathogenicity. Many pathogens utilize QS to regulate the expression of virulence factors, enabling them to effectively invade host tissues and evade the immune response. Moreover, quorum sensing has garnered attention for its potential in developing novel antimicrobial strategies. By disrupting QS pathways, known as quorum quenching, researchers aim to inhibit the coordinated behaviors of pathogenic bacteria, rendering them less virulent and more susceptible to treatment. This approach could be particularly valuable in combating antibiotic-resistant infections.

ABSTRACTS FOR SAROGINI G. PANIGRAHI MEMORIAL AWARD

In Silico Techniques Unveil the Antioxidant Potential of Phytocompounds of *Plumeria* species via Xanthine oxidase inhibition

Geetashree Gyanadarshinee Sahoo

Centre for Biotechnology, School of Pharmaceutical Sciences, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar-751003, Odisha, India

Email: geetashree05@gmail.com

Xanthine oxidase (XO) produces oxygen-derived free radicals that cause oxidative damage to living tissues, contributing to diseases including cancer, inflammation, aging, gout and atherosclerosis. Production of excessive ROS (Reactive oxygen species) destroys nucleic acids and proteins, affecting cellular structure and function, hence the prerequisite of ingesting naturally derived antioxidants as a remedial target. The genus *Plumeria* (common name: temple tree, family Apocynaceae) comprises of large number of species distributed globally. The members of this genus are small laticiferous trees or shrubs that have a characteristic smell and are grown in tropical and subtropical regions. The genus *Plumeria* is mostly grown for its attractive and fragrant flowers. The essential oil isolated from leaves and flowers of *Plumeria* species is widely being used for research purposes, as the volatiles present in these plants possess numerous bioactivities like anti-inflammatory, antimicrobial, antibiofilm, and antioxidant activity etc. The flower and leaf essential oil of *Plumeria* species has several natural bioactive compounds like benzyl benzoate, benzyl salicylate, linalool, geraniol, and α -terpineol, etc., which may contribute to their bioactivities. This work intends to investigate the antioxidant activity of phytoconstituents of *Plumeria* essential oil using a computational biology approach. To better understand XO inhibition mechanisms and select the most effective antioxidants, 75 compounds from the essential oils of genus *Plumeria* were subjected to virtual screening, molecular docking, and MD simulations. The binding energies of the protein-ligand complexes varied between -3.4 and -7.1 kcal/mol. Amongst the docked ligands, aromadendrene (-7.1 kcal/mol), caryophyllene oxide (-7.1 kcal/mol), ledol (-6.9 kcal/mol), and α -longipinene (-6.8 kcal/mol) were found to be strong bioactive molecules with a higher binding affinity to XO and good physiochemical features. These compounds produced a variety of polar and non-polar interactions, including alkyl, pi-alkyl, and pi-sigma bonds with the interacted amino acid residues; therefore, these were perfectly suited to the XO's binding site. MD simulation was used to analyze the inherent dynamics and flexibility of selected ligands and XO complexes. The MD simulation revealed that out of the four selected compounds, aromadendrene, caryophyllene oxide, and α -longipinene are more stable and maintained consistent interactions than ledol, with the XO active site residues through various binding mechanisms. The phytoconstituents under study have demonstrated noteworthy antioxidant properties, which could be taken into account for further research on oxidative stress management and for potential application as antioxidant agents in the pharmaceutical industries.

***Leonotis nepetifolia* Leaf Essential Oil: A Novel Modulator of Inflammation and Oxidative Stress in LPS-Induced RAW 264.7 Cells through TLR4/NF- κ B/MAPK Signaling Pathways**

Omprakash Mohanta

Centre for Biotechnology, Siksha 'O' Anusandhan (Deemed to be University), Kalinga Nagar, Bhubaneswar-751003, India

Email: br.prakashom@gmail.com

Leonotis nepetifolia (L.) R.Br. is a wild-growing shrub with extensive ethnomedicinal and industrial applications worldwide, but its leaf essential oil (LNLEO) remained understudied. This study aims to be the pioneer in deciphering the underlying anti-inflammatory molecular mechanisms of LNLEO utilizing an *in vitro* LPS-induced RAW 264.7 macrophage model. GC-MS analysis unveiled 44 phytometabolites comprising 91.19% of LNLEO with Germacrene D (32.17%), β -Caryophyllene (16.53%), α -Humulene (7.36%), and Phytol (6.67%) as the predominant terpenoids. Cytotoxicity assessment by MTT assay revealed that LNLEO was nontoxic up to 50 μ g/mL concentrations. Overnight incubation with 12.5 and 50 μ g/mL of LNLEO significantly reduced the expression of proinflammatory cytokines (TNF- α , IL-1 β , IL-6), inflammatory enzymes (iNOS, COX-2), and intracellular ROS, while enhancing the levels of endogenous antioxidant enzymes (SOD, GPx, GSH, CAT) in pre-LPS stimulated RAW 264.7 cells. The RT-qPCR results further showed that the LNLEO administration silenced TLR4 and MyD88 expression, pivotal for activating MAPK, and NF- κ B signaling pathways. Besides, the confocal microscopy analysis showed that LNLEO inhibited the translocation of NF- κ B from the cytosol to the nucleus. ELISA studies also indicated that LNLEO suppressed inflammation by targeting and limiting phosphorylation levels of MAPKs, such as pERK, pJNK, and phospho-p38 MAPK that are implicated in the activation of NF- κ B and other transcription factors, indicating its anti-inflammatory characteristics. Overall, the leaf essential oil of *L. nepetifolia* may serve as a potential therapeutic agent for treating inflammatory conditions, and targeting the TLR4/MyD88, NF- κ B, and MAPK signaling pathways may be considered as an attractive approach for anti-inflammatory therapies.

Bulked Segregant RNA Sequencing (BSR-Seq) Combined with SNP Genotyping Towards Mapping and Characterization of a Purple Blotch Resistance Gene in Onion (*Allium cepa* L.)

Jayashree Sahoo, Raj Kumar Joshi*

*Dept. of Biotechnology, Rama Devi Women's University, Vidya Vihar, Bhubaneswar.

*E-mail: rkjoshi@rdwu.ac.in

Purple blotch (PB) disease, caused by the pathogenic fungus *Alternaria porri* (Ellis) Cifferi, poses a significant threat to onion and allied crop production worldwide. This research utilized bulk segregant RNA sequencing (BSR-Seq) to investigate potential PB resistance regions in onion. The study examined Arka Kalyan (resistant parent), Agrifound Rose (susceptible parent), and two sets of their bulks (20 homozygous resistant and 20 susceptible) from an F6 RIL population. Analysis of 278.08 million clean reads from 8 libraries revealed 755 differentially expressed genes (DEGs), with 492 upregulated and 263 downregulated

sequences. Bulk frequency ratio (BFR) calculations between resistant and susceptible bulks identified 2963 common SNPs with BFR >6 on 1439 transcripts. Euclidean distance association analysis located a 7.3 Mb resistance-specific candidate region on chromosome 6 long arm. RNA-Seq detected 23 DEGs in this region, including ACCL_20794 (Chr6: 187,639,724-187,643,297), a CC-NBS-LRR class disease-resistant protein showing elevated expression in resistant pools after PB treatment. Cloning and sequence analysis of ACCL_20794 revealed a single amino acid mutation (histidine to serine) in the resistant genotype Arka Kalyan. Quantitative reverse transcription (qRT)-PCR confirmed significant differential expression of ACCL_20794 in both parents and RIL bulks. These results suggest ACCL_20794 as the candidate resistance gene *ApR1*, potentially involved in the PB resistance response.

ABSTRACTS FOR SHORT ORAL PRESENTATIONS

Adapting Rice Cultivation to Climate Change: Enhancing Submergence Tolerance, Bacterial Blight Resistance, and Yield in Swarna through Gene Pyramiding and MAB Techniques

Shibani Mohapatra¹, Sharat Kumar Pradhan²

¹Centre for Industrial Biotechnology Research, Siksha 'O' Anusandhan University, Bhubaneswar

²Indian Council of Agricultural Research, Krishi Bhavan, New Delhi, India

Email: shibanimohapatra@soa.ac.in¹

The Swarna rice variety, popular in Eastern India, is known to be susceptible to climate-induced stresses such as bacterial blight caused by *Xanthomonas oryzae* pv. *oryzae* and flash floods, which often result in significant yield losses. This study aimed to enhance Swarna by developing a new variant with improved submergence tolerance, bacterial leaf blight resistance, and higher yield. For molecular screening, genomic DNA was extracted from the leaves of 15-day-old seedlings using the CTAB method and was amplified using gene-specific markers (Gn1a, GW2, gw5, OsSPL14, SCM2) to identify yield-influencing QTLs. A marker-assisted backcross breeding approach was employed, incorporating seven key genes/QTLs (Sub1A, Gw2, OsSPL14, SCM2, xa5, xa13, Xa21) from three donor parents (Swarna Sub1, Swarna MAS, Swarna-Habataki) into Swarna. Several progenies possessing all desired genes were selected through multiple breeding cycles for further evaluation. These lines were tested under controlled conditions for their resistance to bacterial blight and their ability to recover from submergence. Engineered lines were found to exhibit significantly reduced lesion lengths compared to Swarna when challenged with Xoo isolates, demonstrating enhanced bacterial resistance. These lines displayed superior regeneration capabilities following submergence, in contrast to the original Swarna, which failed to recover. The final phase of the study involved assessing yield-related traits, where the new lines showed improved culm strength and higher panicle weights, resulting in a notable yield increase. The top-performing line, SSBY-69-840, was recorded to yield 7.52 tonnes per hectare, marking an 18% increase over the traditional Swarna and a 6.8% improvement over other high-yield, resistant varieties. This research successfully illustrates the potential of gene stacking in the development of rice varieties that can withstand multiple stresses while delivering higher yields, offering a promising approach to sustain rice production under adverse climatic conditions.

Potent antioxidant and anti-inflammatory effect of hesperidin in arsenic trioxide induced cardiotoxicity in rat

Gayatri Khuntia¹, Jeevan Ranjan Dash^{1*}, Biswadeep Jena², Uma Kanta Mishra³, Subash Chandra Parija¹

¹ Department of Pharmacology and Toxicology, CVSc and AH, OUAT, Bhubaneswar, India

² Department of Veterinary Surgery and Radiology, CVSc and AH, OUAT, Bhubaneswar, India

³ Department of Veterinary Anatomy and Histology, CVSc and AH, OUAT, Bhubaneswar, India

Email - jeevandash5@gmail.com

To study the antioxidant and anti-inflammatory effect of hesperidine in arsenic trioxide induced cardiotoxicity in rat. Cardiac toxicity was induced by oral administration of 4 mg/kg arsenic trioxide for 30 days. 10% tissue homogenate was prepared in Tris-HCL buffer (0.02 mol/L, pH=7.4) and centrifuged at 1000 rpm for 2 min at 4°C. The supernatant was used for determination of lipid peroxidation and antioxidant enzymes [superoxide dismutase (SOD) and catalase]. IL-6 was assayed by using an Invitrogen IL-6 rat ELISA kit in serum. TBARS activity was significantly increased ($P<0.05$) and SOD and catalase activities were significantly reduced ($P<0.05$) in the arsenic trioxide-treated group compared to the control. Hesperidin significantly improved the antioxidant status. Moreover, IL-6 level was increased significantly ($P<0.05$) in the arsenic trioxide-treated group compared to the control. Hesperidin downregulated serum IL-6 levels in the arsenic trioxide-treated rats. Hesperidin may have potent antioxidant and anti-inflammatory effect in arsenic trioxide induced cardiotoxicity in rat.

Comparative analysis of imidacloprid and thiamethoxam toxicity on the photosystem performance of *Synechocystis* sp. PCC 6803

Smrutirekha Mishra and P. K. Mohapatra

Department of Botany, Ravenshaw University, Cuttack – 753 003

Email - smrutirekhamishra08@gmail.com

Imidacloprid (IMI) and thiamethoxam (TMX), two neonicotinoids (NEOs), are promoted as safe for the environment, having little residual toxicity and no significant mammalian toxicity. However, the soil and aquatic microbiota have been greatly impacted by their prolonged applications, persistence in soil systems, and leaching to water bodies. In the current study, the effects of IMI and TMX on the activity of photosystem I (PS I) and photosystem II (PS II) were assessed using the wild (W) and tolerant (T) strains of *Synechocystis* sp. PCC 6803 on exposure to selected concentrations of insecticides (1 mM and 2 mM of IMI and 75 μ M and 150 μ M of TMX). Under IMI exposure, the W1 and W2 cultures showed greater PS II fluorescence than T1 and T2 cultures, respectively. Additionally, the treated W strain exhibited greater PBS and PC fluorescence emission than the T strain. The PBS/PS II, and PC/PBS ratio changes were significant in the W strain but not in the T strain. The percentage of oxidizable PS I was similarly impacted by the insecticides, and the T strain recovered more quickly than the W strain after a day. In both strains, IMI treatment had a greater impact on the PS II-PS I electron flow than the PS I-NADP⁺ electron flow. On exposure to TMX the W75 cultures exhibited greater fluorescence emission in comparison to the T75 cultures, however the W150 cultures'

emission declined as a result of continuous Chl_a degradation. It was also observed that the W strain had a larger PBS fluorescence emission and reduced PS I function than the T strain. Day-dependent recovery and a rise in reducible PS I were seen in the T strain but not in the W strain.

Sal (*Shorea robusta* Gaertn.) For India's net zero goals: insights from population ecology, phenology, and environmental adaptability

Manas Ranjan Mohanta^{1*}, Sudam Charan Sahu², Sriyakankhsi Dutta¹, Lochan Kumar Sethy¹

^{1*} Dr. Manas Ranjan Mohanta, Assistant Professor, Department of Botany, Dharanidhar University, Keonjhar

² Dr. Sudam Charan Sahu, Assistant Professor, Department of Botany, Maharaja Sriram Chandra Bhanjdeo University, Baripada, Odisha

¹ Sriyakankhsi Dutta, Department of Botany, Dharanidhar University, Keonjhar, Odisha, Email: [Lochan Kumar Sethy](mailto:LochanKumarSethy@gmail.com), Department of Botany, Dharanidhar University, Keonjhar, Odisha

Email: Email: manasranjan.mrm@gmail.com, lochankumarsethy123@gmail.com

A key strategy under India's net zero target for 2070 is to expand forest cover and restore degraded ecosystems to enhance carbon sequestration. In this context, identifying suitable tree species that can effectively support these efforts is crucial for achieving long-term sustainability. "*Shorea robusta* Gaertn." (Sal) is a dominant tree species spanning a wide geographical range across India, from the Himalayan foothills in Assam to the Western Ghats and from eastern West Bengal to western Haryana. The species is known for its broad adaptability to tropical climates. This study explores both the ecological and economic attributes that contribute to dominance of "*S. robusta*" in Indian tropical forests. Our research, conducted in the Similipal Biosphere Reserve (SBR), focused on assessing population ecology, regeneration patterns, and the phenological characteristics of the species over two years. In addition, we reviewed literature on its tolerance to temperature, precipitation, and humidity, and utilized remote sensing data to analyze its environmental tolerance thresholds and preferred conditions. The species was found to be among the top five dominant species in all forest types' i.e. dry deciduous, moist deciduous and semi-evergreen forests of SBR. The regeneration status of the species was also found very well in all the forest types. The species exhibits a semi-evergreen nature, with leaf initiation beginning in February and peaking in March, while leaf senescence initiates in June and reaches a maximum in January. We found that leaf initiation is moderately synchronized (Synchrony index = 0.7), whereas leaf senescence is highly synchronized (Synchrony index = 0.9). Flowering is observed only during February and March, classifying it as a winter-flowering species with flower senescence extending into early summer. Flowering synchrony was moderate (Synchrony index = 0.7). Fruiting, occurring from early April to late May, defines "*S. robusta*" as a summer-fruiting species with a short fruiting period; both fruit initiation and senescence are highly synchronized (Synchrony indices of 1 and 0.9, respectively). The timing and intensity of each phenophase indicates the alignment of the species with seasonal conditions. The study found the monthly minimum temperature playing a critical role in its phenological cycle. Based on distribution data and literature review, the optimal range for monthly minimum temperatures was 15°C-25°C, while for monthly maximum temperatures, it was 30°C-35°C. Although rainfall has limited direct influence on its distribution, the species thrives in areas with annual

precipitation between 1500mm and 2000mm. Moreover, the species has a significant potential for biomass carbon storage due to its capacity for large growth, making it crucial for climate change mitigation efforts and achieving net-zero carbon goals of India by 2070.

Introgression of SUB1 (sub1) QTL in mega rice cultivars increases ethylene production cause the loss of grain-filling under stagnant flooding

Sandhyarani Kuanar¹, R.K. Sarkar² and P.K. Mohapatra³

¹Assistant Professor (stage1,) Netaji Subhash Chandra Bose Govt.College, Sambalpur

²Ex-Principal Scientist, National Rice Research Institute, Cuttack,

³Former Emeritus Prof. CSIR UGC, School of Life Sciences, Sambalpur University,

Email: sandhya_kuanar@rediffmail.com¹, rksarkarcrr@gmail.com², pravat1948@rediffmail.com³

Rice agroecosystem in India are affected by medium depth (25-50) cm to deep water (50-100) cm stagnant flooding. Recently submergence-1 (Sub1) QTL, which imparts tolerance to flash flooding, has been introgressed in some rice cultivars. But resilience of the QTL to stagnant flooding is not known. So, in our experiment two mega rice cultivars Swarna and Savitri and their counterpart Sub1 NIL, SwarnaSub1 and SavitriSub1 were tested on physiology, molecular biology and yield under control and stagnant flooding. Compared to control condition, stagnant grain yield and tiller number and increased plant height and Sub1-introgression mostly matched these effects. Stagnant flooding increased ethylene production by over-expression of ACC-synthase and ACC-oxidase enzyme genes of panicle before anthesis in the parental lines. Expression of the genes changed with Sub1 introgression, where some enzyme isoform genes over-expressed after anthesis under stagnant flooding. Activities of endosperm starch synthesizing enzymes Sucrose synthase and ADP-Glucose pyrophosphorylase declined concomitantly with rise ethylene production in the Sub1 introgressed lines resulting in low starch synthesis and accumulation of soluble carbohydrates in developing spikelets. In conclusion, Sub1 introgression into the cultivars increased susceptibility to stagnant flooding. Subjected to stagnant flooding, the QTL promoted genesis of ethylene in the panicle at anthesis causes the loss of grain yield.

Optimizing light regimes for neutral lipid accumulation in *Dunaliella salina*: A study on physiological status and carbon allocation

Abhishek Mohanta^{1,2}, Nitesh Prasad¹, RiyazatKhadim¹, R.K. Asthana^{1}*

¹ R. N. Singh Memorial Laboratory, Centre of Advanced Study in Botany, Banaras Hindu University, Varanasi

² Department of Botany, Betnoti Degree College, Betnoti-757025

Email: mohantaabhishek44@gmail.com

Dunaliella salina is a potential source of high lipid as a biofuel feedstock, and pharmaceutical compounds, largely dependent on the biomass. Lower biomass production from microalgae is a major constraint in the commercialization at industrial scale. This study aimed to investigate different light

intensities (LI) (50, 100, 200, and 400 $\mu\text{mol m}^{-2} \text{s}^{-1}$) on photosynthetic efficiency, carbon fixation, macromolecular synthesis, neutral lipid accumulation as well as antioxidative defence (ROS scavenging enzymes activities) in *D. salina*. High light (400 $\mu\text{mol m}^{-2} \text{s}^{-1}$) exposure of microalgal cells led decrease in chlorophylla content but carotenoid increased up to 19 %. Interestingly, there was significant change in carbohydrate content also under high light. There was significant increase in carbonic anhydrase (CA) activity, and CO₂ fixation rate, thus maintaining the biomass content in spite of stress inflicted upon the cells under high light intensity. *D. salina* cells exposed to 400 $\mu\text{mol m}^{-2} \text{s}^{-1}$ were harvested and transferred in nitrogen deficient medium, raising the lipid content up to 59.92 % DCW (dry cell weight). However, neutral lipid (NL) constituted 78.26 % of the total lipid and other lipids such as glycolipid (GL) and phospholipid (PL) content reduced, indicating reallocation of the lipid in such cells under nitrogen deficiency, making the organism more suitable for biodiesel / jet fuel purposes. An economic analysis inferred that *D. salina* cells although possessed comparatively longer generation time (3.5 d) over other microalgal cells, but amount of carotenoid produced and lipid quality make it more suitable for commercialization.

Present Status of Sea Grass of Chilika: A Coastal Wetland of International Importance

¹Debasish Mahapatro, ¹Sangeeta Mishra and ²Bita Mohanty

¹ Coastal Management Cell, ICZMP, 4th Floor, Central Laboratory, State Pollution Control Board, Plot No.B-59/2 & 3, Patia, Bhubaneswar-751024, Odisha, India.

² Fakir Mohan University VyasaVihar, Balasore-756020, Odisha, India.

Email: debasish.ocean@gmail.com

Chilika lagoon is one of the unique ecosystems for its multiplicity in the ecological realm. Regarded as the Ramsar site during 1981 and 2002, the Chilika lagoon is extremely rich in flora and faunal communities of the fresh water, marine water and brackish water domain. Among dominant macrophytes sea grass are considered as the complex ecosystems having immense ecological functions and services. All total seven species of seagrass are recorded from the lagoon ecosystem till date. These are *Halophila ovalis*, *Halophila ovata*, *Holodulepinifolia*, *Holoduleuninervis*, *Ruppia maritima*, *Halophila beccarii* and *Cymodocea serrulata* which is reported as recently documented. But detailed illustration about the species and spatio-temporal distribution is not revealed yet. The sea grass *Halophila beccarii* is included in the IUCN Red List as a vulnerable species. Recent surveys conducted to Chilika divulges that the lagoon sea grass is much threatened by several factors such as tropical cyclones, seasonal storms, flash floods, dredging, incongruous fishing, anchoring, plastic pollution, coastal aquaculture etc. Augmenting plastic pollution due to excessive tourist pressure is also providing additional stress to the seagrass resources. Chilika wetland contributes 20–33% of India's seagrass and also large supportive for the benthic invertebrate population, fishes, birds and congregation various larvae of fishes and shell fishes. Shrimpculture encroachment has been noticed at several places of outer channel area, central sector and southern sector of the lagoon. Such negative fishing practise reduces the ecosystem resilience. Regions those are made de-encroachment by the local administration may be considered suitable sites for artificial implantation of sea grass saplings. This will support in order to restore the degraded *ecotone* condition which may bring back the impoverished

taxa further. Since seagrass have many benefits in recharging and revitalising ecosystem and biodiversity respectively therefore appropriate conservation steps must be taken to protect the lagoon biodiversity and sustainability.

Diversity and distribution of invasive alien plant species in Kalahandi district of Odisha, India

Ghanashyam Behera¹, Mr. Nihar Ranjan Nayak², Alok Ranjan Sahu^{2,}*

¹Department of Botany, Maa Manikeshwari University, ManikyaVihar, Bhawanipatna, Odisha, India

²Department of Botany, Maa Manikeshwari University, ManikyaVihar, Bhawanipatna, Odisha, India

³Department of Botany, Vikash Degree College, Bargarh, Odisha, India

*E-mail: alok.btgene@gmail.com,

The floristic survey was carried out during February 2023 to March 2024 in the Kalahandi district of Odisha to assess the diversity and distribution of invasive alien plant species. In this present study a total of 99 species belonging to 88 genera and 37 families are reported. The highest number of species *i.e.* 12 no. were contributed from the family Asteraceae; followed by ten species from Fabaceae; nine species from Poaceae; six species from Amaranthaceae; five species from the family Malvaceae; four species each from five families (Apocynaceae, Convolvulaceae, Euphorbiaceae, Polygonaceae and Solanaceae); three species each from two families (Acanthaceae and Lamiaceae); two species each from six families (Boraginaceae, Cyperaceae, Passifloraceae, Pontederiaceae, Salviniaceae and Verbenaceae); rest 18 families contributed one species each. In this present finding, maximum invasive plant species were found to be native to Tropical America and one species each was native to both the sub-tropical America and Mediterranean, respectively. The present study gives complete and efficient documentation of invasive plants in Kalahandi district of Odisha that will provide a tool for maintenance of the local biodiversity.

Ethnobotanical study of medicinal hydrophytes used by peoples of Bhadrak district of Odisha

Keshari Prasad Mohanty

Department of Botany, Ravenshaw University, Cuttack, Odisha, India

Email- keshariprasadmohanty57@gmail.com

Ethnobotany is the traditional knowledge of indigenous communities about the diversity of plants presents in their surroundings. It is the study about how the people of a particular culture and region use plants for different purposes. Hydrophytes are also known as aquatic plants that have adapted to living in aquatic habitat. Bhadrak district is a coastal district of the state Odisha that contains 7 blocks, 218 gram panchayats and 1370 villages. The district covers 2505 sq.km geographical area and separated from Jajpur district by river Baitarani. The village communities of Bhadrak district depends upon various types of plants for different purposes like food, fodder, fuel, fiber and medicines. Here is an attempt to document the different medicinal hydrophytes along with their medicinal properties and mode of uses by the local communities of Bhadrak district. Entire district is divisible to many zones and the major study sites are Bhandaripokhari, Dhamnagar, Bhadrak, Bonth, Basdevpur, Chandbali and Tihidi. Frequent field visits were

conducted in different seasons of the year 2023. During field study the different medicinal hydrophytes are photographed and their medicinal utility and mode of consumption are recorded in a question answer format. The flowering and fruiting twigs are collected and put into a polythene bag for the purpose of further identification and herbarium preparation. Obtained raw data regarding medicinal importance are again cross checked among 174 individuals of different age groups. From the study total 117 species of hydrophytes were documented from Bhadrak district where the family Cyperaceae represents the dominant family. There are total 49 species of hydrophytes are used by peoples of Bhadrak district for medicinal purposes. The hydrophytes are mainly used for the treatments of different diseases like Leucoderm, Ring worm, Hair fall, Cut wounds, Diarrhoea, Diabetes, Jaundice and skin disease.

Elucidating anti-inflammatory mechanisms of *Zingiber* essential oil phytocompounds: A Network pharmacology and Molecular Dynamics Perspective

Ananya Nayak

Centre for Biotechnology, Siksha 'O' Anusandhan deemed to be University, Bhubaneswar

Email: ananyanayak2601@gmail.com

Zingiber officinale, *Zingiber roseum*, and *Zingiber zerumbet* are medicinally important plant species which can be used in several chronic inflammatory-diseases treatment for their unique therapeutic effects. The present study was designed to use network pharmacology based strategy to predict therapeutic targets of the volatiles of these three species against inflammation. To construct target-functional protein interaction, the core targets were obtained against inflammation and identified by acquisition of verified targets of the selected *Zingiber* essential oil compounds (ZEO). As revealed in network pharmacology analysis, 15 key hub targets for ZEO against inflammation were identified, respectively: PTGS2, PIK3R1, PIK3CD, AKT1, EGFR, IKBKB, SRC, CASP3, CHUK, CCND1, JAK1, IL2, JAK2, IGF1 and KIT. Pathway enrichment analysis by ShinyGO database indicated that ZEO principally regulated the inflammation-associated pathway. The frequently interacted compounds to the pathways can be said potential drug targets against the inflammation and can have inhibitory effects. Molecular docking and dynamics simulation were used to precisely understand the binding affinity between the compounds and the receptors. These findings highlight the predicted therapeutic targets may be potential targets of ZEO for anti-inflammation treatment.

Isolation & identification of endophytic bacteria from Fish Tail Sword Fern

¹Swarna Kumar Dash, ²Nivedita Nayak, ²Bhagyajyoti Baral, ¹Bishnupriya Hansdah, ²Santilata Sahoo

¹Department of Botany, Maharaja SriRam Chandra Bhanj Deo University, Mayurbhanj

²P.G. Dept. of Botany, Udayanath Autonomous College of Science & Technology, Adaspur, Cuttack

E-mail: swarnapapun@gmail.com

Pteridophytes, often designated in vernacular as ferns, are a group of vascular plants that reproduce via spores and are predominantly found in tropical regions, especially in moist, sheltered habitats. These plants play a pivotal role in ecosystem by retaining soil moisture, thereby aiding in soil

conservation. Serving as a fundamental source of nourishment within various food webs, ferns contribute both nutritionally and therapeutically, they can be tapped sources of vegetables for human food and given their considerable medicinal value. Moreover, pteridophytes furnish microhabitats, providing shelter and sustenance for numerous small animal species. Certain pteridophytes exhibit an impressive resilience, capable of colonizing and stabilizing disturbed environments, which make them essential agents in ecological succession. Additionally, pteridophytes possess a natural ability to sequester environmental pollutants, including heavy metals, thus serving as bioindicators that reflect the health and quality of ecosystems. Despite their invaluable ecological contributions, numerous pteridophyte species are threatened by extinction due to the cumulative rate of forest degradation and unsustainable harvesting driven by the economic, medicinal, and aesthetic demands placed upon these plants. *Nephrolepis falcata* is a fern belonging to the family Nephrolepidaceae which is found on shaded areas. It is a large tropical to sub-tropical evergreen herb, leaflet tips are once or twice forked like a fish's tail giving an unusual appearance. It is cultivated in hanging pots as an ornamental plant, while its fronds, rhizomes and young shoots are eaten as vegetable. It is an epiphyte fern, monolete spore type, oblate shape, big size spore with gemmate exine ornamentation. Plants can be regarded as complex micro ecosystems where many areas are exploited by a wide range of microbes like fungi or bacteria that expand either the complete or part of its lifecycle within the healthy tissues of living plants, without causing symptoms of harmful disease are termed as endophytes. Pteridophytes, including *N. falcata*, are an excellent reservoir of bioactive compounds. In this study, a healthy *Nephrolepis falcata* plant was selected for isolation of endophytic bacteria. The below ground part (approx. 30cm.) of the plant along with soil was taken and sterilized for isolation of microbe. The sterilized sample was cultured in Tryptic Soy Agar (TSA) medium well suited for endophytes. The pure culture was screened and identified using VITEK 2 compact system. The biochemical identification by VITEK 2 compact revealed the bacteria as *Bacillus cereus*, which exhibited positive response for 20 biochemicals. These responses confirm the role in nitrogen assimilation & metabolic processes. Its positive response for CYCLODEXTRIN provides information about their protective role against drought & pathogens. The endophyte also showed positive responses for both simple & complex carbohydrates confirming the significant relationship between plant-microbe association. Apart from this the bacteria by producing IAA & 1-aminocyclopropane-1-carboxylic acid deaminase activity, alleviated the stress-mediated impact of formaldehyde. This beneficial alliance between plant-endophyte could have significant contribution for phyto-protection & phytoremediation.

Enriched *Anabaena* sp. PCC 7119 strain causes enhanced degradation of the organophosphorus insecticide chlorpyrifos

Barsha Bhushan Swain and Pradipta Kumar Mohapatra

Department of Botany, Ravenshaw University, Cuttack

Email: barsha.bhushan.swain@gmail.com

Application of insecticides to prevent pest infestation and crop damages are inevitable though excessive use of agrochemicals, specifically the top most insecticides from organophosphorus (OP) group,

chlorpyrifos (CP) leads to its high accumulation in the agroecosystem soil and nearby water bodies leading to serious threats. OP insecticides are a group of chemicals with a central phosphate molecule bearing alkyl or aromatic substituents and occupy the top position in terms of consumption for crop protection. CP is the highest consumed insecticide in Indian crop fields but its slow degradation and high residual toxicity is of great concern. Strategies to remove this insecticide and its toxic metabolites from the soil need a promising ecofriendly approach, which could be fulfilled by using a native organism with potential to eliminate CP residues from the agroecosystem. *Anabaena* sp. PCC 7119 is a heterocystous cyanobacterium having the ability to fix N₂. The enriched strain acquired resistance to tolerate and efficiently degraded the chemical in the laboratory condition as compared to the wild type. Efficient removal of CP, applied up to 20 µM, was observed with the tolerant strain and it was significantly higher than of the wild strain. The day dependent rate of degradation was found exponential with the enriched type showing higher slope values than of the wild strain. Corresponding recovery of the photosynthesis and photosystem performance was seen. The bioconcentration factor (BCF) of the wild type was significantly higher than of the enriched strain. The elevated efficiency of the enriched strain in sustaining insecticide and showing improved physiological performance is discussed.

Chemical composition, antioxidant, antimicrobial and tyrosinase inhibitory activities of the leaf essential oils of *Syzygium schmidii* (Myrtaceae)

Soumya Swarup Panda and Pratap Chandra Panda*

Centre for Biotechnology, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar-751003, India.

*E mail: soumyapanda38@gmail.com , pcpanda2001@yahoo.co.in

The genus *Syzygium* (Myrtaceae) is comprised of more than 1,230 accepted species of trees and shrubs with a wide range of distribution from Africa through southern and south-eastern Asia, Malaysia, and Australia to the Pacific Islands. In India, 102 taxa of *Syzygium* are reported to occur in the wild. Several species of *Syzygium* are a rich source of secondary metabolites and reported to possess antioxidant, antimicrobial, anticancer, antifungal, cytotoxicity, and antiviral properties. The essential oils extracted from different *Syzygium* species show considerable inter- and intraspecific chemical variability and broad range of potent biological activities. In spite of the medicinal and pharmacological importance, no information is yet available with regard to the bioactivities of the essential oil of *Syzygium schmidii* Rathakr. & N. C. Nair (Syn: *Syzygium cuneatum* Brahmam & Saxena). It is a small tree of higher hills in some North-Eastern states, West Bengal and Odisha in India and Bangladesh.

The present paper reports the chemical composition, antioxidant, anti-microbial and anti-tyrosinase activities of leaf essential oil of *Syzygium schmidii* (SSLEO) collected from the Mahendragiri hills of Gajapati district, Odisha. GC-MS analysis of SSLEO revealed the presence of 48 constituents accounting for 93.45% of the total leaf oil. The major chemical group in SSLEO was sesquiterpene hydrocarbons (60.55%), followed by monoterpene hydrocarbons (28.81%), oxygenated sesquiterpenes (2.78%) and oxygenated monoterpenes (0.45%). β-caryophyllene (40.27%), limonene (19.91%), α-humulene (7.38), and β-phellandrene (3.51%) were found to be the major components of the essential oil. The leaf essential oils exhibited strong

antioxidant activity with IC₅₀ values of 18.05 ± 0.82 µg/mL and 7.10 ± 0.21 µg/mL in DPPH and ABTS assays, respectively. It also exhibited strong reducing power ability (EC₅₀ = 7.51 ± 0.31 µg/mL). The antibacterial activity of SSLEO was evaluated against four gram-positive and four gram-negative bacterial strains and differential antimicrobial properties were observed. The EO showed highest sensitivity to *Bacillus cereus* in ZOI (22.33 ± 0.47 mm) assay and *Staphylococcus saprophyticus* in MIC assay (7.82 µg/mL). A moderate tyrosinase inhibitory activity of the oil was recorded with IC₅₀ values of 41.95 ± 1.72 µg/mL in comparison to kojic acid (IC₅₀ = 19.04 ± 0.77 µg/mL). Therefore, the essential oil of *Syzygium schmidtii* may have potential application in pharmaceutical and cosmetics industries.

Antibacterial activity was also studied against four gram-positive (*Staphylococcus aureus*, *Bacillus subtilis*, *Bacillus cereus* and *Staphylococcus saprophyticus*) and four gram-negative (*Pseudomonas aeruginosa*, *Escherichia coli*, *Shigella flexneri* and *Salmonella enterica* serovar *typhimurium*) bacterial strains. And differential antimicrobial properties by different strains have been observed. The study on the melanogenic inhibitory activity using mushroom tyrosinase also showed a moderate anti-tyrosinase activity promising a potential research area in the cosmetics industry.

Studies on ethnobotanical value, phytochemical detection and antibacterial activity of medicinal plants of Udala, Mayurbhanj, Odisha

Subhrakanta Jena^{1*}, Jagatjit Nayak², Omprakash Satpathy and Hemanta Kumar Sahu³

¹*Department of Applied Microbiology, Fakir Mohan University, New Campus, Balasore-89

²KIIT School of Biotechnology, KIIT University, Bhubaneswar

³Department of Zoology, Maharaja Sriram Chandra University, Takatpur, Baripada-757003

* Email: jena.subhrakanta@gmail.com

Ethnobiology is a flourishing branch in the field of biological science, which connects early information from the Vedic age to the modern era concerning the mobilization of medicinal plants and animal species for societal benefits. Early Vedic scriptures and ancient records reveal the medicinal value of plants and their potency in treating ailments. Since the last decade, research has been conducted in India and abroad countries to resolve the efficacious properties of medicinal plants for designing better medication in treating different ailments in humans. Despite intense research in ethnobotany, there are still many information is still lacking. In this context, a study has been undertaken to document the traditional use, phytochemical detection, and antibacterial evaluation of traditional medicinal plants found in the Udala block of Mayurbhanj district. Questioner's survey was conducted to select the traditional plant species in Udala. 11 plants species were found to be used traditionally among the people of Udala in their day-to-day life, which are as follows *Tridax procumbens* (Bisalyakarani), *Phyllanthus emblica* (Pani Anla), *Kalanchoe pinnata* (Amar Poi), *Rouwolfia serpentina* (Patala Goruda), *Terminalia arjuna* (Arjuna), *Saraca asoca* (Ashoka), *Azadirachta indica* (Neema), *Vitex negundo* (Begunia), *Pterocarpus marsupium* (Piasal), *Curcuma longa* (Haladi) and *Butea monosperma* (Palas). The plant samples were collected from their natural habitats in different forms like bark, leaf, root, rhizoid, stem, and seed from four different sites of Udala such as Berhampur, Bisol, Mudadiha, and Bhola gadia. The phytochemical analysis of plant extract shows the

presence of bioactive compounds like Phenol, Tannic acid, Tannin, Alkaloid, Proteins, and Quinon. The antibacterial activity of each plant extract was tested against 4 different human pathogenic bacterial strains i.e. *Staphylococcus aureus* (MTCC 29737), *Bacillus brevis* (MTCC S22), *Shigella flexneri* (MTCC S25) and *Escherichia coli* (MTCC S2) by agar cup well diffusion method and the effectiveness was evaluated by AntibioGram test. We found all the plant extracts have antibacterial activity and, in some plants, were found to be more active than the selected commercial antibiotic Vancomycin as a control, for each bacterial strain 9 plant extracts were found effective. Only 4 plant extracts i.e. *Phyllanthus emblica* (leaf), *Terminalia arjuna* (bark), *Kalanchoe pinnata* (leaf), and *Saraca asoca* (bark) were showing activity at 50 µl and 100 µl for all the strains and only 1 plant extract *Butea monosperma* (bark) was found active at both the concentration against *S. aureus* (MTCC 29737). The AntibioGram result shows that these plant extracts could be a substitute for some of the commercial antibiotics. Further studies on bioprospecting evaluation and enumeration of bioactive compounds of these medicinal plants to discover novel metabolites for designing new medicines and drugs in the field of biomedical science.

ABSTRACTS FOR POSTER PRESENTATIONS

Comprehensive quantification of protein content in millets

*Bhagyajyoti Baral*¹, *Swarna Kumar Dash*¹, *Hrusikesh Nayak*², *Niranjan Mohapatra*³, *Santilata Sahoo*¹

¹P.G. Department of Botany, Udayanath Autonomous College of Sc. &Tech., Adaspur, Cuttack-754011

²P.G Department of Botany, Rajdhani College, Bhubaneswar, Odisha-751003

³D.K.N College, Eranch, Cuttack, Odisha-754105

Email: bhagyajyoti91@gmail.com

Millets, a diverse group of small-seeded grains, are ancient, hardy crops well-suited to dry regions, capable of flourishing with limited water and in nutrient-poor soils. These grains such as pearl millet (*Pennisetum glaucum*), finger millet (*Eleusine coracana*), foxtail millet (*Setaria italica*), little millet (*Panicum sumatrense*), sorghum millet (*Sorghum bicolor*) and other species, are emerging as pivotal crops for bolstering food security, particularly in arid and marginal agricultural regions. Renowned for their formidable resilience to extreme environmental stressors, exceptional nutritional profile, and myriad health benefits, millets are positioned as a promising alternative to conventional staples such as rice, wheat, and maize. Notably, the protein content of millets has attracted considerable scientific attention for its potential to serve as an affordable, nutrient-dense protein source. Despite this, comprehensive quantification and intricate characterization of millet protein content remain relatively underexplored. Using quantitative protein profiling techniques, including the Lowry method and SDS-PAGE analysis, protein was quantitatively & qualitatively analysed in three millet species cultivated under controlled conditions. The results revealed that the protein content across the different millet species ranged from 7% to 13% of their fresh weight, with notable variations depending on the species and cultivation environment. Little millet, for instance, displayed the highest protein content, while sorghum millet exhibited comparatively lower levels. These findings highlight the potential of millets to contribute for dietary protein requirements, especially in regions where protein malnutrition is a prevalent issue. Beyond protein content, key protein fractions are

also responsible for critical biological functions, such as nutrient storage and structural integrity within the grain. For instance, globulins were most abundant in foxtail millet, while finger millet had an enriched profile of albumins, which are associated with better digestibility and bioavailability. This variation in protein fractions not only influences the nutritional quality of each millet species but also provides insights into tailoring millet varieties for specific dietary requirements. The bioactive components further position millets as functional foods that contribute to health beyond basic nutrition. Comparative analysis of protein content and bioactive potential across millet species revealed unique protein profiles that may aid in the selection of specific millet types for targeted nutritional and therapeutic applications. Amidst escalating climate change and environmental pressures, our findings highlight millets as sustainable, protein-dense crops with immense potential. Detailed protein characterization provides valuable insights for breeders to improve protein content and quality via selective breeding and biofortification. This research underscores millets' role as a reliable, nutrient-rich food source that can help address protein deficiencies, especially in developing regions where malnutrition remains a concern, supporting both food security and resilient agricultural practices. This study provides a comprehensive quantification of protein content in millets, showcasing their potential as nutritious, protein-dense grains with unique bioactive properties. The results emphasize the significance of millets in promoting food security, improving dietary protein intake, and fostering sustainable agricultural practices in resource-limited settings.

Plant use values and phytosociological indicators: Implications for conservation in Kandhamal district of Odisha, India.

A. Dash¹, R. K. Mishra² and A. K. Biswal³

¹ Dept. of Botany, Maharaja Sriram Chandra Bhanja Deo University, Baripada

² Dept. of Wildlife and Biodiversity Conservation, Maharaja Sriram Chandra Bhanja Deo University, Baripada

³ Department of Botany, Fakir Mohan University, Nuapadhi, Balasore-756 020

Email: rabikumishra@gmail.com

Diverse livelihood methods, such as using various ethno-ecological contexts, are used by human populations that live in rural, distant, rugged, and biodiverse regions. The current study investigates human use of plant resources in light of cultural variety, plant and habitat accessibility, and availability. Our hypothesis is that humans are more inclined to regularly forage for the most obvious and easily accessible plants and ecosystems. Data from community interviews and phytosociological investigations were used to test this association in the Kandhamal district of Odisha. Analysis was done using the plant's total use values, medicinal use values, and other use values. Phytosociological attributes were used to evaluate plant availability. Utilizing plant usage values in relation to the site-specific explanatory variables like forest/non-forest habitat, nearby/transition/distant areas, and hill/mountainous areas was used to determine the accessibility to various plant life forms. Plant availability, site accessibility, and plant use values were shown to be weakly correlated. However, the value of plant usage differed at the level of use category (medicinal and non-medicinal) and was impacted by ecological (Shannon diversity, species richness) and cultural variables (desire for particular goods and recognition). The Udayagiri Forest Division's higher medicinal use

values showed that knowledge of plant collection and use was less impacted by resource availability and site accessibility and more reliant on product quality and targeted gathering. Social and cultural aspects seem to be the most influential indicators, while plant appearance was not always the significant signal.

Studies on Fungi Associated with Post-Harvest Decay of Carrot (*Daucus carota* L.) and Radish (*Raphanus sativus* L.) in Odisha, India

Akhtari Khatoon¹ Kunja Bihari Satapathy^{2*} and Ashirbad Mohapatra³

¹Department of Botany, Fakir Mohan Autonomous college, Balasore

²P.G. Department of Botany, Centurion University of Technology and Management, Bhubaneswar

³Sri Jayadev College of Education and Technology, Naharkanta, Bhubaneswar

Email: kunjabihari.satapathy@cutm.ac.in

Vegetable salads are the important source of fibres and vitamins that helps us to stay healthy. Radishes and carrots are some of them; we eat them raw to maintain their nutrient value. But due to warm and humid climatic condition of Odisha, their fungal decay occurs during post-harvest storage. An extensive survey on fungi associated with post-harvest deterioration of carrot (*Daucus carota* L.) and radish (*Raphanus sativus* L.) storage roots was conducted during 2015-2017 in different market places of Odisha, India. Rotten samples were collected from different areas of Bhubaneswar, Cuttack, Jajpur, Puri, Balasore and Bhadrak. Three fungal species such as *Aspergillus niger*, *Geotrichum candidum* and *Rhizopus oryzae* were isolated from the rotten samples. These three species were found to be dominantly responsible for their rotting. Of these, *Geotrichum candidum* has highest percentage frequency of occurrence in both carrot and radish (49.1 %). In carrot next to *Geotrichum candidum*, *Rhizopus oryzae* showed more frequency of occurrence than *Aspergillus niger* but in case of radish the case is just opposite, here the percentage of occurrence of *Aspergillus niger* was found to be more than *Rhizopus oryzae*. Pathogenicity tests revealed that all the isolated fungi were pathogenic to their respective host storage roots. However, *Rhizopus oryzae* was found to be most pathogenic on carrot leading to rapid disintegration of the infected roots while *Geotrichum candidum* was the least pathogenic. In case of radish, *Aspergillus niger* was found to be more pathogenic and *Rhizopus oryzae* was least pathogenic. The use of improved varieties, good storage facilities and adequate control measures need to be encouraged in order to reduce storage rot of carrot and radish.

***Nyctanthes arbor-tristis* Linn. A possible candidate for the malaria vector control**

Mamatabala Pani¹ & Aparna Das^{2*}

¹Department of Botany, Haldia College, Khurda, Bhubaneswar, Odisha, India

²Department of Botany, U. N. (Auto.) College of Sc. and Tech., Cuttack, Odisha, India

Email: dasaparnadr@gmail.com

Plants have been used in traditional medicine practices since prehistoric times. The pharmacological properties of plant products or compounds are the source for development of new drugs. The compounds found in plants are diverse, categorized into four major classes: alkaloids, cyanogenic glycosides,

polyphenols and terpenes. During the last decades, the renewed interest in investigating natural products has led to the advent of several important drugs. The plant *Nyctanthesarbor-tristis* is extensively used in Ayurvedic medicines for its various pharmacological properties enabling it to function as a sedative, laxative, expectorant, anti-helminthic, anti-inflammatory, anti-pyretic, anti-rheumatic and anti-cancerous agent besides its use in cough and cold, hair fall, skin ailments, arthritis, sciatica etc. This paper focuses on the analytical study of the chemical constituents of the *Nyctanthesarbor-tristis* Linn in order to evaluate their possible pharmacological and larvicidal effects. To explore the antimalarial potential of *Nyctanthes*, crude extract of various parts (leaf, stem, and flower) were taken to determine phytochemical constituents, followed by qualitative screening. The total antioxidant activity of test extracts was evaluated. The antimalarial assay was conducted using Disc Diffusion method. The larvicidal bioassay as well as dose response bioassay was conducted in four places as suggested by NVBDCP (National Vector Borne Disease Control Program) with proper survey and collection of mosquitoes. Larvicidal mortality in different solvent extracts (chloroform, methanol, aqueous) of *Nyctanthesarbor-tristis* against the larva of *An.culicifacies* after 24 hour exposure was studied. Maximum mortality of 99% at 1000mg/L from flower extract, 10% larval mortality at 750mg/L and 15% at 1000mg/L from bark extract were obtained. Susceptibility test was also studied at four different places wherein *An. culicifacies* was found resistant in various degrees to DDT, Malathion, and Deltamethrin. The results of this research evidently explore the possibility of developing new drug candidates from this plant for enhancing the efficacy of malaria vector control.

Morphological study, ethnomedicinal uses and analysis of secondary metabolites present in some selected Mangroves and their associates in Dhamra Estuary, Bhadrak District, Odisha

Abinash Sahoo¹ and Ranindra Kumar Nayak^{1,2}

¹ P. G. Department of Environmental science, Fakir Mohan University, Balasore, 756089

² Centre of Excellence for Bioresources and Energy conservation Management, Fakir Mohan University, Balasore, 756089

Email: abinashsahoo248@gmail.com

Mangroves are salt-tolerant plants that grow along coastlines, especially in tropical and subtropical regions. They are uniquely adapted to thrive in challenging environments, including saline or brackish water, tidal flooding, and low-oxygen soils. These plants play essential ecological roles, providing critical habitat for a wide range of marine, terrestrial, and bird species and serving as natural barriers that protect coastlines from erosion, storm surges, and tsunamis. The mangrove forests of Bhadrak district are spanning approximately 35 km² along the different coastal regions. The Dhamra Estuary is situated in Bhadrak District of Odisha, hosts a diverse range of mangroves and associated flora with significant ethnobotanical and pharmacological potential. This study explores the morphological characteristics, traditional medicinal applications, and secondary metabolite composition of various mangrove species and their associates in the estuarine environment. Morphological assessments were conducted on species to document structural adaptations and variations, which enable survival in saline, waterlogged conditions typical of estuarine habitats. Ethnomedicinal data were collected through interviews with local communities, revealing the

importance of these species in treating ailments such as skin infections, respiratory issues, and digestive disorders, among others. To further understand the biochemical significance, qualitative analyses of secondary metabolites were performed, focusing on compounds such as alkaloids, flavonoids, saponins, and phenolics, known for their antioxidant, anti-inflammatory, and antimicrobial properties. Results indicate that mangrove species from this estuary are rich in bioactive compounds, underscoring their potential for pharmaceutical applications and conservation importance. This study provides a comprehensive insight into the ecological adaptations, ethnomedicinal roles, and phytochemical profiles of mangroves in Dhamra Estuary, contributing valuable data to support sustainable use and conservation of these ecologically and economically significant resources.

Chemical profiling and antioxidant activity of *Vitex pinnata*

*Alaka Mohanty, Sujata Mohanty**

Department of Biotechnology, Rama Devi Women's University, Bhubaneswar, Odisha, India

Email: sujatamohanty@rdwu.ac.in*, alakamohanty70@gmail.com

Vitex pinnata (Lamiaceae), popular as Laban plant, is a moderate sized wild woody plant distributed in tropical Asia. Traditionally this species is used to treat Jaundice, malaria, epilepsy, Stomach ache, fever, hypertension, bone fractures etc. In spite of its medicinal importance, there is no report on the chemical profiling and bioactivities of its leaf essential oil of this species from India. In the present study, the chemical composition of leaf essential oil of *V. pinnata* grown in India has been reported for the first time along with its antioxidant activities. Chemical profiling of essential oil through GC-MS analysis led to identification of 43 compounds with Sesquiterpene hydrocarbons namely allo-Aromadendrene (15.44%) and γ -Amorphene (14.15%) as the major components of oil. The essential oil exhibited moderate antioxidant capacity in DPPH and ABTS assays with IC₅₀ value of 5 mg/ml and 1.1 mg/ml, respectively.

Role of osmolytes in enhancing tolerance during salinity stress in crops

Ananya Nayak, Arpita Banerjee*

P.G. Department of Botany, Fakir Mohan University, Balasore, Odisha

Email: iamananyanayak91@gmail.com

Plants experience stress from various aspects. Stress in terms of any unfavourable environmental condition that leads to disturbance in growth and natural metabolism of organisms or plants. In plants, stress is of two types one is biotic stress caused by biotic factors and another is abiotic stress caused by abiotic factors. In natural habitats when plants grow near the seashore or on saline land, they experience a type of stress called salinity stress (salt stress). Salinity of land is caused by some various salts and ions naturally or when pesticides, chemical fertilizers are applied to the irrigated land. Na⁺, Cl⁻, K⁺, Ca²⁺, Mg²⁺, So₄²⁻ etc ions usually make the land saline. Some of them increase toxicity in plant cells leading to burning of leaf margin, chlorosis and necrosis resulting in plant death. This also affects metabolism of plants. Some plants adapt the ability to tolerate the salinity of soil by producing osmolytes which decrease water

potential of plant cells. Osmolytes are low molecular weight organic compounds that influence the properties of biological fluids. They play a significant role in regulating homeostasis in various organisms. They maintain water potential of the cells and protects cells from getting damaged by exosmosis, so they are also called osmoprotectants. They are of various types but mainly they are classified into three categories on the basis of molecular nature of osmoprotectants. (i) Ammonium compounds- they are of two types one is polyamine and another one is Betaines. The polyamines of low molecular weight aliphatic nitrogen containing compounds which regulate pH of cellular components. Other type is betaines, belonging to quaternary ammonium compounds which maintain osmotic equilibrium in cells. Ex- Proline-betaine, Glycine-betaine etc. Second category of osmoprotectants are (ii) Sugars and sugar alcohols. They are of two types. One is carbohydrate sugar that provides carbon and energy for normal functioning of cellular metabolism. Ex- Glucose, Sucrose. Another one is sugar alcohol also called polyol. Ex- myoinositol, pinitol, sorbitol and mannitol. (iii) Amino acids are third category of Osmo protectants which includes Proline, the most important osmolyte and signalling molecule that helps in protection of membranes, proteins and enzymes against various stresses. Biosynthesis of these osmolytes and signalling contributes to the redox balance of cells under abiotic stress. These osmolytes increase stress tolerance level in plants by adjusting osmotic pressure and water potential of the plant cells. Under salt stress plants synthesize these solutes in the cytoplasm of the cell and increase water potential of the cell. By this adjustment, water enters the cells to maintain the cell's water potential and regulate ionic balance. Further futuristic studies on osmolytes may contribute to understanding the insights of salt tolerance in crop plants to sustainable agricultural yields in future.

Genetic diversity studies and cluster analysis of doubled haploid lines derived from B × R hybrid based on agro-morphological traits

Anindita Mishra^{1,2}, Nihar Ranjan Singh², Ram Lakhan Verma¹, Sanghamitra Samantaray¹

¹Crop Improvement Division, ICAR-National Rice Research Institute, Cuttack, Odisha 753006, India

²Department of Botany and Biotechnology, Ravenshaw University, Cuttack, Odisha 753003, India

Email: anindita.mishra35@gmail.com

The androgenic-based doubled haploid (DH) technique is a key speed breeding tool that accelerates the production of homozygous progeny, making phenotyping and genotyping more predictive and allowing breeders to evaluate genetic material more accurately. This method can reveal recessive gene traits and promote the identification of novel, beneficial gene combinations, particularly through transgressive segregation, which can highlight unexpected allele interactions beneficial for crop improvement. Genetic diversity is essential for developing rice varieties with enhanced agronomic traits, such as improved yield, stress tolerance, and nutritional quality. Given the complex genetic basis of yield, understanding the relationships between yield and its component traits is crucial for effective selection in breeding programs. Doubled haploid (DH) lines are valuable in genetic diversity studies, offering genetic uniformity, stability, adaptability, and breeding success. This study evaluates genetic diversity across 110 DH lines derived from a cross between maintainer and restorer lines (PMS 17B × CRL 22R) of CRHR 150. Significant

variability among DH lines and their parents was observed across 11 phenotypic traits, with analysis of variance showing highly significant differences. The strong genetic and phenotypic variation, as indicated by genotypic and phenotypic coefficients of variation, highlights a considerable genetic influence on the traits. Traits showing high heritability and genetic advance—suggesting additive gene action—are ideal candidates for phenotypic selection. Correlation studies revealed positive and significant associations between grain yield per plant (GY) and other essential traits, underscoring their role in yield improvement. Path coefficient analysis confirmed the direct positive effects on grain yield, while principal component analysis (PCA) identified five components contributing to total variability. Biplot analysis emphasized the importance of traits like GY and grains per panicle (GPP) in overall variability, making them critical for selection in rice breeding programs. Cluster analysis was used to investigate genetic diversity among the DH lines, with the heat map and dendrogram identifying three main trait clusters influencing grain yield. Hierarchical clustering with Ward's method suggests that integrating DH lines from five distinct clusters, especially those with desirable traits, can produce superior segregants with high yield potential, benefiting breeding efforts. This study provides robust evidence of significant genetic variability, heritability, and trait correlations, indicating that selecting traits such as GY, test weight (TW), and spikelet number (SPN) could enhance grain yield. The combined use of phenotypic selection, path analysis, PCA, and cluster analysis highlights the potential for targeted breeding strategies to improve yield-related traits in rice.

How chlorophyll works as a bio indicator in biotic stress in plants

Ankita Kindo, Arpita Banerjee*

P.G. Department of Botany, Fakir Mohan University, Balasore, Odisha, India

Email: kindoankita25@gmail.com

Plant diseases are a major threat to food security, causing drastic alterations in plant metabolism upon infection by pathogens. This often results in decreased biomass accumulation, slowed growth rates, and diminished yield components. Pathogens, through various life styles, disrupt photosynthesis, the primary metabolic process, through functional and structural damages. The photosynthetic process is one of the most important metabolic pathways through which plants transform the sunlight into chemical energy obtaining carbohydrates to be used in other metabolic events. Biotic stresses such as insects and pathogens result in an increase in ROS creation in plants, due to disruption of cellular homeostasis that can result in oxidative stress. This causes cellular damage that can lead to cell death. Thus the plant needs to respond to this imbalance before destruction of cellular structures to maintain photosynthetic activity and whole-plant survival. Crop sensing by imaging techniques allows early stage detection of biotic stress to avoid damage and significant yield losses. Among the top certified imaging techniques for plant stress detection is chlorophyll a fluorescence (CF) imaging, which can evaluate spatiotemporal leaf changes, permitting the pre-symptomatic monitoring of plant physiological status long before any visible symptoms develop. Advances in the CF instrumentation, including portable devices and remote sensing techniques, have expanded the accessibility and applicability of this technology. In recent years, an increase of portable user-friendly, non-invasive, easy to perform and low cost chlorophyll fluorometers had been used for research in

the plant pathology field for the detection of influence of diverse stresses on plants. Chlorophyll monitoring is crucial for detecting biotic stress in plants because chlorophyll content and fluorescence are sensitive indicators of plant health and stress levels.

Impact of *Burkholderiacepacia* inoculation and organic amendments on growth and physiology of *Crotalaria juncea* L. grown on bauxite mine spoil

*Ankita Tripathy and Bandana Kullu**

P.G. Department of Botany, Utkal University, Vani Vihar

Email: ankitatripathy040@gmail.com

Bauxite mining generates mine spoil that jeopardizes the surrounding environment. Vegetation cover is pivotal for stabilizing the mine spoil and reducing the spread of pollutants. However, the physico-chemical properties of mine spoil are not conducive to plant growth. The present study attempted to investigate the effects of organic amendments and inoculation of native plant growth-promoting rhizobacteria (PGPR) *Burkholderiacepacia* on the growth and physiology of *Crotalaria juncea* grown on mine spoil in a pot culture experiment. Plants were grown with various treatments such as T₀: garden soil, T₁: mine soil, T₂: mine soil (70%) + organic manure (30%), T₃: mine soil (40%) + garden soil (40%) + organic manure (20%) and T₄: mine soil (40%) + garden soil (40%) + organic manure (15%) + biochar (5%) without and with the PGPR *B. cepacia* inoculation. The growth and morphology, photosynthetic pigment and biochemical content, and antioxidative enzyme activities were analyzed after 30 days of plant growth. The growth and physiology of *C. juncea* in T₂ amendment with PGPR inoculation showed the highest enhancement in morphological features, primary metabolite content such as total carbohydrate, reducing sugar, and protein. Antioxidative enzyme CAT, APX, GPX and SOD activities, free amino acid, proline, and phenol content were at the lowest level in T₂ amendment with PGPR inoculation. It was concluded that *B. cepacia* inoculation and 30% of organic manure amendment among all the treatments showed the ideal growth and physiology of *C. juncea*.

Encapsulation of Anthocyanins from Jamun Pomace Extract

Aparna Panda, Minati Mohapatra, N.R. Sahoo, U.S. Pal

College of Agricultural Engineering and Technology, OUAT, Bhubaneswar, (Odisha), India

*Email: minati.agfe@gmail.com

Jamun (*Syzygium cumini*), commonly known as Indian blackberry contains many natural bio-active compounds e.g. anthocyanins, tannins, ellagitannins, ellagic acid, galloyl-galactoside and gallic acid. Extraction of anthocyanins from jamun pomace dried powder were carried out with solid to solution ratio of 1:15 at temperature 45°C for 90 min using two types of solvents i.e. aqueous and ethanol. Purification of anthocyanin in the extracted juice was done using chitosan. The extracts were encapsulated using different combination of sodium alginate as coating material (1.0, 2.0, 3.0 % W/V) and calcium chloride as hardening material (1, 5, 10% W/V) following liquid suspension method and evaluated in terms of encapsulation efficiency, moisture content and bulk density. The ethanolic extracts yield more amount of anthocyanin

contents (290.01 ± 0.02 mg/100g), total phenolic contents (52.8 ± 0.26 mg GAE/100ml extract), antioxidant activity (54.56 ± 0.54). The FTIR analysis of the extract showed, ethanol extract retained maximum number of functional groups as compared to aqueous extract. Encapsulation of anthocyanins bio-active component was found best in 3.0% sodium alginate and 5.0% calcium chloride with maximum encapsulation efficiency ($75.93 \pm 0.61\%$) and formed uniformly.

Preliminary Hairy Root Induction in *Lawsonia inermis* Using In-Vivo Explants: An Assessment of Key Parameters for Transformation

Aryaputri Bedaprabha, Bhaswatimayee Mahakur, Durga Prasad Barik*

Research Scholar (SRF), Department of Botany, Ravenshaw University, Cuttack-753003, Odisha, India.

*Associate Professor, Department of Botany, Ravenshaw University, Cuttack-753003, Odisha, India.

Email: aryaputribedaprava@ravenshawuniversity.ac.in, dpbarik@ravenshawuniversity.ac.in *

Lawsonia inermis or Henna belongs to the Lythraceae family and is highly important in various fields, including cosmetic, traditional, and modern medicine. Hairy roots were successfully induced in *L. inermis* in-vivo explants using two *Agrobacterium rhizogenes* strains, MTCC 532 and MTCC 2364. The highest transformation efficiency was observed in MTCC 2364 strain, with a 35.55% success rate in leaf explants and 24.44% in internodes with average of 2.62 and 2.51 root numbers respectively. In contrast, MTCC 532 failed to induce hairy roots in these explants. The induction process was significantly enhanced by the presence of 100 μ M acetosyringone in the subculture media; no root formation occurred in media lacking acetosyringone. Optimization of infection parameters revealed that the most effective results were achieved with a co-cultivation period of 48 hours and infection times of 45 minutes for leaf explants and 70 minutes for internode explants. Additionally, the bacterial suspension's optical density (OD₆₀₀) played a crucial role in root induction. Maximum transformation frequency was observed with an OD₆₀₀ of 0.75 for leaf explants and 0.8 for internodes. These findings underscore the importance of selecting appropriate bacterial strains and optimizing infection conditions, particularly co-cultivation time, infection duration, and acetosyringone concentration, to achieve high hairy root induction rates in *L. inermis*. The given approach can be used as a guide to creating an industrial-scale hairy root production system that focuses on the bioactive substances present in *Lawsonia inermis* roots. This method may optimize the production process and raise the yield and quality of these compounds, which are critical for use in the medical, cosmetic, and pharmaceutical sectors. Using this methodology to scale up the hairy root culture provides an effective and sustainable way to address the growing demand for these essential natural products.

Approaches employing biotechnology to preserve biodiversity and promote sustainable development agriculture

*B Jyotirmayee, Ipsita Priyadarsini Samal, Sameer Jena and Gyanranjan Mahalik**

Department of Botany, Centurion University of Technology and Management, Odisha, India

*Email: gyanranjan.mahalik@cutm.ac.in

Agriculture worldwide faces a significant challenge from climate change, affecting food production and availability. Improving agricultural output while protecting and expanding biodiversity is one of humanity's most critical challenges. Humans are in danger of losing access to ecosystem services essential to their survival due to poor administration and safeguarding of biodiversity. Anthropogenic dangers and natural changes provide a more significant hazard to endemic plant species, making them more likely to go extinct. Sustainable agriculture faces a considerable challenge in the widespread presence of pests and diseases, which can drastically reduce crop production and quality. Another challenge to sustainable agriculture is soil nutrient shortage, which can lower plant health and crop output. It is more efficient and cost-effective to conduct ex-situ conservation methods, such as seed banking, to aid in ensuring the preservation of endemic species. Farmers and landowners must ensure that plant protection agents are safe and are appropriately used to solve and prevent biodiversity-related concerns. Reproductive biotechniques have emerged as a powerful tool for reintroducing animals to their native habitats by allowing for the transfer of genetic material between populations living in their native habitats and those living in artificial habitats. Developing micropropagation techniques based on plant tissue culture allows for the rapid multiplication of plant material that is virus-free and appropriate for degraded land and temperate regions. The in vitro gene bank method provides for the storage and conservation of germplasm. There will be less need for pesticides if crops treated with nano-enabled seeds are more disease-resistant. There will soon be a surge in research into indigenous plant species conservation, which will help ensure the survival of these priceless genetic assets. Future economic opportunities and developmental challenges may lie in harnessing biotechnology and high-value plants' biodiversity.

Genetic variations in *dirigent* gene (*DIR*) paralogs associated with combined Nitrogen and Phosphorus deficient conditions in rice (*Oryza sativa* L.) at seedling stage.

Baishnab Charan Muduli^{1,2}, Parameswaran Chidambaranathan^{1}, Chinmay Pradhan², Sabarinathan Selvaraj¹, Sanghamitra Samantaray¹*

¹Crop Improvement Division, ICAR- National Rice Research Institute, Cuttack, Odisha, India, 753006

²Department of Botany, Utkal University, Vani Vihar, Bhubaneswar, Odisha, India, 751004

Email: mudulibaishnab@gmail.com, agripames07@gmail.com, chinmay.uubot@gmail.com ,

Dirigent (DIR) genes are essential for plant growth, development, response to plant disease, and adaptation to environmental changes. Nitrogen and Phosphorus uptake and its interaction regulate to optimise the plant growth for achieving optimum yield. However, there's a gap in understanding how *DIR* genes function under combined N and P stress in rice. The objectives of this study were to first perform

haplotype analysis of three *DIR* genes (*OsDIR35*, *OsDIR40*, and *OsDIR41*) and the marker trait association of these genes was performed for identification of phenotypic variance. A panel of 223 *indica* rice genotypes was subjected to combined low N and P stress at 28th days after sowing in both kharif (2023) and rabi seasons (2023-24). Haplotype analysis was conducted to identify major haplotypes associated with phenotypic traits using SNPs and In/Dels identified in the 3k rice database. A total of 9, 22, and 44 SNPs were identified in *OsDIR35*, *OsDIR40*, and *OsDIR41*, respectively. Two major haplotypes were identified for each of the *DIR* genes in rice. *OsDIR41* showed significant differences for six traits (shoot length, root dry weight, shoot area, root area, shoot dry weight and root dry weight) in both the seasons. Additionally, haplotypes of *OsDIR35* and *OsDIR40* showed significant differences in shoot length, in the kharif season and four traits such as shoot area, root area, shoot dry weight, and root dry weight in the rabi season. BesidesHap_2 was found to be favourable for *OsDIR35* and *OsDIR40*, while Hap_1 was favourable for *OsDIR41* in terms of seedling growth under deficient N and P conditions. Tajima's D values indicated balancing selection for *OsDIR35* and *OsDIR41*, and purifying selection for *OsDIR40* genes in rice. Furthermore, Marker-trait association (MTA) analysis was performed using GAPIT3.0 were identified significant in *OsDIR41* (chr11: 3995595) with four traits namely no. of leaves and root length (60.5%) in rabi and root area (25.3%) and shoot dry weight (46.5%) in kharif. Thus, this study provides valuable insights into the genetic diversity and functional significance of *DIR* gene paralogs in rice under combination of low P and N conditions. The identified haplotypes could be employed in haplotypes breeding for enhancing the nutrient use efficiency in rice.

Selenium priming enhances antioxidant defense against oxidative stress induced by *Fusarium nudum* in *Cajanus cajan*

Beda Saurav Behera, Punam Kumari

P. G. Department of Biosciences and Biotechnology, Fakir Mohan University, Vyasa Vihar, Balasore

E-mail: punam.lifescience@gmail.com

Pigeon pea (*Cajanus cajan*) is an essential pulse crop, also known as split dal or toor dal. India is the world's largest producer of pigeon pea and the second most valuable pulse crop after chickpea. The seeds are a significant source of vitamins and nutrients, particularly for vegetarians. Pigeon pea provides 20–22% protein, 1.2% fat, 65% carbohydrates, and 3.8% ash. The crop's output is impacted by a number of pests and diseases, particularly *Fusarium udum* is the major constraint to the production. *F. udum*-related crop loss has raised more concerns than those resulting from other environmental causes. Priming of pigeon pea with a low dose of selenium could be a strategy for conferring resistance against *F. udum* infection. A small dosage of selenium (Se) can enhance photosynthesis, promote plant development, and support the homeostasis of vital nutritional components. In this study, Se-primed seedlings were observed to be grown healthy than unprimed seedlings during *F. udum* stress. An enhanced level of H₂O₂ and MDA were observed in unprimed seedlings as compared to primed seedlings during *F. udum* stress. In primed seedlings, SOD, CAT, APX and GPX activity were observed to be high as compared to unprimed seedlings during *F. udum* stress. Thus, a low

dose of Se priming protects pigeonpea against *F. udum* infection by enhancing the level of antioxidant enzymes with the suppression of oxidants.

Studies on Diversity and Distribution of Aquatic Plants in Khorda district of Odisha, India & Bio-evaluation of therapeutic Potential of *Hydrilla verticillata* (L.f.) Royle.

Bhagyeswari Behera and Kunjabihari Satapathy

Department of Botany, Centurion University of Technology and Management, Odisha, India

Email: kbs_bot@rediffmail.com

Wetlands are potentially rich in aquatic resources, which play a significant role in maintaining biodiversity. They offer habitats suitable for supporting growth of a variety of aquatic life forms. The survey identified 211 species of hydrophytes, including 200 angiosperms, 10 pteridophytes, and one alga, spanning 134 genera and 61 families from 10 localities. Monocots were the most abundant, with 110 species in 85 genera and 16 families, while dicots accounted for 90 species across 41 genera and 37 families. Marshy hydrophytes showed the highest diversity (131 species), followed by amphibious hydrophytes (38 species), submerged (15 species), free-floating (11 species), and fixed floating hydrophytes (9 species). The dominant families were Poaceae (42 species) and Cyperaceae (34 species), with others like Scrophulariaceae, Asteraceae, Hydrocharitaceae, and Fabaceae contributing fewer species.

The study revealed that many waterbodies located in Khorda district of Odisha contain wide range of hydrophytes which are economically and medicinally important. Some of the recorded widely used medicinally important aquatic plants of the area are *Bacopa monnieri* (whole plant used for cardiostonic, diuretic), *Pistia stratiotes* (leaf for diabetes), *Nelumbo nucifera* (petals used in spermatorrhoea), *Nymphaea nouchali* (flower in impotency), *Neptunia oleracea* (root against leucorrhoea), *Hygrophila auriculata* (root juice in piles), *Centella asiatica* (whole plant used for diuretic, dysentery, jaundice) and *Hydrilla verticillata* (diarrhoea, dysentery). The therapeutic potential of *Hydrilla verticillata* was investigated through antibacterial and antioxidant assays using methanolic and n-hexane extracts. The methanolic extract showed superior antibacterial activity, with the highest inhibition zone against *Shigella flexneri* (26 ± 0.75 mm), whereas the n-hexane extract had maximum inhibition against *Enterococcus faecalis* (20 ± 1.41 mm). Antioxidant activity, assessed using DPPH scavenging assays, revealed lower IC₅₀ values for the methanolic extract (16.84 µg/ml) compared to the n-hexane extract (36.26 µg/ml), indicating higher efficacy. Phytochemical analysis identified alkaloids, tannins, triterpenoids, polyphenolic compounds, and glycosides in both extracts, with additional compounds like saponins and flavonoids in the methanolic extract. Overall, the findings highlight *H. verticillata*'s significant antibacterial and antioxidant properties, especially in its methanolic extract, warranting further research into its secondary metabolites for potential therapeutic applications.

In vitro propagation and conservation of *Gloriosa superba* L.: An endangered species From Similipal Biosphere Reserve, Orissa.

B. Mahapatra and B.P. Hansdah

Department of Botany, Maharaja Sriram Chandra BhanjaDeo University, Takatpur, Baripada-757003.

Email: bijaylaxmimahapatra25@gmail.com, bhansdah2020@gmail.com.

Gloriosa superba L., a perennial creeper belonging to the family Colchicaceae, is used in traditional medicine for centuries to treat variety of human ailments for its antibacterial, antimicrobial, anthelmintic and antioxidant properties. In addition, it is a good abortifacient causing expulsion of fetus from the womb. Due to over exploitation for medicinal uses, poor seed germination and tuber dormancy, the plant is at the verge of extinction. Keeping this in view, the present work aims to develop a standard protocol for *in vitro* propagation, conservation and commercial utilization of this taxon. In this investigation an effort was made to establish direct and indirect organogenesis from mature nodal explants of *G. superba* using MS medium supplemented with different concentration of (0.5- 3.0 mg/l) NAA, 2,4-D, BAP and KIN were used either singly or in combination at 25±2°C under a 16/8 hours light/dark photoperiod. The result showed that highest frequency of callus induction i.e. (94%) was observed on MS medium supplemented with 2.5 mg/l BAP within 4 weeks. The second highest frequency of callus proliferation i.e. (84%) was observed in MS medium supplemented with 2.0 mg/l (2,4-D) in combination of 0.5mg/l. Attempts were also made to culture nodal explants in MS medium supplemented with different concentration of (0.5- 3.0 mg/l) BAP in combination of 0.5 mg/l NAA for direct regeneration of shoot. Highest frequency of shoot regeneration was observed on MS medium supplemented with 2mg/l (BAP) and 0.5mg/l (NAA). The shoots were proliferated and elongated upto 6.1 cm within 6 weeks.

Phytoremediation Potential of Medicinal Plants: A Sustainable Approach to Environmental Cleanup

Bimal Kumar Ghose and Ranindra Kumar Nayak

Department of Environmental Science, Fakir Mohan University, Balasore, 756089

Email: bimalghose04@gmail.com

Phytoremediation, the use of plants to remediate polluted environments, has emerged as a promising eco-friendly technology. Medicinal plants, in particular, have shown great potential in phytoremediation due to their unique physiological and biochemical properties. This review highlights the phytoremediation potential of various medicinal plants such as *Aloe vera*, *Ocimum basilicum*, *Mentha spicata*, *Cannabis sativa*, *Bacopa monnieri*, *Dioscorea bulbifera*, etc. including their ability to accumulate, tolerate, and transform heavy metals such as cadmium, mercury, lead and other industrial pollutants. The mechanisms underlying phytoremediation in medicinal plants include phytoaccumulation, phytodegradation, and phytostabilization. Furthermore, the potential benefits of using medicinal plants in phytoremediation, including their ability to produce valuable bioactive compounds and provide ecosystem services have been explored. Overall, this review demonstrates the potential of medicinal plants as a

sustainable and effective tool for environmental cleanup and highlights the need for further research in this area.

Phytochelatin- A marvel in metal induced stress tolerance in plants

*Binayak Acharya*¹, Arpita Banerjee¹*

¹ Department of Botany, Fakir Mohan University, Balasore, 756089

*Email: binayakacharya164@gmail.com

Many heavy metals are harmful even at very low quantities, making them significant environmental contaminations. Since the industrial revolution heavy metal pollution of the biosphere has increased significantly. One of the main abiotic stimuli causing harmful consequences in plants is heavy metal poisoning. Heavy metal toxicity can affect plants and they react a number of ways to prevent negative impacts. Heavy metal transporters ligands including phytochelation, metallothioneins, antioxidants, glycoylase systems, heat shock proteins, proline, polyamines, salicylic acid, nitric oxide have all been shown to have coordinative and additive role in various investigations. They reduce heavy metal stress in variety of ways such as by limiting the uptake and transport of minerals and fostering asymbiotic relationship between plants and rhizobacteria or actomicorrhiza. Based on the result of contemporary plant molecular biology research, the goal of this study is to incorporate a current understanding of the physiological and biochemical mechanism of heavy metal induced plant stress response. With particular reference to phytochelatin synthesis and metallothionein genes, it also discusses the current advancement in transgenic plants for enhancing plant metal stress tolerance and additional uses in phytoremediation. Unquestionably some knowledge of the function of metallothionein genes and phytochelatin synthesis in metal stress resistance has been cultivated by their isolation and over expression. However, it is doubtful that a single gene will contribute to improving resistance heavy metal stress. Consequently, in addition to numerous transcription factor linked to metal stress tolerance, constructs containing combination of phytochelatin synthesis genes such as γ -Glutameincystein synthase (GCS) glutathione synthase (GSH). ATP sulphurylase and serine acetyl transferase may be crucial for creating a phytochelator that can remove heavy metals from soil. The production of phytochelatins (PCs), which bind heavy metals in complexes and sequester the complexes inside their cells, is crucial for plants to deal with the increased levels of heavy metals. Under conditions of heavy metal stress, plants enzymatically produce PCs or metal binding peptides from glutathione (GSH). More recently it was discovered that PCs play a role in phloem's long distance Cd transfer. In some plants there are Mutant lines with no PC production showed sensitivity to Cd and tolerance to As and also the GSH biosynthesis pathway's increased expression in demonstrated that PC production led to Cd tolerance. By attaching metal ion to the enzyme γ - Glutameincystein dipeptidyl transpeptidase (PC synthetase), GSH is converted to phytochelatin, suggesting that GSH production is a likely mechanism through which PC expression may be regulated. Further more the thiol group in PCs cysteine residues allows it to bind to a variety of heavy metal such as Cd²⁺, Hg²⁺, Cu²⁺, Zn²⁺, Ni²⁺, Ag²⁺ and As³⁺.

In vitro shoot multiplication and plant regeneration of *Drimia indica* (Roxb) Jessop, an endangered medicinal plant from Odisha with cytological analysis

Binod Kumar Mahapatra^{1,2*}, *Chinmay Pradhan*¹, *Anath Bandhu Das*¹

¹Department of Botany, Utkal University, Bhubaneswar, 751004, India

²P.G Department of Botany, P.N. College, Khordha, 752057

*E-mail: binod.mohapatra96@gmail.com

Indian squill, *Drimia indica* (Roxb) Jessop, is a rare and endangered medicinal plant belongs to Asparagaceae found in India, as well as parts of Africa and the Mediterranean region. It holds remarkable potential to treat various human ailments, offering cardiogenic, anticancer, antijaundice, anti-dropsy, antiasthmatic, antiepileptic, dermatological, and diuretic properties. Studied of tissue culture from shoot apical meristems of *D. indica* was standardized in MS media. High multiplication of direct shoot regeneration was obtained in MS+4mg/L of BAP + 1mg/L of NAA. Shoot proliferation was significantly more on higher concentration of cytokinin with sized shoot growth which found elongated with low dose of BAP and addition of AdSO₄. The callus mediated shoot regeneration was also obtained in comparatively low BAP from the callus tissue. Cytological observation of the callus and in vitro generated plant roots confirmed that they are polyploidy with 2n=4x=40 chromosomes. Chromosomal stability of in vitro plants confirmed true to type plant regeneration system in Indian squill which protocol can be used for commercial exploitation of secondary metabolites.

Taxonomic Enumeration of Coalfield Algae of Talcher, Angul, Odisha, India

Biswajita Pradhan^{1,2} and *Sunita Nahak*¹

¹School of Biological Sciences, AIPH University, Bhubaneswar-752101, Odisha, India

²Department of Botany, Model Degree College, Rayagada-765017, Odisha, India

Email: pradhan.biswajita2014@gmail.com

The Talcher coalfields, known for their extensive mining activities, provide a distinctive habitat influenced by both natural and anthropogenic factors. The present study provides a taxonomic account of algae from coalfield area of Talcher, Angul district, Odisha. Microphotographs of each sample were taken using a Leica ICC50 HD camera attached to a microscope. Important morphological features such as cell structure, cell/colony size, and colour of the algal species were identified using published literature, monographs, and algal databases. The study revealed 35 species, 21 genera, 18 families, and 15 orders of 5 divisions: Cyanophyta (4 species), Chlorophyta (3 species), Bacillariophyta (19 species), Charophyta (6 species), and Euglenophyta (3 species). Moreover, the result also suggested that Bacillariophyta was most dominant in mining area and four species i.e. *Bacillaria paradoxa* J.F. Gmelin, nom. illeg., *Naviculabacillum* Ehrenberg, *Nitzschiafiliformis* (W. Smith) Van Heurck, and *Lyngbya major* Meneghini ex Gomont were recorded first time in both Odisha and India. Additionally, five species such as *Chroococcuslimneticus* Lemmermann, *Tetrasporagelatinosa* (Vaucher) Desvaux, *Navicula halophila* (Grunow) Cleve, *Pinnulariasaprophila* Lange-Bertalot, Kobayasi & Krammer, and *Synedra affinis* Kützting were recorded for the

first time in Odisha. The findings highlight the resilience and adaptability of algae in mining ecosystems, offering insights into their ecological roles and potential applications in bioremediation. This taxonomic enumeration serves as a valuable resource for further ecological and environmental studies, emphasizing the importance of preserving algal diversity in industrial regions.

Reviving Coastal Ecosystems: The Critical Role of Mangroves in Marine Conservation

Chandrasekhar Bhoi

Assistant Professor (TE) in Botany, M.P.C. Autonomous College, Baripada

Email-cbhoi7918@gmail.com

Coastal ecosystems, particularly mangrove forests, play a vital role in maintaining marine biodiversity, protecting shorelines, and mitigating climate change. However, these critical ecosystems are under threat due to human activities such as deforestation, urban expansion, and pollution, as well as the impacts of climate change. Mangroves, which serve as natural buffers against coastal erosion and storm surges, are among the most effective forms of coastal defense, offering protection to both human communities and biodiversity. Despite their importance, mangrove ecosystems have experienced significant degradation, with global mangrove cover declining by 35% over the last five decades. This article explores the indispensable role of mangroves in marine conservation and coastal ecosystem restoration. Mangroves not only safeguard shorelines but also support diverse marine life, acting as nurseries for fish, crustaceans, and other species that are vital to local fisheries and global biodiversity. Their dense root systems filter pollutants, improve water quality, and sequester substantial amounts of carbon, making them important players in climate change mitigation. Reviving coastal ecosystems through mangrove restoration initiatives has gained momentum globally. Efforts to replant mangroves and protect existing forests are demonstrating positive outcomes, such as enhanced biodiversity, improved fisheries, and increased resilience to climate-induced changes. The success of these initiatives depends on an integrated approach that involves local communities, policymakers, and conservationists. By highlighting case studies of successful mangrove restoration projects, this article underscores the urgent need for continued investment in coastal ecosystem conservation. Reviving mangroves is not only crucial for protecting marine environments but also for sustaining livelihoods and enhancing climate resilience. Mangroves are a key element in the broader effort to restore and conserve coastal ecosystems, offering a pathway to healthier oceans and more resilient coastal communities.

Phytochemical characterisation of Tulsi varieties and their therapeutic application

Chinmaya Kumar Sahu, Biswajit Patra

P.G. Department of Botany, Fakir Mohan University, Odisha

Email: patrabiswajit090@gmail.com

Phytochemical characterization of Tulsi (*Ocimum sanctum*), also known as holy basil, reveals its diverse chemical constituents and their therapeutic applications. Various varieties of Tulsi, such as Rama

Tulsi, Krishna Tulsi, and VanaTulsi, have different phytochemical profiles, which contribute to their unique properties. The phytochemicals in Tulsi exhibit strong antioxidant properties, helping to combat oxidative stress, which is linked to various chronic diseases. Compounds like eugenol and rosmarinic acid can help reduce inflammation, making Tulsi beneficial for conditions like arthritis and other inflammatory diseases. Tulsi has been shown to possess antibacterial, antiviral, and antifungal activities, making it effective against a range of pathogens. The expectorant properties of Tulsi can aid in relieving coughs and respiratory infections, making it useful for respiratory conditions. In this research phytochemicals of different tulsi varieties were investigated.

Submergence sustainability through foliar NSi and SA in Black rice landrace after reaeration

Chinmaya Swarup Pattanaik and Nandita Jena

Dept. of Crop Physiology, Faculty of Agricultural Sciences, SOA DU, Bhubaneswar, Odisha

Email: chinmayaswarupp@gmail.com and nanditajena@soa.ac.in

Submergence stress is a significant environmental challenge in rice cultivation, particularly in regions prone to flooding or excessive rainfall. Odisha is one of the floods prone states in the country even sometimes submergence happen due to heavy rain in the winter besides monsoon rain. While the staple crop rice is traditionally grown in flooded fields, prolonged submergence beyond the plant's tolerance limits can severely affect its growth, leading to reduced yields and even crop failure. Black rice varieties are mostly nutritious, contains antioxidants and climate resilient. A pot experiment was conducted with two black rice varieties (Chakhao & Kalabiroin) and tolerant check Swarna sub-1 to investigate the adaptation capability of 2 indigenous landraces against the stress tolerant genotype. In this experiment 42 DAS old seedlings were completely submerged for 12 days. The objective of the experiment was to study the effect of complete submergence and its mitigation through foliar application (NSi @1mM and SA @100ppm) after 7 days of desubmergence. Seedlings at active tillering stage were subjected to submergence stress to evaluate physiological and biochemical performance. SA @100 ppm induced more plant height under stress, though the increment was minimum in Swarna Sub-1. No. of tillers regeneration after aeration was not significantly different irrespective of all three test varieties. TSC (%) and protein content were decreased in stress control plants in comparisons to normal control plant both in 1 day aeration and 14 days aeration, but less in tolerant check. It was observed that NSi @1mM and SA @100ppm increases more TSC % and protein content respectively over stress control. More accumulation of non-enzymatic antioxidant proline (1.83mg g⁻¹) observed over control condition. Both black rice varieties produced more proline after 14 days of re-aeration than sub-1, showed better recovery compared to 1 day aeration. Decrease in chlorophyll degradation and accumulation of carotenoid in sub-1 expressed its tolerance against submergence stress. In this context SA @100ppm also induced maximum dry matter and proline content at 1 day aeration in compared to NSi @1mM. Total Chlorophyll content was observed higher in NSi @1mM in Chakhao (3.509 & 4.073mg g⁻¹) and Kalabiroin (2.701 & 3.454mg g⁻¹), but in tolerant check SA @100ppm showed highest (4.561 & 5.308mg g⁻¹) both in 1 day and 14 days re-aeration. The overall results revealed that SA was more inductive than NSi, though both were effective against submergence stress control, also reflected in terms

of yield.pl-1 . The performances of Chakhao and Kalabiroin showed their recovery capability under stress after 1day to 14 days af aeration at par with Swarna sub-1 under the alleviation effect of NSi and SA. Hence farmers may rely on traditional landraces in flood prone areas for better survival under the recovery effect of foliar NSi and SA after re-aeration.

Stress Memory in Plants

Chinmayee Behera, Arpita Banerjee*

P.G. Department of Botany, Fakir Mohan University, Balasore, Odisha, India

Email: chinmayee.behera2002@gmail.com

Environmental stresses, including heat, drought, cold, flood, salinity, and pathogen attacks, significantly impact plant growth, development, and productivity. Stress priming enables plants to develop tolerance, while stress memory facilitates physiological, metabolic, and genetic adaptations for survival. The stress priming initially triggers a minor part of a defence response that increases the plant's ability to defend itself against future phenomenon. That allows plants to respond quickly and increase survival which consequently pursued by stress memory. Plant stress memory has great potential for agricultural applications, especially for the development and cultivation of crop varieties with enhanced tolerance to various abiotic stresses. However, the molecular mechanisms by which this plant memory works must be entirely different from the memory in animals which is dependent on the nervous system. Several experiments have been performed on crops such as rice, maize, sugarcane, tomato by applying heat, cold, freeze like priming factors. Some stresses occur occasionally, generating a temporal stress response in plants for the short term. While Some are passed on inherited across generation termed as intergenerational or transgenerational and importantly it is independent of changes in DNA sequence. The phenomenon of the acquired memory of exposure to stress is often referred to as a transgenerational inheritance and it is defined as the ability of an organism to remember. Epigenetic modifications, such as chromatin changes, DNA methylation, histone modifications, non-coding RNA regulation, play crucial roles in stress memory. Numerous experiments have been performed on various high crop plants to observe the inheritance of stress memory from parents to offspring. Several studies on memory effects observed noticeable changes in developmental changes in seed growth conditions. The application of melatonin, Arbuscular mycorrhiza, *Trichoderma harzianum*, salicylic acid explains how Molecular priming contributes to plant abiotic stress tolerance. It is essential to build up new experiments by priming applications which may ignite new stress responsive expression and eventually turn into a boon for agriculture.

Hydroponics vegetative growth analysis of Scented and Non-scented landraces of Dhenkanal District of Odisha

Chinmayee Sahoo^{1}, Geetismita Pal², Abhilipsa Rout², Sumitra Rout², Sourav Ranjan Mohapatra², Silpalipi Rout², Soumya Ranjan Nayak².*

P.G. Department, Botany, Dhenkanal Autonomous College. 759001

Email: chinmayeesahoo460@gmail.com

This study analyzes the hydroponic growth performance of three scented and three non-scented rice varieties, focusing on their root/shoot ratios, alpha diversity, and genetic diversity. Statistical analysis reveals that the non-scented rice varieties—Kalachampa, Swarnasopan, and Sarasmalei—exhibit lower root/shoot ratios (0.844, 0.920, and 0.762, respectively), indicating superior root growth compared to shoot growth. Conversely, scented varieties—Swarna, Basmati, and Marshabhog—display higher root/shoot ratios (1.238, 1.274, and 0.934), suggesting enhanced overall vegetative growth. The alpha diversity analysis shows that non-scented rice possesses higher Simpson's and Shannon diversity indices, reinforcing the idea of a more resilient ecosystem compared to scented counterparts. Furthermore, genetic analysis reveals a maximum pairwise genetic distance of 0.9833, reflecting substantial genetic diversity among the varieties examined. This study concludes that while non-scented rice varieties demonstrate robust root development and greater ecosystem health, scented varieties exhibit notable vegetative growth and genetic variability, underscoring the complexity of rice landrace characteristics.

Investigations on modulation of ferroptosis by quercetin and its neuroprotective effect in cerebral ischemia-reperfusion injury of mice

*Jasasmita Parida, Pratap Chandra Panda and Nirmal Singh**

Centre for Biotechnology, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar 751003

*Department of Pharmaceutical Sciences & Drug Research, Punjabi University, Patiala 147002, Punjab

Email: pcpanda2001@yahoo.co.in

Ischemic stroke is the second leading cause of disability and death worldwide. Cerebral ischemia-reperfusion injury (CI/RI) is the brain damage that occurs when blood flow is restored after a period of reduced supply that was previously ischemic. The present work is aimed at investigating the modulation of ferroptosis by quercetin and its neuroprotective effect in cerebral ischemia-reperfusion (IR) injury of mice. In this study, the mice were subjected to 7 days of pretreatment of quercetin followed by induction of Global cerebral ischemia using bilateral common carotid artery occlusion (BCCAO). After 12 min of injury, the incision was sutured back in layers, and reperfusion was allowed for 24 h. Mice were subjected to acquisition trials and retrieval trials using the Morris Water Maze. Thereafter, the mice were subjected to a series of tests followed by biochemical estimations like brain thiobarbituric acid reactive species (TBARS); reduced glutathione (GSH); Brain Catalase; nuclear factor erythroid 2 related factor-2 (Nrf2); Brain iron estimation; and histopathological studies like H&E staining and Nissl staining. Ischemia-reperfusion injury

produced significant brain injury as evidenced from memory impairment, increased NSS, and various biochemical alterations (increased TBARS, Nrf2 and brain iron and decreased Brain catalase and GSH levels). Significant neutrophil infiltration was observed using hematoxylin and eosin staining. Considerable decrease in Nissl bodies were also observed. Treatment with Quercetin and Deferiprone for 7 days significantly attenuated I/R injury as found from changes in the aforementioned parameters. Furthermore, the level of Nrf2 was also increased in the treated mice. Therefore, based on the results obtained, it may be concluded that quercetin is effective in regulation of cerebral I/R injury *via* its multiple activities with a prominent role in the inhibition of ferroptosis and activation of the Nrf2 pathway in the mouse models.

Innovative Soilless Hydroponic Saffron (*Crocus sativus* L.) Cultivation Technology: A High Yield Approach to Sustainable Saffron Production

Sahoo D¹, Sahoo S, Muduli N¹ and Sahoo KK^{1*}

¹Department of Botany, Ravenshaw University, Cuttack- 753003

Email- khierod555@gmail.com^{1*}, dayanidhisahoo96@gmail.com¹, suchitraranisahoo1998@gmail.com¹

Hydroponics is a worldwide promising method for cultivation of many plants including saffron (*Crocus sativus* L.). Saffron holds a top position as one of the most expensive spices with many therapeutic and nutritional properties. The demand for saffron is rising, but production and quality are declining due to variations in weather conditions across regions, availability of infectious soil pathogen, soil infertility and hardening, intense labour requirement in open field condition and insufficient knowledge of soilless hydroponic cultivation. It is hypothesized that supplementing with balanced nutrient through hydroponic cultivation under controlled condition could enhance the yield and improve the saffron quality of plants. The current research targets to establish an efficient optimized nutrient formulation that enhances the saffron plant growth, healthy flower, high stigma and daughter corm production using soilless hydroponic cultivation under greenhouse condition. Here, we have successfully standardized the hydroponic nutrient formulation for better agronomic traits and high productivity with enriched nutritional value as compared to soil cultivated plants. The nutrient formulation is effective due to better nutrient uptake by the plants which lead to healthy physiological status of the plants under Hydroponic condition. The physiological activities of saffron plants were measured using IRGA (Infra-Red Gas Analyzer, Model: CIRAS-3). The physiological parameters are varied with the progression of the developmental stages. The physiology of the saffron plants, accumulation of crucial bioactive phyto-constituents such as crocin, picrocrocin, safranal found to be in relatively higher in plant grown in optimized nutrient formulation under greenhouse condition. Importantly, a higher photosynthetic rate (A), transpiration rate (E), stomatal conductance (Gs) and decreased the intercellular carbon dioxide concentration (Ci) was observed in plants supplemented with optimized nutrient formulations. This outcome could be due to better uptake of macronutrients and maintenance of healthy physiological status of the plant.

Acknowledgement: Department of science and technology, Government of Odisha, provided fund to carry out the Research project on 'Hydroponics'.

Phytotoxicity of dimethoate and malathion on *Solanum lycopersicum* L.

Debajyoti Behera¹, Anil Kumar Sahoo¹, Kalpana Panigrahi¹, Santi Lata Sahoo², Padan Kumar Jena¹ and Jyoti Ranjan Rout^{1}*

¹School of Biological Sciences, AIPH University, Bhubaneswar-752101, Odisha, India.

² Post Graduate Department of Botany, Utkal University, VaniVihar, Bhubaneswar-751004, Odisha, India.

*Email: routjr@aiph.ac.in/routjr@gmail.com

Nowadays organophosphates are the most commonly used insecticides worldwide which apply to a wide range of crop plants. In the present study, the effect of two commonly used organophosphate insecticides, dimethoate and malathion, was experimented on *Solanum lycopersicum*. More specifically, these selected insecticides were applied to reduce white fly population in tomato plants. Seeds were germinated under *in vivo* conditions and after one month of germination, they were transferred to separate pots. Insecticides were applied in three different concentrations (X, 2X and 4X) using a nozzle spray at 7 days interval for 21 days. After 21 days of treatment, the toxicological responses of plants were confirmed by evaluating morphological, anatomical, photosynthetic pigments and expression of proteins and certain antioxidant enzymes like catalase (CAT), guaiacol peroxidase (GPX) and ascorbate peroxidase (APX). The study revealed that when the application of either dimethoate or malathion was increased, a significant change in growth parameters was noticed with disturbances of micromorphology and alteration of proteins. The activity of CAT, GPX and APX was found to significantly increase due to dimethoate and malathion application up to 4X concentration which was also confirmed by in-gel activity. The results of the present study indicate that the insecticide treatment (even at the recommended dosage) causes overproduction of reactive oxygen species (ROS), stimulating of increased enzymatic antioxidants. This study provides insights into the biochemical mechanism associated with the toxicity caused to the plants by the insecticides; however, further study of molecular interactions is essential to understand the complete phenomenon at cellular and subcellular levels.

Carbon footprint evaluation for sustainable food processing system development

Debashree Pradhan, Aparna Das and Santilata Sahoo

P.G Department of Botany, Udayanath Autonomous College of Science & Technology, Adaspur, Cuttack

E-mail: pradhandebashree188@gmail.com

Currently, increase in global populations of humans & domesticated livestock are impacting the resource use and have a large ecological footprint (EFP). This ever rising EFP of mankind are conversely accelerating climate change, increasing water scarcity with contamination, aggravating soil degradation & dwindling above, below ground biodiversity. Ecological footprint includes resource footprints (RFP) which comprises of land footprints (LFP), water footprints (WFP), nitrogen footprints (NFP), power footprints (PPF), biodiversity footprints (BFP) & carbon footprints (CFP). A carbon footprint is an environmental indicator that represents the amount of greenhouse gases (GHGs) expressed as carbon dioxide equivalents that are emitted directly or indirectly as a result of human activities. The food system has also been

identified as one the major contributors to climate change. The fundamental cause of global climate change is rising carbon emissions, which have put natural system & human security at risk. The main sources of greenhouse gas emissions include nitrous oxide from soil, methane from enteric fermentation in animals & carbon dioxide from land use change, such as deforestation. Emissions also arise from manure management, mineral fertilizer production, rice cultivation, energy usage on farms and from post-farm activities such as processing, packaging, storage, distribution & waste management.

With increasing awareness of climate change, calculating the carbon footprint of food products has become increasingly popular among researchers & companies wanting to determine the impact of their products on global warming and/or to communicate the CFP of their products to consumers. The main step for calculation of a carbon footprint is to take an inventory of gas emissions or an analysis of the lifecycle depending on the type of footprint. Using this as basic information, it is possible to implement an emission reduction strategy based on energy efficiency, cutting back on raw materials, circular economy & process improvements etc. It is vital to examine sustainability criteria such as climate change, energy consumption, user waste production and the advancement of manufacturing & recycling operations while conducting sustainability research using appropriate indicators such as carbon footprints. Effective food supply chain management is intended to lead a decreased carbon footprint, positive environmental outcome & enhanced food safety. To reduce the index of carbon footprint, precise agricultural techniques and new food production methods are being developed which in turn lowers carbon emissions favouring environmentally friendly products.

The main objective of this review is to analyse carbon footprint of food processing operations such as food preservation (refrigeration, freezing), processing & packaging. This study discusses about the utilisation of sustainable energy sources and investment in energy efficient equipment's optimising the supply chain & logistics, minimising water consumption & precisely managing wastes.

Phytochemistry and biological activities of *Bruguiera gymnorhiza*

Deepak Kumar Patra

Department of Botany, Government Women's College, Dhenkanal, India

E mail: deepakpatranayapali@gmail.com

The mangrove *Bruguiera gymnorhiza* belongs to the family Rhizophoraceae and is commonly known as black mangroves. It is a tall and valuable medicinal tree found in wetland on the tropical coast of the Indian Ocean as well as the western region of the Pacific Ocean, wherever the species is a common tree species. The book chapter is intended to review the botany, dietary and pharmaceutical uses, phytochemical constituents extracted from different parts of the plants, and bioactivities of the compounds isolated from *B. gymnorhiza*. A comprehensive literature search was done and we observed that several compounds were isolated from leaves, roots, stems, and bark of the *B. gymnorhiza* plant. The compounds such as terpenoids, steroids, alkaloids, peptides, quinones, polyketides, sulphur-containing compounds, flavonoids, aromatic compounds, and other compounds. Several compounds extracted from the plants have significant biological activities. *B. gymnorhiza* is an abundant creator of metabolites, that have several

pharmacological properties. The compounds existing in different parts of the plant showed anti-inflammatory, anti-diabetic, anti-viral, insecticidal, and mosquito-repellent activity, cytotoxic activity, and anti-microbial actions with enzyme inhibitory activities. For future use, the extracts of *B. gymnorrhiza* play a vital role in the production of pharmacological products.

Potential of *Lathyrus sativus* L. for sustainable agriculture in present climatic condition

*Devirani Mallick, Surjendu Kumar Dey**

P.G. Department of Environmental Science, Fakir Mohan University, Balasore-756089, India

*Email: skd2k9@gmail.com

In the face of climate uncertainty, *Lathyrus sativus* L., or grass pea, stands tall as a beacon of hope for vulnerable communities. This extraordinary legume flourishes in harsh environments, offering a lifeline of benefits, including unwavering tolerance to extreme conditions, innate resistance to diseases and pests, and vital nutrition and sustenance. For centuries, grass pea has sustained communities worldwide, particularly in drought-prone regions. Yet, concerns surrounding the neurotoxin β -ODAP have hindered its widespread adoption. This comprehensive review sheds light on the remarkable advantages of *Lathyrussativus*, showcasing its nutritional and pharmacological wealth, exceptional climate resilience, and disease-resistant properties. The review explores its botanical and agronomic characteristics, nutritional profile, economic value, adaptability to marginal lands, and role in sustainable agriculture. To overcome β -ODAP concerns, cutting-edge breeding and genetic improvements are crucial. Recent breakthroughs in breeding techniques hold immense promise for developing safer, more productive varieties. As the world navigates climate uncertainty, *Lathyrus sativus* emerges as a champion for food security. By addressing its challenges and promoting safe consumption practices, we can unlock its transformative power to revolutionize food security, bolster climate adaptation, and shield vulnerable communities from nutritional insecurity. Grass pea's resilience is a testament to its potential. By harnessing its benefits and addressing challenges, we can create a more sustainable, food-secure future for generations to come. With its impressive profile, *Lathyrus sativus* is poised to make a lasting impact on global food systems, empowering resource-constrained communities and ensuring a healthier, more resilient world.

Indigenous rice varieties from Odisha

Dibyanjan Shaw and Arpita Banerjee*

PG. Department of Botany, Fakir Mohan University, Balasore, Odisha

Email: dibya1206@gmail.com

Odisha, an eastern Indian state, is home to a rich diversity of indigenous rice varieties, many with unique characteristics and cultural significance. This review aims to document the existing literature on indigenous rice varieties from Odisha, highlighting their characteristics, conservation status, and future prospects. Odisha has a long history of rice cultivation, with over 200 indigenous rice varieties grown in the

state. These varieties have adapted to the local climate, soil, and water conditions, making them resilient and sustainable. Traditional crop landraces play dynamic roles in the expression of native biological and cultural diversity via their central position in the genetic resource base, agro ecosystems and social heritage of indigenous peoples. Rice (*Oryza sativa* L.) is the main crop used for staple food in India, where it is cultivated in irrigated or upland cultivation systems. It covers around 25% of the gross sown area (Singh, 1974) and plays an important role in Indian agriculture (Subudhi, 2008). Moreover, two thirds of the World's population, and particularly the South East Asians, eat rice as their staple food (Kulkarni et al., 1998). The Indians have a long tradition of rice cultivation. The country is supposed to be the centre of origin of rice, where maximum genetic diversity of this crop is seen. The Geographic Location of Odisha : Latitude: 17.98°N - 22.73°N, Longitude: 81.32°E - 87.29°E. The loss of folk varieties, their evolution through selection, and the adaptation of new folk varieties from the outside are part of the on-going change of dynamic, small-scale, indigenous farming system. The rate of loss of folk varieties has increased with the modernization and internationalization of agriculture. Here are some indigenous rice varieties from Odisha, India: Aromatic Rice Varieties are Kalajeera: Short-grain, fragrant rice, Chinikamini: Small-grained, aromatic rice, Dubraj: Medium-grained, fragrant rice, Jagannath Rice: Unique, short-grained rice, offered to Lord Jagannath in Puri, Varieties are Hansa: Long-grained, non-sticky rice, Sankati: Short-grained, sticky rice, Bahura: Short-grained, aromatic rice, Karel: Medium-grained, aromatic rice, Drought-Tolerant Rice Varieties : Nalla Chikka: Small-grained, aromatic rice, Kala Gobind: Medium-grained, drought-tolerant rice, Dharial: Short-grained, drought-tolerant rice, Kalinga III: Medium-grained, drought-tolerant rice, CR 103: Short-grained, drought-tolerant rice. Conservation Status: Declining genetic diversity due to hybrid and genetically modified rice varieties, Loss of traditional farming practices and knowledge, Climate change and its impact on rice cultivation, Limited documentation and characterization of indigenous varieties. Future Prospects: Conservation and promotion of indigenous rice varieties through community-led initiatives, Research and development for improved cultivation and processing. The local communities still depend on it. These indigenous types of rice are under serious threat of extinction due to the arrival of high yielding varieties. Conservation of the existing folk varieties is of prime and urgent importance because they can play an important role in the development of sustainable agriculture for the future.

Ethnomedicinal Uses and FTIR Analysis of *Murrayakoenigii* (L.) Spreng.

*Diptimayee Rout*¹ and *Ranindra Kumar Nayak*²

Department of Environmental Science, Fakir Mohan University, Balasore, Odisha

E-mail: ¹ routdiptimayee883@gmail.com, ² ranindra1968@gmail.com.

Murrayakoenigii (L.) Spreng. is a tropical and sub-tropical tree native to Asia. Its leaves, also known as curry leaves, are used in Indian dishes and traditional medicines. The leaves are commonly used in southern and west coast Indian cooking, making thoran, vada, rasam, and kadhi. The oil can be extracted and used to make scented soaps. The leaves are also used as an herb in Ayurvedic and Siddha medicine, believed to possess anti-disease properties. The berries are edible, but the seeds may be toxic to humans. The leaves are rich in carotenoids, beta-carotene, calcium, and iron. The curry tree is versatile and has

numerous traditional uses. It is used as a spice in Indian cooking, enhancing curries, chutneys, soups, stews, and dals. The leaves, roots, and bark can be prepared as tonics for digestive issues, and analgesics for body heat, thirst, inflammation, and itching. The roots can be used as a hair tonic, improving hair growth and maintaining a normal hair tone. The root juice can also be used as a remedy for kidney-related pains. The curry tree's antioxidant, antitumor, anti-inflammatory, antihyperglycemic, hypoglycemic, and hypolipidemic effects make it a valuable addition to any natural remedy. Its chemical composition varies depending on the part examined, such as seeds, fruits, stems and bark, and roots. This research explored the qualitative and quantitative analysis of the phytochemicals of *Murrayakoenigii* (L.) Spreng. by using UV-visible spectrophotometer and FTIR-Analysis to study the present bio-active compounds.

A review on opportunities for blue carbon strategies in Odisha

DS Soumya Ranjan, Arpita Banerjee, Adyasha Panda, Rajashree Das, Biswajit Patra, Anil Kumar Biswal,*

P.G. Department of Botany, Fakir Mohan University, Odisha

Email: routsoumya71@gmail.com

Due to rapid growth in various anthropogenic activities, there is a surge in carbon and other GHG (Green House Gas) emission leading to harmful conditions like climate change. On the other hand, natural regulators of these obnoxious conditions are depleting rapidly. Hence, achieving the goal of reduced emissions while pursuing its socio-economic development poses a great challenge to the world, which requires using the broadest possible range of options to reduce and avoid emissions, while also adapting to climate change. Ocean and coastal ecosystem have absorbed one third of human carbon emission since the advent of industrial revolution. The carbon which is captured, sequestered and stored by marine plants and animals is known as blue carbon. Within the spectrum of marine ecosystems, mangroves, seagrass meadows, and salt marshes emerge as the three vital systems proficient in trapping extensive amounts of carbon from the atmosphere within their ecosystems. Unlike terrestrial ecosystems, these marine environments possess specific features owing to their remarkable proficiency in carbon storage within their substrates. They are especially skilled in taking in carbon dioxide from the air and packing it away in their roots and sediments, operating as blue carbon sinks that may be key in alleviating global greenhouse gas emissions. Furthermore, mangrove forests, salt marsh ecosystems, and seagrass meadows play a crucial role in dampening wave energy and elevating the seabed, thereby safeguarding coastal regions from the impacts of rising sea levels and erosion. Coastal environments characterized by marine vegetation serve as vital natural barriers against the destructive forces of cyclones, wave action, and the inundation and degradation of agricultural and wetland areas. Odisha a coastal state in the eastern part of India is home to the Bhitarkanika National Park and many other patches of mangroves in the estuaries and deltas of east flowing rivers like Mahanadi, Baitarani, Brahmani, Rushikulya and Budhabalang etc. It's among the top states of our country having maximum increase in mangrove forest cover recently and its large coastline of more than 450 km makes it a front runner candidate for blue carbon initiative and strategies to mitigate climate change in accordance with socio economic condition and development of rapidly growing economy of a developing country like India.

Harnessing Beneficial Microbes for Sustainable Agriculture and Eco-Friendly Development.

Elina Das, Aparna Das, Santilata Sahoo

PG Department of Botany, U.N. auto. College of science and technology, Cuttack-754011

Email: daselina64@gmail.com

Sustainability and food security are the major challenges faced by the third world countries for the past several decades. Most of the third world countries are facing problems of climate change, increasing population, overexploitation of natural resources and resource degradation associated with rapid economic growth. Among the scientific and policy circles there are controversies in using inorganic chemicals and biotechnology for sustaining the agricultural productions. Escalating global food demands, coupled with environmental degradation, necessitate a paradigm shift towards sustainable agriculture practices. Beneficial microbes, comprising bacteria, fungi, and microalgae, play a pivotal role in addressing these challenges. This review highlights the effective role of beneficial microbes in achieving sustainable agriculture and eco-friendly developmental goals. Beneficial microbes enhance crop yields, improve nutrient uptake, and promote soil health through Nitrogen fixation and solubilization, Phosphorus mobilization, Plant growth-promoting substances (PGPS), Biocontrol of plant pathogens. Beneficial microbes contribute to environmental sustainability by mitigating climate change through carbon sequestration, reducing chemical fertilizer and pesticide usage, enhancing water retention and efficiency. However they also help in promoting biodiversity and ecosystem services, supporting waste management and pollution remediation. Some Key Beneficial Microbes are *Rhizobia* (nitrogen-fixing bacteria), Mycorrhizal fungi (phosphorus mobilizers), Plant growth-promoting *Rhizobacteria* (PGPR), *Trichoderma* (biocontrol agent). Microalgae (biofertilizers and bioremediators) etc. These microbes are implemented in several agricultural strategies like Integrated Pest Management (IPM) systems, conservation agriculture practices, organic farming technology and methodology, microbe-assisted crop breeding programs etc. Beneficial microbes offer a viable solution for achieving sustainable agriculture and eco-friendly developmental goals. By harnessing their potential, we can enhance food security, reduce environmental degradation; promote ecosystem services, support climate change mitigation, foster sustainable development. By embracing beneficial microbes, we can create a more sustainable, eco-friendly, and food-secure future for generations to come.

Exploiting phytochemicals to target and modulate the nonsense-mediated decay pathway for anticancer therapies

*Gagan Kumar Panigrahi, Sanjoy Majumder, Rutupurna Das and Kunja Bihari Satapathy**

School of Applied Sciences, Centurion University of Technology and Management, Odisha, India

*Email: kunjabihari.satapathy@cutm.ac.in

Cancer continues to be one of the major causes of human mortality across the globe. Current treatment options are not sufficient enough to control deaths caused by cancers and due to this there is high demand for urgent development of novel anticancer therapeutics. Since time immemorial plant

materials are used either as food, drinks and flavor or as traditional medicines for the benefit of human health and wellbeing. Many studies have shown that some of the phytochemicals possess remarkable anticancer properties and can be utilized as potential anticancer therapeutics. There are many cellular pathways which are involved in the process of tumorigenesis. Many studies have shown the significance of involvement of nonsense mediated decay (NMD) pathway in cancer progression. Out of many proteins involved in NMD pathway Up-Frameshift (UPF) proteins UPF1, UPF2, UPF3A and UPF3B are most significant. Developing novel anticancer therapeutics through targeting the NMD pathway can be considered as a sustainable strategy towards good health and well-being (SDG 3). This current research aims to unravel the potential phytochemicals which targets the NMD pathway by modulating the function of UPF1. The molecular docking and *insilico* ADME analysis approach were used to screen the phytochemicals showing the ability to bind with human NMD factor UPF1.

GA3 Application for Enhancing Finger Millet Productivity and Nutrition

Ganesh Kejriwal¹ and Dr. Deepali Dash²

¹M.Sc. (Ag) Plant Physiology, Siksha 'O' Anusandhan Deemed to be University

²Assistant Professor, Dept. of Crop Physiology, Siksha 'O' Anusandhan Deemed to be University

Email: ganeshkejriwal5@gmail.com and deepalidash@soa.ac.in

Ragi, or finger millet (*Eleusine coracana* L.), is a drought-tolerant grain crop celebrated for its high nutritional value and adaptability to poor soils, making it a staple in sustainable agriculture. In India, the 5th largest producer of ragi is Odisha cultivating in around 0.46 lakh ha area with a production of 0.38 lakh tonnes. However, the productivity is poor as compared to other states providing only around 8qt – 9 qt per hectare of yield. This lower productivity issue can be solved by applying plant growth hormones. One such important plant growth hormone endogenously produced in plants is Gibberellic acid which controls the formation of flowers and is responsible for their fertility. This study investigates the effect of varying concentrations of gibberellic acid (GA3) on the quality, yield, and nutritional profile of finger millet varieties. The field experiment was conducted from July to November 2023 at Binjhagiri, Chatabara, under the Institute of Agricultural Sciences, Siksha 'O' Anusandhan, Bhubaneswar. It employed five finger millet varieties—Arjun, Bhodo, Bharati, KMR-204, and VL-379—arranged in a factorial randomized block design with 20 treatments and three replications. The treatments consisted of four GA3 concentrations: 0 ppm (control), 25 ppm, 50 ppm, and 75 ppm. Key parameters assessed including quality indicators (photosynthetic pigments, protein, carbohydrates, reducing and non-reducing sugars, amylose, amylopectin, and starch content), and yield metrics (grain and straw yield). Results demonstrated that 50 ppm GA3 was the optimal concentration, significantly improving Chlorophyll and carotenoid levels were enhanced, boosting photosynthetic efficiency. The application of 50 ppm GA3 elevated protein and carbohydrate content, contributing to higher levels of reducing sugars, amylose, and amylopectin, which enhanced seed quality. Yield analysis revealed a notable 56.5% increase in grain yield with the 50 ppm GA3 treatment. Among the varieties, Arjun demonstrated the highest grain yield and harvest index, followed by KMR-204. These two varieties outperformed others in nearly all parameters. In summary, this study

highlights the potential of GA3, particularly at 50 ppm, to enhance the nutritional quality, and yield of finger millet. Arjun and KMR-204 emerged as the best-performing varieties, showcasing their suitability for maximizing productivity and nutritional content under GA3 treatment. These findings underscore the importance of optimizing GA3 concentrations for sustainable finger millet cultivation, particularly in resource-constrained environments.

Diversity and Distribution of Invasive Alien Weed species in Rice fields of Bhadrak district of Odisha

Gouri Sankar Juga Prakash Jena¹, Prasanna Kumar Mishra² and Kunja Bihari Satapathy³

¹P.G. Department of Botany, Government (Autonomous) College, Angul, Odisha

²Department of Botany, V.N. Autonomous College, Jajpur Road, Odisha, India

³P.G. Department of Botany, School of Applied Sciences, Centurion University of Technology and Management, Odisha, India

Email: kbs_bot@rediffmail.com

A crop weed inventory was conducted in rice fields of Bhadrak district during the year 2016-2018. Four selected community development blocks (Bhadaripokhari, Chandbali, Dhamnagar, and Tihidi) were selected as the study sites. Due to environmental promotion for the unwanted plants in the crop field, weeds were observed to appear and interfere with the growth and productivity of the principal crop. As the district of Bhadrak is frequently experienced diverse natural calamities, hence it directly or indirectly affects agrarian economy and crop productivity in the rice ecosystem. The survey revealed 70 problematic crop weeds in rice fields of these 4 C.D. Blocks. It was found that out of 70 problematic crop weeds, about 35 species of crop weeds are reported to be Invasive Alien crop weed species. These interfere the upgradation of rice ecosystem. Important Invasive alien crop weeds include *Alternanthera philoxeroides*, *Aeschynomene americana*, *Aervajavanica*, *Bidens pilosa*, *Blumea lacera*, *Chrozophora rottleri*, *Corchorus aestuans*, *Croton bonplandianum*, *Eclipta prostrata*, *Eichhornia crassipes*, *Emilia sonchifolia*, *Gnaphalium polycalunon*, *Gomphrena celosoides*, *Ludwigia octovalvis*, *Oxalis corniculata*, *Portulaca oleracea*, *Saccharum spontaneum*, *Tribulus terrestris*, *Xanthium indicum*. Interestingly, it was found that, the local farmers, agricultural labourers, and also 'Vaidyas' use some of these Invasive Alien Crop weeds to treat various human and animal diseases. These include *Alternanthera philoxeroides* (Cough), *Aeschynomene americana* (Impotency), *Aervajavanica* (Diarrhoea), *Chrozophora ottleri* (Hypertension), *Corchorus aestuans* (Dysentery), *Croton bonplandianum* (Injury healing on skin), *Eclipta prostrata* (Hair conditioner), *Eichhornia crassipes* (Lactation of cow), *Emilia sonchifolia* (Cold and fever) and *Xanthium indicum* (Jaundice). Keeping the noxious nature of these weeds in mind, these are being uprooted from time to time without their proper conservation. Hence it is the need of the hour to conserve, explore, identify and document these therapeutically important species in their natural habitat for the sake of plant diversity conservation in the scenario of climate change.

Conservation of medicinal plants cultivated in institute herbal garden through bio-technology

Gyanarasmiswain and Ch. A. Ramulu

Botany Department, RIE (NCERT), Unit-9, Sachivalaya Marg, Bhubaneswar- 751002

Email: gyanarasmiswain1997@gmail.com , chinnala.ramulu@gmail.com

Plant tissue culture is one of the important aspects of Biotechnology, attains special significance to reap the benefits of Micro- propagation, *in vitro* conservation biodiversity and or genetic improvement for human welfare. Plant Propagation is the first phase of complete package of production technology of herbal medicines that passes through cultivation, post harvest drying, herb storage, primary processing, dry extraction and quality control. Ultimate efficacy of herbal drugs mainly depends on its starting materials i.e. characterized germplasm having desired marker (bioactive) compounds. Therefore, outsourcing of right propagates for further large scale multiplication is essential step. Medicinal plants are living resource, exhaustible if overused and sustainable if used with care and wisdom. At present 95% collection of medicinal plant is from the wild. Current practices of harvesting are unsustainable, and many studies have highlighted depletion of resource base. Numerous drugs or their precursors used in the current pharmacopoeias originate from plant sources. Natural products or natural product-derived drugs comprise nearly 28% of all the new chemical entities launched into the market in the last 20 years. 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. This can easily be simplified as; "*when you are eating today, remember to leave some for those who will be there tomorrow*" The ever dwindling natural habitats of these medicinal plants have left only a choice of *ex-situ* conservation. This *ex-situ* conservation falls under the programmes of institutions such as botanic gardens that are encouraged by the Convention on Biological Diversity framework given that botanic gardens all over the world have always been closely linked to ex-situ conservation of medicinal plants, 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 include *Plumbago zylanica*, *Alove vera*, *Sarac ashoka*, *Stevia*, *Elaeocarpus*, *Rauvolfia serpentina*, *Withaniasominefera*, *Chlorophytumborivilianum*, *Rosmarinus officinalis*, *Tinospracardifolia*, *Santalum album* Linn, *Swertia Chirata* Syn, *Bacopa monnieri* (L) pennel, *Typhonium trilobatum*, *Cissus quadrangularis* and *Gymnemasyvestre*. Preservice students involved very actively in propagation, conservation and preservation of these medicinal plants for their investigatory projects etc.

Allelopathic effect of *Mangifera indica* leaves aqueous extract on seed germination, seedling vigour and biochemical content of Mustard (*Brassica nigra*).

Ipsita Das¹ Umabati Sahu^{2*}

¹Department of Botany, Kuntala Kumari Sabat Women's College, Balasore, Odisha,

²PG Department of Botany, Fakir Mohan (Autonomous) College, Balasore, Odisha, India.

Email: umabatisahu@gmail.com*, ipsita3112@gmail.com

Allelopathy is a natural phenomenon of plants and microbes releasing chemical compounds that impact the growth, progress, and dispersal of other plants and microorganisms. According to several studies, allelochemicals (like phenols, terpenoids, and alkaloids, along with their derivatives) are toxic constituents that can execute a plant's usable supply of a nutrient by stopping nutrient uptake, shoot/root growth or attacking a naturally striking symbiotic association. Though the mango (*Mangifera indica* L.) is a common agroforestry tree, many reported crops grown underneath it find it extremely difficult to survive because of its dense canopy and estimated allelopathic effect. A primary attempt was made through the current study to examine the allelopathic impact of aqueous extract of *Mangifera indica* leaf litter on seed germination, biochemical, and growth parameters of mustard seeds (*Brassica nigra*) seedlings affect the germination and early growth performance of food crops and medicinal plants. The experiment showed that all the test concentrations of leachate had a deleterious effect on seed germination, seedling growth-like length, fresh and dry weight, and biochemical parameters such as total chlorophyll and total carbohydrate of the test crop mustard seeds (*Brassica nigra*) seedlings. Further, it was also observed that the inhibitory effects were gradually increased with a rise in the leaf leachate concentration. It is recommended that crops not be associated with different species of *Mangifera indica* due to the allelopathic effect on germination and early vegetative developmental stages of crops.

Role of allelopathy for sustainable weed management

Ipsita Priyadarsini Samal, Gyanranjan Mahalik*

Department of Botany, School of Applied Sciences, Centurion University of Technology and Management, Odisha, India

*Email: gyanranjan.mahalik@cutm.ac.in

Weeds seriously threaten crop productivity because they generate significant crop losses by interfering with crop growth and development. No other pest reduces crop output yield more than weeds. Because of this, synthetic pesticides are now frequently employed to control weeds. However, concerns over the effects of synthetic herbicides on the environment and human health have been raised by their growing use. Due to the numerous health and environmental hazards linked to synthetic pesticides, experts have begun investigating more ecologically friendly methods of controlling weeds. Among these, using allelopathy as a technique in a comprehensive weed control strategy could significantly reduce the need for pesticides. Even though it is known that many vital crops have allelopathic potential, farmers are still hesitant to use this knowledge. Helping farmers and consultants determine whether allelopathy can be

successfully included in an environmentally acceptable weed control approach is therefore essential. Through crop rotation, cover crops, and intercropping, allelopathy can reduce weeds in field crops. Allelopathy will probably be investigated more as a weed control method and might be used as a component of an ecological, integrated, and sustainable weed control plan.

A Comprehensive Study on Ethnomedicinal Plants Used for Treating Skin Diseases in the Tribal Communities of Kandhamal District, Odisha

Jhilli Pradhan¹, Sagarika Nayak¹, Birendra Kumar Bindhani^{2}*

¹Kalinga Institute of Social Sciences [KISS], Deemed to be University, Bhubaneswar, Odisha

^{2*}Kalinga Institute of Industrial Technology [KIIT], Deemed to be University, Bhubaneswar, Odisha

E-mail: bkbindhani@kiitbiotech.ac.in *, jhillikp@gmail.com , sagarika.nayak@kiss.ac.in

Skin diseases have been a prevalent health concern for generations, affecting diverse populations worldwide. Ethno-medicinal practices have played a crucial role in treating skin ailments, and tribal communities have been at the forefront of preserving and passing down this traditional knowledge. This study explores the rich repository of ethno-medicinal knowledge among the tribal communities in the Kandhamal district of Odisha, focusing specifically on the utilization of plants for the treatment of skin diseases. The indigenous communities residing in this region have developed a profound understanding of local flora, harnessing the therapeutic properties embedded in various plant species to address dermatological ailments. This research develops into the traditional healing practices employed by the tribal people, aiming to document and analyze the ethno-medicinal plants used in the treatment of skin diseases. Through ethno-botanical surveys and interviews with traditional healers and community members, a comprehensive inventory of ethno-medicinal plants has been compiled. The study not only identifies the plant species utilized but also investigates the preparation methods and application techniques involved in the treatment. The documentation of these ethno-medicinal practices helps for the preservation of indigenous knowledge. The study also holds potential implications for modern medicine, hinting at novel bioactive compounds with therapeutic properties.

Species authentication in *Ipomoea* L. based on matK and rpoB conserved regions

*Kamalakanta Satapathy, Subhadarshani Dhall, Laxmikanta Acharya**

Centre for Biotechnology, School of Pharmaceutical Sciences, Sikhsha 'O' Anusandan (Deemed to be University), Bhubaneswar, Odisha, India

Email: kk.satapathy84@gmail.com, dhallsubhadarshani@gmail.com, *laxmikantaacharya@soa.ac.in

Ipomoea L. is the largest genus in the family Convolvulaceae, with over 600 species. It is found throughout tropical and subtropical regions of the world although some species also reach temperate zones. These species are used in different parts of the world for the treatment of diabetes, hypertension, dysentery, constipation, fatigue, arthritis, rheumatism. They have antimicrobial, analgesic, hypoglycemic, hypotensive, anticoagulant, anti-inflammatory, psychotomimetic and anticancer activities. In this study,

four species were identified using universally conserved DNA sequences or DNA barcodes. Genetic marker technology is the foundation of DNA barcoding, which is mostly used for species identification or diversity evaluation. We investigated four distinct *Ipomoea* L. taxa (*Ipomoea sagittifolia*, *Ipomoea lacunose*, *Ipomoea obscura*, *Ipomoea mauritiana*) found in and around Bhubaneswar, Odisha. Using nine conserved barcode loci, including atpF-atpH, rpoB, matK, rpoC, psbK-psbL, trnH-psbA, and rbcL. Phylogenetic analysis and sequencing of the amplified bands of the rpoB and matK barcode primers revealed single nucleotide polymorphism, insertions and deletions, resulting in consistent separation of all four species. The total number of unique SNPs and In/Del present in the species has been 43 and 2 in MatK, whereas 11 unique SNPs and 3 In/Del present in rpoB. These markers can therefore be utilised to distinguish between various *Ipomoea* L. species. The focus is on determining the integrity and authenticity of phytomedicinals and herbal products using DNA barcoding to safeguard customers from any health concerns connected with product substitution and contamination.

Exploring the Bioactive Potential of *Lyngbya aestuarii*: Isolation, Characterization, and Antimicrobial Activity of Secondary Metabolites from a Mangrove-isolated Cyanobacterium

Karisma Dash, Pranabjeet Behera, Gayatri Nag, Bhabatarini Panda*

¹Post Graduate Department of Botany, Utkal University, Vanivihar, Bhubaneswar-04

* Email: bhabatarinipanda@rediffmail.com

Lyngbya aestuarii is an interesting cyanobacterium due to its ability to produce a large spectrum of bioactive compounds with potential applications in the pharmaceutical, nutraceutical, and agricultural industries. The organism *L. aestuarii* was isolated from a mangrove habitat, where the ecological and physiological factors might have regulatory effects on the production of secondary metabolites. In our experiment, the cyanobacterium was cultured in a photobioreactor for mass production, and the biochemical parameters were studied on its stationary phase. It was found that the cyanobacteria produced various secondary metabolites such as phenol, tannin, alkaloid, saponin, terpenoid, and glycoside. The chloroform extract of *L. aestuarii* exhibited antibacterial activity against six bacterial strains such as *Klebsiella pneumoniae*, *Salmonella typhi*, *Shigella flexneri*, *Staphylococcus aerus*, *Pseudomonas syringe*, *Escherichia coli*. Further analysis included the detection of antioxidants like Ascorbate peroxidase, Guaiacol peroxidase, and catalase in *L. aestuarii*. The presence of anticancerous compounds in the cyanobacterial extract was also detected and confirmed using thin-layer chromatography and GC-MS. The study revealed the detection, quantification as well as the antimicrobial activity of the *L. aestuarii* extract against different bacterial strains, illustrating the potential applications of bioactive compounds.

Chemical and biological characterisation of orange peel and their effect on skin disease

Kripalinee Devi, Biswajit Patra

P.G. Department of Botany, Fakir Mohan University, Odisha

Email: patrabiswajit090@gmail.com

Orange peel, often discarded as waste, possesses various chemical and biological properties that make it valuable for potential applications in skin health and treatment of skin diseases. Orange peel contains a range of bioactive compounds like flavonoids, carotenoids, essential oils, and minerals. The high concentration of flavonoids and vitamin C helps neutralize free radicals, which can prevent oxidative stress associated with skin aging and various skin diseases. Essential oils and other compounds in orange peel exhibit antimicrobial properties, which can help combat skin infections and conditions like acne. Compounds in orange peel can reduce inflammation, potentially benefiting conditions such as eczema, psoriasis, and dermatitis. The antimicrobial and anti-inflammatory properties can help reduce acne outbreaks and promote healing of existing blemishes. Antioxidant and anti-inflammatory compounds may alleviate symptoms and reduce flare-ups in chronic skin conditions. Orange peel extracts are increasingly used in creams, serums, and masks targeting skin health due to their beneficial properties. In various cultures, orange peel is used in herbal remedies for skin-related ailments. Further research and clinical studies could enhance our understanding of its efficacy and application in dermatology. In this research, phytochemical constituents of orange peel and their health benefits were discussed.

Identification of bacterial blight resistance in rice using molecular markers

Krishna Rani, Anshuman Khandual, Arup Kumar Mukherjee

Molecular Plant Pathology Laboratory, ICAR-National Rice Research Institute, Cuttack, Odisha, India-753006

*Email: titirtua@gmail.com / ak.mukherjee@icar.gov.in

Rice (*Oryza sativa* L.) is the staple food of half the global population. This crop can be grown in a wide range of environmental conditions. Three seasons of cultivation, autumn, winter and summer are practiced by Indian farmers. Broadly, rice cultivation season is categorized into two types 'Aus' and 'Aman'. 'Aus' is the crop grown in May and reaped in September. Fungi, bacteria, viruses and nematodes are the important classes of disease pests. The major fungal diseases include blast, brown spot, sheath blight, false smut etc. while bacterial leaf blight, bacterial leaf streak and panicle blight are caused by bacteria. The other important diseases include rice tungro and ufra caused by virus and nematode, respectively. BLB is caused by a bacterial plant pathogen and the disease was unnoticed prior to Green Revolution. Two pathovars of *X. oryzae* are responsible for causing diseases in rice. *X. oryzae* pv. *oryzae* (*Xoo*) is responsible for BLB disease while *Xanthomonas oryzae* pv. *oryzicola* causes BLS in rice. The bacterium primarily breaches the host plant via hydathodes or wounds caused by insects, sand particles, rubbing of the leaves or intercultural operations. BLB is spotted in the field with three types of symptoms i.e., seedling wilt, leaf blight and pale yellow. BLB is caused by *Xoo* and the population of the pathogen is very dynamic in nature. Due to changing climate scenario, *Xoo* has evolved into a number of forms called races or pathotypes. The races vary from

place to place as well as from varieties to varieties. The resistance in case of *Xoo*/ rice systems follows gene for gene hypothesis. The resistance genes in this system are known as *Xa*/*xa* genes. Hence, a particular *Xa* gene found in rice, could match a specific avirulence gene in the pathogen. This concept has paved the way for pathotyping, screening of genotypes and location specific deployment of *Xa* genes. In view of this, a study was conducted at ICAR-National Rice Research Institute, Cuttack to screen rice genotypes against *Xoo* pathogen and validate the presence of *Xa* genes in the resistance genotypes.

Eco-Efficient Microalgal Cultivation: Synergizing Aquaculture Wastewater Treatment with Valuable Biomass Generation

Kumar Avishek¹, Debaraj Parida^{2}, Sk.Riyazat Khadim²*

¹P.G Department of Botany, Utkal University, Vanivihar, Bhubaneswar, Pin-751004

²P.G Department of Botany, Dhenkanal Autonomous College, Dhenkanal, Pin-759001

*Email: debarajparida569@gmail.com/debarajparida789@gmail.com

In recent years, microalgae have garnered significant interest as a primary feedstock; however, their economic viability remains challenged by high cultivation expenses. The utilisation of commercial media for microalgae culture is costly. Conversely, aquaculture wastewater, which contains substantial amounts of potentially polluting substances, can serve as a nutrient source for microalgal cultivation, thereby reducing production costs. The expanding aquaculture industry generates considerable volumes of wastewater rich in nitrogen and phosphorus. Microalgae have demonstrated the capacity to absorb these compounds and transform them into valuable biomass. Studies have shown that microalgae effectively utilise nitrogen and phosphorus from wastewater for growth. Cultivating algal biomass in fish farm wastewater (FFW) treats wastewater and produces sustainable biofuel, addressing two environmental issues: managing nutrient-rich aquaculture effluents and sourcing renewable energy. This process improves water quality for reuse in aquaculture, reducing the environmental impact on nearby ecosystems. We reviewed the advantages and potential of using fish effluent in algae cultivation to produce useful compounds. Microalgae can harness nutrients from FFW for various applications, including biomass production and lipid accumulation. This approach can yield fuel, along with producing useful bio compounds with desirable properties while simultaneously treating wastewater and reducing the demand for freshwater.

Precision farming to improve crop productivity

Laba Hembram, Aparna Das, Santilata Sahoo

P.G. Department of Botany, Udayanath Autonomous College of Science & Technology, Adaspur,

Cuttack Email: labahembram5@outlook.com

Globally, agriculture faces challenges due to climate change and declining soil health. At the same time, the continuously growing human population makes these challenges even more difficult. Organic matter (OM) is a crucial component in maintaining soil fertility and productivity while providing essential ecosystem services. In the current situation, cultivation of land has been severely decreased every year due

to human settlement and rapid urbanization. Therefore, use of good crop variety is important to increase production of rice, wheat, millet, vegetables fruits, etc. Overdependence on chemical fertilizers and unbalanced nutrient management practices have reduced soil health and ultimate crop production in several countries. Soil organic matter is declining from time to time, which is the most precarious threat to agriculture. Integration of all natural, organic, and inorganic sources of nutrients is an efficient and environmental friendly technique of crop production. Precision farming is an effective technique to manage fertilizers, pesticides, herbicides, and water in the field based on sources of data i.e. soil reports, temperature, nutrients, and other agroclimatic factors. Now a time precision farming is working under advanced technology such as global position systems (GPS), visual observation, remote sensing, and with many advanced technology. Precision agriculture practices can have a significant impact on enhancing the targeted production of rice. These technologies are utilized in various stages such as field preparation, weed management, irrigated water management, fertilizer application, insect-pest control, and harvesting. The present study is to focus on managing and reducing the cost of rice cultivation, and simultaneously emphasizing the production of nutritious staple food.

Encapsulation Technology and Synthetic Seeds: A New Era in Crop Propagation

Lopamudra Dash^{1}, Adyasha Panda²*

^{1, 2} P.G. Department of Botany, Fakir Mohan University, Balasore, Odisha

*Email: dlopamudra68@gmail.com

In nature, seeds serve as the primary means of plant propagation. However, in several crops, seed propagation faces challenges due to heterozygosity, small seed size, lack of endosperm, and the necessity of fungal interaction for germination. As a result, propagation through seeds has not been successful for certain plant species. While vegetative propagation offers an alternative, traditional methods are time-consuming, costly, and inefficient for large-scale production. Synthetic seed technology presents a promising solution to these challenges by enabling the production of artificial seeds that mimic natural seeds, thus offering an efficient method for large-scale plant propagation. Synthetic seeds are categorized into two types: organic (natural) seeds and synthetic seeds. The primary objective of synthetic seed development is to create somatic embryos that closely resemble zygotic embryos in structure and function, particularly in terms of storage and germination. This technology plays a crucial role in clonal propagation, germplasm preservation, and large-scale production of elite plant varieties. Encapsulation technology represents a significant advancement in synthetic seed production. Somatic embryos, either desiccation-tolerant or desiccation-sensitive, are encapsulated in hydrogels to produce hydrated synthetic seeds. These synthetic seeds consist of explant materials such as somatic embryos, axillary shoot tips, nodal segments, callus, bulbs, or hairy roots, all of which function like zygotic embryos in conventional seeds. The preparation of synthetic seeds involves several key steps: tissue culture, embryoid callus formation, filtration of the culture solution, encapsulation, desiccation, and storage. Synthetic seed technology holds significant potential for reducing production costs and enhancing the value of crops. It facilitates the in vitro and ex vitro propagation of numerous plant species, while also enabling the storage, transport, and exchange of

germplasm over short, medium, or long durations. As a versatile and scalable tool, synthetic seed technology serves as a vital alternative to traditional propagation methods, contributing to sustainable agriculture and crop improvement.

Evaluation of Different Hosts for the Mass Rearing of Peach Fruit Fly, *Bactrocera zonata* Saunders (Tephritidae: Diptera)

M. K. Jena¹, S. R. Patel² and Satikanta Sahoo³

¹Section of Applied Entomology, Department of Plant Protection, Institute of Horticulture Sciences, Warsaw University of Life Sciences, Nowoursynowska 159, 02-776 Warsaw, Poland

²Department of Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari- 396 450, Gujarat, India

³Department of Botany, N.C. (Autonomous) College, Jajpur- 755001, Odisha, India

Email: satikanta84@gmail.com

The peach fruit fly *Bactrocera zonata* Saunders (Tephritidae: Diptera) is a polyphagous pest infesting more than forty fruit and vegetable crops including guava, mango, sapota, banana, peach, papaya, watermelon, alfalfa, and citrus fruits. This study aimed to evaluate five different hosts, such as mango, sapota, banana, guava, and papaya for the mass rearing of *B. zonata* at a temperature of 30±5°C and relative humidity of 40±10% at the Department of Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari, and Gujarat, India. The mean life cycle was slightly longer when *B. zonata* was reared on sapota than other host fruits. The life cycle duration was lower on papaya than on other host fruits. Except for papaya, all host fruits were sufficient to support the maggots until the final instars. Banana and sapota were the best hosts for mass production of *B. zonata* throughout the year as compared to other hosts due to their availability throughout the year and the short life cycle of *B. zonata*, whereas, papaya was the least preferred host.

Identification, phytochemical and antimicrobial assessment of some potential ethno medicinal plants of forest fringe areas of Similipal Biosphere Reserve, Mayurbhanj: A review

Mahasweta Mohanta^{1, 2} and Ranindra Kumar Nayak^{2, 3}

¹ P. G. Department of Botany, M.P.C. (Autonomous) College, Baripada, 757003

² P. G. Department of Environmental science, Fakir Mohan University, Balasore, 756089

³Centre of Excellence for Bioresources and Energy conservation Management, Fakir Mohan University, Balasore, 756089

*Email: mohaswetamohanta2010@gmail.com

There is strong relationship between the tribes of Mayurbhanj district and ethno medicinal plants. The local tribes of forest fringe areas of Similipal Biosphere Reserve are basically Mankadia, Bhumija, Santals, Bathudis, Kolhas and Gond. In modern era where most people prefer to use allopathic medicines, till now the local dwellers of Similipal Biosphere Reserve chiefly depends on different plant parts to cure

various common human diseases like cold, cough, fever, jaundice, skin diseases and eczema, gastrointestinal disorders etc. The review work based on earlier published research papers in various scientific journals, text books, websites and data. The present review work reported 230 numbers of ethno medicinal plant species belonging to 88 numbers of families which have been used as traditional medicine by local tribes. Fabaceae has the highest number of plant species followed by Euphorbiaceae. The most used preparation method of plant drugs are infusion and decoction. Among the different parts used in treating various diseases, leaves and roots are mostly used followed by bark seed. This present review work gives ideas and data about the use of ethno-medicinal plants in traditional medicines in adjoining areas of Similipal Biosphere Reserve. It also gives data including plant species, family, used plant parts as medicine, preparation methods and medical use. This work aims to explore diversity of forest fringes and transition zones Similipal Biosphere Reserve, Odisha, India and identify more potential ethno medicinal plants. The main objective of the proposal also to get some potent secondary metabolites with high antimicrobial activities that could prove to be greater importance pharmaceutical industry and could solve the problem of AMR, which is considered as a major threat to the human health. This study may lead discovery of noble drugs which may be proved as a substitute of presently used chemical antibiotics.

Microbial Diversity of Forest Floors: Potential Bioresource for Benefit Flow to Local Communities under the Biological Diversity Act 2002 (Amendment 2023)

*Madhusmita Ghana, Soumya Sephalika Swain, Omprakash Mohanty, Shubhransu Nayak**

Odisha Biodiversity Board, Nayapalli, Bhubaneswar-15

Email: shubhransu.crri@gmail.com*, smitamadhu.ghana@gmail.com, sephalika94@gmail.com,

Forests are one of the Earth's largest and most important ecosystems, globally covering 31% of land area. Meanwhile, in India, forests account for 21.71% whereas forest cover of Odisha is 33.50% of its geographical area. These are essential for biodiversity conservation, sequestering carbon to mitigate climate change, and supporting human well-being by providing resources like clean air, timber and medicinal plants. The forest floor acts as a critical link between plants and microorganisms, enabling the transfer and recycling of essential nutrients. Microorganisms such as fungi, bacteria, and earthworms are the effective natural decomposers of leaves, twigs, fallen trees, animal scat, moss, and other detritus, facilitating the cycling of organic nutrients like nitrogen, phosphorus, and carbon, thereby enhancing ecosystem resilience. Notably, soil microorganisms, particularly from the phyla Firmicutes, Actinobacteria, Proteobacteria, and Bacteroidetes, are the key producers of enzymes involved in the decomposition of cellulose and hemicellulose. Microorganisms like *Trichoderma* spp. promote plant performance by producing growth regulators and protecting the plants through their antagonistic properties against pathogens. The forest soil has also been a novel source of microorganisms having the ability to produce number of industrially important enzymes. Due to lack of interest in general, forest microorganisms often remain understudied inspite of their significant ecological roles, diversity, pharmaceutical and commercial importance. As a result, the local communities are deprived of potential financial benefits from the commercial utilization of these microorganisms. This creates a critical scientific and legal gap that needs to be addressed to improve

our understanding and management of these vital components of forest ecosystems simultaneously financial gain for the local communities. The Biological Diversity Act of 2002 (Amended in 2023) provides such scopes for study, research and survey on bioresources and also benefit sharing through "Guidelines on Access to Biological Resources and Associated Knowledge and Benefits Sharing Regulations, 2014" under internationally adopted "Nagoya Protocol". This protocol has provisions and framework for utilizing microbial resources to benefit local communities by ensuring fair and equitable access and benefit-sharing from the use of genetic resources and traditional knowledge, requiring countries to get consent from local communities and provide compensation for their contributions. The components of the Act mainly implemented in the grassroot level through the local statutory body defined as "Biodiversity Management Committees (BMCs)". The role of the BMCs is to document and preserve local bioresources including microorganisms in the form of People's Biodiversity Registers (PBRs). These BMCs are supposed to promote the sustainable use of microbial products and their incorporation into agricultural practices to ensure long-term soil health. By recognizing the value of microbes in areas like agriculture, medicine, and environmental sustainability, local communities can be empowered to leverage these resources. As per mandate, the Odisha Biodiversity Board has initiated mapping of microbial bioresources through culture-based approach in the Biodiversity Heritage Sites of the State. The results of the study will help for the preparation of management plan of the particular sites along with catalogue of beneficial microorganisms for future ABS.

Cyanobacteria as a Sustainable Solution: Improving Rice Performance under Salinity Stress

Madhusmita Nayak¹, Jagneshwar Dandapat²

1 Govt Women's College, Dhenkanal

*2 Centre of Excellence in Integrated Omics and Computational Biology, Utkal University,
Vani Vihar, Bhubaneswar-751004, Odisha*

Email: m.nayak9@gmail.com

Climate change poses a significant threat to agricultural systems, with salinity stress being one of the most severe environmental stressors affecting rice production. Cyanobacteria, photosynthetic microbes capable of fixing atmospheric nitrogen and producing a variety of biologically active metabolites, offer a promising solution to mitigate these challenges. They are capable of fixing atmospheric nitrogen and producing biologically active metabolites. These organisms have the potential to serve as biofertilizers to enhance rice salinity stress tolerance and yield. This study investigated the potential of a cyanobacterial strain isolated from a saline habitat to colonize the rice phyllosphere and promote plant growth and yield under salt stress. A pot experiment was conducted using soil from a coastal locality, with the cyanobacterial strain inoculated into the soil and applied as a foliar spray. The results of this study demonstrated that the cyanobacteria successfully colonized the rice phyllosphere, significantly improving plant growth and yield under salt stress. Cyanobacterial inoculation increased shoot length, root length, biomass, and grain yield by up to 20%. Foliar spray of cyanobacteria also enhanced the nutritional status of rice plants by increasing nitrogen, phosphorus, and potassium levels in leaves and grains. The cyanobacteria produced various biologically active metabolites, including exopolysaccharides, phytohormones, and osmolytes, which may

have contributed to the observed growth and yield improvement. This inoculation also reduced Na⁺ and Cl⁻ accumulation in plant tissues, mitigating the harmful effects of salt stress.

Overall, the results of this study suggest that cyanobacteria have the potential to be used as a bio fertilizer to improve rice salinity stress tolerance and yield. As rice is a staple food for more than half of the global population and is highly sensitive to abiotic stresses, our study revealing the potential of cyanobacterial inoculum as a foliar spray to enhance rice performance under saline conditions, with improved yield and grain quality, is particularly significant. This study highlights the prospect of cyanobacteria as a future "crop probiotic" and provides a foundation for optimizing inoculation strategies and evaluating their performance in large-scale field trials.

Non Timber Forest Product (N.T.F.P.) in Odisha: Boon or Bane?

Manoranjan Pattanayak¹, Anil Kumar Biswal²

¹Retired OFS officer PrasantiVihar Bhubaneswar

²Adjunct Professor, P.G. Department of Botany, Fakir Mohan University, Balasore

Email: mrpatnaik1962@gmail.com , anilkbiswal@yahoo.com

The National Forest Policy (NFP) of Govt. of India came in the year 1988 which aims to protect, conserve and develop forests. Some main objectives of NFP are to increase Forest cover to 33% of Geographical area and to meet the needs of fuel wood, fodder, NTFP and small timber. Then Govt of India passed a new legislation for Schedule V (PESA Act 1996) which makes Gram Sabha/Gram Panchayat the owner of NTFP. In this line a policy strategy i.e. Policy on procurement and trade of NTFP was announced in 31st March 2000, wherein the Govt of Odisha entrusted 68 NTFP items to Gram Panchayat in the State.

The NTFP items are popularly known as goods of biological origin as well as services derived from Forest land excluding wood in all forms. It includes plant parts like fruits, leaves, roots, flower nuts resin, glue etc. Some examples are Tamarind, Bahada, Mango kernel, Bhuin neem, Amla, Char seed, Nageswar flower, Kochila seeds, Harida, Neem seeds etc. It is observed that in most of the cases, the Gram Panchayats are not aware of the NTFP policy. So yield from the NTFP items are very low. Besides the primary collectors i.e. the tribal people do not get their legitimate dues of NTFP items and the middleman or greedy traders get the maximum benefits

Now there is increasing demand for natural product. Destructive harvesting of NTFP items has become a matter of concern. The Conservation governance mechanism has totally failed to ensure that the harvest is sustainable. Besides there are hundreds of species not defined or classified as NTFP by Forest Department that are being harvested without any harvesting standard. There is no regulatory mechanism in Odisha to check the destructive harvest of NTFP. At present there is no systematic records available on the quantity of NTFP harvested either with Forest Dept. or Panchayati Raj Institutions (PRI). For this lacunae the species like *Asparagus racemosus*, *Oroxylon indicum*, *Eulaliopsis binnata*, *Bauhinia vahlii* are becoming endangered. The age old National Forest Policy 1988 has

become obsolete and time has come to revise the same. Besides the State Govt. may make policy, resolutions or make amendments in forest laws to regulate the NTFP items to save the species from future extinction.

Healing the Planet: Strategies for Ecological Restoration and Conservation

Malay Panigrahi^{1}, Adyasha Panda²*

^{1,2} P.G. Department of Botany, Fakir Mohan University, Balasore, Odisha-756089

Email: malaypanigrahi420@gmail.com

Ecological restoration is based on using ecological knowledge to understand how ecosystems work and then applying that understanding to restore ecosystem conditions that sustain its structure and function. Ecological restoration was first envisaged forty years ago via the prism of natural science. According to the balance-of-nature theory, ecosystems are closed, internally regulated, in equilibrium with the climate, and largely immobile when unaffected. According to this viewpoint, most human activity disrupts nature, but natural succession can restore equilibrium if the harm is not severe. The discussion of advancements in dwarf-shrub heath and grassland re-establishment serves as an example of habitat rehabilitation following harmful activities. It is suggested that an abundant amount of knowledge is now available on which to base appropriate action, and that, assuming the desired species persists, restoration is, to some extent, possible. Some of the concepts influencing habitat creation are discussed. If these guidelines are followed, such establishments can play an important role in nature conservation, while there is room for more inventive plans and basic research into some of the challenges involved. Physiological measures from a variety of species can help us understand how ecosystems work and which factors impact their structure. Such knowledge can help to plan and implement effective restoration strategies that acknowledge the impact of habitat quality on organismal performance. We identified three important phases of the restoration process: planning, implementation, and monitoring. We discovered that evaluation happened both inside and between the three stages, including both formal and informal components, and frequently had an impact on project performance. Physiological tools can be used to measure the success of restoration projects both during and after they have been completed. Introducing physiological responses more deeply into ecological restoration will give practitioners the basic scientific knowledge they need to plan, carry out, and track restoration efforts that will help restore ecosystems all around the world.

Fungal pathogens as biocontrol agents: advancements in agricultural pest management

Minakshi Agrawal and Debaraj Parida

P.G. Department of Botany, Dhenkanal Autonomous College, Dhenkanal-759001, Odisha, India

Email: debarajparida569@gmail.com

Fungi-based biopesticides have emerged as a key component of sustainable agriculture, offering an environmentally friendly and effective alternative to chemical pesticides. These biocontrol agents derived

from fungal species such as *Beauveria bassiana*, *Metarhizium anisopliae*, and *Trichoderma* spp., target a wide range of pests and pathogens through mechanisms like parasitism, toxin production, and competition. Their importance lies not only in their ability to control pest populations but also in their minimal environmental impact. Unlike chemical pesticides, fungal biopesticides are typically species-specific, reducing harm to non-target organisms and promoting biodiversity. This specificity is essential in integrated pest management (IPM) strategies that prioritize ecological balance and the preservation of beneficial organisms. Fungal biopesticides contribute to sustainable development by reducing soil and water contamination, improving soil health, and supporting biodiversity conservation. They are integral to enhancing food security by providing safer, more sustainable pest control methods. When employed as a biopesticide, entomopathogenic fungi have the ability to infect and kill insects and other pests. One such fungus, *Metarhizium*, works well against termites, beetles, and locusts, among other insects and pests. According to reports, *Beauveria baasiana* parasitizes a variety of arthropods, resulting in white muscardine sickness. These fungi assault the digestive system after infiltrating the host. The fungi eventually cause the host's internal organs to shut down. *Trichoderma* increases plant growth and enhances their ability to withstand biotic and abiotic stressors. Attaching a spore to the insect's cuticle, allowing it to germinate, penetrate the cuticle, and spread within the insect is how they combat insects. They therefore help to minimize the sustainable approach to crop development and provide an environmentally benign means of managing pests.

Plant diversity and soil elemental composition of Gangadevi forest of Puri district, Odisha

¹Menaka Nayak, ²Biswajit Patra, ¹Soumya Ranjan Dash

¹School of Biological Sciences, AIPH University, Odisha

²P.G. Department of Botany, Fakir Mohan University, Odisha

*Email: srdash.sanu@gmail.com

The Gangadevi Forest is a notable forest area located in Puri District of Odisha, India. Puri is known for its historical, cultural, and natural landmarks, and the Gangadevi Forest contributes to the region's natural heritage. The Gangadevi Forest is situated in the southern part of Puri district, near the coastal area of Odisha. The forest lies in proximity to the famous town of Puri, which is known for the Jagannath Temple and Puri Beach. The area is characterized by a mix of coastal and inland forest ecosystems, with a variety of flora and fauna that are native to Odisha. The forest is rich in biodiversity, and it is home to a variety of plant species, many of which are part of the tropical dry deciduous ecosystem typical of the region. The faunal population includes several species of birds, small mammals, reptiles, and insects. The forest is also a habitat for various species of migratory and resident birds, especially during the winter months. Puri district is famous for its spiritual and cultural significance, and the Gangadevi Forest is located in a region steeped in local history and folklore. The forest may be named after or associated with "Gangadevi," a local deity or mythological figure. Many such places in Odisha are named after gods, goddesses, and revered figures, adding cultural significance to their natural beauty. As with many coastal and forested areas in Odisha, Gangadevi Forest plays an important role in preserving the coastal ecosystem and protecting the

environment. The forest acts as a buffer against coastal erosion and provides protection to the local villages from the impact of severe weather, particularly during the monsoon season and cyclones. Odisha is known for its conservation programs aimed at preserving its forests and wildlife. The state has several wildlife sanctuaries and national parks, and efforts are made to protect the Gangadevi Forest from deforestation and other environmental threats.

BioControlMethod: A Sustainable Way to Control Algal Blooms.

Minati Desinayak¹, Prasanta Kumar Samataray²

¹PhD Scholar, Ramadevi Women's University, Bhubaneswar, Odisha

²Shailabala Women's (A) College, Cuttack, and Odisha.

Email: mdesinayak23@gmail.com

Algal blooms are a significant environmental issue that jeopardises freshwater ecosystems and public health, resulting in economic losses of billions of rupees annually. These blooms, primarily fuelled by certain phytoplankton species like cyanobacteria, flourish in environments that are rich in nutrients, warm, and have low wind conditions. Given the negative consequences, this review explores different control methods, emphasising the biotic approach as a sustainable solution. Although traditional chemical and physical methods can effectively curate algal populations, they pose ecological risks and may be resource-intensive. Biotic control approaches, such as biomanipulation and using algicidal microorganisms against Harmful Algal Blooms (HABs) to mitigate it like Bacteria, Cyanophage, fish species, Zooplankton, fungi and also some microalga present eco-friendly alternatives that provide long-lasting advantages.

Algal blooms are characterised by a proliferation of microscopic algae. These blooms can indiscriminately kill aquatic wildlife and contaminate food resources, such as cultured fish and bivalves. In extreme cases, they can even kill humans due to exposure to toxic seafood products. As eutrophication results in visible algal blooms, which increase water turbidity and give bad order to the water body, noxious toxins produced during blooms can render water unsafe, causing fish mortality and affecting human health directly or indirectly.

The water bodies, mainly in the coastal areas, are contaminated mostly because of the cyanobacteria, and the reason for the flourishing of bloom depends on the eutrophication. The review emphasises the role of selected microbial species and the mechanism that follows for the mitigation of Harmful Algal Blooms (HABs). The idea to mitigate such blooms is to use extracellular secretion, which is a biologically derived substance released from bacteria that, in turn, could not grow and disturb the environment. This effort to establish a better and faster mechanism can be used in faster strategic remediation for sustainable aquaculture, suitable for different purposes. It can also offer a breakthrough in several global environmental issues.

A review on Kitchen waste composting: An approach for sustainable growth of plants and biofuel production

Mukti Prasad Rath and Dr. Manna Milian*

P.G Department of Botany, Binayak Acharya Govt.College, Berhampur-760006.Odisha

Email: mannamilian07@gmail.com

Kitchen waste is an important component of domestic waste, and it is both harmful and rich in resources. Approximately 1.3 billion tons of kitchen waste are produced every year worldwide. Kitchen waste is high in moisture, is readily decayed, and has an unpleasant smell. Environmental pollution can be caused if this waste is treated improperly. Reduction, harmlessness and recycling are general fundamental principles in kitchen waste treatment. Conventional treatments of kitchen waste (e.g., landfilling, incineration and pulverization discharge) cause environmental, economic, and social problems. This review intends to highlight the latest technological progress in composting kitchen waste for sustainable growth of plants as well as preparation of gaseous fuels, such as biogas, biohythane, biohydrogen and liquid fuels, such as biodiesel, bioethanol, biobutanol and bio-oil, from kitchen waste. Waste edible oil from catering enterprises was used to produce solid alcohol biofuels, and high energy products were obtained. Composted materials are therefore gaining acceptance as organic fertilizers in sustainable agriculture, and there has been a considerable increase in research dedicated to the study of the effects of compost on soil properties and plant growth. Processing of kitchen waste material through composting, reduces the environmental risk by transforming the material into safer and more stable product suitable for application to soil and also reduces the transportation costs. Some researchers discussed the potential of kitchen waste as an effective and low-cost substrate for improved biohydrogen production technology, and proposed the application of nanomaterials to increase the yield of biohydrogen production and to make the entire process more economical and sustainable. Therefore, the development of a harmless and resource-based treatment technology is urgently needed. Profits can be generated from kitchen waste by converting it into biofuels. The transformation of kitchen waste into biofuels reduces pollution and carbon emissions, and changes it into resources, while increasing the economy. This approach conforms to the "decrement, harmlessness and resource recovery" principle for the reasonable utilization of kitchen waste. Breakthroughs have been made in the conversion of kitchen waste into biofuels. However, it is still difficult to produce biofuels on a large scale because of technical and economic obstacles, and biofuels cannot yet compete with fossil fuels. Problems that are encountered in the preparation of biofuels from kitchen waste are discussed to provide a reference for its use in energy utilization. Optimizing the preparation process of biofuels, increasing the efficiency and service life of catalysts for reaction, reasonably treating and utilizing the by-products and reaction residues to eliminate secondary pollution, improving the yield of biofuels, and reducing the cost of biofuels, are the future development directions in the biofuel conversion of kitchen waste. In addition to the preparation of biofuels, the conversion of kitchen waste into bio-fertilizers, bio-feeds, bio-chemicals and bioelectric energy can also be considered.

SOX9 promotes the cisplatin resistance in NSCLC by regulating EMT and β -catenin

Munmun Panda

School of Biological Sciences, AIPH University, Phulnakhara-754001

Email: mpanda@aiph.ac.in

SOX9 is related to drug resistance in many types of cancer, including lung cancer. Herein, we investigated the role of SOX9 and its regulatory signalling in cisplatin-resistant non-small cell lung cancer (NSCLC). The effects of SOX9 on cell viability, proliferation, apoptosis and migration were evaluated *in vitro*. Western blotting and real-time quantitative PCR were used to investigate the underlying mechanism. Kaplan–Meier survival analysis was used to assess the relationship between SOX9 expression and patient survival. A549CR and NCI-H522CR cells exhibited resistance to cisplatin, which was validated by multidrug resistance makers. Furthermore, A549CR and NCI-H522CR expressed more SOX9 protein or mRNA than their parental A549 and NCI-H522 cell lines. Knocking down SOX9 in A549CR and NCI-H522 reduced colony formation and cell migration while increasing apoptosis in A549CR and NCI-H522CR exposed to siSOX9 alone or in combination with CDDP compared to control cells. SOX9 also increases β -catenin; leading to resistance to cisplatin treatment. The regulation of β -catenin by siSOX9 provides a novel target for overcoming cisplatin resistance in non-small cell lung cancer.

Impact of compost prepared from different biowaste on seed germination and plant growth of *Luffa acutangula* (L.) Roxb.

N Bijaya Laxmi Swain

PG Department of Botany, Mayurbhanj College of Accountancy and Management, Baripada-757003, Odisha

Email: swainnurani@gmail.com

Waste are unwanted or unusable materials that disposed of after primary use by its holder or it is worthless, defective and of no use. But all waste are not worthless. Based on the composition it can be recycle and reuse which is a lead to effective waste management to protect human health and the environment and to ensure a sustainable future for generations to come. Here is an attempt to prepare organic compost by using different biowaste such as temple waste, agro-waste, kitchen waste and animal solid waste. These compost are applied to the seed germination of *Luffa acutangula*(L.) Roxb. .A total of six samples were used for the study. The samples were normal soil, soil with temple waste compost, soil with agro waste compost, soil with animal solid waste compost, soil with kitchen waste compost and soil mixed with all types of compost. A standard amount of each compost was put in different pots. It is observed that the highest germination percent is 80% in agro waste compost. Ten seeds are putted in each pot with different type of compost. After germination except one germinated seed in each pot everyone was thrown out. Germination percentage, shoot length and number of leaves are recorded within the interval of 10 days. After 1 month it was observed that there was better growth of the seed with agro-waste compost.

Insilico discovery of dehydroquinase synthase inhibitor for anti-*Mycobacterium tuberculosis*

Nikhil Ranjan Behera¹, Binata Nayak², Pranab Kishor Mohapatra³, Bidyasagar Lenka⁴

^{1 & 2}School of Life Science, Sambalpur University, Burla, Odisha

^{3 & 4} Department of Chemistry, C.V. Raman Global University, BBSR, Odisha

Email: ranjanbeheranikhil08@gmail.com

A significant number of individuals continue to see tuberculosis as a major factor in causing death from infectious diseases. This situation requires finding new targets and drugs. Identifying and validating appropriate targets for drug development is essential but is currently a major obstacle in drug discovery. The shikimate pathway in *Mycobacterium tuberculosis* is crucial for amino acid production, the creation of siderophores to combat starvation, thriving in low oxygen environments, and promoting the pathogen's virulence and proliferation. The role of 3-Dehydroquinase synthase from *Mycobacterium tuberculosis* is crucial in the production of aromatic amino acids and other secondary metabolites through the shikimate pathway, as well as in the development of drug resistance. In this research, Dehydroquinase synthase (DHQS) from *Mycobacterium tuberculosis* was examined with a variety of phytochemicals obtained from different plants to see if they could serve as potential ligands. The target protein DHQS was screened against over 17,967 compounds in the database. This research focuses on combining virtual screening, molecular docking, and ADMET properties.

Volatile Organic Compound as Natural Pesticide

Nikitarani Behera

P.G. Department of Botany, Fakir Mohan University, Balasore, Odisha

Email: beheranikitarani@gmail.com

Chemical pesticides have a narrow range of effects on the pests in agriculture but emit a broad range of negativity toward the environment. Volatile organic compounds can be the best solution for tolerance to biotic stress exposed in agriculture. Herbivore-induced plant volatiles are a more well-known natural pesticide for the herbivorous pest. Volatile chemicals such as isoprene, terpenoids, and amino acid derivatives act as natural pesticides. These chemicals are synthesized by triggering specific phytohormone signaling. Jasmonic acid-mediated signaling is very specific in this transduction pathway against pests. These herbivore-induced plant volatiles are used as very useful plans in the field of integrated pest management. In the present generation to decrease our carbon footprint natural pesticides act as blessings in agriculture. This paper presents the utilization of a plant's defense mechanism to fight against fauna by HIPV and its significant role in organic farming. This study result will play an effective implementation of natural strategy for betterment of agricultural yield.

Indigenous Leafy Vegetables: An Alternative Food Supplement of the Coastline Belts of Balasore District of Odisha, India

Niquehat Noor¹ and Kunja Bihari Satapathy²

¹Department of Botany, Kuntala Kumari Sabat Women's College, Odisha, India

²Department of Botany, School of Applied Sciences, Centurion University of Technology and Management, Odisha, India

Email: kbs_bot@rediffmail.com

Due to the exponential growth of population and the limited availability of arable land in Balasore, the challenges in fulfilling the high demand for food are a major concern. Because of coastal floods, deforestation, and rising soil salinity, Balasore's coastal inhabitants are especially predisposed to food insecurity and malnutrition. Currently, serious health issues such as diabetes, heart disorders, cancer, and obesity have become widespread, putting immense pressure on the healthcare system. Therefore, it is crucial to explore diverse food sources to meet the nutritional needs of the local populace of coastal belts of Balasore. A total of 72 leafy vegetables belonging to 59 genera under 32 families were recorded, which revealed that the local communities consume a good number of wild leafy vegetables. According to their habits, green leafy vegetables are classified as 43 (60%) herbs, followed by 16 (22%) climbers, 8 (11%) trees, 3 (4%) pteridophytes, and 2 (3%) shrubs. Data on the plant parts used as medicines showed that leaves were the most frequently used plant component during the current study by the native people, suggesting their sustainable management by nature. The dominant family, constituted by 11 species, is the Cucurbitaceae, followed by Fabaceae (9 species), Amaranthaceae (8 species), Solanaceae and Acanthaceae (4 species) each in terms of the family-wise distribution of potent leafy vegetables. *Solanum*, on the other hand, was said to be the leading genus, comprising 3 species. Eight species were reported for their ethnomedicinal claims against expelling intestinal worms. Owing to their significant nutritional and medicinal benefits, incorporating more indigenous leafy vegetables into the diet can greatly enhance the nutritional status of the population and help prevent several prevalent health problems. The results of this study revealed that tribal and indigenous people still eat a range of less-known leafy vegetables, which urgently need to be documented and preserved. They are also abundant in antioxidants and nutrients that strengthen our immune systems against a range of illnesses. Unfortunately, they are underutilized since people are not aware of their advantages. In order to use them sustainably in the future, it is recommended that all necessary measures be taken immediately to investigate, document, and preserve them.

***Anisomeles indica* leaf essential oil attenuates oxidative stress in LPS-Stimulated RAW 264.7 cells by inhibiting ROS and related mediators**

Omprakash Mohanta and Pratap Chandra Panda*

Centre of Biotechnology, Siksha O Anusandhan (Deemed to be University), Bhubaneswar, Odisha, India

*E mail: pcpanda2001@yahoo.co.in

Anisomeles indica (L.) Kuntze (Lamiaceae), commonly called catmint, is an essential oil-bearing herb used in traditional systems of medicine against rheumatism, arthritis, convulsions, skin disorders, epilepsy and other inflammatory conditions. Although there are few reports on the antioxidant activity of *A. indica* leaf essential oil (AILEO), its precise mechanism of action against oxidative stress during inflammatory conditions is not known. Therefore, the current study was undertaken to determine the phytochemical profile of AILEO and to decipher the underlying molecular mechanism of its antioxidant activity *in vitro* by employing the LPS-induced RAW 264.7 macrophage model. GC-MS analysis of AILEO revealed the presence of 30 constituents, of which diterpene hydrocarbons such as abietatriene (58.13%) and abietadiene (7.18%) were the predominant compounds. AILEO did not exhibit any cytotoxic effect on RAW 264.7 cells and was non-toxic even at 100 µg/mL. Stimulation with LPS (1 µg/mL) significantly increased the production and expression of reactive oxygen species (ROS) and various proinflammatory mediators including iNOS, and COX-2 in the RAW 264.7 cells. The rise in the ROS levels created an imbalance between its formation and breakdown and the constitutive expression of iNOS elevated the nitric oxide (NO) levels. Together, they created an oxidative intracellular environment that impaired the expression and activation of endogenous antioxidant enzymes (CAT, SOD, GPx, and GSH). However, administration of AILEO at 12.5 and 100 µg/mL significantly reduced the intracellular ROS, NO production, and mRNA expression of iNOS, and COX-2 by many-fold in the LPS-pre stimulated macrophage cells. AILEO treatment also reverted and restored the levels of endogenous antioxidant enzymes (SOD, GSH, GPx, and CAT) in pre-LPS stimulated RAW 264.7 cells. In summary, this study provides valuable insights into the intricate mechanisms by which AILEO exerts anti-oxidative effects, offering a foundation for further exploration of its potential interactions with inflammation and associated signaling pathways.

Unravelling *Drimia indica*'s (Roxb.) Jessop cellular secrets: A Cytological and Phytochemical investigation in Odisha ecotypes

Padmaja Patel*, Chinmay Pradhan and Anath Bandhu Das

P. G. Department of Botany, Utkal University, Vani Vihar, Bhubaneswar - 751004, Odisha

*Email: padmajapatel12@gmail.com

Since the dawn of human civilisation, plants have been crucial in defending the health of both humans and animals against degenerative chronic illnesses. Nearly 80% of the world's population is estimated by the WHO to rely on traditional medicines for their primary medical requirements, and an

astounding number of phytochemicals have been isolated from nature. The wild onion or *Drimia indica* (Roxb.) Jessop. belongs to the Asparagaceae family and is one of the most medicinally significant genera. It has approximately 100 species that are native to the Mediterranean, Africa, and India. Specific chromosomal traits and structural changes in the genome's chromosomes using morphological analysis, somatic chromosome count, detailed karyotype and genome size analysis, and phytochemical quantification showed variations in different ecotypes of Odisha. The development of particular genetic traits required for environmental adaptation leads to variation in morphological characters. At the population level, the vegetative characters may be used as trustworthy taxonomic characters because they show the greatest variation of any morphological feature. The presence of aneuploid and polyploid chromosome counts within ecotypes, ranging from $2n=16$ to $2n=40$, was demonstrated by chromosomal variation. Due to the microclimatic adaptation, the new chromosome numbers $2n=22$, $2n=26$, and $2n=32$ was found. The 2C DNA content, which is correlated with chromosomal number, differed considerably amongst ecotypes. Scillaren and quercetin, two significant beneficial chemicals, are confirmed to be present by phytochemical research. When comparing the Nuagaon ecotype to other ecotypes, the TLC analysis of bulb extract revealed the highest band. Using quercetin and scillaren as standards, HPTLC examination of several *D. indica* ecotypes reveals that the Nuagaon ecotype has the highest area percentages, followed by other ecotypes. As a result, the bulb of *D. indica* contained more scillaren than quercetin. The COLO-205 cancer cell line's anticancer properties after flow cytometric analysis revealed that quercetin-induced cell death is more than that of scillaren. The current study demonstrated that quercetin and scillaren are highly effective plant-based medications against colon cancer cell lines. The ecotype with the highest concentrations of phytochemical constituents is found to be Nuagaon. Therefore, thorough chromosomal, genome and phytochemical analysis of various ecotypes may aid breeders in selecting diverse parents and appropriate high-drug-yielding varieties for future crop improvement initiatives.

***Cannabis sativa*: A Greenshield Initiative**

Pooja Rout

Dept of Biotechnology, Ravenshaw University, Cuttack

Email: routpooja03@gmail.com

Global warming is escalating rapidly, and plastic pollution severely harms the environment. Transitioning to greener resources can improve food security and promote sustainability. Hemp (*Cannabis sativa* L.) is a carbon-negative plant that requires minimal water and is easy to grow. It is durable, high-yielding, biodegradable, pest-resistant, and medicinal. Classified as industrial hemp with less than 0.2% THC, hemp serves many purposes, including the production of paper, fiber, biofuel, packaging, construction, and food. Hemp seeds are nutritionally rich, especially in omega-3 fatty acids, which are essential for heart health. Hemp can be a perfect substitute for plastic. Hemp biofuel can reduce greenhouse emissions. The benefits can also be enhanced with the use of plant biotechnological methods. As a highly versatile plant; it can help us achieve our sustainability goals more easily.

Biological diversity, ethnobotanical significance and conservation status of Figs (*Ficus* species) in Odisha, India

Prabhat Kumar Das & Pratap Chandra Panda

Centre for Biotechnology, Siksha 'O' Anusandhan (Deemed to be University), Kalinga Nagar, Bhubaneswar

Email: prabhatdasnou@gmail.com

The genus *Ficus* (commonly known as figs), belonging to the family Moraceae, is comprised of about 880 species of trees, shrubs, climbers and creepers. Several species of the genus thrive as epiphytes, semi-epiphytes, rheophytes, and lithophytes across tropical and subtropical regions of the world. In India, the genus *Ficus* is represented by 115 taxa, including 91 species and 24 infraspecific categories; 10 species being endemic to the country. Recognized as keystone species, *Ficus* species play crucial ecological roles, offering shelter and food for frugivorous birds, animals, and insects, along with fodder for both wild and domesticated animals, thereby supporting biodiversity in tropical forests. Additionally, many *Ficus* species are valued for their role in traditional medicine, as source of edible fruits, and hold significant cultural and religious importance in rural India, where they are often venerated and associated with mythological stories.

This paper presents an overview of the taxonomic diversity, distribution, ecological characteristics, ethnobotanical applications, and conservation status of 32 wild and cultivated *Ficus* species in Odisha state. These species display remarkable diversity in growth forms, habitats, root systems, leaf morphology, inflorescence types, and mechanisms of pollination and seed dispersal. Species like *Ficus benghalensis*, *F. religiosa*, and *F. hispida* are widespread across diverse habitats, while others, such as *F. exasperata*, *F. auriculata*, *F. semicordata*, and *F. racemosa*, primarily inhabit forests along rivers and stream banks. Certain species, including *F. benghalensis*, *F. religiosa*, *F. benjamina*, and *F. tinctoria* ssp. *gibbosa*, adopt epiphytic, hemiepiphytic, or lithophytic forms, growing on trees, old structures, or rock crevices. Tribal communities of the state consume fruits of *F. auriculata*, *F. benghalensis*, *F. hispida*, *F. racemosa*, and *F. semicordata* as a crucial food resource during periods of scarcity. Several species hold ethnomedicinal value and possess deep cultural and religious significance. Species such as *F. semicordata*, *F. mollis* and *F. arnottiana* are identified as rare species needing immediate conservation interventions.

Integrating Botanic Gardens into Science Education: A NEP 2020 Perspective

Prabhat Kumar Das* and Samarendra Narayan Mallick**

*Centre for Biotechnology, School of Pharmaceutical Sciences, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar

**Department of Botany, Ravenshaw University, Cuttack, Odisha

Email: prabhatdasnou@gmail.com

Botanic gardens offer students the opportunity to observe plant biodiversity, ecosystems, and environmental sustainability first-hand, aligning with the NEP's goal of experiential learning. They serve as living laboratories where students can engage in practical activities like plant identification, ecological

research, and environmental conservation. This direct interaction with nature helps deepen their understanding of biological concepts and environmental issues, enhancing both cognitive and emotional connections to the subject matter. Furthermore, botanic gardens support the NEP's vision of integrating local and indigenous knowledge into curricula. They can showcase native plants, traditional uses, and sustainable agricultural practices, fostering a deeper appreciation for local ecosystems. By facilitating interdisciplinary learning, such gardens can also tie in subjects like geography, chemistry, and climate science, enabling a well-rounded educational experience. The National Education Policy (NEP) 2020 emphasizes holistic and interdisciplinary learning, with a focus on fostering creativity, critical thinking, and hands-on experiences. In essence, botanic gardens align with the NEP's emphasis on experiential, practical, and context-driven learning, offering a valuable platform for engaging students in science education in a meaningful and impactful way. In this context, botanical gardens can play a vital role in science education by providing an outdoor, interactive learning environment.

Plant science innovations in ensuring food security and alleviating poverty in India

Prabin Panigrahi

P.G. Department of Botany, Dhenkanal Autonomous College, Dhenkanal, Odisha Pincode -759001

Email: panigrahip408@gmail.com

India is at a critical juncture where ensuring food security and addressing poverty require sustainable and innovative agricultural solutions. Plant science innovations have emerged as a powerful tool to transform agriculture and rural livelihoods, leveraging modern biotechnology and traditional farming knowledge. These advancements ensure higher productivity, better nutrition, and resilience against climate change while promoting economic empowerment in underprivileged regions. Through genetic engineering and molecular breeding, crops with enhanced resistance to drought, heat, and pests have been developed. For example, drought-tolerant rice and pest-resistant cotton offer stable yields in harsh conditions, reducing the risks faced by smallholder farmers. Biofortification has added nutritional value to staple crops, such as vitamin A-enriched rice and iron-rich millets, directly addressing malnutrition in rural communities. These innovations help alleviate "hidden hunger" and improve overall health in marginalized populations. The integration of artificial intelligence (AI) and precision agriculture further enhances the efficiency of farming practices. AI-driven tools analyze real-time data from satellites, sensors, and weather forecasts to optimize irrigation, pest management, and fertilizer use. This reduces costs, minimizes environmental impacts, and improves yields. Simultaneously, sustainable practices like agroforestry, crop rotation, and intercropping enrich soil health, conserve biodiversity, and create environmentally sound farming models. Economic diversification is another significant impact of plant science innovations. Farmers are encouraged to cultivate high-value crops like medicinal plants, bioenergy crops, and fruits, ensuring stable incomes. Policymakers and researchers play a critical role in bridging gaps by making these technologies affordable and accessible through education, subsidies, and training programs. By integrating modern tools with traditional knowledge, plant science innovations are reshaping agriculture in India. These efforts are key to

achieving sustainable food systems, improving rural economies, and addressing global challenges like poverty and hunger.

Identification of phytoconstituents and in-vitro evaluation of antimicrobial effect of methanolic leaf extract of *Polyalthiasuberosa*

Prachita Das¹, Sasmita Mohanty^{1*}

¹Department of Biotechnology, Rama Devi women's University, Bhubaneswar

*Email: prachitadas@gmail.com , sasmita.mohanty@rdwu.ac.in

Polyalthiasuberosa (Roxb.) Thwaites is a wild edible plant of Annonaceae family traditionally used for treating a number of diseases including coughs, colds and diarrhea. The present study was conducted to investigate the presence of phytoconstituents with the objective of identifying major active compounds, by employing Ultraviolet- Visible (UV-Vis) spectra, Fourier Transform infrared spectroscopy (FTIR) and Gas chromatography Mass spectrometry (GC-MS) from the methanolic leaf extract of *P. suberosa*. The preliminary phytochemical screening on the methanolic leaf extract of *P. suberosa* revealed the presence of alkaloids, flavonoids, carbohydrates, protein, saponin, glycosides, steroid and quinone. The FTIR characterization studies indicated the presence of alkanes, alkynes, alkenes, alcohol, alkyl halides, carboxylic acid, aromatic compounds, nitrocompounds and esters based on peak value in the vicinity of infrared radiation. The GC-MS analysis of the methanolic leaf extract of *P. suberosa* identified the presence of 77 compounds. Out of all the detected compounds, 12-Octadecadienoic acid (Z, Z)-, methyl ester, 9-Octadecenoic acid, methyl ester, (E) - and Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester were identified as the major compounds with 21.48%, 14.17% and 8.22% based on their area percentage, respectively. The agar well diffusion assay was employed to determine the antibacterial effect against two Gram-positive (*Bacillus subtilis* and *Staphylococcus aureus*) and three Gram-negative (*Escherichia Coli*, *Pseudomonas aeruginosa* and *Salmonella typhi*) bacterial strains using four different concentrations (100, 50, 25, 12.5 mg/ml) of methanolic leaf extract of *P. suberosa*. A moderate antibacterial activity was observed against the three tested bacterial strains (*Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Salmonella typhi*) by providing an effective zone of inhibition at the concentration of 12.5 mg/ml of the methanolic leaf extract of *P. suberosa*. Whereas the extent of inhibition against *Staphylococcus aureus* was highest, *E. coli* responded the least to the methanolic leaf extract of the plant.

Based on these preliminary findings we conclude that the extract derived from *P. suberosa* leaf contains a number of vital phytochemicals in different percentage compositions and possess a significant efficacy in inhibiting the proliferation of pathogenic bacteria which assures further biological and pharmacological studies. Further investigation is under process for identification of bioactive compounds in leaf and nutritional quality in the fruits of *P. suberosa*.

Medicinal carnivorous plant: A source of future drugs

Pragati Das*, Dr. Rajashree Das

P.G Department of Botany, Fakir Mohan University, Balasore, Odisha,

Email: pragatiprateekdas72@gmail.com

Nature is the hub of mysterious plants throughout the world. Among them, carnivorous plants are available in most of the part of the world. Carnivorous plants are the plants which get nutrients from trapping and eating of their prey (insects, mosquito larvae, tadpole, protozoa, rotifer, water fleas, nematodes, small fish etc.). With unique carnivory nature it contains some significant secondary metabolites like terpenoids which properly make it medicinally valuable. The ethnic communities are using them as medicinal agents but less claims are documented. Ethno medicinal uses of the plants were first extracted from the relevant literature and also through Passport Data Form (PDF), a semistructured questionnaire with local communities, vaidyas & healers. Likewise, according to Asirvatham and Christina (2012) *D. burmannii*, *D. indica* and *D. peltata* used as vital components in an Ayurvedic preparation called Swarnabhasma (Golden ash). This golden ash has been used against loss of memory, defective eye sight, infertility, body weakness, incidence of early aging, asthma, rheumatoid arthritis, diabetes mellitus, nervous disorder etc. Haron and Chew (2012) reported about the medicinal uses of some *Utricularia* species that is *U. caerulea* and *U. bifida*, used to dress wounds and treat urinary diseases. Egan and Kooy in the year of 2013 reported the secondary metabolites in *Drosera* are active against toothache and stomach ulcer like diseases. Insectivorous plants have been found to be rich in secondary metabolites which are very much useful in the treatment of cancer (Syed and Sai 2018). About 18 species of medicinal carnivorous plants were enumerated which belongs to two genera (*Utricularia* and *Drosera*), along with medicinal value. So; this value brings attention towards its conservation and proper utilization.

Biochemical characterization of selected subaerial algae sourced from Similipal Biosphere Reserve, Odisha

Prajna Paramita Bhuyan¹, Bishnupriya Hansdah¹ and Akshaya Kumar Bastia²

¹Department of Botany, Maharaja Sriram Chandra Bhanja Deo University, Baripada-757003, India

²Department of Applied Microbiology, Fakir Mohan University, Balasore-756089, Odisha

Email: praj nabhuyan2017@gmail.com

The searching for sustainable sources of food and food products has become more important in light of recent rising in global population. Green microalgae and cyanobacteria are the two potentially useful organisms to mitigate the future global demands by their products and services. Certain microalgal species i.e. *Chlorella*, *Dunaliella*, *Spirulina* and *Scenedesmus* are regarded as high-protein resources and their biomass can be utilised in diets because of high protein content. The Similipal Biosphere Reserve, situated in the northern part of Odisha, is a repository of diverse microalgae like cyanobacteria

have immense importance for the welfare of the mankind. Keeping this in view, the present study was carried out on the growth response and biochemical composition of some selected algal isolates collected from different places of Similipal Biosphere Reserve that occur predominantly in the sub-aerial habitats. The cultures were grown on the continuous light of 7.5 W/m² at 26±1 °C and were harvested at 5-days interval. The result showed that growth rate, pigment composition and macromolecular contents of test organisms increased with increase in the incubation periods. The green microalga *Desmodesmus subspicatus* displayed maximum growth and pigment content on 20th day culture followed by *Nostoc entophytum* and *Leptolyngbya foveolarum* among all the test species. However, *Nostoc entophytum* showed maximum carbohydrate content on 20th day culture followed by *Desmodesmus subspicatus* and *Leptolyngbya foveolarum*. Additionally, the cell protein content was observed maximum in *Desmodesmus subspicatus* followed by *Nostoc entophytum* and *Leptolyngbya foveolarum* in comparison to others on the 20th day culture. The preliminary screening of these promising species on growth and primary metabolite productions pave the way to exploit their potential on other areas of technological importance. This conclusion leads to think of optimization of cultural and nutritional conditions of selected subaerial algae for their maximum growth and compound accumulation.

Role of Plant growth promoting microbes for sustainable agriculture

Pranab Behera¹ & Ranindra Kumar Nayak²

¹Department of Botany, Fakir Mohan University, Balasore, Odisha

²Department of Environmental Sciences, Fakir Mohan University, Balasore, Odisha

Email Id- ranindra1968@gmail.com, pranabrinku1986@gmail.com

With increasing population and depleting natural resources there is a need for increasing agricultural productivity in sustainable and ecofriendly manner. The conventional agricultural practices demands a lot of chemical fertilizers for increasing the productivity that poses a threat to agro-ecosystems like food chain contamination, soil quality degradation, water pollution etc. Growing demands for crop and food production have led to a keen interest and requirement towards the usage of biofertilizers not only to improve productivity but also for preserving soil quality and health of the environment as well as that of living beings. To overcome all these problems, there is need to shift towards sustainable agricultural practices like application of Plant Growth Promoting Microbes instead of traditional practices. Biofertilizers comprise of different microorganisms like genera of bacteria, fungi, blue green algae (cyanobacteria), algae as well as their metabolites to be used as fertilizers. These microbes live in soil and are associated with rhizospheric region of plants, where they stimulate growth and productivity of their hosts by different direct and indirect mechanisms e.g. by phytohormones, siderophores, solubilization of minerals, immune intonation, signal transduction and pest control etc. Microbes used to make available soil nutrient to crops without compromising with the soil fertility in environmentally sustainable manner. Various studies have shown positive effects of microbes on growth and yield of various crops in different climatic conditions, soil types also under biotic and abiotic stress conditions. Further, these microbes have also been used successfully as bio-control agents for various pathogens in the plant. Further, application of

controlled or slow release fertilizers or biofertilizers inhibits increased N₂O emissions that ultimately contribute towards air pollution and global warming.

Study of aromatic medicinal plants in Birajakshetra, Jajpur district, Odisha

Priti Priyadarsini Puhan¹ and Satikanta Sahoo²

P.G. Dept. of Botany, N.C. (Autonomous) College, Jajpur, Odisha- 755 001

Email: prutipriyadarsinipuhan30@gmail.com

The present study deals with the survey and documentation of aromatic medicinal plants in Birajakshetra of Jajpur district in Odisha. A survey was carried out during the period of 2023 to collect the aromatic medicinal plant species. The plants were identified by using Flora book. The local people were approached to collect the local name of these plants. Herbarium were prepared by standard method and deposited in P.G. Department of Botany, N.C. Autonomous College, Jajpur. The study reveals that a total number of 25 plant species belongs to 23 genera and 15 families are distributed in the study area. Among them dicot comprises 22 and monocot 03. Different life forms diversity are herbs (08), shrubs (06) and trees (11) of the total flora. These plants facilitate the local people by providing different types of flowers, fruits, seeds, roots, leaves and bark for medicinal use and other purposes. Further it aids to the beauty of that area by providing a special aesthetic look and pleasure. Hence the conservation of these plants is very urgent.

Characterization of Indigenous Phytochemicals for Cell Cycle Arrest in Cultured Glioma Cells

Priya Ranjan Debata^{1}, Sunitee Hansdah¹, Shubhasmita Mohapatra¹, and Anil Kumar Biswal²*

¹P. G. Dept. of Zoology, Maharaja Sriram Chandra Bhanja Deo University, Takatpur, Baripada

²P. G. Department of Botany, Adjunct Professor, Fakir Mohan University, Balasore, Odisha-756089.

*E.mail: prdebata@gmail.com

Gliomas remain among the most aggressive and treatment-resistant forms of cancer, necessitating the exploration of alternative therapeutic strategies. This study investigates the anticancer potential of sixty indigenous medicinal plants, traditionally used in Odisha, against cultured glioma cells. Cytotoxicity and mechanisms of action were evaluated using MTT assays, flow cytometry, and immunocytochemistry. Bioassay-guided fractionation and HR-LCMS analysis identified bioactive compounds from three promising plants: *Vitex negundo*, *Nerium oleander*, and *Plumbago zeylanica*. These compounds demonstrated potent anticancer effects, inducing cell cycle arrest at key checkpoints and activating intrinsic apoptotic pathways. Mechanistically, they were observed to upregulate pro-apoptotic proteins like Bax while suppressing anti-apoptotic proteins such as Bcl-2. Molecular docking studies further corroborated their high binding affinities to cancer-specific molecular targets, supporting their potential as therapeutic agents.

The present study reveals the untapped potential of indigenous phytochemicals useful for glioma treatment and can be adopted for further preclinical and clinical exploration. Moreover, it emphasises on the importance of harnessing biodiversity for developing novel cancer therapeutics.

Diversity of Corticolous Lichens in Kalahandi District of Odisha in Relation to Phorophytes and Habitat Fragmentation

Ramakanta Mishra¹ and Kunja Bihari Satapathy²

¹Department of Botany, Nimapara Autonomous college, Nimapara, Puri-752106, Odisha

²P.G. Department of Botany, Centurion University of Technology and Management, Bhubaneswar

Email: munarama90@gmail.com

Kalahandi one of the thirty districts of Odisha geographically covers an area of 7920 sq. km. lies in between 19°.17'489" to 20°.45' 517" North Latitude and 82°.61'767" to 83°.79' 874" East Longitude. The district occupies the South Western portion of Odisha, bordered to the North by the Balangir district and Nuapada district, to the South by the Nabarangpur district, Koraput district and Rayagada district, and to the East by the Rayagada, Kandhamal district and Boudhdistrict. A transect along the best-preserved hill of the forest was delineated in order to make an inventory and gain a better understanding of the diversity of corticolous lichens on the tree layers of the various environments in Kalahandi district, in which 100 m² squared plots were delimited every 25 m and with different orientations on the slope. Lichen coverage was estimated among trees that had a Diameter at Breast Height (DBH) higher than 30 cm, on the orientation with the greatest lichen coverage. A non-quantitative and opportunistic sampling was conducted, among the same phorophytes. Principal component analysis was used for the examination of the data. The Shannon diversity index was calculated for each orientation on the slope. Both the circular distribution approach and the species indicator analysis were used. The findings show that within every 100 m² square plot, on an average there were 54 individuals of the various phorophyte taxa, which is home to 150 lichen species: 60 (40%) correspond to foliose lichens, 86 (57.33%) to crustose lichens, 2 (1.33%) to fruticose lichens and 2 (1.33%) to dimorphic lichen thalli. Among the different families Graphidaceae is the largest family represented by 45 species followed by Parmeliaceae with 22, Physciaceae with 15, Teloschistaceae with 13 species respectively. The lichen genus *Graphis* with 27 species dominates the district followed by *Parmotrema* (13), *Caloplaca* (7), and *Pyxine* (4) species each. The plant genus *Shorea* and *Mangifera* dominate the tropical dry deciduous forest despite its heterogeneity, which is advantageous to the lichen community despite its susceptibility to changes in the forest structure, the available substratum, and its dispersal capacity. The present data on lichens from the district will be useful for future bio-monitoring studies especially in the areas with high anthropogenic disturbances and also be very much useful to know the status of lichen diversity in Odisha.

Application of Artificial Intelligence and Machine Learning in Plant Research

Priyadarsini Dash

P.G. Department of Botany, Dhenkanal Autonomous College, Dhenkanal, Odisha Pincode -759001

Email: dashbaisakhi2@gmail.com

Artificial Intelligence (AI) and Machine Learning (ML) are revolutionizing plant research, offering innovative solutions to complex challenges in agriculture, ecology, and biotechnology. By leveraging vast

datasets and predictive algorithms, AI and ML enable precise analysis, modeling, and decision-making, which were previously unattainable with traditional methods.

Key applications include:

1. Crop Yield Prediction: AI models analyze weather, soil, and crop data to predict yields, allowing farmers to optimize resource use and enhance productivity.
2. Pest and Disease Management: ML-based image recognition systems identify plant diseases and pests in real time, enabling timely intervention.
3. Plant Phenotyping: Automated phenotyping platforms powered by AI assess plant traits with high accuracy, accelerating breeding programs.
4. Genomic Insights: AI aids in genome sequencing and annotation, identifying genes linked to stress tolerance, disease resistance, and improved growth.
5. Climate Adaptation: Predictive models assess the impact of climate change on plant growth, guiding the development of resilient crop varieties.

Emerging tools, such as deep learning and neural networks, further enhance the ability to process complex biological data, bridging the gap between traditional plantscience and cutting-edge technology. Despite its potential, challenges such as data quality, algorithm bias, and ethical considerations need to be addressed for broader implementation.

This explores the transformative role of AI and ML in plant research, highlighting case studies and future prospects that aim to ensure global food security and sustainable agriculture.

In conclusion, AI and ML are transformative tools in plant research, offering unprecedented opportunities to address global challenges in agriculture and environmental sustainability. By advancing understanding of plant systems and enabling precise interventions, these technologies pave the way for resilient food systems and a sustainable future. Continued interdisciplinary collaboration between plant scientists, data scientists, and policymakers is essential to harness the full potential of AI and ML in this field.

Ethnomedicinal plants and their uses against gastrointestinal disorders in Balasore district of Odisha, India

Ranjitabala Mohapatra¹ and Kunja Bihari Satapathy^{2}*

¹Srinibas Higher Secondary School, Mangalpur, Soro, Balasore, Odisha, India.

^{2*} School of Applied Sciences, Centurion University of Technology & Management, Bhubaneswar

*Email: kbsbot@rediffmail.com

Balasore (latitude 21°3'–21°59' N, longitude 86°20'–87°29' E) is an administrative district which is located in the northern most coastal part of Odisha state, in Eastern India. It is bordered on the North by the Midnapore district of West Bengal, on the East by the Bay of Bengal, on the South by Bhadrak district, and the West by Mayurbhanj and Keonjhardistricts. The district is inhabited by numerous ethnic, linguistic, religious groups, and indigenous tribes such as Santal, Bhumij, Oraon, etc. It is blessed with a good climate, alluvial soil, and perennial rivers that favour rich floral diversity in this region. Intensive seasonal field trips were conducted in the inner pockets of 12 blocks in the Balasore district of Odisha from June 2018 to May

2021. Through semi-structured interviews and discussions, information about the ethnomedicinal uses of a number of plant species against gastrointestinal diseases was gathered. A total of 32 ethnomedicinally potent plant species belonging to 16 families were documented in the study area which was used to treat gastrointestinal disorders. Some of the widely used potential ethnomedicinal plant species are *Cassia fistula* (Fresh bark: dysentery), *Curculigo orchioides* (Root powder: diarrhoea), *Dillenia pentagyna* (Root paste: dysentery), *Ficus benghalensis* (Adventitious root powder: piles), *Holarrhena pubescens* (Fresh bark juice: stomach ache & dysentery), *Kalanchoe pinnata* (Freshly leaf juice: dysentery), *Lagenaria siceraria*. (Immature cooked fruits: constipation), *Litsea glutinosa* (Fresh leaf juice: dysentery & diarrhoea), *Maranta arundinacea* (Rhizome extract: blood dysentery), *Mimusops elengi* (fruit juice with 2 ml honey: diarrhoea in babies), *Murrayakoengii* (Fresh leaf juice: severe acidity), *Oxalis corniculata* (Fresh leaf juice: vomiting and diarrhoea), *Phoenix sylvestris* (Milk of stem: gastritis), *Plectranthus barbatus* (fresh leaf juice: diarrhoea in children), *Rotula aquatica* (Plant decoction: diarrhoea), *Sida cordata* (Leaf juice: dysentery), *Terminalia arjuna* (Bark decoction: dysentery). It is interesting to note that local inhabitants including tribals in the study area possess a good amount of knowledge on medicinal plants. Exploration and documentation of native ethnomedicinal plants would open up new horizons for popularizing their wider consumption by the indigenous people, thereby promoting good health. Further research on a greater scale is required to reveal their potential as the future medicines.

Algal diversity evaluation of Bhitarkanika: A comparative study of pre and post monsoon Phycodiversity

Reshma Rani Dash¹, Dr. Binata Naik² and Dr. Sangeeta Mishra³

Algal Biotechnology, Department of BT and BI

Email: reshmaranii.dash@gmail.com

Phycodiversity is important for maintaining healthy aquatic ecosystems, as algae are primary producers, providing food and oxygen, stabilizing sediments, and supporting biodiversity. Although numerous studies have investigated algal biodiversity in various river systems and coastal regions of Odisha, a comprehensive assessment of phycodiversity in the Bhitarkanika region of tropical eastern India remained to be explored further. The recent study encompasses the phycodiversity assessment of the Bhitarkanika area, which has been conducted up to the species level, leading to the identification of algal species. The elucidate genetic diversity, meta-genomics study was performed on pre- and post- monsoon samples. Bhitarkanika (86°-45"-87°17"E and 20°-47"N) region is a coastal wetland found in tropical regions in Kendrapada district of Odisha, which is a complex ecosystem and is rich in marine algal distribution. The phyco diversity showed their diversification with respect to environmental condition. In the present investigation, 8 different algae (*Spirogyra*, *Phormidium*, *Lyngbya*, *Scytonema*, *Oscillatoria*, Green algae, *Nostoc* and *Diatoms*) has been found from pre monsoon samples whereas 12 types of algae (*Ulothrix*, *Nostoc*, *Anabaena*, *Phormidium*, *Spirogyra*, *Coscinodisus*, *Lyngbya*, *Chlorella*, *Amphora*, *Cymbella*, *Navicula* and *Diatoms*) has been found from the Post monsoon samples collected from Satbhaya, Gupti and Kanika region. From the meta genomic study, it has been found that the DNA bands of sample no. 5 and 10 shows

similarities in their bending patterns in PrM and PM whereas the banding patterns of other samples are comparatively different. It shows that the algal flora of pre-monsoon and post monsoon are different, this may be due to the changes in environmental factors like Salinity, temperature, pH, availability of dissolved solutes, suspended particles, mineral concentration. The wet & dry moisture content also showed seasonality in their variation with respect to the habitat. There is great magnitude of variation was found in seaweed abundance and distribution with space and time. An attempt was made to explain the relationship between the environmental factors and diversity of Algae.

Effect of artificial ripening of banana using calcium carbide and their nutritional quality

Rupali Tripathy, Biswajit Patra

P.G. Department of Botany, Fakir Mohan University, Odisha

Email: patrabiswajit090@gmail.com

Artificial ripening of bananas using calcium carbide is a common practice in many regions, but it raises concerns regarding safety and nutritional quality. Calcium carbide accelerates the ripening process by releasing acetylene gas when it comes into contact with moisture. This hastens the transformation from green to ripe bananas, making them available for sale more quickly. It can help achieve a more uniform ripening process, which is beneficial for commercial purposes. Bananas treated with calcium carbide may exhibit altered texture and color. They may become softer and develop an uneven color compared to naturally ripened fruit. The primary nutrients in bananas—such as carbohydrates, vitamins (like vitamin C and B6), and minerals (such as potassium)—are generally not significantly affected by the use of calcium carbide. However, some studies suggest that the artificial ripening process might influence the levels of certain phytonutrients. Calcium carbide can contain impurities, including arsenic and phosphorus, which may pose health risks if consumed in significant amounts. Regular consumption of artificially ripened bananas may lead to the accumulation of these harmful substances in the body. Bananas ripened naturally tend to have a better flavor profile and sweetness compared to those artificially ripened, which may affect consumer preference. The use of calcium carbide is banned in several countries due to potential health risks, including respiratory issues, skin irritation, and long-term carcinogenic effects. Many health organizations recommend avoiding calcium carbide-treated fruits and instead promoting natural ripening methods to ensure safety and quality. While calcium carbide effectively accelerates banana ripening, its potential health risks and impacts on quality make natural ripening methods preferable. In this study, naturally ripening banana are compared with calcium carbide treated banana and their nutritional quality.

Designing future crops for sustainable agriculture

Rutuparna Barik

P.G. Department of Botany, Dhenkanal Autonomous College, Dhenkanal, Odisha, Pin code-759001

Email: rituparnabarik656@gmail.com

Agricultural environments are continuously threatened by a booming world population, a shortage of arable land, and rapid changes in climate. To ensure food and ecosystem security, there is a need to design future crops for sustainable agriculture development by maximizing net production and minimalizing undesirable effects on the environment. Designing future crops for sustainable agriculture requires maximizing net production, minimizing environment impacts improving current crop, domesticating wild species, redomesticating cultivated crops, improving nutritional quality, increasing agricultural resource use efficiency, improving biotic and abiotic stress tolerance. For example by using Hybrid Breeding, increase the yield of Maize, Canola and Soybean increase the tolerance capacity by GMOs. The goal is to create future crops that can; meet food demand, be climate resilient, to use resources efficiently, to improve nutritional quality and support the circular bio-economy. In this perspective first introduce the background and missions of these projects then outline strategies to design future crops and further discuss how these ambitious goals can be achieved by the recent developments. Finally, we summarize related opportunities and challenges in these projects.

Some ethno- medicinal plants for the treatment of common health problems in Mayurbhanj district

Rupamanjari Behera

Faculty, P.G Dept. of Botany, Mayurbhanj College of Accountancy & Management Baripada- 757003, Odisha

Email: mcambpd@gmail.com

Mayurbhanj, one of Odisha's major districts, has the highest concentration of tribal communities. It is also known for its lush vegetation and the Similipal Tiger Reserve. Santal, Kol, Bhumij, Bhuyan, Gond, Lodha, and Mankidia make up the majority of the tribal population. Most indigenous people rely on the forest and its products for their fundamental needs and livelihood. Ethnomedicinal studies done in various communities of Mayurbhanj District have resulted in recording of numerous traditional uses of locally available plant resources. Our study focuses on the ethnobotanical perception of 50 plant species from 30 families of medicinal plants used by the tribals of Mayurbhanj District, primarily from the Fabaceae, Rutaceae, and Verbenaceae families, including some well-known species such as *Atylosia scarabaeoides* (L.) Benth., *Bombax ceiba* L., and *Clausena excavate* Burm.f. Healthcare facilities are generally inaccessible to the district's other interior areas, where people rely on medicinal plants for primary treatment. Cough, cold, diarrhea, malaria, gynecological disorders, anemia, goiter, and sexual debility are some of the most prevalent ailments treated with this herb.

Biochemical analysis of *Terminalia arjuna* (Roxb. Ex DC.) Wight & Arn. with reference to wild and cultivated condition.

S. Murmu, N. Mandal, B.P.Hansdah.

Department of Botany, MSCB University, Baripada

Email: linknamita@yahoo.co.in*, bhansdah2020@gmail.com, swatimurmu2000@gmail.com

Terminalia arjuna (Roxb. Ex DC.) Wight & Arn. Commonly known as Arjun in India. It is an evergreen tree. It belongs to the family Combretaceae. It is an ayurvedic plant with important medicinal value. It comprises nearly 200 species distributed around the World. Nearly 24 species of *Terminalia* have been reported from various parts of India. *T. arjuna* is about 60- 80 feet in height, with a buttressed trunk and horizontally spreading crown and dropping branches. Biochemical analysis is a branch of science that deals with the study of chemical processes within and relating to living organisms. It involves the analysis of biological samples to understand their composition, structure and function at the molecular level. The Arjun plant's diverse biochemical characteristics make it valuable tool in sericulture. The cultivation of silk through the rearing of silkworms and the production of silk cocoons is called sericulture. According to studies, Arjun extracts contain antibacterial, anti- inflammatory and antioxidant qualities that can aid in the fight against a variety of illness and pests that have an impact on the silk industry. The plant's extracts also have anti-stress qualities that can help silkworms by lowering stress-related mortality and enhancing general health. Chemical analysis Arjun leaves have been conducted, elucidating their moisture content, nitrogen levels, crude protein, crude fiber and total mineral composition. Tasar silk production is largely dependent on the connection between the insect and the host plant. About one third of the overall forest cover of Odisha is covered by tasar food plants, making up around 30% of the area. Also, there are 12,000 hectares of block plantations covering *Terminalia arjuna*. 12,000 families are actively engaged in tasar culture in tribal belts of Odisha, including tribal dominated districts of Mayurbhanj, Keonjhar, Sundergarh, Kandhamal, Rayagada, Koraput, Gajapati, Kalahandi, Nabarangpur, Jajpur, Deogarh and Dhenkanal. Tasar culture is a traditional practice of local tribes in Mayurbhanj district of Odisha. The Arjun plant is leveled and 45cm by 45 cm by 45 cm trenches are dug 6 meters apart from one another. As a base dosage, around 10kg FYM (Farm Yard Manure) and 75:50:30 kg of NPK (Nitrogen, phosphorous and potassium) are applied to each pit and well mixed with soil. In present study it is tried to evaluate the different biochemicals such as proteins, carbohydrates, chlorophyll contents including moisture contents of Arjun leaves in the three regions of Mayurbhanjdistrict (Baripada, Bangriposi and Bisoi) in both cultivated and wild varieties of Arjun. The leaf samples of Arjun plant were collected from both wild and cultivated conditions. Estimation of moisture content, total chlorophyll, total soluble protein, total sugar content of Arjun leaf was done by different biochemical estimation procedures. Our results revealed significant differences in the biochemical compositions of *Terminalia arjuna* leaves between wild and cultivated populations. Specifically, cultivated plants exhibited higher levels of certain Phytochemicals compared to their wild counterparts, possibly due to environmental factors and cultivation practices.

Urban greening with avenue trees along the roadside: an approach for air-pollution management in developing countries

S.S. Ram

Department of Botany, Dhenkanal Mahila Mahavidyalaya, Dhenkanal, Odisha

Email: ssrmmv@gmail.com

Canopies of urban vegetation are efficient absorbers of re-suspended dust. Plant leaves can capture dust on both the surfaces but more on the upper surface. Deposition of air-borne or re-suspended dust on the leaf surfaces is a snowballing process which starts fresh once the rain washes out the dusts from the leaves. This is supported by the observation of approximately 10 fold difference between the winter and monsoon maxima for dust load. The inter species variations in dust interception efficiency of plants is attributed to the differences in morphological structure. Leaf surface characters like presence of trichomes, stomata and surface roughness help in capturing dust particulates. Moreover, plant canopy shapes also account for differences in dust interception potential of plants. Such observations point towards the need for suitable species selection while considering urban greening with an aim to reduce the pollution load.

Sustainability of Plant Biodiversity and Restoration of Microbial Flora through Organic Farming-A case study

Sabita Rani Mishra¹ and Arun K. Rath²

¹ P. G. Department of Botany, Rajdhani College, Bhubaneswar-751 003, Odisha, India.

² Department of Botany, Sri Jayadev College of Education and Technology, Naharkanta, Bhubaneswar

E mail: arunk_rath@yahoo.co.in

Organic farming (OF) is a farming system that uses eco-friendly methods of weed, pest and disease control and management. OF offers an alternative to more widespread, high input farming practices that use synthetic fertilizers, fungicides and pesticides. It is based on the idea that the soil is a living system so these synthetic products are largely excluded from organic farms. Organic agriculture relies on crop rotation, animal manures, crop residues, green manures and the biological control of pests and diseases to maintain soil health and productivity. Organic crops are often of higher value than conventional ones and the volume of organic crops shows a continually increasing production trend. The sale of crops labeled as organic or biological is highly regulated in most advanced markets. The environmental impact of organic farming is low and can be seen as a way of cleaning up and improving degraded agricultural land.

To increase the profitability of marginal farmers, possibility of growing horticultural and agricultural crops are being evaluated at Kadambasole village of block Betnoti, Mayurbhanj, Odisha. The horticultural crops like sweet corn, watermelon, Zucchini (summer squash), pumpkin, and brinjal were cultivated with and without addition of organic manures like FYM, neem cake, mahua cake, azolla etc. Biopesticides, neem based pesticides, yellow card and pheromone traps were implemented to control the pests and diseases. The different biochemical and agronomic parameters were studied to check the productivity and quality of

yield. The result indicated that organic products were less perishable with long duration of field residence period as compared to inorganic products. Moreover, initial evidence indicates that organic agricultural systems deliver greater ecosystem services and social benefits. The microbial population as well as earthworm populations was significantly increased. Although organic agriculture has an untapped role to play when it comes to the establishment of sustainable farming systems, no single approach will safely feed the planet. Rather, a blend of organic and other innovative farming systems is needed. Significant barriers exist to adopting these systems, however, and a diversity of policy instruments will be required to facilitate their development and implementation.

Seasonal variation of dust deposition on plant leaves and its effect on morphological and physiological changes of plants

Sabitri Marndi¹, Biswajit Patra²

P.G. Department of Botany, Fakir Mohan University, Odisha

Email: patrabiswajit090@gmail.com

The seasonal variation of dust deposition on plant leaves can significantly affect both morphological and physiological changes in plants. Dust can originate from natural sources (like deserts and dry regions) and anthropogenic activities (like construction, agriculture, and traffic). The amount and composition of dust can vary seasonally due to factors like weather patterns, vegetation cover, and human activity. Higher levels of dust may be observed due to dry, windy conditions. This can lead to increased deposition on plant leaves. Dust levels may decrease with precipitation and vegetation cover. However, seasonal dry spells can still lead to intermittent dust events. Dust accumulation can alter the surface structure of leaves. This may lead to changes in leaf thickness, size, and overall morphology as plants adapt to increased dust load. Thick layers of dust can obstruct light penetration, potentially reducing the effective photosynthetic area of leaves. This can lead to changes in leaf shape and size over time as plants adapt to maximize light capture. Dust may influence stomatal density and conductance. Increased dust can clog stomata, leading to reduced gas exchange and affecting overall plant health. Dust can decrease photosynthetic efficiency by blocking light. Reduced photosynthesis can lead to stunted growth and lower biomass accumulation. Dust may affect transpiration rates by influencing stomatal behaviour. This can alter the plant's water use efficiency and overall metabolism. Dust can carry nutrients, but excessive deposition might lead to nutrient imbalances or toxicity. This can affect plant health and growth rates. Dust accumulation can lead to oxidative stress in plants, triggering defense mechanisms. This may include the production of secondary metabolites, which can have ecological implications. Understanding the seasonal variation of dust deposition and its impact on plant morphology and physiology is crucial for predicting plant responses to environmental stressors. This knowledge can inform agricultural practices and conservation efforts, especially in areas prone to high dust levels. Effective management strategies could include selecting dust-resistant plant species and implementing practices to reduce dust generation in agricultural settings.

A review on medicinal properties and nutritive value of *Moringa oleifera* Lam. Flowers

**Sagarika Priyadarshini, Arpita Banarjee*

P.G Department of botany, Fakir Mohan University, Balasore

Email: priyadarshinisagarika2000@gmail.com

Moringa oleifera Lam. belongs to family *Moringaceae*, commonly known as drumstick tree, rich in nutrients, amino acids, antioxidants and anti inflammatory properties. Every part of the tree can be used for herbal medicines and in several delicacies. Their flowers have a great nutritional value as these are rich in vitamins, minerals, essential amino acids and bioactive compounds like flavonoids and phenolics. The flowers are also rich in phytosterols like stigmasterol, sitosterol and kampesterol which act as the precursor for reproductive growth hormones which increase the oestrogen production and stimulates mammary gland duct to produce milk. They are widely used in treatment of asthma, catarrh, chest congestion, cholera, conjunctivitis, cough, diarrhoea, eye and ear infections, fever, headache etc. from ancient time. These flowers are also used in preparation of indigenous medicines to treat inflammation and infection as well as cardiovascular, gastrointestinal, haematological and hepato protective disorders. Due to presence of quercetin which is a well-known flavonoid with hepato protective activity, aqueous and alcohol extract of moringa flowers found to have a significant hepato protective effect. These flowers have so many medicinal properties that these are widely consumed as primary medicine for several diseases like diabetes, hypertension, or HIV/AIDS. By eating these flower cooked with green mango, it reduces summer heat and nutrient deficiency in body and also by consuming this flower several problems can be solved in both rural and urban area. Additionally these are also used as the substitute for imported foods for treatment of malnutrition especially in infants and lactating mothers as they have high protein and essential nutrient content. Medicinal properties and nutritive value of *Moringa oleifera* flowers highlight the bioactive compounds, antioxidant potential and their therapeutic applications.

Desiccation tolerant Pteridophytes of Odisha: Imperative resources in developing strategies to drought and desiccation pressure

¹*Sailaja Nandan Ray*, ²*Prasad Kumar Dash*, ¹*Subhani Rath*

¹Maharaja Sriram Chandra Bhanjadeo University, Baripada, Odisha- 757003

²Odisha Biodiversity Board, Forest, Environment & Climate Change Department, Govt. of Odisha, Bhubaneswar-751015, Odisha, India

E-mail: raysailajanandan@gmail.com, prasad.dash2008@gmail.com, subhani.rath@gmail.com

The recent climate change scenario depicts an increased aridity in many areas of the globe, posing serious threats to livelihood security. Globally, both drought and high temperature together emerged as the most important environmental constraint to plant survival and crop productivity. Desiccation Tolerance (DT) is the ability of an organism to equilibrate its internal water potential with that of moderately dry air, and then resume normal function after rehydration. Some bryophytes, ferns, lycophytes and angiosperms

growing in seasonally dry and semi-arid habitats have evolved the mechanism of desiccation-tolerance by which plants can tolerate a loss of 80–95 per cent of their relative water content and resurrect back. Around 330 species of DT/Resurrection plants (RP) under nine pteridophyte and ten angiosperm families have been reported to occur so far. In the context of plant evolution, pteridophytes, comprising of lycophytes and ferns, inhabit an intermediate position between bryophytes and seed plants. They occupied a wide range of habitats that can withstand extreme climatic conditions and various stresses. There is a significant number of pteridophytes that can tolerate desiccation by temporarily arresting their metabolism in the dry state and reactivating it upon rehydration. DT in pteridophytes is an important ecological and physiological trait that allows these plants to survive in environments with intermittent water availability. Their ability to survive extreme dehydration is due to a combination of biochemical, molecular, and structural adaptations that help prevent cellular damage and allow them to rehydrate and resume normal functions when water is available again. Thus, in the current scenario of climate change, identification of DT plants in general and pteridophytes in particular is of vital importance whose gene can be transferred in to food crops for developing drought/stress tolerant crop varieties. During the inventory of Pteridophytic flora, approx. 170 species have been documented from Odisha from different agroclimatic zones. After the comprehensive study on leaf morphology species like *Adiantum caudatum*, *Adiantum incisum*, *Asplenium yoshinagae* subsp. *indicum*, *Hemionitis albormarginata*, *Hemionitis anceps*, *Drynaria quercifolia*, *Trichomanes minutum*, *Hymenophyllum exsertum*, *Selaginella bryopteris* have been identified as the most promising DT/RT plants which can withstand maximum drought and desiccation pressure.

Traditional knowledge on anti-venom plants used by the tribal of Koraput, Odisha

Sameer Jena¹, Sudhansu Sekhar Dash² and Gyanranjan Mahalik^{1*}

¹Department of Botany, School of Applied Sciences, Centurion University of Technology and Management, Odisha - 752050, India

²Head Quarter, Botanical Survey of India, CGO Complex, Salt Lake City, Kolkata, West Bengal - 700064, India

Email: gyanranjan.mahalik@cutm.ac.in

The traditional knowledge of anti-venom plants used by tribal groups in the Koraput area of Odisha is documented in this ethnobotanical study. 125 tribal practitioners and traditional healers participated in the study, conducted in 30 villages using field surveys, semi-structured interviews, and focused group discussions. The study identified 45 plant species from 17 families that are used to cure scorpion stings and snake bites. Botanical names, local names, parts used, preparation technique, and administration mode are all included in the comprehensive paperwork. Fabaceae became the dominant family with 8 species, followed by Asteraceae (5 species) and Apocynaceae (4 species). Roots were the most commonly used plant portion (35%), followed by leaves (28%) and entire plants (15%). According to the study, 40% of the treatments were applied topically at the bite site, while 60% were given orally. High-use value indices were demonstrated by notable species such as *Rauvolfia serpentina*, *Aristolochia indica*, and *Andrographis paniculata*, suggesting their importance in conventional anti-venom therapies. Furthermore, habitat degradation and overexploitation pose conservation hazards to several recognized anti-venom plants. This

study identifies possible species for more pharmaceutical research while highlighting the critical need to preserve biological resources and traditional knowledge. This research directly impacts SDG 15: "Avoid the extinction of threatened species, stop the loss of biodiversity, and limit the degradation of natural environments by taking immediate and substantial action." In addition to supporting biodiversity conservation, the project preserves important indigenous information that may otherwise be lost by recording traditional knowledge about therapeutic plants. This supports the preservation of traditional knowledge systems and sustainable forest management.

Phytochemical screening and antibacterial activity analysis of *Cordia macleodii* (Griff.) Hook. F. & Thomson leaves

Sandeep Kumar Mohanta and Durga Prasad Barik*

Department of Botany, Ravenshaw University, Cuttack-753003, Odisha, India

*Email: dpbarik@ravenshawuniversity.ac.in

Cordia macleodii is an endangered ethnomedicinal tree belonging to the Boraginaceae family, mainly used by tribal healthcare practitioners of different states of India for the treatment of various diseases. The medicinal properties of different plant parts are due to the therapeutic potential of several phytochemicals, vitamins, minerals and several dilatory components. Phytochemicals are a group of major plant-derived compounds which play a crucial role in treating diseases due to their active or passive involvement in different metabolic reactions as substrates or enzymes. To determine the pharmacological properties of different plant parts, it's important to analyse the presence of different phytochemicals present in the plant and their respective roles in different biochemical reactions happening in the body. During the analysis of phytochemicals, solvents play an important role as they have the ability to affect the amount and types of phytochemicals extracted from different plant parts. The phytochemical analysis of medicinal plants is important for the identification of bioactive compounds, validation of ethnomedicinal, antimicrobial activities, and understanding the therapeutic potential of plant parts. In the current study, solvents like-water, acetone, methanol, ethanol and petroleum ether are used for the preliminary phytochemical analysis of *C. macleodii* leaves. The aqueous, acetone, methanol and ethanol leaf extracts show the presence of saponins, tannins, phenolic compounds, alkaloids, cardiac glycosides and steroids, whereas, the petroleum ether leaf extract contains flavonoids and terpenoids. Phytochemicals present in leaves are extensively utilized to treat many human pathogenic bacterial infections. The methanolic leaf extract of *C. macleodii* shows antibacterial properties against gram-negative bacteria such as *Vibrio cholera* and *Salmonella typhi*, and gram-positive bacteria such as *Streptococcus pyogenes* and *Streptococcus mutans*. In contrast, it shows no antibacterial activities against *Shigella flexneri*, a gram-negative bacterium. This preliminary study will help to identify the bioactive compounds for drug designing by the pharma industries.

Ethno medicinal uses of Dongoriakandha of Niyamagiri Hills, Odisha, India.

Sangeeta Das, Swarnalata Pattanaik, A.leelaveni

P.G. Department of Botany, Berhampur University, Berhampur.

Email [id-leelaveni07@gmail.com](mailto:leelaveni07@gmail.com) , man.sangeeta0828@gmail.com

In the current study, the Ethnomedicinal data have been collected from tribal people of the Niyamgiri hill region of the Kalahandi district in Odisha, India. The tribal people of this region have been using medicinal plants to treat various diseases since time immemorial. The main objective is to find out the most used plant parts and their Ethnomedicinal values used to cure different diseases by tribal people of Niyamgiri hill region of Kalahandi district, Odisha, India. It includes recording the information on medicinal uses of plants by leading healers by taking interviews and recording the comprehensive knowledge about the medicinal properties of different plants with the snowball technique and sampling method. Plants are recognized by the local practitioner, also known as Kabiraja or Vaidya on the forest floor and were classified botanically. The present study records the use of different parts of 50 plant species that belongs to 47 genera of 35 families, against 48 human diseases, with special reference to diarrhea, dysentery, cold, cough, piles and fever. The practitioners use these plants to treat ailments like asthma, skin diseases, constipation, diabetes, toothache, wound healing, headache, infertility in women, mouth ulcer, insect bites, ringworms, thirst and eczema. All these medicinal plants are used as healing sources as no modern medical facilities are available nearby. The collected data are analysed through use value (UV). *Bacopamonneri* (UV of 1.50), *Bryonia laciniosa* (UV of 1.33), *Andrographispaniculata* (UV of 1.0), *Bryophyllumpinnatum* (UV of 0.83), and *Celastruspaniculatus* (UV of 0.83) are the most frequently and popularly used medicinal plant species in the study area. 50 plant species were collected from the Niyamgiri hill region. It is found that still a large number of tribal people use their traditional knowledge and culture and have adopted herbal therapy for most diseases because of the strong belief of the local practitioners.

Beneficial Plant Microbes Interaction for Agricultural and Environmental Sustainability: A Review

Dr.Sanjeeb Kumar Das^{1}, Binapani Pattanaik²*

¹ Department of Botany (DESM), Regional Institute of Education (NCERT), Capt. D.P. Choudhury Marg, Ajmer, Rajasthan, 305004

²ITEP, BSC.B.Ed. 2nd Year, RIE (NCERT), Ajmer, Rajasthan

*Email: sanjeebdas75@yahoo.com / dassanjeebbotany75@gmail.com

Food security is one of the major challenges for scientific community and one that is vulnerable to an exponentially increasing global population, unsustainable agricultural practices, and a changing global climate. Food and Agriculture Organization (FAO) of the United Nations foresees that a 60% increase in world food production over the next two decades is required to sustain these populations. Another major problem is plant pathogens which are again the key threats for sustainable global food production and

ecosystem sustainability. These pathogens cause around 25% reduction in the global crop yield every year. Globally, it has been also revealed that the food production system is accountable for loss of about 60% terrestrial biodiversity and increasing greenhouse gas emissions by 25%. Furthermore, climate change has intensified the frequency and severity of abiotic stresses including drought, high and low temperatures, nutrient limitation, and salinity which are an increasing challenge to crop production all over the world. The dependence of the agronomic sector on chemical fertilizers and pesticides is greatly harming the environment and human health. Thus, there is greater need for more reliable and sustainable approaches to deal with each of these global challenges and to move towards clean and green environment. The agricultural applications of beneficial microbes present in either in rhizosphere, internal tissues of plants or phyllosphere of plants is increasingly gaining interest. These beneficial microbes have evolved many mechanisms which contribute to improve the plant fitness, soil health, plant resistance against diseases and abiotic stresses ultimately increasing the productivity. Beneficial microbes sound to be affordable, smart, eco-friendly, economical and potential strategy. Knowledge of the vastness of microbial diversity associated with plants may be limited. The advancements in high-throughput molecular tools and next-generation strategies in genomics and proteomics have revolutionized our understanding of the widespread potential of beneficial microbes. The intervention of next-generation sequencing methods and chip-based technologies also seeks considerable attention from the scientific community for target-oriented exploration of beneficial microbial communities for agricultural and environmental sustainability.

An Empirical Study of Valuation of Economic of Benefits of Anasagar Lake in Ajmer, Rajasthan - A Case study

*Sanjeeb Kumar Das**

*Department of Botany (DESM), Regional Institute of Education (NCERT), Capt. D.P. Choudhury Marg, Ajmer, Rajasthan, 305004

Email: sanjeebdas75@yahoo.com/dassanjeebbotany75@gmail.com

The Ajmer district is located centrally in the Rajasthan state between 25038' to 26056' north latitudes and 73054' to 75022' east longitude with an area of 8481 sq.km. It is bounded in north by Nagaur district, south by Bhilwara district, east by Tonk and Jaipur and West by Pali district. Ajmer falls in agro-climatic zone III 'A' semi-arid-eastern plain zone encompasses Ajmer, Jaipur, Dausa&Tonk districts. Anasagar Lake is situated in the north- west of Ajmer city. The paper tries to evaluate the economic valuation of conserving Anasagar Lake in Ajmer. In the study, it was analyzed that the lake has very less use value and the estimated cost to improve the lake quality is very high which initiates the researcher to work on the development of Lake Front and to increase its rejuvenation value by estimating the willingness to pay i.e. whether the citizen/visitors are ready to pay the minimal amount for the betterment of the lake. The lake is situated in the middle of Ajmer, hence the visitation rate of the people are very high which was examined with the help of Travel cost approach. And further it adds that water quality of lake can also be restored and improved under the water quality scheme of NLCP (National Lake conservation Plan. In the study, it was

analyzed that the lake has very less use value and the estimated cost to improve the lake quality is very high which initiates the researcher to work on the development of Lake Front and to increase its rejuvenation value by estimating the willingness to pay i.e. whether the citizen/visitors are ready to pay the minimal amount for the betterment of the lake.

Investigating Sustainable Development Approaches in the Similipal Biosphere Reserve.

Saraswati Majhi , Prasanta Kumar Samantaray

P.G. Department of Botany, Shailabala Women's (Auto) College , Cuttack , Odisha, India .

Email Id: ismajhi13@gmail.com

Recognizing an existential threat, the Similipal Biosphere Reserve in Odisha, India, is a designated UNESCO World Heritage site. Renowned globally for its rich biodiversity and unique ecosystems, the reserve encompasses various habitats, including tropical moist deciduous forests and montane forests, covering an area of 5,569 square kilometers. Similipal prioritizes biodiversity conservation as the foundational phase of sustainable development. It has been safeguarded under Project Tiger and subsequently designated as a conservation unit for crocodiles and elephants. Protecting this distinctive biosphere necessitates a multifaceted approach that incorporates conservation efforts, sustainable resource management, and community engagement.

Implementing practices that enhance the resilience of ecosystems, such as reforestation and the restoration of native plant species, is vital. Furthermore, fostering awareness among local communities about the significance of preserving biodiversity can encourage collaborative efforts in environmental protection. Joint research and monitoring initiatives can yield valuable insights into the ongoing impacts of climate change, facilitating adaptive strategies to mitigate negative effects. By prioritizing these initiatives, we can strive to ensure the long-term health and vitality of Similipal for future generations.

Similipal faces considerable challenges due to climate change, including extreme weather events and altered precipitation patterns that jeopardize its long-established ecosystems. To effectively address these issues, it is imperative to implement adaptive management strategies that prioritize climate resilience planning and integrate traditional ecological knowledge. The Similipal Biosphere Reserve advocates for a comprehensive conservation approach, which emphasizes plant biodiversity, community involvement, sustainable resource management, and eco-tourism. Ongoing efforts in adaptive management are essential for preserving the reserve and its critical ecosystem services.

This review highlights the necessity for integrated approaches to tackle these challenges, emphasizing capacity building among local stakeholders and participatory decision-making, as illustrated by various research and community engagement initiatives. A significant aspect of this effort involves adopting circular economy principles, promoting organic farming, and developing climate-resilient infrastructure.

A review on drugs discovery from traditional phytotherapy

Saroj Kumar Behera, Anil Kumar Biswal*

P.G. Department of Botany, Fakir Mohan University, Balasore, Odisha 756089

Email: skb42468@gmail.com

Phytotherapy refers to the use of plant extracts for therapeutic purpose. It plays important role in ancient medicine practices. It has been considered as a cornerstone in the development of modern drugs. With the advancement in the field of science and technology, researchers systematically evaluate the medicinal properties of plants. It is an integrative approach that integrates traditional knowledge with modern techniques for identification, isolation, and test for plant derivative compounds. Literature on plant-derived natural products used as suitable precursors for drug discovery and development was included. These papers were carefully evaluated, critically analyzed and structured with accurate information. The process begins with ethnobotanical surveys and the study of traditional medicine to select promising therapeutic potential herb. Phytochemical methods are then employed to extract and isolate the active constituents. The phytotherapy drugs have the natural properties of plants to support health and manage various conditions. Recently in analytical chemistry and genomics have been essential in accelerating the drug discovery process. High-throughput screening, molecular docking, and bioinformatics tools have enabled the rapid identification of bioactive compounds. Traditional phytotherapy has significantly influenced modern medicine by providing a wealth of knowledge about plant-based remedies. Many pharmaceuticals have roots in herbal practices, with compounds isolated from plants forming the basis for effective treatments. This integration of traditional wisdom with scientific research has led to the development of targeted therapies, emphasizing the importance of natural products in drug discovery. As researchers continue to explore plant compounds, traditional phytotherapy remains a vital source for potential new medicines. Moreover, advancements in pharmacokinetics and pharmacodynamics have improved understanding of plant compounds interact with biological systems, enhancing their therapeutic efficacy and safety profiles.

Chlorophyll a key bio indicator of abiotic stress in plants

Sasmita Mohanty, Arpita Banerjee*

P.G. Department of Botany, Fakir Mohan University

Email: sasmita26032003@gmail.com

Stress is an external factor that exerts an adverse influence on plants growth, development and metabolism. Stress is categorized into 2 types according to their medium of occurrence as biotic stress and abiotic stress. Various physical factors which are behind the determinant and effects on plants like excess amount of light, abnormal fluctuations in temperature and water level etc. are category used under abiotic stress. These plant stresses can be identified or screened by means of some signals known as indicators. These indicators may be physical like chlorosis, necrosis, abnormal height etc and there is another type of indicators of stress which is known as physiological indicator which give us result about stressed condition

by estimating efficiency of certain physiological process. Chlorophyll a prominent biomolecule of plants which make them able to perform photosynthesis and produce own food for plants can indicate the level of stress experienced by plant through a method called Chlorophyll Fluorescence. In this method the fluorescence ratio between maximum and variable fluorescence of chlorophyll is qualified and interpreted into results showing the magnitude of stress encountered by plants. Chlorophyll fluorescence F_v/F_m is a key metric in plant physiology, indicating photosynthetic efficiency. Chlorophyll fluorescence is the re-emission of light energy absorbed by chlorophyll molecules in photosynthetic organisms. This phenomenon occurs when excited chlorophyll molecules release excess energy as fluorescence. Chlorophyll fluorescence helps in plant stress detection, photosynthetic efficiency monitoring, and crop yield prediction, environmental stress research like temperature, drought, plant breeding and selection. Several factors such as light intensity, temperature, water availability, nutrient deficiencies, disease and pests and air pollution affect F_v/F_m ratio. The measurement techniques which are used in Chlorophyll fluorescence are pulse-amplitude modulated(PAM) fluorometry, chlorophyll fluorometers, imaging fluorometry. Portable fluorometers calculating fast fluorescence parameters enable abundant information about the photosynthetic machinery performance of numerous samples to be obtained in a relatively short time. This is very important for practitioners who are obliged to make quick decisions concerning agrotechnics or tree maintenance. The possibility of distinguishing the background of stress reaction of trees using the Ch F method would be very advantageous.

A Diversity, Distribution and Therapeutic Potential of Zingiberaceae of Odisha: A Review

Sasmita Rana^a, Rajashree Das^{a,b*}, Anil Kumar Biswal^a

^a Department of Botany, Fakir Mohan University, Balasore-756089, Odisha, India

^b Department of Environmental Science, Fakir Mohan University, Balasore-756089, Odisha, India

*Email: rajashreedas23@gmail.com

Given the Zingiberaceae is the largest family of the order zingiberales. It is highly valued for its ethnomedicinal properties and contains a wide variety of therapeutic plants. This is a valuable natural resource that yields a wide range of items such as food, spices, medicine, colors, fragrances, and more. Zingiberaceae, with 57 genera and more than 1600 species, is one of the largest families in the kingdom of plants. They are mostly found in the Eastern Himalaya, Southern China, India, South-Eastern Asia, Australia, Vietnam, Myanmar, Bangladesh, Indonesia, and other regions with a wide range of habitats, from riverine to limestone areas. The majority of the species distribution in India are found in states like Assam, Bihar, Uttarakhand, Jharkhand, Maharashtra, Kerala, Karnataka, Tamilnadu, and Manipur. This study aims to determine the species richness of zingiberaceae in Odisha and also demonstrate their natives, vernacular names, distribution and therapeutic potential. A total of 31 species under 10 genera were documented. The genera with the diversity were *Alpinia* (3 species), *Amomum* (3 species), *Costus* (1 species), *Curcuma* (8 species), *Curcumorpha* (1 species), *Globba* (3 species), *Kaempferia* (3 species), *Hedychium* (3 species), *Zingiber* (5 species), and *Elettaria* (1 species). The Flora of Odisha, authored by H.O. Saxena and Brahmam M., contains 24 species, and remaining 7 species (*Alpinia galanga*, *Curcuma caesia*, *Hedychium*

spicatum, *Kaempferia parviflora*, *Amomum aromaticum*, *Amomum subulatum*, *Elettaria cardamom*) are derived from various research articles. In Odisha, they are primarily found in places like Similpal, Phulbani, Kandhamal, Mayurbhanj, Rourkela, Bhubaneswar, Malkangiri, Koraput, Ganjam, and Gandhamardhan hills. The extract of zingiberaceae rhizomes contains many essential oil including terpenes, alcohols, ketones, flavonoids and phytoestrogens that use as medicines. The members of zingiberaceae exhibit wide range of therapeutic properties such as Anti-inflammatory, Analgesic, Antihypoglycemic, Antinociceptive, Antidiabetic, Antioxidant, Diuretic, Antibacterial, Carminative, Laxative, Skin disease, Stomachache, Uterine involution etc. Most of the plants under this family are globally cultivated for their therapeutic value in treating different diseases and have been extensively researched for their pharmacological and biochemical properties.

Ethnomedicinal plants used to cure gynecological disorders by the tribals of Bargarh district, Odisha, India

Satikanta Sahoo¹ and Dayanidhi Bagartee²

1. P.G. Dept. of Botany, N.C. (Autonomous) College, Jajpur, Odisha, India - 755 001

2. Dept. of Botany, Anchal College, Padampur, Bargarh, Odisha, India – 768036

Email: satikanta84@gmail.com, dayanidhi.bagartee@gmail.com

The present study deals with the survey and documentation of ethnomedicinal plants used to treat different gynecological disorders by the tribals of different villages of Bargarh district, Odisha. Field survey was conducted during the period of 2022-2023. The gynecological disorders that were taken into consideration for research include menstrual disorders, gonorrhea, lactation problems, delivery problems and abortion. The data was collected from traditional healers, medicinal plant parts vendors and the local tribal people of Bargarh district through face-to-face interviews and questionnaire methods. The quantitative analysis has been conducted using frequency of citation (FC), informant consensus factor (ICF) and relative frequency citation (RFC). FC, RFC and ICF indicate the cultural importance of plant species and also the level of agreement of informants regarding the use of medicinal plants in the treatment of various gynecological disorders. This study has documented a total of 27 plant species under 22 families. Maximum plants are found in the family Fabaceae. *Curcuma longa* has the highest values of FC and RFC which shows the cultural importance of this species. High percentages of plants are used in the treatment of abortion, menstrual disorders and delivery stimulation. Gonorrhoea shows the highest ICF value. The tribal people of Bargarh district generally depends on wild and common medicinal plants in the treatment of gynecological disorders. It is very urgent to save and conserve these medicinal plants which are the sources of natural drugs. Though many scholars have endeavored to study ethnomedicine for gynaecological diseases of the tribals still then the field is wide open for further research.

Study of Pollution remediation aquatic plants in the industrial area of Jajpur District of Odisha

*Satikanta Sahoo¹, R. K. Nayak², D. Bagartee³, B.K. Sahoo⁴, P. Santi⁵ and M.K. Jena⁶

¹ P.G. Dept. of Botany, N.C. (Autonomous) College, Jajpur - 755001

² P.G. Dept. of Environmental Science, Fakir Mohan University, Balasore – 756089

³Dept. of Botany, Anchal Degree College, Padampur, Baragarh - 768036

⁴Department of Botany, S.G. College, Kanikapada, Jajpur-755 011

⁵OSPCB, Central Laboratory, Bhubaneswar, Odisha 751024

⁶Section of Applied Entomology, Warsaw University of Life Sciences, Poland

Email: satikanta84@gmail.com

In 2023, a comprehensive survey was conducted in the industrial areas of Jajpur District, Odisha, to evaluate the pollution mitigating capabilities of wild aquatic plants. The study aimed to document the phytodiversity in these aquatic habitats, focusing on their ecological roles in combating pollution and supporting local communities. A total of 21 aquatic plant species were identified across 20 genera and 17 families. The species composition included 4 marshy species, 6 amphibious species, 2 submerged species, 6 free-floating species and 3 fixed-floating species. This diverse array of plant types highlights the ecological richness of this region. To quantify biodiversity in the selected study area, two indices were employed, the Shannon Index and Simpson's Diversity Index. The calculated Shannon Index ($H' = 1.5336$) indicated moderate diversity, reflecting a balanced distribution of species richness and evenness. This suggests that no single species overwhelmingly dominates the community, promoting ecological stability. In addition, the Simpson Index ($D = 0.2290$) and the corresponding Simpson's Diversity Index ($1 - D = 0.7710$) further illuminated the diversity within the aquatic community. The Simpson's Diversity Index of 0.77 indicates a high probability (77%) that two randomly selected individuals from this ecosystem belong to different species. This high level of diversity enhances the ecosystem's resilience to disturbances, such as pollution and habitat degradation, and underscores the importance of maintaining a diverse plant community. The findings of this study emphasize the critical role of aquatic plants not only in maintaining ecological balance but also in providing essential resources to the local population. These plants contribute to pollution remediation through various biological processes, enhancing water quality and supporting biodiversity. In conclusion, the moderate to high biodiversity indicated by the calculated indices highlights the ecological value of the aquatic plant communities in Jajpur district. Continued research and conservation efforts are essential to protect these bio-resources, ensuring their availability and ecological benefits for future generations. Protecting and promoting aquatic biodiversity is crucial for sustaining the health of ecosystems and the livelihoods of communities dependent on these natural resources.

Mangrove ecosystems & adverse climatic conditions in Odisha: Systematic approach is need of the hour.

Satyajit Mahatab, Uday Chand Basak

Department of Seed Bank and Seed Biology Division, Regional Plant Resource Centre (R&D Institute of Forest, Environment & Climate Change Department, Govt. of Odisha) Bhubaneswar, Odisha, India

*Email: satyajitmahatabrprc@gmail.com

Mangrove ecosystems along Odisha's coastline (Lat. 17°49' N to 22°34' N and Long. 81°27' E to 87°24' E) represent unique coastal environments characterized by remarkable physiological and morphological adaptations to challenging conditions. The Bhitarkanika mangrove ecosystem is unique, featuring important genera like *Heritiera* and *Xylocarpus* that have developed specialized mechanisms to thrive in adverse salinity. These ecosystems serve as crucial transitional zones between marine and terrestrial environments, playing vital roles in coastal protection and ecological stability. This is especially important given the multiple environmental challenges faced by the Odisha coast, including floods, cyclones, droughts, and high tidal waves. The distribution and survival of mangroves are primarily governed by environmental factors such as temperature, salinity, and rainfall patterns, with temperature being especially crucial as both sea surface and air temperatures serve as critical determinants of mangrove latitudinal distribution limits. Research indicates that mangrove distribution correlates closely with mean sea surface temperatures ranging from 24°C to 34°C landward temperature isotherms. Globally, mangrove forests cover only 0.1 percent of the world's land area, with just 15 countries accounting for over 75 percent of the total global mangrove forest area. India makes a substantial contribution with 4,975 Sq km of mangrove cover, representing 3 percent of global mangroves and 8 percent of Asia's mangrove forest area. Within this context, Odisha maintains approximately 251 Sq km of mangrove vegetation in various densities, as reported by the India State of Forest Report (2019).

The combined impact of anthropogenic pressures and climatic variations has resulted in significant coastal vegetation loss and increased salinity ingress, which severely impedes mangrove regeneration and establishment. This degradation has rendered wetland ecosystems increasingly fragile, though paradoxically more responsive during climatic events within the coastal buffer zone. Historical events demonstrate the vulnerability of these ecosystems, such as the 1999 Odisha Super Cyclone, which destroyed around 40-50 percent of mangroves in key districts including Jagatsinghpur, Kendrapara, and Balasore, and more recently, Cyclone Amphan in 2020, which damaged approximately 1,600 Sq km of mangrove forest in the Indian Sundarbans as well as Odisha. Regions like Balasore and Jagatsinghpur show particularly pronounced effects of climate change, necessitating focused restoration and conservation strategies.

To address these challenges effectively, comprehensive management plans are needed, incorporating systematic database creation, capacity building, and enhanced protection measures for marine species. Future initiatives should focus on detailed geological assessments, species selection criteria for re-introduction, establishment of tree spacing and maintenance protocols, and development of robust forest protection and monitoring systems. Additionally, public awareness and engagement programs must

be integrated into restoration efforts to ensure the long-term sustainability of these vital coastal ecosystems.

Study of Photosystem II Activity during the Leaf Development in a Threatened Medicinal Tree

Shasmita^{1,2}, Barsha Bhushan Swain¹, Smrutirekha Mishra¹, Debasish Mohapatra¹, Soumendra Kumar Naik¹, Pradipta Kumar Mohapatra¹

^ADepartment of Botany, Ravenshaw University, Cuttack-753003, Odisha, India

^BP.G. Department of Botany, Dhenkanal Autonomous College, Dhenkanal-759001, Odisha, India

Email: shasmita0108@gmail.com

Saraca asoca (Roxb.) Willd. is a tropical, evergreen and medicinally important tree. Each year, the leaf initiation in *S. asoca* occurs during February to April. The leaf development of this tree is associated with morphological (e.g. shape, size, colour and distribution of internal tissues) and physiological (e.g. photosynthesis) changes. In the present study, we have measured chlorophyll *a* fluorescence, photosystem II (PSII) function and photosynthesis during the leaf development i.e. up to 35 days after opening of lamina (DAOL). During the initial days of leaf ontogeny, a significant increase in chlorophyll content and a negative net photosynthesis was observed. With increase in the age (5-28 DAOL), decrease in O-J rise and increase in J-I, and I-P rise and fluorescence maximum has been observed thereby, indicating a gradual improvement in the PSII functions. This also suggested that with the increase in age, the leaf has moved from heterotrophy to autotrophy. An increase in the function of oxygen evolving complex and electron transport in PSII suggested functional improvements of PSII donor and acceptor side during the leaf ontogeny. The knowledge gained might help in designing the approaches through controlled illumination to improve adaptation of juvenile leaves to outdoor circumstances.

Essential oil extraction from various plant species of Fakir Mohan University campus

Shubhalaxmi Panigrahi, Biswajit Patra

P.G. Department of Botany, Fakir Mohan University, Odisha

Email: shubhalaxmipanigrahi123@gmail.com

Extracting essential oils from various plant species can be a fascinating and rewarding endeavour, especially in a diverse environment like a university campus. Here's a comprehensive overview of essential oil extraction methods, common plant species that may be found on a university campus, and considerations for extraction. The most widely used method, where steam passes through plant material, vaporizing the essential oils, which are then condensed back into liquid form. Involves using solvents to dissolve the essential oils, then removing the solvent, leaving the oil behind. Involves soaking plant materials in a carrier oil, allowing the essential oils to infuse into the oil over time. Ensure that the plants are healthy and free from pesticides or contaminants. Extracting essential oils from plants on a university campus can provide valuable insights into plant properties and uses. By carefully selecting methods and species, you can create a rich collection of essential oils for research, educational purposes, or personal use.

Declaration of Biodiversity Heritage Sites: a new in-situ approach for conservation plant genetic resources in Odisha

¹S. Rath, ²S.S. Hansda, ¹A Mishra, ¹S.R. Mohanty, ¹A.K. Jena, ¹R.S. Sahoo, ¹S. Malik, ¹B. Mohanty & ¹P.K. Dash

¹Odisha Biodiversity Board, Govt. of Odisha, Bhubaneswar- 751015, India

²Utkal University, Vani Vihar, Bhubaneswar, Odisha, 751004, India

*Email: sibadattrath4@gmail.com

Ecosystems rich in biodiversity provide numerous goods and services to millions of rural and urban communities across the world. The biological resources in these ecosystems offer economic and ecological benefits to dependent communities. Loss of biodiversity lowers the ecosystem's productivity and reduces these services. To protect and conserve the biodiversity of Odisha, 24 Protected Areas (PAs) have been created. Even though these PAs have played significant role in protection and conservation of biodiversity in Odisha, they cover only 10.37% of the total forest area and 5.36% of the total geographical area of the State. In these PAs, access to biological resources is also restricted for the users. Outside these PAs, biodiversity is equally rich and diverse and there was no legal strategy for their conservation till the enactment of Biological Diversity Act, 2002. The floral diversity of Odisha comprises 5174 species including lower to higher taxa, many of which sustain the livelihood of the depending communities and are widely distributed outside PAs. For conservation of bioresources outside the PAs, the Biodiversity Heritage Sites (BHSs) have been declared under section 37 (1) of the Biological Diversity Act, 2002. Till now 47 BHSs have been declared in India and government of Odisha has declared 4 BHSs (Mandasaru in Kandhamal, Mahandragiri in Gajapati, Gandhamardan in Bolangir and Bargarh and Gupteswar in Koraput district). All the 4 declared BHSs host threatened and endemic plants, medicinal plants, wild edible plants and wild edible macro-fungi which provides various ecosystem services to the people. We propose how this legal framework will act as a strong alternative strategy to conserve and sustainably utilized the plant genetic resources of the state and also highlighted the importance of integrating legal, ecological, and community perspectives to safeguard the floral diversity for future generations. Access to biological resources vis-a-vis benefit sharing, protection of traditional knowledge and promotion of developmental activities may strengthen the livelihood securities in a regulatory manner which are the three key approaches for conserving plant genetic resources under BHSs.

Role of Physicochemical Parameter on Microalgal Diversity of Kuakhai River Bhubaneswar, Odisha

Soumya Ranjan Dash

Assistant Prof. Dept. of Biological Science, AIPH University, Bbsr, Odisha.

Email: sdash@aiph.ac.in , srdash.sanu@gmail.com

Algae are chlorophyll-containing thalloid plants having universal occurrence .Microalgae have the additional benefit of large metabolic elasticity. This study identified the green microalgae and

physicochemical properties of water taken from the Kuakhai River. Using the direct collection approach, water samples were taken from three distinct rivers and placed into labeled bottles for physicochemical characteristic analysis, and morphological identification. For the research, water samples were preserved in 4% formaldehyde. Then samples were observed under the digital microscope, and then identified the morphological characteristics. The current study focuses on the diversity of algae in the five sites of the bank of the Kuakhai River BBSR, Odisha. This River between 85° 87' E Longitudes and between 20° 31' N Latitudes spread over an area. The investigation was conducted in January 2024 to February 2024. In total 46 algal species have been identified, including 8 species of Cyanophyta, 21 species of Chlorophyta, 10 species of Basillariophyta, 7 species of Desmidiophyta. On the other hand, 17 species are for the first time recorded from Kuakhai River, while 9 species are recorded for the first time from Odisha i.e. namely *Ctenophorapulcella*, *Staurostrum corniculatum*, *Ulnaria biceps*, *Navicula oblonga*, *Surirellatenera*, *Cymbella aspera*, *Oedogonium* and *Ulnaria longa* at near Hanspal square. Further, all the algal species reported in the present investigation indicate the oligotrophic status of the water. However, physicochemical parameter on algal diversity is required to maintain the water quality in these freshwater habitats for the future.

Study on the Antibacterial Potential and Phytochemical Analysis of *Thespesia populnea*(L.) Sol. ex Corr. used in the Treatment of Diarrhoea and Dysentery.

Somani Jethi¹ and Kunja Bihari Satapathy².

¹Department of Botany, S.B. Women's College, Cuttack, Odisha, India.

²School of Applied Sciences, Centurion University of Technology & Management, Bhubaneswar

Email: kbs_bot@rediffmail.com

The plant *Thespesia populnea* Sol. and ex Correa of family Malvaceae is known as Indian tulip tree and considered to be used traditionally in the treatment of diarrhoea and cholera. The current study was to investigate the hidden antibacterial potential of *Thespesia populnea* against some selected bacterial pathogenic strains responsible for diarrhoea and dysentery. Five bacterial strains used in the study were *Escherichia coli* (MTCC-614), *Shigella flexneri* (MTCC 9543), *Staphylococcus aureus* (MTCC-1430), *Salmonella paratyphi* (MTCC-3220) and *Salmonella enterica typhi* (MTCC-733). The study revealed that n-Hexane extract of *T. populnea* exhibited the highest zone of inhibition against *S. aureus* at 6 mg/ml and quite comparable with reference antibiotic Ciprofloxacin (0.5 mg/ml). The methanol extract was moderately effective against all above bacteria. It was found that the n-Hexane extract of *T. populnea* shows more potent antibacterial activity than methanolic extract. The inhibitory effect of the plant extract against bacteria *E. coli*, *S. paratyphi* and *S. aureus* was very promising which indicated the capability of the plant as an effective source of medicine against pathogens of diarrhea and dysentery. The phytochemical analysis showed the presence of tannin, alkaloid, flavonoid, phytosterol and triterpenoids which might be responsible for its potent antibacterial activity. The plant can further be studied for the isolation of important chemical constituents which are specific for the antimicrobial activity. The result indicated that

the bark extracts of *Thespesia populneam* might be a source for a new drug against diarrhoea and dysentery which needs further investigation.

Bio-control of Plant Pathogens by Native *Trichoderma atroviride* isolated from Maize Landrace of Odisha

Soumya Sephalika Swain^{1,2}, Bhabatarini Panda^{1*}, Madhusmita Ghana², Om Prakash Mohanty², Shubhransu Nayak^{2*}

¹Post Graduate Department of Botany, Utkal University, Vanivihar, Bhubaneswar-04

²Odisha Biodiversity Board, Nayapalli, Bhubaneswar-15

*Email: bhabatarini_panda@rediffmail.com , shubhransu.crri@gmail.com

Amid the current climate crisis and increasing crop protection challenges, biological control has become a vital, sustainable approach for managing crop diseases. Unlike synthetic pesticides, which can adversely impact the environment, biological control using natural microorganisms offers a targeted approach to manage pests and pathogens while minimizing ecological disruption. Moreover, the microbes including bacteria and fungi that play a crucial role in enhancing nutrient uptake, soil health, plant growth, and management of pests and diseases. The State of Odisha is well-known for its rich diversity of crop landraces like rice and maize which are valued for their high nutritional content and harboring beneficial microbes. In this context, a local maize landrace was collected from Malipadar village, Koraput, Odisha which has been designated as the 4th Biodiversity Heritage Site (BHS) of Odisha. Microflora associated with seeds of this landrace were isolated on PDA media and evaluated *in vitro* for antagonistic activity. Among all the microbes isolates, the endophytic fungus identified as *Trichoderma atroviride* strain WCF 2 (NCBI GenBank Accession No. PQ035928), exhibited broad-spectrum antagonistic activity against several pathogens of rice crop and the ornamental plant Orchid. The fungus exhibited 99% inhibition against *Helminthosporium oryzae*, *Pyricularia oryzae*, *Sclerotium oryzae* and *Fusarium* sp. which cause brown spot disease, blast disease, stem rot and seedling blight in rice, respectively. The *T. atroviride* also could significantly inhibit (96.35%) *Rhizoctonia solani* which causes sheath blight of rice. Further, complete inhibition of mycelial growth was observed in fungal pathogens isolated from orchid plants belonging to *Dendrobium* sp. which were commercially cultivated at the Regional Plant Resource Centre, Bhubaneswar. In this regard, development of formulations based on the *T. atroviride* strain WCF2 would have greater impact on the enhancement of yield of these two crops. The current study also emphasized maize landraces as vital reservoir of beneficial microorganisms having potential to be utilized for sustainable agriculture. Further, educating and empowering the local communities like BMCs might encourage the implementation of Access and Benefit Sharing (ABS) on microbial bioresources and to gain financial benefits under the Biological Diversity Act 2002 (Amended in 2023).

Ethnomedicinal Plants used by Mankidia Tribes of Similipal Biosphere Reserve, Odisha, India: A Review

Subhasmita Behera¹, Umabati Sahu²

¹Research Scholar, PG Department of Botany, Fakir Mohan University, Balasore

² Assistant Professor, PG Department of Botany, Fakir Mohan Autonomous College, Balasore

Email: subhasmitabehera113@gmail.com

The District Mayurbhanj one of the largest district of Odisha very much famous for the Similipal Biosphere Reserve. It is also known for the highest number of tribal population in the state. Ethno Medicinal studies in some villages of the Mayurbhanj District resulted in the documentation of many therapeutic uses of the locally available medicinal plant resource. Mankidia tribe largely depends on food gathering and hunting. Mankidia is one of the Particularly Vulnerable Tribal Groups (PVTG) are mainly found in Odisha. The sex ratio of Mankidia is 95 females per 108 males. They have been treated as separate group and termed as primitive tribal group. The present study deals with the ethnobotanical perception of 48 plant species belonging to 29 families of medicinal plant used by the tribal people in the rural area as the health care facility is not accessible to the interior part of the district people still depend on the medicinal plants and traditional health care system for their health care. The common diseases for which they are using these plants are cough, cold, diarrhea, gynecological disorders, sexual debility, Malaria and other common fevers, anemia etc. Ethno medicinal uses of plants have been reported since long, most of these plants do not certify the efficacy. The plants reported used for various ailments need to be pharmacologically screened, chemically analysed and tested for various bioactive compound of the plant species 6 species are shrubs, 12 species are herbs, 9 species are climbers and 25 species are trees. The plants used for medicinal preparation were bark, flowers, rhizomes roots, leaves, seeds, latex and whole plants. These ethno medicinal claims may aid in screening and finding novel biomolecules.

Mushroom Diversity of Keonjhar District in the State of Odisha, India

Suchismita Acharya¹ and Kunja Bihari Satapathy²

¹Department of Botany, D. D. University, Keonjhar-758001, Odisha

²School of Applied Sciences, Centurian University of Technology & Management, Bhubaneswar-752050,

Email: suchismitaacharya53@gmail.com

Keonjhar is a district having 8240 sq. km. area, situated between latitudes 21° 1' N & 22° 10' N and longitudes 85° 11' E & 86° 22' E. at an elevation of 480 m with a much-diversified ecosystem. Mushrooms which form an important component of the ecosystem has been poorly studied as regards to the biodiversity studies of Odisha. Mushrooms are the fleshy, spore-bearing fruiting bodies of macro-fungi and occur seasonally in various habitats like humus rich soils, decaying plant litter and wood logs in forests as well as in meadows and even in sandy and other soils. During survey of 15 different sites of the study area, many wild mushrooms species were collected, characterized and identified on the basis of their morphological features such as shape, size, texture, colour and odour of the fruiting body. A total of 56 species of

mushrooms were collected which taxonomically belonged to 38 genera and 25 families. The results of the present study revealed that this area has 18 edible mushrooms and 6 species had medicinal uses. Among others 13 species were unfit for consumption and remaining 21 species were unknown for their usability. *Agaricus campestris*, *Agaricus bisporus* and *Termitomyces microcarpus* were most abundant edible mushrooms found in the study area. *Ganoderma lucidum* and *Trametes versicolor* were the two important mushroom species widely used by local people for curing different ailments. Rural inhabitants, particularly tribal women, have rich experience of mushroom habitats, fruiting times, and species identification passed down through generations. This study represents, perhaps the first endeavour to document the macro-fungi in Keonjhar district of Odisha, signifying a groundbreaking investigation in this domain. Recognizing the nutritional and medicinal importance of these mushrooms, there is an urgent need to explore, taxonomically identify and document the rich mushroom diversity in Keonjhar district of Odisha.

Ascorbic acid mitigates chromium toxicity and boosts growth and bioactive compounds in wheat seedlings

Sudeshna Khatua* and Surjendu Kumar Dey

P. G. Department of Environmental Science, Fakir Mohan University, Vyasa Vihar, Balasore-756089, India

*Email: dsudeshnap@gmail.com

In recent years, soil contamination by heavy metals has intensified due to the widespread use of hexavalent chromium [Cr(VI)] in various chemical industries. The environmental release of Cr(VI) has reached critical levels, resulting in significant toxic pollution. This heavy metal-induced soil contamination generates severe abiotic stress in plants, adversely impacting multiple stages of growth and development and in extreme cases, leading to plant mortality. Furthermore, such contamination presents a serious threat to human food security. The phytotoxic effects of Cr(VI) are dependent on the intensity of exposure. To investigate the role of ascorbic acid (AA), a pivotal low-molecular-weight antioxidant, in mitigating Cr(VI)-induced toxicity, a controlled hydroponic experiment was conducted. Wheat seedlings (*Triticum aestivum* L.) were cultivated for seven days in a half-strength Hoagland nutrient solution supplemented with 1.0 mM Cr(VI) and varying concentrations of exogenous ascorbic acid (1.0, 2.0 and 4.0 mM). The findings revealed that ascorbic acid application, in conjunction with 1.0 mM Cr(VI), markedly enhanced growth parameters, including root and shoot lengths, as well as fresh and dry biomass of both roots and shoots. Additionally, total chlorophyll content and the accumulation of bioactive compounds were significantly elevated compared to seedlings exposed solely to 1.0 mM Cr(VI). In conclusion, this study underscores that Cr(VI) exposure induces oxidative stress during both the germination and early seedling stages of wheat. The presence of Cr(VI) in the environment poses a considerable threat to global agricultural productivity. However, the exogenous application of ascorbic acid demonstrates significant potential in alleviating Cr(VI)-induced phytotoxicity in wheat seedlings.

A comprehensive study of diversity and distribution of Chroococcales algae from Similipal Biosphere Reserve, Odisha

S. Behera^{1*}, S. Bhakta², E. Sahu³, A.K. Bastia¹

^{1*}Department of Botany, Maharaja Sri Ram Chandra Bhanj Deo University, Baripada-757003

²Botanical Survey of India, Andaman and Nicobar Regional Centre, Port Blair - 744102

³Department of Botany, S. R. College, Baliapal, Balasore- 756023

¹Department of Applied Microbiology, Fakir Mohan University, Balasore-756020

E-mail: sudhirnou@gmail.com *, skmrbhakta@gmail.com , emamee.sahu@gmail.com, bastianou@gmail.com

This study investigates the diversity and distribution of Chroococcales algae within the Similipal Biosphere Reserve, Odisha, a region renowned for its rich biodiversity and unique ecosystems. The specimens were collected through systematic sampling across various habitats, including freshwater streams, subaerial corticolous form, and moist soils and identified using morphological techniques. A total of 13 species belonging to the chroococcales order were documented under four families and seven genera, with the dominant occurrence of *Gloeocapsa* (5), followed by *Aphanocapsa* (2), *Chroococcidiopsis* (2) and single species each from *Synechococcus*, *Synechocystis*, *Cyanosarcina*, and *Pseudocapsa*. The distribution of the taxa signified five new records to Odisha state namely *Synechococcus spevelekii*, *Aphanocapsa grevillei*, *Gloeocapsa violacea*, *Gloeocapsa alpina* and *Pseudocapsa dubia*.

The results revealed a heterogeneous distribution pattern influenced by environmental factors such as water quality, light availability, and substrate type. Of these 13 taxa *Gloeocapsa gelatinosa* occurred in form of lithic biofilm, *Synechococcus elongatus*, *Synechocystis spevelekii*, *Gloeocapsa novacekii*, *Pseudocapsa dubia* from soil crust, *Aphanocapsa grevillei*, *Aphanocapsa testacea*, *Gloeocapsa violacea*, *Gloeocapsa alpina*, *Cyanosarcina spectabilis*, *Chroococcidiopsis indica*, *Chroococcidiopsis kashayi* from the subaerial corticolous substrate and *Gloeocapsa gigas* in the form of floating mat. This study enhances the understanding of algal biodiversity in Similipal and provides critical insights for conservation efforts in the region. Our findings underscore the ecological significance of Chroococcales in freshwater habitats and their potential as bioindicators for environmental monitoring. The data obtained will serve as a baseline for future research and conservation strategies be initiated to preserve the unique algal communities of the Similipal Biosphere Reserve.

CRISPR/Cas9 Technology and its Application in Plants

Sudhir kumar Sethy

P.G. Department of Botany, Dhenkanal Autonomous College

Dhenkanal, Odisha pincode-759001

Email: sudhirkumarsethy199@gmail.com

CRISPR/cas9 is a type of gene editing technology which can modify DNA of plants, resulting in a modified plant with a desired trait. It was 1st of all discovered in bacteria by Charpentier and Jennifer in

2011 while studying *Streptococcus* immune system. CRISPR-Cas9 is the immune system of this bacterium which is used for protecting it from viral genome. CRISPR stands for Clustered Regularly Interspaced Short Palindromic Repeats. This CRISPR-Cas9 system is associated with a protein i.e. Cas9 which can cut DNA at specific site. Another protein namely Cas 12 which cuts single stranded DNA. Bacteria use this system to cut viral genome and destroy it. But this system has also various applications in case of plants. We can produce genetically modified plants having desired trait by cutting DNA at specific site followed by introducing a desired gene in that site. It can also be used to increase disease resistance in plants along with improvement of productivity in crops. This system is a highly effective, low cost and easy method than other gene editing methods and by using this technique we can obtain profit in agricultural sector and other biological sector. Keywords: CRISPR-Cas9, genetically modified plants, disease resistance, high productivity

An impact of invasive plant species on ecosystem and biodiversity

Sudipta Supriya Swain

P.G. Department of Botany, Fakir Mohan University, Balasore, Odisha

*Email: sudiptasupriyas@gmail.com

Invasive alien plants species (IAPS) are considered to be one of the major drivers of biodiversity loss and thereby altering the ecosystem services and socio-economic conditions through different mechanisms. Although the ecological impacts of IAPS are well documented, there is a dearth of studies regarding their economic quantification, livelihood considerations, biotechnological prospects (phytoremediation, bioenergy, phyto-synthesis of nanoparticles, biomedical, industrial applications etc.) and human health risk assessments of IAPS. Around the world, invasive plant species pose an increasing threat to native and biodiversity. The prevalence and spread of invasive plant species in various ecosystems may be impacted by the research site factors, such as elevation, climate, soil type, and plant land use. It has been discovered that invasive plant species take on native species for resources, change the structure and function of ecosystem, and decrease biodiversity. This study examines how invasive plant species affect native biodiversity, as well as the causes of their spread and management tactics used to stop them. Cost-effective management methods have been found for many ecosystems after the efficacy and costs of various management techniques, as mechanical removal, herbicide application, and grazing were assessed. Moreover, positive as well as negative implications of the IAPS on environment, health, ecosystem services and socio-economy (livelihood) are listed so that a judicious policy framework could be developed for the IAPS management in order to mitigate the human health implications. The development of more focused management techniques and knowledge of the processes behind how invasive plant species affect native ecosystems should be the main objectives of future study.

Botanical Extracts Combatting Spoilage Bacteria in Non Food Products: A Step Towards a Sustainable Future

Sujogya Kumar Panda^{1,2*}

Centre for Biotechnology, Siksha 'O' Anusandhan (Deemed to be University), Kalinga Nagar, Bhubaneswar

²Department of Biology, KU Leuven, Leuven-3000, Belgium.

* Email: sujogyapanda@soa.ac.in

Microbial contamination in non-food products is inevitable due to industrial production's inability to guarantee sterile end products. Biocides are added to postpone spoilage, but legislation and social acceptance have changed, leading to a growing interest in botanical extracts as alternatives. A study identified bacterial contaminants from 16 expired non-food products, confirming *Pseudomonadaceae* and *Enterobacteriaceae* members as common spoilage organisms. Over 500 botanical extracts were evaluated for antibacterial activity against 11 challenge strains and finally against *Escherichia coli* and *Staphylococcus aureus* in paint and a detergent product matrix. Most extracts showed antibacterial activity against Gram-positive spoilage species, but fewer against Gram-negative species. The activity profiles were diverse, with most active extracts prepared with ethanol, followed by acetone, and water. Most active extracts originate from leaves, bark, fruits, and whole plants. Anacardiaceae, Meliaceae, and Myrtaceae showed the highest frequency of high antibacterial activity of the 76 plant families tested. The product matrix within the paint and detergent product strongly influenced the antibacterial activity of the three selected botanical extracts against *E. coli* and *S. aureus* comparable to a commonly used isothiazolinone chemical preservative, suggesting the feasibility of using plant extracts as preservative biocides. More product challenge tests and large-scale production of plant extracts are needed to further explore their potential as preservatives.

Effect of pH on growth and biochemical parameters of *Chlamydomonas reinhardtii* P. A.

Dangeard

Supriya Devi

Department of Botany, science autonomous college, Hinjilicut, 761102

Email: devi.supriya2012@gmail.com

The effect of pH on biochemical parameters of *Chlamydomonas reinhardtii* was investigated. The results show that the optimum pH for the growth and biochemical components like total chlorophyll content, carotenoids and protein enhanced at the alkaline side especially at pH 9 and shifting pH to the acidic side (pH 4 and 5) significantly decreased. It also observed in different days of culture under different pH range and results shows that the growth, total chlorophyll content, carotenoids and protein content maximum on 19 days culture and it noticeably depressed on 7 days, 13 days and 25 days. The accumulation of carbohydrate found highest of 25 days culture instead of 19 days culture. The amount carbohydrate is also more in comparison to protein of different pH range. From the results we concluded that the *Chlamydomonas reinhardtii* could grow between pH 4 and 9. Accordingly, this species exhibits the wide

tolerance growing at different range pH values, making them suitable candidate for outdoor cultivation and laboratory culture without pH regulation.

Phytoremediation: A solar driven green technology

Suvendu Kumar Mishra*, Anil Kumar Biswal, Biswajit Patra, Arpita Banerjee, Rajashree Das, Adyasha Panda

P.G. Department of Botany, Fakir Mohan University, Odisha

Email: mishrasuvendukumar1999@gmail.com

Phytoremediation uses plants to clean up contaminated soil and groundwater, taking advantage of plants' natural abilities to take up, accumulate, and/or degrade constituents of their soil and water environments. Results of research and development into phytoremediation processes and techniques report it to be applicable to a broad range of contaminants including numerous metals and radionuclides, various organic compounds (such as chlorinated solvents, BTEX, PCBs, PAHs, pesticides/insecticides, explosives, nutrients, and surfactants). According to information reviewed, general site conditions best suited for potential use of phytoremediation include large areas of low to moderate surface soil (0 to 3 feet) contamination or large volumes of water with low-level contaminations subject to low (stringent) treatment standards. Depth to groundwater for in situ treatment is limited to about 10 feet, but ex situ treatment in constructed troughs or wetlands has also been investigated. There are five basic types of phytoremediation techniques: 1) rhizofiltration, a water remediation technique involving the uptake of contaminants by plant roots; 2) phytoextraction, a soil technique involving uptake from soil, 3) phytotransformation, applicable to both soil and water, involving the degradation of contaminants through plant metabolism, 4) phytostimulation or plant-assisted bioremediation, also used for both soil and water, which involves the stimulation of microbial biodegradation through the activities of plants in the root zone, and 5) phytostabilization, using plants to reduce the mobility and migration potential of contaminants in soil. Major advantages reported for phytoremediation as compared to traditional remediation technologies include the possibility of generating fewer secondary wastes, minimal associated environmental disturbance, and the ability to leave soils in place and in a usable condition following treatment. Cited disadvantages include the long lengths of time required (usually several growing seasons), depth limitations (3 feet for soil and 10 feet for groundwater), and the possibility of contaminant entrance into the food chain through animal consumption of plant material.

Role of plant-based nanoparticles in agriculture for abiotic stress tolerance: A review

Swagat Kumar Barik*¹, Umabati Sahu² & Arpita Banerjee³

¹ Research scholar, P G Department of Botany, Fakir Mohan University, Balasore, Odisha.

² Assistant Professor, PG Department of Botany, Fakir Mohan Autonomous College, Balasore, Odisha.

³ Assistant Professor, PG Department of Botany, Fakir Mohan University, Balasore, Odisha.

Email: bswagatkumar.sb@gmail.com*, arpita09061984@gmail.com, umabatisahu@gmail.com

Biogenic nanoparticles have gained significant interest as an innovative strategy to mitigate the effects of abiotic stress on crops. Climate change has intensified global warming and various stress factors,

including drought, salinity, extreme temperatures, and heavy metal toxicity. As a result, there is an increased generation of cytotoxic reactive oxygen species (ROS) in plant cells. These ROS disrupt the cellular balance, damage cell membranes, and negatively affect plant growth and productivity. Nanoparticles solve these significant challenges due to their unique properties arising from a high surface area-to-volume ratio. They enhance plant resilience and promote growth in stressful environmental conditions. Although chemical and physical synthesis of nanoparticles can yield high purity and specific sizes, these methods have disadvantages, such as high costs and hazardous chemicals. Biological synthesis by microorganisms and plants is a sustainable and cost-effective method for producing nanoparticles under ambient conditions. Research shows these biogenic nanoparticles can enhance plant tolerance to abiotic stresses by improving antioxidant activity, nutrient uptake, and cellular structure. The application of biologically derived nanoparticles in agriculture represents a potential breakthrough for enhancing crop resilience to environmental stressors. As this field progresses, it provides a path for creating sustainable agricultural practices to improve global food security amidst climate challenges. Keywords: Nanoparticles, Climate change, reactive oxygen species, agriculture, global food security.

Mut Mapping for trait improvement in popular rice (*Oryza sativa* L) landraces of Odisha

Swagatika Baral^{1,2}, Parameswaran C¹, [Sanghamitra Samantaray](#)¹

¹ Crop Improvement Division, ICAR, NRRI, Cuttack-753006

² Utkal university, Vani Vihar, Bhubaneswar- 751004

Email: swagatikabaral1994@gmail.com, agripames07@gmail.com, smitraray@gmail.com

Landraces are highly suited to their local habitats and are a genetic treasure. Odisha is recognised for its abundant genetic diversity in rice, and farmers continue to cultivate numerous landraces in various parts of the state. The popularity of these landraces in Odisha can be attributed to their aromatic qualities and ability to withstand a variety of biotic and abiotic stress. Due to their fewer productive tillers and lodging during the grain filling stage of the crop, the landraces yield is extremely low. Acharamati is one of the popular landraces in Odisha cultivated across Kalahandi, Nuapada, Balangir, and Rayagada. Furthermore, Acharamati is a moderate yielder, but its tall character causes lodging during the grain filling stage, which lowers the overall yield. Our target is for the reduction in the height of Acharamati while retaining its traditional aroma and grain quality. The approach is by creating the mutants of Acharamati through *in vitro* mutagenesis employing EMS (Ethyl Methane Sulfonate), a chemical mutagen. Till now we have obtained ~70 mutants (M₁ generation), which showed promising reduction in plant height, and at par yield and lodging resistance. Further agronomic characteristics will be assessed in M₂ generation. Additionally, the mutant allele will be mapped using the MutMap approach and recurrent breeding strategy in order to create a superior Acharamati variety tolerant to lodging.

Hidden Dangers in Herbal Medicines: Toxicity and Contaminants

Swapnanjali Nayak

P.G. Department of Botany, Fakir Mohan University, Balasore

Email: swapnanjalinayak2021@gmail.com

Herbal medicines have become more and more popular all over the world since last few decades because it is cheap and locally available. According to WHO, 70-80% of world's population depend on herbal medicines for primary treatment. Generally it is believed that herbal medicines are safe as they are natural. But recent evidences suggest that they also have toxic components and contaminants which impose various health hazards. Herbal medicines contain constituents which can be allergic, toxic, and even can become a potent poison, if they are not used appropriately. The most widely used herb Alfa alfa induces Systemic Lupus Erythematosus like syndrome. Long term use of Aloe vera results in potassium deficiency. Recently it has been reported that Ephedra has many side effects viz; restlessness, irritability, increased blood pressure and heart rhythm disorders. Researchers have shown that Ginkgo fruits and seeds used to improve mental alertness has been associated with increased bleeding time, spontaneous hemorrhage. Herbal medicines can be contaminated by biological contaminants (bacteria, fungi, spores, moulds, viruses, insects etc.) and chemical contaminants. Biological contamination can occur at any stage during production and packaging. Cross contamination is also possible. Spores of Clostridium species can contaminate medicinal herbs and honey. The most common contaminants of raw herbs are moulds of Aspergillus and Penicillium genera. Pesticides (herbicides, insecticides, fungicides, nematocides etc.) are widely applied in the field and get accumulated in plants contaminating herbal extract. Only organochlorine pesticides and organophosphate pesticides have long residual action. Plants grown in soil contaminated with heavy metals also interrupt with the quality of herbal medicines. The most common heavy metals are mercury, lead, and arsenic and others are cadmium, copper and thorium. Apart from that misidentification of herbs and their use has negative impact on health. So before using herbal medicines it is essential to ensure its quality by establishing botanical identity, microscopic and macroscopic evaluation and identity tests. They should be regulated and standardized to meet the safety standards.

Indigenous Knowledge and Socioeconomic Importance of Wild Edible Fruit plants of Soro block in Balasore district of Odisha

Trupti Khamari^{a,b} and Ranindra Kumar Nayak^{b,c,}*

^a P.G Department of Botany, Fakir Mohan University, Vyasa Vihar, Balasore-756089, Odisha

^b P.G Department of Environmental Science Fakir Mohan University, Vyasa Vihar, Balasore-756089, Odisha

^c Centre of Excellence for Bio-resource Management and Energy Conservation Material Development, Fakir Mohan University, Vyasa Vihar, Balasore- 756089, Odisha

*Email: ranindra1968@gmail.com

Wild edible fruit plants (WEFPs) indicate to both indigenous as well as habituated exotic plants occurring in the natural environment. In the times of food scarcity these plants are chief source of dietary

supplement for indigenous and also rural populations. It provides information on food security, sustainability of ecosystem and potential for domestication and commercialization of cultivation of wild edible fruits, which are nutritionally rich and can especially supplement vitamins and micronutrients which support the economic status of the local communities. Soro block in Balasore district of Odisha has rich diversity of wild edible fruit plants, which play a very important role for the economy and nutritional needs of native communities in this region. These wild edible fruit plants are helpful for curing various primary diseases. During the present investigation, 43 Wild Edible Fruit Plant species belonging to 37 genera under 25 families have been reported from different parts of Soro block in Balasore district of Odisha, those fruits have fulfilled the dietary requirement of the local people at the time of food scarcity. This research helps to provide information on diversity, distribution, socioeconomics and conservation significance of medicinal wild edible fruit plants. The study emphasizes the importance of conservation and sustainable harvesting practices to ensure the continued availability of these plants.

Physiological and Biochemical Responses of Rice to Melatonin under Drought Stress

Ujala Rashmi Sahu¹ and Deepali Dash²

¹M.Sc. (Ag) Plant Physiology, Siksha 'O' Anusandhan Deemed to be University

²Assistant Professor, Dept. of Crop Physiology, Siksha 'O' Anusandhan Deemed to be University

Email: ujalarashmisahu20@gmail.com and deepalidash@soa.ac.in

Drought stress significantly impacts rice production globally, necessitating effective mitigation strategies. Recent research has identified melatonin as a potential drought mitigant due to its multifunctional properties. This study investigated melatonin's role in enhancing drought tolerance in three rice varieties: Pooja (local), Swarna (drought-susceptible), and N22 (drought-tolerant). The experiment employed a factorial design, combining four treatments: control, melatonin treatment (100 μ M foliar sprays), drought treatment, and drought with melatonin treatment. Physiological parameters assessed included root morphology, photosynthetic pigments, leaf gas exchange parameters, osmolytes, antioxidant enzyme activity, and oxidative stress markers. Results revealed significant varietal differences in drought tolerance, with N22 exhibiting greater resilience. Melatonin treatment mitigated drought-induced damage in Swarna and enhanced Pooja's inherent tolerance. Melatonin improved root morphology, dry weight, fresh weight, relative water content, and photosynthetic pigments. Leaf gas exchange parameters, including photosynthetic rate and stomatal conductance, were improved. Melatonin modulated osmolyte accumulation, increasing total sugar, starch, and proline content. Antioxidant enzyme activity, including superoxide dismutase and catalase, was enhanced, reducing oxidative stress markers. These findings suggest melatonin's antioxidant and photosynthetic roles contribute to enhanced drought tolerance in rice. The study's results have significant implications for developing melatonin-based drought tolerance strategies in rice, enhancing crop resilience and productivity. Foliar melatonin application emerges as a promising approach for improving drought tolerance, particularly in drought-susceptible varieties. Further research is warranted to explore melatonin's potential in combination with other drought mitigation strategies.

Glowing plant can light up the night sky: The beauty of bioluminescence

Unnati Pallai^{1} & Adyasha Panda²*

^{1,2} P.G. Department of Botany, Fakir Mohan University, Balasore, Odisha

*Email: unnatipallaijasmine@gmail.com

Luminescence, a physical phenomenon that produces cool light *in vivo*, has been observed in bacteria, fungi and animals but not in terrestrial higher plants. However, recent advances in genetic engineering have made it possible to introduce luminescence systems into living plant cells, allowing them to serve as biological markers. Several bioluminescence systems, including the luciferase-luciferin system, the caffeic acid cycle, and bacterial bioluminescence, have been successfully integrated into plants. This has enabled the creation of glowing plants that emit visible light in the dark, making them easily visible to our naked eyes giving a clear lighting asset. Examples of plants modified to exhibit bioluminescence include kale, spinach, arugula, and watercress. These glowing plants have potential applications as natural light sources, such as illuminating streets and replacing conventional light bulbs. In addition to their potential for lighting, bioluminescent plants could also contribute to sustainable energy solutions. For example, they might play a role in solar energy production, harnessing light for various energy needs. This could significantly benefit future energy systems, providing an environmentally friendly and renewable resource. The ability to engineer luminescent plants opens up a range of possibilities, from enhancing aesthetic appeal to reducing reliance on artificial lighting and advancing sustainable technology. As research continues, the integration of luminescence in plants could revolutionize various sectors, including agriculture, urban planning, and renewable energy, ultimately contributing to a greener future.

Microbial Bioremediation of Environmental Pollutants: A Slant towards a Sustainable Technology.

Naba Krushna Panda

Retired Reader in Zoology and Principal (Govt. Autonomous College, Bhawanipatna, 2011)

Email: nkpanda1953@gmail.com

Microbial bioremediation is a biological approach to mitigating environmental pollution by utilizing microorganisms such as bacteria, fungi, yeast, and microalgae to degrade and eliminate pollutants, including industrial wastes, pesticides, heavy metals, hydrocarbons, plastics, and toxic volatiles. These microorganisms use pollutants as energy sources, breaking them down into less harmful substances and aiding in environmental cleanup. Several bioremediation techniques are employed, including bioaugmentation, where exogenous microbes are introduced to enhance pollutant degradation; bioventing, which involves aerating soil to promote microbial activity; bioleaching, or biomining, which uses microorganisms to extract metals from pollutants; and bioparging, which injects pressurized air into soil to foster aerobic bacterial growth. Other methods include biopiling, where polluted soil is piled and aerated to stimulate microbial degradation, and biostimulation, which introduces liquid nutrients to promote microbial activity. Bioreactors use genetically engineered microbes to break down pollutants under optimal

conditions, while windrows and land farming involve rotating and aerating contaminated soil to encourage microbial remediation. Composting, by adding organic material, enhances soil structure and microbial activity, while intrinsic bioremediation relies on native microbes to degrade pollutants without external interventions. Microorganisms play a vital role in bioremediation: bacteria like *Pseudomonas*, *Micrococcus*, and *Bacillus* degrade hydrocarbons, heavy metals, and xenobiotics, while fungi such as *Aspergillus*, *Penicillium*, and *Trichoderma* assist in breaking down textile wastes, heavy metals, and pesticides. Yeasts like *Rhodotorula* and *Saccharomyces* contribute to the biosorption and bioreduction of metallic pollutants, and microalgae such as *Chlamydomonas*, *Chlorella*, and *Scenedesmus* remediate pesticides, textile effluents, and heavy metals. The efficiency of bioremediation is influenced by factors like nutrient availability, pollutant concentration, environmental conditions, and the site's geology and topography. In conclusion, microbial bioremediation presents a sustainable and effective technology for addressing environmental pollution, promoting ecological restoration through natural processes.

Ethnobotanical uses and antibacterial activity of some mangroves in Inchudi Sea Beach along Balasore district of Odisha

Adarsha Pradhan^a and Ranindra Kumar Nayak ^{ab}

^aDepartment of Environmental Science, Fakir Mohan University, Balasore-756089, Odisha

^bCentre of Excellence for Bio-resource Management and Energy Conservation Material Development, Fakir Mohan University, Balasore - 756089, Odisha
Email: adarshapradhanenv.sc656@gmail.com

Mangroves are special group of salt tolerant plants, which are found in the estuarine regions of the coastal districts of Odisha. The coastal areas of the state of Odisha in India are interrupted by several rivers and rivulets such as Mahanadi, Brahmani, Baitarani, Budhabalanga, Rushikulya and Subarnarekha. Five districts of the state of Odishaviz. Balasore, Bhadrak, Jagatsinghpur, Kendrapara and Puri have mangrove distribution along their coasts. Because of their root systems, these are quickly adaptable to any unfavorable climatic conditions, such as floods and cyclones. Balasore district in northern coastal Odisha has rich coastal bio resources which include Mangrove vegetation, sea weeds, horse shoe crab and other organisms. The vegetation of this district including mangroves has much importance to ethnobotanical uses. It has been observed that three species of Avicenniaceae family in coastal regions in Inchudi Sea Beach area along Balasore District have provided protection against unfavorable climatic conditions such as floods, cyclones, tsunami etc. The present survey has been conducted in different locations of Inchudi Sea Beach in Balasore district of Odisha to get a comprehensive idea about the distributional pattern of mangroves, their ethnobotanical uses and antibacterial activity. Mangroves are biochemically distinct, producing a diverse range of natural compounds with unique bioactivity and have long been utilized in traditional medicines. Antibacterial activity of mangroves of Avicenniaceae Family such as *Avicennia alba*, *Avicennia marina*, *Avicennia officinalis* shows that the leaves of these mangroves extracted by using Ethanol have inhibitory effects on the growth of the Gram-negative Bacteria of *Escherichia coli*. It gives an idea that medicines prepared from various parts of these plants will be much effective for

the treatment of various diseases caused by the infection of various microorganisms. Species of the Avicenniaceae family in coastal regions of Inchudi Sea Beach in Balasore District has been depleted at an alarming rate due to the operation of various types of anthropogenic activities such as pisciculture, urbanisation and Defence establishments. There is loss of mangroves in different locations due to tropical cyclones and other environmental hazards. Efforts should be made to conserve the current mangrove vegetation and restore mangroves on degraded lands.

Taxonomy of Family Acanthaceae with special reference to Coastal Districts of Odisha, India

Nabin Kishore Jena^{1,2} and Ranindra Kumar Nayak²

¹Department of Botany, F.M. University, Balasore

²Department of Environmental Sciences, FM University, Balasore

Email: nabinkjena1985@outlook.com

Acanthaceae is one of the top fifteen species-rich flowering plant families, with about 4900 species distributed primarily in the tropical and subtropical regions. The family shows a broad spectrum of variation in growth forms, floral structure and pollen types with a wide distribution. Acanthaceae is among the most taxonomically diverse, geographically widespread, and morphologically and ecologically variable lineages of flowering plants belonging to order Lamiales. This order comprises of 24 families, out of which Acanthaceae bears the most diverse species of plants based on morphology, anatomy and physiology. Though most of the members are gamopetalous and didynamous but besides that the members have myriad differences in morphology and leaf anatomy. Sometimes the flowers are bracteate with two bracteoles. The coastal regions of Odisha have a tropical climate that is influenced by the sea. The climate of coastal region is characterized by several characteristics. The coastal regions have high humidity during summer. The sea moderates the temperatures, resulting in comparatively lesser temperatures than in the Eastern Ghats, which are nearby but have a colder climate. The family acanthaceae includes four subfamilies: Nelsonioideae, Avicennioideae, Thunbergioideae, and Acanthoideae. The acanthaceae includes the Mangrove genus *Avicennia* based on the phylogenetic relations (Andrea E. Schwarzbach, 2002). This monotypic subfamily Avicennioideae of about 8 species comprises the mangrove tree and shrub genus *Avicennia*. Unique in Acanthaceae, plants of *Avicennia* display adaptations to saltwater inundation, including the presence of pneumatophores (Tomlinson, 1986; Verdcourt, 1992; Daniel, 2016); but they lack cystolith.

A Preliminary Report on Mangroves in the Accredited Land at Chudamani, Bhadrak

Astha Mohanty^{a} Anil Kumar Biswal*

^a Department of Botany, Fakir Mohan University, Balasore-756089, Odisha, India

*Email: astha13mohanty@gmail.com

Mangrove groups are shrubs or trees that are mainly tolerant to saline water and thus are found mainly in the coastal regions of saline or brackish water. Mangrove ecosystems are characterised due to their complex root systems, which help them in stabilising the land and protecting against erosion and

supporting biodiversity. Mangroves serve as breeding grounds for fishes, crabs, and many more other marine organisms. Specifically, there are two types of mangroves. One of them is referred to as true mangroves that are found exclusively in mangrove ecosystems, and the other type is referred to as associate mangroves that are species that grow alongside mangroves but can also survive in non-mangrove areas. True mangroves involve species such as *Avicennia officinalis*, and associate mangroves involve species such as *Acanthus ilicifolius*. Odisha is home to rich diversity of mangroves located in the Bhitarkanika Wildlife Sanctuary, as well as along the coastline of Balasore and Bhadrak. Species of this coastline include species such as *Avicennia* spp., *Rhizophora* spp., *Sonneratia* spp., and *Excoecaria agallocha*, which exhibit specialised adaptation for saline water conditions. Mangroves along the coastline of Balasore and Bhadrak provide a critical habitat connectivity. These areas have witnessed restoration efforts aimed at increasing vegetation cover and addressing coastal vulnerability. The mangroves of Odisha coast are situated within the latitudes 19° North and 22° North, and longitudes 85° East and 87° East. Chudamani of Bhadrak district is home to many mangrove species. The vegetation of Chudamani is mainly sandune vegetation. Sporadic mangrove elements are observed near the Chudamani River, which is represented by common species like *Argemone mexicana*, *Clerodendrum viscosum*, and *Ipomoea pes-caprae*. The mangrove plant species are very few in the vegetation of Chudamani, including species such as *Bombax ceiba*, *Cassia occidentalis*, *Heliotropium curassavicum*, *Lantana camara*, *Nerium indicum*, and many more. Mangroves play various crucial roles, the most important being their function as natural barriers against storm surges, cyclones, and erosion. They play significant roles in mitigating climate change by absorbing carbon dioxide, a process referred to as carbon sequestration. Mangroves provide shelter and breeding grounds for various aquatic and terrestrial species. They serve as a source of food, fuel, and timber for coastal communities. Additionally, they help in filtering pollutants and maintaining ecological balance in estuarine ecosystems. Mangroves are crucial for Odisha's economic and environmental resilience, making their conservation vital in areas like Balasore and Bhadrak.

Ethnomedicinal Plants Used by Mankidia Tribes of Similipal Biosphere Reserve, Odisha, India: A Review.

Sanjay Soren^a, Rajashree Das^{a*}

^a Department of Botany, Fakir Mohan University, Balasore-756089, Odisha, India

*Email: rajashreedas23@gmail.com

One of the biggest districts in Odisha, Mayurbhanj, is well-known for the Similipal Biosphere Reserve. It is also famous for having the state's largest concentration of tribal residents. In several Mayurbhanj District villages, ethnomedical research led to the documentation of numerous therapeutic applications of the medicinal plant resource that is accessible locally. The Mankidia tribe mostly depends on hunting and gathering food. Mankidia is one of the Particularly Vulnerable Tribal Groups (PVTG) are mainly found in Odisha. Mankidia had a sex ratio of 95 females to 108 men. They have been considered to be a primitive tribal group and identified as a distinct group. The current study examines the ethnobotanical perception of 48 plant species from 29 families of medicinal plants that are utilized by tribal people in rural

areas since the interior of the district lacks access to healthcare facilities, and people continue to depending on the traditional medical system and medicinal plants for their medical needs. The common diseases for which they are using these plants are cough, cold, diarrhea, gynecological disorders, sexual debility, Malaria and other common fevers, anemia etc. Ethno medicinal uses of plants have been reported since long, most of these plants do not certify the efficacy. The plants that have been utilized to treat different illnesses must undergo pharmacological examination, chemical analysis, and testing for different plant species, bioactive components. There are 6 shrub species, 12 herb species, 9 climber species, and 25 tree species. Plants which include bark, flowers, rhizomes, roots, leaves, seeds, latex, and entire plants were utilized to make medicines. New biomolecules may be found and tested with the use of these ethnomedical claims.

Unlocking the potential of *Spirulina* in Sustainable Food Production: A Nutritious and Environmentally Friendly Solution

Suchismita Behera^a, Rajashree Das^{a}*

^a Department of Botany, Fakir Mohan University, Balasore-756089, Odisha, India

*Email: rajashreedas23@gmail.com

The global food system faces significant challenges in meeting the nutritional needs of a growing population while minimizing environmental impact. *Spirulina*, a microscopic, filamentous Cyanobacterium that grows in alkaline water bodies, offers a promising solution. This paper explores the role of *Spirulina* in sustainable food production, highlighting its high nutritional value, low environmental footprint, requiring minimal water, land and energy, and the ability to thrive in a variety of environments, including waste water and saline water bodies. Extensively used as a nutraceutical food supplement all over the world due to its high levels of functional compounds, such as phycocyanins, phenols etc. with anti-inflammatory, antioxidant, immunomodulating properties both in vivo and in vitro. Also rich in proteins (60-70)%, vitamins and minerals used as protein supplement in diets of malnourished poor children in developing countries. The mass cultivation is achieved both in fresh water and waste water. The micro alga grown in clean water under strictly controlled conditions and in waste water could be used for human nutrition and as animal feed respectively and reducing the need for resource intensive feed crops. Several scientific publications have suggested its positive effects in various pathologies such as cardiovascular diseases, hyperglycemia, tumors, inflammatory diseases, anaemia etc. Different studies revealed the neuroprotective role of *Spirulina*. The present topic was focused on the newly formulated media for cultivation and medicinal properties and various characteristics of *Spirulina platensis*. As the global food system continues to evolve, *Spirulina* offers a promising solution for sustainable food production. Further research and investment are needed to unlock its full potential.

Bio herbicide acts as an eco-friendly tool for sustainable weed management: A Review.

Suchismita Sing^a, Rajashree Das^{a}*

^a Department of Botany, Fakir Mohan University, Balasore-756089, Odisha, India

* Email: rajashreedas23@gmail.com

Weed management is an arduous undertaking in crop production. Integrated weed management, inclusive of the application of bio herbicides, is an emerging weed control strategy toward sustainable agriculture. In general, herbicides are derived either from plants containing phototoxic allelochemicals or certain disease - carrying microbes that can suppress weed population. While bio herbicides have exhibited great promise in deterring weed seed germination and growth, only few in vitro studies have been conducted on the physiological response the Evoke in weeds. This review discusses bio herbicides products that are currently available on the market, bio herbicides impact on weed physiology and potential factors influencing bio herbicide efficacy. A new promising bioherbicidesproducts is introduced at the end of this paper. When absorbed, phototoxic plant extracts or metabolites disrupt cell membrane integrity and important biochemical process in weeds. The phototoxic impact on weed growth is reflected in law level of root cell division, nutrient absorption, and growth hormone and pigment synthesis, as well as in the development of reactive oxygen species (ROS), stress - related hormones, and abnormal antioxidant activity. The inconsistency of bio herbicides efficacy is a primary factor restricting their widespread use, which is influenced by factors such as bioactive compound content, weed control spectrum, formulation, and application method.

Harnessing medicinal plants for diabetes management in the era of Modern challenges

Monalisa Chaudhury

P.G . Department of Botany, Dhenkanal Autonomous College, Dhenkanal,OdishaPincode -759001

Email: monalisachaudhury123@gmail.com

Diabetes mellitus, a chronic metabolic disorder, has emerged as a significant health concern globally, particularly in India and Asia, over the last decade. Recognized as a prevalent lifestyle disease, it adversely affects various physiological systems, leading to complications such as cardiovascular diseases, kidney dysfunction, and neuropathy. Managing diabetes effectively has become a pressing challenge due to its multifaceted impacts on health and quality of life. The primary approaches to diabetes management currently include insulin therapy, oral antidiabetic drugs, and emerging herbal treatments. However, insulin and oral medications, while effective, are not without their drawbacks. These therapies are often associated with side effects like gastrointestinal issues, weight gain, and hypoglycemia. Moreover, the high cost of these treatments places a significant burden on economically disadvantaged populations, particularly those living below the poverty line in India. This economic barrier highlights the urgent need for cost-effective, accessible alternatives. In this context, medicinal plants have gained attention as a promising solution for diabetes management. Herbal medicines, rooted in traditional practices such as Ayurveda, have demonstrated significant efficacy in clinical applications. Numerous studies have shown the hypoglycemic

effects of plant-based compounds, offering a natural and sustainable approach to controlling blood sugar levels. For instance, plants like *Gymnemasylvestre*, *Momordicacharantia* (bitter melon), and *Trigonellafoenum-graecum* (fenugreek) have been widely studied for their potential in regulating glucose metabolism. The pharmacological and phytochemical properties of these medicinal plants are increasingly being validated by scientific research. Bioactive compounds such as alkaloids, flavonoids, terpenoids, and saponins have been identified as key contributors to their antidiabetic effects. Modern pharmacology owes much to plant-based origins, as many widely used drugs, including metformin, atropine, and digitalis, were derived from medicinal plants. This underscores the immense potential of harnessing nature's resources for developing innovative therapies. India, with its rich biodiversity and traditional knowledge, is uniquely positioned to leverage medicinal plants in combating diabetes. The integration of herbal remedies into mainstream diabetes care can provide a holistic approach to treatment, addressing not only the symptoms but also the underlying causes of the disease. Additionally, promoting the cultivation and use of medicinal plants can have economic benefits, supporting rural livelihoods and reducing healthcare costs. In conclusion, harnessing the power of medicinal plants offers a sustainable and affordable strategy for diabetes management in India. By combining traditional wisdom with modern scientific advancements, we can address the challenges posed by diabetes while ensuring equitable healthcare access for all. This approach not only aligns with India's heritage but also represents a forward-looking solution in the era of modern healthcare challenges.

Traditional Medicinal Knowledge and Phytochemical Potential of Selected Plant Species in Kuldiha Wildlife Sanctuary, Odisha

Priyanka Kar¹, Ranindra Kumar Nayak^{*1,2}, Pankaj Kumar Parhi³

¹Centre of Excellence for Bio-resource Management and Energy Conservation Material Development, Fakir Mohan University, Vyasa Vihar, Balasore, Odisha-756089, India

²Department of Environmental Science, Fakir Mohan University, Balasore, Odisha-756089, India

³Department of Chemistry, Fakir Mohan University, Balasore, Odisha-756089, India

*Email: ranindra1968@gmail.com

Ethnomedicinal knowledge serves as a safe, eco-friendly, and accessible alternative to synthetic drugs, particularly in rural areas where modern medical facilities are often unavailable. India, known globally for its vast biodiversity, has a rich tradition of using medicinal plants to treat various ailments, as documented in ancient texts like the Atharva Veda. This study explores the traditional medicinal practices of local communities and investigates the phytochemical properties of selected plant species in the Kuldiha Wildlife Sanctuary, located in the southern part of Balasore district, Odisha. The sanctuary, covering an area of 272.75 sq. km, lies between 21°20'31"–21°29'08" N latitude and 86°25'23"–86°44'50" E longitude. For the tribal communities residing in this region, traditional plant-based remedies often replace inaccessible modern healthcare. Tribal medicine practitioners, known as "Baidya," possess extensive ethnobotanical expertise, playing a vital role in sustaining the health and well-being of local populations. This research

highlights the importance of preserving and scientifically analyzing such indigenous knowledge for future healthcare applications.

Indigenous Knowledge and Ethnobotanical Studies of Medicinal Plants of Kuldiha Wildlife Sanctuary

Sanjay Kumar Behera ^a and Ranindra Kumar Nayak ^{ab*}

^a Department of Environmental Science, Fakir Mohan University, Balasore-756089, Odisha

^b Centre of Excellence for Bio-resource Management and Energy Conservation Material Development, Fakir Mohan University, Balasore - 756089, Odisha

Email: ranindra1968@gmail.com , sanjaykbehera12@gmail.com

The Kuldiha Wildlife Sanctuary, located in the northern part of Odisha, India, is home to a rich diversity of flora and fauna. Among the sanctuary's biological wealth, medicinal plants hold significant importance in the daily lives of indigenous communities living in and around the region. This study explores the ethnobotanical knowledge of the local tribes concerning medicinal plants in the Kuldiha Wildlife Sanctuary. Through a combination of field surveys, interviews with tribal healers, and literature review, this study highlights the plant species used for medicinal purposes, the traditional knowledge systems surrounding their use, and the ongoing challenges to preserving this invaluable heritage. The study found that indigenous knowledge of medicinal plants remains a vital part of local culture, but faces growing threats from modernisation, habitat destruction, and the erosion of traditional practices. This study aims for the integration of indigenous knowledge with conservation efforts to ensure both the survival of medicinal plants and the continuation of traditional healing practices.

***Oxalis corniculata*: A Versatile Traditional Remedy**

Rajita Mishra *, Satpal Singh Bisht

Department of Botany, Polasara Science College, Polasara, Ganjam, Odisha

Soban Singh Jeena University, Almora, Uttarakhand, India

Email: rojitamishra@gmail.com

Oxalis corniculata, a member of the Oxalidaceae family, holds a significant place in traditional medicine, particularly for treating various ailments. Its applications range from neuroprotection to anti-cancer properties, suggesting its potential in modern therapeutic contexts. This plant has been traditionally used across various cultures for a range of ailments, showcasing its importance in folk medicine. Known for its anti-inflammatory and antioxidant properties, it is used to treat conditions like epilepsy, gastric disorders, and neurodegenerative diseases such as Alzheimer's disease. In India, it is used to manage dysentery and diarrhea due to its effectiveness against pathogens like *Entamoeba histolytica* and *Giardia lamblia*. The plant's polysaccharides demonstrate strong antioxidant activities, protecting cells from oxidative damage and making them a potential candidate for dietary supplements in food and cosmetics. Although this plant shows great promise in traditional and modern medicine, further research is needed to

fully understand its mechanisms and optimize its therapeutic potential. During the present investigation the biochemical profiling and In vitro free radical scavenging activity of methanolic extract of the plant (MEO) was carried out. It was found that the total phenolic content of MEO extracts is (16.87 mg of gallic acid/gram of the extract). The IC₅₀ value of the MEO is 32.78 µg/ml respectively.

Potential impact of climate change on soil properties w.r.t. sustainable agricultural practices

R.K. Mishra

Sr. Env. Scientist (Retd.), State Pollution Control Board, Odisha, Bhubaneswar.

Email: rkm.spcb@gmail.com

Despite technological advances i.e. raising the improved variety crops, large scale irrigation system, present days weather condition is putting great thrust on agricultural productivity as well as soil properties. The small and marginal farmers of the state like Odisha are more vulnerable to the climate change impact. The effect of Global warming, climate change on agricultural field are expected mainly through alternation in soil moisture, soil fertility and on whole productivity quantity and quality. The decrease in atmospheric precipitation will result in decrease in water in-filtration and storage of water availability in soil and plant. As soil moisture, soil temperature are the prime factor in agricultural practices. The rise of soil temperature will accelerate rapid decomposition of organic matter, increased microbiological activity, impact on nitrification rate and as a whole vegetation pattern. Soil organic matter is highly susceptible to soil temperature and moisture. Hence, crop development model, yield prediction, fertiliser consumption should be emphasized with special reference to Env. Factors. Also studies to be taken up on the potential effect of atmospheric carbon dioxide on the yield of different crop varieties. The effect of an increase carbon-dioxide would be higher on C3 crops than C4 crops. The impact of extreme climate that would result, the increase in precipitation of soil, moisture would probably result in greater risk of soil erosion, max. of soil hydration according to the high intensity of rainfall.

So, there is need to adopt strategies and chalk out action plan on agriculture for adopting and mitigating the threat of climate change impact like:

- a) Restoration of waste/degraded land.
- b) Protection of forest and grazing land.
- c) Efficient management of water resources.
- d) Implementation of micro irrigation system.
- e) Improvement of Drought resistant variety crops.
- f) In situ-conservation/gene bank for local rice varieties, millets etc.

Traditional uses and phytochemical analysis of potential medicinal plants in Keonjhar District of Odisha

Debasish Patra^a and Ranindra Kumar Nayak^{ab}

^a Department of Environmental Science, Fakir Mohan University, Balasore-756089, Odisha

^b Centre of Excellence for Bio-resource Management and Energy Conservation Material Development, Fakir Mohan University, Balasore - 756089, Odisha

Email: debasishkahna1980@gmail.com

Since the civilization started, different herbaceous plants have been used traditionally as medicines for the treatment of various ailments of human. Ethnobotanical surveys have been conducted in different regions of Keonjhar district of Odisha. Traditional use of plants or their parts are the natural and cultural heritage of this region. The study has been carried out during 2021 to 2023 to assess the medicinal uses of herbaceous plants used by the local tribe and other forest dwellers.

The research work has been carried out with the following aims and objectives.

1. To carry out intensive and extensive studies on drug yielding plants of Keonjhar district and to find out the rare potential drug yielding species with having Interaction with local forest dwellers.
2. Collection of ethno-botanical data and their conservation strategies for sustainable utilisation of bioresources.
3. Proper documentation of the data is to be done in a book form.
4. Collection of information regarding the rare, vulnerable, endangered and plants of other socio- economic importance.
5. Phytochemical analysis of some common medicinal plants of the study areas.

Ethnobotanical surveys have been undertaken in the forest dominated area of Anandpur, Sadar and Champua sub-division of the Keonjhar district. Ethnobotanical data have been collected through field assessment from traditional healers of the tribe by means of personal interviews and semi- structured questionnaires. Voucher specimens were collected following standard methods and identified with the help of the regional flora books. The herbarium specimens have been deposited in the P.G. Department of Environmental Science, Fakir Mohan University, Balasore, India for future reference. The impacts of various biotic factors, which are responsible for habitat destruction, have been assessed and the present statuses of different medicinal plants have been evaluated. Phytochemical analysis of ten medicinal plants has been carried out during the study. A total of 78 herbaceous species belonging to 28 families have been reported during the study. It has been observed that root parts are widely used for medicinal purposes. It is followed by the leaf, bark, seed and stem. Ethnomedicinal uses and phytochemical analysis of 22 potential medicinal plants have been carried out and documented. This investigation reveals that herbaceous medicinal plants are widely used as medicines for the primary health care of tribe of this region. Herbaceous medicinal plants also have the potential to form the basis of pharmaceutical drugs for the treatment of various diseases. Phytochemical analysis of some selected herbaceous plants are useful for the validation of the ethnobotanical data for further clinical use.

Phosphate Solubilization Potential of Rhizosphere Fungi Isolated from rice field

Pallavi Dehury, Rojali Maharana, Sourav Kumar Rout and Ipsita Pati*

¹ Post graduate Department of Botany, Utkal University, Vanivihar, Bhubaneswar 751004, Odisha, India

*Email: rojalimaharana111@gmail.com

Phosphorus is the second most critical macronutrient after nitrogen required for metabolism, growth, and development of plants. Despite the abundance of phosphorus in both organic and inorganic forms in the soil, it is mostly unavailable for plant uptake due to its complexation with metal ions in the soil. The use of agrochemicals to satisfy the demand for phosphorus to improve crop yield has led to the deterioration of the ecosystem and soil health, as well as an imbalance in the soil microbiota. Consequently, there is a demand for an alternate cost-effective and eco-friendly strategy for the biofortification of phosphorus. One such strategy is the application of phosphate-solubilizing microorganisms which can solubilize insoluble phosphates in soil by different mechanisms like secretion of organic acids, enzyme production, and excretion of siderophores that can chelate the metal ions and form complexes, making phosphates available for plant uptake. These microbes not only solubilize phosphates but also promote plant growth and crop yield by producing plant- growth-promoting hormones like auxins, gibberellins, and cytokinins, antibiosis against pathogens, 1-aminocyclopropane-1-carboxylic acid deaminase which enhances plant growth under stress conditions, improving plant resistance to heavy metal toxicity, and so on. Pyrroloquinoline quinine (pqq) and glucose dehydrogenase (gcd) are the representative genes for phosphorus solubilization in microorganisms. Therefore, the experiment was conducted to evaluate the phosphate solubilizing fungi on inorganic phosphate solubilization in the PVK broth. Mineral phosphate solubilizing activities of two fungal isolates were tested in tricalcium phosphate medium by analyzing the possible phosphorus release from 5th, 10th and 15th day of incubation. Maximum P release was observed on 5th and 10th day of incubation in tricalcium phosphate medium, by two isolates. Among the isolates, *Aspergillus niger* induced highest P release of 675 and 605 µg ml⁻¹ and resulted in 76 and 72% P solubilisation in tricalcium phosphate medium. The pH of the culture filtrate medium gradually decreased with the progress of incubation and maximum decrease was observed between 5- 10th day of incubation by all the fungal species.

Bacterial solubilization of mineral phosphates isolated from rhizospheric soil

Rachita Tarai, Rojali Maharana, Sourav Kumar Rout and Pallavi Jali*

¹ Post graduate Department of Botany, Utkal University, Vanivihar, Bhubaneswar 751004, Odisha, India

*Email: rojalimaharana111@gmail.com

Phosphorus (P) is one of the most important nutrients that limit crop production, and on average, soil contains 0.02–0.5% total P, which generally exists as poorly soluble inorganic P, with only 1% of soil P readily available for plant utilization. In soils, the poorly accessible P typically comprises calcium phosphate (Ca-P), iron phosphate (Fe-P), and aluminum phosphate (Al-P), with their solubility decreasing in the following order: Ca-P > Al-P > Fe-P. In acidic soils, a large portion of the introduced phosphorus is fixed by

free oxides and hydroxides of aluminum and iron, and under these forms is unavailable to plant. However, many soil bacteria and fungi have the capacity to solubilize inorganic P and to increase P availability. Kucey 1983 found significant correlation between the numbers of P-solubilizing bacteria and the levels of total P in the soil and demonstrated that bacteria were superior to fungus in solubilizing Ca-P. Several studies have shown that increase in yield or plant growth can be achieved through the inoculation of P-solubilizing bacteria in either pot experiments or under field conditions. Therefore, the experiment was conducted to evaluate the phosphate solubilizing bacteria on inorganic phosphate solubilization in the PVK broth. Mineral phosphate solubilizing activities of two bacterial isolates were tested in tricalcium phosphate medium by analyzing the possible phosphorus release from 6th, 12th and 24th day of incubation. Maximum P release was observed on 6th and 12th day of incubation in tricalcium phosphate medium, by two isolates. Among the isolates, *Bacillus thuringiensis* induced highest P release of 655 and 705 µg ml⁻¹ and resulted in 70 and 74% P solubilisation in tricalcium phosphate medium. The pH of the culture filtrate medium gradually decreased with the progress of incubation and maximum decrease was observed between 6- 12th day of incubation by both the bacterial species.

Insectivorous medicinal plant *Drosera* ecology conservation through techniques of tissue culture and sustainable biotechnology as related to the environment.

Sushil Pradhan

Green Paradise, Plot No. 116(1) Vivekananda Nagar, Sonepur- 767017 (Odisha) India

Email: drsushilpradhan@gmail.com

Insectivorous Medicinal Plant *Drosera* belongs to the family Droseraceae, Order-Caryophyllales, Dicotyledoneae, and Angiospermae. Locally called "Patkanduri" (Odisha), "Mukhajali" (Hindi) "Sundew" (English). India harbours only three species. From Odisha only *Drosera burmannii* Vahl is being reported. This is a small red colour annual herb with white pentamerous flowers completing its life cycle during September-- March and dies in March first week due to hot climate. Local village physicians (Kabiraj and Baidyas) use this plant for the treatment of cold and cough in children. In the present field investigation an attempt has been made to understand its unique reproductive phase and life cycle thereby planning for its conservation and propagation through various techniques of tissue culture and biotechnology.

Molecular breeding approach for Development of Rice Lines with QTLs for Phosphorus uptake efficiency, Deeper rooting, and Yield under drought stress in Upland ecology

Sourav Surav Yadav¹, Soumya Abhilipsa Satpathy¹, Abhijit Parida¹, Namrata Nayak¹, Satyabrata Moahnta¹,
Sharat Kumar Pradhan² and Elssa Pandit^{1*}

¹ Department of Biosciences and Biotechnology, Fakir Mohan University, Balasore- 756089

² Department of Applied Microbiology, Fakir Mohan University, Balasore- 756089

³ Crop Sciences Division, Indian Council of Agricultural Research, Krishi Bhawan, New Delhi 110001

*Email: elsambio@gmail.com

Almost 50% of 143Mha rice growing area in India is under rainfed condition that faces erratic rainfall and severe drought. Rice being a shallow rooting plant becomes vulnerable to the stress. Changing the root architecture from shallow to deeper rooting by altering the root angle can help the rice plant to escape drought. One major QTL/gene for deep rooting *Dro1* has been cloned. In addition to drought, low phosphorus availability is a major limitation in upland ecology. The cost of required phosphatic fertilizers to improve yield is becoming constraint to Indian farmers. A major QTL *Pup1* on chromosome 12 exhibiting 78.8% phenotypic variance for P-uptake is the only QTL available for marker-assisted breeding programs for efficient P-uptake. Yield under drought stress is a necessary trait required for varietal improvement. The major drought yield QTLs, *qDTY1.1*, *qDTY2.1*, *qDTY2.2*, *qDTY2.3*, *qDTY3.1*, *qDTY3.2*, *qDTY4.1*, *qDTY1.1*, *qDTY6.1*, *qDTY6.2*, *qDTY9.1*, *qDTY10.1* and *qDTY12.1*, have been demonstrated to give tolerance to reproductive stage drought stress minimizing the yield loss. Marker-assisted backcrossing (MABC) method was followed for pyramiding the deeper rooting (*Dro1*), P-uptake (*Pup1*) and yield under reproductive stage drought stress QTLs (*qDTY12.1*) into a popular variety.

Out of 514 screened SSR markers 75 were polymorphic and 53 were selected for Background Selection to obtain maximum coverage from all the 12 Chromosomes. The generated cross seeds were grown and subjected to true hybridity test. The true F₁s were again crossed with recurrent parent to generate BC₁F₁ seeds. 252 BC₁F₁ plants were subjected to foreground selection with linked /gene specific markers for deeper rooting, P-uptake and yield under drought. The foreground selection with *Pup1*-K46 marker showed 61 plants having *Pup1* QTL, 139 lines were positive for *Dro1* using RM6089 whereas only 32 were positive for *Dro1* QTL. 42 lines were positive for yield QTL under drought. Nine lines designated as SMN-3, 26, 41, 77, 92, 99, 117, 152 and 241 possessed all the four QTLs. These nine lines were subjected to background selection with 53 SSR markers. The percentage of genome recovery ranged from 66.98 to 81.13% with an average of 74.94% which is close to the ideal Mendelian value of 75%. The line SMN-99 with highest genome recovery i.e, 81.13% was backcrossed to get the BC₂F₁ seeds. The harvested BC₂F₁ cross seeds were grown following standard methods. The BC₁F₁ plant having all the four QTLs and highest genome recovery will be used for developing BC₂F₁ plants that will further be subjected to MABC to develop elite lines with in-built capacity to tolerate drought having deeper rooting, better uptake of Phosphorous with better yield potential under reproductive stage drought stress.

***In-silico* analysis of divergence pattern of indigenous *Macrophomina* isolates collected from sesame in eastern India.**

¹Ashutosh Nanda, ²Nirakar Ranasingh, ³Curie Parhi and ¹Elssa Pandit*

¹Department of Biosciences and Biotechnology, Fakir Mohan University, Balasore, Odisha, India

²Odisha University of Agriculture and Technology, Bhawanipatna, Odisha, India

³SOA Deemed to be University, Bhubaneswar, Odisha, India

*Email: elsambio@gmail.com

An increasingly common disease in sesame called as charcoal rot (or MSR) caused by the fungus *Macrophominaphaseolina* (Tassi) Goid which causes heavy yield loss worldwide. Diversity information of pathogen at crop field level is crucial for understanding the disease epidemiology and host-pathogen interactions and it is very important for the proper management of the disease. The present investigation aims for proper diversity study using internal transcribed spacer (ITS) sequencing of the 18S rRNA gene, of seven isolates of sesame exhibiting equal symptoms collected from different locations in eastern India. The morphological and cultural characteristics showed symmetrical traits whereas the molecular identification using ITS sequencing technique revealed all the isolates as *Macrophomina* species. Secondary structure of the ITS region was predicted in this study, which serves as an essential supplementary information set for precise pathogen speciation. The foreseen secondary structure data exhibited larger variability in the isolates collected from all the places. The neighbour joining tree constructed using the consensus sequence information of ITS region revealed that the isolate collected from different geographical locations was closer to *Macrophomina phaseolina*, *Macrophomina pseudophaseolina* and *Macrophomina tecta*. Therefore, the findings suggested that the primary sequencing data when combined with structure analysis, can offer fresh perspectives for accurate species identification and establishment of genetic diversity among different strains isolated from different geographical origins.

Marker-trait association study for the detection of genomic regions controlling deeper rooting trait in *indica* rice (*Oryza sativa* L.)

Soumya Abhilipsa Satpathy¹, Sourav Surav Yadav¹, Swati Behera¹, Sanjib Kumar Singh², Sharat Kumar Pradhan³ and Elssa Pandit*¹

¹Department of Biosciences and Biotechnology, Fakir Mohan University, Balasore- 756089

²Department of Applied Microbiology, Fakir Mohan University, Balasore- 756089

³Crop Sciences Division, Indian Council of Agricultural Research, Krishi Bhawan, New Delhi 110001

*Email: elsambio@gmail.com

Rice being shallow rooting plant becomes vulnerable to drought stress. Almost half of the rice growing area faces drought stress under the changing climatic scenario. Deeper rooting property can help the rice plants to avoid drought stress by getting water from deeper soil. Deeper rooting trait accounts for better root angle thereby helping the plant to receive water from deeper soil even root length remaining

same. Two major QTLs *Dro1* and *Dro2* accounting for 66.6% and 32-56% of phenotypic variance, respectively, have been mapped, of which *Dro1* has been cloned. Three minor QTLs namely *Dro3*, *Dro4* and *Dro5* have also been mapped. But all these QTLs responsible for root angle have been mapped from a population developed from cross between IR64 and Kinandang Patong (*japonica*) genotypes through bi-parental mapping. But association mapping is done from natural population consisting many genotypes, which is preferable over bi-parental mapping in recent days. No novel QTLs are reported globally for deeper rooting trait in any *indica* genotypes. The present study aimed to identify novel QTLs responsible for deeper rooting in *indica* rice through association mapping.

A panel of population constituting 100 *indica* genotypes were studied for detecting the novel genes/QTLs through association mapping. For phenotyping analysis of deeper rooting trait basket method was used. By using SSR markers covering all the 12 chromosomes genotyping of the panel population was studied. PowerMarker v3.25 and STRUCTURE 2.3.6, Darwin5, GenAlEx 6.5 softwares were used for the analysis of genetic diversity parameters and population structure. To identify QTLs/genes responsible for deeper rooting trait GLM and MLM models of TASSEL5 software were used in Marker-trait association mapping. *Dro1*, *Dro2*, *Dro3*, *Dro4* & *Dro5* QTLs were validated and novel QTLs were identified which may be directly or indirectly involved for deeper rooting. The identified QTLs will be useful in future molecular breeding programs for Potential donor lines having deeper rooting trait in varietal improvement to avoid drought stress and identification of novel genomic regions governing the deeper rooting property will show light into the detailed mechanism operating behind it. And novel gene (s) those would be identified conferring deeper rooting in *indica* rice can be filed for patents.

Sustainable Utilization of Chicken Waste: Developing Nutrient-Rich Hydrolysates for Biotechnological Applications

Susmita Gharai¹ and Gargee Mohanty^{2}*

¹Ph.D research scholar and ²Assistant Professor

P.G. Department of Zoology, Maharaja Sriram Chandra Bhanja Deo University, Takatpur, Baripada

Email: gargee.mohanty@gmail.com *, gharaisusmita3@gmail.com

Chicken meat is a widely consumed and one of the sources of protein in human food stuffs but its processing generates waste, consisting feathers, skin, bones, and visceral remnants etc. These by-products are often discarded, or dumped to environment causing pollution and sustainability. However, chicken waste is rich in keratin from (feathers), collagen and elastin (skin), and other protein contents from visceral mass, making it a potential resource for developing sustainable high-value products. This study focuses on the extraction and utilization of hydrolysates derived from chicken waste to create nutrient media for bacteria, animal cell, and insect cell cultures, with the aim of reducing waste and producing cost-effective alternatives to conventional culture media. The chicken waste was treated with acid, alkaline, and enzymatic hydrolysis methods to break down complex proteins into simpler, bioavailable hydrolysates. It is observed that chicken waste supports significant microbial growth, as compared to commercial culture media.

Feather-derived hydrolysates are rich in keratin, were found to be very effective, while collagen and elastin from skin contributed essential amino acids and structural proteins necessary for cell proliferation. Visceral waste, with a protein content of approximately 68.26%, proved to be an excellent source of nitrogen and amino acids, further enhancing the growth of microbial cells. The findings highlight the potential of chicken waste as a low-cost, sustainable alternative for culture media production. Further these hydrolysates obtained from chicken waste can have broader applications, to develop biofertilizers for sustainable agriculture, can serve substrates for industrial enzyme production and also can be used to formulate nutritional supplements for human and animal consumption, addressing malnutrition and protein deficiencies in cost-effective ways. The utilization of chicken waste for the production of nutrient-rich hydrolysates not only mitigates environmental waste but also contributes to a circular economy by transforming a low-value by-product into a high-value resource for biotechnology, pharmaceuticals, agriculture, and food industries.

Ethnomedicinal Use of Potential Medicinal Plants in Malyagiri Hill Ranges of Odisha

Manoj Kumar Pradhan^a and Ranindra Kumar Nayak^b

^a Department of Botany, N.C. Autonomous college, Jajpur-755001

^b Department of Environmental Science, Fakir Mohan University, Balasore - 756089, Odisha

Email: manojkupradhan17@gmail.com

Malyagiri hill ranges located on the south of Pallahra town of Angul district in the state of Odisha is endowed rich biodiversity including large number of flora and fauna. This area is rich with large number of medicinal plants and plants of other socioeconomic importance. It consists of no. of small and large hills attaining height upto 1187 mtrs. It is the third highest mountain peak in Odisha. Malyagiri hills affiliated with Eastern ghats of India present within 85° 16' 58" E longitude and 21° 23' 30" N latitude, comes under Deogarh forest division and covers around 115 sq. k.m. From the past floristic studies conducted by early workers it is evident that intensive floristic studies have not been conducted in this region. Large number of tribal people also inhabit around Malyagiri and its periphery. These people are utilizing various plant and plant products for medicinal and other purpose. Thus, this area is also much rich with indigenous knowledge which is on the verge of extinction due to advent of modern allopathy system of medicine.

Keeping these facts in mind regular field trips have been conducted in different seasons of the year to various locations of the study area to know the distribution pattern and natural habitat of medicinal plants. The plant species were identified with help of regional flora book.

During the present investigation 486 medicinal plants and plants of other socioeconomic importance have been collected and identified from different location of this region. It has been observed that some species of medicinal plants are also on verge of extinction in this region due to habitat loss. Phytochemical analysis of some selected plants has been carried out which are useful for validation of ethnomedicinal data for their application in herbal drug industries.

ABSTRACTS FOR SMT. PRIYAMBADA MISHRA MEMORIAL AWARD COMPETITION

Artificial photosynthesis, a promising trend for future

Smaraki Pattnaik

U.N. Autonomous College of Science and Technology, Adaspur

Email: smarakipattnaik1997@gmail.com

Synthetic biology has accelerated the scope of biological research by incorporating the derived principles of interdisciplinary life sciences. This rising domain has its roots since 1900, when extensive studies were done on microbial level and since then it has endowed remarkable achievements in the field of biology. One such achievement could be traced back to the emergence of Artificial Photosynthesis, a laboratory process which biomimics the food processing mechanism in natural plants. The process of trapping sunlight and artificial photolysis is carried out by constructing a "half leaf", by attaching two photovoltaic cells together associated with an electrocatalyst. The protons obtained could be used to generate a large number of hydrogen, which along with reduced carbon dioxide proves to be a substantial resource for synthetic fuel production. A combination of Perovskite and Bismuth Vanadate possibly drives the reduction of CO₂ and H₂O, combined by Tin metal. The source of CO₂ is water with added Potassium Bicarbonate and dissolved CO₂. The main aim of this process is to produce a fuel from sunlight or solar fuel that could be stored and later supplied for use. As it is mainly carried out in a closed room, the variations in light intensity along with the limited efficiency of the catalyst are major drawbacks for the successful outcome of this artificial process. The application of this artificial mechanism has widened the possibility of producing more than one form of fuel, along with other forms of energy. Thus, this Artificial Photosynthesis would be a potential technology of source for a sustainable form of energy in future.

Phytoremediation: The Nature's Mercy

Samina Khatun

Department of Botany, Fakir Mohan Autonomous College, Balasore

Email: saminakhatun6789@gmail.com

As industrialisation increases, soil and water pollution also grows simultaneously due to industrial effluents, which can be metallic and non-metallic. Since the heavy metals are non-biodegradable, they gather in the habitat and pollute the food chain. Some heavy metals are carcinogenic, mutagenic and endocrine disruptors, while others cause neurological and behavioural changes, especially in children. So to decrease these pollution, a green technology known as phytoremediation taken up in process. Phytoremediation is an eco-friendly, cost-effective and sustainable method that uses living organisms like plants, algae, seaweeds and microbes to remove or degrade toxic substances from soil. It uses various mechanism, the mainly used mechanism are phytoextraction, phytodegradation, phytofiltration, phytovolatalization and phytostabilization. The species like cyanobacteria, rhizobia, mycorrhiza, halophytes and lichens, which show these characteristics, are called hyperaccumulators, which show hyperaccumulation properties. This is a sustainable biotechnological methodology based on plant-microbe

interaction and facilitates ecological balance, enhances biodiversity, improves soil quality and improves plant health, thereby presenting a solution to agro-pollution on a global scale. Plant growth-promoting rhizobacteria (PGPR) plays a vital role in improving the efficiency of the phytoremediation process. It is a mercy of nature that some species have these characteristics so that our nature can clean itself without human interaction. It involves the interaction of plant roots and PGPR to remove metals, radionuclides, explosives, pesticides, crude oil, organic compounds and various other contaminants. This process includes plants using accumulated metals at high levels and adapts the toxic environment while preventing soil erosion. This is a global remedy to restore the ecosystem and environment.

Biotechnological approaches for biodiversity conservation and development of climate resilient plant

Devi Prasanna Dash

M.Sc. Student, Biotechnology, Ravenshaw University, Cuttack

Email: deviprasannadash193@gmail.com

Biotechnology plays a vital role in both conserving biodiversity and developing plants that can withstand the challenges posed by climate change. With ecosystems under threat from climate shifts and habitat destruction, biotechnological tools such as genetic engineering and tissue culture have revolutionized plant breeding. These technologies enable the development of crop varieties that can endure extreme environmental conditions, such as drought, salinity, and fluctuating temperatures. Beyond improving agriculture, biotechnology also helps protect endangered plant species by promoting genetic diversity and aiding in habitat restoration efforts. Furthermore, these innovations can strengthen plants' resistance to pests and diseases. Molecular markers are another key tool, allowing scientists to measure genetic diversity and direct breeding programs toward more sustainable, resilient plants. In this presentation, we will explore the latest breakthroughs in plant biotechnology, showcase successful climate-resilient crops, and discuss how these technologies can be integrated into long-term biodiversity conservation strategies.

Vertical Farming in Urban Environment: A View of Architectural Integration and Food Security

Ananya Mohanty

P.G. Department of Botany, Udayanath Autonomous College of Science & Technology, Adaspur, Cuttack

Email: mohantyananya2002@gmail.com

Vertical farming in urban environment act as an important tool to address the challenges of food security by utilizing limited spaces in urban areas. Urbanization and population growth resulted huge pressure on traditional agriculture. Vertical farming is the practice of growing crops in vertically and horizontally stacked layers. The modern concept of vertical farming was proposed in 1999 by "Dickson Despommier", Professor of Public and Environmental health at Columbia University. Vertical farms can be set up in a variety of locations, including buildings, warehouses, shipping containers, green houses or even

on rooftops or balconies. It is a resource efficient way of producing food that can address the challenges of climate change and urban population growth. Hydroponics, Aeroponics, Aquaponics, Drip irrigation, Nutrient film technique are some specialized irrigation methods of vertical farming. Measure crops of this type of farming are: Leafy vegetables (Lettuce, spinach, arugula), Turmeric, Mushrooms, Peas, Strawberries, Tomatoes, Herbs Basil, Parsley, Mint, Cilantro), Peppers, Cucumbers, Beans, Collard greens. In Asia, countries like -: Japan, Singapore, China, USA, Canada, South Korea, Thailand, and Taiwan are leading in vertical farming adoption due to high urbanization rates and technological advancement. In India cities like New Delhi, Kolkata, Mumbai, Chennai, Kerala, Gujarat also adapted to vertical farming. Artificial lighting system & metal reflectors are used to mimic sunlight. The integration of vertical farming into urban architecture is a complicated endeavor that involves consideration of space utilization, energy efficiency & sustainable practices. The symbiotic relationship between architecture & agriculture is crucial for optimizing resource utilization, efficient energy distribution & minimizing environmental impact. It examines the role of technology by creating automated farming systems that can be integrated into urban structures. The integration of sensors, artificial intelligence & robotics enhances precision farming. Vertical farming has many benefits like space efficiency, year-round production, reduce water uses (95% less water than traditional farm), better working environment & minimize the occurrence of pest infections. It reduces the dependence on long distance transportation, minimize carbon footprints & enhance food supply chains by bringing food production closer to urban centers. Additionally, the controlled environment of vertical farm mitigates the impact of climate variability on crop yards. It also contributes for more stable & secure food production. So, by eliminating the use of chemical substances & integrating technologies like hydroponics, aeroponics & climate resilience vertical farming can be adopted. In India it contributes vector resource utilization & pollution prevention. It is indeed a method of farming in future.

Disruptions in plant-microbe symbiosis induced by climatic variability

Chinmayee Dhall

P.G. Department of Botany, Udayanath Autonomous College of Science & Technology, Adaspur, Cuttack

Email: chinmayeedhall5@gmail.com

Plant mutualistic association with various beneficial microbes is referred to as the plant enhancer microbiome. These microbes are found either in episphere or endosphere of the plant tissues. Several pieces of evidence have highlighted that plant microbiomes and soil play a pivotal role in making soil nutrient balance which is readily available to plants and provide strength under various stresses. Hence an important cognizance to above & below plant microbial diversity must be done. The region surrounding the aerial portion of the plant is termed the phyllosphere. The phyllospheric region is very dynamic and greatly influenced by several factors like temperature, precipitation, light, etc. The bacterial population present in the phyllosphere α and γ proteobacteria belong to proteobacterial (phyla- Bacteroidetes & Actinobacteria) that is mostly non-pathogenic and hyper-diverse in nature. The phyllosphere fungi associated with forest trees are saprobic and key decomposers of leaf litter along with another group which are latent pathogens. The microbial population residing in soil system includes various Plant Growth Promoting Rhizobacteria

(PGPR), fungi, actinomycetes, algae, yeasts, cyanobacteria, and many more. They aid in transforming organic matter into simpler form that can be assimilated by plants. Phyllospheric microbiome is affected by environmental factors. Environmental factors include temperature, CO₂ concentration; increased exposure of UV radiation. Elevated temperature increases the virulence of bacteria *Pectobacterium atrosepticum* causing soft rot and certain other seed born microbes that promoted degradation of cell wall enzyme and increase disease incidence in plants. The atmospheric CO₂ is very crucial in regulating carbon allocation and composition of root exudates in the soil environment, which imparts a potential effect on the rhizospheric environment with beneficial microbes. The soil environment contains a higher proportion of CO₂ than the atmosphere. Microbes such as fungi, bacteria, actinomycetes show variable responses to elevated CO₂ conditions. Moreover, the role of rhizospheric microorganisms under eCO₂ level is needed to be assessed for climate-resilient agriculture along with rigorous effort in scaling up to explore the long-term effect of soil microbes to increased CO₂ conditions and efficient carbon sequestration by plant-microbe interaction. Increasing UV-radiations changes cell oxygen yield, photosynthetic system, and growth of cyanobacteria. The scarcity of water in the rhizospheric region reduces mycorrhizal mycelium formation in the plant roots. It is evident there are multiple drivers of plant microbiota association aboveground and belowground communities. They regulate the structure and activities of microbes and also have considerable influence on plant system. Climate change is concurrent phenomenon of global concern and increase in climatic adversity, the food security has been emerged worldwide as alteration in existing climatic patterns adversely affects plant and microbial growth. The adverse effect of climate change is also a matter of discussion for microbe structure & functioning in ecological niches. To what extent we can manipulate the plant microbiome to increase sustainable agricultural yield, maintaining an eco-friendly environment, needs to be investigated. Recently host genetic factor could facilitate study of microbiome diversity and structure which may help in selection of trait-based microbiomes. To explore broader knowledge of the host-specific plant microbe interaction, there is a need of advance integrated novel molecular approaches such as ecological models, meta-omics and bioinformatics that could interlink the correlation between microbial community and environmental function.

Promoting sustainable agriculture through climate smart practices

Dibyapranjya Tripathy

P.G. Department of Botany, Udayanath Autonomous College of Science & Technology, Adaspur, Cuttack

Email: dibyapranjyatripathy@gmail.com

The living world is home to a diverse range of microbes, animals, and plants that exist in varying abundance across the globe. Climate play a vital role in our daily lives and impacts the environment, health, economy, and food security. India experiences a variety of climate including tropical, sub – tropical, temperate, alpine, semi – arid and monsoon climate. These climates influenced by various factors like: - volcanic eruptions, solar variability, green-house gases, deforestation, fossil fuel burning, industrial process, transportation, and population growth. Thus, for the changing climate the globe was witnessing reduced crop yields, shifting growing seasons, increased pest and disease pressure, monsoon variability, drought,

floods and heat waves and ultimate effects of EL- NINO. These changes pose major challenges for global food production and sustainability. To address these challenges and promote sustainable agriculture adopting climate smart agriculture (CSA) practices is essential which is also known as, smart integrated farming. According to United Nations, Food and Agriculture Organization (FAO) "sustainable agriculture is an approach that emphasizes the maintenance of soil – fertility, biodiversity, and ecosystem services while minimizing environmental impacts and promoting social equity and economic viability". If all beings were adopting these techniques, it will create various profound impact on crops like: - Increasing crop yield and improving crop quality, enhancing drought tolerance and water – stress management, reducing the soil erosion and greenhouse emissions, improving heat stress management, strengthening resistance to pests and diseases, improving soil – carbon sequestration, farmers income and reducing the production costs and risks, enhancing food security and nutrition. To achieve this vision, every farming must scale up climate-smart agriculture globally, support policy and institutional frameworks, invest in agricultural research and development, enhance capacity building and knowledge sharing, and foster international cooperation. Here are some working examples of successful sustainable agriculture around the world: - Argentina's Regenerative Agriculture, Brazil's Agroforestry, China's Agroforestry, Chile's Organic Farming, Canada's Organic Farming, Denmark's Organic Farming, Germany's Biodynamic Farming, Ghana's Cocoa Agroforestry, India's System Of Rice Intensification, Italy's Agroforestry, Japan's Organic Farming, Kenya's Small – Scale Irrigation, Mexico's Agroforestry, Rwanda's Organic Farming, US's Regenerative Agriculture. Sustainable agriculture through climate-smart practices is a vital approach to ensuring global food security, mitigating climate change, and promoting ecosystem resilience. Together, the world can create a climate- resilient, sustainable, and equitable food system, ensuring a liveable future for generations to come.

Bioinnovation: PGPB based solution for crop improvement

Jyotirmayee Behera

P.G. Department of Botany, Udayanath Autonomous College of Science & Technology, Adaspur, Cuttack

Email: jyotirmayeebehera993@gmail.com

Agriculture Plays a key role in ensuring food security and economic development, but it faces many issues like climate change, soil degradation and pesticidal attacks. Many traditional farming methods rely on chemical fertilizers and pesticides, which can harm both the environment and human health. To address these issues, researchers have been exploring sustainable solutions for crop improvement. One great option is using Plant growth promoting bacteria (PGPB). These beneficial bacteria can enhance the plant growth, increase harvest yields and help crops resist various stresses, supporting more sustainable farming approaches. Plant growth promoting Bacteria plays an ecofriendly role in achieving sustainable agriculture. Free living PGPB, such as *Pseudomonas* and *Bacillus*, inhabit in the soil near plant roots and offer benefits without needing to attach to specific plant and also may be rhizospheric or endophytic bacteria found on plant parts. These bacteria are broadly grouped based on their functional roles and ecological niches rather than strict taxonomic classification. They include bacteria from several phyla, mainly Proteobacteria, Actinobacteria, Firmicutes, Bacteroidetes and cyanobacteria. Such bacteria promote plant growth directly

via solubilization of phosphorus, potassium and zinc. This enhances production of phytohormones and nitrogen fixation or indirect production of Lytic enzymes, hydrogen cyanide, ammonia and antibiotics. These beneficial micro-organisms offer a comprehensive solution for crop improvement. One of the most significant roles of PGPB in sustainable agriculture is their ability to biologically fix nitrogen. This process is essential for crops like legumes, which develop symbiotic partnership with nitrogen - fixing bacteria (such as *Rhizobium spp.*), This Improves soil fertility and reduces the demand for chemical nitrogen fertilizers, which have negative effects on the environment. Some well-known species, like *Azospirillum* and *Azotobacter*, play a crucial role in enhancing non-leguminous crops by supplying nitrogen in a form that's easily accessible, promoting overall plant growth across various species. In addition to nitrogen fixation, PGPB facilitate the availability of other essential nutrients such as phosphorus and potassium by solubilizing these elements from insoluble forms of soil. This nutrient solubilizing capacity allows PGPB to reduce dependency on chemical fertilizers, which can cause pollution in soil and water when used excessively. Another critical function of PGPB is the Production of Plant growth stimulators like auxins, cytokinins and gibberellins. These hormones stimulate root elongation and branching leading to an expanded root surface area that improves nutrient and water uptake. Now a days global climate change significantly contributes to both non-living and living stresses that impact agricultural productivity. These challenges the potential for increased production and threatens sustainable farming. PGPB help plants to tolerate abiotic stresses like drought, temperature and salinity by hormone regulation and stimulate antioxidant enzymes Like catalases, peroxidases, Superoxide dismutase to scavenge Reactive oxygen species (ROS) and also improved soil health as well as disease suppression by producing antibiotics and biofilm formation.

***Azolla* biofertilizer is an effective replacement for urea fertilizer and vegetable crops**

Nupur Mishra

P.G Department of Botany, Udayanath Autonomous College of Science and Technology, Adaspur, Cuttack

Email: nupurmishra2902@gmail.com

Azolla, a small aquatic fern, has garnered attention as a promising biofertilizer, particularly as a sustainable alternative to urea in vegetable crop production. Research has demonstrated that the application of *Azolla* as a biofertilizer can significantly enhance the growth and productivity of various vegetable crops. Studies indicate that crops treated with *Azolla* exhibit improved growth parameters, such as plant height, leaf area, and biomass accumulation, compared to those fertilized with urea. The incorporation of *Azolla* into farming practices can improve soil structure and fertility, increase moisture retention, and reduce the need for supplementary irrigation. Additionally, the use of this biofertilizer decreases the reliance on chemical inputs, thereby lowering the risk of soil and water contamination. By reducing dependence on synthetic fertilizers like urea, *Azolla* helps to decrease greenhouse gas emissions associated with fertilizer production and application. This fern has a symbiotic relationship with the nitrogen-fixing cyanobacterium *Anabaena*, which enables it to capture atmospheric nitrogen and convert it into a form accessible to plants. The use of *Azolla* aligns with sustainable agricultural practices that aim to maintain soil health, conserve water, and reduce environmental impacts. *Azolla* can help to lower

greenhouse gas emissions associated with fertilizer production and application. This approach supports sustainable agricultural practices aimed at preserving soil health, conserving water, and minimizing environmental footprints. Despite its numerous advantages, the adoption of *Azolla* as a biofertilizer faces some barriers, including limited farmer awareness and challenges in large-scale cultivation. As the agricultural sector increasingly seeks environmentally friendly solutions, *Azolla* biofertilizer has the potential to significantly contribute to sustainable cultivation, addressing both food security and ecological concerns. To promote its use, educational programs and support initiatives are essential to inform farmers about the benefits of *Azolla* and provide guidance on effective application techniques. These abstract reviews the efficacy of *Azolla* biofertilizer, its ecological benefits, and its role in enhancing crop yields while mitigating the environmental issues associated with synthetic fertilizers.

Bioprospecting of plants and microbes

Partha Sarathi Rout

P.G. Department of Botany, Udayanath Autonomous College of Science and Technology, Adaspur, Cuttack, Odisha-754011

Email: psrout29@gmail.com

Bioprospecting is an innovative and interdisciplinary field that involves the systematic search for novel bioactive compounds and genetic resources within plants and microorganisms. This endeavour aims to discover and utilize natural products with potential applications across various industries, including pharmaceuticals, agriculture, and biotechnology. By exploring the immense diversity of flora and microbial life in different ecosystems, researchers can identify unique molecules and genes that offer significant commercial and scientific value. The bioprospecting of plants focuses on identifying secondary metabolites such as alkaloids, flavonoids, terpenoids, and phenolics, which have demonstrated therapeutic, nutritional, and pesticidal properties. For example, the Madagascar periwinkle (*Catharanthus roseus*) has been a pivotal source of alkaloids like vincristine and vinblastine, which are used in cancer treatments. Similarly, the neem tree (*Azadirachta indica*) produces compounds with potent insecticidal and medicinal properties, playing a crucial role in sustainable agriculture and traditional medicine. Microbial bioprospecting leverages the vast metabolic diversity of bacteria, fungi, algae, and other microorganisms to uncover bioactive molecules. Soil bacteria, such as those belonging to the genus *Streptomyces*, have been prolific sources of antibiotics, with streptomycin being one of the earliest discovered to treat tuberculosis. Thermophilic bacteria from extreme environments, like *Thermus aquaticus* from hot springs, have provided industrially significant enzymes such as Taq polymerase, essential for the Polymerase Chain Reaction (PCR) in molecular biology. Another magic of bioprospecting is the renowned discovery of 'Penicillin' from the fungal mould of *Penicillium notatum* by the great scientist, Alexander Fleming, played a major role in revolutionizing the field of medicine and drugs. The use of advanced techniques such as genomics, metagenomics, and bioinformatics has revolutionized bioprospecting, enabling researchers to analyze genetic material directly from environmental samples. This approach has led to the identification of novel genes and biosynthetic pathways that produce valuable natural products. Genomic and metagenomic analyses facilitate the discovery of new antibiotics, enzymes,

and other bioactive compounds that traditional methods might overlook. Ethical and legal considerations are paramount in bioprospecting. Benefit-sharing with indigenous communities and countries of origin is essential to ensure fair and equitable use of biological resources. The Convention on Biological Diversity (CBD) and the Nagoya Protocol provide frameworks for access and benefit-sharing, promoting sustainable and responsible bioprospecting practices. This technology not only drives innovation but also underscores the importance of biodiversity conservation. The discovery of new bioactive compounds reinforces the need to protect natural habitats and the myriad species they harbor. By harnessing nature's chemical diversity, this process contributes to the development of new drugs, sustainable agricultural practices, and industrial processes, highlighting the critical intersection between biology, chemistry, and technology.

In conclusion, bioprospecting of plants and microbes offers a promising avenue for discovering novel bioactive compounds and genetic resources that can address global challenges in health, agriculture, and environmental sustainability. Through responsible and ethical exploration of nature's biodiversity, bioprospecting holds the potential to unlock solutions that benefit both humanity and the planet. Therefore, it can be assumed that bioprospecting acts a bridge between cutting-edge scientific methods and biological heritage which helps in conserving our biodiversity.

Cultural gastronomy: an exploration of sustainable food choices and global challenges

Preeti Prada Udayasingh

PG Department of Botany, Udayanath Autonomous College of Science and Technology, Adaspur, Cuttack

Email - preetipradaudayasingh@gmail.com

Culture and food heritage play a crucial role in promoting sustainable food choices and addressing global challenges through their influence on dietary patterns, agricultural practices, and community resilience. Scientific studies highlight several mechanisms through which these factors contribute to sustainability. Firstly, traditional diets often emphasize the consumption of local, seasonal, and minimally processed foods, which are associated with lower carbon footprints compared to industrially produced food. Research has shown that diets rich in plant-based foods and local ingredients can significantly reduce greenhouse gas emissions. It was expert mentality to observed that shifting towards plant-based diets could reduce food-related emissions by up to 70% by 2050. This shift aligns with many cultural practices that prioritize local sourcing and seasonal food habit. Secondly, food heritage encompasses conserved agricultural practices that promote biodiversity and ecological balance. Indigenous and traditional farming methods, such as agroecology, polyculture, and crop rotation, have been shown to enhance soil health and increase resilience to climate change. For example, an agroecological practices can improve crop yields while reducing the need for chemical inputs, thereby contributing to sustainable food production systems. Moreover, the cultural significance attached to food can foster community engagement and collective action towards sustainable practices. Research indicates that communities that embrace their food heritage are more likely to support local farmers, participate in community-supported agriculture (CSA) programs, and engage in initiatives that promote food sovereignty. A study in "Social Science & Medicine" highlighted that community-based food initiatives not only enhance food security but also strengthen social ties and

cultural identity, creating a more resilient food system. The integration of culture and food heritage into sustainable food practices can significantly contribute to tackling global challenges such as climate change, food insecurity, and health issues. By valuing traditional knowledge and promoting local food systems, we can create a more sustainable and equitable food future.

The role of cyanobacteria in sustainable and climate resilient agriculture

Priyadarshini Jena

PG Department of Botany, Udayanath Autonomous College of Science and Technology, Adaspur, Cuttack

Email: jenapriyadarshini123@gmail.com

Agriculture has been the backbone of Indian economy and culture for centuries where more than 50% of total population depends on agriculture and this sector contributes significantly to the country's GDP. India with diverse geography and vast population is vulnerable to the impacts of climate change such as rising temperature, changing precipitation patterns and extreme weather events which affecting agriculture in various ways such as crop productivity, soil fertility, food price and livelihood of farmer. To meet the gradually increasing demand of food to the increasing population, sustainable climate resilient agriculture techniques need to be implemented. Cyanobacteria or Blue- green algae (BGA), a prokaryotic group of microorganism has unique features that can help in sustainable agriculture which is environment friendly .It has great ability to fix atmospheric Nitrogen which can be used by plants directly, increases soil fertility, plant growth and yield as a natural fertilizer, maintains nutrient cycling, phosphorous bioavailability, environmental protection , disease prevention , high biomass yield , oxygenic photosynthesis(to grow in unsuitable land and contaminated water), generation of useful byproducts and biofuels and reduces green house emission . The presence of oxygenic photosynthesis and nitrogen fixation makes them adaptable to various environment. They also contribute positively on bioremediation. The biomass acts as an effective biofertilizer reducing the use of chemical fertilizer and improves soil fertility and water holding capacity. Genetically engineering Cyanobacteria are used in production of biofuels such as bio-diesel, bio-methane, bio-hydrogen which is economically sustainable. Some Cyanobacteria has biological active compounds like pigments , amino acids , polysaccharides and vitamins that support plant growth also it has some biological compounds that has antibacterial , anticancer , antiviral , antifungal properties which prevents disease to the crop. The use of cyanobacteria in agricultural fields has the potential to increase productivity while reducing the use of resources such as chemical fertilizer etc. Cyanobacterial Nitrogen fixation can be integrated as an climate smart agricultural technique through innovative strategies. These organisms are skilled nitrogen fixers and to make biofertilizer, mass production, biomass harvesting and formulation are needed for agricultural practices .To implement this farmer's awareness, training and economical support are also necessary. To culture cyanobacteria on high amount, creative bioreactor designs and affordable manufacturing techniques are also important. The agriculture status of today can be changed if cyanobacterial nitrogen fixation can be integrated into climate smart agricultural practices.

Mangrove and resilience of coastal ecosystem

Priyambada Swain

P.G Department of Botany, Udayanath Autonomous College of Science & Technology, Adaspur, Cuttack

E-mail: priyambadaswain099@gmail.com

Mangroves are often misunderstood and undervalued ecosystems. These coastal forests are sometimes perceived as “dirty” or “dead areas”, wastelands that could be cleared in favour of sandy beaches, swanky resorts or other developments. However these myths about mangroves could not be farther from the truth. They are the only trees that thrive in salty waters and improving water quality by filtering out nutrients and sediments. Mangroves are much more than mere trees in saline conditions. They are architects of unique thriving ecosystems that offer vital services to our planet. Typically, mangroves have aerial, breathing roots and waxy succulent leaves and are flowering plants. These salt tolerant trees create a bridge between the sea and the land, forming a unique brackish water habitat that teems with life, from colourful crabs scuttling in the mud to vibrant birds in the canopy above. More than 1,500 plant and animal species depend on mangroves, including fish and birds that use the shallow waters beneath the trees as nurseries. Research now indicates that mangrove is also critical for larger mammals, such as monkeys, sloths, tigers, hyenas and African wild dogs. Mangroves represent a littoral forest, which means they thrive in saline or brackish water in coastal regions. In India, many locations such as, Bhitarkanika in Odisha, Sundarbana in West Bengal and the Godavari Krishna delta in Andhra Pradesh boast rich mangrove ecosystem. Beyond supporting biodiversity, mangroves are powerhouses for carbon sequestration, helping in mitigate the impact of climate change. Mangroves play a crucial role in protecting coastal communities from natural disasters. Their intricate root systems help stabilize the coastline, reduce erosion and buffer against storms surges and tsunamis. To be an effective defense against tsunamis, reducing wave heights between 5-35%. It has been found recently, when cyclone DANA, made landfall close to Bhitarkanika National Park and Dhamara port in Odisha, it did not cause any feared damage because of the rich mangrove forest which cover the Bhitarkanika. Despite their importance, mangrove forest has not escaped the impact of human activity, more than a third of all mangrove forests have disappeared since the mid 20th century due to agriculture, logging and urbanization. If present deforestation rates continue all mangroves could be lost by the end of this century. They are nature’s true multi taskers. Not only do they provide homes for diverse array of animal and plant species, but they also protect coastlines, filter pollutants, and store a vast amount of carbon. Conserving mangroves brings with it a lot of benefits. It preserves biodiversity and support human communities by offering a potent weapon against climate change. Supporting local, national and international efforts focused on mangrove conservation and restoration is crucial. Through increased understanding and concerted conservation efforts, we can work toward a future where these incredible ecosystems continue to thrive and protect us. In safeguarding mangroves, we are safeguarding our planet’s future.

Sustainable food production and demand

Sarbeswar Pujari

P.G. Department of Botany, Udayanath Autonomous College of Science and Technology, Adaspur, Cuttack

E-mail: sarbeswarpujari54@gmail.com

Sustainable food production is a process of food production that meets current needs without compromising the ability of future generations, so that every generation can meet the availability of food. As it is known how the way we grow and consume food is changing landscape mode and societies globally. At its core, sustainable food production integrates agricultural methods that are environmentally friendly, economically feasible and socially responsible. It compasses diverse practices organic farming, agroecology, permaculture, and regenerative agriculture. These methods prioritize biodiversity, soil health, and water conservation, ultimately reducing the reliance on synthetic inputs like pesticides and fertilizers, By focusing on local food system and minimizing transportation, sustainable food production aims to decrease carbon footprints and enhance food security. India consists of 28 states and 8 union territories of approximately about 1.4 billion population with the availability of land of approximately 33 lakh sq. kms. Keeping India aside, Odisha consists of 30 districts with a total population of approximately 4.7 crores with the availability of land areas of approximately 1.5 Lakhs Sq. Kms. India, with a large number of population and large areas of land for agricultural expense, makes it a global player in food production. The nation's agricultural sector sustains a variety of crops, contributing significantly to its economy and cultural production. Agriculture is the backbone of the Indian economy and plays the most crucial role in the economic sphere of the country. India is a country of about 1.4 billion people and more than 70% of India's population lives in rural areas where the main occupation is agriculture. To maintain food production, some trends are there to be treated in such a manner that can either increase or change the mode of production of food like diversification of food services, urbanization, food habits, dietary concerns, role of technology, etc. However, increasing the quantity of production, attention should be focused on the future food quality. Some steps to be kept in mind like enhancing productivity, strengthening the food system, and empowering farmers and consumers. Indian food industries have come a long way since the time of Independence. It has emerged as a food basket for the world as India is the largest country in terms of food production, processing, supply, and consumption. It would not be wrong to say that India is today the largest producer of every kind of food product. With the rapid growth of the Indian economy, a shift is also seen in the consumption pattern of the country from cereals to a more varied and nutritious diet of millets, fruits and vegetables. All these efforts have considerably enhanced the status of food processing industries.

Last but not the least, understanding and addressing the evolving trends of food production and consumption in the world of crucial for ensuring food security promoting healthy eating habits, and building a sustainable food system that nourishes the nation. By embracing innovation, fostering. Collaboration and prioritizing sustainability of the world can shape a future where food is abundant, nutritious, and accessible to all.

Opportunities and solutions for sustainable food production

Sonalika Nayak

P.G. Department of Botany, Udayanath Autonomous College of Science & Technology, Adaspur, Cuttack,
Odisha-754011

E-mail: sonalikanayak60@gmail.com

Sustainable Production is the creation of goods and services using processes & systems that are Non-polluting conserving energy & natural resources. Economically viable, safe & healthful for workers, Communities & consumers. food sustainability means producing food in a way that protects the environment makes efficient use of natural resources, ensures that farmers can support themselves enhance the quality of life in communities that produce food Including the animals as well as people. Sustainable food production as a method on Production of food using processes and system that are non-polluting, conserve non-renewable energy and natural resource are economically efficient and safe for workers, communities. Consumers and do not compromise needs of Future generation. The demand for food will greatly increase due to rising incomes and additional 2 or 3 billion people to feed. Agriculture needs to change to meet that demand. investing in Agriculture also one of the most effective strategies for achieving critical Post2025 development goals related to poverty & hunger, nutrition and health, education, economic & Social growth, peace and Security & preserving the world's environment. Here it has been proposed for a key goal of post-2025 frame work for sustainable increase in food production and we provide example of available solution we believe that it is possible to eradicate extreme poverty, hunger under nutrition by 2030 and sustainable food security without irreversibly damaging the world's natural resources, even in a time of climate changes & extremes. To achieve that rising food yields must be decoupled from unsustainable utilization of water, energy, Fertilizers, chemicals and land we call for a multifaceted agro-ecological Intensification of food production. Environmental degradation, competition for resource, increase food demand integration of agriculture into the international economy threaten the sustainability of many food production systems.

Despite these concerns, the concept of sustainable food Production System remain unclear, Environmental accounting identifies biophysical limits for Agriculture. Sustainable yields refer to output levels that can be maintained continuously. Carrying capacity defines maximum population level many studies into sustainable Agriculture cover more than one of these perspectives, indicating concept is complex & embraces issues relating to biophysical, Social and economic environment. one of the key aspects of sustainable food system is reducing the ecological Foot print of Agriculture. This involves practices like crop rotation, organic farming & agroforestry which enhance biodiversity and soil health Sustainable system also emphasize water conservation & the reduction of green house gases emission by minimizing the use of synthetic fertilizers in Pesticides these method help preserve ecosystem and environment Many studies into sustainable agriculture cover more than one of these perspectives, indicating the concept is complex and embraces issues relating to the biophysical, social, and economic environments. Clarification of the concept would facilitate the development of frameworks and analytical systems for appraising the sustainability of food production systems.

Role of society in the production of sustainable food through organic farming

Subhashree Behera

P.G.Department of Botany, Udaynath Autonomous College of Science and Technology, Adaspur-754011

Cuttack, Odisha

Email: susbhashreeb118@gmail.com

Sustainable food production is the sufficient amount of material for human population and future generation using environmental safe method. It can create a mutually supportive relationship between farmer and consumer. Indian farming mainly covering 60% of countries net cultivated area for 40% of the total food production. Organic farming is the key for sustainable food production. India occupies the 2nd position for number of certified organic farmers. Sustainable development is a step of enhancing food production. It increased traditional knowledge of farming in all over the world. Climate change is the relationship between sustainable food production and farming. Organic farming avoid synthetic fertilizer pesticides, use of natural methods. It contain higher nutrient like Iron, vit-c, Magnesium with other essential metals, and bacteria like E.coli, cyanobacteria. It helps to build healthy soil and control erosion, promote biodiversity, reduce water pollution. Organic farming yields range between 0.75 & 0.80 of conventional farming. This type of organic farming addresses the crop and live stock yield gaps. Food production is based on ecological process and function and included innovative technique of farmers. Food production through organic practices involve low external input organic farming and agroforestry. Organic farms increased the diversity which contributes for the pollination of crops and wild plants over in larger area. Crop rotation needed for a positive effect on diversity. The farmers are use different techniques for soil fertility and mostly carried out by animal manure, composted residues and intermediate crops. All the technique helps in the carbon sequestration on fields. Nowadays food production and organic farming prevalent in both rural and urban areas. City habitat people are interested to buy organic vegetable but the higher price and lack of originality certificate; poor guideline small holders are affected. From the social point of view full participation needed for sustainable food supplying. The goals of social development to increase the income of rural house holds. A social supporting program which is needed for encouraging woman and economically backward people. This technique will improve the food distribution across the world and make food production system more resilient.

AI in agriculture - the future farming

Sudipa Pradhan

P.G. Department of Botany, Udayanath Autonomous College of Science & Technology, Adaspur,

Cuttack, Odisha-754011

E-mail: sudipapradhan@gmail.com

The growth of the global population, which is projected to reach 10 billion by 2050, is placing significant pressure on the agricultural sector to increase crop production and maximize yields. To address looming food shortages, two potential approaches have emerged. Expanding land use and adopting large

scale farming or embracing innovative practices and leveraging technological advancements to enhance productivity on existing farm land. Agriculture is one of the world's oldest and most important industries. It has been the backbone of human civilization for millennia providing sustenance as well as contributing to economic development, while even the most primitive AI only emerged several decades ago. Innovative ideas are being introduced in every industry, and agriculture is no exception. In recent years the world has witnessed rapid advancements in agricultural technology, revolutionizing farming practices. These innovations are becoming increasingly essential as global challenges such as climate change, population growth, resource scarcity etc. Artificial Intelligence has been extensively applied in farming recently. To cultivate crops, manage pests, monitor soil and growing conditions, analyse data for farmers, and enhance other management activities of the food supply chain, the agriculture sector is turning to AI technology. It makes challenging for farmers to choose the ideal time to plant seeds. AI helps farmers choose the optimum seed for a particular weather scenario. It also offers data on weather forecasts. AI-powered solutions will help farmers produce more with fewer resources, increase crop quality and hasten product time to reach the market. AI aids in understanding soil qualities. AI helps farmers by suggesting the nutrients they should apply to increase the quality of the soil. An AI-powered system provides farmers with information on the health of their crops and the nutrients that need to be given to enhance yield quality and quantity. Using AI farmers can now access advanced data and analytics tools that will foster better farming, improve efficiencies, and reduce waste in biofuel and food production while minimising the negative environmental impacts. AI and machine learning have transformed various industries, and the AI wave has now reached the agriculture sector. Companies are developing several technologies to make monitoring farmers crop and soil health easier. AI utilized plant growth data to further advise on crops that are more resilient to extreme weather, disease or harmful pests. AI algorithms can analyze the chemical composition of soil samples to determine which nutrients may be lacking. AI can also identify or predict crop diseases and enhance crop yields. AI is sure to play an increasingly large role in agriculture and food sustainability over the coming years.

"Artificial Intelligence is not a man versus machine saga; it's in fact, man with machine synergy."

Phycoremediation: An Eco-Friendly Approach to Solve Water Pollution Problems

Sudipta Mishra

P.G. Department of Botany, Udayanath Autonomous College of Science and Technology, Adaspur, Cuttack, Odisha-754011

Email: sudiptamishra530@gmail.com

Issues related to environmental pollution are becoming more serious with the increasing population, urbanization, industrialization and their direct or indirect effects on ecosystem. In this context, mixing of untreated wastewater in aquatic bodies emerging up as one of the major issues, that is challenging the stability of nations. This is mainly due to the reason that majority of population in developing countries are directly or indirectly dependant on the freshwater resources for their day-to-day activities. Although the strategic importance of fresh water is universally recognized and issues related to

sustainable water management can be found in almost all scientific, social and political agendas, still the availability and quality of water resources are at risk worldwide due to increased pollution, industrialization and rapid economic development. The capacity of wastewater treatment systems to remove these toxins has considerable importance. Conventional primary and secondary wastewater treatments, which oxidize organic matter present in wastewater, are not efficient at removing nitrogen, phosphorus, minerals and heavy metals. These pollutants may be accumulated in plants and animals, when they take up such contaminated water, and then make their way into human food chain. The report of World Health Organization (WHO 2000) and a survey of Central Pollution Control Board, India (CPCB 2009) stated that, only 31 and 35 % of the total sewage wastewater is treated up to secondary level in Asia and urban cities of India, respectively. Further, the presence of excess nutrients (N and P) in untreated wastewater is resulting in eutrophication, algal blooms, uncontrolled spread of certain aquatic macrophytes, oxygen depletion and loss of key floral and faunal species, leading to the total degradation of water bodies. Several remediation technologies have been employed to take up the pollutants, but those technology require high energy, continuous monitoring and induce secondary pollution. Recently, attention has been focused on research into biological methods of wastewater treatment. There are numerous advantages to using biological techniques for pollutant removal, including the possibility of bioremediation *in situ*, no production of secondary pollution and the economic viability of implementation. Cultures of microalgae are therefore an emerging treatment option for wastewater containing high levels of nutrients, CO₂, toxic organic compounds and heavy metals. Microalgae are prokaryotic or eukaryotic photosynthetic microorganisms and can grow quickly and live in adverse conditions due to their simple morphology. Prokaryotic microalgae are known as cyanobacteria, and eukaryotic include green algae (Chlorophyta), diatoms (Bacillariophyta) and among other groups. The use of algae to clean wastewater, appears smarter, more sustainable and eco-friendlier because compounds like nitrogen, phosphorus, sulfur and minerals are 'nutrients' for algae rather than 'contaminants'. Algae consume a large amount of CO₂ that is converted into biomass; resulting release of oxygen (O₂) into the atmosphere through photosynthesis. They are able to remove urea from water, which intensifies their bioconversion activity. Microalgae requirement is mostly based on light, sugar, CO₂, nitrogen, phosphorus and potassium. They can synthesize large amounts of lipids, proteins and carbohydrates that can be processed and converted into biofuels. Some high-value-added chemical products, such as docosahexaenoic acid (DHA) and carotenoids can also be coming out as an end product. So phycoremediation is an environmentally safe process that supports the green technology.

Phosphate solubilising bacteria: mechanisms and their role in phosphate solubilisation

Archit Amlan Behera

¹Post graduate Department of Botany, Utkal University, Vanivihar, Bhubaneswar 751004, Odisha, India

Email: architamlan786@gmail.com

Phosphorus is less available in most tropical soils; this is a limiting factor in plant productivity and thus requires the application of high doses of phosphate fertilizers to increase productivity. The low availability of phosphorus is due to its immobilization as a result of strong interactions with the components

of weathered soils to form insoluble inorganic calcium, aluminum, and iron phosphates. Solubilization of these compounds is an important strategy for increasing phosphate availability in the soil. One option for improving the efficiency of endogenous phosphorus sources is to use microorganisms that exude substances capable of facilitating the solubilization of insoluble phosphates. Bacteria that nodulate legumes, commonly known as rhizobia, are among those with the greatest solubilization potential. In addition to fixing atmospheric nitrogen, some isolates can also solubilize insoluble phosphates, further contributing to plant growth. In this context, the management of rhizobium-legume symbiosis is a key strategy for sustainable agricultural management and decreasing the dependence on chemical fertilizers. Therefore, it is important to select strains that can efficiently fix atmospheric nitrogen and are also able to solubilize insoluble phosphates. The decrease in pH in the proximity of organic acid-producing microorganisms is considered the principal mechanism for phosphate solubilization. Therefore, the objectives of this overview were to discuss the isolation, selection and identification of phosphate solubilising bacteria that are effective in both biological nitrogen fixation (BNF) and the solubilization of insoluble inorganic phosphates and the identification and quantification of the organic acids produced and define their role in the solubilizing ability of the isolated bacteria.

In vitro solubilisation of inorganic phosphate by phosphate solubilising fungus: Overview, mechanisms and applications

Anshuman Swain

¹Post graduate Department of Botany, Utkal University, Vanivihar, Bhubaneswar 751004, Odisha, India

Email: anshumanswain341@gmail.com

Phosphorus (P) is one of the most indispensable macronutrients next to nitrogen for the growth and development of plants. A greater part of soil phosphorus, approximately 95–99%, is present in insoluble form complexed with cations like iron, aluminum, and calcium that cannot be utilized by the plants. The use of natural phosphate-bearing materials such as rock phosphate (RP) as fertilizer for P-deficient soils has received due attention in recent years since substantial deposits of cheaper and low grade RP are locally available in many countries of the world. However, its solubilization rarely occurs in nonacidic soils with a pH greater than 5.5 to 6.0. Conventionally, RP is chemically processed by reacting with sulphuric acid or phosphoric acid to produce partially acidulated RP. The process incurs high cost and makes the environmental health worse. A much cheaper and convenient alternative is reclamation of exhausted soil through use of P-solubilizing microorganisms that have opened the possibility for solubilization of RP in soils. Thus, soil microorganisms play a critical role in natural phosphorus cycle and recently microbial-based approaches have been proposed to improve the agronomic value of RP. According to research, utilization of microbial mediated RP has several advantages over conventional chemical fertilizers for agricultural purposes. These advantages are as follows: (1) microbial products are considered safer than many of the chemical fertilizers now in use; (2) neither toxic substances nor microbes themselves will be accumulated in the food chain. Among the rhizosphere microbes, the important genera of P-solubilizing bacteria include *Rhizobium*, *Bacillus*, and *Pseudomonas*. *Penicillium* and *Aspergillus* spp. are the dominant P-

solubilizing filamentous fungi found in rhizosphere. Filamentous fungi are highly important in RP solubilization. They are widely used as producers of organic acid. *Aspergillus niger* and some *Penicillium* species have been tested for solubilization of RP and other biotechnological importance such as biocontrol, biodegradation, and phosphate mobilization.

Drought and salt stress mitigation in crop plants using stress-tolerant microorganisms: A futuristic approach towards sustainable agriculture

Ranjit Sumar Swain

¹Post graduate Department of Botany, Utkal University, Vanivihar, Bhubaneswar 751004, Odisha, India

Email: ranjitswain393@gmail.com

Abiotic stresses, especially drought stress and salt stress in crop plants are accelerating due to climate change. The combined impact of drought and salt is anticipated to lead to the loss of up to 50% of arable land globally, resulting in diminished growth and substantial yield losses threatening food security. Addressing the challenges, agriculture through sustainable practices emerges as a potential solution to achieve Zero Hunger, one of the sustainable development goals set by the IUCN. Plants deploy a myriad of mechanisms to effectively address drought and salt stress with phytohormones playing pivotal roles as crucial signalling molecules for stress tolerance. The phytohormone auxin, particularly indole acetic acid (IAA) emerges as a paramount regulator integral to numerous aspects of plant growth and development. During both drought and salt stress conditions, auxin plays crucial roles for tolerance, but stress-induced processes lead to decreased levels of endogenous free auxin in the plant, leading to an urgent need for auxin production. With an aim to augment this auxin deficiency, several researchers have extensively investigated auxin production, particularly IAA by plant-associated microorganisms, including endophytic bacteria. These endophytic bacteria have been introduced into various crop plants subjected to drought or salt stress and potential isolates promoting plant growth have been identified. However, post-identification, essential studies on translational research to advance these potential isolates from the laboratory to the field are lacking. This review aims to offer an overview of stress tolerant auxin-producing endophytic bacterial isolates while identifying research gaps that need to be fulfilled to utilize this knowledge for the formulation of crop-specific and stress-specific endophyte bioinoculants for the plant to cope with auxin imbalance occurring during these stress conditions.



f @ @ @ @ @labkafe



FAKIR MOHAN UNIVERSITY, ODISHA



IIT DHANBAD



IIT DHARWAD



IIT MANDI



NIT ANDHRA PRADESH



IIT KHARAGPUR

QUALITY
LAB FURNITURE
| N O W A T R E A C H

+91 91471 63562
sales@labkafe.com
www.labkafe.com



**SISCO
RESEARCH
LABORATORIES
PVT. LTD.**

A trusted name since last 49 years for High Purity Laboratory Chemicals, Reagents, Fine Chemicals, Biochemicals, Nano Compounds, Dehydrated Culture Media and PCR Reagents



Range:

- HPLC, GC-MS, NMR, Spectroscopy MB Grade & AR Solvents.
- Organic Intermediates, Indicators, Spectrophotometric Reagents, Alkaloid, Growth Regulators, etc.
- Inorganic Reagents, AAS Solutions, Catalysts and Rare Metals.
- Enzymes & Substrates, Amino Acids, Peptides & Linking Reagents, Biological Buffers & Detergents, Carbohydrates, Proteins, Electrophoresis Reagents, Gel Filtration Media, Biocatalysts, etc.
- Nano Grade Metals, Compounds & Catalysts.
- TAQ Polymerase, Linkers, Primers, RNA & DNA Extraction kits and other PCR Reagents, etc.
- Dehydrated Culture Media and Supplements, Biological Ingredients.

On rate contract & approved vendors to:

CSIR, ICMR, ICAR, DRDO, IIT, NIT, IISER, NISER, BARC, ISRO and other Central & State Govt. Laboratories, Central and State Govt. & Private Universities, Colleges, Medical Institutes and Hospitals.

Our prominent pharma and allied customers:

Dr. Reddy's, Biocon, Reliance Lifesciences, Unilever, Sanofi, Lupin, Cipla, Unichem, Intas, Sunpharma, Iffco, Bharat Biotech, J. Mitra, Agappe Diagnostic, Glenmark and many other accredited companies.

Distribution centers at: Bhiwandi, Kolkata, Chennai, Hyderabad, New Delhi.

Authorised stockist in all the states at important cities in India.

Overseas distributors in 86 Countries.

Our Catalogue and Profile available at www.srlchem.com

For stockistship and enquiries, contact:

SISCO RESEARCH LABORATORIES PVT. LTD.

608-B, Satellite Gazebo, Near Solitaire Corporate Park, Andheri Ghatkopar Link Road, Chakala, Andheri (East), Mumbai 400 099, India

Email ID: marketing@srlchem.com • Phone: +91-22-42685812/813

endless PROCESS of science...



SCIENTIFIC TRADERS

Authoized Distributor

MERCK

BOROSIL

HIMEDIA

TARSONS

OLYMPUS

REMI

SRL

WHATMAN



**SCIENTIFIC,
ANALYTICAL
INSTRUMENTS**



**LABORATORY
CHEMICALS**



GLASSWARES



PLASTICWARES

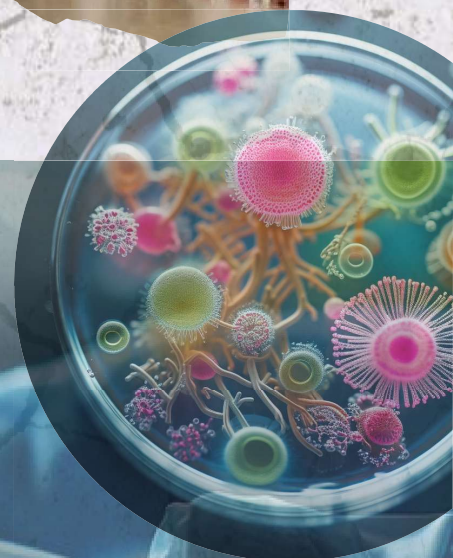


**OTHER LAB
EQUIPMENTS**

9437296320, 9348668127, 9437453638, 9438147567, 9438290687, 9348668127

scientific_bls@yahoo.co.in

Station road, Balasore -756001



Published by

Dr. Mihir Tanay Das

Organizing Secretary, OBS &

Coordinator, P.G. Department of Botany

Fakir Mohan University

Vyasa Vihar, Balasore -756089



ISBN: 978-9-33416-238-7



9 789334 162387