FLOURISHING GREENS

A BOTANICAL ODYSSEY

NEWS LETTER

DEPARTMENT OF BOTANY

DECEMBER 2024

BOTANY
NEWSLETTER

INSIDE THIS ISSUE

Learning out of the box – cover story

ISSUE 5 (DECEMBER 2024)

Learning is a continuous process from the minute we are born, until we die. This newsletter provides an excellent platform to show case the achievement of the department of botany, Durgapur Government college and the excellent journey of the young mind of our department nurturing the nature.

Our mission should be to develop a dais of excellence that is committed to attracting and retaining diverse talent; creating a collaborative environment open to the free exchange of ideas, where learning, creativity, innovation can flourish

The Dual Language of Plants

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The dual language of plants is supposed to be as 'chemical and electrical signalling' in plant communication. Chemical signalling in plants describes the intricate network of communication that takes place through the creation, transmission, and detection of chemical signals both internally and externally among plants. This mechanism allows plants to react to environmental changes, organize their growth and development, and engage with other living organisms.

Types of Chemical Signals in Plants:

1. Hormones: Plant hormones, such as auxins, gibberellins, cytokinins, abscisic acid, and ethylene, play a crucial role in regulating plant growth and development.
2. Volatiles: Volatile organic compounds (VOCs), such as terpenes, phenolics, and green leaf volatiles, are released into the air and can convey information between plants and other organisms.
3. Peptide signals: Peptide hormones, such as systemin and CLAVATA3, are involved in cell-to-cell communication and regulate various physiological processes.
4. Phytohormone-like signals: Molecules like salicylic acid, jasmonic acid, and azelaic acid have hormone-like properties and play roles in plant defence and stress responses.

Mechanisms of Chemical Signalling in Plants:

1. Biosynthesis: Chemical signals are synthesized through various biochemical pathways, often involving enzymes and cofactors.
2. Transport: Signals can be transported within plants through the xylem, phloem, or apoplast, or released into the air as VOCs.
3. Reception: Specific receptors, often located on the cell surface or within the cell, recognize and bind to the chemical signals.
4. Signal transduction: The binding of the signal to its receptor triggers a cascade of downstream signalling events, ultimately leading to changes in gene expression, protein activity, or other physiological responses.

Functions of Chemical Signalling in Plants:

1. Growth and development: Hormones and other chemical signals regulate plant growth, differentiation, and patterning.
2. Stress responses: Chemical signals help plants respond to environmental stresses, such as drought, heat, cold, and pathogens.
3. Defence against herbivores and pathogens: Chemical signals can activate plant defence mechanisms, such as the production of defence compounds or the recruitment of beneficial insects.
4. Symbiotic interactions: Chemical signals facilitate communication between plants and other organisms, such as mycorrhizal fungi or nitrogen-fixing bacteria.
5. Communication between plants: Chemical signals can convey information between plants, allowing them to coordinate their behaviour and respond to their environment.

Key Players in Chemical Signalling in Plants:

1. Receptors: Proteins that recognize and bind to chemical signals, triggering downstream signalling events.
2. Signalling pathways: Complex networks of proteins, kinases, and transcription factors that transmit and amplify the signal.
3. Transcription factors: Proteins that regulate gene expression in response to chemical signals.
4. Hormone biosynthetic enzymes: Enzymes involved in the synthesis of plant hormones and other chemical signals.

Techniques to Study Chemical Signalling in Plants:

1. Molecular biology: Techniques like PCR, RNA sequencing, and gene editing allow researchers to study the molecular mechanisms underlying chemical signalling.
2. Biochemistry: Methods like chromatography, mass spectrometry, and enzyme assays enable researchers to analyze the biochemical pathways involved in chemical signaling.
3. Imaging techniques: Methods like fluorescence microscopy, confocal microscopy, and live-cell imaging allow researchers to visualize chemical signalling events in real-time.
4. Genetic approaches: Mutagenesis, gene knockout, and over expression studies help researchers understand the functions of specific genes and signalling pathways involved in chemical signalling.

Electrical Signalling:

For a long time, the focus on electrical signalling was overlooked, with plant signalling research primarily cantered on chemical and hydraulic signals. Recent studies have demonstrated that plants can generate, process, and transmit bioelectrical signals to manage a variety of physiological functions. These cellular electrical phenomena accompany many significant biological and physiological processes, supporting the idea that bioelectricity serves as a crucial 'model' for how organisms respond to environmental stresses and regenerate. Electrical signals have also been identified and differentiated in genetically modified plants subjected to stress from feeding insects and/or the use of systemic insecticides.

These findings can inform upcoming research that seeks to clarify the elements contributing to stress resistance and plant defence mechanisms, thereby supporting the creation of effective strategies in integrated pest management. Consequently, this mini article presents the findings from investigations focused on electrical signalling in reaction to biotic stress. We tried to illustrate precisely about the process of generating and transmitting electrical signals and provided an overview of idea. Electrical signalling in plants involves the generation and transmission of electrical impulses in response to different stimuli, including light, touch, temperature, and injury. These electrical signals are essential for communication, behaviour, and adaptation in plants as they interact with their surroundings.

Types of Electrical Signals in Plants:

1. Action potentials: Similar to those in animal neurons, action potentials are rapid, transient changes in electrical potential that propagate along plant cells.
2. Variations in membrane potential: Changes in the electrical potential difference across plant cell membranes can also serve as signals.
3. Electrical impulses: Plants can generate electrical impulses in response to stimuli, which can be transmitted through the plant's tissues.

Mechanisms of Electrical Signalling in Plants:

1. Ion channels and pumps: Plant cells have ion channels and pumps that regulate the flow of ions across the cell membrane, generating electrical signals.
2. Electrical synapses: Plants have electrical synapses, similar to those in animals, which allow for direct communication between cells.
3. Plasmodesmata: These narrow channels connect plant cells and allow for the exchange of ions, metabolites, and signalling molecules.

Functions of Electrical Signalling in Plants:

1. Rapid signalling: Electrical signals can transmit information rapidly throughout the plant, allowing for quick responses to stimuli.
2. Coordination of activities: Electrical signalling helps coordinate activities such as photosynthesis, stomatal opening, and root growth.
3. Defence responses: Electrical signals can trigger defence responses, such as the production of defence compounds or the activation of defence genes.
4. Communication with other organisms: Plants can communicate with other organisms, such as insects or microorganisms, through electrical signals.

Examples of Electrical Signalling in Plants:

1. The Venus flytrap: The Venus flytrap (*Dionaea muscipula*) uses electrical signals to trigger the closure of its leaves in response to prey.
2. *Mimosa pudica*: The sensitive plant (*Mimosa pudica*) uses electrical signals to trigger the folding of its leaves in response to touch or vibrations.
3. Plant responses to light: Plants use electrical signals to respond to light and darkness, regulating processes such as photosynthesis and stomatal opening.


Venus Fly Trap

Techniques to Study Electrical Signalling in Plants:

1. Electrophysiology: Techniques such as patch-clamp recording and extracellular recording allow researchers to measure electrical signals in plant cells.
2. Imaging techniques: Methods such as fluorescence microscopy and calcium imaging enable researchers to visualize electrical signalling events in real-time.
3. Genetic approaches: Mutagenesis, gene knockout, and over expression studies help researchers understand the functions of specific genes and signalling pathways involved in electrical signalling.
4. Bioinformatics and modelling: Computational models and bioinformatics tools help researchers analyze and simulate electrical signalling networks in plants.

Bibliography:

1. Plant Hormone Signalling" by Nemhauser et al. (2006) in Annual Review of Plant Biology (Vol. 57, pp. 441-464).

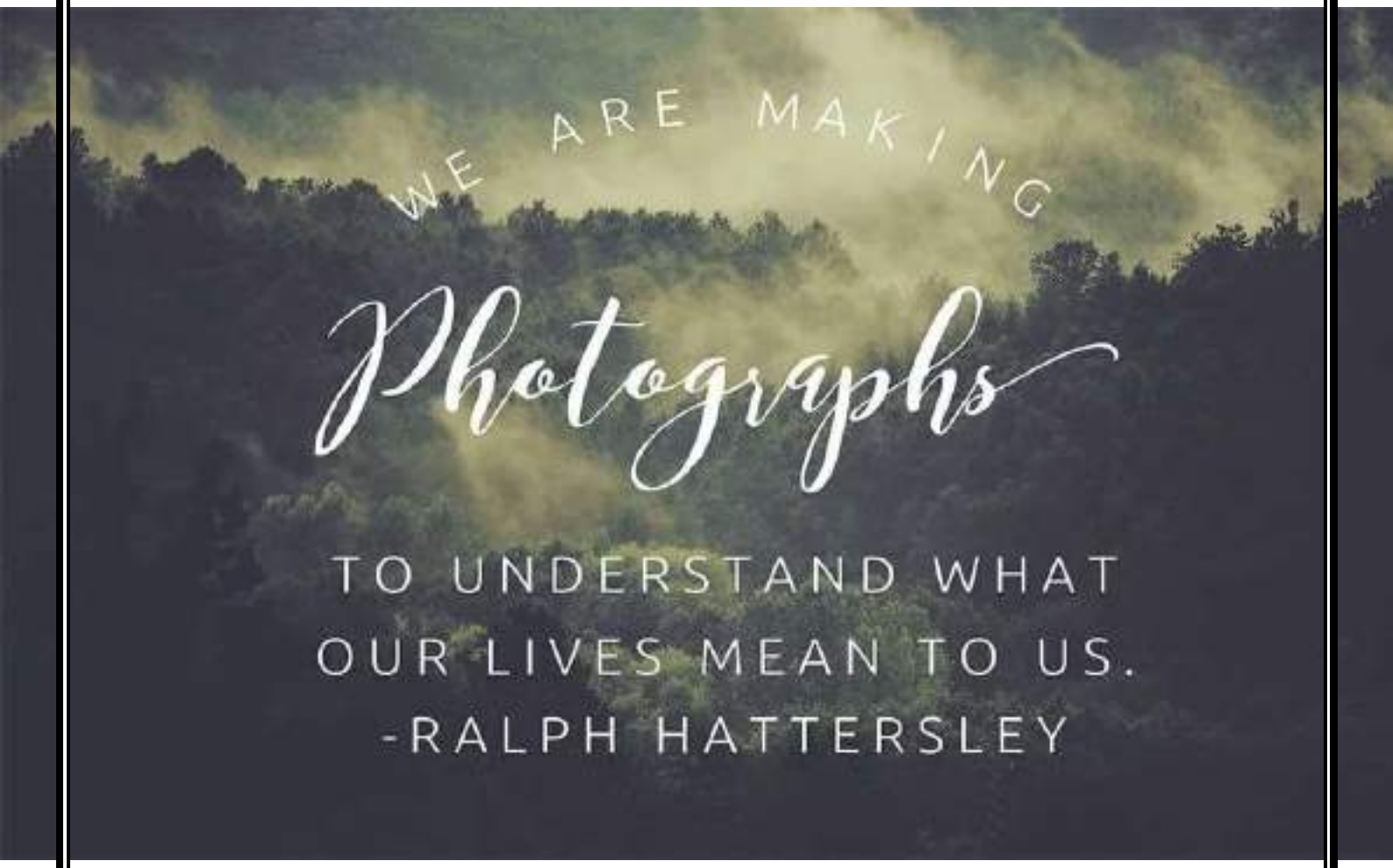
2. Electrical Signaling in Plants" by Fromm et al. (2013) in Plant, Cell and Environment (Vol. 36, No. 2, pp. 249-263).

3. Chemical and Electrical Signaling in Plant-Plant Interactions" by Falik et al. (2018) in Journal of Experimental Botany (Vol. 69, No. 10, pp. 2515-2526).

Students` Corner

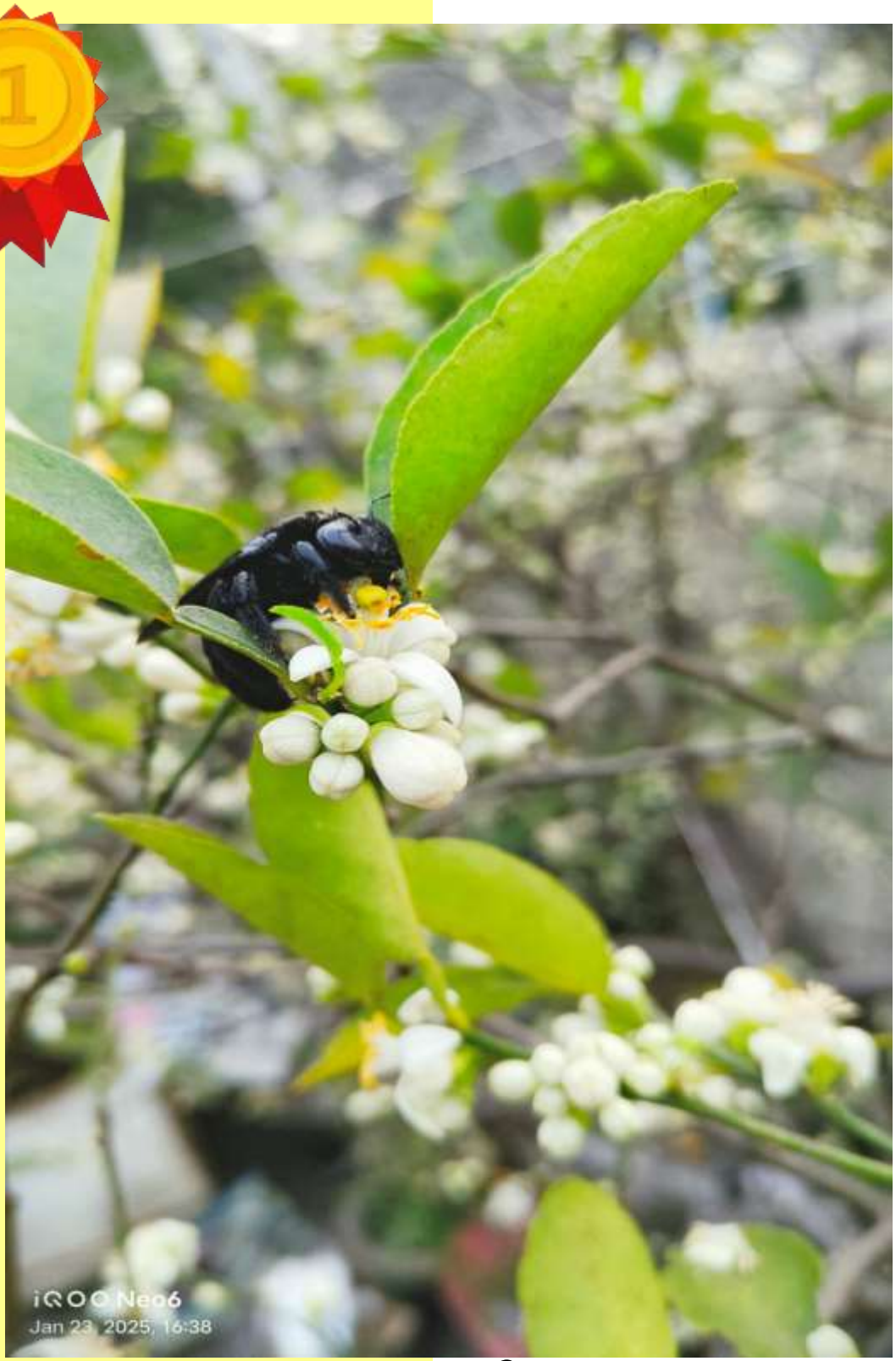
TOGETHER
TOGETHER
TOGETHER

NATURE PHOTOGRAPHY COMPETITION



Photograph taken by:_ABHINABA KARMAKAR

3rd SEM BOTANY HONOURS



Ray of Hope

Photograph taken by:_NIRJHAR BANERJEE

1st SEM BOTANY HONOURS

All the Beautiful Things

Photograph taken by: TITHI DEY

5RD SEMESTER BOTANY PROGRAM

Life in Wings

Photograph taken by:
DEBJIT SHOW

3rd SEMESTER BOTANY HONOURS

Photograph taken by:
DEBRAJ SAHA

1st SEMESTER BOTANY HONOURS

Photograph taken by:
SAWASTIKA MUKHERJEE

1st SEMESTER BOTANY HONOURS

DBT star college scheme sponsored oral presentation and scientific model making competition on science and technology: the recent trend organized by Durgapur Government College on 16.12.2024

Debjit Show has participated in model making and stood 2nd

abhinaba Karmakar has participated in oral presentation making and stood 3rd

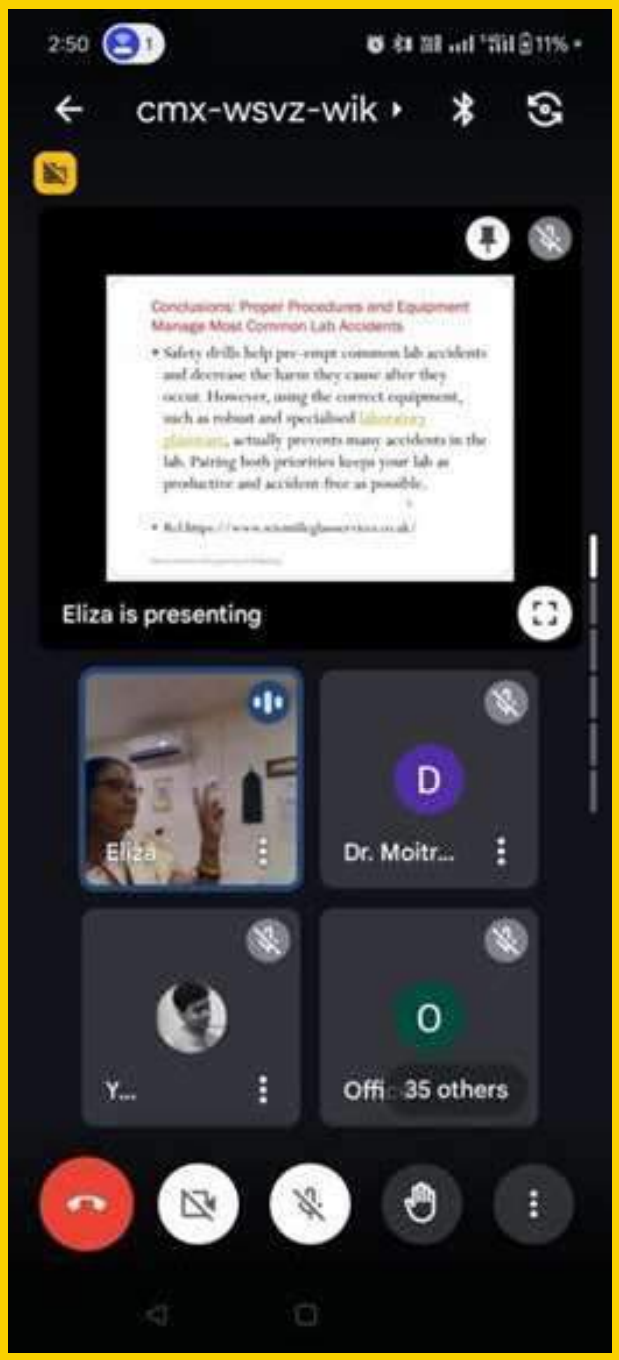
oral presentation by Debanjana Das and Debangona das

Debanjana Das and Debangona das stood 2nd in oral presentation

Knowledge Exchange

BIOLOGICAL WASTE DISPOSAL

Workshop



HAPPY MUSHROOM GARDENING

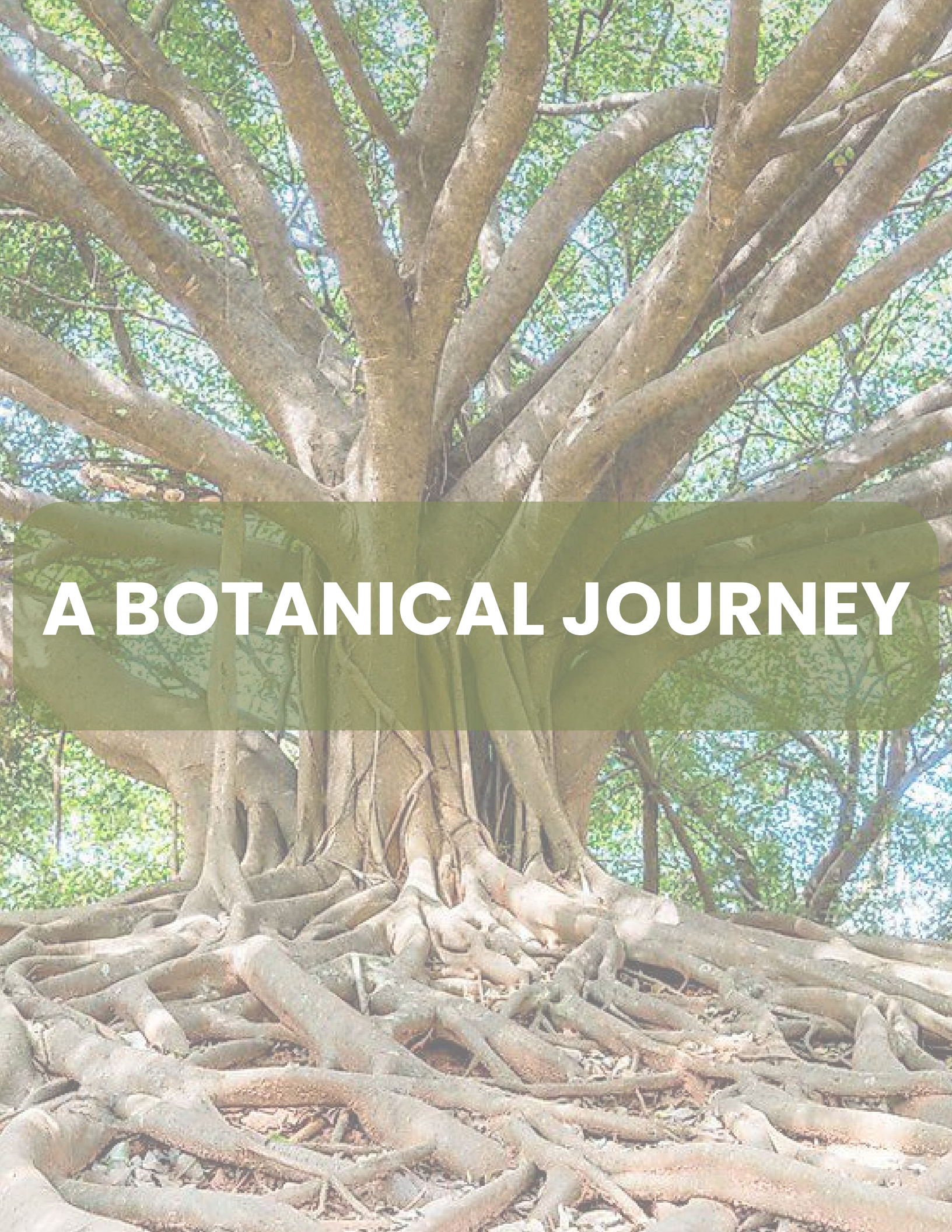
workshop

AUGMENTATION OF SCIENTIFIC APTITUDE THROUGH BIOINOVATION AND ENTREPRENEURSHIP

WORKSHOP

R WORKSHOP WITH STATISTICAL METHODOLOGY FOR BIOLOGICAL SCIENCE

workshop



A BOTANICAL JOURNEY

A Visit to Indian Botanic Garden, Shibpur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Google

A Visit to Malandighi Forest

A Visit to Borjora Horticulture Farm

A Visit to Fossil Search of Gondwana Basin in Mejia