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P-05

The effects of tea metabolites of different altitude grown tea against multidrug resistant bacteria

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Abstract:

Multidrug resistant bacteria is the threat of modern era due to over and random usage of the drugs like antibiotics. To overcome the antibiotic resistance of bacteria, as well as to escape from the adverse side effects of the synthetic and semi synthetic drugs, there is a need of natural plant based medicinal products like active secondary metabolites isolated from medicinal plants. Tea is not only famous for its exquisite aroma as beverage but also well known for its medicinal properties. Secondary metabolite like flavonoids (epigallocatechin gallate, rutin, quercetin) are found in tea, are responsible for human health benefits. Variable amount of the tea flavonoids is found while tea leaf samples are collected from different altitudes of Himalayan region. Darjeeling (high altitude at around 4500 ft msl) is famous for its exquisite aroma while low altitude Dooars grown tea (1000 ft msl) is also well known for its beverage quality. Here in this paper, we have seen the differences in polyphenols and flavonoid content of different altitude grown tea which is being higher in high altitude grown Darjeeling tea. Such active metabolites like flavonoids have been characterized by HPLC, FTIR, TLC and spectrophotometric scan. Moreover, this higher flavonoid content is responsible to show the higher antioxidant and antimicrobial potentials which are manifested as their therapeutic qualities. The antimicrobial potentials are tested against some isolated multi drug resistant bacterial strains like *Bacillus clausii*, *Bacillus cereus*, LS12(*Bacillus safensis*), SS3 (*Terribacillus halophilus*), SS19 (*Comamonas aquatica*), LS14 (*Bacillus australimaris*). In all the cases, the zone of inhibitions was measured from the solid Mueller Hinton media against such organisms with tea extracts of high and low altitude grown tea. This paper aims to show higher therapeutic qualities of high altitude grown tea clones than low altitude grown same tea clone (TV25).

Keywords: Flavonoid, High altitude, Low altitude, tea, Metabolite, Multidrug resistant bacteria

P-06

Enhancing stress tolerance and secondary metabolite production in *Bacopa monnieri* (L.) Wettst.via Salicylic acid treatment

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Abstract:

Bacopa monnieri (L.) Wettst., that is commonly known as Brahmi, is a protuberant medicinal herb extensively used in the Ayurvedic formulations because of its memory-enhancement, antioxidant and neuroprotective properties. The impacts of therapeutic are majorly attributed for its highly enriched bioactive secondary metabolites, mainly bacosides. However, the metabolic activity and plant growth are highly sensitive to abiotic stresses such as salinity, oxidative imbalance and drought, which majorly impact its commercial viability and phytochemical yield. SA, a phenolic plant hormone, is well-known for its alteration of abiotic stress responses and improving secondary metabolism in several crops. In this study Bacopa monnieri plants were treated with SA at a specific concentration of 100 µM under regulating abiotic stress conditions and monitored for 2 days and 7 days respectively. The main goal of the study is to examine whether the treatment of SA would indorse stress tolerance and production of secondary metabolites. Physiological observations and biochemical assays were performed to assess stress symptoms and metabolite levels. Observable symptoms such as chlorosis, reduced Vigor and leaf curling were more noticeable in the SA treated plants compared to the control plant. All these observations conclude that under specific concertation and exposed durations, SA t acts as a stress enhancer rather than a stress mitigator in the medicinal plant like B. monnieri. The study highlighted that SA is known for inducing a stress adaptive stress response in many species. This study contributes to understanding of the complex hormonal control stress in medicinal plants.

Keywords: *Bacopa monnieri*, Salicylic Acid, Secondary metabolites, Stress regulation, Phytohormone, Gene Expression.

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Molecular and Metabolic Insights into Alkaloid Biosynthesis and Stress Adaptation in *Catharanthus roseus* (L.) G.Don

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Abstract:

Catharanthus roseus (L.) G.Don, commonly known as Madagascar periwinkle, is recognized for the production of powerful anticancer alkaloids such as vincristine and vinblastine. The monoterpenoid indole alkaloids (MIAs) are useful for treating cancers like leukemia, lymphoma, and also breast cancer. This research analyses gene expression with metabolite content for MIA biosynthesis in *C. roseus* wild type. This provides a solid foundation by allowing us to understand its normal metabolic capabilities. For the purpose of detecting key intermediates such as strictosidine and secologanin plant extracts were analyzed. Extracts using Liquid Chromatography-Mass Spectrometry (LC-MS) revealed both vindoline and vincristine successfully. In order to perform the extraction of polar alkaloids such as vincristine in addition to secologanin, methanol was determined by researchers to be a far more efficient solvent than organic extracts. Quantitative PCR (qPCR) was completed in parallel for four key genes of the MIA biosynthetic pathway on gene expression analysis: Strictosidine Synthase (STR),

Deoxyxylulose 5-Phosphate Reductoisomerase (DXR), Peroxidase 1 (PRX1), and Deacetylvindoline 4-O-Acetyltransferase (DAT), all expressed actively in wild-type tissues. In addition, plant health was assessed through physiological evaluations that measured chlorophyll content in conjunction with proline levels including antioxidant activity in addition to total polyphenol and flavonoid content. Target alkaloids were produced effectively by wild-type plants so physiological conditions were stable. Generally, this study offers perceptions of value into the native metabolic and genetic landscape within *C. roseus*, as this supports future efforts for optimizing the natural production of vinblastine and vincristine through biotechnological as well as cultivation- based approaches.

Keywords: *Catharanthus roseus*, Vincristine, Vinblastine, Alkaloid biosynthesis, Metabolite profiling, Gene expression analysis, Monoterpenoid indole alkaloids (MIAs),

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Microbial Fuel Cell Driven Device for Monitoring Immune Responses: A Prototype Design

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Abstract:

Microbial Fuel Cell (MFC) is a bio-electrochemical system that converts microbial metabolic energy into electric impulse. In this process, the Pigment produced by the bacteria, a redox-active agent. It facilitates electron transfer in an MFC set up by shuttling electrons from bacterial cell to the anode. This process generates bioelectricity as electrons flow through an external circuit to the cathode completing the circuit. This study presents a self-powered wearable patch-based device that integrates Microbial Fuel Cells (MFCs) and graphene-based electrochemical detection to monitor the immune responses. Microorganisms in the MFC generate electricity by oxidizing organic substrates. This automatically powers the patch.
A graphene microneedle serves as a sensing element. It undergoes oxidation when exposed to biological fluids. This oxidation is accelerated under infected conditions due to elevated production of reactive oxygen species (ROS) generated by immune cells, particularly at inflammatory sites. The Graphene Oxide (GO) interacts selectively with cytokines and binds with them through various mechanisms, including covalent bonding, electrostatic interaction, π–π stacking, hydrogen bonding, and hydrophobic interactions. These interactions alter electrochemical properties that produces measurable voltage fluctuations. An integrated circuit—comprising a voltmeter, Analog to Digital Converter (ADC), and microcontroller—captures these signals and wirelessly transmits them via Bluetooth module.
This wearable patch enables continuous monitoring of immune responses. It also offers a significant potential for early detection and management of diseases like sepsis, autoimmune disorders, cancer and chronic inflammations. Its self-powering capacity allows a dynamic immune surveillance without external power or laboratory equipment. This study is paving the way for combating human diseases.

Keywords: Microbial Fuel Cell (MFC), Pigment, Cytokine detection, Electrochemical Signal, Immune Monitor, Early detection of Disease, Self-powered wearable patch.

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Role of salicylic acid in secondary metabolism of *Andrographis paniculata* (Burm.f.) Wall. ex Nees: A Molecular and Metabolic Study

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Abstract:

Andrographis paniculata (Burm.f.) Wall. ex Nees, commonly known as Kalmegh, a traditional medicinal plant, has been used in parts of the continents of Asia, America, and Africa for the treatment of multiple life- threatening and chronic diseases which includes diabetes, high blood pressure, ulcers, leprosy, and even malaria. *Andrographis paniculata* (Burm.f.) Wall. ex Nees produces abundant secondary metabolites through secondary metabolism, just like most other plants. The phenylpropanoid pathway is one of the major pathways responsible for catalysing the synthesis of various secondary metabolites which includes polyphenols and flavonoids. In this pathway, Phenylalanine Ammonia-Lyase (PAL), the gateway enzyme (a specific kind of enzyme mix used in a recombination reaction to transfer DNA fragments between vectors), catalyses the conversion of phenylalanine to trans- cinnamic acid, along-with Chalcone Synthase (CHS). This enzyme is responsible for the first committed step in flavonoid biosynthesis, and Dihydroflavonol-4-reductase (DFR). It catalyses the reduction of dihydroflavonols to leucoanthocyanidins. These secondary metabolites act as defence mechanisms against various biotic and abiotic stresses. These stresses can range from fungi, bacteria, virus to extreme temperature, drought, salinity and metal-induced stress as they posses antioxidant, antimicrobial, antiviral, and even anti-fungal properties. This study employs high performance liquid chromatography (HPLC) and various biochemical assays to provide a systemic profiling of the secondary metabolites. When the plant is treated with salicylic acid, a common elicitor, it explores the gene expression patterns of key enzymes in the phenylpropanoid pathway by utilising Polymerase chain reaction (PCR).

Keywords: *Andrographis paniculata* (Burm.f.) Wall. ex Nees, polyphenol, flavonoid, phenylpropanoid pathway, antioxidant activity, secondary metabolites, salicylic acid.

P-20

Determination of Antimicrobial Activity of the Extracts of *Centella asiatica* Leaves Against Different Bacterial Strains

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Abstract:

Emergence of microorganisms resistant to antibiotics and antimicrobials lead to the introduction of novel antibiotics and antimicrobials sourced from plants and plant extracts. This study involves the plant ***Centella asiatica***, also known as **Thankuni** which is rich in bioactive compounds such as triterpenoids ,flavonoids ,phenolic acids ,alkaloids and essential oils, possessing in antimicrobial properties that can be used for the development of natural and novel antimicrobial drugs. This aims for determining the antimicrobial activity of the leaf extracts of *Centella asiatica* against Gram positive bacteria such as ***Bacillus cereus*** and ***Staphylococcus gallinerium*** and Gram negative bacteria such as ***Pseudomonas aeruginosa*** and ***Klebsiella pneumonia***. Plant extract was prepared by drying the isolated leaves from the stems, suspended in three solvents, chloroform, ethanol and methanol and again dried using rotary vaccum evaporator and stored in DMSO. Azithromycin was used as the standard. The four bacterial cultures were prepared and the antimicrobial properties of ***Centella asiatica*** were determined by Agar Well Diffusion method. The study reveals that the ethanolic-leaf extract showed maximum zone of inhibition resulting in inhibition of all the four strains whereas the chloroform-leaf extract showed no zone of inhibition for the Gram positive bacteria but showed clear zones for Gram negative bacteria. The methanolic-leaf extract could also inhibit all the four strains. ***Centella asiatica*** can be used as an effective solution for the antibiotic resistance and solve major health challenges of recent times.