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ELICITING PHYTOCHEMICAL PROFILE OF *POLYGONATUM VERTICILLATUM* (L.) ALL.: A HIGHLY USEFUL ASTAVARGA HERB

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Polygonatum verticillatum (L.) All., an *Asparagaceae* member, is an important and highly useful Astavarga medicinal herb of North West Himalaya. *P. verticillatum* has well established biological activities in terms of pain alleviation, antipyretic, anti-malarial, anti-inflammatory, diuretic, cardiotonic and energizer activities. Underground part of the plant is used traditionally in several health rejuvenating preparations in India. Seed dormancy, slow rate of natural regeneration, imprudent harvesting in nature necessitates its conservation. The plant was successfully established *in vitro* through sprouted buds. Elicitation of its phytochemical profile was done by foliar application of several chemical elicitors which are well-established signal molecules forming an integral part of plant defence system. Remarkable increase in medicinally important compounds was achieved in differently treated plants. The study showed that elicitation not only enhances the bioactive compounds but also stimulate the synthesis of new compounds. These interesting results of elicitation may help in value addition of the bioactive compounds of the plant to improve the quality of plant-based medicine on an industrial scale.

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THE CENTERS OF PREMELTONS SIGNAL THE BEGINNING AND ENDS OF GENES

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Premeltons are examples of emergent structures (i.e., structural solitons) that arise spontaneously in DNA due to the presence of nonlinear excitations in its structure. They are of two kinds: B-B (or A-A) premeltons form at specific DNA-regions to nucleate site-specific DNA melting. These are stationary and, being globally nontopological, undergo breather motions that allow drugs and dyes to intercalate into DNA. B-A (or A-B) premeltons, on the other hand, are mobile, and being globally topological, act as phase-boundaries transforming B-into A- DNA during the structural phase-transition. They are not expected to undergo breather-motions. A key feature of both types of premeltons is the presence of an intermediate structural-form in their central regions (proposed as being a transition-state intermediate in DNA-melting and in the B- to A- transition), which differs from either A-or B- DNA. Called beta-DNA, this is both metastable and hyperflexible – and contains an alternating sugar-puckering pattern along the polymer-backbone combined with the partial-unstacking (in its lower energy-forms) of every other base-pair. Beta-DNA is connected to either B- or to A- DNA on either side by boundaries possessing a gradation of nonlinear structural-change, these being called the kink and the antikink regions. The presence of premeltons in DNA leads to a unifying theory to understand much of DNA physical-chemistry and molecular-biology. In particular, premeltons are predicted to define the 5' and 3' ends of genes in naked-DNA and DNA in active-chromatin, this having important implications for understanding physical aspects of the initiation, elongation and termination of RNA-synthesis during transcription. For these and other reasons, the model will be of broader interest to the general audience working in these areas. The model explains a wide variety of data, and carries within it a number of experimental predictions – all readily testable – as will be described in my talk.

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STRATEGIC MANAGEMENT OF PLANT AND SOIL HEALTH UNDER THE INFLUENCE OF TWO AGRIUSABLE NANOCOMPOUNDS IN MAIZE BY TWO *BACILLUS* SPECIES

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The unique physical properties of nanoparticles facilitate their wider application in various fields including agriculture. In general, application of Nano compounds in agricultural practices is reported to decrease nutrient loss and pathogen infestation. Precise use of Nano compounds improves crop production. Zeolites have wider applications in agriculture and environmental engineering. Nanochitosan is used for seed treatment but it can also act as a biopesticide and helps the plants to fight against fungal infections. Zeolite incorporation in soil is found to increase crop yields by promoting nutrient use efficiency. In the present study effect of nanochitosan and nanozeolite was evaluated on plant health, productivity, soil enzymes and microbial population in maize rhizosphere under natural field conditions in the presence of two plant growth promotory *Bacillus* species. Under combined treatment of nanocompounds and PGPRs, significant increase in plant height (8.11%), root length (114%), leaf area (15%), biochemical parameters like chlorophyll (118%), carotenoid content (74.80), protein content (80%) and antioxidant enzyme activity (41%) was reported in treated maize plants as compared to control. Performance of nanozeolite along with two *Bacillus* sp. was better than the nanochitosan treatments in respect to biochemical parameters but activities of catalase, peroxidase and superoxide dismutase (antioxidant enzymes) of maize leaves were high in the treatment containing nanochitosan and *Bacillus* sp.. Study of microbial population of the treated soil using qRT-PCR showed abundance of 16S rDNA in the form of copy number as compared to control. Two fold increase in the activities of two major indicator enzymes (Fluoroscine diacetate hydrolase and arylesterase) of soil health was observed in the treated soil as compared to control. Enzyme activities were maximum in the presence of nanozeolite and *Bacillus* sp. as compared to nanochitosan and *Bacillus* treatments. It was concluded that nanochitosan and nanozeolite showed positive effect on plant health, crop productivity, microbial population of maize rhizosphere and soil health.

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INTERACTION IN PLANT GROWTH REGULATOR AND PHYSIOLOGICAL PROCESSES TO CONTROL PLANT REGENERATION AND *IN VITRO* DEVELOPMENT OF *TULBAGHIA SIMMLERI*

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The endogenous auxin and cytokinin contents of *in vitro* regenerated *Tulbaghia simmleri* maintained on applied plant growth regulators in Murashige and Skoog (MS) medium were investigated using UHPLC-MS analysis. The highest number of shoots (27.6 per leaf) were produced in MS medium supplemented with 2.5 µM thidiazuron. A higher number of these shoots were rooted with 10 µM 6-(2-hydroxy-3-methylbenzylamino) purine (PI-55, cytokinin antagonist). Production of somatic embryos (SEs: 16.4 – 4.6, globular to cotyledonary stages) improved significantly with liquid MS medium containing 2.5 µM picloram, 2.5 µM phloroglucinol (PG) and 1.5 µM gibberellic acid or 1.5 µM PI-55 and 1.0 µM trans-zeatin. SEs (torpedo and cotyledonary stages) germinated (100%) in plant growth regulator free MS medium. The plantlets were acclimatized, and all survived in the greenhouse. Higher levels of endogenous auxin, 2-oxindole-3-acetic acid (oxIAA, 371.52 pmol/g DW) and indole-3-acetylaspartate (IAAsp, 141.56 pmol/g DW) were detected in shoots from PG treatments. The roots of garden-grown-mother plants possessed the highest level of indole-3-acetic acid (IAA, 630.54 pmol/g DW) and oxIAA (515.26 pmol/g DW). Cytokinins [CKs: trans-zeatin-O-glucoside (tZOG), cis-zeatin (cZ) and N6-isopentenyladenosine-5´-monophosphate (iPRMP)] levels were relatively high in shoots and roots of plantlets *in vitro*. However, PI-55 treatments influenced the development of plantlets promoting a higher biosynthesis level of iPRMP (418.06 pmol/g DW in root) and cZRMP (904.61 pmol/g DW in roots and 1427.83 pmol/g DW in shoots). The reported protocol highlights the significance of exogenous and endogenous hormonal effects on large-scale production of *in vitro* plant development and improves the understanding of physiological processes of CK metabolism, signalling and transport in *in vitro* development.

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