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Content

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PHYSALIS MINIMA L.– A COMPREHENSIVE REVIEW ON MORPHO-ANATOMICAL, PHYTOCHEMICAL AND THERAPEUTIC PROPERTIES

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Abstract: *Physalis minima* Linn is an important medicinal plant widely used in traditional medicine in India. Various parts of the plant are employed in the treatment of several conditions such as inflammation, fever, hypertension, cancer, spleen disorders, and diabetes. Characterization of the plant across multiple aspects has been determined to enable accurate identification. Key phytochemicals such as flavonoids, phenols, steroids, and tannins have been extracted from different plant parts using various extraction methods and these compounds possess anti-inflammatory, anti-cancer, antimicrobial, and antioxidant properties. Physalin and withanolides, two potent steroidal compounds that exhibit anti-inflammatory activates through mechnanisms such as inhibition of NO production, NF-κB pathway, COX-2 expression, STAT3, upregulation of HO-1 expression, blocking MAPK signalling pathway and secretion of IL-6, IL-1β, and TNF-α. These compounds also exhibit anti-cancerous activity through caspase-3, P53 and c-Myc apoptotic pathways and PI3K/AKT and RAS/MAPK signalling pathways.

Keywords: Anti-inflammatory, Anti-cancer, Antioxidant, Antimicrobial, *Physalis minima*, Phytochemicals

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DEVELOPMENT OF FRIABLE EMBRYOGENIC CALLI FROM GINGER SHOOTS OF VARYING MATURITY

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Abstract: Ginger is a vegetative propagated monocot with medicinal properties and is cultivated mainly in the tropics as a spice crop. The lack of seed setting limits genetic improvement in this crop to clonal selection and mutation breeding. Therefore, assistance from modern technologies, like genetic transformation and genome editing, can be used to broaden the genetic base and improve traits like yield, quality, and climate resilience in ginger. Callus induction is a crucial step in Agrobacterium-mediated genetic transformation, genome editing, production of somaclonal variants, *in vitro* production of phytochemicals, etc. Production of friable embryogenic calli requires fine-tuning the hormonal composition in the callus induction media in a genotype- and explant-specific manner. In this study, we have optimised the callus induction protocol for the variety IISR Varada using five different explant tissues, like leaf lamina, immature shoot tip, immature shoot base, mature shoot tip, and mature shoot base. We found that the shoot bases from the mature and immature shoots of IISR Varada were capable of responding to the exogenous application of 2,4-D and developed calli with an induction rate of 75%. The mature shoot tip also responded to a combination of 2,4-D and BAP.

Keywords: Genetic engineering, Genome editing, Tissue culture, Ginger, Zingiber officinale

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IN VITRO, ASSESS THE IMPACT OF SALT STRESS ON GERMINATION AND PHYSIOLOGICAL RESPONSE OF COWPEA

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Abstract: Soil salinity is the primary constraint on plant growth and affects sustainable agriculture. This study examined the impact of salt stress (NaCl) on cowpea germination and nutritional qualities at varying NaCl concentrations (50 mM,100 mM,150 mM, and 200mM NaCl concentrations) by laboratory bioassay. Germination of cowpea was observed after seven days of bioassay. The study's findings indicate that both seedling growth and germination rates were impacted by an increase in salt concentrations. Viable and surface-sterilized seeds were chosen to germinate in varying NaCl concentrations and distilled water as a control. The experiment was conducted in a triplet with a control. Final observations were recorded after fifteen days of germination of cowpea. Experimental findings revealed that salt concentration significantly affects the germination and physiological growth of cowpea. Increasing salt concentration also significantly affects protein and total sugar content.

Keywords: Germination, Bio-assay, Salt stress, Seedlings, Nutrients

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BIOGENIC SYNTHESIS AND CHARACTERIZATION OF NANO-HYDROXYAPATITE USING *BACILLUS SUBTILIS*, *BACILLUS LICHENIFORMIS*, AND *PSEUDOMONAS FLUORESCENS*

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Abstract: This study investigates the biogenic synthesis of nano-hydroxyapatite (nHAP) using *Bacillus licheniformis*, *Bacillus subtilis*, and *Pseudomonas fluorescens*, followed by comprehensive characterization to assess their physicochemical and structural properties. UV–Vis spectroscopy confirmed nanoparticle formation with absorption peaks at 238 and 280 nm (*B. licheniformis*), 241 and 278 nm (*B. subtilis*), and 245 and 281 nm (*P. fluorescens*), suggesting nucleation and presence of organic moieties. Spectral shoulders in *B. subtilis* and *P. fluorescens* indicated biomolecular interaction, unlike the sharper profile of *B. licheniformis*. FTIR analysis showed characteristic phosphate (PO_4^{3-}) bands (~1040 and 560–565 cm^{-1}), hydroxyl groups (~3570 cm^{-1}), and minor carbonate (~1450 cm^{-1}) in all samples. Strong amide I (~1640 cm^{-1}) and II (~1540 cm^{-1}) bands in *B. subtilis* and *P. fluorescens* pointed to proteinaceous capping and biogenic origin, whereas *B. licheniformis* had sharper phosphate peaks and minimal organic signatures, indicating higher crystallinity. EDX confirmed elemental composition with Ca/P ratios near the ideal 1.67. *B. licheniformis* (1.61) produced the most stoichiometric and pure nHAP, followed by *B. subtilis* (1.59) and *P. fluorescens* (1.58), aligning with FTIR observations. DLS and zeta potential results showed *B. licheniformis* synthesized the smallest (32.4 ± 1.2 nm), most monodisperse (PDI 0.186), and stable (−34.2 ± 1.7 mV) particles. In contrast, *P. fluorescens*-derived nHAP was larger (39.3 ± 1.9 nm), more polydisperse (PDI 0.264), and less stable (−26.5 ± 2.2 mV).In conclusion, all three strains synthesized nHAP, but only *B. subtilis* and *P. fluorescens* exhibited strong biogenic characteristics. *B. licheniformis* yielded highly crystalline, near-stoichiometric nHAP, resembling chemically synthesized material, making it ideal for high-purity applications such as agriculture.

Keywords: Agricultural nanomaterials, *Bacillus licheniformis*, *Bacillus subtilis*, *Pseudomonas fluorescens*

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QUALITY ASSESSMENT OF TRIPHALACHOORNAM: EVALUATION OF HEAVY METAL CONTAMINATION AND MICRONUTRIENT COMPOSITION

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Abstract: Triphalachoornam, a classical Ayurvedic polyherbal formulation composed of the dried fruits of *Emblica officinalis*, *Terminalia bellirica*, and *Terminalia chebula*, is well known for its therapeutic properties. Given increasing

concerns over heavy metal contamination in herbal preparations, this study evaluated ten commercial samples of Triphalachoornam for their heavy metal and micronutrient profiles using Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES). Eleven elements were quantified—six essential micronutrients (Ca, Mg, Fe, Mn, Zn, Cu) and five potentially toxic heavy metals (Cd, Cr, Ni, Pb, Hg)—and compared against WHO/FAO safety limits. Sixty percent of the samples complied with permissible levels, while the remaining 40% exceeded limits for Chromium and Nickel. These findings highlight the need for stringent quality control and regulatory surveillance in the herbal product industry to safeguard consumer health and ensure product integrity.

Keywords: Triphalachoornam, Heavy metals, Micronutrients, Elemental profiling, Herbal formulation safety