Synthesis and Characterization of Oil-in-Water Nanoemulsion using High Energy Methods Encapsulating Phytomolecule for Combating Papaya Ring Spot Virus

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Bioactive compounds play a pivotal role in orchestrating the defense mechanisms of plants, one such potent bioactive compound is dodecanoic acid, which is found to be present in wild papaya genotypes like *Vasconcellea candamarcensis* and *Vasconcellea Cauliflora*, but conspicuously absent in cultivated varieties of papaya. This compound demonstrates promising antiviral activity against Papaya Ring Spot Virus (PRSV). This study concentrated on synthesis of nanoemulsion of this bioactive compound which is known for its inherent hydrophobic properties, necessitating conversion into a hydrophilic form through advanced techniques such as High Energy Homogenization and Ultra-Sonication. The resulting nanoemulsion exhibited remarkable characteristics, with a z-average diameter of 52.30 nm, showcasing a distinct spherical droplet structure, as corroborated by TEM imaging. In assessing its efficacy, plant bioassays with eight treatments each replicated thrice, were conducted under controlled glasshouse conditions using mechanical inoculation methods with 45 days old seedlings of TNAU papaya CO.8 variety. Strikingly, pre-inoculation and co-inoculation with the nanoemulsion prevented any manifestation of PRSV infection symptoms in papaya seedlings and also has positive effects on plant growth. However, in the post-inoculation, seedlings treated with the dodecanoic acid nanoformulation displayed symptoms of PRSV infection. Further rigorous investigations are underway to pinpoint the optimal concentration of the nanoformulation for effectively combatting PRSV infection across various growth stages. Additionally, comprehensive analysis of its molecular properties is being pursued to unravel the mechanisms underlying its antiviral activity.

Keywords: Papaya ring spot virus, Phytomolecules, Dodecanoic acid, Nanoformulation