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Phytosynthesized Iron Nanoparticles Elicited Growth and Biosynthesis of Steviol Glycosides in Invitro Stevia rebaudiana Plant Cultures

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Abstract : The application of nanomaterials is becoming the most effective strategy of elicitation to produce a desirable level of plant biomass with complex medicinal compounds. This study was designed to check the influence of phytosynthesized iron nanoparticles (FeNPs) on physical growth characteristics, antioxidant status, and production of steviol glycosides of in vitro grown Stevia rebaudiana. Effect of different concentrations of iron nanoparticles replacement of iron sulfate in MS medium (stock solution) on invitro stevia plant growth following positive control (MS basal medium), negative control (iron sulfate devoid medium), iron sulfate devoid MS medium and supplemented with FeNPs at different concentrations (5.6 mg/L, 11.2 mg/L, 16.8 mg/L, 22.4 mg/L) was evaluated. The iron deficiency leads to a drastic reduction in plant growth. In contrast, applying FeNPs leads to improvement in plant height, leave diameter, improved leave morphology, etc., in a concentration-dependent manner. Furthermore, the stress caused by FeNPs at 16.8 mg/L in cultures produced higher levels of total phenolic content (3.7 ± 0.042 mg/g dry weight: DW) and total flavonoid content (1.9 ± 0.022 mg/g DW and antioxidant activity (78 ± 4.6%). In addition, plants grown in the presence of FeNPs at 22.4 mg/L resulted in higher enzymatic antioxidant activities (SOD = 3.5 ± 0.042 U/mg; POD = 2.6 ± 0.026 U/mg; CAT = 2.8 ± 0.034 U/mg and APx = 3.6 ± 0.043 U/ mg), respectively. Furthermore, exposure to a higher dose of FeNPs (22.4 mg/L) exhibited the maximum amount of stevioside (stevioside: 4.6 ± 0.058 mg/g (DW) and rebaudioside A: 4.9 ± 0.068 mg/g DW) as compared to other doses. The current investigation confirms the effectiveness of FeNPs in growth media. It offers a suitable prospect for commercially desirable production of S. rebaudiana biomass with higher sweet glycosides profiles in vitro.

Keywords : cell culture, stevia, iron nanoparticles, antioxidants
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