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Hydroponic Cultivation Enhances the Morpho-Physiological Traits and Quality Flower Production in Tagetes patula L

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Abstract : In soil-less agriculture, hydroponic is considered a potential farming system for the production of uniform quality plant material in significantly less time. Therefore, for the first time, the current investigation corroborates the effect of different cultivation conditions (open-field, poly-house, and hydroponic) on morpho-physiological traits, phenolic content, and essential oil components analysis in three flower color variants (yellow, scarlet red, and orange) of Tagetes patula. The results revealed that the maximum plant height, number of secondary branches, number of flowers, photosynthesis, stomatal conductance, and transpiration rate were observed under the hydroponic system as compared to other conditions. However, the maximum content of gallic acid (0.82 mg/g DW), syringic acid (3.98 mg/g DW), epicatechin (0.48 mg/g DW), p-coumaric acid (7.28 mg/g DW), protocatechuic acid (0.59 mg/g DW), ferulic acid (2.58 mg/g DW), and luteolin (8.24 mg/g DW) were quantified maximally under open-field conditions. However, under hydroponic conditions, the higher content of vanillic acid (0.43 mg/g DW), caffeic acid (0.49 mg/g DW), and quercetin (0.92 mg/g DW) were quantified. Moreover, a total of nineteen volatile components were identified in the essential oil of different flower color variants of T. patula cultivated under different conditions. The major reported volatile components in essential oil were (-)-caryophyllene oxide, trans-β-caryophyllene, trans-geraniol, 3 methyl-benzyl alcohol, and 2,2’:5’,2”-terthiophene. It has also been observed that the volatile component percentage range in all variants was observed in open-field (70.85 % to 90.54 %), poly-house (59.03 % to 77.93 %), and hydroponic (68.78 % to 89.41 %). In conclusion, the research highlighted that morpho-physiological performance with flower production was enhanced in the hydroponic system. However, phenolic content and volatile components were maximally observed in open-field conditions. However, significant results have been reported under hydroponic conditions in all studied parameters, so it could be a potential strategy for quality biomass production in T. patula.

Keywords : Tagetes patula, cultivation conditions, hydroponic, morpho-physiology
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