Elevation of secondary metabolite production by using light-emitting diodes illumination in Mulberry (*Morus* spp.)

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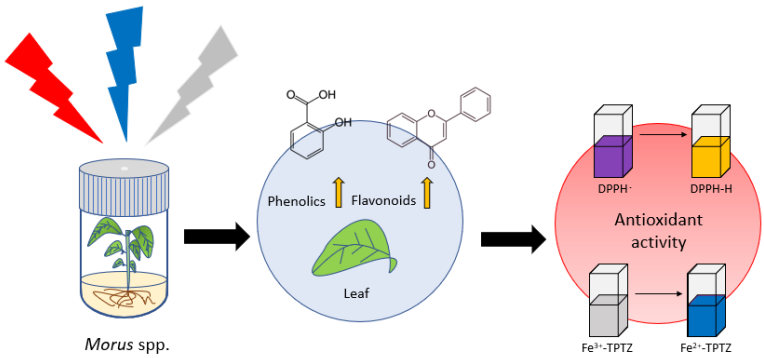
Abstract: Mulberry leaves have long been used in traditional medicine and are associated with several impressive health benefits. Recently, light-emitting diode (LED) is widely used as a light source in plant growing systems. Therefore, the objectives of this study were to investigate the effect of LEDs on secondary metabolite production in mulberry leaves and evaluate their antioxidant activities using ferric reducing antioxidant power (FRAP) and 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assays. Mulberry plants cultured in vitro were exposed to red, blue, and white LEDs for 7 days. Lighting experiments were performed under controlled conditions (PPFD - 100 μmol m^{-2} s^{-1}; 16/8 h photoperiod; 25 ± 2 °C). Blue light illumination resulted in the greatest phenolic content (9.13 ± 1.2 mg gallic acid equivalent (GAE) g^{-1}) measured by the Folin-Ciocalteu reagent method. Total flavonoid contents were found to be in the range of 8 - 13 mg quercetin equivalent (QE) g^{-1}), as determined by the aluminium chloride colorimetric method. However, there was no significant change in total flavonoid content between red, blue, white LEDs, and fluorescent light used as a control. Furthermore, the most potent antioxidant activity, measured by FRAP assay, was in the plants treated with blue light, suggesting that phenolic compounds might be associated with this effect. All extracts could inhibit, but not significantly, the DPPH radicals approximately at 70 - 80%. Taken together, the results of this study support that LEDs might be utilized as an alternative light source to improve the production of some valuable secondary metabolites in mulberry leaves.

Graphical abstract:



Keywords: antioxidant; light-emitting diode; mulberry; secondary metabolite; tissue culture

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