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Hypericum perforatum cells accumulate anthocyanins and flavonoids at the expense of xanthone biosynthesis during light adaptation

*Franklin, G., Dias, A.C.P.

CITAB – Department of Biology, University of Minho, 4710-057 Braga, Portugal

*Corresponding author, e-mail: franklin@bio.uminho.pt

Topic: Molecular tools and approaches

Hypericum perforatum L. (HP) is well-known for its medicinal uses. Extracts of HP have been used in traditional medicine worldwide for several ailments (Franklin et al 2009). Pharmacological properties of HP extracts such as antidepressant, antioxidant, anti-inflammatory, hepatoprotective, and anticancer activities can be attributed to the phenolic compounds such as naphtodianthrones, xanthones, flavonoids etc., produced by HP (Conceição et al 2006).

The present study was conducted to analyse the secondary metabolic changes in HP cells under light stress. HP cell suspension cultures were yellowish green in colour under 20 µmol s^{-1} m^{-2} intensity light illumination. Whereas, when transferred to 60 µmol s^{-1} m^{-2} light intensity, these cultures gradually attained a pink colouration within 15 days. HPLC-DAD analysis revealed that these cells present higher accumulation of anthocyanins and flavonoids, while decreasing the otherwise predominant xanthone production. Transfer of these pink cultures back to 20 µmol s^{-1} m^{-2} light condition resulted in xanthone accumulation, while diminishing anthocyanins and flavonoids production. Simultaneous to this metabolic change, the cells also regained their normal colour within 15 days. Interestingly, maintenance of pink cultures under high light intensity for about 60 days (6 subcultures) also completely reversed the cultures to their normal colour indicating that the differential accumulation of phenolics in HP cultures is associated with their acclimatization to high light condition. It is known that xanthones, flavonoids and anthocyanins are biosynthetically related compounds, and share a common pool of precursors (Liu et al 2003, Conceição et al 2006). Hence, under light stress, these precursors might have been shifted towards flavonoids and anthocyanins production by shutting down the xanthone biosynthesis temporarily. We propose that a two-way molecular switch operates at the key branch point, where benzophenone synthase (BPS) and chalcone synthase (CHS) operates. This is currently under investigation.

References

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