

Differential Production of Tropane Alkaloids in Hairy Roots and *in vitro* Cultured Two Accessions of *Atropa belladonna* L. under Nitrate Treatments

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Plants are a potential source of a large number of valuable secondary metabolites. *In vitro* cultures are being considered as an alternative to agricultural processes for studying valuable secondary metabolites. In this way, nutritive factors are important parameters influencing the production of these compounds in plants. Effects of nitrate concentrations (KNO_3) on the production of two tropane alkaloids, hyoscyamine and scopolamine, and the growth of aerial parts and roots of two *in vitro* propagated accessions of *Atropa belladonna* and hairy roots were investigated. As hairy roots cultures are able to keep a stable production of alkaloids over long periods of subculturing, they are considered as an interesting option for the study of alkaloid biosynthesis. A hairy roots culture of *Atropa belladonna* was established by transformation with *Agrobacterium rhizogenes* strain AR15834. The results of our study showed that a rise in KNO_3 concentration caused a decline in hairy roots growth, and had a remarkable effect on the alkaloid content. The alkaloid concentrations obtained in the hairy roots were 3–20 times higher than that in the plants at 35 mM of KNO_3 . Increasing the nitrate concentration in the medium of hairy roots also improved the hyoscyamine/scopolamine ratio, while it increased the scopolamine/hyoscyamine ratio in the studied plants.

Key words: *Agrobacterium rhizogenes*, *Atropa belladonna*, Hairy Roots, Tropane Alkaloids