Devil's Claw Hairy Root Culture in Flasks and in a 3-L Bioreactor: Bioactive Metabolite Accumulation and Flow Cytometry©

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Phenylethanoids are a group of natural water-soluble compounds with high biological value, which could potentially be commercially produced by hairy root cultures. Thus, we have examined the capacity of transformed root cultures of Devil's claw (*Harpagophytum procumbens*) to accumulate four phenylethanoid glycosides – *b*-OH-verbascoside, verbascoside, leucosceptoside A, and martynoside – in shake-flasks and a 3-L stirred tank reactor. Verbascoside was found to be the major phenylethanoid, and its maximal contents were the same (1.12 mg/g dry weight) in both kinds of culture. However, peak leucosceptoside A contents were 1.6-times higher in bioreactor cultures than in shake-flask cultures. Flow cytometry analysis revealed that $G_0 + G_1$-phase cells predominated throughout the growth of the cultures, which was in accordance with the very high proportion of quiescent cells in the transformed roots. The results provide the first demonstration of the potential utility of Devil's claw hairy roots as biofactories for producing high-value phenylethanoid glycosides.

Key words: Hairy Root, *Harpagophytum procumbens*, Phenylethanoids