Enhanced production of withaferin-A in shoot cultures of Withania somnifera (L) Dunal

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ABSTRACT

Withania somnifera (L) Dunal, commonly known as ashwagandha or Indian ginseng, is the source of large number of pharmacologically active withanolides. Withaferin-A (WS-3), a major withanolide of W. somnifera, has been proven to be an effective anti-cancer molecule. In this study, a liquid culture system for shoot proliferation, biomass accumulation and withaferin-A production of an elite accession (AGB002) of W. somnifera was investigated. The nodal explants cultured on Murashige and Skoog (MS) semi-solid medium supplemented with various concentrations of 6-benzyl adenine (BA) and Kinetin (Kn) elicited varied responses. The highest number of regenerated shoots per ex-plant (35 ± 3.25) and the maximum average shoot length (5.0 ± 0.25 cm) were recorded on MS medium supplemented with BA (5.0 μM). The shoots were further proliferated in half and full strength MS liquid medium supplemented with the same concentration BA. It was interesting to note that shoots cultured on MS half strength liquid medium fortified with 4 gL-1 FW (fresh weight) shoot inoculum mass derived from 5 week old nodal explants of W. somnifera showed highest accumulation of biomass and withaferin A content in 5 weeks. Withaferin A was produced in relatively high amounts (1.30 % and 1.10 % DW) in shoots cultured in half and full strength MS liquid media respectively as compared to natural field grown plants (0.85 % DW). A considerable amount of the withaferin A was also excreted in the culture medium. Successful proliferation of shoots in liquid medium and the synthesis of withaferin A in vitro opens new avenues for bioreactor scale-up and the large-scale production of the compound.

Keyword: Growth regulators; Shoot cultures; Withaferin A; Withania somnifera