Essential Oil and Antioxidant Production by Plant Tissue Culture

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Summary
In this study, we investigated on essential oil and polyphenol production by plant tissue culture.

The shoot cultures of Roman chamomile (Anthemis nobilis L.) were established from young shoots of the plants cultivated in a field. Essential oil components were determined by GC-MS. We found that A.nobilis shoot cultured in Murashige-Skoog (MS) liquid medium, small amounts of geranyl isovalerate were produced in the shoot part of the in vitro plantlets, and large amounts of geranyl isovalerate were produced in the root. The geranyl isovalerate was not detected in essential oil of plantlets cultivated in a field.

Then we established shoot cultures with no root system and adventitious roots culture for confirmation of the geranyl isovalerate production part. Shoot cultures having no roots do not produce the geranyl isovalerate. On the other hand, a large amount (200µg/g fresh weight) of geranyl isovalerate was produced in the roots obtained adventitious root culture. Therefore, we found that the root is the organ which specifically biosynthetizes the geranyl isovalerate.

The shoot cultures of Peppermint (Mentha piperita L.) were established from young shoots of the plants cultivated in a field. Essential oil components were determined by GC-MS. In the shoots cultured on MS solid medium, carvone was detected as the main constituent. The menthol was the main components of plantlets cultivated in a field, and it was not detected in the shoots cultured on MS solid medium. The plantlets obtained by culturing on MS solid medium were transplanted to pots. The production of carvone increased rapidly, and production of menthol was started.

Lamiaceae and Boraginaceae plants commonly contain caffeic acid derivative phenolic, rosmarinic acid (RA), lithospermic acid (LA) and lithospermic acid B (LAB). As well as antioxidant activity, these compounds (particularly LAB) are expected to have new medicinal bioactivity used for treatments of renal disease, anti-HIV etc. Therefore we investigated mass production of these polyphenol by plant tissue culture.

The contents of phenolics were analyzed by HPLC. Contents of RA, LA and LAB in several Lamiaceae and Boraginaceae cultivated in a field and the in vitro plantlets were investigated. Sweet basil (Ocimum basilicum "sweet") cultivated in a field and the in vitro plantlets produced highest contents of RA. Therefore we selected Sweet basil and investigated for mass production of RA.

Adventitious root cultures of Sweet basil were established from roots of in vitro plantlets.
Greater amounts (6.78% as dry weight) of RA was produced in the roots of adventitious root culture than that of in vitro plantlets. Hairy root cultures of Sweet basil were established from roots of in vitro plantlets. Greater amounts (14.07% as dry weight) of RA was produced in the roots of hairy root culture than that of in adventitious root culture.