West Pomeranian University of Technology Szczecin

Faculty Of Environmental Management And Agriculture

SUMMARY
Dominika Andrys, M.Sc.

The narrow-leaved lavender is a valued herbaceous plant due to its decorative values and production of essential oils, which are characterized by strong aroma, and constituting a mixture of natural volatile compounds. Essential oils are classified as plant secondary metabolites and they can be obtained from plant material (e.g., flowers, buds, stems and other parts) by using water steam distillation method. Secondary metabolites are produced by plants often at very low levels, or during specific developmental stages (e.g., during flowering or in response to stressors). *In vitro* cultures are an efficient method for production of large amounts of plant tissues, and growth conditions may contribute to the production of essential oils with altered chemical composition, with different and desired qualities. However, a precise selection of environmental factors – in particular the content of plant growth regulators in the medium – affecting the efficiency of the process must be conducted.

In the first part of the study, the effect of BAP, 2iP and KIN (0.2 – 5 $mg \cdot dm^{-3}$) on the micropropagation and mineral composition of auxins (IBA and NAA) on the rooting of three narrow-leaved lavender cultivars (Ellagance Purple, Blue River and Munstead) was determined in *in vitro* cultures.

Subsequently, the biological activity of the plant material and the essential oils isolated from the above lavender cultivars propagated *in vitro* and cultivated in the field were compared. Analysis of the composition of essential oils was conducted by using gas chromatography coupled with mass spectrometry (GC/MS). GC/MS showed that the plant growth conditions led to a change of the chemical profile of the essential oils. The majority of the compounds belonged to the monoterpenoids. In the essentials oils isolated from field-grown plants, 82 to 87 compounds were identified, whereas in the oils isolated from *in vitro* plants, 64 to 72 compounds were found. Essential oils isolated from lavenders cultivated in the field were characterized by high borneol, linalool and globulol content, whereas the oils isolated from *in vitro* plants were dominated by borneol and epi-α-cadinol. The essential oils isolated from *in vitro* plants contained compounds not identified in essential oils isolated from field-grown plants, which were thymol, carvacrol, khusinol, 8-cedren-13-ol and trans-calamenene.

Furthermore, the study compared antioxidant and antimicrobial properties of field-grown and *in vitro* lavenders. DPPH, FRAP and ABTS methods were used to evaluate the antioxidant activity of the extracts. Extracts from dried *in vitro* plants were characterized by considerably higher (sometimes four-fold) antioxidant activity than extracts from dried field-grown plants and they contained larger amounts of polyphenols. The antimicrobial activity examination included the evaluation of the effect of isolated essential oils on the reference bacteria strains: Gram-positive (*S. aureus, S. epidermidis*),

Gram-negative (*E. coli, P. aeruginosa*) and on yeast fungus cells (*C. albicans*). The essential oils isolated from *in vitro* plants were characterized by considerably stronger antimicrobial activity than those isolated from field-grown plants. In the study, a comparison of secretory trichomes of *in vitro* and field-grown plants was conducted. For the studied cultivars, the secretory trichomes with greater diameter were determined for field-grown plants.

The factors used in *in vitro* cultures, which significantly alter the composition, as well as the scale of secondary metabolites production are elicitors (i.e., stressor substances). The most commonly used elicitor is jasmonic acid (JA), yet its influence on the chemical composition of essential oils isolated from plant tissues propagated in *in vitro* cultures is poorly understood. Thus, a study has been conducted to determine the influence of JA on narrow-leaved lavender cultivar Munstead propagated in *in vitro* cultures and on the biological activity of the plants. In the study, no significant influence of lower concentrations of JA (0.2 and 0.5 $mg \cdot dm^{-3}$) on the height and weight of the plants was observed. On the other side, the use of higher concentrations of JA (1 and 1.5 $mg \cdot dm^{-3}$) influenced the decrease of lavender shoot height, number of shoots and plant weight as compared to the control. In addition, the number of secretory trichomes was reduced.

In the following part of the study, the influence of JA added to media on the chemical composition of essential oils was determined. Using the GC/MS method, a variable number of chemical compounds was determined depending on the JA concentration in the medium: 23 for the essentials oils obtained from lavender plants propagated on the medium without addition of JA and 30 to 34 of different compounds in the case of lavenders propagated on media with different concentrations of the added JA. With the increase of JA concentration, the number of monoterpene compounds increased from 14 (control) to 22-26 (medium with JA), as well as their percentage share increased two-fold. In the essentials oils isolated from plants propagated on media with addition of JA, appearance of such compounds as p-cymene, cis-β-terpineol and linalool was determined, which were absent in oils isolated from plants propagated on the control medium.

The above essentials oils were tested for their antimicrobial activity. It was determined that all tested oils (in 10% and 50% concentration) isolated from narrow-leaved lavender Munstead, propagated on media with variable JA content, exhibited antimicrobial activity toward *P. aeruginosa, S. aureus, S. epidermidis, E. coli* and *C. albicans*. The analysis also included examination of antioxidant activity of extracts. It was determined, that the antioxidant activity, assessed by using DPPH, FRAP and ABTS methods is higher for the extracts of plants propagated on media with addition of JA than in the control. Moreover, addition of jasmonic acid also influenced the increase of the polyphenols content.

The high antimicrobial activity of essential oils isolated from lavender tissues was the cause to conduct study on the determination of the influence of essential oils isolated from *in vitro* plants on the protection against contamination of a cosmetic emulsion. It was determined that essential oil may constitute an alternative for synthetic preservatives used to protect the product against microorganism growth. In addition, it was found that essential oil used at concentration of 0.01% and isolated from plants propagated *in vitro* can stimulate procollagen I production by fibroblasts.

The presented study showed its applicability character. The obtained results indicate the possibility to use biologically active plant substances, isolated from *in vitro* plant tissues in the technology of cosmetics production, especially in the field of natural cosmetics, which is growing in recent years.

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