

Poster session

Research on the composition and biological activity of raw materials and plant extracts

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7. Effect of the extraction method on the phytochemical profile and antioxidant activity of the *Lavandula angustifolia* and *Lavandula x intermedia* cultivars

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8. Antihyaluronidase, antioxidant and antibacterial properties of the European dewberry (*Rubus caesius* L.)

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9. The state of research on the species from the genus *Papaver* L. growing in Mongolia

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10. A comparative study of the antioxidant potential and health-promoting properties of various grapevine cultivars fruits

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11. Biological activity of methanol extracts obtained from flowers and leaves *Achillea erba-rotta* all. subsp. *Moschata*

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Introduction. Lavender is a valuable perennial plant from the *Lamiaceae* family. It is cultivated mainly for its essential oil, but it also contains many other compounds such as polyphenols, coumarins, triterpenes, sterols, and tannins. Polyphenols are secondary plant metabolites that are classified into several groups, such as phenolic acids, flavonoids, lignans and stilbenes. They have antioxidant activity owing to their ability to scavenge free radicals, chelate metal ions, like Fe^{2+} , Cu^{2+} , and inhibit the activity of pro-oxidative enzymes. Their level in the plant extract depends on the species, cultivars, geographical origin, climatic conditions, harvest time, and as well as on the extraction method. Lavender has antioxidant, anti-inflammatory, sedative, antidepressant, spasmolytic, antifungal and antibacterial properties. Lavender is known as medicinal product used internally for relief of symptoms of mental stress, insomnia, and digestive disorders, whereas externally in aromatherapy, neuralgia, and antiseptic.

Materials and methods. The authors investigated the effect of several extraction procedures (maceration, decoction and ultrasound-assisted extraction) applied to 4 cultivars of lavender (*Lavandula angustifolia* Mill.) and 3 cultivars of lavandin (*Lavandula x intermedia* Emeric ex Loisel.) on the yield of the polyphenolic compounds and antioxidant activity. The inflorescences of cultivars of lavender (Betty's Blue, Elizabeth, Hidcote, Blue Mountain White) and lavandin (Grosso, Gros Bleu, Alba) were used. Phenolic profile was determined by chromatographic method (HPLC - High Performance Liquid Chromatography). Ferric reducing antioxidant power assay (FRAP) and DPPH free radical scavenging assay (DPPH-EPR) were used to determine the antioxidant activity of plant extracts. The relationships between total polyphenols, total flavonoids and the antioxidant activity were also analysed using Pearson's correlation coefficient and Principal Component Analysis (PCA).

Results. High Performance Liquid Chromatography analysis showed the presence of the rosmarinic acid (2.52 – 10.82 mg/g), ferulic acid glucoside (2.94 – 10.63 mg/g), caffeic acid (0.81 – 3.10 mg/g), morin (0.77 – 13.63 mg/g), coumarin (1.01 – 6.36 mg/g) and herniarin (1.05 – 8.02 mg/g). The content of phenolic acids and flavonoids was higher in lavender, while the content of coumarins was higher in lavandin in all types of extracts. The antioxidant activity was 104.58 – 206.77 $\mu\text{mol Trolox/g}$ as determined by DPPH-EPR assay and 79.21 – 203.06 $\mu\text{mol Trolox/g}$ according to FRAP assay.

Conclusions. The obtained results showed that the cultivar is the dominant factor differentiating the samples. Still, the extraction method plays an important role in the final bioactive substances content and antioxidant properties of obtained extracts.

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8. Antihyaluronidase, antioxidant and antibacterial properties of the European dewberry (*Rubus caesius* L.)

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Introduction. The European dewberry (*Rubus caesius* L., *Rosaceae*) it is a widespread species both in Europe and Asia. The fruit that appears in July is a popular source of compounds with antioxidant and anti-aging properties. On the other hand, little attention is paid to the health-promoting properties of freshly developed leaves and stems, which appear in early spring and can be used to improve the functioning of the body.

Materials and methods. Freshly developed The European dewberry leaves and stems were harvested in early spring. Aqueous and ethanol extracts were made from previously separated leaves and stems. The extracts were analyzed for their ability to inhibit the activity of the hyaluronidase enzyme as well as the antioxidant activity in two tests: DPPH and FRAP. The studies also estimated the effect of The European dewberry extracts on both Gram positive and Gram negative bacteria.

Results. A concentration-dependent ability to inhibit the activity of the hyaluronidase enzyme was demonstrated by both aqueous and ethanolic extracts made from young stems, while leaf extracts showed only a slight effect on the activity of hyaluronidase. Both antioxidant tests showed a high ability to inhibit the DPPH radical and to reduce iron (FRAP test). Among the tested bacterial strains, *Clostridium bifermentans*, *Clostridium sporogenes*, as well as *Enterococcus faecalis* proved to be the most sensitive to extracts of young leaves and stems of The European dewberry.

Conclusions. Water and ethanol extracts from young leaves and twigs of The European dewberry can be successfully used to improve the functioning of the body due to its antioxidant, antibacterial and anti-inflammatory effects.

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9. The state of research on the species from the genus *Papaver* L. growing in Mongolia

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Introduction:

The growing interest in compounds of natural origin, herbal medicines and their use causes a return to traditionally used plant substances in the prevention of civilization diseases. Despite the frequent use of traditional herbal remedies in therapy, there are still few plant substances that have been adequately researched. Of the 760 species in Papaveraceae family there are 44 types of poppies, whereas in Mongolia there are as many as 32 species of 7 types. One of those plants growing on the territory of Mongolia is *Papaver nudicaule* L of the Papaveraceae family.

This plant is abundantly grown in Mongolian soil and widely used to treat many illnesses in Mongolian traditional medicine even if its phytochemical characteristics has not been thoroughly studied.

Materials and methods. The conducted meta-analysis collects the current literature on *Papaver* species cultivated in Mongolia, taking into account the diversity of morphological, phytochemical and pharmacognostic features of *Papaver* L. based on the works searched in scientific databases like Scopus, Pubmed and Web of Science, but also in local internet browsers.

Assessment results: So far, thirty species of poppies have been identified in Mongolia. Three hundred and twenty alkaloids, mainly from the group of isoquinolines, have been identified in the extracts obtained from poppies. Among them, the presence of nudicaulin was underlined, as it determines the color of *Papaver nudicaule* flowers and is responsible for attracting pollinating insects, was emphasized [1].

Conclusion: The latest research on *Papaver nudicaule* L. shows that its extracts obtained with ethyl acetate from the overground parts of the plant showed antioxidant activity. In addition, the anti-inflammatory effect of the extract was confirmed in a test in which inflammation was induced by lipopolysaccharides on RAW264.7 cell lines [2]. Extracts from *Papaver nudicaule* L. poppy grown in Mongolia also showed anti-cancer, anti-mutagenic, and protective activity against liver cells and genetic material.

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10. A comparative study of the antioxidant potential and health-promoting properties of various grapevine cultivars fruits

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Introduction. The fruit of the grapevine is a natural resource known from ancient times, with pro-health properties, used for a number of ailments and diseases, recommended in numerous disease entities [1]. Grapevine fruit extracts are used in the prevention and the treatment of cardiovascular diseases, Alzheimer's disease and other diseases of the nervous system. They owe their antioxidant properties to the high content of polyphenolic compounds, in particular proanthocyanide, resveratrol and catechin. Increasingly, you can find supplements containing fruit or grape seed extract on the market. They come in the form of capsules, tablets, powders and drops [2,3].

Materials and methods. Under the study the comparative assays of the antioxidant properties of fruit extracts of twelve grape varieties obtained from the vineyard „Nad Dworskim Potokiem” (Łazy near Bochnia) (four red cultivars: Cabernet Cortis, Cascade, Marenchal Foch, Regent and eight white cultivars: Aurora, Bianca, Folle Blanche, Hibernat, Jutrzenka, Muscat, Seyval Blanc, Solaris), were performed. In aqueous-ethanolic solutions, using spectrophotometric methods, the total polyphenols and sugars content was determined, antioxidant potential was measured (with DPPH reduction method), as well as Fe²⁺ ions chelating activity was evaluated.

Results. The fruit of the grapevine showed a very high antioxidant activity, reaching 69-85% inhibition of oxidation processes (in relation to a sample containing no extract). The content of polyphenols ranged from 182 to 433 mg/g of dry extract depending on cultivar, and a much higher content of these compounds were attributed to the red cultivars. Grape fruit extracts showed also high chelating ability of metal compounds (up to 96%).

Conclusions. Results indicates that the grape extracts can neutralize harmful heavy metals. Therefore, they are a valuable source of biologically active compounds that protect the body against free radicals and heavy metals, and support the natural defense mechanisms. Particularly high health-promoting potential was found for *V. vinifera* Solaris and Cabernet Cortis.

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11. Biological activity of methanol extracts obtained from flowers and leaves *Achillea erba-rotta* all. subsp. *moschata*

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Introduction. *Achillea* L. species are used in traditional medicine to treat bleeding, skin inflammation and stomach problems. The effect of plant materials on the human body also results from their antioxidant activity, because the excess of reactive oxygen species in the body accelerates the aging processes, increases the risk of cancer and the risk of developing neurodegenerative diseases. On the other hand, the increase in the resistance of pathogenic microorganisms to antibiotics causes the need to search for medicinal substances with a bactericidal effect.

Material and methods. Methanol extracts from flowers and leaves of *Achillea erba-rotta* ALL subsp. *moschata* were obtained by ASE extraction. The total content of polyphenols (TPC) was determined, as well as the antioxidant and antimicrobial activity. The antioxidant power of the extracts was tested with the DPPH free radical. The obtained results were compared with the activity of standard substances (gallic acid, caffeic acid, Trolox, chlorogenic acid, butylhydroxytoluene). TPC was determined using a modified Folin-Ciocalteu method.

The evaluation of the antimicrobial effect of the extracts was performed using the technique of serial dilutions in a liquid medium, in accordance with the EUCAST and CLSI recommendations. The following values were determined: MIC, MBC and MFC against reference bacteria and yeast-like fungi.

Results. Total TPC polyphenol content, calculated as gallic acid equivalent (GAE) was 169.21 ± 6.33 mg GAE/g for flowers and 269.22 ± 4.84 mg GAE/g for leaves. The analysis of the EC₅₀ inhibition coefficient showed that methanol leaf extract (EC₅₀ = 0.116 ± 0.0160 mg/mL) showed a greater antioxidant potential than flower extract (EC₅₀ = 0.128 ± 0.0026 mg/mL).

Research on antimicrobial activity against reference Gram-negative and Gram-positive bacteria showed a stronger effect of herbal extracts against *Bacillus* bacteria: *B. subtilis* and *B. cereus* (MIC = 0.31 -1.25 mg/mL). The high total antimicrobial activity (TAA) was also determined for bacteria of the genus *Bacillus*: 230 - 929 mL/g for the herb extract and 196 mL/g for the flower extract. Some antifungal activity against *Candida* spp. yeasts was also observed (MFC - ≥ 20 mg/mL).

Conclusions. The obtained results indicate that the tested extracts of *Achillea erba-rotta* ALL. subsp. *moschata* may have potential importance as natural antioxidant agents, for use in medicine and in anti-aging cosmetic preparations. It was also found to be active against reference bacteria, mainly Gram-positive bacteria of the genus *Bacillus* and fungi, hence the possibility of using the extracts in the case of infections caused by these microorganisms.