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**2nd ACTA PHARMACEUTICA SCIENCIA
INTERNATIONAL SYMPOSIUM (AP SIS) ON
MEDICINAL PLANTS AND PHYTOTHERAPY**

ABSTRACT BOOK

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Phytosomes as biocompatible delivery system for herbal medicines

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ABSTRACT

Phytosomes represent a promising approach for administering herbal medications, enhancing absorption and creating a distinctive dosage form for plant extracts by utilizing phosphatidylcholine. In comparison to pharmaceuticals derived from synthetic compounds, phytosomal systems possess the potential to heighten therapeutic efficacy while mitigating adverse effects. Central to phytotherapy, the production and utilization of phytosomes as delivery systems are focal points. Critical evaluation factors like particle size, zeta potential, and entrapment efficiency are essential considerations. To ensure optimal quality and effectiveness of phytosomal formulations, various parameters must undergo thorough assessment. Anticipated future applications of phytosomal delivery techniques hold significant market potential, particularly with the growing preference for natural remedies over conventional options.

Key words: Phytosomes, phytotherapy, nanotechnology, phosphatidylcholine



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ESCOP and the monographs using the newest example “Passiflorae herba

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ABSTRACT

ESCOP is an umbrella organisation of national associations of phytotherapy across Europe founded in 1989 in Cologne for the enhancement of the scientific status of herbal medicinal products and for the harmonisation of their regulatory status in Europe. ESCOP has 11 member associations. A Scientific Committee produces reference monographs on the therapeutic use of herbal medicines compiling data on the quality, safety and efficacy. The ESCOP monographs provide the evidence base for the clinical use of herbal medicinal products. In 1990 the first monographs were published. Since then more than 110 monographs were compiled and revised on a regular basis in loose leaflet binders, two books and since 2011 single monographs are published electronically. At the moment more than 80 single monographs are available for download. By the example of one of the most recent monographs, namely *Passiflorae herba* the structure, content and importance of ESCOP monographs are discussed and highlighted.

Key words: Background of ESCOP, ESCOP monographs, *Passiflorae herba*



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A Journey from Plant to Drug: The Role of Ethnobotany

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ABSTRACT

The first remedies known since ancient times were plants and medicines prepared from them in various ways. Ethnobotany deals with plants used in animal diseases, in the production of various tools, in dyeing, for protection against evil eyes and spells, and as food, as well as plants with medicinal uses. Ethnobotanical research records the cultural heritage, natural richness, traditions and customs, and life of the people of the studied region. The importance of these studies has increased even more as the population living in rural areas migrates to cities and moves away from nature. Information is obtained through ethnobotanical studies and new discoveries are made. There has been an increase in medicinal plant research in recent years and it has begun to attract great attention again in the media and scientific community. Many commercially available drugs/chemicals are derived from plants used by indigenous cultures. Curcumin, Quercetin, Silibinin, Resveratrol and Sulforaphane are the best known and most used examples. There are many factors that need to be taken into consideration regarding the cultivation, collection and processing of plants used to obtain drugs. With the emergence of new approaches to drug discovery, innovative strategies will be needed to reveal the full chemical diversity of these valuable natural products and contribute to the drug discovery process.

Key words: Medicinal plant, ethnobotany, ethnomedicine, drug



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From Ethnobotany to the Modern Clinical Applications: HerbalMedicine

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ABSTRACT

From ancient times to the present day, plant resources have played a significant role in drug discovery and development processes. Plants that have been used in traditional medicine for a long time have served as a starting point for the discovery and isolation of natural products and their active compounds. In modern drug discovery processes, the chemical analysis of herbal products, pharmacological tests, and clinical studies contribute significantly. Turkey is a country known for its rich biological diversity, extensive medical history, and traditional medical practices. Therefore, the ethnobotanical uses of plants and the potential of herbal products in drug development hold great importance for Turkey. This study focuses on examining the ethnobotanical uses of plants, the drug development processes of herbal products and active compounds derived from herbal sources, and describes in detail the methodology of clinical trials important for making these assessments, focusing on the efficacy and safety of plants. Furthermore, this study serves as an important resource for better understanding the ethnobotanical and clinical uses of plants and the potential of herbal products in drug development.

Key words: Ethnobotany, Turkey, Traditional herbal medicine, Drug discovery, Clinical studies



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**Evaluation of phytoconstituents for immunomodulatory effect and exploring their
deposition in tissues of rats**

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ABSTRACT

The fruits of *Aegle marmelos* are rich in coumarins like marmin, psoralen, scoparone, xanthotoxol, umbelliferone, skimmianine, scopoletin, imperatorin (marmelosin). On observations of results coumarins of *A. marmelos* possess immunostimulant activity in rat models. The HPTLC analysis identified and confirmed the presence of umbelliferone, scopoletin, imperatorin, and psoralen with similar retention factor (R_f) of external standards with R_f 0.44 ± 0.002 , 0.30 ± 0.002 , 0.68 ± 0.002 , and 0.65 ± 0.002 respectively in 1:1 v/v toluene: diethyl ether, mobile phase saturated with 10% acetic acid. In cellular immunity model on day 1, animals were sensitized with 0.1 ml sRBCs by the intraperitoneal route and dosed with ethyl acetate extract and the residual ethanolic extract at 100 mg/kg/day and 200 mg/kg/day for 14 days. On the 15th day, animals challenged by 0.1 ml sRBC into the left hind footpad, the increased paw volume response indicated the stimulant effect of ethyl acetate fraction appears due to presence of coumarins. Hematological evaluations displayed a notable rise in blood cell counts with ethyl acetate fraction, while residual fraction exhibited no significant change compared to the disease group. HPTLC analysis of samples recovered from rat tissue such as liver, lung, heart, spleen, thymus, kidney and brain done after 24 hr of dosing the chromatogram showed the presence of degradant peaks in the brain, heart, kidney and thymus. The investigation provided reliable scientific foundation that coumarins-rich

extract have immunostimulant activity. The chromatogram supports pharmacokinetic profiling of phytoconstituent and their degradation at various tissues.

Keywords: Coumarins, phytoconstituents, HPTLC, drug deposition, *Aegle marmelos*



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Anticholinesterase activity of the fruits of *Heracleum persicum*

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ABSTRACT

Background: According to Persian Medicine (PM) manuscripts, the fruits of *Heracleum persicum* are known for anti-dementia properties. This study aimed to explore the inhibitory effects of this herb's extracts and essential oil on the cholinesterase enzyme by Ellman test and in silico study of the major phytochemicals of volatile oil and effective extracts. Methods: Clevenger extracted the powdered fruits' essential oil, and the plant extracts were obtained by Soxhlet apparatus. The extractions were performed using petroleum ether, dichloromethane, and methanol solvents, and in the second stage, n-hexane, ethyl acetate, and ethanol solvents were used. Two drying methods, vacuum and freeze drying, were used to dry the solvents. Various concentrations of extracts and essential oils were studied on acetylcholinesterase enzyme, and the absorption of different concentrations of the extracts was measured using the Ellman method. Molecular modeling studies were performed with AutoDocktools-1.5.6 software to study the interaction mechanism of the major compounds in volatile oil and extracts. Results and discussion: The petroleum ether, ethanol, methanol extracts, and the essential oil of *H.persicum* showed anti-cholinesterase effects. The calculated IC₅₀ values of the essential oil (containing hexyl butyrate and octyl acetate) and the vacuum dried form of petroleum ether extract (containing isobergaptin and sphondin) were 66 µg/ml and 59 µg/ml, respectively. Molecular docking simulation results showed that the coumarins of petroleum

ether extract, sphondin and isobergapten, octyl acetate, and hexyl butyrate from the volatile oil showed acceptable affinity to cholinesterase enzyme. Freeze-dried extracts showed lower activity than vacuum-dried ones, perhaps due to the degradation of active compounds during freeze-drying. The inhibitory activity of petroleum ether extract is higher than essential oil, consistent with docking results.

Conclusion: the active extracts of *H. persicum* and the active phytochemicals, sphondin, isobergapten, octyl acetate and hexyl butyrate, should be investigated thoroughly by in vivo routes.

Key words: *Heracleum persicum*, Anticholinesterase activity, Molecular docking, essential oil, extract.



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**Antimicrobial activity of *Helichrysum italicum* (Roth) G. Don. essential oil from Bosnia
and Herzegovina**

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ABSTRACT

Genus *Helichrysum* is a medicinal aromatic plant that belongs to the family Asteraceae and includes over 600 species distributed mainly in the Mediterranean area, at sea level up to 1700 m, and growing preferably on sandy or loamy soils. *Helichrysum italicum* (Roth.) G. Don. subsp. *italicum* is one of the most common species. The essential oil found mainly in the green parts of the plants is widely used in traditional medicine as a source of choleric, diuretic, and expectorant material. In this research, the antimicrobial activity of essential oils from three plantation fields in Herzegovina was analyzed. GC/MS analysis showed that all samples were rich in sesquiterpenes (45.19%-50.07%) and monoterpenes (21.15%-23.21%), followed by oxygenated monoterpenes (9.92%-14.03%). The main components in essential oils were γ -curcumene, α -pinene, β -selinene and neril-acetate. The antimicrobial activity of the essential oil was assayed by using the agar disk diffusion method according to the American Clinical Laboratory Standards Institute (CLSI). Gram-positive, Gram-negative and fungi strains were used for testing. *E. coli* was most resistant against all three tested *H.*

italicum essential oils, while moderate inhibitory activity against *S. aureus* and *C. albicans* was detected. The *L. monocytogenes* was the most sensitive; all three tested samples showed inhibitory activity. The tested essential oils contained flavoring substances, such as neryl acetate, pinenes, limonene, curcumenes and they could be applied in the food industry and as perfume supplements. Since the biological activity is correlated with the chemical composition, further research is needed on other biological activities.

Key words: Essential oils, *Helichrysum italicum*, antimicrobial activity, neryl acetate



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Apiaceae essential oil and extracts: insight into antioxidant and antimicrobial potential

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ABSTRACT

Apiaceae (=Umbelliferae) is a well known family of aromatic and economically important plants, with more than 2500-3000 species in the world. Species from this family demonstrate medicinal properties because of their chemical characteristics and have been used in traditional medicine since antique period. In this study we present the chemical composition of the essential oils (using GC and GC-MS), antioxidant and antimicrobial activity of different extracts type obtained from *Opopanax hispidus* (Friv.) Griseb., *Cachrys cristata* DC., *Tordylium maximum* L., *Heracleum sphondylium* L., *Eryngium serbicum* Pančić, from *Peucedanum* genus (*P. officinale* L., *P. longifolium* W. et K., *P. aegopdioides* (Boiss.) Vand. and *P. alsaticum* L.), from *Seseli* genus (*S. pallasii* Besser, *S. libanotis* (L.) Koch ssp. *libanotis* and *S. libanotis* (L.) Koch ssp. *intermedium* (Rupr.) P. W. Ball). Spectrophotometric methods were used for measuring of total phenols, total flavonoids, as well as antioxidant potential by using DPPH and ABTS methods. The total phenolic content in the extracts was determined using Folin-Ciocalteu reagent and their amounts ranged between 22.6 in ethyl acetate extracts and 166.9 mg gallic acid/g in acetone extracts. The concentrations of flavonoids in the extracts varied from 4.4 in aqueous extract to 234.6 mg quercetin hydrate/g in ethyl acetate extract. The highest antioxidant activity had aqueous extract 0.309 IC₅₀ (mg/ml) for *P. officinale* and 3.7 mg vitamin C/g for acetone extract in *P. officinale* tested with the DPPH and ABTS reagents, respectively. Significant antimicrobial activity, using a micro-well dilution assay, was recorded

against *Bacillus cereus* and *Listeria monocytogenes* strains, which frequent causes a food spoilage. This finding suggests that Apiaceae species from Serbia may be considered as a natural source of antioxidants and antimicrobial agents and can be used like spices and natural food supplements.

Key words: Apiaceae, essential oil, extracts, total phenolic content, total flavonoid content



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**Anti-obesity effect of green coffee bean extract loaded solid lipid nanoparticles and
evaluation on 3T3-F442A cell lines**

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ABSTRACT

Obesity is widely regarded as one of the most significant health concerns of our time. Encouraging healthy lifestyles is a top priority, and it is widely acknowledged that reducing obesity is a crucial element of this effort. With this in mind, it is worth noting that the consumption of caffeine and chlorogenic acid, which are major components found in green coffee, have been shown to increase thermogenesis in brown fat. To ensure cost-effectiveness, tissue-localization and high stability, solid lipid nanoparticles loaded CF, CLA, and CF+CLA were developed in this study. Our research has found nanoparticles to be a valuable resource. The optimized formulation was selected using the central composite design model. Quantification of the CF and CLA amounts was carried out using UHPLC. The SLN formulation was prepared using the high-pressure homogenization (HPH) method in the presence of Poloxamer® 407 (surfactant) and Compritol® 888 ATO (solid lipid). Using 3T3-F442A cell lines to compare adipogenesis levels is a crucial step in advancing our understanding of this process. By analyzing adipogenic markers with both rt-PCR and ELISA methods, we could obtain a comprehensive view of the system and make significant strides in this field. The optimized formulations of CF, CLA, and CF+CLA-loaded SLN were found to have a size of around 110.2 ± 0.1 nm. The effectiveness of the CF (1 mM) + CLA (0.5 mM) -

loaded SLN formulation has been proven to be significantly effective by utilizing the PPAR- γ /C/EBP- α pathways. In a nutshell, our study has shown that CF+ CLA loaded-SLN has been affected 45.8% times more than regular extracted coffee ($p < 0.05$) on the adipocyte cells.

Key words: Adipogenesis; green coffee beans; solid lipid nanoparticles; 3T3-F442A cell line



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**The committee on herbal medicinal products of the European medicines agency:
Harmonisation of requirements for herbal medicinal products**

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ABSTRACT

The requirements for herbal medicinal products had a significantly divergent history among European countries. With increasing number of member states of the European Union a harmonisation of the regulatory and scientific requirements for herbal medicinal products became necessary. In parallel the requirements for the demonstration of clinical efficacy of medicinal products increased. As most of the widely used herbal preparations could not comply with these requirements a new category of medicinal products, the ‘traditional herbal medicinal products’ have been established in the legislation of the European Union.

In order to facilitate a harmonised assessment of herbal medicinal products the committee on herbal medicinal products (HMPC) at the European Medicines Agency (EMA) has been established in 2004. The main tasks are the developments of EU herbal monographs on safety and efficacy of herbal preparations, the elaboration of guidance documents related to quality, efficacy and safety as well as the safety assessment of potentially harmful plant constituents. The HMPC is not responsible for the assessment of dossiers and for recommendations regarding marketing authorisations of herbal medicinal products. The committee is composed of one member per EU member state and five co-opted members with specific scientific expertise.

So far 158 EU herbal monographs on traditional medicinal use and 25 monographs on well-established use with demonstrated clinical efficacy are published on the website of the EMA. 24 public statements have been published for such cases where no EU herbal monograph could be established (missing data, safety concerns, ...). Monographs are updated regularly.

Important guidance documents related to the quality documentation of herbal medicinal products facilitated the harmonisation of quality assessment. Currently the HMPC focusses on

the guidance related to potentially toxic plant constituents as pyrrolizidine alkaloids and estragol.

Key words: EMA, HMPC, herbal medicinal products, EU herbal monographs