

# Conservation of European Biodiversity through Exploitation of Traditional Herbal Knowledge for the Development of Innovative Products

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## Introduction

EthnoHERBS is a H2020-MSCA-RISE project aiming to record and evaluate information on South East European traditional knowledge, explore in a high-throughput manner the biodiversity of Balkan Peninsula flora and elaborate cutting-edge technologies in Natural Products Chemistry to discover and develop innovative cosmeceutical products against skin disorders.

Beside the collection of scientific publications concerning ethnopharmacological surveys conducted in Balkan territory, one of the main objectives of Ethnoherbs is the evaluation of plant compounds with *in silico* methods against skin related targets using similarity and docking approaches. *In silico* screening results were used in combination with biodiversity data to select the most promising herbs for further phytochemical analysis.

The assessment of all results will indicate 20 plants as

the most promising ones. The selected species will be cultivated following organic agricultural methods and propagation treatments will be adjusted to the needs of each species, aiming to the increase of rooting percentage and the production of elite organic propagation material of the selected species. Following specific experimental designs, five selected crops will be installed in organic farms. Finally, pilot scale batches of the 5 selected natural products will be used as ingredients for the development of at least 4 final products with potential anti-aging, wound healing, anti-melanoma, anti-inflammatory and antimicrobial properties.

## Material and methods

Initially, published data related to traditional uses of plants against skin disorders were collected via Scopus, PubMed, Reaxys, Google scholar etc while three

ethnopharmacological surveys were carried out in small cities and villages of North Greece and Central Serbia.

Additionally, 198 scientific publications concerning ethnobotanical surveys conducted in Balkan territory and in other Mediterranean regions were evaluated. The data were implemented through ancient and traditional references that are preserved in cultural institutions in Greece, Serbia and Bulgaria. The evaluation and classification of the collected information was performed with Microsoft Excel. Furthermore, more than 350 preparations of herbal and animal origin have been identified for the treatment of skin diseases in Dioscorides' work "De Materia Medica" and finally four independent databases, containing different set of ethnobotanical data, have been established.

The evaluation of the aforementioned data resulted in the selection of 240 plant species, that were collected according to good botanical practices and laws. Moreover, the selected species investigated through in silico procedure. More specifically, the secondary metabolites that have been isolated from the selected species were searched in REAXYS database and their chemical structures were designed and converted to the appropriate form (SMILES strings) for the in silico study.

Furthermore, the selected plant material was extracted in lab-scale with Ultrasound Assisted Extraction using dichloromethane, methanol and methanol:water 50:50, successively and the generated extracts (ca. 720) were forwarded for chemical profiling using HPTLC, HPLC-DAD, and NMR methodologies and cell-free bioassays for evaluation of their biological properties (antioxidant, enzymes inhibition). Based on the chemical profiles and preliminary biological results ca. 100 extracts have been selected for further investigation for the isolation of bioactive compounds.

## Results and discussion

### *Ethnopharmacological Data*

More than 1,000 plant species have been identified for their traditional use against skin ailments taking into consideration: (i) scientific publications concerning ethnobotanical surveys conducted in Balkan territory and secondarily in other Mediterranean regions, where flora has some similarities with the SE European one, (ii) ancient and byzantine texts that exist in digital libraries and databases (iii) existing collections of manuscripts found in public institutions, (iv) the three ethnopharmacological surveys carried out in small cities and villages of North Greece and Central Serbia. The results of the medicinal plants used traditionally for skin related problems in Albania, Cyprus, Greece and Turkey have been recently published (Tsioutsiou et al. 2022).

### *Extraction and Chemical Profiling of Extracts*

More than 400 extracts have been prepared and the investigation of their phytochemical profile was performed using chromatometric (TFC, TPC) and analytical (HPTLC, HPLC, NMR) methods. The extracts that demonstrated high TPC and TFC content are mainly represented by plant species extracted with methanol and methanol:water 50:50. In general, HPTLC, HPLC and NMR profiling revealed several types of chemical categories in the extracts such as terpenoids, flavonoids, lactones, thiophenes, anthocyanins, anthraquinones etc.

### *In-silico*

Almost 210.000 ligands were docked within the experimental binding cavity of selected enzymes (tyrosinase, hyaluronidase, elastase, cyclooxygenase, lipoxygenase, collagenase and xanthinoxidase) searched in Protein Data Bank.

### *Bioassays*

More than 400 extracts have been evaluated for their DPPH and ABTS scavenging properties as well as their inhibitory activity against tyrosinase, collagenase and elastase enzymes.

## Conclusion

Phytochemical and biological screening of more than 400 plant extracts was performed, resulting to the identification of *Cistus*, *Origanum*, *Dittrichia*, *Hypericum*, *Echinops*, and *Centaurea* among the most promising candidates.

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## References

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