



HAL
open science

Ethnopharmacology-guided metabolomics of a forgotten medicinal plant from Provence

Clémentine Baccati, Charifat Saïd Hassane, Sok-Siya Bun, Béatrice Baghdikian,
Elnur Garayev

► **To cite this version:**

Clémentine Baccati, Charifat Saïd Hassane, Sok-Siya Bun, Béatrice Baghdikian, Elnur Garayev. Ethnopharmacology-guided metabolomics of a forgotten medicinal plant from Provence. *Metabolomics*, Jun 2025, Prague (Czech Republic), Czech Republic. <hal-05263359>

HAL Id: hal-05263359

<https://hal.science/hal-05263359v1>

Submitted on 16 Sep 2025

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



HAL Authorization

ETHNOPHARMACOLOGY-GUIDED METABOLOMICS OF A FORGOTTEN MEDICINAL PLANT FROM PROVENCE

Clémentine ACHARD-BACCATI*, Charifat SAÏD HASSANE, Sok-Siya BUN-LLOPET, Béatrice BAGHDIKIAN & Elnur GARAYEV
Aix Marseille Univ, CNRS 7263, IRD 237, Avignon Université, IMBE,
Service of Pharmacognosy and Ethnopharmacology, Faculty of Pharmacy, 27 blvd Jean Moulin, 13385 Marseille, France
*corresponding author: clementine.baccati@univ-amu.fr

Plantago sempervirens Crantz (Plantaginaceae) is a medicinal plant widely used in Provence as a **traditional remedy for external skin ailments**, and was even considered as a **dermatological panacea** [1]. However, its chemical composition and biological properties remain **poorly documented in the scientific literature**. This study aims to assess its pharmacological properties through a **multi-target screening approach based on traditional indications** in relation with skin disorders (anti-oxidant, anti-inflammatory, wound-healing and anti-microbial properties), describe its chemical composition through **metabolomics analyses by UHPLC-HRMS/MS**, and to characterize the metabolites potentially responsible for the observed biological activities using **molecular networking**.

A EXPERIMENTAL WORKFLOW

1) EXTRACTION & FRACTIONATION

- Flowering aerial parts of *P. sempervirens* underwent ultrasound extraction in an hydroethanolic solvent (70/30, V/V) to obtain crude extract (EtOH)
- EtOH extract has been fractionated using increasing polarity organic solvents: hexane (HX), dichloromethane (DC), ethyle acetate (EA), butanol (BU), and the residual aqueous fraction (Aq) was conserved

2) PHARMACOLOGICAL SCREENING

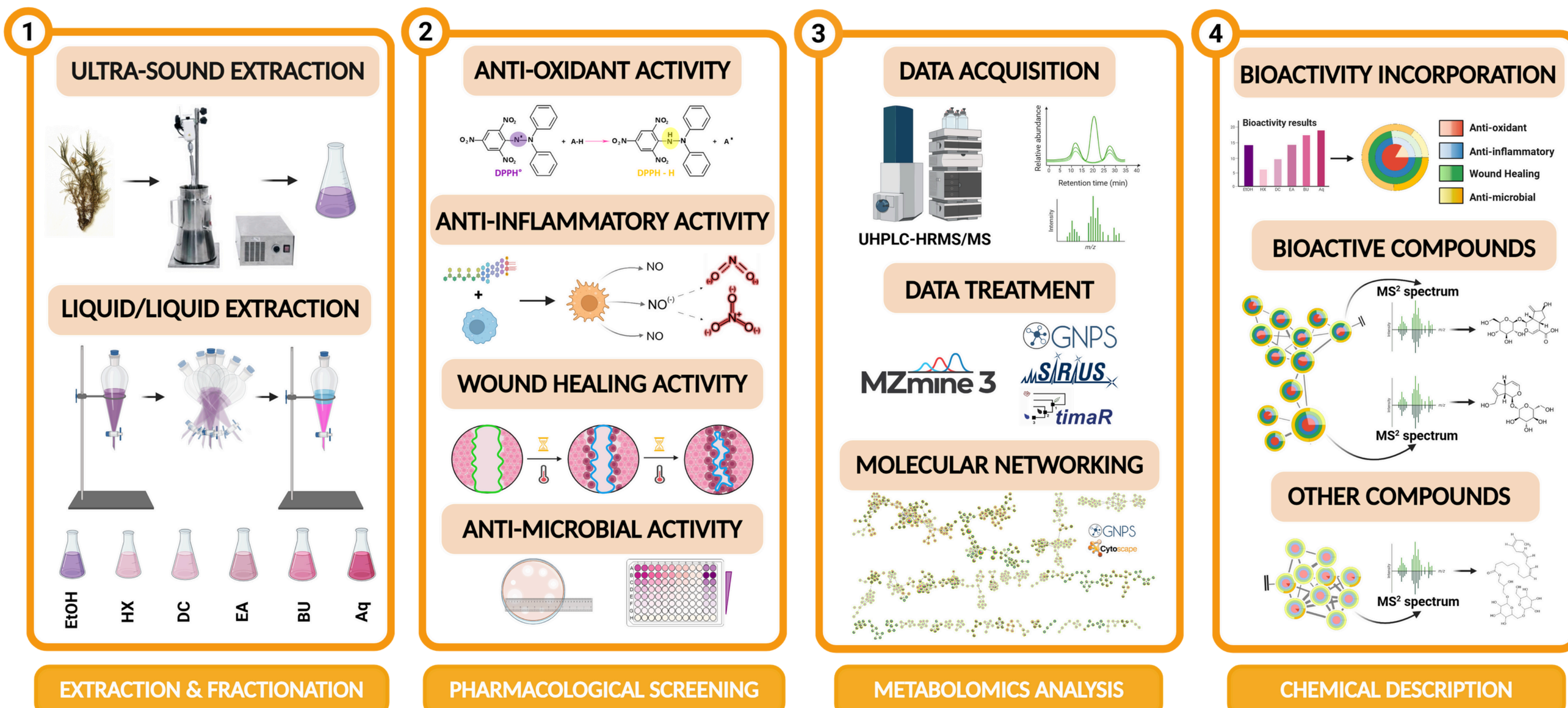
- Biological activities linked to traditional indications have been assessed for crude extract and its fractions: anti-oxidant, anti-inflammatory, wound healing and anti-microbial
- Results of each pharmacological activity ranked by levels (inactive, active, very active), and encoded as metadata

3) METABOLOMICS ANALYSIS

- Chemical description based on UHPLC-HRMS/MS analysis (in negative ionization mode)
- Chromatographic and spectral data were treated using untargeted metabolomics workflow [2] and molecular network was constructed using GNPS Feature Based Molecular Networking algorithm [3]

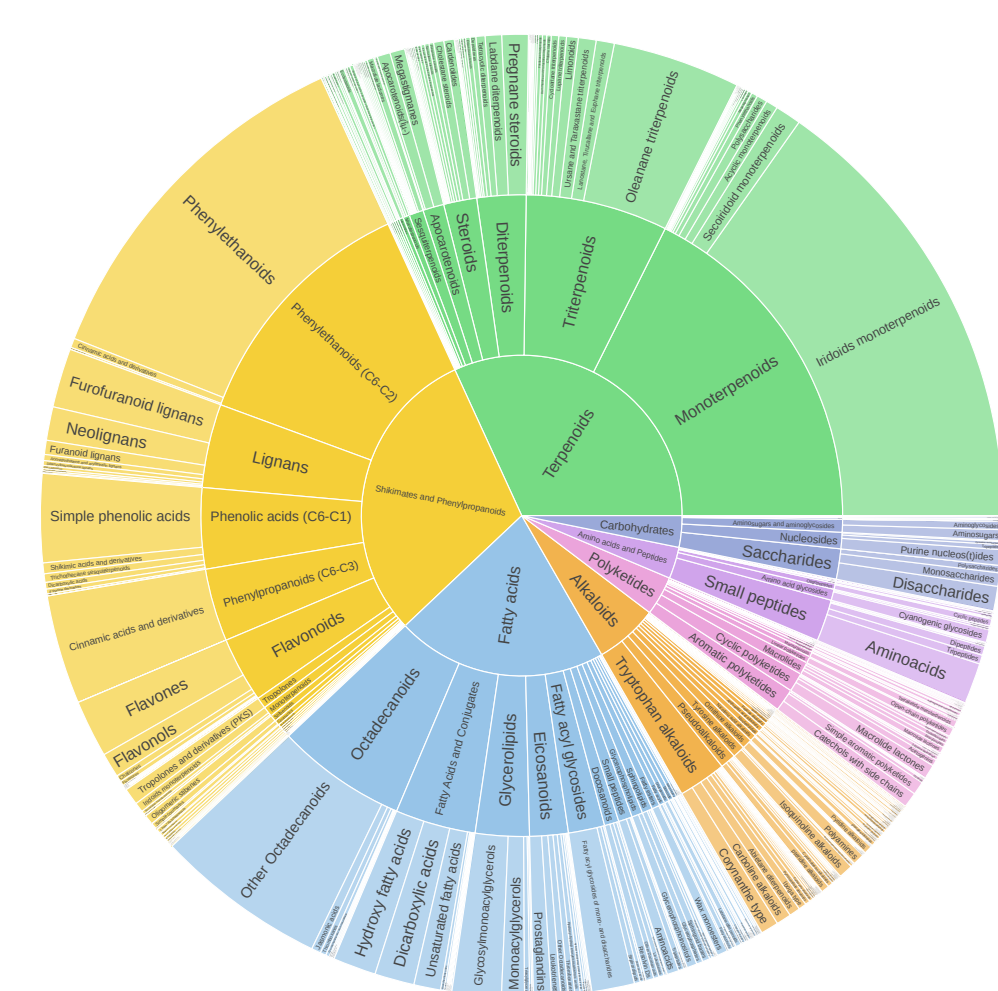
4) CHEMICAL DESCRIPTION

- Integration of the pharmacological screening metadata in the Molecular Network
- Targeted annotation of the metabolites potentially involved in the biological activities



B CHEMICAL DIVERSITY

Compounds classification of EtOH extract based on CANOPUS tool predictions according to NPCClassifier ontology

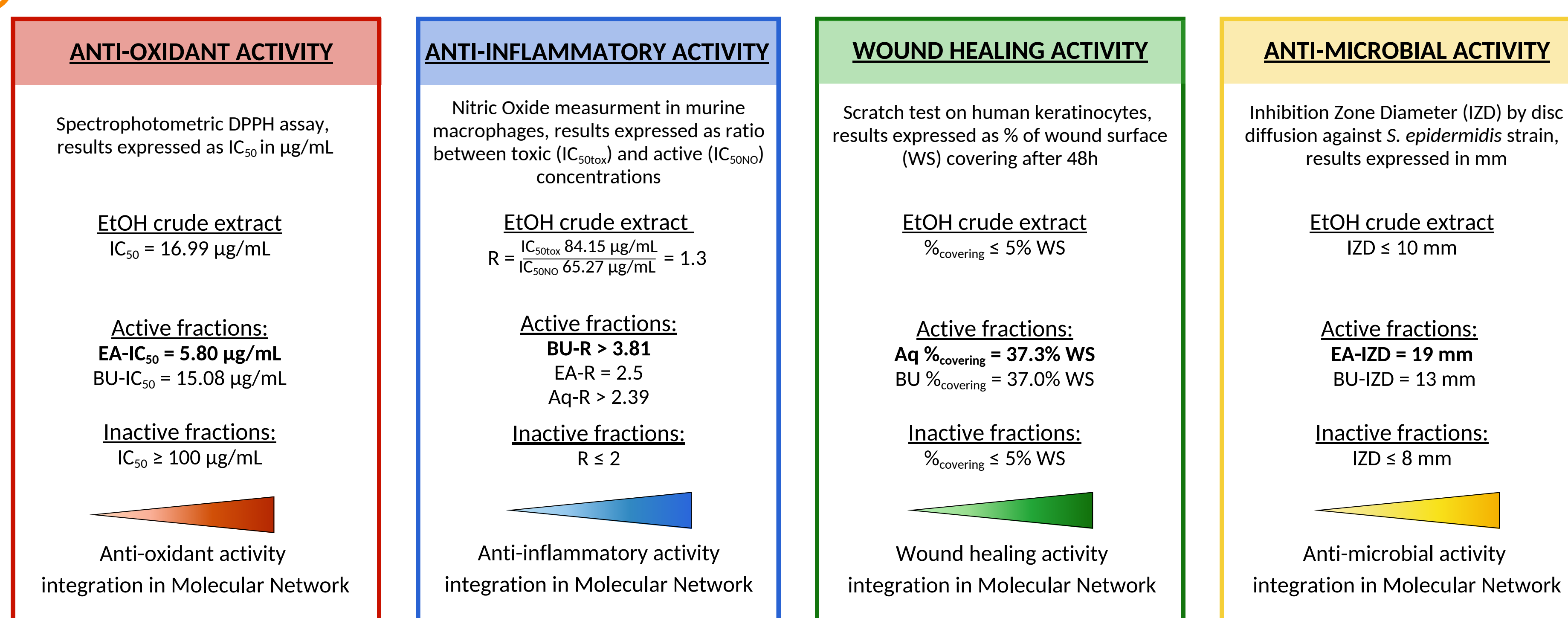


MSI/US
NPCClassifier
ALKALOIDS
SHIKIMATES & PHENYLPROPANOIDS
TERPENOIDS
FATTY ACIDS
CARBOHYDRATES
AMINO ACIDS & PEPTIDES
POLYKETIDES

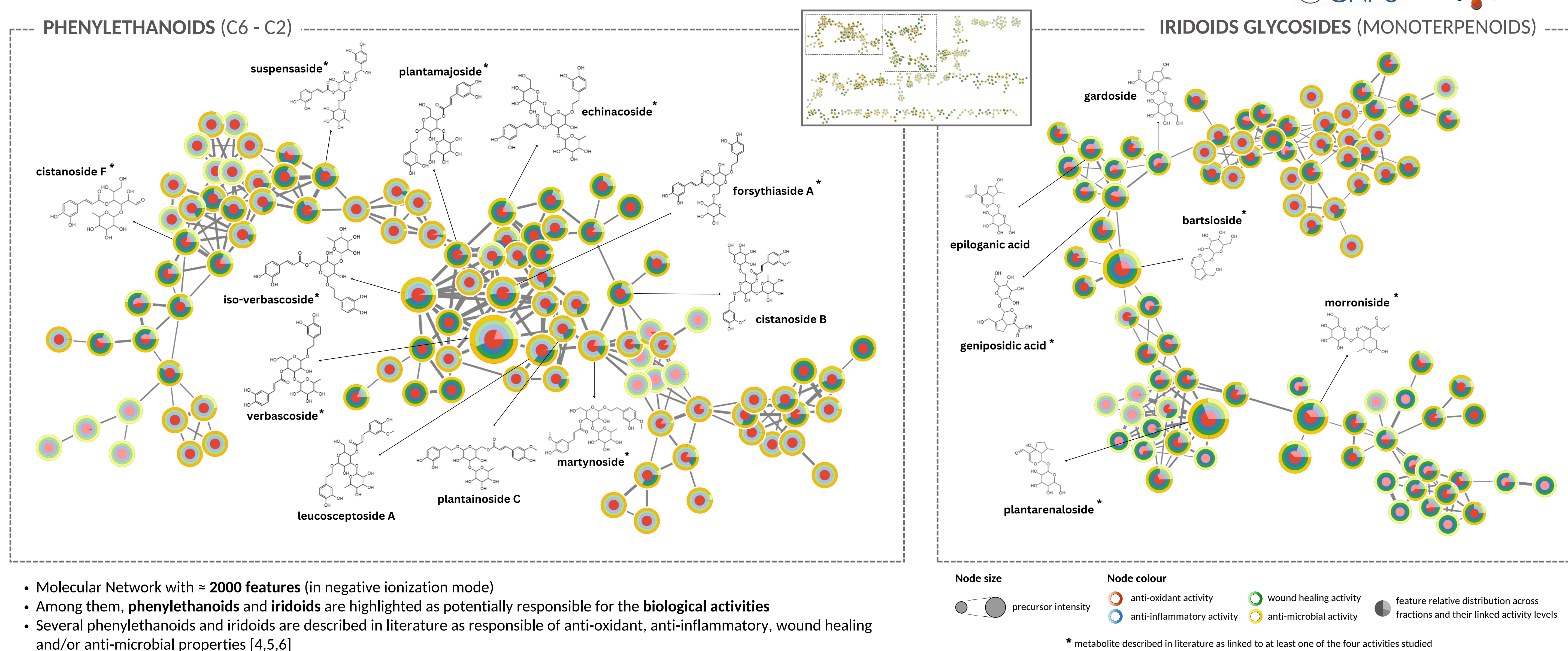
Chemical composition dominated by:

- Terpenoids, especially iridoids monoterpenoids and oleanane triterpenoids
- Shikimates & Phenylpropanoids, especially phenylethanoids (C6 - C2)
- Fatty acids, especially octadecanoids

C PHARMACOLOGICAL SCREENING RESULTS



D FOCUS ON SOME CLUSTERS WITH POTENTIALLY BIOACTIVE COMPOUNDS



This integrated approach allowed to evaluate pharmacological properties of *P. sempervirens*, describe its chemical composition and annotate potential bioactive metabolites:

- phenylethanoids** and **iridoids** are abundant and potentially active metabolites,
- moderately polar to polar fractions** (ethyle acetate, butanol or aqueous fractions) are generally **more active** than apolar fractions

In perspective, **targeted purification** and **screening of isolated compounds** are necessary to confirm both pharmacological properties and chemical structures.

References

- Parard, P., Lieutaghi, P., & Vidal-Gonzalez, P. (2023). Ethnomedical and ethnoveterinary use of *Plantago sempervirens* Crantz: a comparative study in Spain and the South of France. [Researchsquare Pre-print]
- Heuckeroth, S., Damiani, T., Smirnov, A., Mokshyna, O., Brungs, C., Korf, A., ... & Pluskal, T. (2024). Reproducible mass spectrometry data processing and compound annotation in MZmine 3. *Nature protocols*, 19(9).
- Nothias, L. F., Petras, D., Schmid, R., Dührkop, K., Rainer, J., Sarvepalli, A., ... & Dorrestein, P. C. (2020). Feature-based molecular networking in the GNPS analysis environment. *Nature methods*, 17(9).
- Wu, L., Georgiev, M., Cao, H., Nahar, L., El-Seedi, H.R., Sarker, S.D., Xiao, J. and Lu, B. (2020) Therapeutic potential of phenylethanoid glycosides: A systematic review. *Medicinal Research Reviews*, 40 (6).
- Tian, X. Y., Li, M. X., Lin, T., Qiu, Y., Zhu, Y. T., Li, X. L., ... & Chen, L. P. (2021). A review on the structure and pharmacological activity of phenylethanoid glycosides. *European Journal of Medicinal Chemistry*, 209.
- Wang, C., Gong, X., Bo, A., Zhang, L., Zhang, M., Zang, E., ... & Li, M. (2020). Iridoids: research advances in their phytochemistry, biological activities, and pharmacokinetics. *Molecules*, 25(2).

