ULST Timisoara

Multidisciplinary Conference on Sustainable Development

21-22 May 2026

2026 MULTIDISCIPLINARY CONFERENCE ON SUSTAINABLE DEVELOPMENT

BIOACTIVE COMPOUNDS IN EDIBLE PARTS OF *CHENOPODIUM ALBUM L.*: IMPLICATIONS FOR HUMAN NUTRITION

Mihaela LĂCĂTUŞ[1], Patricia TARKANYI[1], Mariana-Atena POIANĂ[1,2], Roxana POPESCU[3], Laura Rădulescu[2], Despina-Maria BORDEAN[1,2]*

[1]Doctoral School "Engineering of Vegetable and Animal Resources", University of Life Sciences "King Mihai I" from Timisoara, Calea Aradului 119, 300645-Timisoara, Romania;

[2]Faculty of Food Engineering, University of Life Sciences "King Mihai I" from Timisoara, Department of Food Control and Expertise, Department of Food Science, Calea Aradului 119, 300645-Timisoara,,

[3]University of Medicine and Pharmacy "Victor Babes", 300041, Department of Cellular and Molecular Biology, E. Murgu, 2, Timisoara, Romania;

* Corresponding author: despinabordean@usvt.ro

Abstract: **Background:** Growing interest in plant-based diets has increased attention toward underutilized wild edible plants such as *Chenopodium album*, known for its potential health-promoting compounds.

Aim: To evaluate the variability of total polyphenol content (TPC) and total antioxidant activity (TAC) in different edible parts (leaves, stems, seeds) and assess their nutritional relevance.

Methods: A literature-based analysis of peer-reviewed studies was conducted using databases including ScienceDirect, PubMed, and Google Scholar.

Results: Leaves showed the highest TPC and antioxidant activity, stems the lowest, and seeds moderate levels, with variability influenced by maturity and processing.

Conclusion: *Chenopodium album* is a valuable antioxidant source, especially its leaves. Nutritional potential varies by plant part, highlighting the importance of targeted consumption in functional and sustainable diets.

Introduction

The increasing interest in plant-based diets has highlighted the need for sustainable, nutrient-rich alternative food sources [1,2]. In this context, plant- based foods rich in polyphenols and antioxidants are gaining attention due to their role in reducing oxidative stress and supporting human health [3,4]. Wild edible plants are an important but underexploited resource, traditionally consumed and well adapted to diverse environments, contributing to sustainable nutrition and food diversification [6–9]. *Chenopodium album L.* is a widespread wild species whose leaves, stems, and seeds are used in traditional diets, but its full nutritional potential remains insufficiently explored [10]. Previous studies indicate higher polyphenol content and antioxidant activity in leaves compared to other plant parts, with variability depending on plant organ and environmental factors [3,15–17].

Due to the use of different analytical methods and measurement units, the reported values cannot be directly compared; therefore, the Integrated Bioactive Index (IBI) was applied. This index combines antioxidant capacity and total phenolic content into a single standardized metric, allowing efficient comparison of plant parts and identification of those with the highest potential for functional food and nutraceutical applications.

This study aims to evaluate the variability of total polyphenol content and antioxidant activity in different edible parts of *Chenopodium album* and their potential contribution to human nutrition based on literature data.

Material and method

The study was based on a structured synthesis of peer-reviewed literature focusing on polyphenol content and antioxidant activity in *Chenopodium album* edible parts.

The Integrated Bioactive Index (IBI) was used as a dimensionless composite indicator to integrate antioxidant capacity and total phenolic content.

Antioxidant activity (CAT), including assays such as FRAP, DPPH, ABTS, and TEAC, and total phenolic content (TPC), expressed as GAE, TAE, or tannins, were considered. ***To enable comparability, all values were normalized to a scale between 0 and 1, where 0 represents the lowest and 1 the highest value within the dataset.***

The IBI was calculated using the following equation:

$$\mathbf{IBI = 0.5 \times CAT\_score + 0.5 \times TPC\_score,}$$

Where:
CAT_score represents the normalized antioxidant activity and
TPC_score represents the normalized total phenolic content.

The resulting IBI values range from 0 (very low bioactive potential) to 1 (very high bioactive potential). Graphical analysis was performed using GraphPad Prism, and the heatmap was generated with AI support.

Results and discussions

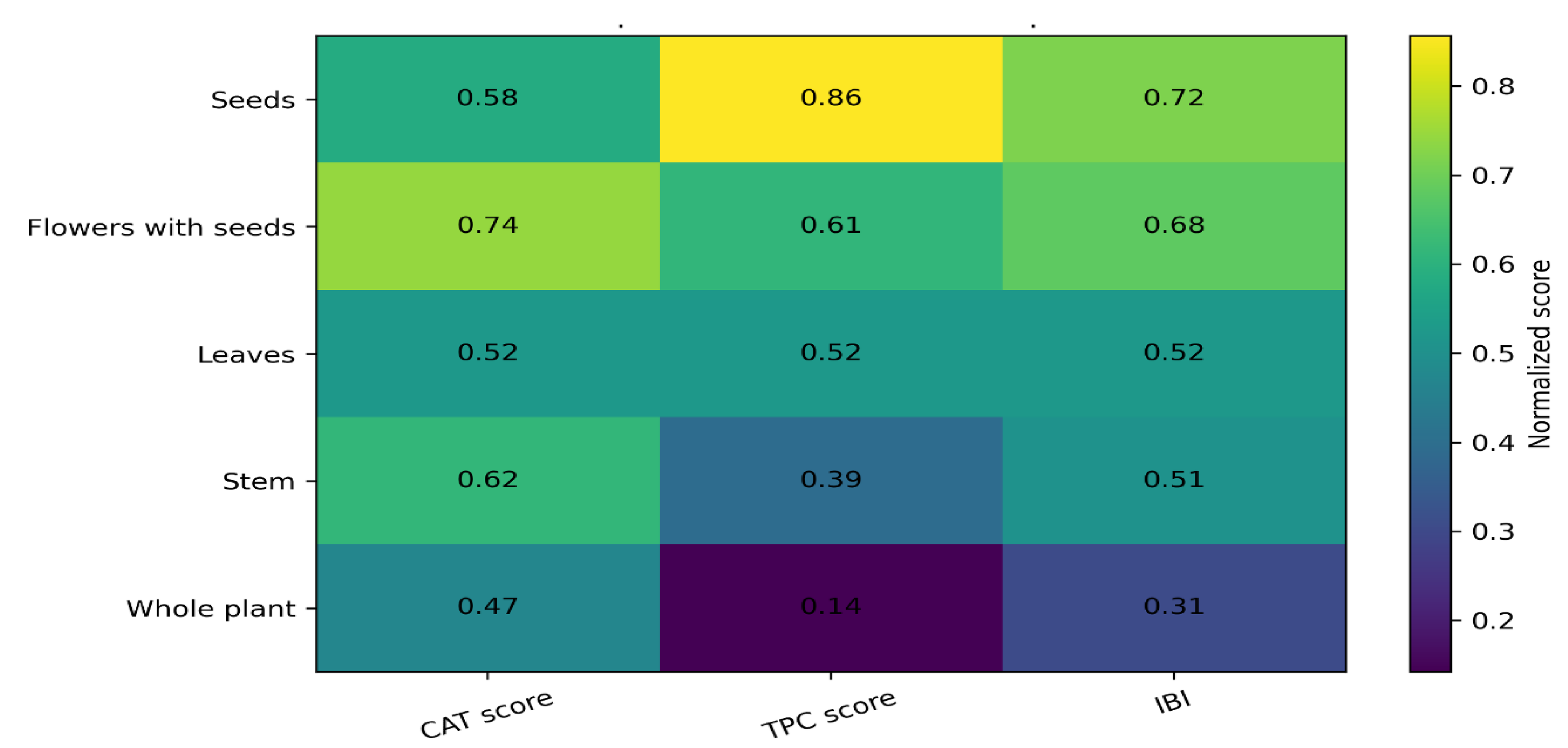

Figure 2. Heatmap of modelled bioactive potential and Integrated Bioactive Index (IBI) across different plant parts. Created with the assistance of ChatGPT (OpenAI, 2026) [19].
Legend: CAT- Total antioxidant capacity; TPC-Total polyphenol content

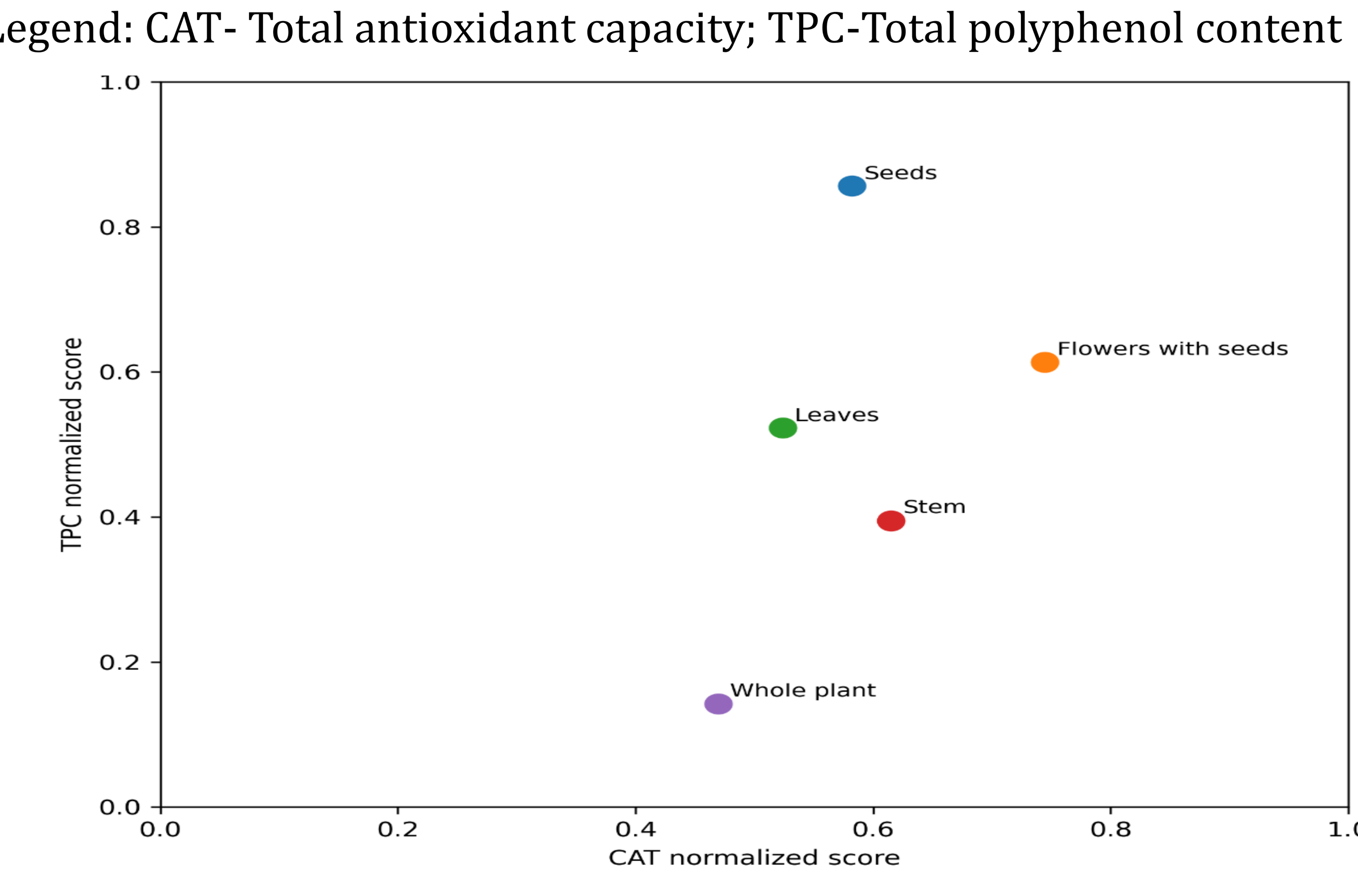

Figure 2. CAT-TPC Bioactive positioning map
Legend: CAT-Total antioxidant capacity; TPC-Total polyphenol content

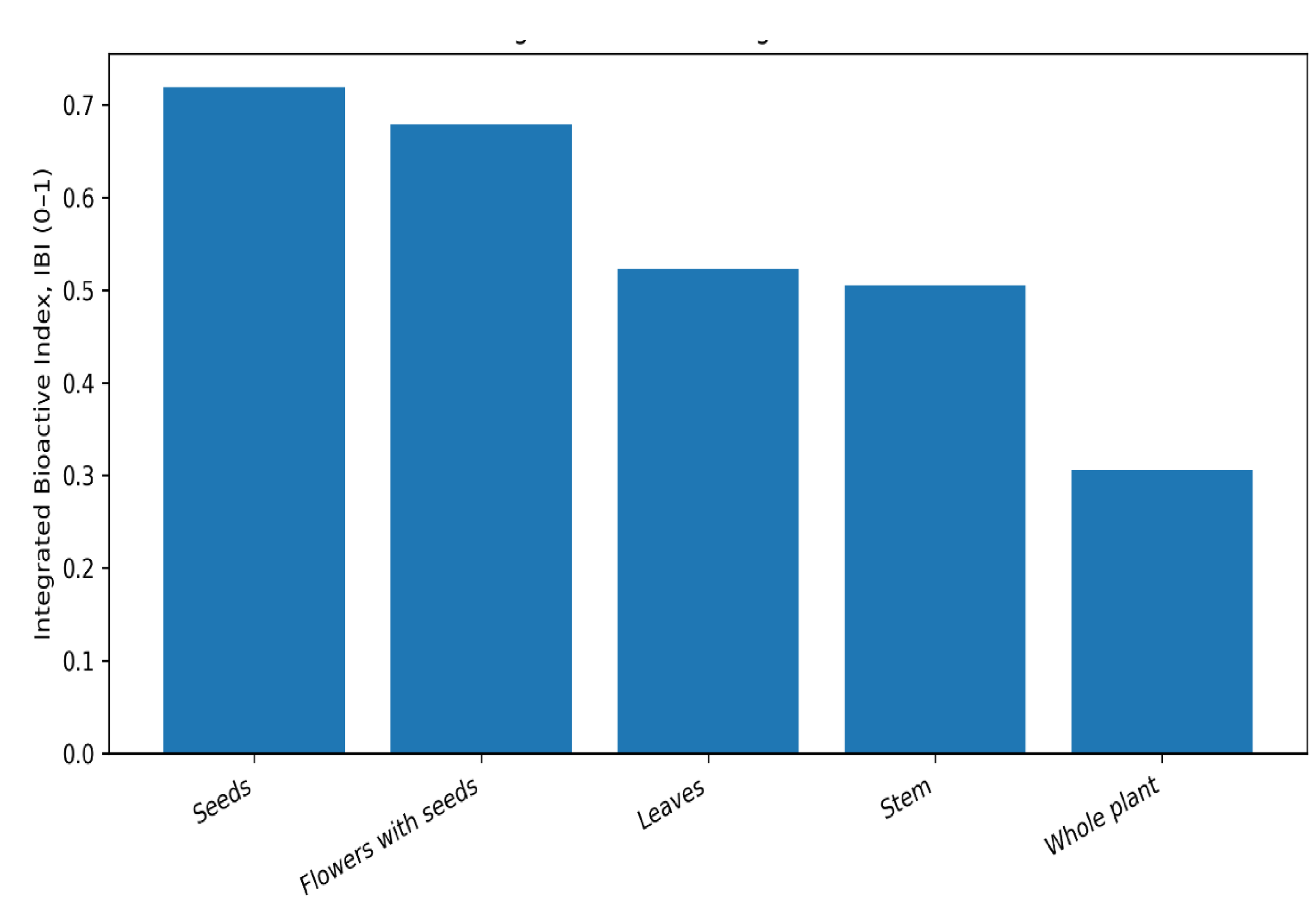

Figure 3. Mathematical modelling of CAT +TPC using normalized dimensionless scores
Legend: CAT-Total antioxidant capacity; TPC-Total polyphenol content

Conclusions

The study highlights *Chenopodium album* as a valuable functional food with relevance for sustainable nutrition. Polyphenols help reduce oxidative stress and support human health. As an underutilized species, it requires minimal resources, diversifies diets, and supports sustainability. Further research is needed on less studied parts (stems and roots), as current studies focus mainly on leaves.

Acknowledgement: This study was funded by the University of Life Sciences "King Mihai I" from Timisoara" and the results will be included in the PhD Thesis of Mihaela Lăcătuş under the supervision of Prof Habil.Dr.Eng. Despina-Maria Bordean. Project PhD Thesis, Doctoral Grant, Doctoral School Engineering of Vegetable and Animal Resources USVT, 2024- 2028, "Analysis of Bioactive Compounds from Plants and Their Application in the Development of Dietary Supplements". The authors would like to thank to the Doctoral School "Engineering of Vegetable and Animal Resources", University of Life Sciences "King Mihai I" from Timişoara, Calea Aradului 119, 300645, for the academic support and resources provided throughout the development of this research.