

## DANDELION (*TARAXACUM OFFICINALE WEBER*): BOTANICAL STUDY AND PHYTOTHERAPEUTIC CONSIDERATIONS

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### RESEARCH ARTICLE

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#### Abstract

The common dandelion (*Taraxacum officinale Weber*), designated in this study as TO is a widely distributed medicinal plant traditionally employed in hepatobiliary, digestive, and metabolic disorders. This study aimed to provide a concise botanical characterization of the species based on material collected from spontaneous flora in Bihor County, Romania. Macroscopic evaluation included the examination of roots, leaves, flowering stems, flowers, seeds and pollens, while microscopic analysis focused on diagnostic anatomical elements relevant for pharmacognostic authentication. Plant material was manually sectioned, and transverse anatomical sections were prepared for microscopic examination. were analyzed under light microscopy.

The results confirmed the characteristic morphological traits of TO, including a vertical taproot rich in latex, a basal rosette of deeply pinnatisect leaves, a hollow flowering stem, and a yellow ligulate capitulum. Microscopic analysis revealed inulin-rich parenchyma, latex canals (laticifers), dorsiventral leaf structure with anomocytic stomata, and collateral vascular bundles in the stem. Pollen grains appeared spheroidal and echinulate, consistent with Asteraceae family characteristics.

The anatomical observations support the accurate identification of the species and correlate with its documented phytotherapeutic properties, such as hepatoprotective, diuretic, and antioxidant effects associated with sesquiterpene lactones, triterpenes, phenolic acids, flavonoids, and inulin. These findings highlight the relevance of morphological and anatomical authentication in ensuring the quality and proper use of TO in medicinal preparations.

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**Keywords:** *Taraxacum officinale Weber*; dandelion; botanical and phytochemical profile; ethnopharmacological relevance; phytotherapeutic applications.

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#### INTRODUCTION

The common dandelion (*Taraxacum officinale Weber*), designated in this study as TO is one of the most widely distributed medicinal plants in the Northern Hemisphere, traditionally used in hepatobiliary, digestive and metabolic disorders (Schutz et al., 2006). Historical sources indicate its therapeutic value since ancient Egyptian, Greek and Roman civilizations, while medieval medical texts describe its utility in liver congestion and urinary complaints (Fan et al., 2023). In Romania TO is abundant in spontaneous flora and is included among the most commonly used

ethnomedicinal species (Pallag, 2015). Current phytochemical studies highlight a rich composition of sesquiterpene lactones (taraxacin, taraxacerin), triterpenes (taraxasterol, taraxerol), phenolic acids (chlorogenic, caffeic), flavonoids (luteolin, apigenin), carotenoids, inulin and significant mineral content, particularly potassium (Popescu et al., 2010; Yan et al., 2024). These compounds correlate with reported diuretic, choloretic, hepatoprotective, anti-inflammatory, hypouricemic and antioxidant effects (Gonzales et al., 2012; Herrera et al. 2025; Zhou et al., 2025).

Previous pharmacological reports suggest that aqueous and hydroalcoholic extracts of TO may modulate lipid metabolism, inhibit

adipogenesis, protect hepatocytes against xenobiotic injury, and reduce oxidative stress through polyphenolic mechanisms (Gruszecki et al., 2024; Telerovska et al., 2025). However, botanical identification and correct anatomical characterization remain essential, given the high morphological variability within the genus *Taraxacum* (over 250 species globally, nine documented in Romania) (Ardelean, 2008; Gruszecki et al., 2024).

The study emphasizes the critical importance of accurately identifying TO through its defining morphological and anatomical features, ensuring that plant material collected from spontaneous flora is correctly distinguished from related or visually similar species; accordingly, it aims to demonstrate that standardized macro- and microscopic pharmacognostic methods provide reliable authentication, supporting proper selection, safe use, and avoidance of accidental substitution during harvesting.

## MATERIAL AND METHOD

Vegetal material of TO was collected from spontaneous, non-polluted habitats in the Oradea area (Bihar County, Romania), at the coordinates 47°04'28.7"N, 21°56'14.8"E and an altitude of 151 m, during the flowering period (May–June 2025). Only healthy, well developed specimens, free of mechanical damage, chlorosis, desiccation, or parasitic infestation, were selected for analysis. All vegetative organs of the species (roots, leaves, flowering stems, flowers, seeds, pollens) were subjected to both macroscopic and microscopic examination. Whole plants were used for morpho-anatomical analysis, with approximately 100 g fresh weight per specimen.

Macroscopic evaluation was performed according to pharmacognostic requirements, assessing organ morphology, dimensions, colour, texture and latex exudation. The characterization followed the guidelines of the Romanian Pharmacopoeia, 10th edition, including the assessment of appearance, odour and taste for each plant organ (Ph.10<sup>th</sup>). Plant material was manually cleaned, dried at room temperature, fragmented and stored in paper envelopes under controlled ambient conditions until further use (Szabo, 2007).

For microscopic analysis, thin handmade transverse sections were obtained from the root, leaf flowering stems, flowers, seeds and

pollens using sterile razor blades, and subsequently cleared with chloral hydrate or glycerinated water. Additional preparations were stained with a hydroalcoholic Genevez reagent (Congo red and chrysoidine) for 5 minutes, followed by repeated rinsing with distilled water to remove excess dye (Paşca et al., 2025; Szabo, 2004).

Microscopic observations were performed using an Optika C-B10+ (24010) optical microscope (Ponteranica, Italy) equipped with 10×, 20× and 40× objectives and an Optika B10 digital camera (Gîtea et al., 2023). Diagnostic tissues were identified for each organ, including epidermis, collenchyma, parenchyma, vascular bundles, secretory ducts, articulated laticifers and inulin-containing parenchyma (Pallag, 2015). Pollen grains were collected by gently tapping mature capitula onto glass slides and fixing the material in glycerin jelly (Nemeth et al., 1998). Photographic documentation of both macroscopic and microscopic features was obtained using a Canon EOS R5 camera with a Canon RF 35 mm F1.8 Macro IS STM lens, and images were processed for clarity and documentation (Paşca et al., 2025). Representative voucher specimens from TO were preserved in the Herbarium of the Faculty of Medicine and Pharmacy, University of Oradea, Romania, and registered in the NYBG Steere Herbarium reference system.

## RESULTS AND DISCUSSIONS

### Macroscopic characteristics

Macroscopic analysis confirmed the diagnostic features of TO (as follows in Table 1), including fleshy vertical rhizome, producing a milky latex upon sectioning. Leaves form a basal rosette, are simple, lanceolate, deeply pinnatisect with unequal triangular lobes. The flowering stems (scape) is hollow, cylindrical and terminates in a solitary capitulum of bright yellow ligulate florets that open in the morning and close in the evening. These characters match the classical species description from Romanian flora. The seeds are enclosed in globose achenes equipped with an umbrella-like pappus, and measure approximately 0.3–0.5 mm in length, and the pappus facilitates effective wind mediated dispersal of the species in nature.

### Microscopic characteristics

#### Root anatomy

The transverse root section revealed a thick periderm, a broad parenchymatous cortex containing inulin deposits, latex canals (laticifers) distributed irregularly, and a multilayered secondary phloem. Xylem vessels were radially arranged, confirming previously reported structural models for Asteraceae roots.

#### Leaf anatomy

Microscopy of the lamina showed dorsiventral structure with a single-layered epidermis, abundant anomocytic stomata, well-developed palisade tissue, and spongy parenchyma containing calcium oxalate traces. Latex canals (laticifers) were present along the midrib (Figure 1), a key diagnostic feature for the subfamily *Cichorioideae* (Pallag, 2015).

#### Flowering stems anatomy

Sections of the flowering stem exhibited a uniseriate epidermis, subepidermal collenchyma and large parenchymatous cortex, with collateral vascular bundles arranged

irregularly along the circumference. Central parenchyma was prominent and aeriferous, consistent with previously published descriptions.

#### Pollen

Pollen grains were spheroidal, echinulate, characteristic of Asteraceae, and correspond to the genus-specific morphology observed in the literature. These anatomical traits correlate with the plant's phytochemical profile, supporting its therapeutic applications.

#### Integration with phytotherapeutic relevance

The presence of laticifers correlates with sesquiterpene lactones (taraxacin, taraxacerin), while inulin deposits in the root support its known prebiotic, hypoglycemic and metabolic modulatory effects (Yan et al., 2024; Neagu et al., 2023). Anatomical authentication is essential, given the high interspecific variability within TO, ensuring correct identification for pharmacognostic and industrial use.

Table 1

| Macroscopic assessment results of dandelion ( <i>Taraxacum officinale</i> Weber) |                                  |                                  |                 |                      |                                   |
|--|----------------------------------|----------------------------------|-----------------|----------------------|-----------------------------------|
| Vegetative Organ   | Aspect / Form                    | Surface / Fracture               | Dimensions      | Colour               | Smell / Taste                     |
| Root   | branched roots                   | irregular surface                | up to 10 cm     | light brown exterior | odorless                          |
| Leaf   | long, lanceolate, deeply incised | smooth surface                   | 10–30 cm        | dark green           | odorless                          |
| Flowering Stem   | erect, cylindrical, with nodes   | smooth, slightly brittle surface | up to 60 cm     | light green          | slightly characteristic odor      |
| Flower   | Inflorescence, capitulum         | smooth, shiny surface            | 2–5 cm diameter | bright yellow        | characteristic, slightly fragrant |
| Seed   | elongated shape                  | smooth surface                   | 0.3–0.5 mm      | brown                | odorless                          |
| Pollen   | fine powder                      | smooth surface                   | 100–200 $\mu$ m | yellow-green         | odorless                          |

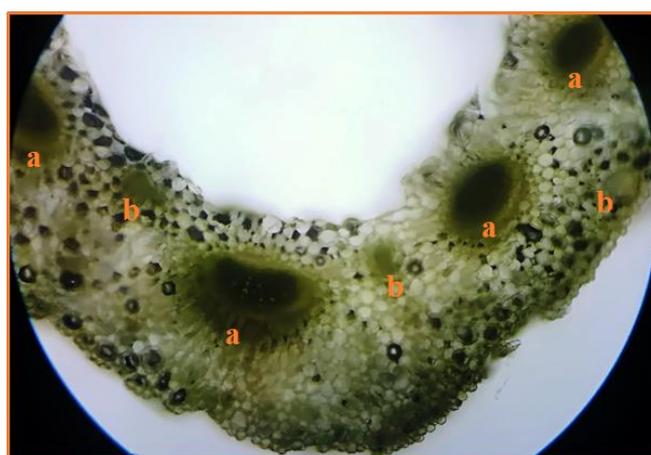


Figure 1. Transverse section of the leaf of *Taraxacum officinale* Weber (obj. 40 $\times$ ) (a = vascular bundles, b = latex tubes, laticifers).

## CONCLUSIONS

Morphological and anatomical analyses confirmed the correct identification of TO

collected from spontaneous flora in Bihor County. The consistent presence of articulated laticifers, inulin-rich parenchyma, dorsiventral leaf anatomy and echinulate pollen grains provide reliable diagnostic criteria essential for

preventing species substitution during harvesting and ensuring the botanical authenticity of the vegetal material. Macroscopic examination, performed in accordance with the Romanian Pharmacopoeia (Ph.10<sup>th</sup>), accurately characterized the organoleptic and morphological features of the species, while microscopic investigations, conducted on transversal, longitudinal and peeled sections stained with Genevez reagent—revealed the specific anatomical structures. The root exhibited a well-defined network of latex tubes and storage parenchyma rich in inulin, whereas leaves and flowering stems displayed irregularly thickened epidermal cells and prominent latex canals (laticifers). Vascular bundle distribution within the leaf differed between the upper and lower lamina, but remained consistent among all collected samples. The correct elucidation of these structures proves essential for a thorough understanding of medicinal plant products and for establishing correlations between morphological traits and bioactive compound content. Overall, the findings support the suitability of TO from Bihor County as authentic vegetal material for phytotherapeutic applications and reinforce the importance of rigorous species identification in preventing misidentification or substitution.

## REFERENCES

- Ardelean, A.G.M. *Atlas of the Flora of Romania*. All Publisher, Bucharest, 2008.
- Fan M, Zhang X, Song H, Zhang Y. Dandelion (*Taraxacum* Genus): A Review of Chemical Constituents and Pharmacological Effects. *Molecules*. 2023 Jun 27;28(13):5022. doi: 10.3390/molecules28135022. PMID: 37446683; PMCID: PMC10343869.
- Gitea, M.A.; Gitea, D.; Mirela Tit, D.; Bungau, S.G.; Bogdan, M.A.; Radu, A.-F.; Dulf, F.V.; Pasca, M.B. Organically Cultivated Vine Varieties—Distinctive Qualities of the Oils Obtained from *Grape Seeds*. *Sustainability* 2023, 15, 11037. <https://doi.org/10.3390/su151411037>
- González-Castejón M, Visioli F, Rodríguez-Casado A. Diverse biological activities of dandelion. *Nutr Rev*. 2012 Sep;70(9):534-47. doi: 10.1111/j.1753-4887.2012.00509.x. Epub 2012 Aug 17. PMID: 22946853.
- Gruszecki R, Walasek-Janusz M, Caruso G, Pokluda R, Tallarita AV, Golubkina N, Sękara A. Multilateral Use of Dandelion in Folk Medicine of Central-Eastern Europe. *Plants (Basel)*. 2024 Dec 30;14(1):84. doi: 10.3390/plants14010084. PMID: 39795344; PMCID: PMC11723127.
- Herrera Vielma F, Quiñones San Martín M, Muñoz-Carrasco N, Berrocal-Navarrete F, González DR, Zúñiga-Hernández J. The Role of Dandelion (*Taraxacum officinale*) in Liver Health and Hepatoprotective Properties. *Pharmaceuticals (Basel)*. 2025 Jul 1;18(7):990. doi: 10.3390/ph18070990. PMID: 40732279; PMCID: PMC12299503.
- General Methods of Analysis, in *Romanian Pharmacopoeia*, 10th edition, Bucharest: Medical Publisher, 1993, pp. 1051–105.
- Neagu, O.M.; Ghitea, T.; Marian, E.; Vlase, L.; Vlase, A.-M.; Ciavoi, G.; Fehér, P.; Pallag, A.; Bácskay, I.; Nemes, D.; et al. Formulation and Characterization of Mucoadhesive Polymeric Films Containing Extracts of *Taraxaci Folium* and *Matricariae Flos*. *Molecules* 2023, 28, 4002. <https://doi.org/10.3390/molecules28104002>
- Nemeth, T., Ardelean, A., Ursu, M.P., Szabo, I. *Guide for Practical Works in Pharmacognosy (Histology of Medicinal Plants)*, 1st ed., University of Oradea, 1998.
- Pallag, A. *Pharmaceutical Botany – Systematics of Cormobionta*, University of Oradea Publisher, 2015.
- Pasca, M.B.; Costa, A.-D.; Gitea, D.; Moisa, C.; Jurca, T.; Burlou-Nagy, C.; Olah, N.K.; Pallag, A.; Gitea, M.A. Comprehensive Pharmacobotanical and Phytochemical Profiling of *Glechoma hederacea* L. from Bihor County, North-West Romania. *Life* 2025, 15, 1466. <https://doi.org/10.3390/life15091466>
- Popescu M.L., Dinu M., Ursache D.D., *Contributions to the pharmacognostical and phytobiological study on Taraxacum officinale (L.) Weber*, revista Farmacia, vol.58, 5, 2010, pp. 646-653.
- Schütz K, Carle R, Schieber A. Taraxacum—a review on its phytochemical and pharmacological profile. *J Ethnopharmacol*. 2006 Oct 11;107(3):313-23. doi: 10.1016/j.jep.2006.07.021. Epub 2006 Jul 22. PMID: 16950583.
- Szabo, I., Nemeth, T.S. *Microscopy in Pharmaceutical Botany*, University of Oradea Publisher, 2004.
- Szabo, I., Pallag, A. *Microscopic Analyses*. University of Oradea Publisher, 2007.
- Teterovska, R.; Skotele, R.E.; Maurina, B.; Sile, I. Medicinal Plants in Food Supplements for Gastrointestinal Disorders: Critical Assessment of Health Claims on Gastric Acid Regulation. *Nutrients* 2025, 17, 3674. <https://doi.org/10.3390/nu17233674>
- Yan Q, Xing Q, Liu Z, Zou Y, Liu X, Xia H. The phytochemical and pharmacological profile of dandelion. *Biomed Pharmacother*. 2024 Oct;179:117334. doi: 10.1016/j.biopha.2024.117334. Epub 2024 Aug 24. PMID: 39180794.
- Zhou, X.; Liu, T.; Xu, B.; Zhang, W.; Li, X.; Wei, F.; Lv, H.; Ji, X.; Zhang, B.; Wang, S. Dandelion Leaf Aqueous Extract Relieves Hyperuricemia and Its Complications via Modulating Uric Acid Metabolism, Renal Inflammation, and Gut Microbes. *Foods* 2025, 14, 3843. <https://doi.org/10.3390/foods14223843>