

Distribution areas and medicinal importance of the species of *Cirsium* Mill. found in Azerbaijan

Alshanli Ulviyya Suddar

Ganja State University, Faculty: Chemical Biology; Department: Anatomy, Physiology and Zoology; Doctoral student of the Institute of Botany, Azerbaijan National Academy of Sciences; AZ2000, Ganja, Azerbaijan;

Abstract

The article analyzes the geographical distribution areas, ecological characteristics and medicinal importance of the species of the genus *Cirsium* Mill. of the Asteraceae family, which are widespread in Azerbaijan. At the same time, the protection and effective use of species belonging to the genus are discussed. **Problem:** *Cirsium* Mill., one of the widespread medicinal plants in Azerbaijan, is considered an important component of biodiversity. These plants are mainly distributed in foothills, meadows, semi-deserts and roadside areas. *Cirsium* Mill. species are found especially in the Lesser Caucasus, Greater Caucasus, Talysh zone and lowland regions. In the high mountain belts of the area, it is found in rocky, stony, stony-gravel and gravelly vegetation. As a result of the location of *Cirsium* Mill. plant individuals at a certain distance from each other in rocky areas, sparse and poorly developed vegetation is formed. Studies show that *Cirsium* Mill. plants are rich in flavonoids, alkaloids, essential oils and antioxidant substances. In folk medicine, their roots, leaves, and seeds are used to treat liver, biliary tract, digestive system, and inflammatory diseases. **Method:** Field studies and comparative morphological analyses of several species, especially *Cirsium tricholoma*, *Cirsium rhizocephalum* and *Cirsium frickii*, were carried out in the mountainous regions of the Lesser and Greater Caucasus during the vegetation period. Herbarium materials and phytochemical analyses were also used to determine ecological and medicinal characteristics of the species. **Result:** The obtained results indicate that these species are ecologically adapted to subalp and alp meadow ecosystems and possess important pharmacological potential due to the presence of biologically active compounds such as flavonoids, alkaloids and phenolic substances. **Conclusion:** The study emphasizes the ecological role, medicinal value and necessity of protection and sustainable use of *Cirsium* Mill. species in Azerbaijan flora.

Keywords: *Cirsium* Mill., flavonoid, folk medicine, areal, subalpine

Introduction

Plants form the basis of life for all living organisms on the planet, and the organic world and living life began with plants. The plant kingdom has the ability to directly utilize sunlight through the unique process of photosynthesis, which creates the appearance of the Earth that we observe. It is precisely plants that provide the Earth with oxygen and thereby act as the driving force of evolution. They are a rich reserve of organic matter and a highly valuable natural resource. The vegetation cover of each region is constantly subjected to changes as a result of the continuous complex influence of environmental factors. These changes occur depending on the physical-geographical conditions of the area, global warming, and the disruption of the ecological balance of the atmosphere. Depending on the geobotanical and bioecological characteristics of vegetation types, certain dynamics are observed in the species composition of plant cover, associations and formations, projective cover, and cenotypic features of phytocenoses in the areas where they are distributed. Human beings are not the rulers of nature, but only elements endowed with reason; they must serve nature, help it, and stand by its side. Nature protection is a global and universal task. Biologically active substances secreted by plant roots help improve soil structure and increase its capacity to retain and filter water [4].

Among such plants are the thistle species belonging to the genus *Cirsium* Mill. *Cirsium* Mill. species are distinguished by their ability to adapt to various ecological conditions and play an important functional role in soil-ecosystem relationships. The strong and deep root system of the plant positively affects the improvement of soil structure, the reduction of erosion processes, and the increase of water retention and filtration capacity in the soil. Biologically active substances secreted by the roots of *Cirsium* Mill. enhance the activity of soil microflora and contribute to the preservation of soil fertility. In this regard, *Cirsium* Mill. is considered one of the plant examples with important phytomeliorative significance in ensuring ecological stability [1].

Materials and Methods

The research material consisted of species belonging to the genus *Cirsium* distributed in the flora of Azerbaijan, especially *Cirsium tricholoma*, *Cirsium rhizocephalum* and *Cirsium frickii*. Samples were collected from the northern part of the Lesser Caucasus, mountainous zones of the Greater Caucasus, as well as subalpine and alpine



meadows. Natural populations of the plants were observed under field conditions during the flowering and vegetation periods (VI–IX months), and herbarium specimens were prepared and identified in the laboratory. During species identification, morphological characteristics such as stem height, leaf shape, degree of spininess, structure of inflorescences and features of the root system were taken as the main criteria [8].

Classical botanical-systematic methods, comparative morphological analysis and phytocenological observations were used as methodological approaches. The distribution areas of the plants were recorded based on GPS coordinates, taking into account altitudinal zonality. Ecological conditions such as soil type, humidity, slope inclination and degree of illumination were documented through field records [5,6].

For the preliminary evaluation of the chemical composition, qualitative reactions were carried out on dried plant materials, and the presence of flavonoids, phenolic compounds, alkaloids and saponins was determined using standard phytochemical methods. At the same time, the pharmacological properties of the species were comparatively analyzed based on literature sources.

Discussion

In Azerbaijan, species belonging to the genus *Cirsium* are found particularly in the alpine and subalpine meadow belts, on grassy mountain-meadow soils, at altitudes of approximately 1800–2600 meters above sea level. The subalpine belt, located in the upper part of the forest zone, forms a transitional zone with the alpine belt, and the favorable hydrothermal conditions formed here positively affect the development of *Cirsium* species. Species of the genus *Cirsium* mainly participate in the floristic composition of subalpine meadows as perennial herbaceous plants and play an important role in the formation of phytocenotic biodiversity. These plants spread together with other mesophytic species in tall-herb meadows, contributing to the formation of productive forage areas. They serve to reduce erosion processes and maintain the ecological stability of mountain ecosystems. *Cirsium* species are also considered valuable due to their medicinal properties, in addition to their importance as forage plants in summer pastures [7].

Subalpine meadows are mainly characterized by tall-herb plants as dominant edificators. Among these, species belonging to the genus *Cirsium* occupy an important place. Tall-herb plants develop on mountain-meadow soils that have emerged from forest zones, contributing to the formation of subalpine tall-herb vegetation and forest-edge humid meadows. In the tall-herb layer of subalpine meadows, species of the genus *Heracleum* L. are widely distributed, forming distinct plant formations. In these “hogweed communities,” species such as *Aconitum orientale* Mill., *Delphinium flexuosum* Bieb., *Knautia montana* (Bieb.) DC., *Cephalaria gigantea* (Ledeb.), *Dactylis glomerata* L., *Adenostyles platyphylloides* (Somm. et Levier) Czer., and *Doronicum macrophyllum* Fisch. ex Hornem. are commonly found. In regenerating ruderal areas, species of the genera *Urtica* L., *Rumex* L., *Dryopteris* Adans., and *Cirsium* Mill. form monodominant associations.

Cirsium Mill. is represented by 30 species in the flora of Azerbaijan. In this study, the morphological and botanical characteristics, ecological distribution, and pharmacological importance of some species belonging to the genus were analyzed. At the same time, the healing properties of biologically active compounds such as flavonoids, alkaloids, essential oils, and other substances contained in these species were investigated, and information was provided on their use in folk medicine and phytotherapy.

Cirsium tomentosum C.A.Mey. 1831 – woolly thistle is a perennial herbaceous plant with a long rhizome and is a hemicryptophyte. The plant reaches a height of 70–100 cm and is mainly distributed in lower, middle mountain, subalpine, and alpine zones, on gravelly slopes and rocky debris areas. The species is considered characteristic for the East Caucasian flora and is widely found in the mountainous regions of the Greater Caucasus in Azerbaijan. It is also distributed in Southwest Asia, particularly in the floras of Turkey and Iran. This species is important not only floristically but also pharmacologically. In *Cirsium tomentosum*, biologically active compounds such as flavonoids, phenolic compounds, alkaloids, tannins, saponins, and essential oils have been identified. These compounds possess antioxidant, anti-inflammatory, antimicrobial, and hepatoprotective properties. In folk medicine, the aerial parts of the plant are used as a wound-healing, diuretic, and digestive-regulating remedy. At the same time, phenolic and flavonoid complexes found in *Cirsium* species play an important role in reducing the effects of free radicals in the human body.

Cirsium kosmelii (Adams.) Fisch. ex Hohen. – Kosmeli thistle is a perennial herbaceous plant with a long rhizome and a hemicryptophyte life form. The plant reaches a height of 50–80 cm and is mainly distributed in mid-mountain and subalpine zones, as well as on dry mountain slopes and foothill areas. The species was described from the Central Caucasus and is also distributed in Southwest Asia, particularly in the flora of Turkey.

This species is believed to contain biologically active compounds such as flavonoids, phenolic compounds, tannins, alkaloids, saponins, and essential oils. These compounds exhibit antioxidant and anti-inflammatory effects, thereby reducing the impact of free radicals in the body. In folk medicine, the aerial parts of *Cirsium* species are reported to be used as diuretic, wound-healing, and digestive-regulating agents.

Cirsium osseticum (Adams.) Petr. – Osetian thistle is a biennial herbaceous plant reaching a height of 50–100 cm. This hemicryptophyte species is mainly distributed in mid-mountain and subalpine zones, as well as in forest



clearings and mountain meadows. It is considered characteristic of the Central Caucasian flora and is also found in Turkey and Iran.

Phytochemical investigations have identified flavonoids, phenolic acids, tannins, essential oils, and various antioxidant compounds in this species. These constituents exhibit antimicrobial, anti-inflammatory, and immunostimulatory properties. In folk medicine, different parts of *Cirsium osseticum* are reported to be used in the treatment of inflammatory conditions, skin lesions, and digestive disorders. Its biochemical composition also supports its potential value as a promising medicinal plant.

Cirsium tricholoma Fisch. et C.A.Mey. ex DC. – woolly thistle is a biennial herbaceous plant with a hemicryptophyte life form. It reaches a height of 80–110 cm, and its flowering period occurs in June–July. The species is mainly distributed in the northern part of the Lesser Caucasus, in subalpine zones, and in mountain meadows. It belongs to the Caucasian flora and was originally described from the Eastern Caucasus.

The species contains biologically active compounds such as flavonoids, phenolic compounds, alkaloids, saponins, and essential oils. These substances exhibit antioxidant, anti-inflammatory, and antimicrobial activities. In folk medicine, the aerial parts are reported to be used for various inflammatory conditions and for general strengthening of the organism.

Cirsium rhizocephalum C.A.Mey. – root-headed thistle is a perennial herbaceous plant with a rhizomatous root system and a hemicryptophyte life form. The plant height ranges between 5–20 cm, and it is mainly distributed in subalpine and alpine zones, particularly in high-mountain meadows. This species is considered a Caucasian subendemic and was described from the Eastern and Central Caucasus.

The chemical composition of the species includes flavonoids, phenolic acids, tannins, saponins, and other antioxidant compounds. These constituents exhibit protective effects at the cellular level, reduce inflammatory processes, and enhance resistance against microorganisms. In folk medicine, both root and aerial parts may be used for regulating the digestive system and for anti-inflammatory purposes.

Cirsium frickii Fisch. et C.A.Mey. – Frick's thistle is a perennial herbaceous plant with a rhizomatous root system, reaching a height of 10–20 cm, and it also exhibits a hemicryptophyte life form. It is mainly distributed in the northern part of the Lesser Caucasus, on high mountain slopes and in subalpine zones. The species was originally described from the flora of Turkey and has a distribution range covering the Caucasus–Southwest Asia region.

This species is also presumed to contain biologically active compounds such as flavonoids, phenolic compounds, essential oils, and saponins. These constituents contribute to antioxidant and anti-inflammatory activities, enhancing the medicinal potential of the plant. In folk medicine, it is reported to be used similarly to other *Cirsium* species in the treatment of various inflammatory and skin diseases [3].

Conclusion

The conducted study shows that species belonging to the genus *Cirsium*, which are widely distributed in the flora of Azerbaijan, particularly *Cirsium tricholoma*, *Cirsium rhizocephalum*, and *Cirsium frickii*, are important components of high-mountain ecosystems, especially subalpine and alpine meadows. These species are mainly distributed in the mountainous regions of the Lesser and Greater Caucasus, as well as across different altitudinal zones, demonstrating a high level of adaptation to environmental conditions. Morphological and ecological analyses indicate that these species are characterized by a hemicryptophyte life form and are resistant to harsh climatic conditions. The root systems of these plants play a significant role in soil stabilization, reducing erosion, and maintaining the stability of mountain ecosystems.

From a phytochemical perspective, the presence of flavonoids, phenolic compounds, saponins, alkaloids, and essential oils in these species confirms their high biological activity. These compounds possess antioxidant, anti-inflammatory, and antimicrobial properties, thereby enhancing the medicinal value of the plants.

Overall, species of the genus *Cirsium* play an important phytocenotic role in ecological systems and are considered promising medicinal plants with significant pharmacological potential.

Declarations

Ethical Approval Certificate

Not applicable.

Author Contribution Statement

Ramil Mammadov: Conceptualization, methodology, data collection, formal analysis, writing – original draft, review & editing.

Funding Statement

This work was not funded by any institution or organization.





Conflict of Interest

The author declares no conflict of interest.

Acknowledgments

The author expresses gratitude to the staff of Specially Protected Natural Areas for their assistance in data collection and field observations.

References

- Alshanli U.S. Bioecological characteristics of species of the genus *Cirsium* Mill. growing in the north-eastern part of the Lesser Caucasus. 2024, Vol. 10, No. 3, pp. 100–103.
- Baku: Publishing House of the Academy of Sciences of the Azerbaijan SSR, 1962, 171 pp.
- Gadzhiev V.D. Subalpine vegetation of the Greater Caucasus (within the Azerbaijan SSR).
- Hajiyev V.C. Dynamics and productivity of high-mountain plant formations. Baku: Science, 1974, 105 pp.
- Hajiyev V.C. Ecosystems of high-mountain vegetation of Azerbaijan. Baku: Education-Science, 2004, 132 pp.
- Qarakhani P.X., Alshanli U.S. Species of the genus *Cirsium* Mill. distributed in the Ganja region. Conference proceedings. ANAS Department of Biological Sciences, Mardakan Arboretum Institute, International Conference “Modern stage of botanical gardens in nature conservation”, Baku, 24–27.09.2010, p. 415.
- Qarakhani P.X., Alshanli U.S. The genus thistle (*Cirsium* Mill.) in the flora of Azerbaijan. Proceedings of the Institute of Botany of ANAS, Baku, 2010, pp. 19–21.
- Qurbanov E.M. Vegetation of Azerbaijan. Monograph. Baku: Elm, 2024, 536 pp.
- Novruzov V.S. Fundamentals of Phytocenology (Geobotany). Baku: Science, 2010, 308 pp.

