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ЭТНОЛОГИЯ, АНТРОПОЛОГИЯ

ETHNOLOGY, ANTHROPOLOGY

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ӘЗЕРБАЙЖАН ДӘСТҮРЛІ МЕДИЦИНАСЫНДАҒЫ ДӘРІЛІК ӨСІМДІКТЕР: ЭТНОБОТАНИКАЛЫҚ БІЛІМ ЖӘНЕ ФАРМАКОЛОГИЯЛЫҚ ӘЛЕУЕТ

Аңдатпа: Дәстүрлі медицина – өткен күннің қалдығы емес, заманауи денсаулық сақтау жүйесінің іргетасы болып табылатын стратегиялық ресурс. Синтетикалық фармакологияның үстемдігіне қарамастан, дәрілік өсімдіктер терапиялық парадигманың баламасыз қайнар көзі болып қала береді. Ежелгі өркениеттер тоғысында орналасқан Әзербайжан өзінің ерекше ботаникалық суверенитетімен және мыңжылдықтар бойы патологияларға қарсы жүйелі түрде қолданылып келген терең этномедициналық дәстүрлерімен ерекшеленеді.

Бұл зерттеу Әзербайжанның жергілікті флорасына басымдық бере отырып, негізгі дәрілік таксондардың фармакологиялық қасиеттері мен терапиялық тиімділігін қатаң ғылыми сараптауды мақсат етеді. Дәлелді медицина қағидаттарына сүйене отырып, 2005–2024 жылдар аралығындағы PubMed, Scopus, Web of Science және Google Scholar сияқты элиталық дерекқорлардағы 118 іргелі ғылыми еңбекке терең ретроспективті талдау жасалды.

Зерттеу нәтижелері *Zingiber officinale* мен *Curcuma longa* сияқты жаһандық түрлермен қатар, Әзербайжанның этно-таксондары – *Thymus caucasicus*, *Urtica dioica* және *Plantago major*-дың қабынуға қарсы, микробқа қарсы және регенеративті қасиеттері бойынша синтетикалық балама-лардан еш кем түспейтінін растайды. Бұл Әзербайжан халық медицинасының тарихи тұрғыдан ескерусіз қалған, бірақ іс жүзінде өте күрделі эмпирикалық жүйе екенін дәлелдейді.

Қорытындылай келе, дәрілік өсімдіктерді заманауи дәлелді медицинаның ажырамас бөлігі ретінде қарастыру – уақыт талабы. Традициялық білімді маргиналдандыру үдерісіне клиникалық валидация арқылы тосқауыл қою қажет. Бұл мақала этно-тарихи деректерді заманауи фармакологияға интеграциялау арқылы биологиялық және мәдени тұрақтылықты қамтамасыз етуге бағытталған ғылыми үндеу болып табылады.

Түйін сөздер: дәстүрлі медицина, этноботаникалық мұра, фитотерапия, фармакологиялық валидация, Әзербайжан.

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Medicinal Plants in Traditional Azerbaijani Medicine: Bridging Ethnobotanical Heritage with Modern Pharmacological Imperatives

Abstract: Traditional medicine is not merely a relic of the past but a foundational healthcare system that remains vital in the modern era. Despite the dominance of synthetic pharmacology, medicinal plants represent an indispensable repository of therapeutic wisdom. Azerbaijan, a crossroads of ancient civilizations, possesses a unique botanical sovereignty and deep-rooted ethnomedical traditions that have systematically addressed human pathology for millennia.

This study executes a rigorous evaluation of the pharmacological properties and therapeutic efficacy of key medicinal taxa, with a specific focus on the indigenous flora of Azerbaijan. Moving beyond anecdotal evidence, a narrative evidence-based synthesis was performed, scrutinizing peer-reviewed literature from 2005 to 2024 across elite databases (PubMed, Scopus, Web of Science, and Google Scholar). A total of 118 high-impact studies were analyzed to validate traditional claims through the lens of modern science.

The findings confirm that while global species like *Zingiber officinale* and *Curcuma longa* hold established merit, the specific Azerbaijani ethno-taxa—namely *Thymus caucasicus*, *Urtica dioica*, and *Plantago major*—exhibit potent anti-inflammatory, antimicrobial, and regenerative properties that often rival synthetic alternatives. These results demonstrate that Azerbaijani folk medicine is built upon a sophisticated, albeit historically neglected, empirical framework.

In conclusion, this research asserts that medicinal plants are a critical frontier for evidence-based medicine. We argue that the systematic marginalization of traditional knowledge must be countered by standardized clinical validation. This study serves as a call to integrate ethno-historical data into modern drug discovery to ensure biological and cultural sustainability.

Keywords: traditional medicine; medicinal plants; ethnobotany; herbal therapy; pharmacology; Azerbaijan.

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Introduction

Traditional medicine represents one of the earliest forms of healthcare developed by human societies and continues to play an important role in contemporary health systems. For many Eurasian cultures, particularly among Turkic communities of the Caucasus and Central Asia, medicinal plants have historically served as essential therapeutic resources for the prevention and treatment of diseases. Historical sources indicate that plant-based remedies formed a significant component of early medical knowledge. For example, Mahmud al-Kashgari's *Dīwān Lughāt al-Turk* (1072) contains references to the use of various herbs in everyday health practices among Turkic populations. This historical evidence reflects the existence of a shared ethnomedical tradition extending across large parts of Eurasia. Even today, a considerable proportion of the global population continues to rely on herbal remedies as part of primary healthcare systems (Ali & Blunden, 2003).

In recent decades, increasing global interest in natural and complementary medicine has stimulated extensive scientific investigation into the pharmacological potential of plant-derived compounds. Numerous studies demonstrate that bioactive constituents of medicinal plants possess significant anti-inflammatory, antimicrobial, antioxidant, and immunomodulatory properties (Hewlings & Kalman, 2017; Grzanna et al., 2005). These findings indicate that modern pharmacological research frequently confirms therapeutic effects that were historically recognized through empirical traditional knowledge. Consequently, the integration of ethnomedical traditions with contemporary biomedical research has become an important direction in modern pharmacology.

Azerbaijan occupies a unique position in this context due to its exceptional botanical diversity and its historical role as a cultural and commercial crossroads along the Great Silk Road. The country's diverse ecological zones have contributed to the development of a rich tradition of herbal medicine. Historical medical literature, particularly the works of Abu Ali ibn Sina (Avicenna), significantly influenced traditional medical practices in the region. His *Canon of Medicine* served for centuries as an important reference for physicians throughout the broader Islamic and Eurasian world. Ethnobotanical studies conducted in Azerbaijan confirm that plant species such as *Hypericum perforatum*, *Plantago major*, *Urtica dioica*, and *Thymus caucasicus* have long been used in local traditional medicine for the treatment of respiratory diseases, inflammatory conditions, digestive disorders, and wound healing (İsmayılova & Məmmədov, 2010; Əlizadə, 2016). These practices represent an important component of both cultural heritage and traditional medical knowledge in the region.

Despite the widespread historical use of medicinal plants, their scientific evaluation remains uneven. Modern pharmaceutical research has traditionally prioritized synthetic compounds, leaving many indigenous medicinal species insufficiently investigated. Although certain plants have been extensively studied, numerous others remain poorly characterized in terms of their pharmacological mechanisms and clinical efficacy. Therefore, systematic analysis of available scientific evidence is necessary in order to better understand their therapeutic potential and possible applications in contemporary healthcare (Ekor, 2014; Huseynov, 2021).

The aim of this study is to evaluate the pharmacological properties and therapeutic effectiveness of selected medicinal plants commonly used in traditional medicine, with particular emphasis on species employed in Azerbaijani ethnomedical practice. By synthesizing ethnobotanical knowledge with modern pharmacological research, this study seeks to contribute to a better understanding of the scientific relevance of traditional medicinal plants.

Materials and methods

Research Design

This study was conducted as a narrative evidence-based review aimed at evaluating the pharmacological properties and therapeutic effectiveness of medicinal plants used in traditional medicine. Particular attention was given to plant species widely applied in Azerbaijani ethnomedical practice. The review approach allowed the integration of ethnobotanical knowledge with findings from pharmacological and clinical studies.

Data Sources and Search Strategy

A comprehensive literature search was performed using several major scientific databases, including PubMed, Scopus, Web of Science, and Google Scholar. The search focused on scientific publications published between 2005 and 2024 in order to include recent developments in phytochemistry, pharmacology, and clinical research related to medicinal plants.

The search strategy included combinations of the following keywords: *traditional medicine*, *medicinal plants*, *herbal therapy*, *pharmacological activity*, *clinical effectiveness*, and *ethnobotany*. In addition to general search terms, specific plant species commonly used in Azerbaijani traditional medicine were included as taxonomic keywords.

Inclusion and Exclusion Criteria

Clear inclusion and exclusion criteria were established in order to ensure the scientific reliability and relevance of the sources included in this review.

Inclusion criteria:

• peer-reviewed scientific publications

• studies investigating medicinal plants used in traditional medicine

• pharmacological or clinical research evaluating therapeutic properties

• studies with clear relevance to human health

Exclusion criteria:

• non-scientific or popular publications

• grey literature lacking academic peer review

• studies without clear pharmacological or clinical relevance

• experimental studies conducted exclusively on animals without clear translational clinical interpretation

Data Selection and Analysis

Following the initial screening process, relevant studies meeting the inclusion criteria were selected for further analysis.

Following the initial screening process, a total of 118 relevant scientific studies were selected for detailed analysis. The selected publications were examined to identify pharmacological properties, therapeutic mechanisms, and reported clinical outcomes associated with commonly used medicinal plants.

Ethnobotanical Focus

Special attention was given to plant species traditionally used in Azerbaijani folk medicine, including *Thymus caucasicus*, *Urtica dioica*, and *Plantago major*. These plants were analyzed from both ethnobotanical and pharmacological perspectives in order to evaluate their traditional uses and potential therapeutic significance within modern scientific research.

Figure 1

Selected medicinal plants used in traditional Azerbaijani medicine: Aloe vera, Zingiber officinale, Curcuma longa, Nigella sativa, Mentha piperita, Thymus caucasicus, Urtica dioica, and Plantago major.

Source: Author's compilation.

Results

Pharmacological properties of selected medicinal plants

The pharmacological properties of several widely used medicinal plants were analyzed based on available scientific literature. These plants demonstrate a variety of biological activities that support their traditional therapeutic applications.

Aloe vera

Aloe vera is one of the most extensively studied medicinal plants and has been widely used in traditional medicine for the treatment of various dermatological conditions. Pharmacological studies indicate that the therapeutic properties of *Aloe vera* are associated with the presence of polysaccharides, anthraquinones, vitamins, and phenolic compounds. These bioactive components contribute to anti-inflammatory, antimicrobial, and wound-healing effects. Clinical studies have demonstrated that topical preparations of *Aloe vera* can accelerate tissue regeneration and improve healing in burns and inflammatory skin lesions (Gupta & Malhotra, 2004).

Zingiber officinale (Ginger)

Zingiber officinale is widely recognized for its pharmacological activity, primarily attributed to bioactive compounds such as gingerols and shogaols. Experimental and clinical studies indicate that ginger exhibits anti-inflammatory, antioxidant, and antiemetic effects. Research findings suggest that ginger supplementation may help reduce nausea, alleviate symptoms of osteoarthritis, and improve digestive disorders. Its anti-inflammatory effects are associated with the inhibition of pro-inflammatory cytokines and prostaglandins (Grzanna et al., 2005).

Curcuma longa (Turmeric)

Curcuma longa contains the bioactive compound curcumin, which has attracted significant scientific interest due to its strong antioxidant and anti-inflammatory properties. Pharmacological studies indicate that curcumin modulates inflammatory signaling pathways and reduces oxidative stress. Clinical research suggests that curcumin may contribute to the management of chronic inflammatory conditions, including arthritis and metabolic disorders (Hewlings & Kalman, 2017).

Nigella sativa (Black seed)

Nigella sativa has long been used in traditional medicine across Eurasia and the Middle East. Historical medical texts, including Ibn Sina's *Canon of Medicine*, describe its therapeutic applications in various diseases. Modern pharmacological studies indicate that the principal bioactive compound of *Nigella sativa*, thymoquinone, exhibits antioxidant, antimicrobial, anti-inflammatory, and antihypertensive properties. Clinical investigations suggest that *Nigella sativa* may improve glycemic control and support cardiovascular health (Ali & Blunden, 2003).

Mentha piperita (Peppermint)

Mentha piperita is commonly used in herbal medicine for the treatment of gastrointestinal disorders. Peppermint oil contains menthol and other volatile compounds that exert antispasmodic effects on the smooth muscles of the gastrointestinal tract. Clinical studies indicate that peppermint oil may significantly reduce symptoms associated with irritable bowel syndrome (IBS), including abdominal pain and intestinal spasms (Khanna & MacDonald, 2014).

Table 1

The pharmacological properties and traditional uses of the selected medicinal plants are summarized in Table 1.

Plant species	Common name	Major bioactive compounds	Pharmacological properties	Traditional uses
Aloe vera	Aloe	Polysaccharides, anthraquinones, vitamins	Anti-inflammatory, antimicrobial, wound-healing	Burns, skin infections, wound healing
Zingiber officinale	Ginger	Gingerols, shogaols, essential oils	Anti-inflammatory, anti-nausea, antioxidant	Digestive disorders, nausea, inflammation
Curcuma longa	Turmeric	Curcumin, curcuminoids	Antioxidant, anti-inflammatory	Arthritis, metabolic disorders
Nigella sativa	Black seed	Thymoquinone, alkaloids	Antioxidant, antimicrobial, immunomodulatory	Respiratory diseases, immune support
Mentha piperita	Peppermint	Menthol, menthone	Antispasmodic, analgesic	Gastrointestinal disorders

Continuation of the table

Plant species	Common name	Major bioactive compounds	Pharmacological properties	Traditional uses
Thymus caucasicus	Mountain thyme	Thymol, carvacrol	Antimicrobial, expectorant	Respiratory infections, cough
Urtica dioica	Stinging nettle	Flavonoids, phenolic acids, minerals	Anti-inflammatory, antioxidant	Anemia, skin diseases
Plantago major	Plantain	Polysaccharides, iridoid glycosides	Wound-healing, antibacterial	Wounds, burns, digestive problems

Note: The table summarizes the major bioactive compounds, pharmacological properties, and traditional uses of selected medicinal plants based on the analyzed literature.

Table 2

Dermatological and cosmeceutical applications of selected medicinal plants (Source: Author's compilation based on the reviewed literature (2005–2024)).

Plant species	Major bioactive compounds	Dermatological / cosmetic effects	Traditional / modern applications	Major bioactive compounds
Aloe vera	Polysaccharides, acemannan, vitamins	Anti-inflammatory, moisturizing, wound-healing	Skin regeneration, burns, dermatological creams	*Aloe vera*
Curcuma longa	Curcumin, curcuminoids	Antioxidant, anti-inflammatory	Skin inflammation treatment, cosmetic formulations	*Curcuma longa*
Mentha piperita	Menthol, menthone	Cooling, antimicrobial, analgesic	Topical gels, oral hygiene products, skin care	*Mentha piperita*
Urtica dioica	Flavonoids, phenolic acids, minerals	Improves scalp circulation, antioxidant	Hair growth products, scalp treatments	*Urtica dioica*
Plantago major	Iridoid glycosides, polysaccharides	Wound-healing, antibacterial	Skin irritation treatment, dermatological patches	*Plantago major*

Traditional Azerbaijani Ethno-Pharmacopeia: Historical Validation

The use of medicinal plants in Azerbaijan represents a long-standing empirical medical tradition rather than a collection of folkloric practices. This knowledge is deeply embedded in the linguistic and cultural heritage of the Turkic world. Historical sources indicate that several medicinal plants were already recognized for their therapeutic value as early as the 11th century in Mahmud al-Kashgari's *Dīwān Lughāt al-Turk* (Kashgari, 1072).

Azerbaijani ethnomedicine has developed within a geographically diverse environment characterized by nine distinct ecological zones. These conditions have supported a rich diversity of medicinal flora traditionally used for the treatment of various diseases.

Among the most frequently used species in Azerbaijani folk medicine are:

Thymus caucasicus (kəklikotu; Kazakh: кекіре).

This species has traditionally been used as an antimicrobial and expectorant agent in the treatment of respiratory infections. Phytochemical analyses indicate that its therapeutic activity is largely associated with essential oils rich in thymol and carvacrol (İsmayılova & Məmmədov, 2010).

Urtica dioica (gicitkən; Kazakh: қалақай).

This plant is widely used in traditional medicine due to its anti-inflammatory and hematopoietic properties. It has historically been applied in the treatment of anemia and inflammatory disorders. Pharmacological studies demonstrate that its biological activity is associated with flavonoids, phenolic acids, and mineral compounds (Əlizadə, 2016).

Plantago major (bağayarpağı; Kazakh: бақажапырақ).

Traditionally known for its wound-healing properties, *Plantago major* has been widely used

in the treatment of cuts, burns, and skin infections. Its pharmacological activity is attributed to bioactive compounds such as polysaccharides and iridoid glycosides, which promote tissue regeneration and exhibit antibacterial effects (Həsənov, 2018).

These examples illustrate that Azerbaijani ethnomedical knowledge represents a historically developed system of plant-based therapeutic practices supported by empirical observations accumulated over generations.

Dermatological and Cosmeceutical Applications of Medicinal Plants

The use of medicinal plants has also expanded into dermatology and cosmetic science. Plant-derived compounds with antioxidant, antimicrobial, and anti-inflammatory properties have become important components of modern dermatological formulations.

Aloe vera is one of the most widely used plants in dermatological preparations. The gel extracted from its leaves contains polysaccharides, vitamins, enzymes, and amino acids that promote skin hydration and tissue regeneration. Clinical studies confirm its effectiveness in wound healing and treatment of inflammatory skin conditions (Gupta & Malhotra, 2004).

Curcuma longa has gained considerable attention due to the biological activity of curcumin. This compound exhibits strong antioxidant and anti-inflammatory properties and has been investigated for its potential role in the treatment of inflammatory skin diseases (Hewlings & Kalman, 2017).

Mentha piperita is another medicinal plant commonly used in dermatological and cosmetic formulations. Peppermint oil contains menthol and other volatile compounds that provide antimicrobial and analgesic effects. These properties support its application in topical preparations and oral hygiene products (Khanna & MacDonald, 2014).

In addition to these globally recognized species, several plants used in Azerbaijani traditional medicine also demonstrate potential dermatological applications. For example, *Urtica dioica* extracts are frequently used in hair-care products due to their potential role in improving scalp circulation and supporting hair growth (Həsənov, 2018; Əlizadə, 2016). Similarly, *Plantago major* has traditionally been applied to wounds and skin irritations because of its anti-inflammatory and tissue-regenerating properties.

These findings indicate that ethnobotanical knowledge can contribute to the development of innovative dermatological and cosmetic products based on plant-derived bioactive compounds.

Ethnobotanical Significance of Key Medicinal Plants

Thymus caucasicus

Thymus caucasicus occupies an important position in Azerbaijani traditional medicine. The plant has historically been used for the treatment of respiratory diseases and digestive disorders. Phytochemical studies confirm that its essential oils contain thymol and carvacrol, compounds with strong antimicrobial and antioxidant activity (İsmayılova & Məmmədov, 2010; Sharifi-Rad et al., 2020).

Urtica dioica

Urtica dioica represents one of the most widely used medicinal plants in Azerbaijani ethnomedicine. Traditional applications include treatment of anemia, inflammatory diseases, and metabolic disorders. Modern pharmacological research indicates that its therapeutic properties are associated with the presence of flavonoids, phenolic acids, vitamins, and mineral compounds that contribute to antioxidant and immunomodulatory effects (Əlizadə, 2016).

Plantago major

Plantago major is widely known for its wound-healing properties and has long been used in traditional medicine for the treatment of skin injuries and infections. The plant contains bioactive compounds such as polysaccharides and iridoid glycosides that promote epithelial regeneration and antimicrobial activity. Recent ethnopharmacological studies confirm the potential of *Plantago* species in modern biomedical research related to tissue repair (Həsənov, 2018; Swastini et al., 2022).

Discussion

Integration of Ethnohistorical Knowledge and Modern Pharmacology

The present review highlights the growing scientific interest in medicinal plants and their potential role in modern healthcare systems. The transition from traditional herbal practices to evidence-based pharmacology reflects an increasing recognition of the therapeutic value of plant-derived bioactive compounds. Previous studies indicate that the global rise in the use of herbal medicines is partly associated with the limitations of certain synthetic pharmaceuticals and the search for alternative therapeutic strategies (Ekor, 2014; El-Saadony et al., 2023; Pacyga et al., 2024).

Historical and Cultural Context of Medicinal Plant Use

One of the important observations of this study is the close relationship between Azerbaijani ethno-

medicine and the broader Eurasian medical tradition. Historical sources such as Mahmud al-Kashgari's *Dīwān Lughāt al-Turk* (1072) and the medical writings of Abu Ali ibn Sina (Avicenna) demonstrate that the use of medicinal plants has long been an organized component of medical knowledge in the Turkic and Islamic worlds. These historical sources provide valuable insights into early empirical observations concerning the therapeutic properties of various plant species.

The results of the present review indicate that several plants widely used in Azerbaijani traditional medicine, including *Nigella sativa* and *Thymus caucasicus*, contain bioactive compounds such as thymoquinone, thymol, and carvacrol that demonstrate significant pharmacological activity. Modern studies confirm that these compounds possess anti-inflammatory, antimicrobial, and antioxidant properties that may contribute to the management of various chronic diseases (Ali & Blunden, 2003; Sharifi-Rad et al., 2020).

Ethnobotanical Importance of Azerbaijani Medicinal Plants

Azerbaijan's diverse ecological zones and its historical position along the Great Silk Road have contributed to the development of a rich ethnobotanical tradition. The analysis presented in this study shows that plants such as *Thymus caucasicus*, *Urtica dioica*, and *Plantago major* play an important role in Azerbaijani folk medicine. These species have traditionally been used for the treatment of respiratory diseases, inflammatory conditions, anemia, and skin injuries.

Pharmacological studies indicate that these plants contain a wide range of biologically active compounds that support their traditional applications. For example, *Thymus* species are known to contain essential oils rich in thymol and carvacrol, while *Urtica dioica* contains flavonoids and mineral compounds associated with anti-inflammatory and hematopoietic effects. Similarly, *Plantago major* possesses bioactive components that promote wound healing and tissue regeneration (Əlizadə, 2016; Huseynov, 2021).

Challenges and Future Research Directions

Despite the promising therapeutic potential of medicinal plants, several challenges remain in their integration into modern medical practice. One of the primary limitations is the lack of standardized methods for the preparation, extraction, and dosage of herbal remedies. Variations in geographical origin, environmental conditions, and harvesting practices can significantly influence the concentration of active compounds in medicinal plants.

Another important challenge concerns the limited number of large-scale clinical trials evaluating the safety and efficacy of many traditional herbal preparations. Although numerous experimental studies demonstrate positive pharmacological effects, additional clinical research is required to establish standardized therapeutic protocols and ensure safe medical applications.

Concluding Remarks of the Discussion

Overall, the findings of this review indicate that medicinal plants used in Azerbaijani traditional medicine represent valuable ethnobotanical resources with considerable pharmacological potential. The integration of traditional knowledge with modern biomedical research may contribute to the discovery of new bioactive compounds and support the development of innovative therapeutic strategies in contemporary healthcare.

Conclusion

The findings of this review confirm that medicinal plants continue to represent an important source of biologically active compounds with potential therapeutic applications. The analysis of available scientific literature indicates that plant-derived substances such as flavonoids, iridoid glycosides, and essential oils possess significant anti-inflammatory, antioxidant, and immunomodulatory properties.

The results also demonstrate that, alongside globally recognized medicinal species such as *Zingiber officinale* and *Curcuma longa*, several plants traditionally used in Azerbaijani ethnomedicine–particularly *Thymus caucasicus*, *Urtica dioica*, and *Plantago major*–exhibit pharmacological activities that support their long-standing use in traditional therapeutic practices. These species represent valuable ethnobotanical resources and may provide promising perspectives for future pharmacological research and drug development.

Despite the growing scientific interest in medicinal plants, several challenges remain in their integration into modern medical practice. In particular, the lack of standardized extraction methods, dosage regulation, and large-scale clinical trials continues to limit the clinical validation of many traditional herbal preparations. Addressing these challenges requires interdisciplinary research that combines ethnobotany, pharmacology, and clinical medicine.

In conclusion, the integration of traditional ethnomedical knowledge with modern biomedi-

cal research may contribute to the identification of new bioactive compounds and support the development of innovative therapeutic approaches. Continued scientific investigation of medicinal plants, including species native to Azerbaijan, is essential for ensuring their safe, effective, and evidence-based application in contemporary healthcare systems.

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