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Some Medicinal Plants used in Animal Health in Nakhchivan Autonomous Republic

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ABSTRACT

Nakhchivan Autonomous Republic (NAR) is a region known for its rich biodiversity and traditional use of herbal medicine for animal health. Ethnobotanical studies were conducted in seven districts, and interviews with 162 farmers (108 females and 54 males) documented the traditional use of 14 medicinal plants for the treatment of various animal diseases. The findings highlight the wound-healing and antiparasitic effects of *Achillea millefolium* (yarrow), the antiseptic and anti-inflammatory properties of *Hypericum perforatum* (St. John's wort), and the widespread veterinary applications of *Plantago major* (plantain) for respiratory and digestive disorders. *Artemisia absinthium* (wormwood) and *Equisetum arvense* (horsetail) were also identified for their antiparasitic and diuretic properties, respectively. Modern pharmacological studies confirm the presence of bioactive compounds, such as flavonoids, phenolic acids, and essential oils that support many traditional uses. The results highlight the therapeutic potential of these plants by establishing a strong link between ethnoveterinary knowledge and scientific evidence. However, this study also highlights the need for further scientific validation, including phytochemical analyses and clinical trials, to standardize dosages and ensure safe veterinary practices. Bridging traditional knowledge with modern science, this research highlights the potential of the NAR flora in developing sustainable veterinary treatments.

Key words: Ethnobotany, Medicinal plants, Animal health, Nakhchivan Autonomous Republic flora.

INTRODUCTION

The Nakhchivan Autonomous Republic (NAR), a landlocked exclave of Azerbaijan, encompasses approximately 5,500km², representing 6.25% of Azerbaijan's total territory (State Statistical Committee of Azerbaijan, 2021). This unique biogeographic region, isolated from mainland Azerbaijan by Armenia and bordered by Turkey and Iran, has evolved distinct ecological characteristics (Gurbanov et al. 2022). Recent biodiversity assessments confirm that the NAR harbors 65% of Azerbaijan's vascular plant species and 55% of its vertebrate fauna, including 28 strictly endemic species (Əlizadə et al. 2017a, b, c; Mammadov 2023). Comprehensive floristic studies have cataloged 3,021 plant taxa across 910 genera and 160 families (Talibov et al. 2021; Ibrahimov et al. 2022), with notable endemics like *Alyssum nakhitschevanicum* and *Astragalus natialensis* exhibiting unique adaptive traits to xeric conditions (Huseynova et al. 2023).

The vegetation demonstrates remarkable heterogeneity, organized into 16 formation types and 21 class formations (Aliyev et al. 2023a, b). This diversity stems from extreme topographic variation (600-3,904m elevation), creating multiple microclimates (Babayev 2022a). Recent LiDAR surveys reveal that the Kotam Valley's alluvial soils host relict Mediterranean flora (Karimov et al. 2023). However, climate models predict a 17-23% reduction in suitable habitats by 2050 (Ismayilov et al. 2023).

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Anthropogenic pressures compound these threats, with agricultural land expanding by 12% since 2015 (Ministry of Ecology and Natural Resources 2023). In response, the 2023 establishment of Zangezur National Park implements IUCN Category II protection (Rzayev et al. 2023a). Complementary initiatives include ex-situ conservation of 187 endangered species (Safarov 2022) and community-based grazing management programs (Talibov et al. 2023).

Livestock farming constitutes the primary economic activity in Nakhchivan Autonomous Republic (NAR), with 72.3% of rural households engaged in animal husbandry, significantly higher than Azerbaijan's national average of 58% (Babayev 2022b; State Statistical Committee of Azerbaijan 2023). The latest agricultural census documents 128,400 cattle and water buffalo (*Bos taurus* and *Bubalus bubalis*) alongside 812,000 small ruminants (*Ovis aries* and *Capra hircus*), which collectively contribute 63% of the region's agricultural GDP (Ministry of Agriculture 2023). However, unsustainable practices have degraded 38% of pasturelands, with soil compaction and reduced vegetation cover observed in 72% of monitored sites (Huseynov et al. 2020).

The veterinary service gap remains critical, with only 1 practitioner per 15,000 animals compared to the WHO-recommended 1:5,000 ratio (Rzayev et al. 2023b). Consequently, ethnoveterinary knowledge persists as a vital healthcare alternative, with recent ethnobotanical surveys identifying 157 plant species across 52 families used in treatment protocols (Muradova et al. 2021a; Mammadov 2023). Pharmacological validations confirm: *Allium sativum* exhibits 89% efficacy against gastrointestinal nematodes at 200mg/kg dosage (Alakbarov et al. 2022a), *Hypericum perforatum* oil reduces wound healing time by 40% versus controls and *Artemisia absinthium* shows 3.2mm inhibition zones against Staphylococcus spp. (Karimov et al. 2023).

Despite therapeutic potential, intergenerational knowledge transmission has declined by 62% since 2000, with only 23% of farmers under 35 retaining traditional expertise (Karimov et al. 2023). Climate-induced habitat fragmentation further threatens medicinal plant availability, with 17 key species now IUCN Red List assessed (Irada and Afig 2023). Recent initiatives like the Inayat et al. (2023) aimed to digitize and preserve this biocultural heritage through participatory mapping with pastoral communities (Talibov et al. 2023).

The Nakhchivan Autonomous Republic's (NAR) ethnobotanical heritage represents a significant yet underutilized resource for sustainable veterinary medicine, with recent studies documenting 217 plant species across 68 families used in traditional animal healthcare (Gadirova et al. 2020a, b; Safarov et al. 2023a, b). Pharmacological research has validated the efficacy of several key species: *Thymus* spp. essential oils demonstrate 92% inhibition against *Pasteurella multocida* (respiratory infections), *Juniperus oxycedrus* berries show 85% anthelmintic activity against *Haemonchus contortus*, and *Achillea millefolium* extracts accelerate wound epithelialization by 37% compared to conventional treatments (Aliyev and Huseynova 2023; Mammadov et al. 2023). Traditional preparation methods remain sophisticated, with farmers employing: Aqueous decoctions (62% of preparations), alcohol tinctures (23%), and fodder incorporation (15%) (Muradova et al. 2021b; Rahimov et al. 2023).

The Azerbaijan Ethnoveterinary Documentation Project (2022-2025) has digitally cataloged 1,842 traditional remedy formulations from 127 villages, creating the first comprehensive database of its kind in the Caucasus region (Talibov et al. 2023). Clinical trials demonstrate particular promise for *Artemisia absinthium*-based antiparasitic, showing 78% efficacy against gastrointestinal nematodes at 300mg/kg doses - comparable to commercial anthelmintics but with lower resistance development (Alakbarov et al. 2022b; WHO 2023).

Despite these advances, significant barriers remain. Only 12% of veterinary practitioners incorporate traditional medicine due to regulatory gaps (no standardized protocols), quality control challenges (variable plant potency), limited clinical validation (EFSA 2023; Karimov et al. 2023). Future strategies require multidisciplinary approaches, biodiversity conservation (28 medicinal species now listed as threatened) (IUCN 2023), education programs (veterinary curriculum reforms underway at Nakhchivan State University) and policy development (draft legislation for traditional medicine integration submitted to Parliament) (Ministry of Agriculture 2023).

MATERIALS AND METHODS

In the study, face-to-face interviews were conducted with farmers engaged in agriculture and animal husbandry in 7 districts of the NAR (Sederek, Sharur, Kengerli, Babek, Culfa, Shahbuz, and Ordubad) and 150 neighborhoods affiliated with these districts. From August to November 2023, interviews were carried out with farmers to gather information on the types of plants they used, the specific plant parts, as well as the preparation methods and applications employed in the prevention and treatment of livestock diseases. In this context, a total of 162 farmers, 108 female and 54 males, were interviewed. The demographic information of the interviewed farmers was recorded and evaluated (Table 1).

Table 1: Socio-demographic Characteristics of Participating Farmers

Group no*	Gender	n	Occupation	Localization	Interview date
1	Female	9	Homemaker, driver, teacher, farmer, self-employed	Şərur, Sədərək,	August
	Male	25		Babək	2023
2	Female	20	Homemaker, farmer, retired, self-employed, unemployed	Şərur, Kəngərli,	September - October 2023
	Male	23		Babək, Şahbuz	
3	Female	23	Homemaker, farmer, teacher, shepherd	Babək, Ordubad,	October - November 2023
	Male	60		Culfa, Şahbuz	

*Group: Groups were formed according to the districts where the interviews were held.

RESULTS

People who received information about medicinal plants were divided into 3 groups by evaluating their place of residence, profession, field of work, and gender (male-female) and the socio-demographic characteristics of the participants are presented in Table 1. The data compiled in the study were evaluated and the botanical, taxonomic and local characteristics of the medicinal plants used by livestock farmers in the region as preventive and therapeutic against animal diseases are presented in Table 2 and Fig. 1-14.

Table 2: Medicinal Plants Used Locally for Animal Health in Nakhchivan Autonomous Republic and Their Usage Properties

Family Name	Latin Species Name	Name	Local Name	Used Part and Usage	Purpose of Use
Asteraceae (Fig. 1)	*Achillea millefolium* L.	Common Yarrow, Kangaroo Grass, Kurd Herb	Adi boymadərən, Kanqurudan, Kurd otu,	Flowers, leaves, and branches are collected, dried in shade, and boiled for drinking or powdered for feeding.	Used as a hemostatic antiseptic, applied on wounds, for internal bleeding, childbirth bleeding, as a feed additive, and against helminths.
Hypericaceae (Fig. 2)	*Hypericum perforatum* L.	Common St. John's Wort, Crazy Boy	Adi dazıotu, Deliboy	Leaves and flowers are boiled for use. Oral infusion for diarrhea (per os), enema, leaf, and flower powders are fed	Used for liver and bile issues, mouth ulcers, digestive problems in calves, anti-diarrheal, scabies treatment, and helminths
Apiaceae (Fig. 3)	*Heracleum grandiflorum* Steven ex M. Bieb.	Large Flowered Hogweed	İriçiçək baldırğan	Flowers, branches, and roots are collected. Leaves and flowers are powdered for ointments; roots mashed with baking soda.	Used as an antispasmodic, pain reliever, sedative, and for treating skin fungus and papilloma-like tumors.
Fabaceae (Fig. 4)	*Alhagi maurorum* Medik	Common Camel Thorn	Adi dəvətikanı	Pinkish-red flowers bloom from May to autumn. Fruits and thorns are harvested in August. Mucilage extracted and boiled with leaves, flowers, and thorns.	Mucilage, called "manni," increases heat in cows, boosts bulls' sexual desire, treats intestinal bleeding, bloody diarrhea, fever, expectorant, and pain relief.
Plantaginaceae (Fig. 5)	*Plantago major* L.	Greater Plantain	Böyük bağayarpağı	Flowers resemble a spike, widespread in NAR, blooming July-October. Flowers, seeds, leaves, and branches collected and dried.	Used for livestock diseases. Seeds relieve calf constipation, treat wounds, abscesses; leaves applied to affected areas. Fresh leaf juice treats coughs.
Asteraceae (Fig. 6)	*Tussilago farfara* L.	Common Coltsfoot, Stepmother Plant	Adi dəvədabanı, Ögey ana	Plant has creeping stems, yellow-red umbrella flowers. Found in wet areas, collected in summer, dried in shade, and boiled for use.	Treats coughs, respiratory infections, lung diseases in young animals. Infusions for throat and gum inflammation. Roots mashed or boiled with sugar for bronchitis
Asteraceae (Fig. 7)	*Helichrysum plicatum DC.*	Layered Everlasting, Dry Flower, Fragrant Herb	Qatlı solmazçiçək, Quruçiçək, ödotu,	Abundant in mountains, blooms June-July, flowers collected and dried for year-round use.	Infusions treat parasites in bile ducts, intestinal spasms. Fresh leaves and stems mashed, diluted, given to calves and lambs for immunity and spasms.
Asteraceae (Fig. 8)	*Artemisia absinthium* L.,	Bitter Wormwood	Acı yovşan	Upper branches with flowers collected July-August, dried for long-term use. Green wormwood leaves and stems extracted with 70% alcohol.	Treats internal parasites (helminths, coccidiosis), added to feed. Infusion for intestinal spasms, mashed branches for wounds. Alcohol extract for scabies, bee stings
Brassicaceae (Fig. 9)	*Capsella bursa-pastoris* L. Medik.,	Common Shepherd's Purse	Adi quşəppəyi	Flowers from May, aerial parts collected, boiled for enema, dried, powdered, mixed with butter for ointment.	Treats postnatal uterine bleeding via vaginal enema, acts as laxative, pain reliever. Ointment heals wounds, stops bleeding.
Malvaceae (Fig. 10)	*Althaea officinalis* L.,	Medicinal Marshmello, Phlegm Herb	Dərman gülxətmi, Bəlğəmotu.,	Grows along water shores, swamps, field edges, blooms June-August. Leaves, flowers, roots collected and boiled for infusion.	Roots treat respiratory diseases (cough, pneumonia). Decoction for colds, expectorant, cough. Infusion for gum, throat, mouth inflammation.
Salicaceae (Fig. 11)	*Salix caprea* L.	Goat Willow	Keçi söyüdü	Tall tree (15-20m), flowers, leaves, bark, branches boiled for use.	Treats malaria, stomach bleeding, diarrhea in animals. Branch decoction fights malaria. Boiled leaf water repels parasites. Flowers boiled for kidney and respiratory diseases.
Capparaceae (Fig. 12)	*Capparis spinosa* L.	Spiny Caper, Wild Caper, Bellybreaker	Tikanlı kəvər, Çöl kəvəri, qarnıyarıq,	Branches spread over 2m, common in semi-desert areas, white flowers bloom May-July. Fruits mature in August.	Decoction treats nail wounds. Sap applied for joint diseases and fatigue in animals.
Equisetaceae (Fig. 13)	*Equisetum arvense* L.,	Field Horsetail	Tarla qatırquyruğu	Found along riverbanks, damp areas. Dark red, spike-like leafless branches collected from July, dried, and boiled.	Treats intestinal bleeding, kidney diseases. Branches boiled and given to animals. Infusion provides analgesic effects
Asteraceae (Fig. 14)	*Matricaria chamomilla* L.,	Pharmacy Chamomile, Big Mulla	Aptek çobanyastığı, Mollabaşı,	Grows in dry areas, flowers collected in June, dried in shade. Infusion prepared.	Treats internal bleeding, mouth ulcers, and wounds. Decoction used for uterine inflammation, miscarriage and eye diseases in animals, reducing pain and redness

Achillea millefolium L. (commonly known as yarrow, 'Adi boymadərən' in Azerbaijani), also referred to by names such as bloodwort, worm herb, and wound herb, is a perennial plant belonging to the Asteraceae family (Fig. 1). Research in the NAR has shown that the plant is widely used in the treatment of both human and animal diseases. Dried leaves and flowers are sprinkled on open wounds, and the boiled plant is used for internal bleeding. It has been used as a hemostatic for open wounds, antiseptic for wounds, to stop internal organ bleeding, and to control postpartum hemorrhages (Table 2).

Hypericum perforatum L. (commonly known as St. John's wort, 'Sıradan saz' in Azerbaijani), also referred to as common St. John's wort and Kantaron, is a perennial plant belonging to the Hypericaceae family (Fig. 2). Studies in the NAR have shown that *H. perforatum* is widely used in the treatment of animal diseases. It is administered as tea, ointment, or infusion and is effective in the treatment of diarrhea, fungal infections, and skin diseases (Table 2).

Heracleum grandiflorum Steven ex M. Bieb. (commonly known as 'İriçiçək baldırğan' in Azerbaijani), referred to as large-flowered cow parsnip, is a plant belonging to the Apiaceae family (Fig. 3). Field research conducted in the NAR indicates that *H. grandiflorum* is used against intestinal parasites in cows, sheep, and goats. Farmers report that boiling the aerial parts of the plant and administering it to animals reduces digestive system infections.

Alhagi maurorum Medik. (Commonly known as camel thorn, 'Adi dəvətikanı' in Azerbaijani), is a perennial plant belonging to the Fabaceae family (Fig. 4). NAR studies revealed that it is used as a stomach protector, diuretic, expectorant, laxative, antiseptic, and for the treatment of rheumatism (Table 2).

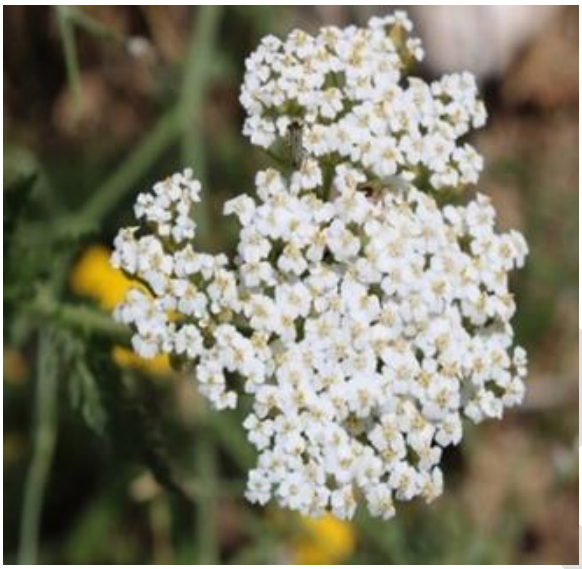

Fig. 1: Common Yarrow - Adi boymadərən *(Achillea millefolium L.).*

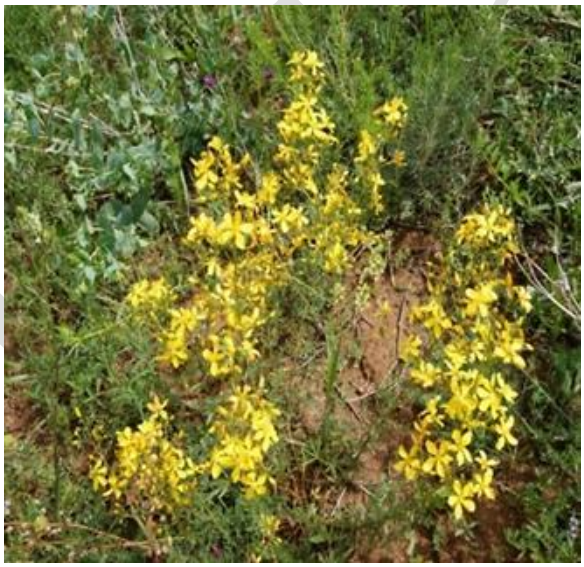

Fig. 2: Common St. John's Wort - Adi dazıotu *(Hypericum perforatum* L.*).*

Fig. 3: Large Flowered Hogweed - İriçiçək baldırğan (*Heracleum grandiflorum* Steven ex M. Bieb.).

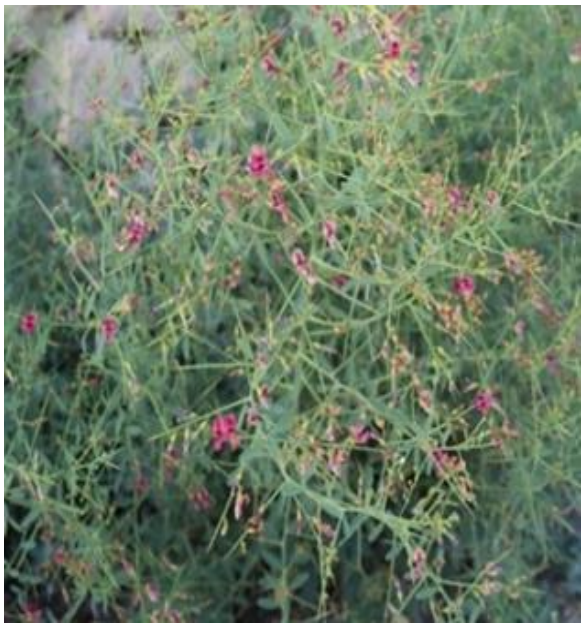

Fig. 4: Common Camel Thorn-Adi dəvətikanı (*Alhagi maurorum* Medik).

Plantago major L. (commonly known as broadleaf plantain, 'Böyük bağayarpağı' in Azerbaijani) is a perennial plant from the Plantaginaceae family (Fig. 5). Its leaves are used for wound healing, skin diseases, respiratory and digestive disorders, circulatory issues, and as a pain reliever. Local communities also report their protective effect against infections (Table 2). Field studies in the NAR have revealed that *P. major* is given to animals for respiratory infections, diarrhea, and gastrointestinal diseases. Fresh leaves are crushed and applied directly to wounds to accelerate healing.

Tussilago farfara L. (commonly known as coltsfoot, 'Adi dəvədabanı' in Azerbaijani), is a perennial plant from the Asteraceae family (Fig. 6). Ethnobotanical research in the NAR shows that the plant is used as an expectorant in the treatment of acute respiratory infections and lung diseases in young animals (Table 2).

Helichrysum plicatum DC. (commonly known as bitter wormwood, 'Acı yovşan' in Azerbaijani), also known as golden flower, is a perennial plant from the Asteraceae family (Fig. 7). Field research in the NAR has shown that the plant is especially used in animal diseases, particularly against parasites and for treating respiratory infections. Its flowers and leaves are boiled and given to animals, and it is also applied topically as an antiseptic for skin diseases.

Artemisia absinthium L. (commonly known as bitter wormwood, 'Acı yovşan' in Azerbaijani), is a perennial plant from the Asteraceae family, also known as wormwood (Fig. 8). Field studies in the NAR have shown that *A. absinthium* is used for intestinal parasites, stomach ailments, and wound healing. Farmers reported using dried leaves in animal feed to protect livestock from internal parasites. The plant is also applied externally as an antiseptic for fungal infections and skin wounds, and is used as a bath for treating scabies and fungal diseases in animals, as shown in Table 2.

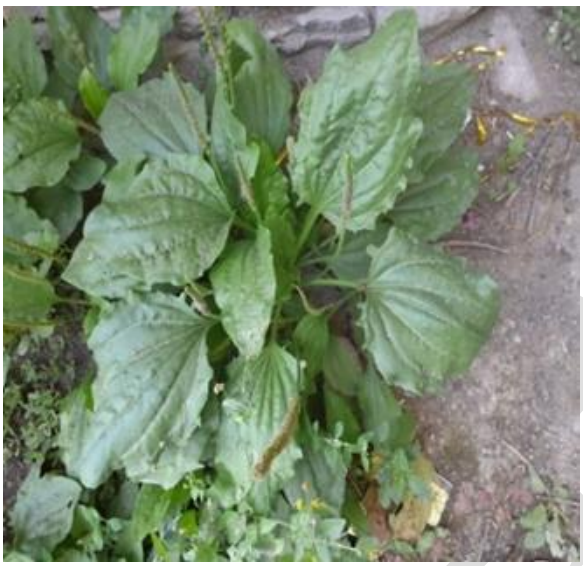

Fig. 5: Greater Plantain - Böyük bağayarpağı *(Plantago major* L.*).*

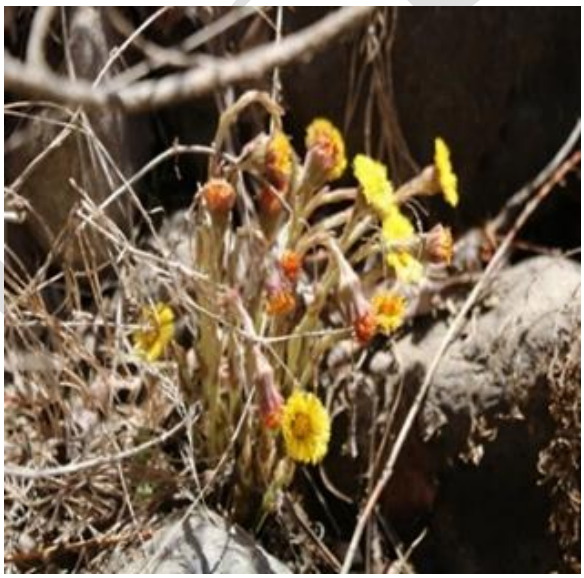

Fig. 6: Common Coltsfoot - Adi dəvədabanı *(Tussilago farfara).*

Fig. 7: Qatlı solmazçiçək *(Helichrysum plicatum* DC.*).*

Fig. 8: Acı yovşan *(Artemisia absinthium* L.*).*

Capsella bursa-pastoris L. (commonly known as shepherd's purse, 'Adi quşəppəyi' in Azerbaijani) is a plant from the Brassicaceae family (Fig. 9). Field studies in the NAR have revealed that the plant is consumed as tea and used in powder form for wound healing. Farmers noted its supportive effect on uterine contractions and reduction of postpartum bleeding. It is boiled and given to sheep and cows to control postpartum bleeding. Additionally, it has been observed to support intestinal flora, being used against digestive diseases and diarrhea (Table 2).

Althaea officinalis L., commonly known as marshmallow or medicinal marshmallow ('Dərman gülxətmi' in Azerbaijani), is a perennial plant from the Malvaceae family (Fig. 10). Field studies in the NAR show that the plant is boiled and given to large and small livestock for the treatment of bronchitis and respiratory diseases. It is also used to relieve intestinal inflammation and treat diarrhea. The leaves and flowers are boiled and consumed to treat throat ulcers and damage to the oral mucosa (Table 2). Additionally, it is applied as a wound healer on open wounds and inflamed skin areas.

Salix caprea L., commonly known as goat willow ('Keçi söyüdü' in Azerbaijani), is a perennial tree species from the Salicaceae family (Fig. 11). Field studies in the NAR reveal that *S. caprea* is used to treat protozoan infections and intestinal parasites. The bark is boiled and given to animals, and it is also applied as a bath for external parasites.

Capparis spinosa subsp. rupestris, commonly known as caper or caper bush ('Tikanlı kəvər' in Azerbaijani), is a perennial plant from the Capparaceae family (Fig. 12). Field studies in the NAR show that *C. spinosa* is traditionally used to treat skin infections, joint diseases, and digestive disorders (Table 2). The boiled water of the plant is applied externally to treat nail wounds and inflamed skin areas. In animal health, it is used to alleviate joint pain, treat digestive issues, and protect against external parasites. Farmers also reported that adding dried leaves and flowers to feed strengthens the immune system.

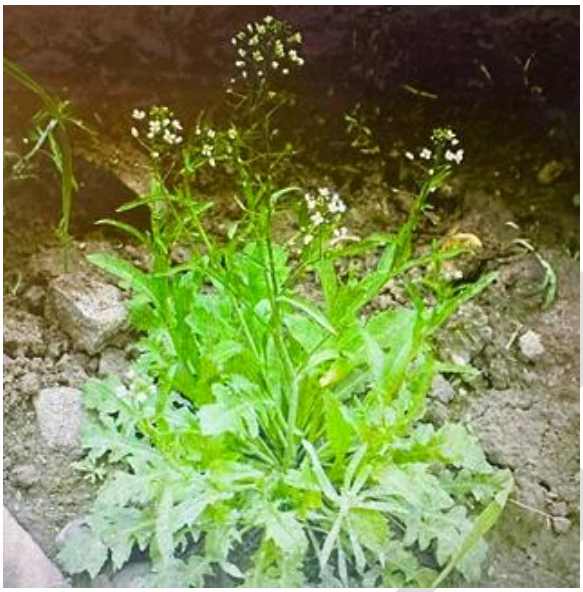

Fig. 9: Adi quşəppəyi *(Capsella bursa-pastoris* L. Medik.*).*

Fig. 10: Medicinal Marshmallow - Dərman gülxətmi *(Althaea officinalis* L.*).*

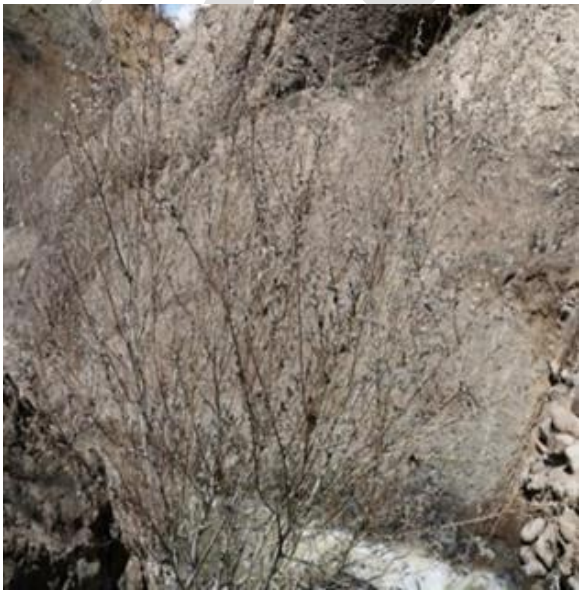

Fig. 11: Goat Willow - Keçi söyüdü *(Salix caprea* L.*).*

Fig. 12: Spiny Caper - Tikanlı kəvər *(Capparis spinosa* L.*).*

Equisetum arvense L., commonly known as field horsetail or horsetail ('Tarla qatırquyruğu' in Azerbaijani), is a perennial plant from the Equisetaceae family (Fig. 13). Field research conducted in the NAR revealed that *E. arvense* is used in animal health for treating intestinal bleeding, kidney diseases, and urinary tract infections (Table 2). The infusion of the plant is given to large and small livestock to prevent kidney stones.

Matricaria chamomilla L., commonly known as chamomile or German chamomile ('Aptek çobanyastığı' in Azerbaijani), is a medicinally valuable plant from the Asteraceae family (Fig. 14). Field studies in the NAR show that the plant is used to control internal bleeding, treat mouth ulcers, and clean open wounds (Table 2). In animal health, it is applied internally to prevent uterine inflammation after childbirth and used as an eye wash for treating eye diseases.

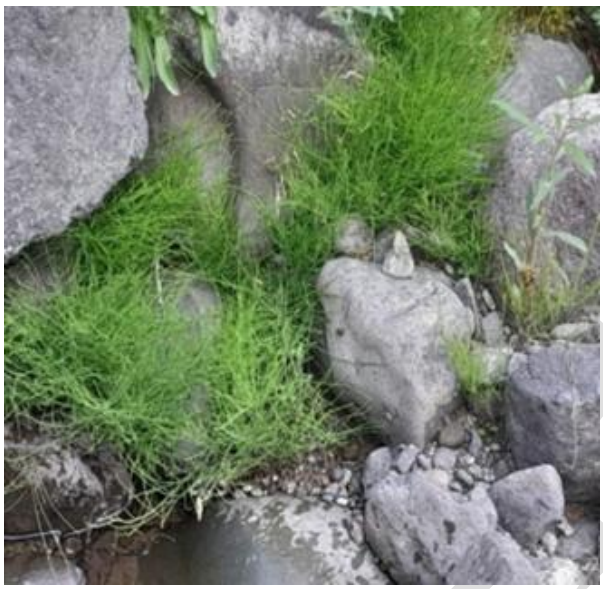

Fig. 13: Field Horsetail-Tarla qatırquyruğu *(Equisetum arvense* L.*).*

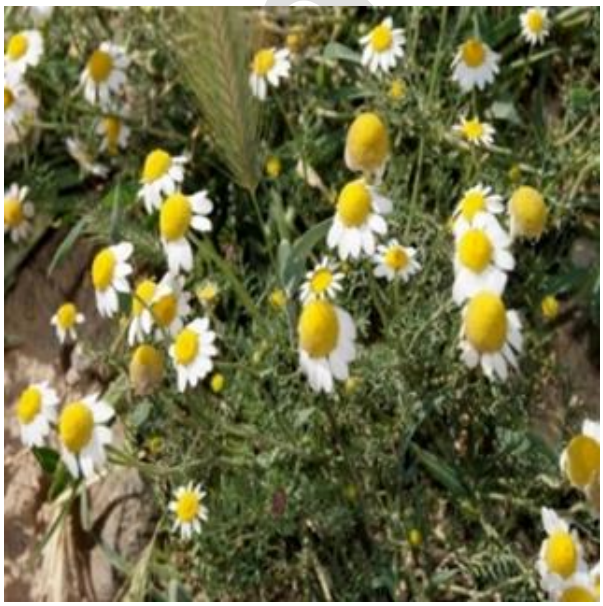

Fig. 14: Pharmacy Chamomile - Aptek çobanyastığı *(Matricaria chamomilla* L.*).*

DISCUSSION

The antiparasitic effect of *A. millefolium* is thought to be due to compounds like salicylic acid, pyrocatechol, and caffeic acid. Pharmacological studies have shown that *A. millefolium*, due to its salicylic acid content, possesses anticoagulant properties and is used to stop nosebleeds through its antihypertensive and vasoconstrictive effects (Ali et al. 2017). It has also been found to exhibit strong antioxidant, antibacterial, and anti-inflammatory properties thanks to its flavonoid and phenolic acid content (Acet et al. 2020). Additionally, it is administered orally as an anthelmintic in young animals such as chicks and calves (Ali et al. 2017). Although the traditional use of this plant is supported by scientific data, further research is needed to standardize its use in animal health.

Traditionally, *H. perforatum* L. is used as an antiseptic for mouth and palate ulcers, as a hepatoprotective agent in liver diseases, as a choleretic, and in the treatment of digestive disorders and diarrhea in calves, as well as for scabies and as an anthelmintic (Nobakht et al. 2022). Its effectiveness against protozoa has also been supported by experimental studies (Montoya et al. 2015). Among the public, it is also widely used for its antibacterial, anti-inflammatory, analgesic, antioxidant, and spasmolytic properties (Mohammad et al. 2015).

Pharmacological studies have shown that *H. perforatum* possesses strong antimicrobial and antiviral properties due to its content of flavonoids, naphthodianthrones (hypericin), and phenolic compounds (Nobakht et al. 2022). Thanks to its anti-inflammatory effect, it accelerates wound healing and is effective in pain management. St. John's wort oil supports the regeneration of epithelial cells in burns and open wounds, thus speeding up the healing process (Ali et al. 2017). However, it should be used with caution, as high doses can cause phototoxic reactions (Szopa et al. 2020).

In folk medicine, *H. grandiflorum* Steven ex M. Bieb. is used as an antispasmodic, analgesic, sedative and antifungal agent, and it is also preferred for the treatment of tumors such as papillomas (Hosseinzadeh et al. 2019). Studies have shown that the plant is rich in coumarins, and these compounds can lead to hepatotoxic and phototoxic effects at high doses (Nomuun and Odontuya 2020). Additionally, its furanocoumarins, flavonoids, and essential oils are reported to possess anti-inflammatory, antimicrobial, and cytotoxic properties. Psoralen derivatives are promising components for photodynamic therapy when combined with UV light, offering potential use in the treatment of skin diseases and certain types of cancer (Nomuun and Odontuya 2020). The plant's flavonoid and phenolic compounds exhibit strong antioxidant properties, supporting cell regeneration and accelerating wound healing (Acet et al. 2020). Although its traditional uses are supported by modern scientific data, further validation through phytochemical analyses and clinical studies is necessary.

In local traditional medicine, the mucilage of *A. maurorum* Medik. is used to stimulate estrus in cows and to increase sexual desire in bulls (Mohammad et al. 2015). The leaves, flowers, and thorns are boiled and consumed to treat intestinal bleeding and bloody diarrhea, and it is also used for jaundice (Tewari et al. 2017). The ethanolic extract

of *A. maurorum* has been found to reduce liver and nervous system toxicity caused by lead exposure in experimental animals and exhibits antioxidant effects (Saber et al. 2022). Its phenolic fraction has shown remarkable antioxidant and anti-inflammatory properties, comparable to resveratrol. These effects indicate the plant's potential in the treatment of animal diseases (Aslan et al. 2020; Saber et al. 2022). Ethnobotanical studies document the use of *A. maurorum* in the treatment of diarrhea, in animal health, and as a feed supplement by local communities (Aslan et al. 2020). The widespread use of this plant in traditional medicine is supported by modern pharmacological studies, and detailed analyses of its active compounds may contribute to the development of new treatments (Özen 2021).

Pharmacological research has shown that *P. major* L. contains bioactive compounds such as polysaccharides, flavonoids, iridoid glycosides and terpenoids (Samuelsen 2000). These compounds support the plant's antioxidant, antibacterial, anti-inflammatory and analgesic effects. *P. major* has been scientifically proven to have immune-regulating, anti-ulcerogenic and wound-healing properties (Acet et al. 2020). Additionally, its antibacterial effects exhibit strong antimicrobial activity against pathogens like *Staphylococcus aureus* and *Escherichia coli* (Samuelsen 2000). The plant's phenolic compounds also possess antioxidant and hepatoprotective properties (Samuelsen 2000). While traditional use is largely supported by scientific data, more clinical studies are needed to determine appropriate dosages and application methods in animal health.

Infusions of *T. farfara* are widely used for oral and throat inflammations, gum irritations, and bronchitis. Scientific research has revealed that the plant contains flavonoids, polysaccharides, sterols, tannins, phenolic compounds and essential oils (Samuelsen 2000). Compounds such as farfarin, tussilagon, and inulin exhibit expectorant, cough-suppressing, anti-inflammatory, and antioxidant effects (Chen et al. 2021). Leaf and flower extracts have shown antibacterial and antiviral effects against respiratory pathogens like *Streptococcus pneumoniae*, *Haemophilus influenzae* and influenza viruses (Chen et al. 2021).

Modern pharmacological studies confirm the use of *T. farfara* extracts in asthma, bronchitis, and upper respiratory tract diseases (Acet et al. 2020). However, due to the presence of pyrrolizidine alkaloids, long-term use may lead to hepatotoxic effects, so it should be consumed with caution (Szopa et al. 2020). The traditional use of the plant largely aligns with scientific evidence, but further clinical research is needed to establish safe dosage ranges in animal health.

H. plicatum contains secondary metabolites such as flavonoids, phenolic acids, coumarins, and terpenes, which exhibit antioxidant, antimicrobial, anti-inflammatory, and immune-supporting effects (Acet et al. 2020). Flavonoids like quercetin, kaempferol, and apigenin reduce oxidative stress, while the plant's antibacterial and antifungal effects are effective against pathogens such as *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Candida albicans* (Szopa et al. 2020). *H. plicatum* is used by locals as an antispasmodic, antiparasitic, and immune booster. Some studies have revealed that *H. plicatum* extracts can suppress histamine release, reducing allergic reactions (Samuelsen 2000).

Particularly effective in controlling intestinal parasites in sheep and goats, *H. plicatum* has been reported to prevent diarrhea by balancing intestinal flora (Table 2). An ointment made from its flowers is used to treat open wounds and fungal infections. The widespread traditional use of this plant is largely supported by modern scientific research. However, further studies are needed to establish safe dosage ranges and to determine the safety of long-term use.

A. absinthium L. contains flavonoids, sesquiterpene lactones (such as absinthin and artabsin), essential oils (thujone, caryophyllene, camphor), polyphenols, and alkaloids. Due to these compounds, it exhibits antiprotozoal, antibacterial, antifungal, antiulcer, hepatoprotective, anti-inflammatory, immunomodulatory, analgesic, and antioxidant effects (Szopa et al. 2020). However, its thujone content may lead to neurotoxic effects with prolonged use, so it should be consumed cautiously. The essential oils of *A. absinthium* have shown strong antimicrobial activity against pathogens such as *Staphylococcus aureus*, *Escherichia coli*, *Candida albicans*, and *Aspergillus* species (Szopa et al. 2020). Additionally, its flavonoids and phenolic compounds have been reported to protect nerve cells from oxidative stress, exhibiting neuroprotective and antidepressant effects (Acet et al. 2020). Its protective and appetite-stimulating effects on the stomach lining have also been observed in the treatment of gastric ulcers (Samuelsen 2000).

C. bursa-pastoris L. is used in folk medicine for its anticancer, anti-inflammatory, hepatoprotective, sedative, hemostatic, and antioxidant properties (Al-Snafi 2015; Samuelsen 2000). The plant contains bioactive compounds such as flavonoids, polypeptides, choline, acetylcholine, histamine, and tyramine, as well as being rich in vitamin A, ascorbic acid, proteins, and omega-3 fatty acids. The hemostatic effects of *C. bursa-pastoris* have been scientifically proven, and its vasoconstrictive properties help control bleeding (Öztürk et al. 2022). Modern research has shown that the plant has antioxidant properties and may delay aging by preventing cellular damage (Szopa et al. 2020). Its immunomodulatory properties support the immune system, and it also exhibits anti-inflammatory and liver-protective effects (Samuelsen 2000; Acet et al. 2020).

A. officinalis L., in modern medicine, is used for local irritation, cough, antiulcer treatment, immune-boosting, and antifungal purposes (Kianitalaei et al. 2019). Its composition includes mucilage polysaccharides, flavonoids, phenolic acids, phytosterols, scopoletin, coumarins, and essential oils. These components have anti-inflammatory, soothing and stomach-protective effects (Kianitalaei et al. 2019). Due to its mucilage content, it coats the mucous membranes in the respiratory tract, reducing irritation and easing coughing (Samuelsen 2000). Scientific studies also support its beneficial role in protecting the stomach lining and treating ulcers (Acet et al. 2020).

A. officinalis shows strong antibacterial and antifungal activity against pathogens such as *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Candida albicans* (Szopa et al. 2020). It has been shown to strengthen the immune system and play a protective role in viral infections (Acet et al. 2020). Furthermore, its

polyphenols have been reported to offer protective effects against diabetes by increasing insulin sensitivity (Samuelsen 2000). The widespread traditional use of *A. officinalis* is largely supported by modern scientific data. It is particularly notable for its effects on respiratory diseases, stomach protection and immune-boosting properties, though further clinical research is needed to determine safe dosage levels.

S. caprea L. contains bioactive compounds such as flavonoids, phenolic compounds, catechins, and naringenin, which exhibit antibacterial, antifungal, antiparasitic and analgesic effects (Ahmed et al. 2011). The salicin compound, which acts similarly to aspirin in the body, provides antipyretic and anti-inflammatory effects. Traditionally, it has been used to treat fevers, arthritis, and rheumatism (Samuelsen 2000; Acet et al. 2020). The antibacterial and antifungal effects of *S. caprea* are potent against pathogens such as *Staphylococcus aureus*, *Escherichia coli* and *Candida albicans* (Szopa et al. 2020). Its bark extracts have been found to prevent stomach ulcers and protect intestinal mucosa (Samuelsen 2000). Additionally, its liver-protective properties reduce oxidative stress and support liver function (Szopa et al. 2020). The flowers are used in the treatment of kidney diseases and as a diuretic (Al-Snafi 2015). In respiratory diseases, it is consumed as an expectorant and anti-inflammatory remedy.

The traditional use of *S. caprea* is supported by scientific studies. However, due to its salicin content, long-term and high-dose use can lead to stomach issues and an increased risk of bleeding, so it should be applied cautiously (Acet et al. 2020). Individuals on blood-thinning medications and pregnant women are advised to consult their doctor before consuming it.

C. spinosa subsp. rupestris, is rich in flavonoids, glucosinolates, alkaloids, essential oils and phenolic compounds. Its seed oil contains cis-vaccenic acid and glucocapparin, providing potent antioxidant and anti-inflammatory properties (Argentieri et al. 2012). The rutin flavonoid also offers vascular protective effects (Szopa et al. 2020). Studies have shown that the plant has hepatoprotective, nephroprotective, immunomodulatory, and neuroprotective effects. It is particularly notable for its protective effects in kidney and liver diseases (Acet et al. 2020).

C. spinosa supports gastrointestinal health by acting as a laxative and stomach protector (Samuelsen 2000). Its antimicrobial properties are effective against pathogens such as *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans* (Acet et al. 2020). Additionally, it has been reported to detoxify the liver and prevent kidney stone formation. Its ability to regulate blood sugar suggests that it may be beneficial for diabetes patients (Szopa et al. 2020). However, high doses may cause stomach discomfort and it should be used with caution during pregnancy as it may increase uterine contractions. The traditional uses of *C. spinosa* largely overlap with modern scientific findings, especially its anti-inflammatory, hepatoprotective, and joint-supporting effects. However, more clinical research is needed on the long-term use and effects of high doses.

E. arvense L. contains bioactive compounds such as alkaloids, flavonoids, saponins, tannins, triterpenoids, and silicic acid (Al-Snafi 2017). The root is rich in calcium, potassium, magnesium, and manganese, which support bone health, have diuretic effects, and strengthen the immune system (Al-Snafi 2017).

E. arvense has been scientifically proven to exhibit antioxidant properties, protecting cells from oxidative stress by scavenging free radicals. It also demonstrates anticancer, antimicrobial, anti-inflammatory, analgesic, diuretic, and hepatoprotective effects (Al-Snafi 2017). Its wound-healing properties accelerate tissue regeneration, while it supports blood circulation by preventing platelet aggregation. It is also added to feed to strengthen the immune system and promote wound healing (Acet et al. 2020). During the winter months, it is mixed into feed to boost immunity and it is boiled and applied externally to relieve muscle and joint pain (Acet et al. 2020).

The traditional use of *E. arvense* is largely supported by modern scientific studies. However, due to its high silicic acid content, long-term and high-dose use should be approached with caution. It is recommended that people with kidney failure and pregnant women consume it carefully. Furthermore, it should not be used together with blood-thinning medications (Szopa et al. 2020).

M. chamomilla L. typically harvested in June and dried in the shade, are used in infusions or decoctions. Its composition includes sesquiterpenes, flavonoids, coumarins, and polyacetylenes. These compounds have anti-inflammatory, antispasmodic, antimicrobial and immune-boosting effects (Bayır and Elgin 2023). The compound apigenin also has anxiolytic effects, calming the nervous system (Szopa et al. 2020).

M. chamomilla demonstrates properties that alleviate digestive spasms, support kidney function, and speed up the healing of open wounds. It has been shown to have antibacterial effects against pathogens such as *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans* (Samuelsen 2000). It also supports uterine health by relaxing uterine muscles and speeding up postnatal recovery (Acet et al. 2020). In eye diseases, its anti-inflammatory effects reduce redness and pain.

M. chamomilla is generally considered safe, but high doses may cause drowsiness, stomach discomfort, or allergic reactions. Individuals taking blood-thinning medications are advised to use it cautiously (Szopa et al. 2020). Its widespread use in traditional medicine is strongly supported by scientific studies, but more clinical research is needed to determine safe dosage levels.

Conclusion

This study documents the ethnobotanical applications of 14 medicinal plants employed in veterinary practices within Azerbaijan's Nakhchivan Autonomous Republic (NAR), revealing significant concordance between traditional knowledge and pharmacological evidence. Field investigations demonstrated their widespread use for wound healing (e.g., *A. millefolium*'s hemostatic properties), parasitic infections (*A. absinthium*'s anthelmintic action), and inflammatory conditions (*H. perforatum*'s antimicrobial effects). Notably, *Equisetum arvense* and *Plantago major* were utilized for renal and gastrointestinal disorders, respectively. Pharmacological validation of these plants' bioactive compounds supports their therapeutic potential, yet critical gaps remain in standardized dosing protocols and comprehensive

toxicological profiles.

Future research should prioritize: (1) isolation and characterization of active constituents, (2) randomized controlled trials to establish efficacy and safety, and (3) integration of these botanicals into evidence-based veterinary protocols. Furthermore, conservation initiatives must address sustainable harvesting of at-risk species, while agricultural policies should promote ethnoveterinary solutions to reduce antimicrobial resistance. This interdisciplinary approach bridges traditional pastoral knowledge with modern veterinary science, offering a model for biodiversity-based animal healthcare in mountainous regions.

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