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# Ethnobotanical studies in Iran's rangelands

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**Iran's rich plant biodiversity includes over 8,400 species, of which more than 2,300 possess medicinal properties. The research community comprised scientific documents on ethnobotany published between 2010 and 2022. Keywords related to ethnobotany, rangeland, and Iran were searched in the databases of scientific journals. All articles were downloaded and read. The collected data were analyzed using Excel. This study focuses on ethnobotanical research conducted in Iran's rangelands and documents 158 ethnomedicinal species from 62 families. The most represented families were Lamiaceae, Asteraceae, Apiaceae, and Fabaceae. Leaves were the most commonly used plant part, and the dominant life forms observed were hemicryptophytes, therophytes, and phanerophytes. Female professors showed a higher interest in studying ethnobotanical knowledge compared to males. Despite a decline in traditional knowledge among the younger generation, Iranian residents continue to use plants for medicinal purposes. Further research is needed to identify additional species and conduct phytochemical and pharmacological studies, particularly for high-value plants. Evaluating efficacy and safety is crucial, with a priority on bioassay and toxicity studies. Understanding and preserving Iran's rich ethnobotanical heritage is important for the sustainable use of medicinal plants**.

**Key words:** Ethnobotany, scientific documents, biodiversity, indigenous knowledge, medicinal plants, Iran.

## INTRODUCTION

Nature has been a source of medicinal treatments for thousands of years. Biodiversity is essential for human survival and economic well-being and for the ecosystem function and stability (Singh, 2002; Bargali et al., 2014, 2015; Gosain et al., 2015; Baboo et al., 2017). Population pressure, agricultural expansion/intensification and development of infrastructure have been suggested as major threats to biodiversity (Davidar et al., 2010; Bargali et al., 2019) and especially traditional crops (Padalia et al., 2022). All these practices have converted the natural forests into grass/rangeland and croplands and adversely affected the ecosystem processes (Manral et al., 2020). Plants and plant based products have been used traditionally by native inhabitants in world from ancient times (Bargali et al., 2003).

About 80% of the world's population in developing countries uses traditional medicines based on the forest/plant products (Gupta, 2001; Parihaar et al., 2014; Padalia et al., 2017). Forests as well as protected areas are the important repositories of terrestrial biodiversity

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and play a key role in influencing socio-ecological and cultural attributes of human ecology including livelihood activities of traditional societies living as well as associated to these forests (Hermann, 2006; Karki et al., 2017; Bisht et al., 2023a, b). In developing countries, a large number of people depend on products derived from plants for curing human and livestock ailments. In the beginning, these were the main source of the folk or ethnomedicine (Bargali and Shrivastava, 2002; Padalia et al., 2015).

Plants have always played a vital role in human life by providing essential resources such as food, clothing, medicine, and shelter. The knowledge and practice of using herbs have been passed down through generations, forming a legacy of traditional wisdom. Ethnobotany is the scientific study that explores the relationship between humans and plants (Prabhu et al., 2021). Coined by American botanist John Harshberger in 1896, ethnobotany is defined as the branch of traditional knowledge that investigates the medicinal use of plants for treating diseases (Qureshi, 2007). It encompasses the study of cultural, ecological, and cognitive connections between humans and the plant environment (Soejarto, 2005).

Ethnobotany signifies a culture's interest in medicinal plants and serves as a testament to the trust and reliance placed on these plants for healing purposes (Vandebroek, 2013). The primary objective of ethnobotanical research is to document non-written traditional knowledge about plants, enabling rational utilization of resources and effective conservation of plant biodiversity and cultural information. This information has led to the identification of numerous valuable plants with diverse applications in the pharmaceutical, food, cosmetic, and healthcare industries (Silva, 2010).

Ethnobotany is a multidisciplinary science that explores the interaction between humans and plants within a specific environment. Apart from preserving information about cultural heritage, this field has the potential to uncover new therapeutic compounds, thus aiding drug discovery efforts (Agelet and Vales, 2003). Ethnobotanical surveys have played a crucial role in unearthing lost information from the past, which can potentially lead to the discovery and utilization of novel and effective therapeutic compounds in the future (Bulut et al., 2017). These studies primarily focused on traditional medicine, identifying plants commonly used by local communities for treating health conditions.

During the last few decades, there has been an increasing interest in the study of medicinal plants and their traditional use in different parts of the world (Pande et al., 2016; Hanazaki et al., 2000; Heinrich, 2000; Vibhuti et al., 2022). Out of approximately 422,000 known flowering plant species worldwide, it is estimated that around 50,000 species are used for medicinal purposes (Govaerts, 2001; Schippmann et al., 2002; Ullah et al., 2013). Ethnobotanical research has been conducted in various regions including South American countries like Brazil, Asian countries such as China, India, Pakistan, and Thailand as well as certain African countries like Guinea and Laos. In Iran, several researchers have contributed to this field with the first ethnobotanical research on medicinal plants conducted by Hooper and Field in 1937.

Iran's diverse nature and climate have resulted in a rich abundance of plants leading inhabitants of different regions to utilize them for treating various diseases (Zolfaghary and Confectionery, 2001). Given Iran's vegetation diversity and wealth of traditional and scientific knowledge preserved in the field of traditional medicine exploring this information can provide valuable insights and discoveries regarding lesser-known medicinal plants and herbal medicines. The abundance of Iran's plant flora combined with extensive knowledge of Iranians regarding medicinal plant use presence of scientific institutions and reputable sources such as works of Abu Ali Sina and Razi who popularized herbal medicine among Iranian population further emphasize need to give prominence to this scientific field.

Therefore, the objective of this study is to document the indigenous knowledge of plants and evaluate the significance of medicinal plants used in Iran's rangelands through a systematic review and data collection process encompassing qualitative and quantitative analysis. The findings of this study will make a significant contribution to the identification and utilization of medicinal plants in Iran's rangelands, including their methods of use, utilized plant parts, and vegetative forms. Moreover, it emphasizes the importance of considering multiple uses of rangelands, particularly in the context of medicinal plants, for natural resource and environmental managers, as well as policymakers.

## MATERIALS AND METHODS

### Description of study area and vegetation

Iran's land exhibits considerable variability in terms of natural features, climate, and vegetation. The altitude ranges from -24 to 5,678 m above sea level, and temperatures can fluctuate between 50 and -30°C. Overall, more than 90% of Iran experiences an arid and semi-arid climate. However, due to the presence of the Alborz Mountain range, the Caspian Sea, and the Zagros mountains, the northern slopes of Alborz and the western slopes of Zagros have a humid to semi-humid climate. The average annual rainfall ranges from 56 mm in Yazd to 1,951 mm in Bandar Anzali, with an average of approximately 240 mm.

These climatic variations have resulted in diverse vegetation, encompassing plant communities found in completely dry deserts, steppes, shrublands, and forests. Iran, with a total area of 187,395,900 ha, is home to approximately 8,000 plant species, reflecting the diversity of natural habitats and ecosystems within the country. The total area of natural resources in Iran is 130,002,570 ha, accounting for 69.37% of Iran's total area. Among these natural resource areas, forest lands (including forest lands, plantations, groves, and shrublands) occupy 17,649,890 ha (9.42%), forests alone (with a tree canopy coverage of more than 5%) cover

11,794,339 ha (6.29%), pasture lands span 83,309,167 ha (44.46%), and desert phenomena (land with less than 5% coverage and no vegetation) cover 29,043,513 ha (15.5%) (NRWMO, 2020).

### Data collections

Data for this study were collected from research articles and journals focusing on ethnobotany in Iran. The process involved a systematic review of relevant literature including article selection extraction of pertinent information analysis of findings and presentation of results.

The research community comprised scientific documents on ethnobotany published between 2010 and 2022. Keywords related to ethnobotany rangeland and Iran were searched in the databases of Science Direct and SID.ir (in all Persian journals from Iran). All articles were downloaded and read. The collected data were analyzed using Excel.

Innovatively, this study also collected information regarding gender of corresponding author, first author, and informants from reviewed articles. This gender analysis aims to investigate level of interest and involvement of women and men in ethnobotanical research and shed light on whether ethnobotany is predominantly pursued by either gender. Different ailments prevalent in the study area were categorized into various ailment categories, including:

(1) General diseases: Health and body strengthening, fever, anti-infection, sore throat, allergy, backache, insomnia, drowsiness, and weight loss.
(2) Digestive diseases: Constipation, Hemorrhoids, intestinal parasites, gastrointestinal cancer, gastric ulcer, liver cancer, kidney stone, gallstones, gastric reflux, metabolic disorders, nausea, dyspepsia, anorexia, vomiting, stomachache, bloat, hemoptysis, anemia, weight reduction, gastritis, hiatal hernia, diverticulosis, bladder calculus, and Jaundice.
(3) Ophthalmic diseases: Cataract, stye, glaucoma, astigmatism, corneal disorders, drooping eyelid, strabismus, eyelid protrusion, presbyopia, trachoma, amblyopia, esotropia, corneal abrasion, hyperopia, nyctalopia, colorblindness, keratoconus, visual impairment, pterygium, and myopia.
(4) Cardiovascular diseases: Blood pressure (hypertension and hypotension), palpitation, heart failure, peripheral artery diseases, valvular heart diseases, inflammatory heart diseases, rheumatic heart disease, angina pectoris (chest pain), aortic aneurysm, atherosclerosis, cardiomyopathy, Raynaud's syndrome, hypovolemic shock, pericarditis, myocarditis, mitral regurgitation, and hemorrhoids.
(5) Blood diseases: Anemia, coagulation disorders, hyperlipidemia, thalassemia, polycythemia vera, lymphoma, leukemia, myelodysplastic syndromes (MDS), thrombocytopenia, immune thrombocytopenic purpura, Von Willebrand factor disorders, hemophilia, thrombosis, and multiple myeloma.
(6) Musculoskeletal disorders: Rheumatism, gout, waist disc, cervical disc, scoliosis, osteoarthritis, osteomalacia, osteoporosis, tendinitis, varicose veins, sciatica, and osteomyelitis.
(7) Neurological disorders: Convulsions, Migraine, meningitis, stroke, dementia, Parkinson's disease, multiple sclerosis (MS), epilepsy, Bell's palsy, and Guillain-Barré syndrome (GBS).
(8) Respiratory diseases: Influenza, asthma, pulmonary embolism, bronchitis, nasal polyps, laryngotracheobronchitis, tuberculosis, pneumonia, coronavirus, epistaxis (nosebleed), and pharyngitis.
(9) Skin diseases: Malaria, leishmaniasis, piedra, eczema, warts, head lice, acne, chickenpox, shingles, scabies, blister, rash, urticaria, and psoriasis.
(10) Diabetes: Type 1 diabetes (T1D), diabetes mellitus type 2, gestational diabetes, prediabetes, and diabetes insipidus.
(11) Women's diseases: Endometriosis, ovarian cancer, cervical cancer, breast cancer, and pelvic inflammatory disease.

## RESULTS AND DISCUSSION

### Demography of authors and informants

The study recorded a total of 2,055 informants, with 49% being male and 51% female. Among the first authors, 68% were female, while 64% of corresponding authors were male (Table 1). This suggests a higher representation of female first authors and a higher percentage of male corresponding authors in the field of ethnobotany in Iran.

### Documented plant species and their taxonomy

A total of 158 ethnomedicinal species belonging to 132 genera and 62 families were documented. The families with the highest number of species were Lamiaceae (45 species), Asteraceae (44 species), Apiaceae (32 species), and Fabaceae (27 species each) (Table 2). The most commonly used plant parts were leaves (27%), flowers (15%), seeds (13%), and whole plants (9%) (Figure 1). Leaves are often preferred for the preparation of herbal medicines due to their likely presence of active compounds and ease of study. They are easily accessible in nature and relatively abundant compared to other plant parts (Faruque et al., 2018; Islam et al., 2020). Leaves also play a role in food and metabolite production and are used to treat hypertension (Ghorbani, 2005; Semenya et al., 2012a, 2012b; Semenya and Potgieter, 2014). Plants with leaves used for medicinal purposes or consumed raw as vegetables are typically collected in spring. On the other hand, plants with flowers used medicinally are collected in late spring or early summer, coinciding with their flowering season. Similarly, plants with seeds used for medicinal or culinary purposes are harvested at the end of summer, aligning with their seeding time. Plants with medicinal or edible roots can be harvested throughout the year (Moameri et al., 2020).

### Life forms

The plant life forms were classified based on Raunkiaer's (1934) system which categorizes plants based on their adaptations for surviving unfavorable seasons. The dominant life forms in studied flora were hemicryptophytes (50%), therophytes or annual plants (20%), and phanerophytes (12%) (Figure 2). Hemicryptophytes include rosettes small-stemmed plants tall herbs Umbelliferae-like herbs and graminoids. Therophytes complete their life cycle during favorable season and survive as seeds in arid conditions while phanerophytes are plants with perennial above-ground structures. These dominant life forms reflect climate of the study area with hemicryptophytes and therophytes adapted to survive cold winters and arid summers (Memariani et al., 2009; Barbero et al., 1990).

**Table 1.** Demographic data on ethnic groups.

| References | Gender of authors | | No. of informant | Gender of informant (%) | | Education of informant (%) | |
|---|---|---|---|---|---|---|---|
| | First author | Corresponding author | | Female | Male | Literate | Illiterate |
| Arvin (2021) | Male | Male | 72 | 62.5 | 37.5 | 35.5 | 64.5 |
| Didevar et al. (2021) | Female | Male | 95 | 49.47 | 50.52 | 72.63 | 27.36 |
| Moameri et al. (2020) | Male | Male | - | 58 | 42 | 82 | 18 |
| Sabzi et al. (2021) | Male | Male | 40 | 37.5 | 62.5 | - | - |
| Vafadar and Toghranegar (2020) | Female | Female | 143 | 36.36 | 63.63 | 65.03 | 34.96 |
| Mehrnia and Hoseini (2020) | Male | Male | 165 | 30.3 | 69.7 | 94.9 | 5.1 |
| Hoseini et al. (2020) | Male | Male | 129 | 35.65 | 64.34 | - | - |
| Delfan and Azizi (2020) | Male | Male | - | - | - | - | - |
| Hoseini et al. (2020) | Female | Male | 70 | 42.85 | 57.14 | 57.14 | 42.85 |
| Haerinasab and Abbasi (2020) | Female | Female | 20 | 45 | 55 | 80 | 20 |
| Abtahi (2019) | Female | Female | 250 | 63 | 37 | - | - |
| Kiasi and Froze (2019) | Female | Male | 80 | 61.25 | 38.75 | - | - |
| Mirshekar et al. (2019) | Female | Female | 107 | 36.45 | 63.55 | 43 | 57 |
| Moghanloo et al. (2019) | Female | Male | 32 | 46.87 | 53.12 | - | - |
| Ghavam and Kiani (2018) | Female | Female | 336 | 54.5 | 45.5 | - | - |
| Razmjoue and Zarei (2017) | Male | Male | 86 | 60.46 | 39.53 | 63.95 | 36.04 |
| Eslami and Khodayari (2016) | Female | Male | 53 | 69.81 | 30.18 | - | - |
| Ramezanian and Minaiefar (2016) | Female | Female | - | - | - | - | - |
| Azizi and Keshavarzi (2015) | Female | Female | - | - | - | - | - |
| Mirdeilami et al. (2014) | Female | Male | 234 | - | - | - | - |
| Difrakhsh et al. (2014) | Female | Male | - | - | - | - | - |
| Dolatkhahi and Nabipour (2013) | Male | Male | 120 | - | - | - | - |
| Sharififar et al. (2014) | Female | Female | 23 | 73.91 | 26.09 | 20.88 | 79.12 |
| Maghsoodi and Salehi (2015) | Female | Female | - | - | - | - | - |
| Abbasi et al. (2012) | Female | Male | - | - | - | - | - |
| Average | | | | 50.82 | 49.18 | 61.5 | 38.5 |

## Modes of preparation and administration

Medicinal plants were used in various forms with infusion and decoction being most notable methods of preparation (Figure 3). Decoctions were taken orally or as enemas for internal ailments. Plants were also incinerated, powdered and used as snuff. Oral medications were commonly used for coughs, colds, fever, diarrhea, dysentery, gastric issues, abdominal pain, indigestion, and digestive disorders (Islam et al., 2020). Decoctions such as rhizome decoctions as stimulants and blood purifier's warm leaf decoctions for asthma and seed decoctions for coughs and bronchitis were widely used for various medicinal purposes.

## Medicinal use

The documented plant species were used to treat various diseases and ailments categorized into 11 disease categories. The highest number of species (22.6) was used for digestive disorders, followed by general diseases (19.2) (Figure 4).

Some of the key plants used for treating digestive diseases, include *Glycyrrhiza glabra* L., *Withania somnifera* L., *Psammogeton canescens* (DC. ex Boiss.), *Artemisia vulgaris* L., *Ruta graveolens* L., *Gaillonia aucheri* (Guill.) Jaub. and Spach, *Rheum ribes* L., *Artemisia aucheri* Boiss, *Cassia fistula* L., *Thymus transcaspicus* L., *Artemisia siberi* Besser, *Rosa damascena* Herrm, *Descurainia sophia* L., and *Cichorium intybus* L. (Didehvar et al., 2021; Arvin and Firuzeh, 2022; Moameri et al., 2021).

To treat or prevent colds, coughs, and the flu, plants from the Lamiaceae family such as *Thymus kotchyanous* Boiss. and Hohen., *Ziziphora clinopodioides* Lam., *Nepeta menthoides* Boiss. and Buhse, and *Stachys lavandulifolia* Vahl. are commonly used (Frouzeh et al., 2014; Saadatpour et al., 2017; Bibak and Moghbeli, 2017). *Malva sylvestris* L. and *Matricaria chamomilla* L. are also used as tranquilizers and for their anti-cough and cold properties (Forouze et al., 2014; Saadatpour et al.,

**Table 2.** List of plant species used for medicinal purposes.

| Family name/scientific name | Life form | Plant part used | Modes of preparation | Medicinal use |
|---|---|---|---|---|
| **Acanthaceae** | | | | |
| *Blepharis edulis* (Forssk.) Pers. | He | E | h | 1, 3, 8 |
| **Adianthaceae** | | | | |
| *Adiantum capillus-veneris* L. | Ge | M | a, b | 1, 2, 7 |
| **Alliaceae** | | | | |
| *Allium ampeloprasum* Thunb. | He | B, L | b, e | 2, 3, 4 |
| *Allium schoenoprasum* L. | Cr | B, L | i | 1, 5, 8, 10 |
| **Amaranthaceae** | | | | |
| *Amaranthus hybridus* Vell. | Th | H | a, b, d | 2, 9 |
| *Chenopodium album* L. | Th | B, C, E | a, e, h | 2 |
| *Amaranthus retroflexus* L. | Th | E | a, b, d | 2 |
| *Amaranthus tricolor* L. | Th | B, C | - | 2 |
| *Spinacia oleracea* L. | Th | B | e | 2, 7 |
| *Atriplex leucoclada* Boiss. | Th | B | b, d | 3, 4, 9 |
| **Amarydillaceae** | | | | |
| *Ixiolirion tataricum* (Pall.) Schult. & Schult.f. | Ge | B, C, F | e | 9 |
| *Allium akaka* S.G.Gmel. ex Schult. & Schult.f. | Ge | B, F | b | 1, 6, 8 |
| *Allium jesdianum* Boiss. & Buhse | Ge | B, F, L | f | 1 |
| *Allium hirtifolium* Regel | Ge | B, L, K | e, f | 1, 6 |
| *Allium ampeloprasum* Boiss. | Ge | B, L, K | e, f | 1, 3 |
| **Anacardiaceae** | | | | |
| *Pistacia atlantica* Desf. | Ph | B, D, E, I | b, e, f, g | 1 |
| *Rhus coriaria* L. | Ph | D | a, b, c | 1, 2, 4, 5 |
| *Pistacia khinjuk* Stocks | Ph | D, E | e | 1, 5, 6 |
| **Apiaceae** | | | | |
| *Ammi visnaga* (L.) Lam. | Th | E | b, e, h, i | 4, 8 |
| *Anthriscus cerefolium* (L.) Hoffm. | He | H | e | 1, 2, 8, 11 |
| *Anthriscus nemorosa* Baker & S.Moore | He | H | c, e | 2, 9 |
| *Anthemis cotula* L. | He | H | a | 2, 7 |
| *Apium graveolens* L. | He | E | h, a | 2 |
| *Bifora testiculata* (L.) Spreng. | He | H | e | 1, 2, 8 |
| *Bunium persicum* (Boiss.) B.Fedtsch. | Ge | D | h, i | 2, 11 |
| *Conium maculatum* L. | He | B, D | a, b | 1, 7, 8 |
| *Echinophora spinosa* L. | He | C | b | 11 |
| *Eryngium billardierei* Heldr. ex Boiss. | He | M | b, e | 10 |
| *Eryngium campestre* L. | He | B | a | 2, 5, 8 |
| *Eryngium caucasicum* Trautv. | He | M | a | 10 |
| *Falcaria vulgaris* Bernh. | He | A, B | a | 1, 6 |
| *Ferula asafetida* (Falc.) H.Karst. | He | I | b | 1, 2, 5 |
| *Ferula ovina* Boiss | He | I | b, e, h | 1,2, 7, 8,11 |
| *Ferula persica* Willd. | He | M | a | 1, 2 |
| *Ferulago angulate* (Schltdl.) Boiss. | He | M, A | b, d, e, h | 6, 9, 7, 11 |
| *Foeniculum vulgare* Mill | He | A, E | a, b, d, h, i | 1, 2, 8, 11 |
| *Malabaila isfahanica* (Alava) Pimenov & Ostr. | He | B | h | 2 |

**Table 2.** Contd.

| | | | | |
|---|---|---|---|---|
| **Acanthaceae** | | | | |
| *Blepharis edulis* (Forssk.) Pers. | He | E | h | 1, 3, 8 |
| **Adianthaceae** | | | | |
| *Adiantum capillus-veneris* L. | Ge | M | a, b | 1, 2, 7 |
| **Alliaceae** | | | | |
| *Allium ampeloprasum* Thunb. | He | B, L | b, e | 2, 3, 4 |
| *Allium schoenoprasum* L. | Cr | B, L | i | 1, 5, 8, 10 |
| **Amaranthaceae** | | | | |
| *Amaranthus hybridus* Vell. | Th | H | a, b, d | 2, 9 |
| *Chenopodium album* L. | Th | B, C, E | a, e, h | 2 |
| *Amaranthus retroflexus* L. | Th | E | a, b, d | 2 |
| *Amaranthus tricolor* L. | Th | B, C | - | 2 |
| *Spinacia oleracea* L. | Th | B | e | 2, 7 |
| *Atriplex leucoclada* Boiss. | Th | B | b, d | 3, 4, 9 |
| **Amarydillaceae** | | | | |
| *Ixiolirion tataricum* (Pall.) Schult. & Schult.f. | Ge | B, C, F | e | 9 |
| *Allium akaka* S.G.Gmel. ex Schult. & Schult.f. | Ge | B, F | b | 1, 6, 8 |
| *Allium jesdianum* Boiss. & Buhse | Ge | B, F, L | f | 1 |
| *Allium hirtifolium* Regel | Ge | B, L, K | e, f | 1, 6 |
| *Allium ampeloprasum* Boiss. | Ge | B, L, K | e, f | 1, 3 |
| **Anacardiaceae** | | | | |
| *Pistacia atlantica* Desf. | Ph | B, D, E, I | b, e, f, g | 1 |
| *Rhus coriaria* L. | Ph | D | a, b, c | 1, 2, 4, 5 |
| *Pistacia khinjuk* Stocks | Ph | D, E | e | 1, 5, 6 |
| **Apiaceae** | | | | |
| *Ammi visnaga* (L.) Lam. | Th | E | b, e, h, i | 4, 8 |
| *Anthriscus cerefolium* (L.) Hoffm. | He | H | e | 1, 2, 8, 11 |
| *Anthriscus nemorosa* Baker & S.Moore | He | H | c, e | 2, 9 |
| *Anthemis cotula* L. | He | H | a | 2, 7 |
| *Apium graveolens* L. | He | E | h, a | 2 |
| *Bifora testiculata* (L.) Spreng. | He | H | e | 1, 2, 8 |
| *Bunium persicum* (Boiss.) B.Fedtsch. | Ge | D | h, i | 2, 11 |
| *Conium maculatum* L. | He | B, D | a, b | 1, 7, 8 |
| *Echinophora spinosa* L. | He | C | b | 11 |
| *Eryngium billardierei* Heldr. ex Boiss. | He | M | b, e | 10 |
| *Eryngium campestre* L. | He | B | a | 2, 5, 8 |
| *Eryngium caucasicum* Trautv. | He | M | a | 10 |
| *Falcaria vulgaris* Bernh. | He | A, B | a | 1, 6 |
| *Ferula asafetida* (Falc.) H.Karst. | He | I | b | 1, 2, 5 |
| *Ferula ovina* Boiss | He | I | b, e, h | 1,2, 7, 8,11 |
| *Ferula persica* Willd. | He | M | a | 1, 2 |
| *Ferulago angulate* (Schltdl.) Boiss. | He | M, A | b, d, e, h | 6, 9, 7, 11 |
| *Foeniculum vulgare* Mill | He | A, E | a, b, d, h, i | 1, 2, 8, 11 |
| *Malabaila isfahanica* (Alava) Pimenov & Ostr. | He | B | h | 2 |
| *Grammosciadium platycarpum* (Boiss. & Hausskn.) Schischk. | He | H | c, e, f | 2, 7 |
| *Heracleum persicum* Desf. ex Fisch., C.A.Mey. & Avé-Lall. | He | H | a, b, e | 2 |

**Table 2.** Contd.

| | | | | |
|---|---|---|---|---|
| *Heracleum rawianum* C.C.Towns. | He | E, F | a, h | 7, 10 |
| *Psammogeton canescens* (DC. ex Boiss.) Vatke | He | E | b, g | 1, 2, 8 |
| *Prangos ferulacea* (L.) Lindl. | He | B | - | 2 |
| *Prangos latiloba* Korovin | He | B | f | 1 |
| *Smyrnium cordifolium* Boiss | He | B, F | e, f | 10 |
| *Trachyspermum copticum* (L.) Link | He | C, D | h, i | 2 |
| *Dorema ammoniacum* D.Don | He | B | b, e, h | 2 |
| *Ferulago contracta* Boiss. & Hausskn. | He | B, C | b, e, h | 2 |
| *Dorema aucheri* Boiss. | He | B, F | b, e, h | 4 |
| *Ferula assa-foetida* L. | He | B, I | b, e, h | 2, 4, 8 |
| *Ferula gummosa* Boiss. | He | B, J | b, e, h | 2, 11 |
| **Apocynaceae** | | | | |
| *Caralluma edulis* A.Chev. | He | D | b | 5 |
| *Rhazya stricta* Decne. | He | A, B | b | 2, 3, 7, 10 |
| *Periploca aphylla* Decne. | Ch | B, E | b | 2 |
| *Nerium oleander* L. | Ch | B, C | d | 9 |
| **Asclepiadaceae** | | | | |
| *Calotropis procera* (Aiton) W.T.Aiton | Ph | B, J | d | 1, 6 |
| **Asparagaceae** | | | | |
| *Muscari neglectum* Guss. ex Ten. | Ge | A, B, C | d | 1 |
| **Araceae** | | | | |
| *Solanum nigrum* L. | He | B, D, G | b | 1, 2, 6, 7, 8 |
| *Arum elongatum* Steven | Ge | B | f | 5 |
| **Asteraceae** | | | | |
| *Artemisia aucheri* Boiss. | Ch | B, C | a, e | 2 |
| *Achillea wilhelmsii* K.Koch | He | H | a, b, e | 1, 2, 4, 11 |
| *Achillea arabica* Kotschy | He | C | a | 2, 7 |
| *Achillea biebersteinii* Kotschy | He | B, C | a | 4, 5 |
| *Achillea millefolium* L. | He | B, C, G | a, b, d | 4, 5 |
| *Achillea santolinoides* Lag. | He | H | a, b, e | 1, 2, 3, 8, 11 |
| *Anthemis odontostephana* Boiss. | Th | C | b, i | 1, 3, 2, 7, 8, 9 |
| *Arctium lappa* L. | He | A, B, E | a, b, i | 1, 2, 6, 9 |
| *Artemisia abaensis* Y.R.Ling & S.Y.Zhao | Ch | M, G | a, b | 1, 2, 8, 11 |
| *Artemisia absinthium* L. | Ch | M | b | 2 |
| *Artemisia fragrans* Willd. | He | B, C, E | a, h | 2, 6 |
| *Artemisia kopetdaghensis* Rech.f. | Ch | M | a, h | 2, 10 |
| *Artemisia sieberi* Besser | Ch | B, C | a, h | 1, 2, 8 |
| *Artemisia vulgaris* L. | Ch | B, E | a, b | 2 |
| *Calendula persica* C.A.Mey. | Th | C | b | 1 |
| *Calendula officinalis* L. | Th | C | a, i | 9, 11 |
| *Carthamus oxyacanthus* M.Bieb. | Th | E | b, h | 2, 8, 9 |
| *Centaurea benedicta* (L.) L. | Th | H | a, b | 1, 2, 6, 7 |
| *Centaurea depressa* M.Bieb. | Th | C, F | a, b | 2, 5, 6, 8 |
| *Centaurea behen* DC. | Th | H | b, h | 4, 9 |
| *Centaurea solstitialis* L. | Th | M | a, b | 1, 2 |
| *Centaurea virgate* Besser | He | C | a | 2, 5, 6, 8 |
| *Cichorium intybus* L. | He | H | a,b,c,e,f,h,i | 1, 2, 4, 9 |

**Table 2.** Contd.

| | | | | |
|---|---|---|---|---|
| *Cirsium arvense* (L.) Scop. | He | H | a, b | 1, 2, 9 |
| *Cirsium lappaceum* Lam. | He | B, C, F | b | 1, 2 |
| *Cota tinctoria* (L.) J.Gay | He | M | a, b | 2, 6, 7, 8, 11 |
| *Cyanus depressus* (M.Bieb.) Soják | Th | C | a | 1 |
| *Gundelia tournefortii* L. | He | H | a, e, f | 1, 2, 5 |
| *Matricaria chamomilla* L. | He | C | a, i | 2, 7 |
| *Onopordum heteracanthum* C.A.Mey. | He | C | b | 5, 8, 10 |
| *Rhaponticum repens* (L.) Hidalgo | He | B, D, G | a, b, d | 2 |
| *Silybum marianum* (L.) Gaertn. | He | M | a, h, i | 1, 2 |
| *Scorzonera grossheimi* Lipsch. & Vassilcz. | He | A, B, F | b, e, h | 1, 2, 5, 8 |
| *Tanacetum kotschyi* Boiss. | He | M | a | 1, 2, 9 |
| *Taraxacum officinale* F.H.Wigg. | He | A, B, C | a, i | 2, 6 |
| *Tragopogon buphthalmoides* (DC.) Boiss. | He | A, B, C | a, b, e | 1, 2, 6 |
| *Tragopogon graminifolius* DC. | He | M | e | 2, 4 |
| *Tragopogon pratensis* L. | He | A | b | 6, 8 |
| *Tussilago farfara* L. | Ge | M | a | 8 |
| *Xanthium spinosum* L. | Th | H | a, b | 1, 9 |
| *Anthemis nobilis* L. | He | C | a, b | 1, 2 |
| *Achillea eriophora* DC. | He | B, E | a, b | 3, 7 |
| *Cousinia stocksii* C.Winkl. | He | B | b | 2 |
| *Echinops ritrodes* Bunge | He | H | b, e | 7, 8 |
| **Berberidaceae** | | | | |
| *Berberis integerrima* K.Koch | Ph | A, B, D, F | a, b | 1, 4, 5, 7, 10 |
| *Berberis vulgaris* L. | Ph | D | a, b | 1, 2, 7 |
| **Biebersteiniaceae** | | | | |
| *Biebersteinia multifida* DC. | Ge | A | b, d | 1, 5, 6 |
| **Boraginaceae** | | | | |
| *Anchusa azurea* Schur. | Th | H | a, b, f | 4, 7, 8 |
| *Echium amoenum* Fisch. & C.A.Mey. | He | B, C, E | a, i | 1, 7 |
| *Heliotropium europaeum* L. | Th | H | a, b, d | 1, 2, 4, 7, 11 |
| **Brassicaceae** | | | | |
| *Alyssum linifolium* Stephan ex Willd. | Th | E | a | 8 |
| *Descurainia sophia* (L.) Webb ex Prantl | Th | B, C, E | a, b, d | 1, 2 |
| *Alyssum campestre* (L.) L. | Th | E | b | 8 |
| *Conringia orientalis* (L.) C.Presl | He | B, E | a | 2 |
| *Capsella bursa-pastoris* (L.) Medik. | He | H | a, b, d, h | 1, 2, 11 |
| *Lepidium latifolium* L. | He | E, B | d, e | 5, 8 |
| *Nasturtium officinale* W.T.Aiton | He | B, E, G | a, b, e | 2, 6, 9, 10 |
| *Sisymbrium Sophia* L. | He | E | a, b | 1, 9, 10 |
| *Alyssum minutum* Patrin ex DC. | Th | E | b | 1, 8 |
| *Physorhynchus brahuicus* Hook. | He | B, E, F | b | 8 |
| *Alyssum campestre* (L.) L. | Th | E | - | 1 |
| **Caryophyllaceae** | | | | |
| *Acanthophyllum glandulosum* Bunge ex Boiss. | Ch | M | b | 1, 9 |
| *Dianthus caryophyllus* L. | He | C | a,h | 2 |
| *Herniaria hirsuta* M.Bieb. | He | H | h | 1, 7, 9 |
| *Nigella sativa* L. | He | E | h | 2, 11 |

**Table 2.** Contd.

| | | | | |
|---|---|---|---|---|
| **Convolvulaceae** | | | | |
| *Convolvulus arvensis* L. | Th, He | A, B, C, E | a, b, d | 1, 2 |
| **Cupressaceae** | | | | |
| *Juniperus polycarpos* K.Koch | Ph | E | b, h | 1, 3, 6, 7, 11 |
| **Cuscutaceae** | | | | |
| *Cuscuta approximate* Bab. | Th | H | a, h | 2 |
| *Cuscuta epithymum* (L.) L. | Th | H | a, b, e | 2 |
| **Cucurbitaceae** | | | | |
| *Citrullus colocynthis* (L.) Schrad. | He | B, E | d, e | 10 |
| **Colchicaceae** | | | | |
| *Colchicum autumnale* L. | Ge | C | b | 1, 7, 8 |
| **Elaeagnaceae** | | | | |
| *Elaeagnus angustifolia* L. | Ph | B, ,C, D, E | b, d, e, h | 1, 8, 9 |
| **Euphorbiaceae** | | | | |
| *Euphorbia monostyla* Prokh. | He | J | B, d | 8 |
| *Euphorbia helioscopia* L. | He | C, E | b, d | 2, 4, 6, 9 |
| *Ricinus communis* L. | He | E | d | 2 |
| *Euphorbia macrostegia* Bornm. | He | A, E, J | b,d | 9 |
| *Euphorbia cheiradenia* Rech.f. | He | A, E, J | b,d | 9 |
| **Equisetaceae** | | | | |
| *Equisetum arvense* L. | Ge | H | a, b, d | 1, 2, 6, 10, 11 |
| **Fabaceae** | | | | |
| *Alhagi camelorum* Medik. | Ch | A,M | b, i | 1, 2, 9 |
| *Glycyrrhiza glabra* L. | He | A, B | a, b, h, i | 1, 2, 3, 8, 9 |
| *Lotus corniculatus* L. | He | M | a, b, i | 1, 4 |
| *Melilotus officinalis* (L.) Pall. | He | M | i | 1, 2, 4, 7 |
| *Sophora pachycarpa* Schrenk ex C.A.Mey. | He | M | i | 2, 3 |
| *Tribulus terrestris* L. | Th | M | a, i | 1 |
| *Trifolium repens* L. | He | M | i | 1 |
| *Cassia fistula* L. | He | D, E | b | 2 |
| *Astragalus angustifolius* Lam. | He | C | a | 1, 2, 8 |
| *Astragalus aureus* Willd. | He | C | a | 2, 7, 8 |
| *Vicia ervilia* (L.) Willd. | He | E | h | 2 |
| *Alhagi mannifera* Boiss. | Th | H | b, i | 1, 2, 8 |
| *Astragalus adscendens* Fisch. | Th | A | a, b | 2, 8 |
| *Astragalus gossypinus* Fisch. | Th | A | b | 9 |
| *Medicago sativa* L. | He | B, F | a, b, d, h, i | 5 |
| *Alhagi maurorum* Medik. | Th | A, B, C | b, i | 6, 7 |
| *Trifolium resupinatum* L. | He | C | a, b | 1 |
| *Cassia abbreviate* Oliv. | He | B, E | a | 1, 7, 8 |
| *Vicia sativa* L. | Th | E | b, e | 1, 2, 7 |
| *Taverniera cuniefolia* (Roth) Arn. | Th | B | d | 2 |
| *Ononis spinosa* L. | He | A, B, C | a, b | 1, 2, 6 |
| *Lens culinaris* (L.) Coss. & Germ. | He | B, E | a, b, f | 2, 3, 4, 5, 9 |

**Table 2.** Contd.

| | | | | |
|---|---|---|---|---|
| *Melilotus officinalis* (L.) Pall. | He | H | a, b, d | 1, 2, 5, 6, 7, 8 |
| *Pisum sativum* Lam. | He | E | e, f | 5 |
| *Securigera varia* (L.) Lassen | He | H | a, b, d, f | 2 |
| *Trifolium pretense* L. | He | B, C, G | a, b, d, e | 2, 7, 9 |
| *Astragalus susianus* Boiss. | Ch | I | b | 9 |
| | | | | |
| **Geraniaceae** | | | | |
| *Erodium cicutarium* (L.) L'Hér. ex Aiton | Th | H | a | 2, 11 |
| | | | | |
| **Hypericaceae** | | | | |
| *Hypericum perforatum* L. | He | M | a, i | 1, 2, 4, 7 |
| | | | | |
| **Iridaceae** | | | | |
| *Crocus abantensis* T.Baytop & B.Mathew | Ge | C | b | 2, 7, 8 |
| *Crocus haussknechtii* (Boiss. & Reut. ex Maw) Boiss. | Ge | C, D | - | 1, 6 |
| *Iris songarica* Schrenk | Ge | C, F | b | 1 |
| | | | | |
| ***Liliaceae*** | | | | |
| *Fritillaria imperialis* L. | Ge | A, C | d | 2 |
| | | | | |
| **Lamiaceae** | | | | |
| *Hyssopus officinalis* L. | Ch | B, C | a, b | 7, 8 |
| *Lavandula officinalis* Mill. | Ch | M | a, b | 1, 2, 9, 11 |
| *Marrubium duabense* Murata | He | M | a | 8 |
| *Marrubium vulgare* L. | He | M | a, e | 2 |
| *Melissa officinalis* L. | He | M | a, i | 2, 4, 7 |
| *Mentha longifolia* (L.) Huds. | Ch | A, B, G, F | a, b, c, e, i | 2, 8, 9, 11 |
| *Origanum vulgare* Linnaeus | He | M, G | a, b, h | 1, 7 |
| *perovskia abrotanoides* Karel. | Ch | B, C | a, b | 1, 2, 8, 9 |
| *Salvia aethiopis* L. | He | M | a | 1, 2, 8, 10 |
| *Salvia atropatana* Bunge | He | B | a, i | 2, 9 |
| *Stachys lavandulifolia* Vahl | He | M, G | a, b | 1, 2, 4, 7 |
| *Teucrium polium* L. | He | B, C, E | b, d, g, h | 2 |
| *Thymus transcaspicus* L. | Ch | M | a, i | 1, 2, 8, 11 |
| *Otostegia persica* Boiss. | He | B, C | b | 6, 7, 10 |
| *Thymus koeieanus* Ronniger | Ch | B, C, G | a, b, d, h | 1, 8, 9 |
| *Ziziphora clinopodioides* Lam. | Ch | B, C, E | a, b, c, h, i | 1, 8, 9 |
| *Nepeta menthoides* Boiss. & Buhse | He | B | a, h | 1, 8 |
| *Phlomis aucheri* Boiss. | He | B, C, G | a, b | 2, 4 |
| *Mentha arvensis* L. | He | B, F | a, i | 1, 2 |
| *Rosmarinus officinalis* L. | He | B, C | a, h | 1, 9 |
| *Lallemantia iberica* (M.Bieb.) Fisch. & C.A.Mey. | Th | B, E | a, b, e, f | 2, 7, 8 |
| *Lamium album* L. | Th | A ,B, C, G | a, b, e | 1, 2, 8, 11 |
| *Lamium amplexicaule* L. | Th | M | a, b, d, e | 1, 2, 6, 7 |
| *Teucrium polium* L. | Ch | B, G | a, b, d, e | 1, 5, 6, 9 |
| *Salvia macrosiphon* Boiss. | He | H | a, b, e | 1, 2, 5 |
| *Ziziphora tenuior* L. | Th | B, E, F,E, G, M | a, b | 1, 2, 4, 7, 8 |
| *Ocimum basilicum* L. | He | H | e | 2, 8 |
| *Leonurus cardiac* L. | He | M | a | 1, 4, 6, 7, 8 |
| *Zataria multiflora* Boiss. | Ch | M | a, b | 2, 8 |
| *Mentha mozaffarianii* Jamzad | Th | M | e | 1, 2, 7 |
| *Mentha pulegium* L. | Th | M | a, b, i | 1, 2, 11 |

**Table 2.** Contd.

| | | | | |
|---|---|---|---|---|
| *Thymus vulgaris* L. | Ch | M | a, b, i | 2, 5, 8, 9 |
| *Salvia officinalis* L. | He | A, M | a, b, d | 1, 2, 5, 7, 11 |
| *Lavandula officinalis* Chaix. | Th | B, C, G | a, b | 1, 2, 7, 8 |
| *Satureja Montana* L. | Th | M | a, b, i | 1, 2, 7, 11 |
| *Stachys schtschegleevii* (Stschegl.) Takht. | Ch | B, G | a, b, i | 1, 6, 8 |
| *Dracocephalum kotschy* Boiss. | Ch | B | b | 6 |
| *Mentha aquatic* L. | He | M | a, d | 2 |
| *Satureja hortensis* L. | He | G | a | 1, 2 |
| *Salvia rhytidea* Benth. | He | B, E | b | 2, 7 |
| *Hymenocrater platystegius* Rech.f | Ch | G | b | 2, 6, 7, 8, 9 |
| *Thymus daenensis* Celak. | Ch | B | b | 2, 8 |
| *Ballota aucheri* (Boiss.) Salmaki & Siadati | He | H | b, d | 3, 4, 8 |
| *Marrubium supinum* (Stephan ex Willd.) Ikonn.-Gal. | He | B, G | b | 2, 11 |
| **Lythraceae** | | | | |
| *Lythrum salicaria* L. | He | B, E | d | 1, 2, 3, 9, 11 |
| *Lawsonia alba Lam.* | He | B | a, b | 1, 9 |
| **Malvaceae** | | | | |
| *Alcea rhyticarpa* (Trautv.) Iljin | He | A, C | a, d | 1, 8, 9 |
| *Malva neglecta* Wallr. | He | A, B, C | a, b, d | 1, 2, 8, 9 |
| *Alcea setosa* (Boiss.) Alef. | He | B, C | a, h | 1, 8, 9 |
| *Malva sylvestris* | He | B, C | a, b, e, f, i | 1, 2, 8 |
| *Malva parviflora* Huds. | He | B, E | a, b, d | 2, 8, 11 |
| *Hibiscus rosa-sinensis* (Spreng.) Balle | Th | H | e | 1, 2, 5, 9 |
| *Althaea officinalis* L. | He | C | a, i | 1, 8 |
| *Althaea biennis* (M.Bieb.) Kuntze | He | C | b | 8 |
| *Althaea officinalis* L. | He | B, C | b | 2, 8 |
| *Althaea rosea* (L.) Cav. | He | B, C | b | 2, 8 |
| **Moraceae** | | | | |
| *Ficus carica* L. | Ph | D | e, f | 2, 8 |
| **Myrtaceae** | | | | |
| *Myrtus communis* S.Vidal | Ph | B | h | 9 |
| Eugenia caryophyllata Thunb. | Ph | C | c | 1, 2, 7 |
| **Nitrariaceae** | | | | |
| *Peganum harmala* L. | He | A, B, E | d, e, g | 1, 6, 7, 11 |
| **Oleaceae** | | | | |
| *Fraxinus excelsior* L. | Ph | B | a | 1, 2, 6, 7 |
| **Onagraceae** | | | | |
| *Epilobium hirsutum* L. | Ge | H | a | 7, 9 |
| **Orchidaceae** | | | | |
| *Orchis latifolia* Scop. | Ge | I | b, f | 8 |
| **Papaveraceae** | | | | |
| *Glaucium elegans* Fisch. & C.A.Mey. | Th | M | a, h | 1, 7 |
| *Papaver orientale* L. | Th | A, B, C, D | a, b | 8, 9 |

**Table 2.** Contd.

| | | | | |
|---|---|---|---|---|
| *Fumaria officinalis* Burm.f. | Th | B, C | a, b, i | 2, 5, 9 |
| *Fumaria vaillantii* Loisel. | Th | H | a, b, e | 1, 4, 9 |
| *Hypecoum pendulum* L. | Th | H | a, b | 4, 7 |
| *Papaver dubium* L. | Th | A, B, E | d | 7, 9 |
| **Plantaginaceae** | | | | |
| *Plantago lanceolata* L. | He | A, B, E | a, b, h | 1, 2, 8, 9 |
| *Plantago atrata* Hoppe | He | B, E | b | 2, 8 |
| *Plantago major* L. | He | A, B, E | a, b, e, i | 1, 2, 3, 5, 8, 9 |
| *Plantago psyllium* (Jaub. & Spach) Nevski | He | E | a, e | 1, 2, 8 |
| *Plantago ovata* Forssk. | He | E | a, e | 1, 5, 7 |
| *Veronica anagallis-aquatica* L. | He | H | d | 5, 9 |
| **Platanaceae** | | | | |
| *Platanus orientalis* L. | Th | B, F | i | 11 |
| **Poaceae** | | | | |
| *Sorghum halepense* (L.) Pers. | He | A | a | 1 |
| *Avena sativa* L. | Th | H | a | 2,6 |
| *Cynodon dactylon* (L.) Pers. | Ge | A,B | a,b | 1, 2, 4, 8, 9 |
| *Secale cereal* L. | Th | E | b | 2, 9 |
| *Imperata cylindrica* (L.) Raeusch. | He | A | a, d | 9 |
| *Phragmites australis* (Cav.) Trin. ex Steud. | He | H | a, b, f | 1, 2, 3, 6, 11 |
| **Portulacaceae** | | | | |
| *Portulaca oleracea* L. | Th | B, E | d | 1,4, 8 |
| **Proteaceae** | | | | |
| *Brabejum stellatifolium* L. | Ph | E | e, f, h | 1 |
| **Polygonaceae** | | | | |
| *Rheum ribes* L. | Th | B,F | a, b, e | 1, 2, 3, 7, 9 |
| *Rumex scutatus* L. | Ge | A,B,E | a, b, e | 1, 2, 9 |
| *Rumex acetosa* L. | Ge | B,F | a, b, d, e | 1, 2, 4, 9 |
| *Polygonum aviculare* L. | Ge | H | b, d | 2, 8, 11 |
| *Rumex acetosella* L. | Ge | A,B,E | a, b | 4 |
| *Rumex pulcher* L. | Ge | A | b | 2 |
| **Primulaceae** | | | | |
| *Dionysia revolute* Boiss. | Th | B | g | 1 |
| **Plumbaginaceae** | | | | |
| *Acantholimon nigricans* Mobayen | Ch | A, B, C | b | 4 |
| **Rhamnaceae** | | | | |
| *Paliurus spina-christi* Mill. | Ph | D | b | 1, 10 |
| *Ziziphus nummularia* (Burm.f.) Wight & Arn. | Ph | B, D | b | 1, 7, 9 |
| **Rosaceae** | | | | |
| *Crataegus azarolus* L. | Ph | B, C | a | 4, 5, 7 |
| *Cydonia oblonga* Mill. | Ph | B, E | a | 1, 2, 8 |
| *Rosa canina* L. | Ph | B, C, D | a, b, h | 1, 2, 4, 5, 7, 9 |

**Table 2.** Contd.

| | | | | |
|---|---|---|---|---|
| *Rosa damascene* Herrm. | Ph | C | a, h, i | 1, 2, 4, 7, 8, 9 |
| *Rubus caesius* Thunb. ex Maxim. | Ph | B | i | 2 |
| *Amygdalus scoparia* (Spach) C.K.Schneid. | Ph | B, D | b, e | 5, 10 |
| *Rubus sanctus* Schreb. | Ch | B, D | b | 4, 9 |
| *Crataegus aronia* (L.) Bosc ex DC. | Ph | B, C, D | a, b, e, i | 2, 4, 5, 7 |
| *Cotoneaster nummularius* Lindl. | Ph | D | a | 1, 2 |
| *Prunus cerasifera* Ehrh. | Ph | B, D | a | 3, 4, 5 |
| *Cotoneaster nummularioides* Pojark. | Ph | D, E | a,b | 2, 7, 8 |
| *Potentilla reptans* Georgi | He | H | a, b | 1, 2, 4 |
| *Sanguisorba minor* Scop. | He | H | a, b | 1, 2, 9, 11 |
| *Rubus anatolicus* (Focke) Hausskn. | Ch | D | a, e | 2, 8 |
| *Crataegus monogyna* Jacq. | Ph | C,D | a, e | 1,4 |
| *Hulthemia persica* (Michaut ex Juss.) Bornm. | He | C,D | a, b | 7 |
| *Amygdalus lycioides* Spach | Ph | D | b, d | 1,5,10 |
| **Rubiaceae** | | | | |
| *Gaillonia aucheri* (Guill.) Jaub. & Spach | He | D | b | 2 |
| *Galium verum* L. | Th | H | a, b | 1, 7, 9 |
| **Ranunculaceae** | | | | |
| *Adonis aestivalis* L. | Th | H | a, b | 1, 4, 7 |
| *Ficaria fascicularis* K.Koch | Th | M | d | 1 |
| **Rutaceae** | | | | |
| *Ruta graveolens* L. | He | C, D | b. d | 2, 6 |
| **Resedaceae** | | | | |
| *Reseda lutea* L. | He | A, B, E, G | a, b, e | 1 |
| **Salicaceae** | | | | |
| *Salix pycnostachya* Andersson | Ph | B, D, F | b, i | 1, 2, 8, 9 |
| *Salix excels* S.G.Gmel. | Ph | B, G | a, b, d | 1, 2, 6, 8, 9, 10 |
| *Salix aegyptiaca* Thunb. | Ph | B, D, F | i | 2, 5, 7 |
| **Sapindaceae** | | | | |
| *Dodonaea viscosa* Jacq. | Ph | B, D | b | 1, 3 |
| **Scrophulariaceae** | | | | |
| *Verbascum speciosum* Schrad. | He | B, C | a, d | 1, 2, 8, 9 |
| *Verbascum gossypinum* M.Bieb. | He | A, B, C | a, h | 8, 9 |
| *Scrophularia striata* Boiss. | Ch | H | g | 9 |
| *Verbascum phlomoides* L. | He | B,C | a | 1, 6, 8 |
| *Verbascum thapsoides* Vill. | He | C | b, d, h | 8, 9 |
| *Verbascum cheiranthifolium* Boiss. | He | B,C | a, b, d, h | 8, 9 |
| **Solanaceae** | | | | |
| *Datura stramonium* L. | Th | H | a | 7 |
| *Hyoscyamus turcomanicus* Pojark. | He | E | a, h | 7 |
| *Solanum dulcamara* L. | Ph | D | a, h | 1, 2, 6, 11 |
| *Withania somnifera* (L.) Dunal | Ge | B, D | d, h | 2, 5, 6, 10 |
| *Solanum nigrum* L. | Th | B, D | b, d | 8 |
| *Physalis alkekengi* Lour. | He | B, D, F | e, f | 1 |

**Table 2.** Contd.

| | | | | |
|---|---|---|---|---|
| *Hyoscyamus niger* L. | He | B | - | 2, 6, 7 |
| **Tamaricaceae** | | | | |
| *Tamarix ramosissima* Ledeb. | Ph | B | b | 9 |
| *Tamarix gallica* L. | Ph | B | a, g | 2, 6 |
| **Tropaeolaceae** | | | | |
| *Tropaeolum majus* L. | He | H | a | 8, 9 |
| **Tymelaeaceae** | | | | |
| *Daphne angustifolia* K.Koch | He | B | e | 2 |
| **Ulmaceae** | | | | |
| *Celtis australis* L. | Ph | H | d, h | 2, 7, 8, 11 |
| **Urticaceae** | | | | |
| *Urtica dioica* L. | He | H | a, b, d, i | 5, 9 |
| **Verbenaceae** | | | | |
| *Vitex pseudonegundo* (Hausskn.) Hand.-Mazz. | Ph | H | E | 11 |
| *Lantana camara* L. | Ch | B, C | - | 11 |
| **Violaceae** | | | | |
| *Viola odorata* L. | Th | M | a | 1, 2, 8 |
| *Viola suavis* M.Bieb. | He | B, C | a | 7, 8 |
| **Vitaceae** | | | | |
| *Vitis sylvestris* C.C.Gmel. | Ph | J | e, f | 3 |
| **Zygophyllaceae** | | | | |
| *Peganum harmala* L. | He | D, E | b, d, g, h | 1, 2, 5, 7, 11 |
| *Zygophyllum fabago* L. | Ch | B, E | a, b | 3 |
| *Tribulus terrestris* Muhl. | Th | A, B, D, E | a, b, i | 1, 7, 11 |

Life forms: Hemicryptophyte (He), Therophyte (Th), Phanerophyte (Ph), Chamaephyte (Ch), and Geophyte (Ge); Organs used: Root (A), Leaf (B), Flower (C), Fruit (D), Seed (E), Stem (F), Flowering Head (G), Whole Plant (H), Gum (I), Sap (J), Pollen (K), Onion (L), Shoot (M); Methods of Use: Infusion (a), Decoction (b), Spice (c), Poultice (d), Raw (e), Cooked (f), Smoking (g), Powder (h), Tincture (i); Medicinal use: Description of different ailments categorized in the study area 1 to 11.

2017; Bibak and Moghbeli, 2017). Other plants such as *Malva neglecta* Wallr. are used for treating coughs, *Achillea millefolium* L. for reducing fever and relieving heartburn and heartache, and *Heracleum persicum* Desf. ex Fisch. for treating flatulence and disinfecting the environment (Alimirzaei et al., 2017; Hosseini et al., 2019, 2020). Additionally, *Foeniculum vulgare* Miller is known for regulating female hormones and increasing milk supply, *Rosmarinus officinalis* L. has blood thinning properties, and *Lavandula angustifolia* Mill. is used for treating anxiety and stress (Ameri et al., 2016; Ghavam and Kiani, 2018).

Indigenous knowledge of medicinal plants not only encompasses their properties and uses but also provides valuable information about the ecological characteristics of the plants. This knowledge allows for estimating the approximate distribution of plants without the need for extensive ecological assessments. For instance, the presence of *Mentha aquatica* (water mint; syn. *Mentha hirsuta* Huds) and *Tribulus terrestris* L. indicates a preference for moist environments, while *C. intybus* L. is widely distributed in areas with a high concentration of organic matter, often associated with livestock (Iranmanesh et al., 2010; Sabzi et al., 2021).

Several studies have been conducted worldwide to explore indigenous knowledge of medicinal plants, and

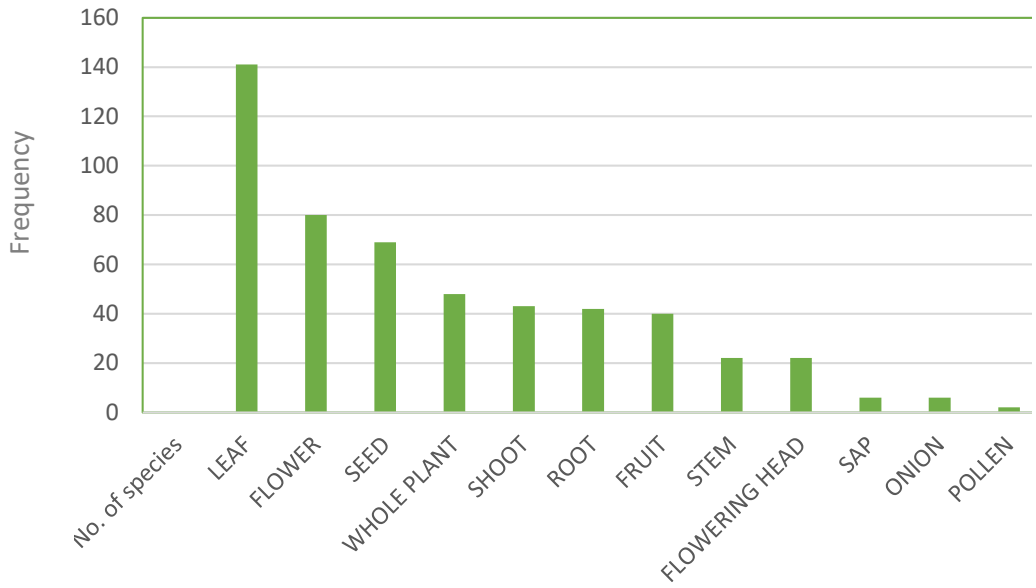


**Figure 1.** List of plant parts and their frequency of use for ethnomedicine preparation.

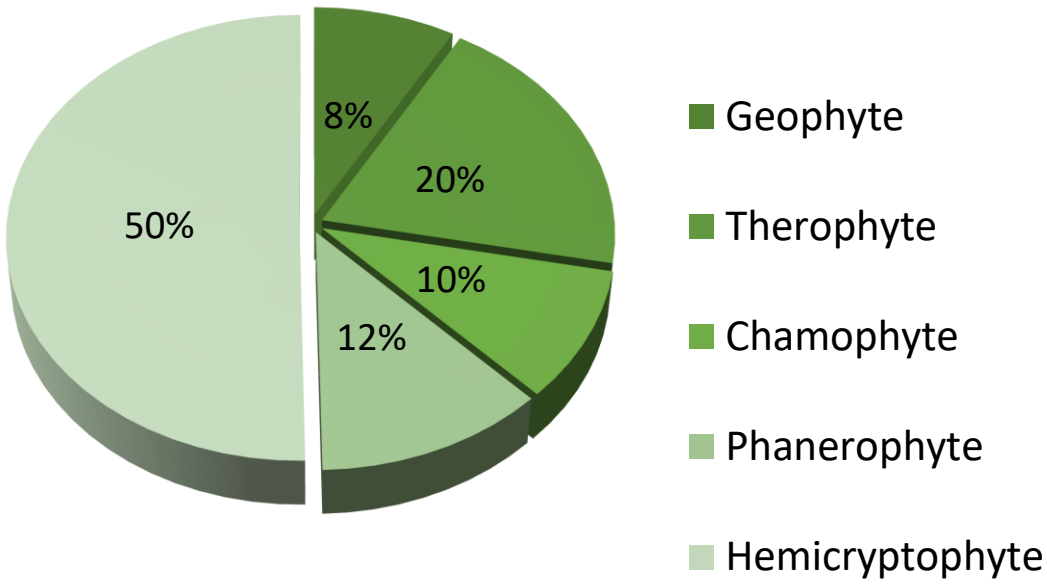


**Figure 2.** Frequency (%) of plant species based on life form.

comparisons with the current research reveal similarities in their applications. For instance, a study conducted in the Shigar Valley of the Baltistan region in Pakistan documented 84 plant species from 36 families and 72 genera. The Fabaceae family was dominant, followed by Asteraceae, Lamiaceae, and Rosaceae. Leaves, roots, flowers, seeds, and fruits were commonly utilized, with decoction being the most frequently employed form of preparation (Abbas et al., 2017).

In northern Guangxi, southwest China, an ethnobotanical study investigated medicinal plants among the Maonans, identifying 368 species used to treat 95 human diseases (Hong et al., 2015). Similarly, a study conducted among the Chácobo participants collected ethnobotanical information and medicinal knowledge from 301 individuals (Zambrana et al., 2018). Another research project conducted in the Patuakhali and Barguna districts of southern Bangladesh focused on the ethnobotany of

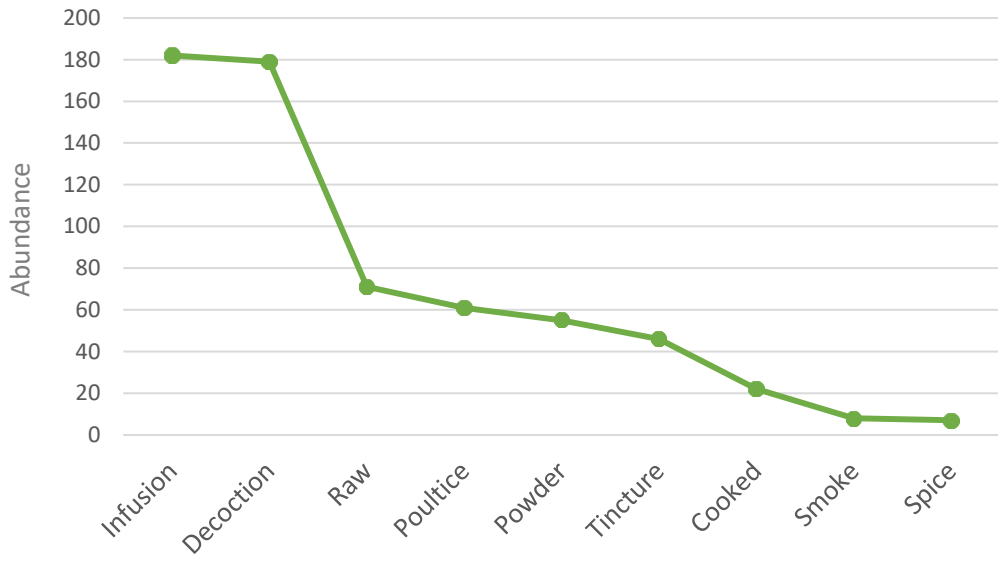


**Figure 3.** Abundance of herbal medicine preparation methods.

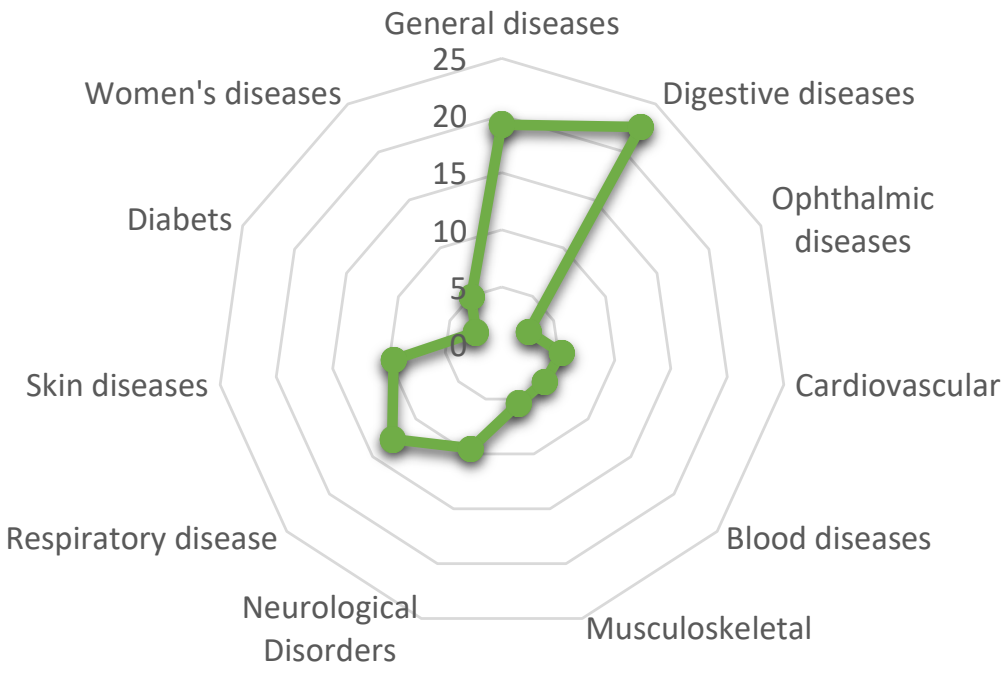


**Figure 4.** Main categories of medicinal plant use as recorded.

medicinal plants used by Rakhine indigenous communities, documenting 86 plant species belonging to 43 families (Islam et al., 2020). Medical and food ethnobotany among Albanians and Serbs living in the Shtërpcë/Štrpce area of South Kosovo revealed a total of 122 botanical and fungal folk taxa (Mustafa et al., 2020). Additionally, Zulu medicinal ethnobotany was investigated, highlighting the prevalence of the Fabaceae and Asteraceae families (Mhlongo and Van Wyk, 2019). Indigenous knowledge and medicinal plants were also valued in other studies (Ugulu et al., 2009; Long and Li, 2004). These diverse findings contribute valuable insights into author and informant demographics, documented plant taxonomy, commonly used plant parts, life forms of plants, preparation and administration methods, and medicinal uses. They enrich our understanding of

ethnobotanical practices in Iran.

## Conclusion

The ethnobotanical study in Iran's rangelands illuminates essential aspects of traditional medicinal plant usage. 159 ethnomedicinal species from 132 genera and 62 families were documented, showcasing the abundance and diversity of medicinal flora. Leaves emerged as the primary plant part used in herbal medicine, aligned with their accessibility and potential bioactive compounds. The dominant life forms: hemicryptophytes, therophytes, and phanerophytes, highlight the adaptation of plants to Iran's climatic conditions.

Furthermore, intriguing gender dynamics was found among authors, with a higher representation of female first authors, suggesting a notable interest in studying ethnobotanical knowledge. Infusion and decoction were prominent methods of preparation and administration, deeply rooted in local culture.

The medicinal uses were categorized into 11 ailment groups, emphasizing the role of traditional medicine in addressing various health concerns. This knowledge offers a foundation for further phytochemical and pharmacological investigations, vital for validating the efficacy and safety of these traditional remedies.

In general, this study underscores the need to preserve and validate indigenous knowledge, promote sustainable utilization of medicinal plants, and foster collaboration between policymakers, researchers, and local communities. Integrating traditional wisdom with modern research can lead to innovative healthcare solutions, benefiting both communities and society at large. We hope our work inspires continued exploration, conservation, and responsible utilization of Iran's unique plant resources for improved human health and environmental well-being.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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