



# Ethnobotanical inventory and evaluation of the medicinal virtues of traditional plants of Djelfa (central Algeria)

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## Correspondence

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## Research

### Abstract

*Background:* Medicinal plants are an essential part of natural and cultural heritage, playing a fundamental role in traditional health systems, particularly in developing countries where they are often the main therapeutic resource available to rural populations.

*Objective:* This floristic and ethnobotanical study was conducted with the aim of compiling the most comprehensive inventory possible of medicinal plants and gathering as much information as possible on therapeutic practices in the Djelfa region in central Algeria.

*Methods:* Relying on a semi-structured questionnaire and a stratified random sampling method, a total of 120 local informants were interviewed. The data obtained was processed using quantitative tools specific to ethnobotany in order to better understand the relative importance of the species surveyed.

*Results:* The survey identified 105 medicinal species distributed across 86 genera and 34 botanical families, with the most represented being the Lamiaceae (11 species) and Asteraceae (7 species), with a marked preference for infusion (34.28%), leaves (25.71%), flowers (15.23%), and fruits (14.28%) as methods of preparation.

*Conclusions:* The results obtained provide a valuable basis for the enhancement of local traditional pharmacopeia and highlight the potential of these plant resources within the framework of sustainable development strategies and the promotion of traditional medicine in Algerian rural areas.

*Keywords:* Ethnobotanical study, Inventory, Traditional medicine, Djelfa, Algeria.

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## Background

Medicinal plants represent an invaluable resource for humanity, both in terms of health and heritage. Their use is widespread across the world, particularly in developing countries, where they play a crucial role as a therapeutic alternative for populations without regular access to modern healthcare facilities (Bouزيد *et al.* 2007; Fitzgerald *et al.* 2020). Of the approximately 500,000 plant species recorded worldwide, about 80,000 possess proven medicinal properties and generally exhibit low toxicity (Bruneton 1999; Bendif *et al.* 2021). Today, plants are the main source of inspiration for the research and development of new pharmacological treatments (Enyew *et al.* 2014; Goodla *et al.* 2017; Şen *et al.* 2022).

Algerian plant biodiversity represents an invaluable natural heritage, inherited from millions of years of evolution and shaped by a wide variety of climates and terrains. Among the thousands of identified species, several are endemic or rare, and many of them have been used for generations in traditional medicine (Quezel 2000; Hani *et al.* 2023). In recent years, Algerians have increasingly turned to medicinal plants as therapeutic alternatives due to the high cost and limited effectiveness of conventional therapies (Khitri *et al.* 2016).

The Djelfa region, due to its location (semi-arid to arid climate), its terrain (high plateaus, mountains, plains), and its vegetation cover, occupies a special place in terms of its wealth of medicinal plant species, most of which grow wild. However, there is a significant lack of comprehensive ethnobotanical studies in this area. Only fragmentary studies have been conducted, and existing research has often lacked quantitative analyses using ethnobotanical indices such as use value and informant consensus factor; these tools could provide a more objective assessment of the importance of medicinal plants. Furthermore, the conservation status of these plant species has not been comprehensively documented, raising concerns about overexploitation and environmental pressures that threaten their availability. Studies are also needed to understand how socioeconomic factors influence the selection and use of these plants by local communities (Chermat & Gharzouli 2015).

Recently, ethnobotanical studies have attracted the attention of many researchers at the national level, highlighting the importance of documenting the ethnomedical knowledge of local populations in various regions of Algeria (Chermat & Gharzouli 2015; Zatout *et al.* 2021; Senouci *et al.* 2023).

The study conducted in the form of questionnaires and interviews with the local populations and herbalists of the Djelfa region thus, our study aims to provide a complete floristic analysis, a phytotherapeutic evaluation, and a taxonomic inventory of the medicinal plants of this region. Furthermore, this research aims to validate traditional uses thru biochemical or pharmacological analyzes and to explore the transmission of ethnomedical knowledge among local populations.

## Materials and Methods

### Study area

The Wilaya of Djelfa is located in the central part of Northern Algeria, beyond the southern foothills of the Tell Atlas when coming from the North, with the capital of the Wilaya being 300 kilometers south of the capital. It is located between 2° and 5° East longitude and between 33° and 35° North latitude. It is bordered: To the North by the Wilayates of Medea and Tissemsilt; To the East by the Wilayates of M'Sila and Biskra; To the West by the Wilayates of Lghouat and Tiaret; To the South by the Wilayates of Ouargla, El Oued, and Ghardaïa, which was elevated to the status of Wilaya following the administrative reorganization of 1974, this part of the territory with a total area of 32,194.01 km<sup>2</sup>, representing 1.36 % of the country's total area, currently consists of 36 communes grouped into 12 Dairates. The ethnobotanical study was conducted in five localities (Fig.1, Table 1) of the Djelfa area.

Table 1. Localities of the study sites.

Localities	Latitude	Longitude	Surface
Ain Maabed	34°48'17" North	3°07'46" East	328,02 km <sup>2</sup>
Had Sahary	35° 21' 6" North	3° 21' 39" East	854,09 km <sup>2</sup>
Senalba Forest	34.7475° North	3.2233° East	621,72 km <sup>2</sup>
Charef	34° 37' 5" North	2° 48' 4" East	590,55 km <sup>2</sup>
Taadmit	34° 17' 12" North	2° 59' 19" East	788,58 km <sup>2</sup>

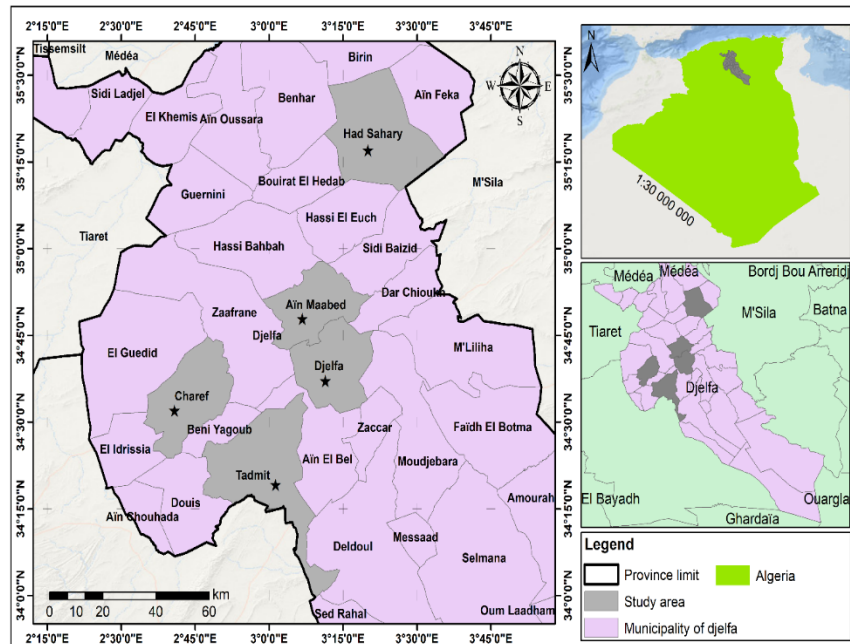


Figure 1. Map of the study site locations, Djelfa province.

#### Ethnobotanical data collection

This study was based on a floristic inventory and an ethnopharmacological survey conducted between May 2024 and April 2025 in five villages in the Djelfa region (Ain Maabed, Had Sahary, Senalba Forest, Charef, and Taadmit), using 120 questionnaires completed by local informants (villagers and herbalists). During this study, we organized several field visits to the research areas, where we were accompanied by elderly guides (traditional healers) considered to be the most knowledgeable experts on local medicinal plants, who directly identified the plant taxa.

For the floristic inventory, we developed subjective sampling because it is the simplest method and consists of choosing homogeneous and representative areas (Gounot, 1969).

#### Herbarium preparation

Once the species are collected in their natural environment, they are pressed between newspaper pages, then placed in a herbarium, labeled, and referenced with details of the place and date of collection, altitude, environmental conditions, and local names. The different taxa were determined by referring to the works of Maire (1957), the new flora of Algeria and southern desert regions (Quezel and Santa 1962-1963), Flowers of Algeria (Bensiton, 1984), Flora of the Sahara (Ozenda, 1991), Baba Aissa (1991-2000), Dobignard and Chatelain (2010-2013), and the Tela-botanica website (<http://www.tela-botanica.org>).

#### Ethnobotanical survey

The ethnobotanical survey was conducted in several municipalities (Ain Maabed, Had Sahary, Senalba Forest, Charef, and Taadmit) of the Djelfa province. These surveys were conducted between 2024 and 2025 with various stakeholders (traditional healers, plant sellers, and local users) involved in the use of medicinal plants. They were conducted in the form of discussions with various people, under anonymity. This survey was based on semi-structured interviews, relying on a pre-established and methodically organized questionnaire. The questionnaire is of the direct type and includes two distinct sections: the first concerns the socio-demographic data of the respondents (age, gender, experience in the field...), while the second focuses on information related to the plants (local name, parts used, preparation, therapeutic indications, etc.), based on an herbarium presented to the participants. In total, the survey involved one hundred and twenty people.

#### Quantitative data analysis

The collected data were analyzed using the following quantitative index: Frequency Citation (FC) and Relative Frequency Citation (RFC).

**Frequency Citation (FC)**

The frequency index or frequency of citation is calculated by the formula used by Phillips & Gentry (1993).

$$FC = (n/N) \times 100$$

Where “n” is the number of persons citing the species, and “N” is the total number of persons interviewed. The frequency index is high when many informants mention a particular plant and low when there were few reports (Sulaiman et al. 2022).

**Relative Frequency Citation (RFC)**

It is used to assess the local therapeutic significance of each plant taxa. It is calculated according to the formula of Tardío & Pardo-De-Santayana (2008).

$$RFC = FC / N \quad (0 < RFC < 1).$$

Where “FC” is the number of informants who cited the use of the species, and “N” is the total number of persons interviewed

**Data analysis**

Once the surveys were completed in each area, we proceeded with the analysis of the questionnaires. The collected data was sorted and entered into a matrix from which we created various graphs and tables using Excel software (Microsoft Office 2016 version).

**Results****Profiles of the respondents**

During this study, 120 people were interviewed in the five municipalities considered (Ain Maabed, Had Sahary, Senalba Forest, Charef, and Taadmit) (Table 2). Women (64%) outnumbered men (36%) in terms of identification with traditional medicine (Fig. 2). the majority of those concerned belong to the 30-40 age group (29%). However, people over 60 and under 24 represent a small percentage (<5%).

Table 2. Sociodemographic profile of informants.

Variables	Categories	Number of informants	Frequency (%)
<b>Gender</b>	Female	77	64.16
	Male	43	35.84
<b>Age (years)</b>	20-30	29	24
	30-40	35	29
	40-50	28	23
	50-60	23	19
	> 60	6	5
<b>Origin of the information</b>	Healers	20	16
	Experiences of others	71	59.4
	Herbalist	14	11.6
	Reading	16	13
<b>Therapeutic practice</b>	Modern medicine	45	37.5
	Phytotherapy	50	41.6
	Both	25	20.8

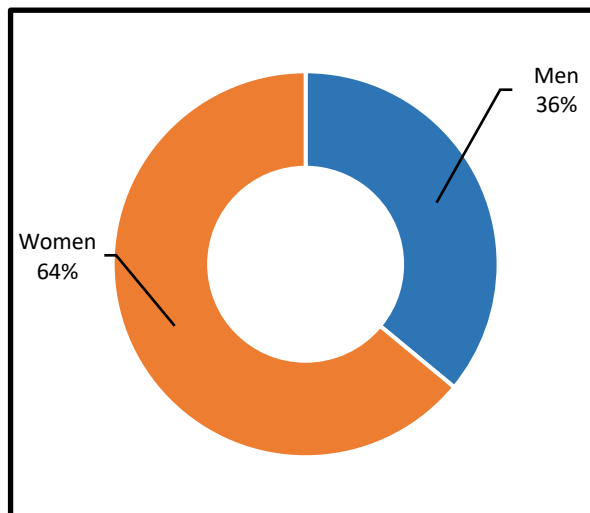


Figure 2. Spectrum of information on the respondents.

#### Variety of therapeutic phytodiversity used in the study sites

The floristic medicinal inventory conducted in this study allowed us to identify 105 taxa distributed across 86 genera and 34 botanical families. The listed medicinal plants and their properties (their family name, scientific name, part used, method of preparation, therapeutic uses, RFC) are grouped in Table 3 and 4.

Moreover, botanical identification showed that there is a redundancy of the same floristic list in almost all the studied sites. Thus, the Lamiaceae and Asteraceae are the most represented with 11 plant taxa (10.47%) and 7 taxa (6.66%) successively, followed by the Poaceae with 5 taxa (4.76%), the Apiaceae; the Brassicaceae and Fabaceae with four taxa (3.8% for each). The remaining families are represented by one, two, or three taxa (Fig. 3). These results demonstrate the enormous diversity of medicinal plants in the Djelfa area as well as the extent of the local population's knowledge in using medicinal plants to treat numerous diseases.

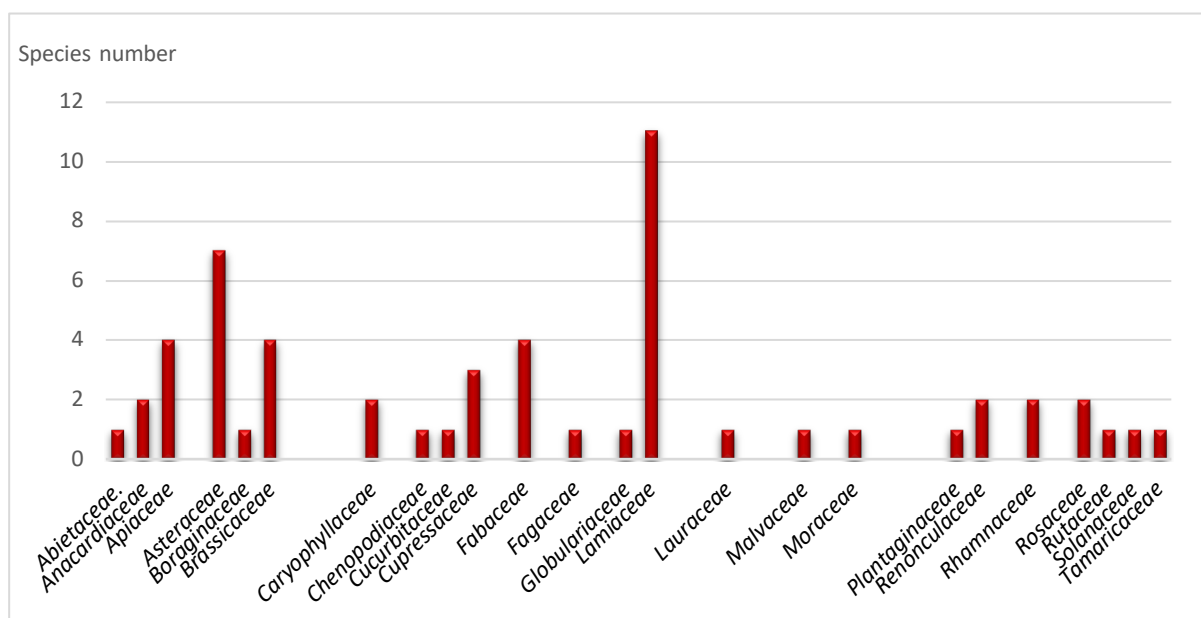


Figure 3. Distribution of species by botanical family in the study area.

Table 3. Classification of plants listed according to their families, therapeutic property, parts used, and method of preparation.

Scientific name	Family name	Therapeutic property	Used part	Method of preparation
<i>Pinus halepensis</i> Mill.	Abietaceae.	Expectorant, balsamic, diuretic, astringent. Beneficial action on the respiratory system, the urinary system, antiseptic, it stimulates the adrenal glands, recommended against respiratory ailments: bronchitis, pneumonia, and colds	The buds, the leaves.	In decoction, the bark is primarily used to treat burns, wounds, and skin inflammation. The mixture of resin powder with honey or olive oil is used in cases of flu and cough. As a poultice, it is used against rheumatism.
<i>Pistacia atlantica</i> DESF	Anacardiaceae	Chewing, hygienic, against stomach diseases, against coughs, against stomach aches, and with plaster-based leaves against scrofula	The pistachio gum, the fruit almond, the fruit almond oil, the leaves.	/
<i>Pistacia lentiscus</i> L.		The essential oil has great decongestant value (venous, lymphatic, prostatic). It is particularly indicated for varicose veins, spider veins, hemorrhoids, and uterine congestion.	The Leaves, fruits.	In infusion, and for external use, it acts as a healing agent.
<i>Coriandrum sativum</i> L.	Apiaceae	Antiasthénique, antiseptique, antispasmodique, carminatif, stimulant, stomachique.	The fruits and the leaves.	Coriander is most often used in infusions against abdominal and colic pains. It is belching and carminative.
<i>Foeniculum vulgare</i> (Miller) Gaertn		Aperitive, aromatic, carminative, digestive, diuretic, emmenagogue, tonic, vermifuge.	Seeds, leaves.	Against colic, spasms, and flatulence. By infusion.
<i>Pituranthus scopariu</i> (Coss et Dur) Benth et Hook		In poultices, against headaches	The aerial part.	/
<i>Thapsia garganica</i> L.		Rubefacient, against rheumatic pains.	The roots.	It is to grind the thapsia root by mixing it with olive oil, then compress it on the site of the ailments (rheumatism, abscess maturation).
<i>Nerium oleander</i> L.	Apocynaceae	Poison, oleandrin toxin, cardiotoxic, analgesic.	The Leaves.	Used against skin diseases and as an antibiotic, as a gargle it is used against toothaches.
<i>Artemisia campestris</i> L.	Asteraceae	Calms digestive disorders, stomachaches, nausea, and menstrual pain. In external use, it is recommended as a vulnerary, anti-hemorrhagic in poultices.	The leaves and the tops.	In infusion or powder. For external use (it is used in a poultice against migraines, wounds, and burns).
<i>Artemisia herba-alba</i> Asso		Antigastralgic, antispasmodic, emmenagogue, stomachic, vermifuge. Its roots are indicated against certain nervous disorders: tics, spasms, convulsions, and as sedatives, emmenagogue.	The flowers, the leaves, the stems, and the roots.	In infusion, As a poultice. The drops from chewing certain leaves of this plant are used to treat ringing in the ears.

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<i>Cynara cardunculus</i> L.		Antidiarrheal, aperitif, cholagogue, choleric, blood purifier, diuretic, energizing, hypoglycemic, nutritious, and stimulating.	The leaves and the stems.	In decoction, the plant is very effective against gastric pains.
<i>Inula viscosa</i> L.		Analgesic, antiseptic, healing, diuretic, hemostatic, and vermifuge	The leaves.	Its use is limited to external application. Steamed leaves are used in the form of compresses against rheumatic pains and headaches. In powder form, they are used against wounds and burns.
<i>Matricaria chamomilla</i> L.		Physical soothing: used in cosmetics to calm skin irritations. Healing.	Flowers, flowering tops	By infusion, Decoction
<i>Scorzonera undulata</i> Batt.		Soothing, purifying, diuretic, emollient, pectoral, and sudorific.	The leaves and the roots.	The infusion of the plant's leaves is used as a diuretic, carminative, and stomachic.
<i>Taraxacum officinale</i> Weber ex Wiggers.		Diuretic, Depurative.	The leaves and the roots.	Decoction, Infusion
<i>Borago officinalis</i> L.	Boraginaceae	Used against menstrual disorders, intestinal irritations, eczema, high blood pressure, and arthritis.	The entire plant, particularly the flower.	Therapists use borage for food, in the form of salad, and as fodder for animals.
<i>Capsella bursa pastoris</i> L.	Brassicaceae	Uterine muscle tonic present in hemorrhages.	The Fruits.	Remedy for dysentery and certain eye conditions.
<i>Lepidium sativum</i> L.		It is a remineralizing, depurative, hypoglycemic, tonic that is given to women after childbirth, to children, and to weakened or convalescing adults. it is also a remarkable aperitif.	The leaves and the seeds	Therapists use the seeds of this plant and henna against rheumatic pains and arthritis.
<i>Moricandia arvensis</i> (L.) DC.	Brassicaceae	Poultice, warming, against burns.	The leaves	/
<i>Raphanus raphanistrum</i> L.		Aperitive, emetic, pectoral, hemostatic, rubefacient, stimulating.	Plant sap, seeds	/
<i>Paronychia argentea</i> (Pourr) Lamk	Caryophyllaceae	Diuretic, aseptic, slightly spasmodic, urinary tract treatment	The leaves and the sap of the plant.	The infusion of a few leaves in boiling water is recommended in cases of kidney and urinary tract diseases and hemorrhoids.
<i>Saponaria vaccaria</i> L.		Antipruritic, antirheumatic, cholagogue, depurative, diuretic, expectorant, sudorific, and tonic.	The aerial parts and the roots.	Used for the treatment of female infertility.
<i>Atriplex hortensis</i> L.	Chenopodiaceae	Diuretic, emollient, laxative, its seeds are used as emetics.	/	The mixture of plant powder with olive oil is very effective in treating fractures.

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<i>Ecballium elaterium</i> Rich.	Cucurbitaceae	Purgative, drastic, resolvent, rubefacient, emetic, and vulnerary.	The Fruits.	The only use of Momordica is to treat jaundice. It is often used in combination with alaterne (M'liless) in the form of nasal instillations of the fruit juice.
<i>Cupressus sempervirens</i> L.	Cupressaceae	It is a venous, lymphatic, and prostatic decongestant, anti-infectious, antispasmodic, and antibacterial.	The cones and the branches	The infusion of twigs and leaves is used in the treatment of hemorrhoids and urinary incontinence.
<i>Juniperus oxycedrus</i> L.		Antiseptic, parasiticide, vermifuge.	Branches, fruit berries.	Therapists extract from the wood of the oxycedar, cade oil "Cuettrane" and use it for ornamental purposes.
<i>Juniperus phoenicea</i> L.		Anti-parasitic, antiseptic, astringent, carminative, anti-diarrheal, and diuretic.	Branches, wood, fruits.	The infusion of juniper leaves has an effect in the treatment of abdominal pain.
<i>Calycotome spinosa</i> (L.) Lamk.	Fabaceae	Aphrodisiac for women, diuretic.	Flowers, the leaves, the seeds.	The infusion, decoction. It can be used in powder form to treat fresh wounds.
<i>Retama retam</i> Webb		Healing, anti-diarrheal, skin condition, against fever.	Aerial part.	In infusion of dried leaves against abdominal pain. For external use, the mixture of the stem powder with olive oil is very effective in treating wounds and back pain.
<i>Trifolium repens</i> L.		Antispasmodic, antiseptic, antipyretic, colic, flu, leukorrhea.	Aerial part.	Infusion
<i>Trigonella foenum-graecum</i> L.		Soothing, anabolic, emollient, antipyretic, galactagogue, hypoglycemic, tonic.	The seeds.	For internal use, the decoction of the seeds is used to soothe abdominal pain, coughs, and diarrhea. It promotes weight gain and acts as an appetizer and calming agent. In external use, the seeds are used to eliminate dandruff from the hair.
<i>Quercus ilex</i> L.	Fagaceae	Antidiarrheal, antiseptic, astringent, antipyretic, hemostatic sweet acorns are nutritious and tonic. They contain starch, sugar, lipids, flavonoids, albumin, and tannins.	Glands, leaves, the bark (Young branches on everything between 12-20 years)	The leaves are used in infusions to relieve abdominal pain and kidney stones. In a poultice, the mixture of leaf powder with olive oil is very effective in treating corns.
<i>Erodium cicutarium</i> L'Her.	Geraniaceae	Hemostatic, uterotonic.	The entire plant.	/
<i>Geranium robertianum</i> L.		Astringent, tonic, anti-diarrheal, depurative, hemostatic, vulnerary, sedative.	Aerial parties	/

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<i>Globularia alypum</i> L.	Globulariaceae	Purgative, cholagogue, stimulant, depurative, laxative, diuretic, anti-fungal.	Leaves, bark.	Globularia is commonly used in the Djelfa area. The infusion of this plant is recommended to treat gastric disorders, diarrhea, and menstrual pain. In powder form, it is used against eczema, burns, and wounds.
<i>Ajuga iva</i> (L.) Schreber	Lamiaceae	Astringent, antiseptic, vulnerary, vermifuge, febrifuge	Rootless Plant.	In infusion mode, used to treat headaches, abdominal and colic pains, as well as diabetes. It is aperitive and very useful in the treatment of kidney stones, so the powder is mixed with germander (khayata) and the juice from the infusion of barley seeds.
<i>Marrubium alysson</i> L.		Emmenagogue, antispasmodic, stomachic, anti-rheumatic.	Leaves, the whole plant.	/
<i>Marrubium supinum</i> L.		Emmenagogue, antispasmodic, stomachic, antirheumatic.	Leaves, the whole plant.	/
<i>Marrubium vulgare</i> L.		Emmenagogue, antispasmodic, stomachic diuretic, anti-influenza, vulnerary, antidiarrheal, antipyretic, antirheumatic.	Flowering tops and leaves.	In infusion to relieve pain in general (abdominal, gastric, dental, ear, menstrual, and headaches), kidney stones, and sunburn.
<i>Mentha spicata</i> L.		Analgesic, antiseptic, antispasmodic, aromatic, carminative, cholagogue, digestive, stimulating, tonic.	The Leaves.	In infusion as carminative, odontalgic, tonic, stomachic, calming, hypotensive, and hypocholesterolemic. It's used to treat dysmenorrhea, urinary incontinence, and oral conditions. In powder form, spearmint is used to treat wounds and burns as well as to nourish the hair.
<i>Origanum glandulosum</i> Desf.		Antiseptic, antispasmodic, carminative, digestive, emmenagogue, expectorant, calming, antitussive, and aperitif.	The flowering tops.	Mode infusion or inhalation to treat colds, coughs, and gastrointestinal conditions. Furthermore, it is used as a mouthwash to treat oral conditions (canker sores).
<i>Rosmarinus officinalis</i> L.		Antiseptics, antispasmodics, antirheumatics, healing agents, detoxifiers, diuretics, muscle relaxants, a decongestant, and a cardiac tonic.	Flowering tops, the leaves.	In the form of decoction or infusion against gastric disorders, colic, and menstrual and back pain. It is particularly indicated for infectious conditions in and recommended for massage.
<i>Salvia verbenaca</i> L.		Stimulant, tonic, antiseptic.	Flowering tops, the leaves.	Decoction; the aerial part of the plant is used for the stomach.
<i>Teucrium chamaedrys</i> L.		Antiseptic, aperitive, choleric, digestive, febrifuge, stomachic.	Leaves, flowering tops.	/

<i>Teucrium polium</i> L.		Febrifuge, anti-inflammatory, astringent, detergent, tonic, bitter.	Flowering tops, the leaves.	In the form of an infusion against abdominal pain, colic, and stomach ulcers.
<i>Thymus hirtus</i> Willd.		Antifungal, antiseptic, antispasmodic, aperitif, bechic, detergent, digestive, stomachic, tonic, vulnerary, vermifuge.	Leaves, flowering tops.	In Tisane.
<i>Laurus nobilis</i> L.	Lauraceae	Antiseptic, aromatic, aperitif, carminative, digestive, parasiticide, sedative, stomachic, stimulant, sudorific.	The leaves without petioles and the fruits.	The decoction of noble laurel leaves is used in the treatment of hypertension.
<i>Allium cepa</i> L.	Liliaceae	The treatment of otalgia, infected wounds, thorax, otitis, gangrene, eyes, bronchitis, antiputrid, constipation, headaches, hair loss, lungs and breathing, analgesic, antiasthenic, anti-infectious, anti-inflammatory, antiscorbutic, antirheumatic, antiseptic, bactericidal, bacteriostatic (gastrointestinal), cholagogue, diuretic, emmenagogue, emollient, glandular balancing.	The bulbs.	For internal use, the mixture of onion juice with sugar is very effective in treating coughs and laryngitis. For external use, it is used in the form of compresses against sunburn, headaches, and hemorrhoids.
<i>Allium sativum</i> L.		Anti-inflammatory, antiseptic, antispasmodic, bactericidal, coricide, depurative, diuretic, expectorant, febrifuge, hypoglycemic, hypotensive, stimulant, sudorific, tonic, and vermifuge.	The bulbs.	For external use, it is used as an antiseptic for insect bites as well as against ringworm and warts.
<i>Asparagus acutifolius</i> L.		Diuretic, tonic, depurative.	Roots, suckers.	By Decoction; asparagus leaves are used with olive oil against glaucoma. By Tisane.
<i>Malva sylvestris</i> L.	Malvaceae	Emollient, soothing, chronic constipation, stomatitis, glossitis, carminative, and vulnerary.	Flowers, leaves, roots.	In infusion to treat abdominal pain, colic, and in cases of otitis and asthma. To treat female infertility.
<i>Ficus carica</i> L.	Moraceae	Fruits : antiasthénique, depurative, diuretic, emollient, laxative, nutritive, pectoral, and tonic. Latex : coricide, resolvent, and vermifuge.	The fruits and the latex.	In infusion, the fruits are used to treat coughs, and the latex is used externally against warts.
<i>Eucalyptus globulus</i> Labill.	Myrtaceae	Antibiotic, antiseptic, bactericidal, carminative, diaphoretic, expectorant, antipyretic, and stimulant action.	The leaves.	The dried or fresh leaves are used in fumigation to disinfect houses during flu season. In infusion against angina and respiratory tract ailments. Eucalyptus essence has the reputation of repelling mosquitoes. Combined with olive oil, it has a calming effect on rheumatic pains and burns.

<i>Olea europea</i> L.Var <i>sativa</i> .	Oleaceae	Hypotensive, Spasmolytic, emollient, Antiarrhythmic, vasodilator, coronary dilator, antipyretic, tonic.	The Leaves, Fruits, oil.	The infusion of olive leaves is used as a gargle against oral conditions (gum inflammation, canker sores, and bad-breath). Olive oil is useful against coughs, colds, hoarseness, skin redness, sinusitis, and chronic constipation.
<i>Phillyrea angustifolia</i> L		Diuretic, emmenagogue, febrifuge, against canker sores, stomatitis, headaches.	The Leaves, Flowers.	By Deduction.
<i>Glaucium corniculatum</i> Curtis	Papaveraceae	Used against eye conditions.	The leaves, the seeds.	/
<i>Papaver rhoeas</i> L.		Anti-inflammatory, antitussive, expectorant, emollient; respiratory disorders.	Flowers, and sometimes the empty seed pods.	The infusion of flowers is used as a calming agent and antitussive.
<i>Plantago albicans</i> L.	Plantaginaceae	Soothing, astringent, emollient, diuretic, and laxative.	The leaves and the roots.	In the form of an infusion, this plant is used for a woman who has recently given birth and in the treatment of headaches.
<i>Ampelodesma mauritanicum</i> (Poir) Dur et schinz.	Poaceae	/	The leaves.	Infusion of the leaves is used to treat kidney stones.
<i>Avena alba</i> L		/	The whole plant.	/
<i>Avena sterilis</i> L.		Soothing, anti-asthenic, emollient, nutritive, sedative, stimulating.	The whole plant.	/
<i>Cynodon dactylon</i> (L.) Pers.		/	The whole plant.	Care for urinary infections, arthritis, and rheumatic pains.
<i>Stipa tenacissemata</i> L.		Washing, treatment of chronic scalp ulcers.	The leaves.	The infusion of crushed Alfa strands in boiling water is very effective in treating kidney stones.
<i>Triticum vulgare</i> Vill.		/	The seeds.	In the treatment of gastric pain, anemia, and fractures. It is considered a galactagogue, hypocholesterolemic, and odontalgic.
<i>Anagallis arvensis</i> L.		Primulaceae	Disinfectant, detergent, diuretic, expectorant, anti-inflammatory.	Aerial organs.
<i>Clematis cirrhosa</i> L.	Renonculaceae	Treatment of neuralgias and rheumatic pains.	The leaves.	/
<i>Nigella sativa</i> L.		Analgesic, antiseptic, antispasmodic, aperitive, carminative, digestive, diuretic, expectorant, febrifuge, galactagogue, vermifuge.	The seeds.	The use of nigella is very effective against the flu thru the inhalation of crushed seeds.
<i>Rhamnus alaternus</i> L.	Rhamnaceae	Astringent, laxative, purgative, effective against hepatic jaundice.	The leaves and the stems.	In the form of an infusion in combination with <i>Momordica</i> to treat jaundice and abdominal pain.

<i>Ziziphus lotus</i> (L.) Desf.		Emollient, pectoral, anti-inflammatory, sedative, tonic, diuretic.	The Fruits, the roots.	The powder obtained from the leaves is particularly described for wounds. Use the decocted leaves for headaches. Therapists also use the fruits for food and use the aerial part for making hedges.
<i>Prunus armeniaca</i> L.	Rosaceae	Anti-asthenic, anti-anemic, aperitifs, astringent, laxative (dried fruits), nutritious, revitalizing, tonic.	The ripe fruits, the bark, and the almond.	The fruits are used against anemia, diarrhea, and in the form of poultices against hemorrhoids after drying and then infusing them. For beauty care, the decoction of dried fruits is used in the form of cream for skin-toning applications.
<i>Rosa canina</i> L.		Vitaminizing, tonic, emollient, anti-inflammatory, diuretic, depurative, hypoglycemic; anemia, anorexia, avitaminosis, colitis, diabetes, convulsive cough, urinary, gastric system, and cardiac disorders.	Fruits, the leaves, the flowers.	Decoction, Infusion.
<i>Ruta montana</i> (Clus.) L.	Rutaceae	Analgesic, antispasmodic, anti-inflammatory (ophthalmia), diuretic, emmenagogue, sedative, sudorific, vermifuge.	The leaves.	In infusion.
<i>Lycium europeum</i> L.	Solanaceae	Antispasmodic, anti-ophthalmic, diuretic, antipyretic, hypotensive, purgative.	Roots, dried berries.	Therapists use the aerial part in the form of poultices for ophthalmia.
<i>Tamarix africana</i> L-Poiret	Tamaricaceae	Anticatarrhal, aperitive, astringent, diuretic, hemostatic, sudorific.	The leaves, the bark, and the gall.	The infusion of the roots is used to treat kidney stones.
<i>Tamarix gallica</i> L.		Chills, cold, tonsillitis, sudorific, eyedise-ases, boils, diarrhea.	Aerial part.	Decoction, Poultice, Infusion.
<i>Thymelaea hirsuta</i> Endl.	Thymeleaeceae	Expectorant, hydragogue, anthelmintic.	The leafy stems.	In a decoction of the leaves, it is recommended against dandruff.
<i>Thymelaea microphylla</i> Coss.et Dur.		/	The leafy stems.	Treat rheumatism, fight respiratory infections, Reduce hypoglycemia.
<i>Peganum harmala</i> L.	Zygophyllaceae	Stimulant, Euphoric, Hemorrhoids.	Seeds, The whole plant.	Highly recommended plant. The seeds are used in powdered form in the treatment of rheumatic pains, back pain, and hemorrhoids.

## Quantitative analysis

## Relative frequency of citation (RFC)

The assessment of knowledge and use of medicinal plants in the Djelfa region involved defining relative citation frequency (RFC) as a key indicator. This indicator provides valuable information for biological studies, hence its importance. The results are presented in Table 4. The relative citation frequency among participants varies between 0.02 and 0.79.

Table 4. Relative citation frequency (RFC) values

Scientific name	Family name	Therapeutic property	RFC
<i>Pinus halepensis</i> Mill.	Abietaceae.	Expectorant	0.16
		Balsamic	0.12
		Diuretic	0.29
		Astringent	0.16
		Beneficial action on the respiratory system	0.79
		the urinary system	0.1
		Antiseptic	0.32
<i>Pistacia atlantica</i> DESF	Anacardiaceae	Chewing	0.09
		Hygienic	0.3
		against stomach diseases	0.19
		against coughs	0.15
<i>Pistacia lentiscus</i> L.	Anacardiaceae	against stomach aches	0.15
		The essential oil has great decongestant value (venous, lymphatic, prostatic)	0.39
		It is particularly indicated for varicose veins, spider veins, hemorrhoids Uterine congestion.	0.71
<i>Coriandrum sativum</i> L.	Apiaceae	0.16	0.16
		Antiasthenique	0.08
		Antiseptique	0.15
		Antispasmodique	0.07
		Carminatif	0.09
		stimulant	0.07
stomachique	0.11		
<i>Foeniculum vulgare</i> (Miller) Gaertn	Apiaceae	Aperitive	0.06
		Aromatic	0.18
		Carminative	0.15
		Digestive	0.2
		Diuretic	0.14
		Emmenagogue	0.08
		Tonic	0.13
		Vermifuge	0.16
<i>Pituranthus scopariu</i> (Coss et Dur) benth et Hook		against headaches	0.74
<i>Thapsia garganica</i> L.	Apiaceae	Rubefacient	0.15
		against rheumatic pains	0.54
<i>Nerium oleander</i> L.	Apocynaceae	Poison	0.65
		oleandrin toxin	0.37
		cardiotonic	0.18
		analgesic	0.50
<i>Artemisia campestris</i> L.	Asteraceae	Calms digestive disorders	
		Stomachaches	0.66
		Nausea	0.62
		menstrual pain	0.28
		In external use, it is recommended as a vulnerary	0.17
		anti-hemorrhagic in poultices	0.19

<i>Artemisia herba-alba</i> Asso		Antigastralgic Antispasmodic Emmenagogue Stomachic Vermifuge Convulsions Sedatives	0.34 0.19 0.14 0.45 0.13 0.09 0.15
<i>Cynara cardunculus</i> L.	Asteraceae	Antidiarrheal Aperitif Cholagogue Choleretic Blood purifier Diuretic Energizing Hypoglycemic Nutritious Stimulating	0.08 0.13 0.09 0.05 0.04 0.13 0.07 0.06 0.09 0.06
<i>Inula viscosa</i> L.		Analgesic Antiseptic Healing Diuretic Hemostatic Vermifuge	0.16 0.09 0.14 0.18 0.07 0.09
<i>Matricaria chamomilla</i> L.		Physical soothing: used in cosmetics to calm skin irritations. Healing	0.62 0.2
<i>Scorzonera undulata</i> Batt.		Soothing Purifying Diuretic Emollient Pectora Sudorific	0.05 0.08 0.15 0.03 0.03 0.08
<i>Taraxacum officinale</i> Weber ex Wiggers.		Diuretic Depurative	0.01 0.06
<i>Borago officinalis</i> L.		Boraginaceae	Used against menstrual disorders Intestinal Irritations Eczema High Blood Pressure Arthritis
<i>Capsella bursa pastoris</i> L.	Brassicaceae	Uterine muscle tonic present in hemorrhages	0.12
<i>Lepidium sativum</i> L.		Remineralizing Depurative Hypoglycemic Tonic Aperitif	0.03 0.09 0.13 0.17 0.19
<i>Moricandia arvensis</i> (L.) DC.		Poultice Warming Against Burns	0.11 0.18 0.21
<i>Raphanus raphanistrum</i> L.		Aperitive Emetic Pectoral Hemostatic Rubefacient Stimulating	0.01 0.08 0.11 0.15 0.08 0.06
<i>Paronychia argentea</i> (Pourr) Lamk		Caryophyllaceae	Diuretic Aseptic Slightly Spasmodic Urinary Tract Treatment

<i>Saponaria vaccaria</i> L.		Antipruritic Antirheumatic Cholagogue Depurative Diuretic Expectorant Sudorific Tonic	0.04 0.09 0.11 0.07 0.17 0.05 0.02 0.10
<i>Atriplex hortensis</i> L.	Chenopodiaceae	Diuretic Emollient Laxative Its Seeds are used as Emetics	0.20 0.11 0.15 0.17
<i>Ecballium elaterium</i> Rich.	Cucurbitaceae	Purgative Drastic Resolvent Rubefacient Emetic Vulnerary	0.07 0.10 0.14 0.04 0.05 0.12
<i>Cupressus sempervirens</i> L.	Cupressaceae	Venous Lymphatic Prostatic Decongestant Anti-Infectious Antispasmodic Antibacterial	0.20 0.17 0.15 0.11 0.08 0.06
<i>Juniperus oxycedrus</i> L.		Antiseptic Parasiticide Vermifuge	0.35 0.19 0.26
<i>Juniperus phoenicea</i> L.		Anti-Parasitic Antiseptic Astringent Carminative Anti-Diarrheal Diuretic	0.17 0.25 0.09 0.06 0.38 0.01
<i>Calycotome spinosa</i> (L.) Lamk.	Fabaceae	Aphrodisiac for women Diuretic	0.14 0.08
<i>Retama retam</i> Webb		Healing Anti-Diarrheal Skin Condition Against Fever	0.07 0.1 0.07 0.13
<i>Trifolium repens</i> L.		Antispasmodic Antiseptic Antipyretic Colic Flu Leukorrhea	0.01 0.08 0.10 0.04 0.01 0.03
<i>Trigonella faenumgraecum</i> L.		Soothing Anabolic Emollient Antipyretic Galactagogue Hypoglycemic Tonic	0.06 0.06 0.02 0.03 0.08 0.05 0.1
<i>Quercus ilex</i> L.	Fagaceae	Antidiarrheal Antiseptic Astringent Antipyretic Hemostatic sweet acorns are Nutritious Tonic	0.21 0.12 0.1 0.06 0.09 0.15
<i>Erodium cicutarium</i> L'Her.	Geraniaceae	Hemostatic Uterotonic	0.17 0.10

<i>Geranium robertianum</i> L		Astringent Tonic Anti-Diarrheal Depurative Hemostatic Vulnerary Sedative	0.06 0.09 0.05 0.10 0.03 0.01 0.05
<i>Globularia alypum</i> L.	Globulariaceae	Purgative Cholagogue Stimulant Depurative Laxative Diuretic Anti-Fungal	0.15 0.08 0.19 0.14 0.16 0.13 0.07
<i>Ajuga iva</i> (L.) Schreber		Astringent Antiseptic Vulnerary Vermifuge Febrifuge	0.08 0.21 0.15 0.09 0.10
<i>Marrubium alysson</i> L.		Emmenagogue Antispasmodic Stomachic Anti-Rheumatic	0.06 0.11 0.05 0.07
<i>Marrubium supinum</i> L.		Emmenagogue Antispasmodic Stomachic Antirheumatic	0.06 0.02 0.08 0.1
<i>Marrubium vulgare</i> L.		Emmenagogue Antispasmodic Stomachic Diuretic Anti-Influenza Vulnerary Antidiarrheal Antipyretic Antirheumatic	0.07 0.15 0.14 0.07 0.05 0.13 0.13 0.04 0.15
<i>Mentha spicata</i> L.	Lamiaceae	Analgesic Antiseptic Antispasmodic Aromatic Carminative Cholagogue Digestive Stimulating Tonic	0.05 0.09 0.13 0.38 0.27 0.23 0.55 0.1 0.13
<i>Origanum glandulosum</i> Desf.		Antiseptic Antispasmodic Carminative Digestive Emmenagogue Expectorant Calming Antitussive Aperitif	0.08 0.13 0.17 0.28 0.05 0.09 0.08 0.05 0.08
<i>Rosmarinus officinalis</i> L.		Antiseptics Antispasmodics Antirheumatics Healing Agents Detoxifiers Diuretics Muscle Relaxants Decongestant Cardiac Tonic	0.06 0.15 0.11 0.18 0.06 0.10 0.1 0.09 0.07

<i>Salvia verbenaca</i> L.		Stimulant Tonic Antiseptic	0.07 0.03 0.1
<i>Teucrium chamaedrys</i> L.		Antiseptic Aperitive Choleretic Digestive Febrifuge Stomachic	0.09 0.13 0.07 0.12 0.09 0.14
<i>Teucrium polium</i> L.		Febrifuge Anti-Inflammatory Astringent Detergent Tonic Bitter	0.09 0.15 0.11 0.06 0.18 0.08
<i>Thymus hirtus</i> Willd.	Lamiaceae	Antifungal Antiseptic Antispasmodic Aperitif Bechic Detergent Digestive Stomachic Tonic Vulnerary Vermifuge	0.05 0.15 0.11 0.17 0.03 0.07 0.20 0.27 0.15 0.13 0.10
<i>Laurus nobilis</i> L.	Lauraceae	Antiseptic Aromatic Aperitif Carminative Digestive Parasiticide Sedative Stomachic Stimulant Sudorific	0.02 0.15 0.06 0.07 0.09 0.05 0.06 0.10 0.12 0.05
<i>Allium cepa</i> L.	Liliaceae	Antiputrid Constipation Headaches Hair Loss Lungs and Breathing Analgesic Antiasthenic Anti-Infectious Anti-Inflammatory Antiscorbutic Antirheumatic Antiseptic Bactericidal Bacteriostatic (Gastrointestinal) Cholagogue Diuretic Emmenagogue Emollient Glandular Balancing	0.05 0.09 0.15 0.17 0.09 0.15 0.07 0.19 0.21 0.06 0.05 0.23 0.09 0.07 0.04 0.05 0.02 0.05 0.03

<i>Allium sativum</i> L.		Anti-Inflammatory Antiseptic Antispasmodic Bactericidal Coricide Depurative Diuretic Expectorant Febrifuge Hypoglycemic Hypotensive Stimulant Sudorific Tonic Vermifuge	0.09 0.14 0.07 0.1 0.06 0.05 0.05 0.01 0.07 0.02 0.02 0.06 0.09 0.1 0.1
<i>Asparagus acutifolius</i> L.	Liliaceae	Diuretic Tonic Depurative	0.05 0.09 0.04
<i>Malva sylvestris</i> L.	Malvaceae	Emollient Soothing Chronic Constipation Stomatitis Glossitis Carminative Vulnerary	0.01 0.22 0.15 0.18 0.13 0.09 0.14
<i>Ficus carica</i> L.	Moraceae	Antiasthénique Depurative Diuretic Emollient Laxative Nutritive Pectoral Tonic Coricide Resolvent Vermifuge	0.15 0.11 0.17 0.06 0.19 0.33 0.09 0.05 0.03 0.05 0.05
<i>Eucalyptus globulus</i> Labill.	Myrtaceae	Antibiotic Antiseptic Bactericidal Carminative Diaphoretic Expectorant Antipyretic Stimulant Action	0.19 0.30 0.13 0.09 0.06 0.10 0.07 0.11
<i>Olea europea</i> L. var <i>sativa</i> .	Oleaceae	Hypotensive Spasmolytic Emollient Antiarrhythmic Vasodilator Coronary Dilator Antipyretic Tonic	0.34 0.09 0.10 0.07 0.05 0.03 0.06 0.12
<i>Phillyrea angustifolia</i> L.		Diuretic Emmenagogue Febrifuge Against Canker Sores Stomatitis Headaches	0.04 0.07 0.1 0.05 0.06 0.11
<i>Glaucium corniculatum</i> Curtis	Papaveraceae	Used against eye conditions	0.06

<i>Papaver rhoeas</i> L.		Anti-Inflammatory Antitussive Expectorant Emollient Respiratory Disorders	0.13 0.07 0.10 0.06 0.16
<i>Plantago albicans</i> L.	Plantaginaceae	Soothing Astringent Emollient Diuretic Laxative	0.05 0.10 0.05 0.11 0.09
<i>Ampelodesma mauritanicum</i> (Poir) Dur et schinz.	Poaceae	/	/
<i>Avena alba</i> L.		/	/
<i>Avena sterilis</i> L.		Soothing Anti-Asthenic	0.02 0.07
<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Emollient Nutritive Sedative Stimulating	0.08 0.17 0.05 0.13
<i>Stipa tenacissem</i> L.		/	/
<i>Triticum vulgare</i> Vill.		/	/
<i>Anagallis arvensis</i> L.	Primulaceae	Disinfectant Detergent Diuretic Expectorant Anti-Inflammatory	0.01 0.06 0.10 0.03 0.1
<i>Clematis cirrhosa</i> L.		Treatment Of Neuralgias Rheumatic Pains	0.06 0.09
<i>Nigella sativa</i> L.	Ranunculaceae	Analgesic Antiseptic Antispasmodic Aperitive Carminative Digestive Diuretic Expectorant Febrifuge Galactagogue Vermifuge	0.15 0.09 0.18 0.07 0.08 0.10 0.10 0.06 0.14 0.05 0.02
<i>Rhamnus alaternus</i> L.	Rhamnaceae	Astringent Laxative Purgative Effective Against Hepatic Jaundice	0.10 0.08 0.13 0.06
<i>Ziziphus lotus</i> (L.) Desf.		Emollient Pectoral Anti-Inflammatory Sedative Tonic Diuretic	0.09 0.07 0.24 0.15 0.16 0.11
<i>Prunus armeniaca</i> L.	Rosaceae	Anti-Asthenic Anti-Anemic Aperitifs Astringent Laxative (Dried Fruits) Nutritious Revitalizing Tonic	0.06 0.1 0.14 0.08 0.20 0.34 0.27 0.19

<i>Rosa canina</i> L.		Vitaminizing Tonic Emollient Anti-Inflammatory Diuretic Depurative Hypoglycemic Anemia Anorexia Avitaminosis Colitis Diabetes Convulsive Cough Urinary Gastric System Cardiac Disorders	0.07 0.1 0.03 0.15 0.09 0.06 0.07 0.08 0.05 0.06 0.02 0.12 0.09 0.14 0.13 0.05
<i>Ruta montana</i> (Clus.) L.	Rutaceae	Analgesic Antispasmodic Anti-Inflammatory (Ophthalmia) Diuretic Emmenagogue Sedative Sudorific Vermifuge	0.08 0.10 0.08 0.15 0.1 0.07 0.09 0.11
<i>Lycium europeum</i> L.	Solanaceae	Antispasmodic Anti-Ophthalmic Diuretic Antipyretic Hypotensive Purgative	0.10 0.21 0.05 0.1 0.15 0.08
<i>Tamarix africana</i> L-Poiret	Tamaricaceae	Anticatarrhal Aperitive Astringent Diuretic Hemostatic Sudorific	0.3 0.15 0.1 0.14 0.09 0.07
<i>Tamarix gallica</i> L.		Chills Cold Tonsillitis Sudorific Eyediseases Boils Diarrhea	0.05 0.09 0.12 0.2 0.14 0.09 0.16
<i>Thymelaea hirsuta</i> Endl.	Thymeleaeceae	Expectorant Hydragogue Anthelmintic	0.1 0.07 0.14
<i>Thymelaea microphylla</i> Coss.et Dur.		/	/
<i>Peganum harmala</i> L.	Zygophyllaceae	Stimulant Euphoric Hemorrhoids	0.2 0.14 0.27

#### Parts of the plants used

Table (5) groups the percentage of each part of the plant used by the local populations near the sampled sites in the Djelfa province.

The leaves were the most used part, accounting for 25.71% of all plant parts. The flowers, fruits, and seeds, with 15.23%, 14.28%, and 13.33% respectively, are the second most used groups of organs, followed by the roots and aerial parts (11.42%) and (9.52%), while the stems account for only 5.71% (Fig. 4).

Table 5. Parts of plants used by the local population of the sampled sites in the Djelfa province.

Parts of plants used	Percentage (%)
Leaves	25.71 %
Aerial Parts	9.52 %
Seeds	13.33 %
Fruits	14.28 %
Roots	11.42 %
Flowers	15.23 %
Stems	5.71 %

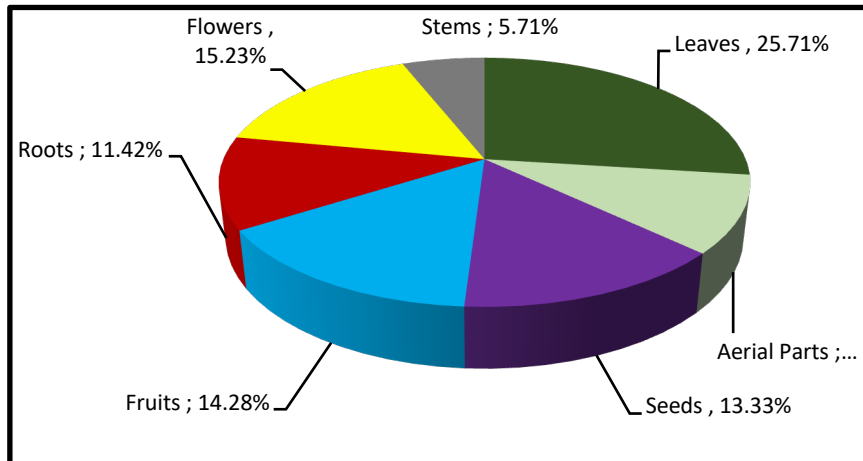


Figure 4. Percentage of plant parts used by the local populations near the sampled sites.

**Preparation method**

Table (6) and figure (5) represent the percentages of each preparation method most commonly used by the riparian populations in our study region.

Table 6. Methods of plant preparation by the riparian populations of the sampled sites.

Recipe preparation techniques	Percentage (%)
Decoction	15.23 %
Infusion	34.28 %
External use	16.19 %
Poultice	5.71%
Powder	10.47 %
Cooked	1.9 %
Remedy	0.95 %
Internal use	2.85 %
Herbal tea	1.9 %

Infusion (34.28%), external use (16.19%), decoction (15.23%), and powder (10.47%) are the most commonly used preparation methods in our study region. The other preparation methods (Poultice, Cooked, Remedy, Internal Use, Herbal Tea) are mentioned with quantities less than 5% each (Figure 5). Generally, the method of preparation is related to the type of pathology to be treated.

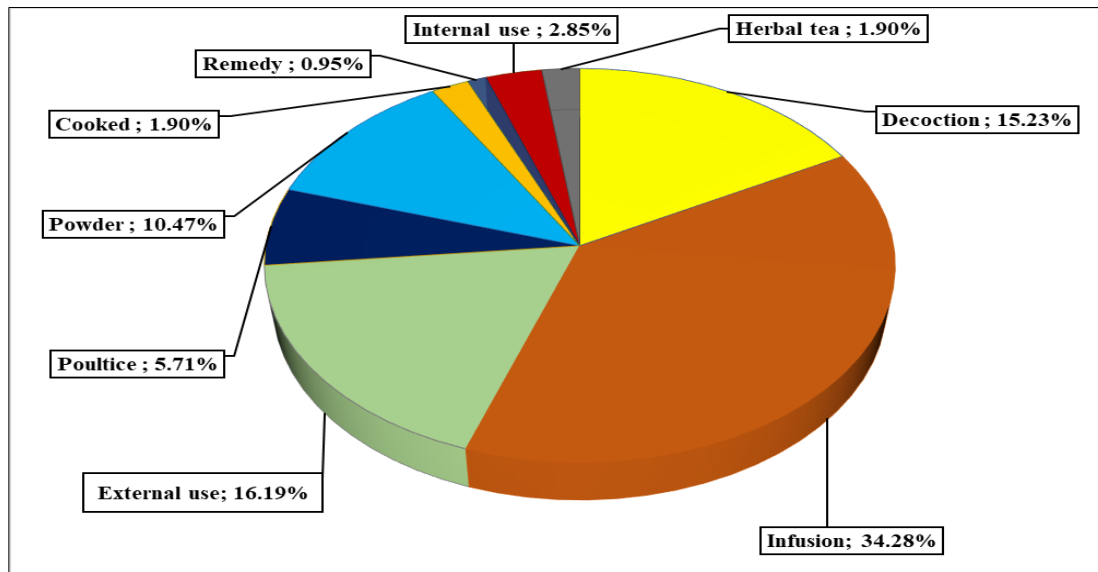


Figure 5. Percentage of preparation methods for plant parts used by the local populations near the sampled sites

## Discussion

The predominance of women in the use of medicinal plants can be explained by the fact that they trust natural remedies and always take things seriously, even in cases of minor illnesses. They are also attentive to anything that may affect their children's health and use simple herbal remedies.

Comparing our results with those of previous studies that reported the same findings as those presented in this study, we confirmed that older people (predominantly women in the 60+ age group) are the most knowledgeable and the most likely to provide reliable information on the virtues and use of medicinal plants (González-Tejero *et al.* 2008; Bouasla *et al.* 2017; Djedaia, 2017; Yabrir *et al.* 2018; Miara *et al.* 2018; Lazli *et al.* 2019; Senouci *et al.* 2019; Ouadeh *et al.* 2021).

Recent ethnobotanical research conducted in different regions of Algeria has revealed differences between regions. Meddour *et al.* (2022) identified 136 medicinal plant taxa in the province of Bouira, belonging to 54 families, the most represented being Asteraceae (18 taxa) and Lamiaceae (16 taxa). Meddour & Sahar (2023) identified 121 plant taxa belonging to 108 genera and 56 families in the Djurdjura, with a predominance of Lamiaceae (10.7%) and Asteraceae (9.1%). Zatout *et al.* (2021) reported 109 taxa belonging to 54 families in Tlemcen National Park, the most common being Lamiaceae (15.5%) and Asteraceae (11.9%). However, Djelaila *et al.* (2022) in El Bayadh identified only 40 plant taxa belonging to 23 families, the most important of which were Lamiaceae (17.5%) and Fabaceae (12.5%).

The same observations have been made in neighboring regions of Algeria (Boudjelal *et al.* 2013; Sarri *et al.* 2014; Yabrir *et al.* 2018-2019; Habib *et al.* 2020; Daoud *et al.* 2022).

In previous research conducted in various regions of the world, the Lamiaceae and Asteraceae families were also identified as the most common: Morocco (Taïbi *et al.* 2023), Pakistan (Rehman *et al.* 2023a), Nepal (Karki *et al.* 2023), Spain (Rigat *et al.* 2015), Cameroon (Bruno *et al.* 2023), while Rosaceae was the most commonly used family in different regions of Turkey (Karaköse *et al.* 2019, Güler *et al.* 2021, Karaköse 2022, Şen *et al.* 2022).

The presence of these species in this environment reflects their adaptation to climatic and edaphic conditions and testifies to the floristic richness of this area, which constitutes a resource whose enhancement and maintenance, in the context of system sustainability, must be everyone's concern. The presence and distribution of populations and biocoenoses are closely linked to environmental factors (Duvignaud, 1980). Among the species listed: *Artemisia campestris*, *Stipa tenacissima*, *Lygeum spartum* and *Ziziphus lotus* have forage value and provide a dietary supplement for grazing domestic animals, while other species are used in traditional medicine as a source of remedy for certain ailments or diseases (Maiza *et al.* 1993; Hammiche *et al.* 2006).

Regarding the intensive use of the leaves, it can be deduced that it is consistent with many other ethnobotanical studies around the world, such as in Algeria: (35.30%) (Bendif *et al.* 2018), (25%) (Yabrir *et al.* 2019); (46.4%) (Benlarbi *et al.* 2023). In Morocco: (39.65%) (Afrokh *et al.* 2023), (18.6%) (Benkhniqie *et al.* 2023), (48%) (Taïbi *et al.* 2023), (41.6%) (Tlemcane *et al.* 2023), (35%) (Aftab *et al.* 2023), (24.22%) (Rehman *et al.* 2023a), (28.57%) (Rehman *et al.* 2023b).

In Cameroon: (Bruno *et al.* 2023) (68.18%). In Mexico : (39.8%) (Torres-León *et al.* 2023). In India : (25%) (Hussain *et al.* 2023). In Côte d'Ivoire : a rate of 96% (Kouadio *et al.* 2016 ; Rouabhi *et al.* 2019). In Turkey: a rate of 37.03% (Güler *et al.* 2021) and 61.95% (Şen *et al.* 2022).

The high frequency of leaf use is explained by their availability and the ease with which they can be harvested (Nasution *et al.* 2018) and by the fact that their harvesting does not damage or affect plant growth (Brito *et al.* 2017). Moreover, the leaves are the site of photosynthesis and the storage of secondary metabolites responsible for medicinal effects (Slimani *et al.* 2016; Susanti & Zuhud, 2019).

In Algeria, Azzi *et al.* (2012) ; Sarri *et al.* (2014) report that leaves represent the most commonly used plant organ. This can be explained by the fact that leaves are the site of photosynthesis and sometimes the storage of secondary metabolites responsible for the biological properties of the plant (Bitsindou, 1986).

The information on the distribution patterns of medicinal plants and their therapeutic properties can vary from person to person for the same plant. Based on our surveys, we found that our results are consistent with those obtained in the Souf region of Algeria (Bouallala *et al.*, 2014), the M'Sila region (Boudjelal *et al.* 2013; Sarri *et al.* 2014; Ouadeh *et al.* 2021), and the Djelfa region (Yabrir *et al.* 2018-2019).

The work of Sarri *et al.* (2017) (45%), Bendif *et al.* (2018) (41%), and Benlarbi *et al.* (2023) (38.8%) confirms our findings.

Other methods of use have been mentioned, but with higher frequencies than those observed in our study: powder (Béné *et al.* 2016) and poultice (Daoudi *et al.* 2015).

#### **Ethnobotanical implications and contribution to local health practices**

The results of this study provide valuable information on the persistence and cultural relevance of traditional herbal medicine in the Djelfa region. The predominance of wild plants, the preference for simple preparation techniques such as infusion and decoction, and the frequent use of leaves reflect both the ecological availability of resources and the deeply rooted traditional knowledge of the local population.

These practices demonstrate the resilience of ethnobotanical traditions in meeting healthcare needs, particularly in rural communities where modern medical services are often limited or costly. The findings also highlight the importance of preserving this intangible cultural heritage, which holds potential not only for local healthcare but also for future pharmacological research. In this context, integrating ethnobotanical knowledge into public health policies could support sustainable healthcare strategies while preserving biodiversity and cultural identity.

#### **Conclusion**

This ethnobotanical study provides the first comprehensive inventory of medicinal plants used by local communities in the Djelfa region of central Algeria. The results reveal remarkable floristic diversity, with 105 medicinal species divided into 86 genera and 34 families, and highlight the central role of herbs and wild plants in traditional health practices.

The predominance of the Lamiaceae and Asteraceae families is consistent with trends observed in Mediterranean and North African regions, reinforcing the strong biogeographical and cultural consistency in the selection and use of medicinal plants.

Above all, the study not only lists plant species and their therapeutic indications, but also provides detailed information on the ethnobotanical practices of the local population, such as the preferred parts of plants (leaves), methods of preparation (infusion, decoction), and the main health problems treated, with digestive and metabolic disorders being the most frequently cited.

These findings demonstrate the persistence of herbal therapies as a cornerstone of primary health care in rural and semi-arid settings, where access to modern health care may be limited. They also echo similar patterns observed in other

traditional societies, where the use of medicinal plants remains a strategy for adapting to local ecological and socioeconomic conditions.

The quantitative approach and the use of usage indices such as RFC reinforce the scientific rigor of the results and enable relevant comparisons with similar studies at the regional and global levels. In addition, the identification of certain species with high citation value offers promising candidates for further pharmacological validation and bioactivity screening. This can contribute to the promotion of traditional knowledge and open up new perspectives in the search for natural therapeutic agents.

Protecting these resources is therefore essential not only for biodiversity, but also for preserving the cultural identity and traditional knowledge of local populations. Integrating this traditional knowledge into pharmacological research could promote the discovery of new bioactive compounds and contribute to sustainable rural development.

It is therefore crucial to promote the rational use and conservation of these plant resources, encourage the intergenerational transmission of ethnobotanical knowledge, and support collaborative research between local communities and scientists. Such interdisciplinary efforts can strengthen the links between biodiversity, cultural heritage, and health, offering valuable opportunities for sustainable development and bioprospecting in Algeria and beyond.

This study not only enriches Algeria's ethnobotanical database, but also serves as a valuable reference for future research, conservation planning, and the development of phytotherapeutic products. Ultimately, these findings underscore the global relevance of local knowledge systems and their potential contributions to health sciences, biodiversity conservation, and cultural sustainability.

## Declarations

**Ethics approval and consent to participate:** All participants provided oral prior informed consent.

**Consent for publication:** Not applicable.

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**Author contributions:** S.B. collected and analyzed the data and wrote the text, conceptualization, study, and methodology. He also drafted the final version of the manuscript. Y.B. and H.A.B. participated in data management, formal analysis, and manuscript review and validation. All authors reviewed and approved the final version of the manuscript.

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