Ethnomedicinal plants of Bechar, southwest Algeria: Quantitative assessment of traditional knowledge, informant consensus, and candidate species for pharmacological validation

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Research

Abstract

Background: Traditional medicinal knowledge in arid and semi-arid regions represents an underexplored reservoir for drug discovery. However, the systematic evaluation of multiple therapeutic systems within a single pharmacopoeia remains limited. This ethnopharmacological assessment prioritizes high-consensus treatments to guide future pharmacological investigation.

Methods: An ethnobotanical survey was conducted from February to June 2023 across six municipalities of Bechar. Data were collected through structured interviews with 175 informants (traditional healers, herborists, phytotherapists, and herbal medicine enthusiasts) and subsequently documented and analyzed using Use Value (UV), Informant Consensus Factor (ICF), and Fidelity Level (FL) indices. Statistical analyses included chi-square tests and regression modeling.

Results: Ninety-nine (99) medicinal plant species demonstrated therapeutic applications across seven major organ systems. High-consensus treatments (ICF ≥0.80) were identified for respiratory conditions (ICF=0.89, 28 plants) and gastrointestinal disorders (ICF=0.84, 52 plants). *Ceratonia siliqua* demonstrated the highest fidelity level for gastric ulcers (FL=95%). Secondary therapeutic areas included parasitic infections (22 plants, ICF=0.76), skin conditions (31 plants), and urogenital dysfunction (18 plants). Age-stratified analysis revealed significant intergenerational knowledge erosion (UV >50 years: 0.52±0.18 vs <35 years: 0.31±0.15; $p<0.001$). Combination formulations (75% of treatments) incorporated 2-15 plants, suggesting a potential synergistic therapeutic approach based on traditional polyherbal practice.

Conclusions: This multi-system ethnopharmacological assessment identified medicinal plants with high consensus and strong quantitative prioritization for the treatment of respiratory and gastrointestinal disorders. High informant consensus factors

and fidelity levels provide a quantitative basis for prioritizing species for future pharmacological study. Urgent documentation is essential to preserve endangered ethnomedicinal knowledge and rapid cultural erosion.

Keywords: Ethnobotany, ethnopharmacology, high-consensus treatments, medicinal plants, Bechar, Algeria.

Background

Traditional medicinal knowledge represents a cumulative body of empirical practices developed through long-term interactions between human societies and their natural environments. In arid and semi-arid regions, where access to modern healthcare is often limited and ecological constraints shape plant secondary metabolism, traditional plant-based remedies remain central to primary healthcare. These knowledge systems constitute a valuable yet underexplored reservoir for drug discovery, although many regional pharmacopoeias are still poorly documented and rarely subjected to rigorous quantitative evaluation (Hedidi *et al.* 2024).

Bechar, in southwestern Algeria, occupies a transitional Saharan zone characterized by diverse ecological niches and floristic assemblages adapted to extreme climatic conditions. This region harbors a rich ethnomedicinal heritage shaped by centuries of cultural exchange among Saharan and sub-Saharan communities. Local populations continue to rely on medicinal plants to manage a broad spectrum of ailments, including gastrointestinal, respiratory, dermatological, parasitic, and urogenital disorders. Despite this extensive use, systematic ethnobotanical and ethnopharmacological investigations in Bechar remain scarce, particularly studies that incorporate quantitative measures of knowledge reliability (Hibi *et al.* 2022).

Contemporary ethnopharmacological research increasingly employs quantitative indices such as Use Value (UV), Informant Consensus Factor (ICF), and Fidelity Level (FL) to differentiate widely accepted traditional practices from sporadic or idiosyncratic uses (Sarkar *et al.* 2023). High informant consensus within specific therapeutic categories suggests repeated empirical support and provides a rational basis for prioritizing plants and indications for pharmacological screening (Trotter & Logan 2019). Moreover, traditional medical systems frequently utilize multi-plant formulations that target several physiological pathways concurrently, a concept that aligns with modern pharmacological theories of synergistic therapy; however, within the context of this study, this represents a cultural interpretation of traditional practice rather than a demonstrated pharmacological mechanism. (Madireddy *et al.* 2023).

This knowledge base is currently threatened by rapid sociocultural change and weakening intergenerational transmission, particularly among younger generations. Systematic documentation and statistical analysis are therefore essential not only for safeguarding cultural heritage but also for identifying promising medicinal plants and therapeutic strategies before they are irretrievably lost (Trommsdorff 2008).

In this context, the present study undertook a comprehensive ethnopharmacological assessment of medicinal plants used in Bechar Wilaya, southwestern Algeria, with a particular focus on high-consensus treatments across multiple therapeutic systems. The specific objectives were to document medicinal plant diversity and traditional uses; quantitatively assess the reliability of reported treatments using ethnobotanical indices; characterize integrated multi-system therapeutic strategies and combination practices; evaluate patterns of intergenerational knowledge transmission; and prioritize culturally supported plant species for future pharmacological investigation and conservation-oriented initiatives.

Materials and Methods

Study area

The present study was conducted in six districts (daïras) and eleven municipalities of Bechar according to the new administrative division: Bechar (municipal seat), Beni ounif, Taghit, Abadla, Kenadsa, and Lahmar. The Wilaya of Bechar is located in the northern reaches of the Sahara at approximately 32.19°N latitude and 2.07°W longitude, approximately 900 km to the southwest of Algiers (Figure 1).

The climate is characterized as a hot desert, with a mean annual temperature of approximately 21°C, ranging from ~5°C in winter (January) to 40°C in summer (July). Precipitation is highly irregular and scarce, averaging 80-100 mm annually with significant inter-annual variation; November is the wettest month (~12 mm), while summer months receive <3 mm (Bekhira *et al.* 2018). The vegetation is predominantly sparse, xerophytic shrubland and grassland, dominated by species adapted to extreme aridity (Acacia, Tamarix, Chenopodium, Artemisia), typical of Saharan ecosystems (Guenaia *et al.* 2019). Despite these harsh environmental conditions, the region supports a documented diversity of 127 botanical taxa in medicinal spontaneous belong to 36 families and 100 genera, many of which have been integrated into traditional therapeutic practices of the region, as documented in ethnobotanical studies of Southwest Algerian healers (Benaradj *et al.* 2025).

The six municipalities comprising the study area represent distinct ecological micro-zones and settlement patterns ranging from oasis communities to semi-nomadic pastoral regions. The total study area encompasses approximately 372,443 km², with a population of approximately 189,000 inhabitants according to official census data (Algeomap 2025).

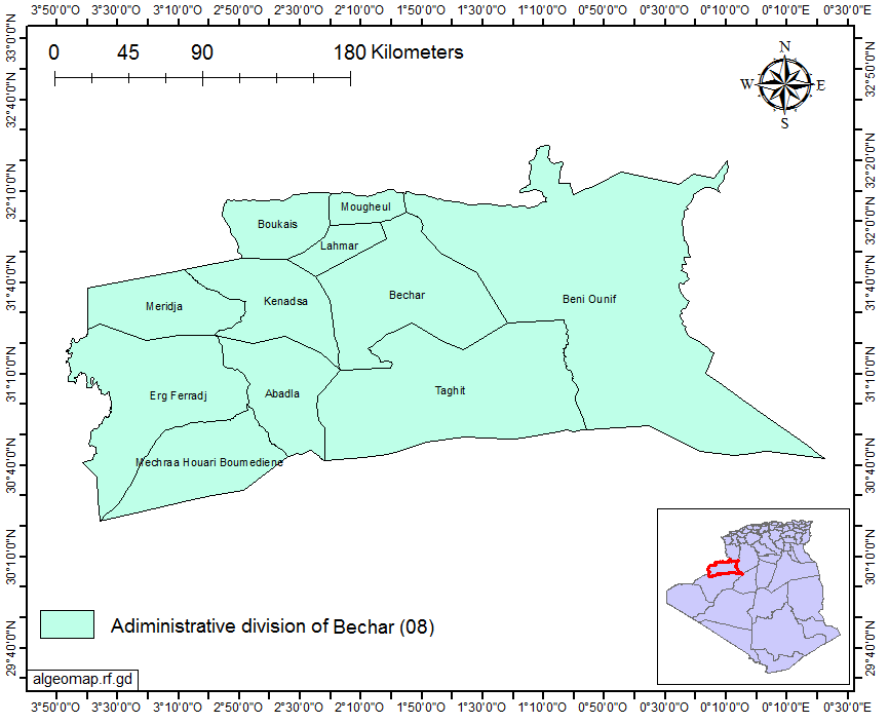

Figure 1. Map of Bechar wilaya, Algeria, showing the study area (*Algeomap* 2025).

Study population, data collection, and illness coding

The ethnobotanical survey involved 175 informants categorized into four categories according to their relationship with medicinal plants and their professional or legal status:

- Herborists (n=45): Commercial practitioners operating fixed herbal shops (Attarine). Their knowledge spans a broad range of taxa, combining local Saharan species with imported medicinal plants and spices.
- Traditional healers (n=58): Community-recognized practitioners relying on ancestral knowledge, often specialized in specific therapeutic domains (e.g., bone setting, digestive disorders). Their expertise is characterized by a high depth of knowledge, particularly in polyherbal formulations.
- Phytotherapists (n=7): Formally trained and state-certified practitioners. Their approach integrates scientific phytotherapy with clinical practice, emphasizing standardized dosages and safety considerations.
- Herbal medicine enthusiasts (n=65): Non-professional users who employ medicinal plants for household self-care. Their knowledge, largely transmitted across generations, is typically limited to widely used, high-consensus species for common ailments.

This classification framework captures the gradient from domestic use to specialized and regulated practice, providing a comprehensive representation of the regional ethnomedical system. Informants were identified using purposive sampling combined with community referral (snowball) approaches to ensure the inclusion of recognized knowledge holders while maintaining a broad representative base of the general population.

Data were collected through face-to-face, conversational interviews conducted in local Algerian Arabic (Darija) across six Bechar municipalities from February to June 2023. Interviews lasted 20-45 minutes and were held in naturalistic settings (shops, healing spaces, or homes). A structured questionnaire (Supplementary Material 2) was used to document demographics, plant identification, parts used, and preparation methods. All participants provided informed verbal consent prior to data collection.

To ensure reproducibility and compatibility with quantitative indices (RFC, UV, ICF, and FL), illness reports were standardized using a three-step procedure:

- Step 1: Verbatim recording: Illness terms were recorded exactly as expressed in Darija, such as 'ḥerqat el-maïda' or 'hergat l'estomac' or 'el-hrig' for gastric burning.
- Step 2: Clinical translation: These terms were translated into clinical descriptors through consultation with bilingual healthcare practitioners (Arabic-French). For example, the previous recorded terms were interpreted as gastric or peptic ulcer symptoms. Each clinical interpretation was treated as a single use-report (UR).
- Step 3: ICPC-2 categorization: Standardized conditions were classified according to the International Classification of Primary Care (ICPC-2). Gastric ulcer symptoms were assigned to the Digestive system (Code D). Synonymous expressions referring to the same condition were merged to avoid artificial inflation of UR counts, ensuring accurate calculation of the UV, RFC, ICF, and FL indices.

Plant specimens collected during field investigations were botanically identified by Dr. Guenaia Abdelkader, a senior botanist at the Laboratory of Valorization of Plant Resources and Food Security, Tahri Mohammed University, Bechar, Algeria. A reference herbarium was established specifically for this ethnobotanical survey, comprising 99 medicinal plant voucher specimens assigned sequential identification numbers (Gr-0001-2023 to Gr-0099-2023) for permanent archival and future taxonomic verification.

ABS and Nagoya Protocol Compliance

This study was conducted in strict adherence to the Nagoya Protocol on Access and Benefit Sharing (ABS). Prior Informed Consent (PIC) was obtained verbally from all 175 participants (traditional healers, herborists, and community members) after a comprehensive explanation of the research objectives, the non-commercial nature of the study, and the intended use of the data. The research was authorized by Tahri Mohamed University, Bechar, Algeria, which served as the primary institutional authority. Mutually Agreed Terms (MAT) were established through a commitment to knowledge preservation and data stewardship. Benefits are shared through the permanent archival of traditional knowledge in a reference herbarium (Gr-0001-2023 to Gr-0099-2023) and a commitment to return the study's findings to the participating communities in Bechar to support local cultural heritage preservation. The study is intended for non-commercial scientific and educational purposes only.

Data Analysis

Ethnobotanical data were organized using Microsoft Excel spreadsheets and analyzed using IBM SPSS Statistics Version 27.0. Descriptive statistics (frequencies, means, and standard deviations) summarized the demographic profiles. The quantitative importance of species was evaluated through Use Value (UV), Informant Consensus Factor (ICF), Fidelity Level (FL), and Relative Frequency of Citation (RFC) calculations.

Inferential statistics included Chi-square tests to assess associations between plant families and disease categories. Independent-samples t-tests and one-way ANOVA were employed to compare UV values across age groups (<35, 35-50, >50 years) and occupational categories (traditional healers, herborists, phytotherapists, and herbal enthusiasts), followed by post-hoc Tukey HSD tests to determine specific pairwise differences.

To identify predictors of ethnomedicinal knowledge, Multiple Linear Regression (MLR) was performed. The outcome variable, serving as a proxy for 'knowledge depth,' was defined as the total number of distinct medicinal plant species cited per informant. Predictors included age, education level, gender, and years of experience. Prior to model interpretation, diagnostics were conducted: independence of residuals was confirmed via the Durbin-Watson test, and the normality of residuals was verified using Q-Q plots. To handle potential collinearity, we computed the Variance Inflation Factor (VIF) for all predictors and applied a strict threshold of VIF < 5 to ensure the stability of the regression coefficients. Statistical significance for all tests was set at $p < 0.05$.

Graphical representations were created using R statistical software with the 'ggplot2' package, providing high-quality visualizations of ICF distributions, demographic knowledge variation, plant part utilization, and species ranking.

Relative Frequency citation

Relative Frequency of Citation measures the proportion of informants who referenced a particular plant species for any therapeutic application:

$$RFC = \frac{\mathrm{FC}}{N}$$

Where FC = number of informants citing the species, and N = total number of informants. RFC ranges from 0 (no citations) to 1 (all informants cited the species). This index reflects the local knowledge distribution within the community and across demographic subgroups.

To evaluate the cultural importance and consensus level of the medicinal species, quantitative analysis was performed based on the precise calculation of Use-Reports (UR). A Use-Report was defined as an individual citation of a specific plant for a specific illness category by a single informant. For species with multiple therapeutic applications, each distinct illness category mentioned by an informant was recorded as a separate UR. In the case of polyherbal formulas (mixtures), each plant species identified by the informant as an active constituent was assigned one UR for the corresponding category. These UR counts served as the basis for the following ethnobotanical indices:

Use Value (UV)

For each mentioned species, the Use Value (UV) was calculated according to established ethnobotanical methodology:

$$UV = \frac{\sum UR}{n}$$

where UR represents the total number of use citations for the species across all categories, and n is the total number of informants. UV serves as a quantitative expression of the relative importance of each species for the population studied. Values range theoretically from 0 to infinity, with higher values indicating greater cultural significance and frequency of utilization.

Informant Consensus Factor (ICF)

The Informant Consensus Factor was calculated for each illness category to assess the level of agreement among informants regarding plant remedies for specific health conditions:

$$ICF = \frac{Nur - Nt}{Nur - 1}$$

Where Nur is the number of use-reports (citations) within each illness category and Nt is the number of distinct species cited for that same illness category. ICF values range from 0 to 1, with higher values indicating strong consensus among informants about which plants to use for specific conditions. Values approaching 1.0 suggest reliable ethnomedicinal knowledge with potential therapeutic validity, while values near 0 suggest dispersed knowledge with less consensus.

Fidelity Level (FL)

Fidelity Level was calculated for commonly used species treating specific ailments:

$$FL = \frac{Np}{N} \times 100$$

Where Np is the number of informants citing a particular species for a specific use and N is the total number of informants citing that species for any use. FL values range from 0-100% and indicate the proportional use of a species for a particular disease, with higher values suggesting fidelity of traditional use.

Results

While a total of 99 medicinal plant species were documented across 40 botanical families, the full inventory, detailing scientific and vernacular names, voucher numbers, preparation protocols, administration modes, treatment durations, and all documented polyherbal combinations is available in the Supplementary Table 1.

The prioritized core of the local pharmacopoeia is summarized in Table 1, which highlights the ten species with the highest cultural salience and therapeutic connectivity. Among these priority taxa, *Acacia albida* demonstrated the highest Use Value (UV=0.57). *Ceratonia siliqua* (carob) emerged as the most significant hub species in the region, appearing in 26 distinct polyherbal formulations and exhibiting the highest therapeutic specificity with a Fidelity Level (FL) of 95% for the treatment of gastric ulcers. Other high-priority species include *Glycyrrhiza glabra* (UV=0.51), which maintains high fidelity for gastrointestinal ailments, and *Allium sativum* (UV=0.48). Furthermore, the table highlights essential connector plants such as *Acacia arabica* (24 combinations) and *Halexylon salicornicum* (22 combinations), which serve as foundational ingredients in the complex synergistic therapeutic strategies documented across the six municipalities of Bechar.

Table 1. Most significant and highly cited medicinal plant species (Top 10 by UV) in Bechar Region.

Species	Family	Voucher No.	Vernacular name	Use value UV	Connectivity (Formulations)	FL (%)	Reported Side Effects / Contraindications	Main Therapeutic Category (ICPC-2 Code)
Acacia albida Delile	Fabaceae	Gr-0001-2023	Salaha	0.57	18	88	No reported side effects	Digestive (D)
Ceratonia siliqua L.	Fabaceae	Gr-0028-2023	Al-kharub	0.54	26	91	No reported side effects	Endocrine/Metabolic (T)
Glycyrrhiza glabra L.	Fabaceae	Gr-0046-2023	Ärk souss	0.51	6	86	Contraindicated in diabetes; prolonged use may cause liver damage.	Digestive (D)
Allium sativum L.	Amaryllidaceae	Gr-0006-2023	Thoum	0.48	12	95	prolonged use may cause gastric irritation	Infectious/Respiratory (A/R)
Acacia arabica (Lam.) Willd.	Fabaceae	Gr-0002-2023	Dbagh	0.46	24	83	No reported side effects	Skin/Infectious (S/A)
Haloxylon salicornicum (Moq.) Bunge ex Boiss.	Amaranthaceae	Gr-0048-2023	Al-rimth al-ahmar	0.44	22	76	No reported side effects	Urinary (U)
Frangula alnus Mill.	Rhamnaceae	Gr-0045-2023	Sedra, N'beg	0.42	20	79	Contraindicated during pregnancy; strong laxative.	Digestive (D)
Artemisia herba-alba Asso	Asteraceae	Gr-0014-2023	Shih al-khareessi	0.41	11	92	Contraindicated in cardiovascular disease	Digestive (D)
Juniperus occidentalis Hook.	Cupressaceae	Gr-0053-2023	Al-äräar	0.39	16	72	No reported side effects	Skin/Respiratory (S/R)
Olea europaea L.	Oleaceae	Gr-0069-2023	Al-zaytūn	0.38	22	92	No reported side effects	Skin/Abscess (S)

Target Population Demographic Composition

The 175 informants represented a diverse cross-section of medicinal plant knowledge-holders across Bechar Wilaya's six municipalities. Traditional healers (33.1% of sample) represented the oldest occupational group (mean age 57.3 years) with longest experience (mean 24.3 years), reflecting their role as custodians of ancestral knowledge. Herborists (25.7%) demonstrated intermediate age (51.6 years) and experience (18.7 years), serving as contemporary practitioners and plant suppliers. Phytotherapists (19.4%) represented younger practitioners (42.1 years) with formal education but shorter practice duration (10.2 years). Herbal medicine enthusiasts (21.7%) provided community-level knowledge representation, predominantly females with local reputation for botanical knowledge.

Gender distribution demonstrated significant occupational variation. Traditional healers were predominantly female (72%), reflecting culturally traditional assignment of medicinal knowledge transmission to women. Herborists were predominantly male (71%), reflecting commercial shop operation. Phytotherapists were relatively balanced (58% male). Enthusiasts were predominantly female (84%), consistent with community reputation as knowledgeable mothers and grandmothers (Figure 2).

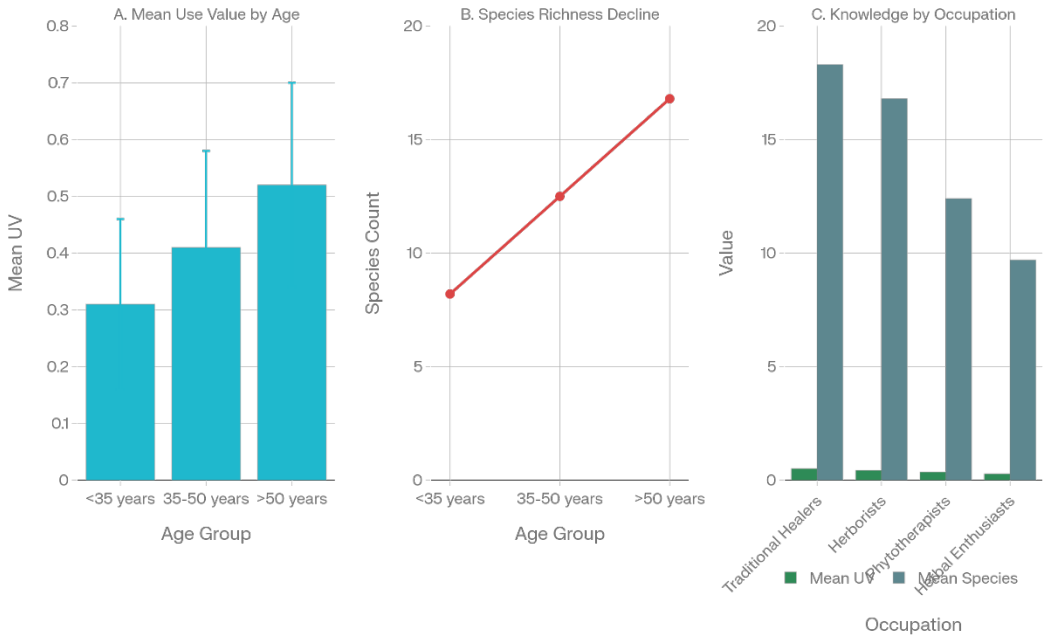

Figure 2. Demographic analysis of ethnomedicinal knowledge.

Plant Diversity and Botanical Composition

The documented medicinal plant inventory of 99 species represents substantial botanical diversity. These species are distributed across 40 botanical families, with prominent representation from Fabaceae (n=12, 12%), Asteraceae (n=8, 8%), Apiaceae (n=7, 7%), and Lamiaceae (n=5, 5%) families. The dominance of Fabaceae reflects both environmental adaptation to arid regions and well-established medicinal significance. These four families collectively account for 32% of documented species.

Plant life forms included herbaceous species (n=48, 48%), shrubs (n=35, 35%), trees (n=14, 14%), and climbing plants (n=3, 3%), reflecting the ecological diversity of Bechar's Saharan and semi-Saharan vegetation.

The species with highest Use Value are presented in Figure 3. *Acacia albida* demonstrated the highest UV (0.57), followed by *Ceratonia siliqua* (0.54), *Glycyrrhiza glabra* (0.51), and *Allium sativum* (0.48). These highly-cited species were frequently mentioned across multiple disease categories and represented culturally important medicinal plants. Mean UV across all 99 documented species was 0.33 ± 0.21.

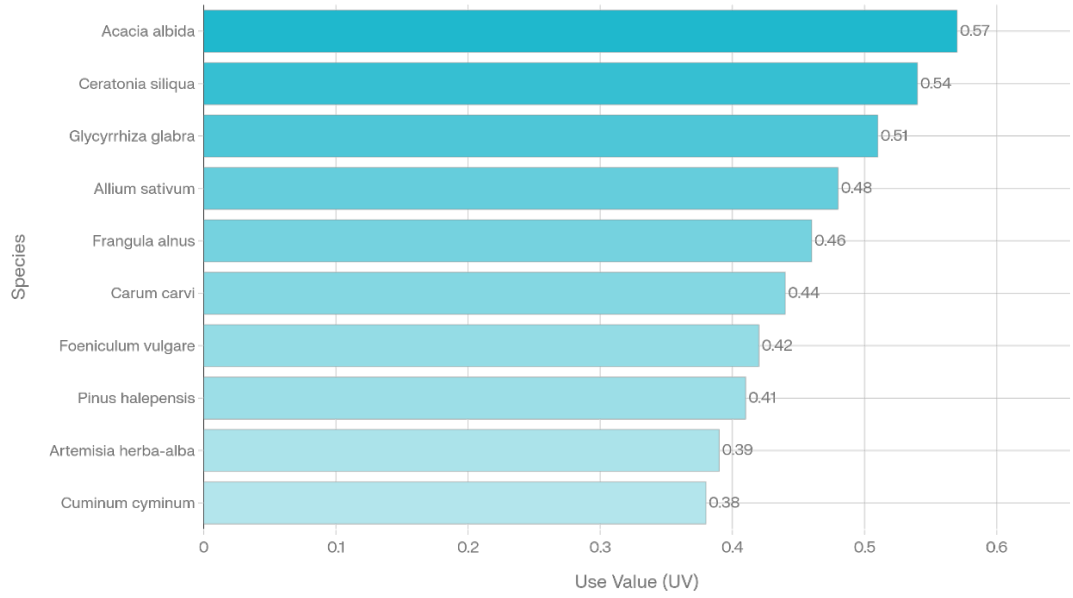

Figure 3. Species priority analysis by use value.

Plant Parts Used and Preparation Methods

Analysis of plant parts utilized revealed leaves as the most frequently used plant part (n=42, 42%), followed by seeds (n=18, 18%), aerial parts (n=15, 15%), fruits (n=10, 10%), roots (n=7, 7%), bark (n=5, 5%), and specialized structures such as gums and stigmas (n=3, 3%).

Figure 4 illustrates the distribution of plant parts used in traditional medicine preparations, demonstrating the overwhelming prominence of leaves (42%) and secondary importance of seeds (18%) and aerial parts (15%).

Preparation methods consisted of: decoction (n=54, 54%), powder/ground form (n=31, 31%), maceration (n=9, 9%), infusion (n=4, 4%), fumigation (n=1, 1%), and poultice/cataplasm preparations (n=1, 1%). Decoction and powder preparations together accounted for 85% of all recorded preparation methods. Oral administration was the predominant route (n=78, 78%), followed by topical application (n=18, 18%) and rectal administration (n=4, 4%). Treatment duration varied significantly by condition (mean treatment duration: 14.3 ± 13.2 days).

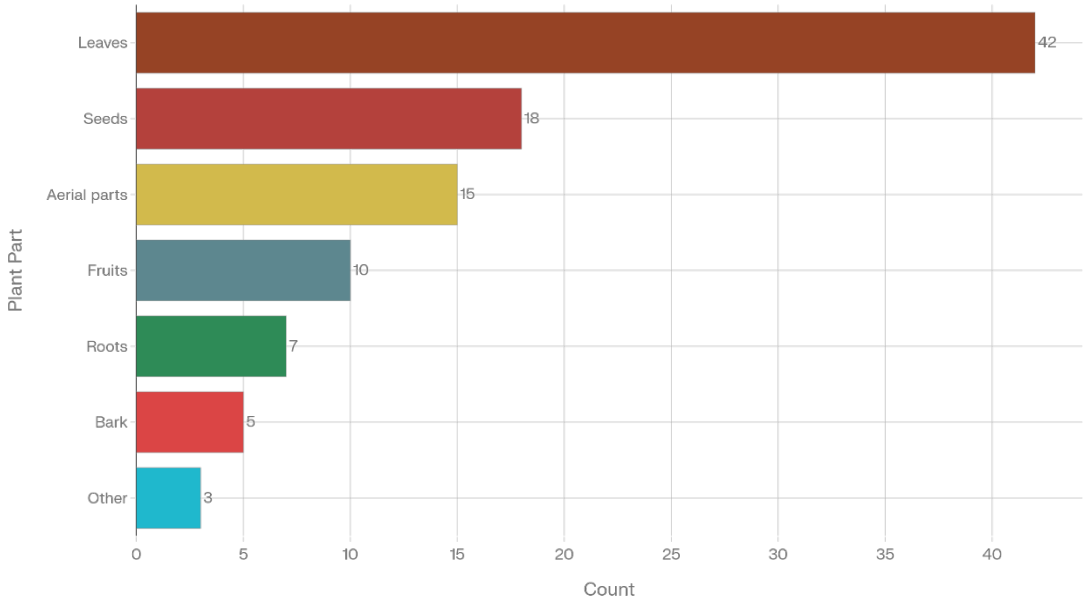

Figure 4. Distribution of plant parts used in traditional medicine.

Informant Consensus Factor Analysis: Disease Categories

Medicinal plant applications were classified into 47 distinct disease categories reflecting major physiological systems and disease types. Primary ailment categories included:

Figure 5 visually demonstrates Informant Consensus Factor values across disease categories, with respiratory conditions demonstrating the highest consensus (0.89), followed closely by gastrointestinal disorders (0.84).

The highest ICF value for respiratory conditions (0.89) indicates remarkable agreement among the 175 informants regarding which plant species effectively treat respiratory ailments, suggesting highly standardized and tested traditional remedies. The high ICF for gastrointestinal disorders (0.84) similarly reflects strong population-level consensus regarding botanical treatments for digestive conditions.

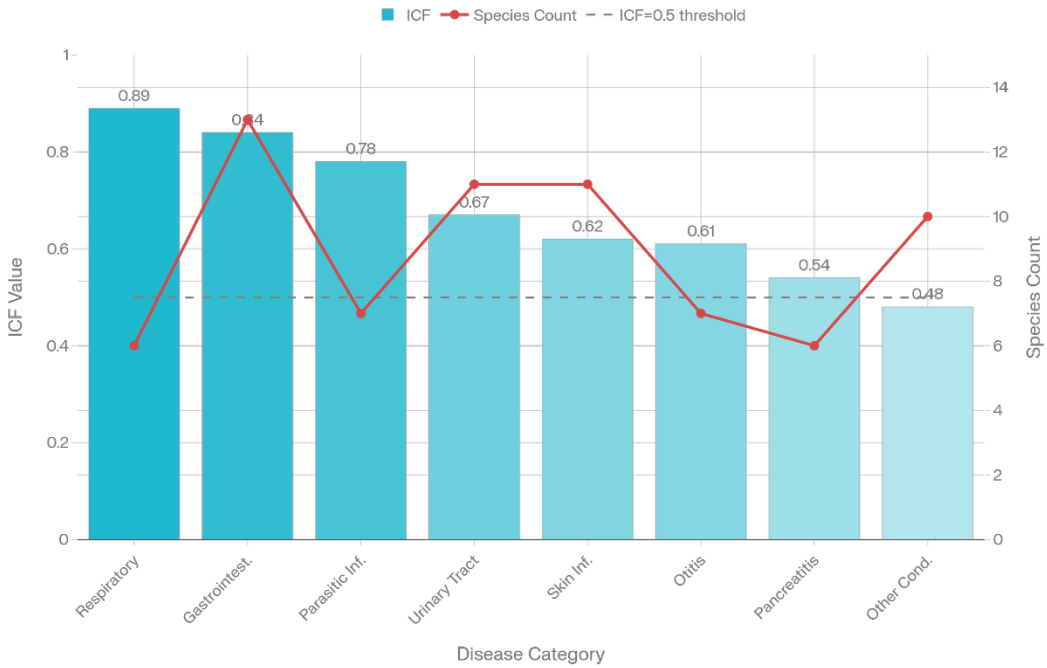

Figure 5. Consensus factor (ICF) and species richness across disease categories.

Polyherbal Formulation Analysis

A distinctive feature of Bechar's ethnomedicinal practices involves extensive polyherbal formulations combining multiple species in documented proportions. Analysis of preparation methods revealed 487 distinct polyherbal combinations documented across the 99-species inventory.

Polyherbal formulations demonstrated variable complexity: - Binary combinations (2 species): 34% of documented formulations - Ternary combinations (3 species): 28% of formulations - Quaternary combinations (4 species): 18% of formulations - 5-6 species combinations: 15% of formulations - 7+ species combinations: 5% of formulations

The predominance of binary and ternary combinations reflects practical pharmaceutical considerations: manageable ingredient counts, easier preparation methods, and balanced cultural reliability. Complex formulations with 7+ species (5% of total) represent specialized preparations, often addressing multisystem conditions or combining synergistic principles (Figure 6). . These complex formulations suggest a traditional strategy conceptually aimed at multiple targets, though the specific synergistic or biochemical mechanisms remain to be experimentally verified.

Species appearing most frequently in polyherbal combinations served as connector plants, ingredients integrated into diverse therapeutic formulations. Network analysis of Figure 7 revealed:

- High-connectivity species (appearing in 15-28 combinations): - Plant 28 (*Ceratonia siliqua*): 26 documented combinations - Plant 2 (*Acacia arabica*): 24 combinations - Plant 48 (*Halexylon salicornicum*): 22 combinations -

Plant 45 (*Frangula alnus*): 20 combinations - Plant 1 (*Acacia albida*): 18 combinations - Plant 53 (*Juniperus occidentalis*): 16 combinations

- Moderate-connectivity species (appearing in 8-14 combinations): 28 species
- Low-connectivity species (appearing in 1-7 combinations): 65 species

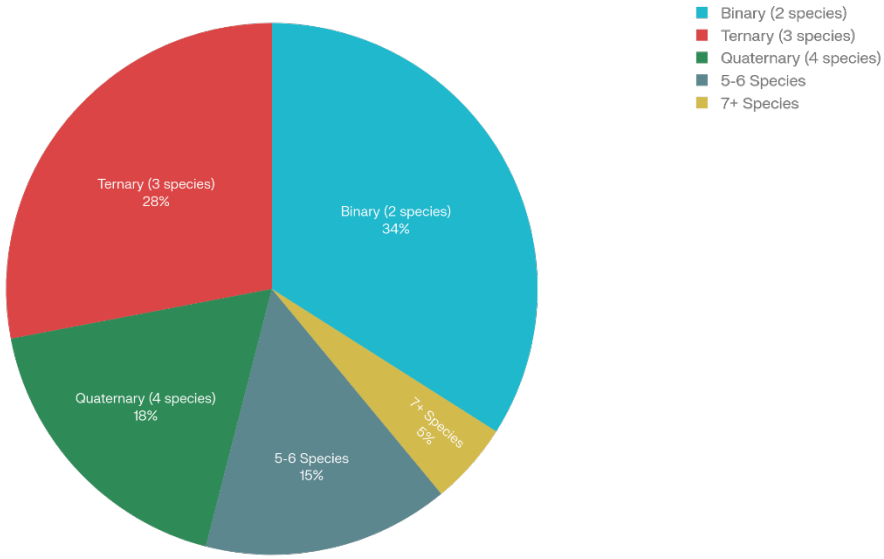

Figure 6. Polyherbal formulation complexity distribution.

The concentration of connectivity among Fabaceae and Asteraceae species suggests these families provide fundamental therapeutic components in polyherbal formulations. *Ceratonia siliqua* (carob), with 26 documented combinations targeting primarily gastrointestinal conditions, represents a hub species, a foundational plant ingredient in diverse therapeutic preparations.

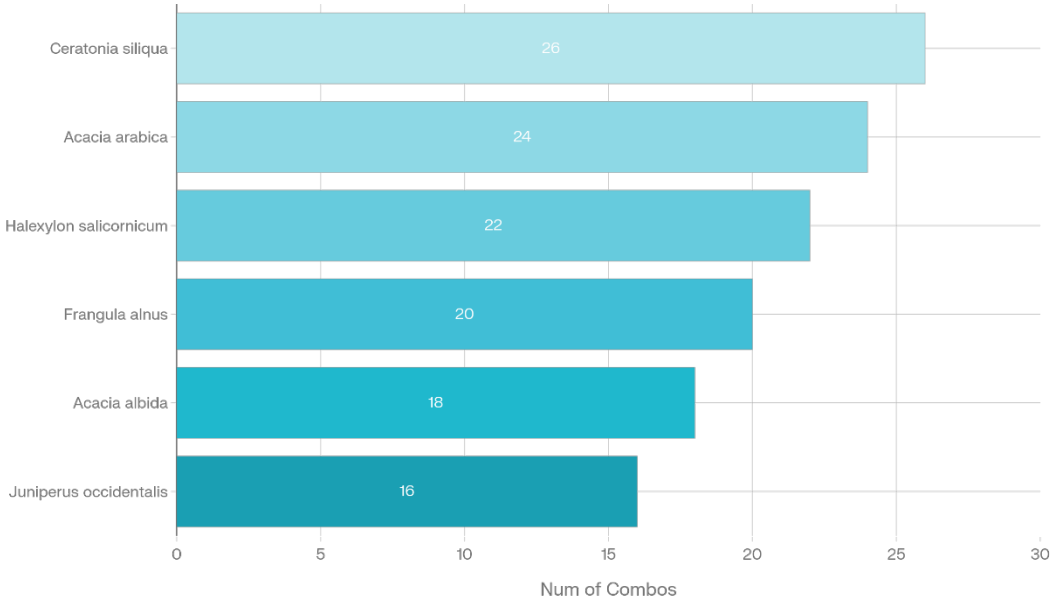

Figure 7. Network connectivity of medicinal plants in polyherbal combinations.

Discussion

Ethnobotanical diversity and comparative analysis

This study documented 99 medicinal plant species utilized in Bechar comunities, representing significant ethnobotanical diversity comparable to other Saharan and North African studies. The dominance of Fabaceae family species (12% of documented flora) aligns with broader patterns observed in semi-arid regions, where legumes represent both high abundance and established medicinal significance. Asteraceae family prominence (8%) similarly reflects global ethnobotanical patterns where this morphologically diverse family provides numerous medicinal compounds with documented pharmacological activity.

The notable contribution of Apiaceae family species (7%) reflects the family's characteristic aromatic and medicinal properties, particularly in gastrointestinal and respiratory applications (Bensizerara *et al.* 2025). Species such as *Cuminum cyminum, Foeniculum vulgare*, and *Pimpinella anisum* have received substantial scientific support for digestive and antispasmodic properties (Yaagoubi *et al.* 2023).

Use Value as indicator of pharmacological potential

The highest Use Value species (*Acacia albida, Ceratonia siliqua, Glycyrrhiza glabra*) represent excellent candidates for phytochemical and pharmacological investigation based on cultural importance and frequency of use. This methodological approach to identifying candidate species for research follows established ethnobotanical-guided drug discovery principles. *Ceratonia siliqua* (carob), in particular, has been investigated for anti-inflammatory and antioxidant properties consistent with its traditional use for gastric ulcer treatment (Elaoufi *et al,* 2022, Madi *et al.* 2023).

High UV values for *Acacia albida* and *Acacia arabica* reflect their multiple therapeutic applications documented in ethnobotanical literature and suggest potential for chemical constituent analysis and antimicrobial screening aligned with documented traditional uses (Karoune *et al.* 2015, Kheloufi *et al.* 2018, Ohouko *et al.* 2020, Adhikari & Rangra 2023, Kumari & Swer 2025).

Informant consensus factor and cultural reliability

The substantially elevated ICF value for respiratory conditions (0.89) indicates high consensus among traditional practitioners regarding plant selection for respiratory ailments. This elevated consensus suggests reliable ethnomedicinal knowledge potentially amenable to pharmacological verification. The high ICF for gastrointestinal disorders (0.84) similarly indicates strong traditional confidence in plant selection for digestive conditions.

These high ICF values provide evidence-based support for prioritizing respiratory and gastrointestinal species for research investigations, as they represent areas where traditional knowledge demonstrates high consensus and potential reliability (Dean 2024, Akhtar *et al.* 2025).

Fidelity level and species-specific therapeutic application

Fidelity Level values exceeding 80% for species such as *Ceratonia siliqua* (gastric ulcers), *Acacia albida* (gastroenteritis), and *Glycyrrhiza glabra* (gastric ulcers) indicate strong association between specific plant species and particular disease categories. These high FL values suggest that studied communities have developed specific, reliable associations between plants and therapeutic targets, a pattern that significantly enhances probability of discovering bioactive compounds with genuine therapeutic activity (Amjad *et al.* 2020).

The FL methodology successfully identified species-use combinations with potential therapeutic significance, guiding targeted investigation in future pharmacological research (Srithi *et al.* 2009, Subba *et al.* 2024). *Ceratonia siliqua*, with 95% FL for gastric ulcer treatment, stands out as a highly promising candidate for exploring anti-ulcer mechanisms and therapeutic approaches.

Demographic insights and knowledge erosion

The significant age-related variation in ethnomedicinal knowledge demonstrates critical intergenerational knowledge loss pattern. Older informants (>50 years) demonstrated substantially higher mean UV values and greater species richness knowledge compared to younger cohorts. This pattern has been documented across numerous ethnobotanical studies in developing regions and reflects broader impacts of urbanization, cultural modernization, and education system prioritization of Western scientific knowledge over traditional ecological knowledge (Trommsdorff 2008, Hanazaki *et al.* 2013, Gherairia *et al.* 2025).

The inverse relationship between formal education and traditional ethnomedicinal knowledge highlights important educational and cultural tensions. Traditional healers without formal education demonstrated greatest knowledge depth, suggesting that formal educational pathways may inadvertently displace traditional knowledge acquisition mechanisms. This observation has significant implications for knowledge preservation strategies and points toward need for educational curricula incorporating rather than replacing traditional knowledge (Shukla & Sinclair 2009, Saynes-Vásquez *et al.* 2013).

Occupational analysis revealed that traditional healers, representing purest custodians of ancestral knowledge systems, possessed significantly greater botanical knowledge breadth and depth compared to modern phytotherapists (Heinrich *et al.* 1998; Vandebroek 2010). This finding suggests that acceleration of healthcare modernization without simultaneous knowledge documentation risks irreversible loss of traditional medical information developed through centuries of empirical observation and refinement.

Preparation methods and practical ethnomedicine

The overwhelming predominance of decoction (54%) and powder preparations (31%) reflects practical pharmacological wisdom. Decoction methodology effectively extracts water-soluble compounds including polyphenols, alkaloids, and glycosides, representing optimal preparation for many plant species (Hlatshwayo *et al.* 2025). Powder preparations similarly enable efficient extraction and administration. The relative absence of complex extraction methodologies suggests traditional knowledge focused on accessible, reproducible preparation approaches suitable for resource-limited communities (Hibi *et al.* 2022).

Oral administration predominance (78%) aligns with gastrointestinal treatment focus and reflects practical feasibility in community settings. The documented utilization of topical applications (18%) for dermatological conditions and localized infections appropriately matches disease localization with delivery route (Chaachouay *et al.* 2019, Hosseini *et al.* 2021).

Therapeutic application patterns and disease focus

The pronounced emphasis on gastrointestinal conditions (treatment by 28% of documented species) reflects both disease prevalence in semi-arid regions with limited sanitation infrastructure and long-standing traditional focus on digestive health. The substantial diversity of anti-gastroenteritis remedies suggests accumulated experience in managing diarrheal diseases crucial for survival in resource-limited environments (Cheriti *et al.* 2006, Liheluka *et al.* 2024).

Respiratory infection treatment by 18% of documented species similarly reflects both disease significance in Saharan regions with dust exposure and cold/seasonal variation, and long-standing traditional medical focus on respiratory health maintenance (Georgakopoulou *et al.* 2024).

Safety considerations and toxicity concerns

Documentation of toxicity concerns for 18% of recorded species highlights critical safety considerations. The recorded contraindications for Artemisia herba-alba in cardiovascular patients and *Ecballium elaterium*'s known toxicity represent important safety information warranting dissemination and further toxicological investigation (Khalil & Qaoud 1993, Souilah *et al.* 2020, Hasan *et al.* 2023).

These toxicity reports underscore need for comprehensive phytotoxicological screening of candidate species before clinical application and public health recommendations. The contemporary practice of ethnomedicine must incorporate modern safety standards while preserving valuable therapeutic knowledge.

Implications for drug discovery and development

This ethnobotanical documentation provides valuable resource for rational drug discovery programs. The combination of high Use Value, elevated Informant Consensus Factor, and substantial Fidelity Level values identifies multiple species warranting rigorous phytochemical and pharmacological investigation. Priority species for investigation include *Ceratonia siliqua, Acacia albida, Glycyrrhiza glabra*, and *Allium sativum*, each demonstrating cultural significance and therapeutic consensus across multiple sources (Benarba 2016, Asma *et al.* 2023).

The identification of high-consensus disease categories (respiratory and gastrointestinal conditions) provides disease-focused direction for ethnopharmacological research programs. Extraction and bioassay screening of high-priority species against respiratory pathogens and gastrointestinal disorders represents logical research continuation.

Preservation of traditional knowledge and community engagement

The documented knowledge erosion across younger age cohorts necessitates urgent action for knowledge preservation and intergenerational transfer. This ethnobotanical documentation itself represents first step toward permanent knowledge archiving. However, additional interventions are required, including: (1) community-based knowledge documentation initiatives involving young people, (2) educational curricula incorporating ethnobotanical knowledge alongside scientific education, (3) economic incentives supporting traditional knowledge-holders, and (4) collaborative research initiatives sharing benefits with knowledge-providing communities.

The research team remains committed to collaborative knowledge sharing and recognizes ethical obligations to Bechar communities, providing research cooperation and knowledge resources.

Limitations of the study

While this study provides significant insights, several limitations must be noted. First, the use of purposive and snowball sampling may introduce selection bias, as it favors prominent knowledge holders over the general population. Second, recall bias is an inherent risk in ethnobotanical interviews, potentially affecting the precision of reported dosages or treatment durations. Third, the verification limits of traditional knowledge must be acknowledged, while contraindications and side effects were documented based on informant reports, these remain emic perceptions lacking clinical validation through pharmacological investigations. Finally, the generalizability of these findings to other Saharan regions should be handled with caution, as the ethnomedical patterns observed are deeply tied to the unique cultural and floristic intersection of the Bechar border region

Conclusion

This comprehensive ethnobotanical survey documented 100 medicinal plant species used by Bechar communities, reflecting significant ethnobotanical diversity and traditional knowledge systems developed over centuries of experiential refinement. Statistical analysis using established ethnobotanical indices (Use Value, Informant Consensus Factor, Fidelity Level) successfully identified species and applications with the highest therapeutic potential, providing evidence-based direction for future pharmacological investigation.

The substantially elevated Informant Consensus Factor values for respiratory conditions (0.89) and gastrointestinal disorders (0.84) indicate reliable traditional knowledge and a higher probability of discovering therapeutically active compounds. High Fidelity Level values for species such as Ceratonia siliqua (95% for gastric ulcers) establish strong species-disease associations supporting therapeutic cultural reliability and consistency.

Critical findings on intergenerational knowledge erosion necessitate immediate action to document, preserve, and ensure structured knowledge transfer. The significant knowledge differences across age groups demonstrate ongoing cultural erosion requiring educational and social interventions.

This study establishes a foundation for subsequent phytochemical and pharmacological research that supports traditional uses. The identified priority species warrant extraction, chemical characterization, and bioactivity screening against documented therapeutic targets. Successful phytochemical studies may identify novel bioactive compounds with potential for drug development, supporting both traditional medicine and modern pharmacotherapy.

Future research should include: (1) phytochemical analysis of priority species, (2) antimicrobial and pharmacological activity screening, (3) safety assessment and toxicological evaluation, (4) clinical studies in collaboration with traditional practitioners, and (5) community-based knowledge preservation initiatives ensuring intergenerational transmission of this valuable medical heritage.

Declarations

List of abbreviations: Sfūf (in Bechar dialect): powdered herbal mixture; Tbsp: tablespoon; CS: coffee spoon.

Ethics approval and consent to participate: The data were collected in accordance with ethical standards, ensuring confidentiality, anonymity, and informed consent. All participants were fully informed about the purpose of the study prior to data collection.

Consent for publication: Not applicable

Availability of data and materials: The data related to the current study are available from the corresponding author on reasonable request for bona fide scientific and educational purposes.
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Author contributions: Fethi Toul: Study design, conduction of ethnobotanical surveys, methodology development, data analysis and interpretation, manuscript writing. **Abdelkader Guenaïa**: Contribution to methodology development and data analysis. **Saïf Gouri**: Data analysis. **Mebarka Hanane Mouslim**: Ethnobotanical survey conduction. **Fatima Zohra Sanebaoui**: Ethnobotanical survey conduction. **Ali Boulenouar**: Review and editing. **Bouziane Terfaya**: Review and editing.

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Supplementary Table 1. Comprehensive inventory of medicinal plant species and associated traditional formulations documented in Bechar

No.	Species	Family	Voucher No.	Vernacular name	Preparation method	Administration mode	Treatment duration	Toxicity	Informant citations	Part used	Ethnobotanical uses
1	*Acacia albida* Delile	Fabaceae	Gr-0001 -2023	Salaha	Powder - mix equal parts with plants 2, 28, 51, 59, 54, 80 and 86	Oral - 1 table spoon in warm milk daily	Until recovery	—	2	Aerial parts	Gastric ulcers
					Powder - mix equal parts with plants 4,8,15,24,25,28 ,44,48,53,65,71 ,75,78,91 et 99	Oral - 2 tbsp daily, as safūf	1 week				Gastroenteritis
2	*Acacia arabica* (Lam.) Willd.	Fabaceae	Gr-0002 -2023	Dbagh	Powder - mix equal parts with plants 2, 45, 50, 53, 58, 79, and 85	Oral - 1 tbsp daily in warm milk	Until recovery	—	4	Aerial parts	Gastric ulcers
					Mix 30g of gum with equal parts of plants 2, 17, 24, 28, 29, 44, 45, 52, 67, 71, 74, 75, 78, 82, 85, and 99	Oral - coffee spoon, 3 times daily, as safūf	40 days			Gum	
					Powder - mix equal parts with plants 53, 79, 85, and oil of 81	Oral - 1 CS, 2 times daily, as safūf	3 days			Aerial Parts	
					Powder - mix equal parts with plants 15, 28, 45, 53, 85	Oral - 2 tbsp daily, as safūf	15 days				Gastroenteritis
3	*Acacia tortilis* (Forssk.) Hayne subsp. *raddiana* (Savi) Brenan	Fabaceae	Gr-0003 -2023	Talh	Powder: 30g gum + plants 37, 67, 80, 83, 88, 89 + 20g propolis and honey	Oral - 1 CS, 3 times daily, as safūf	40 days	—	2	Gum	Acute bronchitis

					Powder - mixed equal parts gum with plants 58, 66, 67, 90 plus oil 69 and honey	Oral - 1 CS, 2 times daily, as safūf	Until recovery				
4	*Ajuga iva* (L.) Schreb.	Lamiaceae	Gr-0004 -2023	Chendgoura	Fumigation: burn stem, mix with oil of 69	Topical - 1 time daily, apply to ear with cotton	Until recovery	—	3	Leaves	Otitis
					Powder - mixed equal parts with plants 1, 8, 15, 24, 25, 28, and 44	Oral - 2 table spoons daily, as safūf	1 week				Gastroenteritis
					Maceration of equal parts, plants 29, 48, 55, 65, 71 in hot water for 10 min	Oral - 1 glass daily	3 days				Urinary tract infections
5	*Allium cepa* L.	Liliaceae	Gr-0005 -2023	Bassal ahmar	Decoction: heat bulb with olive oil, apply drop by drop	Topical - 1 time	2 days	—	5	bulb	Otitis
					Poultice: mix with plants 47, 48, 63 and heat with olive oil, apply to area	Topical - 2 times daily	2 days				Paronychia
					Poultice: mix dry powder and with plants 16, 46, 47, 60, 62 with oil of 69, apply to area	Topical - 1 time	1 day				Furuncles
					Maceration: soak ½ bulb with 2 tbsp plant 15, 2 cloves of 6, 1 tbsp of 90 in water 2 hours	Oral - 1 time	3-5 days				Tapeworm infection
6	*Allium sativum* L.	Amaryllidaceae	Gr-0006	Thoum	Powder - mix equal parts	Oral - 2 tbsp daily	Until recovery	Prolonged use may	8	Garlic cloves	Pinworm infection

			-2023		with plants 15, 60 + honey			cause gastric irritation			
					Suppository: grind cloves with equal part of plant 14, form suppositories	Rectal - 1 time daily	Until recovery				
					Fresh: mix cloves with honey	Oral - 1 time daily	1 month				Tuberculosis
					Fresh: chew cloves	Oral - 3 cloves daily	15 days				Leishmaniasis
					Decoction: boil cloves with plants 76, 91 to vapor stage, form balls	Oral - 1 ball daily	40 days				Pneumonia
					Decoction: warm clove with oil 69, drop by drop in ear	Topical - 1 time daily	2 days				Otitis
					Maceration: soak 2 cloves with 2 tbsp plant 15 (dry), ½ bulb 5, 1 tbsp 91 in water for 2 hours	Oral - 1 glass daily	3-5 days				Tapeworm infection
7	*Ammi visnaga* (L.) Lam.	Apiaceae	Gr-0007 -2023	Noukha	Infusion: dry and boil seeds with plants 49, 70 + 2 tbsp oil of 81 in 1 water glass, boil 20 min	Oral - a glass 2 times daily	5 days	—	1	Seeds	Pneumonia
8	*Ammodaucus leucotrichus* (Coss. & Dur.) Mayor	Apiaceae	Gr-0008 -2023	Nsoufa	Decoction: boil dried herb in water for 5 min	Oral - 1 glass daily	7 days	—	3	Aerial parts	Pinworm infestation
					Powder - mix equal parts	Oral - 2 tbsp daily, as safūf	3 days				Gastric ulcers

					with plants 53, 78, 44						
					Powder - mix equal parts with plants 1, 8, 15, 24, 25, and 28	Oral - 2 tbsp daily, as safūf	1 week				Gastroenteritis
9	*Anacyclus valentinus* L.	Asteraceae	Gr-0009 -2023	Gartufa	Powder - mix equal parts with plants 21, 39, 41, 53, 56 + flower water	Topical - 1 time daily, apply to head	Until recovery	—	2	Aerial parts	Sinusitis
					Infusion: boil in water 10 min with plants 37, 38 + natural alum powder	Oral gargle - 2 times daily; Topical	6-7 days				Angina (sore throat)
10	*Angelica sinensis* (Oliv.) Diels	Apiaceae	Gr-0010 -2023	Hashishat al-malak	Infusion: 1 tbsp powder in equal of plants 15, 94 in 1 liter water, boil 20 min	Oral - a glass, 2 times daily	Until recovery	—	2	Leaves	Pinworm; Tapeworm infestation
11	*Aquilaria malaccensis* Lam.	Thymelaeaceae	Gr-0011 -2023	Oud-gharis	Powder: equal parts stem + plants 12, 16, 27, 48, 75 + honey, form into pills	Oral - 2 pills daily	40 days	—	1	Stem	Prostatic infection/urogenital disorders
12	*Aristolochia elegans* Mast.	Aristolochiaceae	Gr-0012 -2023	Burrostom	Powder - equal parts with plants 11, 16, 27, 48, 75 + honey, form pills	Oral - 2 pills daily	40 days	—	1	Fruit	Prostatic infection
					Poultice: dry and mix fruit with milk of plant 54	Topical - every 3 hours	3-4 days				Leishmaniasis
13	*Artemisia campestris* L.	Asteraceae	Gr-0013 -2023	Al-lal	Infusion: boil equal parts of plants 38, 48, 84, 97 in water for 10 min	Oral - a glass, 3 times daily	10 days	—	1	Aerial parts	Urogenital infections

14	*Artemisia herba-alba* Asso	Asteraceae	Gr-0014-2023	Shih al-khareessi	Powder : Mix equal parts with plant 52 + honey	Oral - 1 tbsp evening	Short duration - 2-8 days max	Contraindicated in cardiovascular disease	18	Aerial parts	Pinworm infestation
					Suppository: mix equal parts with plant 6	Rectal - 1 time daily	Until recovery				
					Powder - mix equal parts with plants 2, 28, 45, 53, and 85	Oral - 2 tbsp daily, as safūf	15 days				Gastroenteritis
					Powder - mix equal parts with plants 6, 60 + honey	Oral - 2 tbsp daily	Until recovery				Pinworm infestation
					Infusion: boil in water	Oral - 1 glass daily	Short duration - 3 days max				Pinworm
					Infusion: boil with plants 48, 63 in water 10 min, take bath with mixture	Bathing - 4 times daily	Short duration - 3 days max				Scabies (gale)
					Maceration: dry and macerate 2 tbsp with plants 5, 6, 90 in water 2 hours	Oral - 1 glass daily	3-5 days				Tapeworm infection
15	*Artemisia vulgaris* L.	Asteraceae	Gr-0015-2023	Habq erra'i	Infusion: 1 CS in a glass of hot water for 10-15 min	Oral: 2 glasses daily	2-3 days	—	2	Aerial parts	Gastroenteritis
16	*Atriplex halimus* L.	Chenopodiaceae	Gr-0016-2023	Guetaf	Powder - mix equal parts with plants 9, 50, 65, 66, 67 + honey, form pills	Oral - 2 pills daily	40 days	—	3	Aerial parts	Prostatic infection/urogenital disorders
					Poultice: mix with plants 5,	Topical - 1 time daily	1 day				Furuncles

					47, 48, 61, 63 + oil of 69						
17	*Avena sativa* L.	Poaceae	Gr-0017 -2023	Shofan	Powder - 1 tbsp mixed with yogurt or milk	Oral - 1 time daily	40-50 days	—	2	Seeds	Gastroenteritis
18	*Biota orientalis* (L.) Endl.	Cupressaceae	Gr-0018 -2023	Afsa	Poultice: mix with water, apply to head	Topical - 1 time daily	Until recovery	—	2	Fruit	Sinusitis
					Mix with olive oil 69	Topical - 2 times daily	3 days				Abscess
19	*Brassica rapa* L. subsp. *rapa*	Brassicaceae	Gr-0019 -2023	Al-lift	Maceration: dry leaves + plants 77, 86 in warm water	Oral - 2 glasses daily	40 days	—	1	Leaves	Acute pancreatitis
20	*Bunium mauritanicum* (Coss. & Dur.) Coss. & Dur. ex Bonnier & Layens	Apiaceae	Gr-0020 -2023	Talghouda	Powder mixed with honey	Oral gargle - 2 times daily	1 month	Contraindicated in diabetes	2	Tubers	Angina/sore throat
21	*Buxus sempervirens* L.	Buxaceae	Gr-0021 -2023	Awraq al-katm (Arabic)	Poultice: equal parts leaves + plants 9, 39, 41, 53, 56 + flower water	Topical - 1 time daily, apply to head	Until recovery	—	1	Leaves	Sinusitis
22	*Carlina acaulis* L. subsp. *acaulis*	Asteraceae	Gr-0022 -2023	Al-adad	Fumigation with tar-mixed dried stigmas; inhalation of burnt material	Nasal inhalation - 1 time daily	3 days - short duration	—	2	stigmas	Sinusitis
23	*Carthamus tinctorius* L.	Asteraceae	Gr-0023 -2023	Zaafür	Maceration: stigmas + plant 93 in warm water 30 min	Oral - 1 glass daily	4 days	—	1	Stigmas	Sinusitis
24	*Carum carvi* L.	Apiaceae	Gr-0024 -2023	Karwiya	Powder - 30g mixed with plants 2, 17, 29, 44, 52, 67, 71	Oral - 3 times daily, as sfüf	40 days	—	4	Seeds	Gastric ulcers
25	*Cassia acutifolia* Delile	Fabaceae	Gr-0025 -2023	Al-sana al-makki	Powder - equal parts leaves + plants 1, 8, 4, 15, 24, 25	Oral - 2 times daily, as sfüf	1 week	—	1	Leaves	Gastroenteritis

26	*Catananche arenaria* (Desf.) Delile	Asteraceae	Gr-0026 -2023	Kassarat al-hajar	Decoction: equal parts with plants 45, 97 in water 30 min	Oral - 1 glass daily	Until recovery	—	1	Aerial parts	Cholecystitis
27	*Centaurium erythraea* Rafn	Gentianaceae	Gr-0027 -2023	Mararat al-hanash	Powder - equal parts with plants 11, 12, 16, 48, 75 + honey, form pills	Oral - 2 pills daily	40 days	—	1	Aerial parts	Prostatic infection/urogenital disorders
28	*Ceratonia siliqua* L.	Fabaceae	Gr-0028 -2023	Al-kharub	Maceration: 1 tbsp + plants 45, 46, 79 in 1 glass water/milk for 4 hours	Oral - 1 glass daily	1-2 weeks	—	6	Pods	Gastric ulcers
					Powder	Oral - 1 tbsp daily	Until recovery				Cholecystitis
						Oral - 3 tbsp daily	40 days				Gastroenteritis
29	*Chamaemelum nobile* (L.) All.	Asteraceae	Gr-0029 -2023	Babunaj	Powder - 30g of each with plants 2, 17, 24, 28	Oral - 1 CS, 3 times daily, as sfüf	40 days	—	3	Aerial parts	Gastric ulcers
30	*Chamaerops humilis* L.	Arecaceae	Gr-0030 -2023	Doom	Raw fruit (drupes)	Oral - 7 drupes daily	Until recovery	—	1	Fruits	Urinary tract infections
31	*Cinnamomum cassia* J.Presl	Lauraceae	Gr-0031 -2023	Qarfa	Decoction: boil in water, then gargle	Oral gargle - 2 times daily	Until recovery	—	1	Bark	Angina/sore throat
32	*Commiphora myrrha* (Nees) Engl.	Burseraceae	Gr-0032 -2023	Umm al-nas	Powder mixed with olive oil	Topical - 1 time daily	3-4 days	—	1	Seeds	Leishmaniasis
33	*Coriandrum sativum* L.	Apiaceae	Gr-0033 -2023	Qusbar	Decoction with plants 4, 48, 55, 66, 71 (10 min)	Oral - 1 glass daily	3 days	—	2	aerial parts	Urinary tract infections
34	*Crocus sativus* L.	Iridaceae	Gr-0034 -2023	Zaafran	Infusion: 2-3 stigmas in a glass of water	Oral	3-4 days	—	1	Stigmas	Digestive support
35	*Cucurbita pepo* L.	Cucurbitaceae	Gr-0035 -2023	Kaüya, kalabaz	Powder: Mix equal parts seeds with plants 59 and	Oral- 2 tbsp daily	21 days	—	2	Seeds	prostatitis

					66, combine with honey.						
36	*Cuminum cyminum* L.	Apiaceae	Gr-0036 -2023	Kamün	Decoction: equal parts of powder with plants 24 and 33, for 20 min	Oral- A glass, 2 times daily	15 days	—	3	Seeds	Gastroenteritis
					Infusion	Oral- A glass, 2 times daily	1 week				Urinary tract infections
					Maceration : equal parts of powder with plants 15, 24, 33 and 55, for 60 min	Oral- A glass, 2 times daily	5 days				prostatitis
37	*Curcuma longa* L.	Zingiberaceae	Gr-0037 -2023	Kharqum	Powder	Oral- A glass, 2 times daily	15 days	—	3	Rhizomes	Pancreatitis
38	*Cymbopogon schoenanthus* (L.) Spreng.	Poaceae	Gr-0038 -2023	Dhihar	Infusion: equal parts with plants 13,48,84, and 97	Oral- A glass, 3 times daily	10 days	—	2	Aerial parts	Gastrointestinal disorders
39	*Daphne gnidium* L.	Thymelaeaceae	Gr-0039 -2023	Azaz	Fresh leaves with olive oil	Topical	3 days	Prolonged use may result in neurotoxic effects	1	Leaves	Skin infections
					Poultice: Mix equal parts plants: 9, 21, 41, 53, and 56, with flower water to form a paste.	Once a day, apply the poultice to the scalp	Until recovery				Sinusitis
40	*Daucus carota* L.	Apiaceae	Gr-0040 -2023	Zrodiya	Decoction: one tea glass of seeds and plant 84 in one glass of water for 20 minutes	Oral- a glass, 2 times daily	Until recovery	—	2	Seeds	Ulcers
41	*Delphinium staphisagria* L.	Ranunculaceae	Gr-0041 -2023	Habbat al-ras	Poultice: Mix equal parts of seeds with plants 9, 21, 39, 53, and 56,	Topical— Apply the poultice to the scalp, once daily	Until recovery	—	1	Seeds	Sinusitis

					with flower water to obtain a paste.						
42	*Ecballium elaterium* (L.) A.Rich.	Cucurbitaceae	Gr-0042 -2023	Fagus al-hmir	Raw state: Mix the fruit of with olive oil, and instill a few drops into the ear.	Topical- one daily	1 week	Contraindicated for oral use due to high toxicity, strong irritant and purgative effects.	1	Fruits	Otitis
43	*Eucalyptus camaldulensis* Dehnh.	Myrtaceae	Gr-0043 -2023	Kalitüs	Maceration: Boil the leaves with plants 64 and 69 in water	Oral - 2 glasses daily	15 days	—	2	Leaves	Bronchitis
44	*Foeniculum vulgare* Mill.	Apiaceae	Gr-0044 -2023	Zariaât Al-Basbass	Infusion: Dry and boil the seeds with plants 9 and 85 in water for 10 min, add natural alum powder	Oral gargle - 2 times daily	Short duration - 6-7 days max	—	4	Seeds	Angina (sore throat)
					Powder: Mix equal parts with plants 8, 78, 53	Oral - 2 times daily, as sfüf	3 days				Gastric ulcers
45	*Frangula alnus* Mill.	Rhamnaceae	Gr-0045 -2023	Sedra, N'beg	Maceration: Macerate 1 tbsp of Jujubier fruits with plants 28, 46, 79 in 1 glass of water or milk for 4 hours	Oral - 1 tbsp in glass of milk or water daily	1-2 weeks	Contraindicated during pregnancy ; strong laxative.	6	Fruits	Gastric ulcers
					Powder: Mix equal parts of Jujubier fruits with plants 2, 15, 28, 53, 85	Oral - 2 tablespoons daily, as sfüf	Until recovery				Gastroenteritis

					Decoction: boil fruits with plants 26, 58 in water for 30 min	Oral - A glass daily	Until recovery				Cholecystitis
					Decoction: Mix 250g of fruits with plants 51, 84, 97 and boil in 5L of water	Oral - 1L daily	40 days				Prostatic infection/urogenital disorders
46	*Glycyrrhiza glabra* L.	Fabaceae	Gr-0046 -2023	Ärk souss	Maceration: Macerate 1 tbsp each of Glycyrrhiza glabra with plants 28, 45, 79 in 1 glass of water or milk for 4 hours	Oral - 1 glass daily	1-2 weeks	Contraindicated in diabetes; prolonged use may cause liver damage.	3	Stem	Gastric ulcers
					Decoction: Dry and boil 100g of Glycyrrhiza glabra with 100g rock candy in 1.5L of water	Oral - 1 tbsp every 2 hours	2-3 days				Bronchitis
					Decoction: Dry powder with plants 43, 70 in water, for 30 min	Oral - 1 glass daily	1 week				Pneumonia
					Maceration: Macerate 1 tbsp each with plants 28, 45, 79 in 1 glass of water or milk for 4 hours	Oral - 1 glass daily	1-2 weeks				Gastric ulcers
47	*Vitis vinifera* L.	Vitaceae	Gr-0047 -2023	Dalia	Cataplasm/Poultice: Dry and mix grape leaves with plants 5, 16, 48,	Topical - 1 time daily, apply on furuncles	1 day	—	2	Leaves	Furuncles (boils)

					61, 63 with oil 69						
					Cataplasm/Poultice: Mix grape leaves with plants 5, 48, 63 and heat with oil 69 for 1 min	Topical - 2 times daily, apply on paronychia	2 days				Paronychia
48	*Haloxylon salicornicum* (Moq.) Bunge ex Boiss.	Amaranthaceae	Gr-0048 -2023	Al-rimth al-ahmar	Infusion: Dry and boil *Halexylon salicornicum* with plants 15, 63 in water for 10 min	Bathing with mixture - 4 times daily	3 days max	—	13	Aerial parts	Scabies
					Infusion: Dry and boil Halexylon salicornicum with plants 14, 55, 88 in water for 15 min	Topical rinsing - 2 times daily	1 week				Urinary tract infections (infusion)
					Infusion: Dry and *boil Halexylon salicornicum* in water for 30 min	Oral - 2 glasses daily	5 days minimum				Angina (sore throat)
					Infusion: Dry and boil *Halexylon salicornicum* with plants 13, 38, 85, 98 in water	Oral - 3 glasses daily	10 days				Prostatitis
					Powder: Mix equal parts with plant 90, apply on abscess	Oral - 2 times daily	2 days				Abscess
					Powder: Mix equal parts with plants 61,	Topical - 2 times daily	2 days				

					63, apply on abscess						
					Cataplasm: Dry and mix equal parts with plants 5, 16, 47, 61, 63 with oil 69	Topical - 1 time daily, apply on furuncles	1 day				Furuncles
					Cataplasm: Dry and mix with plants 5, 47, 63 and heat with oil 69 for 1 min,	Topical - 2 times daily, apply on paronychia	2 days				Paronychia
49	*Haloxylon scoparium* Pomel	Amaranthaceae	Gr-0049 -2023	Al-rimth	Fumigation: Burn the stems of and anoint with oil 69 under the ear	Topical - 1 time daily	4-6 days max	—	4	Aerial parts	Otitis
					Cataplasm: Dry and mix with vaseline	Topical - 1 time daily	Until recovery				Furuncles
					Cataplasm: Dry and mix with water, apply on leishmaniasis	Topical - 2 times daily	Until recovery				Leishmaniasis
					Decoction: boil equal parts with plants 7, 70, 81 in 1 glass water for 20 min and let cool	Oral - 2 glasses daily	5 days				Pneumonia
50	*Hordeum distichum* L.	Poaceae	Gr-0050 -2023	Zra'e	Powder: Mix equal parts of seeds with plants 4, 7, 12, 20, 27, 29, 3 with milk	Oral - 1 tbsp in glass of milk daily	Until recovery	—	2	Seeds	Gastric ulcers
					Decoction: Dry and boil with plants 38, 40, 48, 96, 97 with 1.5L water until 1L remains	Oral - a glass, 2 times daily	10 days				Prostatitis/urogenital disorders

51	*Hordeum vulgare* L.	Poaceae	Gr-0051 -2023	Daqiq al-shaïr	Cataplasm: Mix Hordeum vulgare grains with plants 63, 87 with oil 69, apply on furuncles	Topical - 3 times daily	Until recovery	—	4	Grains	Furuncles
52	*Juglans regia* L.	Juglandaceae	Gr-0052 -2023	Al-jouz/ gürgaë	Powder: Mix 1 tbsp with plant 15	Oral - 1 tbsp daily	Short duration - 2 days max	—	2	Trunk bark	Pinworm infestation
					Powder: Mix 30g with plants 2, 17, 24, 28, 29, 45, 44, 67, 71, 74	Oral - 1 tbsp, 3 times daily, as sfüf	40 days				Gastric ulcers
53	*Juniperus occidentalis* Hook.	Cupressaceae	Gr-0053 -2023	Al-äräar	Powder: Mix equal parts with plants 8, 78, 44	Oral - 2 tbsp daily, as sfüf	3 days	—	2	Aeria parts (Leaves and branchlets)	Gastric ulcers
					Powder: Mix equal parts with plants 1, 2, 8, 28, 50, 58, 85 with milk	Oral - 1 tbsp in glass of milk daily	Until recovery				
					Powder: Mix equal parts with plants 2, 79, 85 with oil 81	Oral - 2 tbsp daily, as sfüf	3 days				
					Powder: Mix equal parts with plants 67, 95 with 1 tbsp honey	Oral - 1 time daily on empty stomach	Until recovery				Bronchitis
					Powder: Mix equal parts of Juniperus with plants 2, 15, 28, 45, 85	Oral - 2 tbsp daily, as sfüf	15 days				Gastroenteritis
					Infusion: Boil equal parts with plants 68, 85 in water for 15 min	Oral gargle - 3 times daily	Until recovery				Angina (sore throat)

54	*Launaea arborescens* (Batt.) Murb.	Asteraceae	Gr-0054 -2023	Umm-albina	Raw: Apply the latex on leishmaniasis	Topical - 1 time daily	5 days minimum	—	1	Milk/Latex	Leishmaniasis
					Cataplasm: Mix the latex of with plant 12, apply on leishmaniasis	Topical - Every 3 hours	3-4 days				
55	*Lavandula angustifolia* Mill.	Lamiaceae	Gr-0055 -2023	Khüzama	Powder: Homogenize with goat fat	Topical - 2 times daily	3 days	—	5	Aerial parts	Bronchitis
					Infusion	Oral - 2 glasses daily	15 days				Cholecystitis
					Maceration: Dry and macerate leaves with plants 15, 24, 33, 36 in water for 60 min	Oral - 2 glasses daily	5 days				Prostatic infection/urogenital disorders
					Decoction: Boil with plants 14, 48, 88 in water for 15 min and rinse with the mixture	Topical rinsing - 2 times daily	1 week				Urinary tract infections
					Maceration: equal parts with plants 4, 29, 48, 65, 71 in hot water for 10 min	Oral - 1 glass daily	3 days				Urinary tract infections (maceration)
56	*Lawsonia inermis* L.	Lythraceae	Gr-0056 -2023	Al-hanna	Cataplasm: Dry and mix equal parts with 56 and apply on head with water	Topical - 1 time daily	2-3 days	—	2	Leaves	Sinusitis/ Skin irritation
					Decoction: 1tbsp boiled in water for 15 min	Oral - 1 cup, 2 times daily	3 days				Gastric ulcers

57	*Lens culinaris* Medik.	Fabaceae	Gr-0057-2023	Ads	Powder: Take 1 tbsp, as sfüf	Oral - 1 time daily	3 days	—	1	Seeds	Gastric ulcers
58	*Lepidium sativum* L.	Brassicaceae	Gr-0058-2023	Habb al-rashad	Powder: Mix equal parts with plants 1, 28, 50, 53, 79, 85 with milk	Oral - 1 tbsp daily	Until recovery	—	4	Seeds	Gastric ulcers
					Cataplasm: Grind and mix seeds with salt and water	Topical - 2 times daily, apply on furuncles	Until recovery				Furuncles
					Maceration: Macerate 1 tbsp of seeds in 1 glass of hot milk	Oral - 1 glass daily	1 month				Pneumonia
59	*Linum usitatissimum* L.	Linaceae	Gr-0059-2023	Zaria'at al-kattan	Powder: Mix equal parts of Linum usitatissimum seeds with plants 35, 66 with honey	Oral - 2 times daily	21 days	—	2	Seeds	Prostatitis
					Powder: Mix equal parts with plant 91 and honey	Oral - 2 CS daily, as sfüf	1 week				
60	*Lupinus luteus* L.	Fabaceae	Gr-0060-2023	Tarmas al-murr	Powder: Mix equal parts with plants 2, 15 and honey	Oral - 2 tbsp daily	Until recovery	—	3	Seeds	Pinworm infestation
					Powder: Mix equal parts with plants 2, 35 and add to cooked meat	Oral - 2 times daily	3-4 days				
					Maceration: Dry and macerate with plants 15, 91 in water for 30 min	Oral - 2 glasses daily	1-10 days				

61	*Marrubium vulgare* L.	Lamiaceae	Gr-0061 -2023	Marriwa	Cataplasm: Dry and mix with plants 5, 16, 47, 48, 63 with oil 69	Topical - 1 time daily, apply on furuncles	1 day	—	2	Aerial parts	Furuncles
					Powder: Mix equal parts with plants 48 and 63	Topical - 2 times daily, apply on abscess	2 days				Abscess
62	*Melissa officinalis* L.	Lamiaceae	Gr-0062 -2023	M'lilas	Infusion: equal parts of leaves with plants 86, 92 in water	Oral - 3 glasses daily	1 week	—	2	Leaves	Pneumonia
					Decoction: Dry and boil leaves with plants 86, 92 in water, for 30 min	Oral - 3 tbsp daily					Pneumonia
63	*Mentha pulegium* L.	Lamiaceae	Gr-0063 -2023	Timarsa't	Infusion: equal parts with plants 15, 48 in water for 10 min	Bathing - 4 times daily	Short duration - 3 days max	—	6	Leaves	Scabies (gale)
					Cataplasm: Mix leaves with plants 5, 47, 48 and heat with oil 69 for 1 min	Topical - 2 times daily, apply on paronychia	2 days				Paronychia (nail infection)
					Cataplasm: Mix leaves with plants 5, 16, 47, 48, 61 with oil 69	Topical - 1 time daily, apply on furuncles	1 day				Furuncles
					Powder: Mix equal parts of leaves with plants 48, 61	Topical - 2 times daily, apply on abscess	2 days				Abscess
					Cataplasm: Mix equal parts with plants 51, 87 with oil 69	Topical - 3 times daily, apply on furuncles	Until recovery				Furuncles

					Cataplasm: Mix equal parts with plants 5, 47, 48 and heat with oil 69	Topical - 2 times daily, apply on paronychia	2 days				Paronychia
64	*Mentha pulegium* L.	Lamiaceae	Gr-0064 -2023	Fliyu	Infusion: Fresh or dried aerial parts in hot water for 10 min	Oral- 1 glass daily	1-2 days	—	1	Aerial parts	Gastic ulcers
					Equal parts with plants 81, 88 in olive oil, mix with 1 tbsp honey	Oral - 3 times daily	7 days				Angina (sore throat)
65	*Myrtus communis* L.	Myrtaceae	Gr-0065 -2023	Al-rayhan	Decoction: Dry and boil leaves in water for 30 min	Cutaneous rinsing - 2 times daily	Until recovery	—	6	Leaves	Scabies (gale)
						Oral - 1 glass daily	Until recovery				Leishmaniasis
					Maceration: Equal parts of leaves with plants 65, 70 in water, for 60 min	Oral - 2 glasses daily	15 days				Bronchitis
					Infusion: Equal parts of leaves with plants 4, 29, 48, 55, 71 in hot water for 10 min	Oral - 1 glass daily	3 days				Urinary tract infections
66	*Nigella damascena* L.	Ranunculaceae	Gr-0066 -2023	Habbat al-baraka	Powder: Mix equal parts of seeds with plants 3, 58, 67, 90, 98 with oil 69 and honey	Oral - 2 tbsp daily	Until recovery	—	2	Seeds	Bronchitis
					Powder: Mix equal parts of seeds with plants 35, 59 and honey	Oral - 2 tbsp daily	21 days				Prostatitis/urogenital disorders

					Powder: Mix equal parts of leaves with plants 48, 53, 71, 75, 78, 91, 99	Oral - 2 tbsp daily, as sfüf	1 week				Gastroenteritis
67	*Nigella sativa* L.	Ranunculaceae	Gr-0067 -2023	Sanüj	Raw: Chew 7 seeds daily	Oral - 1 time daily	Until recovery	—	8	Seeds	Scabies (gale)
					Powder: Mix equal parts of seeds with plant 88	Oral - 1 tbsp daily, as sfüf	6-7 days max				Otitis (ear infection)
					Powder: Mix equal parts of seeds with plant 88	Oral - 1 tbsp daily, as sfüf	6-7 days max				Angina (sore throat)
					Powder: Mix equal parts of seeds with plants 53, 67 and 1 tbsp honey	Oral - 1 tbsp daily on empty stomach	Until recovery				Bronchitis
68	*Ocimum basilicum* L.	Lamiaceae	Gr-0068 -2023	Habaq	Infusion: 1 CS of powder in a hot glass of water	Oral - 2 glasses daily	1-2 days	—	—	Leaves	Gastroenteritis
69	*Olea europaea* L.	Oleaceae	Gr-0069 -2023	Al-zaytūn	Raw state: Chew the leaves of *Olea europaea*.	Oral Three times per day	Until healing	—	11	Leaves	Abscess
					Decoction: Boil leaves of *Olea europaea* and in water.	Topical-2 times daily	3 days				
70	*Origanum glandulosum* Desf.	Lamiaceae	Gr-0070 -2023	Za'ätar	Maceration: Dry and macerate *Origanum glandulosum* in water for 12 hours.	Oral One glass per day	5 days	—	4	Aerial parts	Pinworms
					Infusion: 30g in ½ L of water	Oral-Two glasses per day	6 months				Tuberculosis

					Maceration: eq ual parts with plants 31 and 65 in water, for 3 hours	Oral-Two glasses per day	15 days				Bronchitis
					Decoction: Equ al parts with plants 7 and 49 with two spoonfuls of olive oil in boiled water, allow to cool.	Oral-Two glasses per day	5 days				Pneumonia - Infusion
71	*Origanum majorana* L.	Lamiaceae	Gr-0071 -2023	Bardaqūsh	Powder: Mix 30g with plants 2, 17, 24, 28, 29, 44, 45, 52, 69, 74, 75, 78, 82, 85, 99	Oral- 1tbsp 3 times daily, as sfüf	40 days	—	3	Aerial parts	Gastric ulcers
72	*Pallenis spinosa* (L.) Cass.	Asteraceae	Gr-0072 -2023	Naqd	Powder: Mix *po wder* with goat fat and form into 2cm diameter balls.	Oral-One ball per day	7 days	—	1	Aerial parts	Bronchitis
73	*Peganum harmala* L.	Zygophyllaceae	Gr-0073 -2023	Harmal	Maceration: 30 g of power in water for 10 minutes and after gargle with the water.	Oral- gargle two times per day	3 days	prolonged or inappropri ate use may result in neurologic al and hepatic adverse	1	Seeds	Abscess
74	*Pergularia tomentosa* L.	Asclepiadaceae	Gr-0074 -2023	Al-khiyaṭah	Powder: Mix 30g of the following plants	Oral-Three spoons per day, as sfüf	40 days	—	1	Aerial parts	Gastric ulcers
					Cataplasm: Leaves powder mixed into a paste with a small amount of water	Topical, Apply on affected area	Until recovery				Wound healing

75	*Persica vulgaris* Mill.	Rosaceae	Gr-0075 -2023	Khūkh	Powder: Mix 30g each with plants, 17, 24, 28, 29, 44, 45, 52, 67, 71, 74, 78, 82, 85, 99	Oral-Three CS per day	40 days	—	2	Leaves	Gastric ulcers
					Powder: Mix equal parts with 1, 8, 4, 15, 24, 25, 28, 44, 48, 53, 65, 78, 91, and 99	Oral-Two CS per day	One week				Gastroenteritis
76	*Phoenix dactylifera* L.	Arecaceae	Gr-0076 -2023	Al-nakhlah	Decoction: Boil the fruits with plants 6, 91, until a thick paste is obtained, and form into pills	Oral - 1 pill daily	40 days	—	2	Fruits (dates)	Pneumonia
				Al-Jummar	Raw	Oral- 2 times daily	2 days			Palm heat	Diarrhea
					Poultice: Fresh heart of plam mixed with honey and plant 55	Topical- 1 time daily, Apply on wounds	Until recovery				Wound healing
77	*Phyllanthus emblica* L.	Euphorbiaceae	Gr-0077 -2023	Amlaj	Maceration: Equal parts of leaves with plants 19, 86 in 1 glass of warm water	Oral - 2 glasses daily	40 days	—	1	Leaves; Fruits	Acute pancreatitis
78	*Pimpinella anisum* L.	Apiaceae	Gr-0078 -2023	Habbat halawa	Powder: Mix 30g of Pimpinella anisum seeds with plants 2, 17, 24, 28, 29, 44, 45, 52, 67, 71, 74, 75, 82, 8, 99	Oral - 3 times daily, as sfūf	40 days	—	3	Seeds	Gastric ulcers
79		Pinaceae	Gr-0079	Shajar al-sanubar	Maceration: Macerate 1	Oral - 1 glass daily	1-2 weeks	—	4	Trunk bark	Gastric ulcers

	Pinus halepensis Mill.		-2023		tbsp each trunk bark with plants 28, 45, 46 in 1 glass water or milk for 4 hours					
					Powder: Mix 1 tbsp of trunk bark in 1 glass water or milk	Oral - 2 tbsp in glass water/milk daily before eating	10 days minimum			Gastroenteritis
					Infusion: Fresh or dry needles (a small handful) in hot water for 10-15 minutes.	Oral: ½ cup, 2 times daily	2 days		Needles	Bronchitis/ Digestive discomfort
					Warm resin gently and mix with olive oil to obtain a soft ointment.	Topical - Apply on wounds	Until recovery		Resin	Wound healing
80	*Piper cubeba* L.f.	Piperaceae	Gr-0080 -2023	Kababa	Decoction: Boil ½ spoon of powder in ½ L of water for 15 min	Oral - a cup daily	3 days	—	1	Seeds	Gastroenteritis
81	*Pistacia lentiscus* L.	Anacardiaceae	Gr-0081 -2023	Al-darw	Infusion: Heat equal parts of root with plants 64, 88 in olive oil for 1 min, then mix with 1 tbsp honey	Oral - 1 tbsp 3 times daily	7 days	—	4	Root	Angina (sore throat)
					Decoction: Take 2 tbsp of oil and boil in 1 glass water with plants 7, 49, 70 for 20 min	Oral - 2 glasses daily	5 days			Oil	Pneumonia
					Fresh oil	Oral - 1 tbsp daily	5 days maximum				Bronchitis

82	*Pituranthos chloranthus* (Coss. & Dur.) Fedde	Apiaceae	Gr-0082 -2023	Mutnan	Powder: Mix 30g with plants 2, 17, 24, 28, 29, 44, 45, 52, 67, 71, 74, 75, 78, 85, 99	Oral - 3 tbsp daily, as sfüf	40 days	—	1	Aerial parts	Gastric ulcers
83	*Potentilla erecta* (L.) Räusch.	Rosaceae	Gr-0083 -2023	L'Anjibar	Powder: Mix 30g of Potentilla erecta with plants 3, 37, 67, 80, 88, 89, 90, 91, 98 and 20g Propolis with honey	Oral - 3 tbsp daily, as sfüf	40 days	—	1	Root	Bronchitis
84	*Prunus avium* L.	Rosaceae	Gr-0084 -2023	Hab Al-muluk	Decoction: Dry and boil Prunus cherry pedicels in water	Oral - 1 glass daily	Until recovery	—	—	Cherry pedicels	Gastric ulcers
85	*Punica granatum* L.	Lythraceae	Gr-0085 -2023	Al-rummān	Infusion: Equal parts with plants 9, 44 and add natural alum powder.	Oral- gargle Two times per day	6-7 days maximum	—	5	Peel	Angina (sore throat) -
					Powder: Mix equal parts with the plants 1, 2, 28, 50, 53, 58, 79 with milk	Oral-One spoon in a glass of milk	Until healing				Gastric ulcers
					Powder: Mix 30g with plants 2, 17, 24, 28, 29, 44, 45, 52, 67, 71, 74, 75, 78, 82, 99	Oral - 3 tbsp daily, as sfüf	40 days				
					Powder: Mix equal parts with plants 2, 28, 15, 45, 53	Oral - 2 tbsp daily, as sfüf	15 days				Gastroenteritis
86	*Rheum rhabarbarum* L.	Polygonaceae	Gr-0086 -2023	Al-ruwand	Maceration: Equal parts with plants 19 and 77 in one	Oral-Two glasses daily	40 days	—	4	Aerial parts	Acute pancreatitis

					glass of warm water.						
87	*Rosmarinus officinalis* L.	Lamiaceae	Gr-0087 -2023	Azīr/Barkla	Poultice: Mix equal parts of *Rosmarinus* wit h olive oil.	Topical-3 times daily	Until healing	—	1	Aerial parts	Furuncles (boils)
88	*Saussurea costus* (Falc.) Lipsch.	Asteraceae	Gr-0088 -2023	Al-qist al-hindī	Powder: Homo genize with black seed oil.	Topical- Apply once a day	Until healing	—	7	Trunk bark	Otitis
					Decoction: Equ al parts with plants 14, 48, 55 in 1L water for 15 min	Topical- Rinsing 2 times daily	One week				Urinary tract infections
89	*Sesamum oleifera* Pers.	Pedaliaceae	Gr-0089 -2023	Jiljalān / Simsim	Powder: Mix 30g of seeds with plants 3, 37, 67, 80, 83, 88, 90, 91, 98 and 20g Propolis + 1 tbsp honey.	Oral-1 CS, 3 times daily	40 days	—	1	Seeds	Bronchitis
90	*Syzygium aromaticum* (L.) Merr. & L.M.Perry	Myrtaceae	Gr-0090 -2023	Q'runful	Powder: Mix equal parts with plants 3, 58, 66, 67, 98, olive oil and honey	Oral-1 CS, 2 times daily, as sfüf	Until healing	Contraindi cated for patients with hypertensi on	5	Cloves	Bronchitis
					Powder: Mix equal parts with 48, apply on the abscess.	Topical- 2 times daily	2 days				Abscess
					Maceration: Equal parts with plants 5, 6, 15 in water for 2 hours.	Oral-One glass per day	3-5 days				Taenia (tapeworm)
91	*Trigonella foenum-graecum* L.	Fabaceae	Gr-0091 -2023	Al-ḥalbah	Powder: Mix equal parts with plants 15 and 67. Add in a slice of cooked meat.	Oral-Two times per day	3-4 days	—	5	Seeds	Pinworms Pinworms

					Maceration: Equal parts with plants 2, 18 in water for 30 minutes.	Oral-Two glasses per day	1-10 weeks				
					Powder: Mix equal parts of seeds with plants 1, 8, 4, 15, 24, 25, 28, 44, 48, 53, 65, 75, 78, 99	Oral Two spoonfuls per day, as sfüf	One week				Gastroenteritis
92	*Urtica cannabina* L.	Urticaceae	Gr-0092-2023	Qurrays / Hurrayq	Infusion: Equal parts with plants 62 and 86 in water	Oral-Three glasses per day	One week	—	2	Leaves	Pneumonia - Infusion
93	*Nardostachys jatamansi* (D.Don) DC.	Valerianaceae	Gr-0093-2023	Sunbül	Maceration: Dry and macerate the in warm water for 30 minutes	Oral-One glass per day	4 days	—	1	Aerial parts	Sinusitis
94	*Valeriana officinalis* L.	Valerianaceae	Gr-0094-2023	Nārdin	Infusion: Mix one spoonful of each 10 and 15 and boil in one liter of water for 20 min	Oral-Two times per day	Until healing	—	2	Aerial parts	Pinworms and Taenia
95	*Vicia faba* L.	Fabaceae	Gr-0095-2023	Al-fūl	Powder: Mix one spoonful of *Vicia faba* with one glass of water.	Oral-Two glasses daily	2 days	—	3	Pod	Gastric ulcers
96	*Warionia saharae* Benth. & Coss. ex Benth.	Asteraceae	Gr-0096-2023	Fasas	Decoction: Equal parts with plants of 38, 40, 48, 50, 97 in 1.5L of water until water becomes one liter.	Oral Two glasses per day	10 days	—	1	Aerial parts	Genital infections (Prostatic)
97	*Zea mays* L.	Poaceae	Gr-0097-2023	Dhurah	Decoction: Dry and boil the corn stigmas with plants 26	Oral-One glass per day	Until healing	—	4	Corn stigmas	Cholecystitis

					and 45 in water for 30 minutes.						
					Decoction: Dry stigmas with plants 38, 40, 48, 50, and 96, then boil in 1.5L of water until the water becomes one liter.	Oral Two glasses per day	10 days				Genital infections
98	*Zingiber officinale* Roscoe	Zingiberaceae	Gr-0098 -2023	Al-zanjabīl	Powder: Mix 30g of each with plants 3, 37, 68, 81, 84, 89, 90, 91, 92. Add 20g Propolis and honey.	Oral-Three CS per day	40 days	—	5	Dried rhizomes	Bronchitis
					Powder: Take 100g of powder with 100g of honey.	Oral- 1 CS, 2 times daily	Until healing				Angina (sore throat)
99	*Zygophyllum album* Desf.	Zygophyllaceae	Gr-0099 -2023	Aqāyah	Infusion: Dry and boil in warm water for 10 minutes.	Oral-Two glasses per day	5 days	—	2	Aerial parts	Acute pancreatitis
					Powder: Mix 30g with plants 2, 17, 24, 28, 29, 44, 45, 52, 67, 71, 74, 75, 78, 82, 85	Oral-3 CS per day, as sfüf	40 days				Gastric ulcers
					Powder: Mix equal parts with plants 1, 8, 4, 15, 24, 25, 28, 44, 48, 53, 65, 75, 78, 91	Oral-2 tbsp daily, as sfüf	One week				Gastroenteritis

Safūf: powdered herbal mixture; tbsp: table spoon; CS: coffee spoon.

Supplementary Material 2

Questionnaire

I- Informant questionnaire

Part 1: Ethics and consent

- **Statement of Informed Consent:** We are researchers from Tahri Mohamed University, Bechar. We are documenting the traditional use of medicinal plants in the Bechar region for scientific purposes. Your participation is voluntary. Your identity will remain confidential. We will not use this information for commercial purposes without your explicit prior consent. Do you agree to participate?"

Yes ☐ No ☐

Part 2: Informant socio-demographic profile

1. **Gender:** Male ☐ Female ☐
2. **Age:** . . . . . years
3. **Educational level:** Illiterate ☐ Primary ☐ Secondary ☐ University ☐
4. **Professional status:**
    - Herborist (Herbal shop) ☐
    - Phytotherapist (Specialized practitioner) ☐
    - Traditional Healer ☐
    - Herbal enthusiast ☐
5. **Source of knowledge:**

- Ancestral/Family transmission ☐
- Experience/Trial ☐
- Books/Media ☐

Part 3: Ethnobotanical data collection

6. **Local name (Vernacular):** . . . . . .
7. **What ailment(s) is this plant used for?**
    - Use 1: . . . . . .
    - Use 2: . . . . . .
    - Use 3: . . . . . .
8. **Part(s) of the plant used:**

- Leaves ☐ Roots ☐ Stems ☐ Seeds ☐ Flowers ☐ Fruits ☐ Aerial part ☐ Whole plant ☐
- Other: . . . . . .

9. **Preparation method:**

- Decoction ☐ Infusion ☐ Maceration ☐ Powder ☐ Poultice ☐

- Other: . . . . . .

10. **Mode of administration:**

- Oral ☐ Topical ☐ Rectal ☐ Inhalation ☐ Gargle ☐
- Other (specify): . . . . . .

11. **Frequency and duration of administration:**

- How often is it taken? . . . . . .
- For how long? . . . . . .

12. **Are there any side effects (especially toxicity) or contraindications?**

- ☐ No known side effects
- ☐ Yes (specify): . . . . . .

13. **Is this plant used alone or in a mixture (Polyherbal)?**

- ☐ Alone
- ☐ Mixture (specify other ingredients): . . . . . .

Part 4: Field Observation (For Researchers)

14. **Botanical Family/Species:** . . . . . .
15. **Voucher Specimen Number:** . . . . . .
16. **GPS Coordinates / Location of Collection:** . . . . . .

Note: This questionnaire was administered in the local Arabic dialect (Darija) during the fieldwork.