



Quantifying intergenerational erosion of ethnobotanical knowledge in Coastal Iran: A comparative study of Bandar Abbas and Qeshm Island

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Ethnobotany Research and Applications 36:02 (2026) - <http://dx.doi.org/10.32859/era.36.2.1-25>

Manuscript received: 08/09/2026 - Revised manuscript received: 03/10/2026 - Published: 04/10/2026

Research

Abstract

Background: Indigenous botanical knowledge is eroding worldwide due to urbanization and declining intergenerational transmission. Iran's coastal regions, especially Hormozgan Province with its mangrove ecosystems and ethnic diversity, remain understudied.

Methods: This mixed-method study (2023–2026) was conducted in Bandar Abbas and Qeshm Island. Data were collected via semi-structured interviews and participant observation with 150 informants selected through purposive and snowball sampling. Plant specimens were identified and deposited as herbarium vouchers. Quantitative indices (UV, RFC, ICF, FL) were calculated, and statistical analyses (t-test, ANOVA, Pearson correlation) examined relationships between sociodemographic factors and ethnobotanical knowledge.

Results: A total of 173 species from 134 genera and 48 families were documented, with Asteraceae (18), Lamiaceae (17), and Fabaceae (15) being most diverse. *Avicennia marina* (UV=1.76), *Calotropis procera* (UV=1.67), and *Prosopis cineraria* (UV=1.62) had the highest use values. Gastrointestinal (ICF=0.86) and dermatological (ICF=0.85) disorders showed the highest consensus. *Avicennia marina* (FL=90.2%), *Calotropis procera* (FL=87.5%), and *Citrullus colocynthis* (FL=84.9%) demonstrated the strongest fidelity. Women (11.2 vs. 6.8 species, $P<0.01$), elderly individuals (>70 years: 14.8 vs. 5.2 species, $P<0.001$), Baloch and Arab ethnic groups, and those with no formal education (14.1 vs. 5.0 species, $P<0.001$) possessed significantly greater knowledge, indicating severe intergenerational erosion.

Conclusions: This study provides quantitative evidence of declining indigenous plant knowledge in Iran's coastal regions. Urbanization, modernization, and formal education have failed to transmit traditional ecological knowledge. Urgent biocultural conservation strategies—participatory documentation, community empowerment, and integration into formal education—are essential to safeguard this heritage.

Keywords: Ethnobotany, indigenous knowledge, Hormozgan Province, biocultural conservation, intergenerational knowledge erosion, Persian Gulf

Background

Medicinal plants have been fundamental to human healthcare across civilizations, with approximately 80% of populations in developing countries relying on traditional plant-based remedies (WHO 2013). Ethnobotany, which systematically documents the intricate relationships between human societies and plant resources, serves as a crucial bridge between traditional knowledge and modern pharmacological discovery (Martin 1995, Cotton 1996). These studies not only preserve indigenous knowledge facing rapid erosion but also provide essential data for biodiversity conservation and the identification of novel bioactive compounds (Cunningham 2001, Berkes 2018).

Iran represents one of the world's most significant centers of plant diversity and ethnomedicinal heritage. With approximately 8,000 vascular plant species, of which 2,300 possess documented medicinal properties, and over 2,500 angiosperm species endemic to Iran, the country constitutes a remarkable reservoir of phytodiversity (Mozaffarian 2013, Ghahremaninejad & Hoseini 2015, Ghahremaninejad *et al.* 2025). This exceptional floristic richness stems from Iran's climatic heterogeneity, complex topography, and biogeographic position at the crossroads of three major phytogeographic regions. Iranian traditional medicine, shaped over millennia through scholarly traditions exemplified by Avicenna's Canon of Medicine, which documented 800 herbal medicines, continues to inform contemporary herbal practices (Amin 1991, Zargari 1990). This ancient heritage represents accumulated knowledge transmitted across generations who identified and utilized beneficial herbs (Hooper 1937, Mozaffarian 2013). Traditional Iranian plant-based preparations, particularly herbal distillates (hydrosols), represent a distinctive cultural and therapeutic heritage that has evolved over centuries into a sophisticated system of beverage and medicinal production (Ghahremaninejad *et al.* 2026).

In recent decades, ethnobotanical research in Iran has expanded considerably, documenting medicinal plant knowledge across various ecological zones. Studies consistently highlight the predominance of families such as Lamiaceae, Asteraceae, Apiaceae, and Fabaceae in traditional pharmacopoeias, with gastrointestinal, respiratory, and dermatological disorders comprising the most frequently treated conditions (Ghorbani 2005, Mosaddegh *et al.* 2012, Amiri & Joharchi 2013, Motahhari *et al.* 2022, Jalali *et al.* 2026). For instance, research in southern Fars Province documented 171 medicinal plant species from 53 families, with Lamiaceae and Fabaceae being the most represented (Mohammadi *et al.* 2023). Similarly, studies in Shahrababak recorded 141 medicinal plants from 43 families, with Lamiaceae (18 species) dominant (Bibak *et al.* 2024). Research in Minab and Rudan counties within Hormozgan Province documented 118 medicinal plant species across 44 families and, notably, identified that 41% of recorded therapeutic applications represented novel indigenous uses not previously documented in any major national or international medicinal plant databases (Hosseini *et al.* 2026). These findings underscore the rich yet understudied ethnobotanical heritage of southern Iran, particularly in coastal regions.

Ethnobotanical knowledge is intrinsically linked to socio-demographic factors, with patterns of knowledge retention and transmission shaped by age, gender, ethnicity, education, and degree of urbanization (Berkes 2018, Reyes-García *et al.* 2013, Vandebroek & Voeks 2019). Research consistently demonstrates that older individuals, women, ethnic minorities, and those with lower formal education often possess deeper and more extensive botanical knowledge, reflecting their primary roles in healthcare, food preparation, and household management (Quave & Pieroni 2015, Panyadee *et al.* 2023). Conversely, urbanization, formal education, migration, and socio-economic shifts have accelerated the erosion of traditional ecological knowledge, particularly among younger generations (Reyes-García *et al.* 2013, Vandebroek & Voeks 2019). As noted by Hosseini *et al.* (2026), traditional knowledge in southern Iran is undergoing rapid erosion due to generational shift and modernization. This intergenerational knowledge loss represents a critical conservation priority, threatening both cultural heritage and the pharmaceutical potential inherent in traditional plant knowledge (Berkes 2018, Albuquerque *et al.* 2014). Furthermore, the interpretation of quantitative ethnobotanical indices must consider spatial availability as a confounding factor, as recently demonstrated by Nazari and Bussmann (2026), who introduced the Spatial Availability Score to distinguish between cultural importance and ecological accessibility of plant species.

Despite the substantial body of ethnobotanical research in Iran, significant geographical and thematic gaps persist. The vast majority of studies have concentrated on mountainous regions of the Zagros and Alborz ranges, rural communities, and tribal societies, while coastal regions of southern Iran, particularly Hormozgan Province with its unique mangrove ecosystems and exceptional ethnic-cultural diversity, remain critically understudied (Safa *et al.* 2013, Hosseini *et al.* 2026). Hormozgan Province, situated along the Persian Gulf and Gulf of Oman, harbors unique ecosystems including the mangrove forests of Qeshm Island, recognized as a UNESCO Biosphere Reserve, which have sustained centuries of traditional knowledge regarding boat building, fuel, livestock feeding, and local medicine (Rashvand & Sadeghi 2014, Safiari 2017). The cultural landscape is equally rich, with Persians, Arabs, Baloch, and Afro-Iranian communities coexisting for centuries, creating distinctive systems of knowledge, beliefs, and rituals including the Zar therapeutic ceremony (Moghaddam 2013, Fariborzi 2013). However, few studies have employed rigorous quantitative ethnobotanical indices (UV, RFC, ICF, FL) or conducted

comparative analyses between urban contexts such as Bandar Abbas and more traditional settings such as Qeshm Island (Safa *et al.* 2013, Hosseini *et al.* 2026). This methodological gap has limited our understanding of how socio-demographic factors influence knowledge persistence or erosion in coastal Iran and how urbanization impacts the sustainability of indigenous botanical knowledge systems.

Against this background, the present study aims to document and quantitatively analyze the ethnobotanical knowledge of plants used in local communities of Bandar Abbas and Qeshm Island, and to investigate the social factors affecting the sustainability or erosion of this knowledge. By combining qualitative observations with quantitative ethnobotanical indices and statistical analyses, this research situates Hormozgan within both national and global discussions on biocultural conservation and knowledge erosion. Based on previous ethnobotanical studies documenting the influence of urbanization, modernization, and socio-demographic factors on traditional knowledge persistence (Berkas 2018, Vandeboek & Voeks 2019, Reyes-García *et al.* 2013, Hosseini *et al.* 2026, Nazari & Bussmann 2026), we formulated several testable hypotheses. First, we predict a significant difference in ethnobotanical knowledge between Bandar Abbas (urbanized) and Qeshm Island (more traditional), with lower knowledge depth in the urban context reflecting accelerated erosion due to modernization. Second, we anticipate that age, gender, ethnicity, and education significantly influence the extent of plant knowledge, such that older individuals, women, ethnic minorities (Baloch and Arab), and those with lower formal education will possess greater knowledge, reflecting the primary roles of these groups in traditional healthcare and intergenerational knowledge transmission (Quave & Pieroni 2015, Reyes-García *et al.* 2013, Hosseini *et al.* 2026). Third, we hypothesize that indigenous plant knowledge in Hormozgan is undergoing severe intergenerational erosion, as evidenced by significantly lower knowledge among younger generations compared to their elders, a trend documented globally and particularly noted in southern Iran where traditional knowledge is rapidly eroding (Panyadee *et al.* 2023, Hosseini *et al.* 2026). By testing these hypotheses, the study contributes robust quantitative evidence to Iranian ethnobotany, fills a critical geographical gap in coastal southern Iran, and provides a framework for comparing traditional knowledge persistence across urban and rural contexts, thereby informing urgently needed biocultural conservation strategies and supporting the sustainable management of the region's unique botanical heritage (Nazari & Bussmann 2026, Ghahremaninejad *et al.* 2026).

Materials and Methods

Study area

This study was conducted in Hormozgan Province, southern Iran, in two distinct areas: Bandar Abbas city and Qeshm Island (Fig. 1). Bandar Abbas (27°11'N, 56°16'E), the provincial capital with over 680,000 inhabitants, is a major commercial port that has experienced rapid urbanization in recent decades. Qeshm Island (26°40'–26°57'N, 55°55'–56°40'E), Iran's largest island (1,491 km², ~150,000 inhabitants), maintains more traditional social structures despite its free trade zone status (Safa *et al.* 2013, Safiari 2017). The region's ethnic composition includes Persians, Arabs, Baloch, and Afro-Iranian communities. The region has a hot desert climate (BWh) with mean annual temperature ~27°C, summer maxima exceeding 50°C, annual precipitation below 200 mm, and relative humidity often above 70% (Hosseini *et al.* 2026, Safa *et al.* 2013). Vegetation ranges from mangrove forests (*Avicennia marina*) along the coasts to xerophytic and halophytic inland species including *Prosopis cineraria*, *Ziziphus spina-christi*, *Tamarix spp.*, and *Artemisia spp.* (Rashvand & Sadeghi 2014). Qeshm's mangroves are a UNESCO Biosphere Reserve, while Geno Mountain (2,347 m) provides montane habitats (Safiari 2017).

Selection of participants

Participants were selected using a purposive sampling strategy followed by snowball sampling, standard approaches in ethnobotanical research aimed at identifying knowledgeable individuals (Martin 1995, Albuquerque *et al.* 2014). Initial key informants were identified through collaboration with village leaders, local health workers, and community elders in each study area. These initial participants were then asked to recommend other knowledgeable individuals from their communities, particularly those with specialized or complementary knowledge (Cunningham 2001).

A total of 150 participants were selected for the final sample, comprising 85 individuals from Bandar Abbas and 65 from Qeshm Island. The sample size was determined based on theoretical saturation, the point at which additional participants (Albuquerque *et al.* 2014) were providing no new information. Inclusion criteria for participants included: (I) Minimum age of 40 years to ensure sufficient life experience and traditional knowledge accumulation. (II) At least 20 years of continuous residence in the study area to guarantee familiarity with local environments and resources. (III) Practical experience in using plants, either personally or for community members. (IV) Willingness to participate voluntarily in the study and share knowledge. The sample was stratified to ensure diversity in gender (47 males, 103 females), age (ranging from 40 to 94 years), ethnicity (Persians, Arabs, Baloch, and mixed backgrounds), occupation (traditional healers, farmers, herders, anglers, homemakers, and retired individuals), and education levels (from illiterate to university graduates). All participants provided

prior informed oral consent before interviews commenced, and their rights to withdraw from the study at any stage were clearly explained.

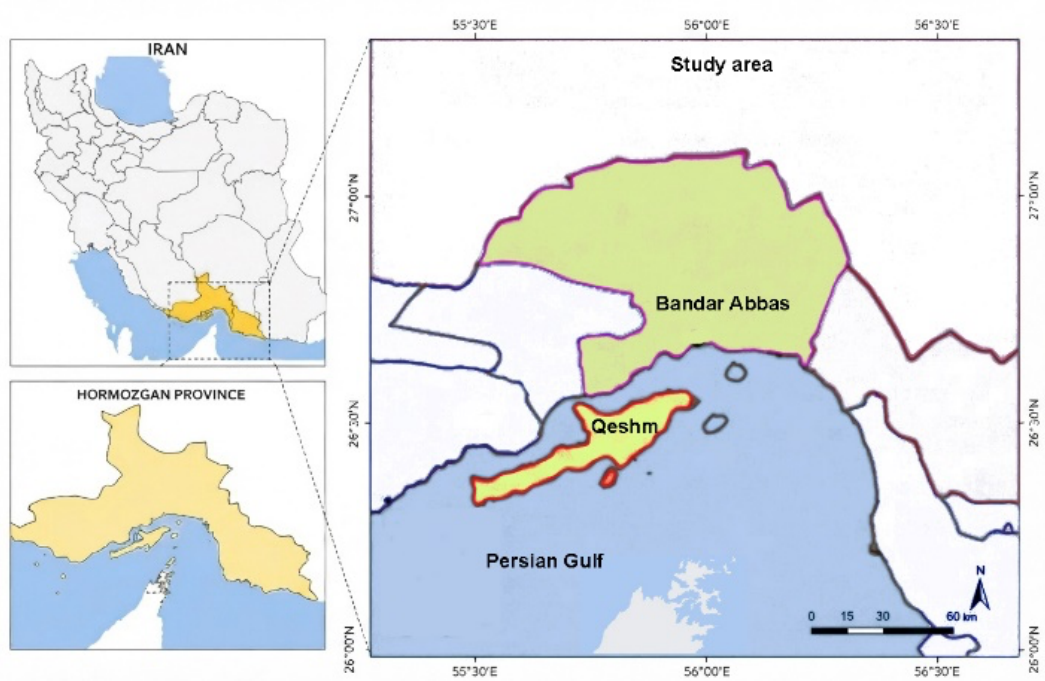


Figure 1. Location of the study area in Hormozgan Province, southern Iran, showing Bandar Abbas city and Qeshm Island. The inset map indicates the position of Hormozgan Province within Iran. Source: Prepared by the authors.

Data collection

Fieldwork was conducted over a 24-month period from summer 2023 to summer 2026 in both study areas. Data collection employed a mixed-method approach combining qualitative and quantitative techniques (Albuquerque *et al.* 2014, Martin 1995).

Semi-structured interviews

A semi-structured questionnaire was designed based on the study objectives and review of previous ethnobotanical research in Iran and comparable regions (Mosaddegh *et al.* 2012, Amiri & Joharchi 2013, Safa *et al.* 2013, Hosseini *et al.* 2026, Jalali *et al.* 2026). The questionnaire comprised three main sections. The first section collected demographic and background information including age, gender, ethnicity, education level, occupation, years of residence in the area, and primary sources of plant knowledge. The second section formed the core of the questionnaire, documenting for each plant mentioned by informants: local names (with careful phonetic transcription), plant parts used, preparation methods, therapeutic applications, season of harvest, and frequency of use. The third section assessed informants' perspectives on changes in traditional knowledge over time, perceived threats to knowledge persistence, and attitudes toward knowledge conservation. Interviews were conducted in Persian and, when informants were more fluent in local dialects (Hormozi Arabic or Balochi), with assistance from local guides, then translated into Persian. Each interview lasted between 45 and 90 minutes, depending on the informant's knowledge depth and willingness to share information. A subset of 30 key informants, identified as possessing exceptionally deep traditional knowledge, participated in additional in-depth semi-structured interviews exploring cultural beliefs, seasonal harvesting indicators, and traditional classification systems.

Participant observation

To validate and complement interview data, participant observation was employed (Martin 1995, Cunningham 2001). The researcher accompanied local informants during field visits to important plant habitats including mangrove forests of Qeshm Island, Geno Mountain, and coastal plains of Bandar Abbas. During these visits, plant identification, harvesting techniques, and traditional processing methods were directly observed and documented. Additionally, visits to local herbal markets and traditional attari shops in both Bandar Abbas and Qeshm Island were conducted to observe plant trade and preparation practices. This approach enabled validation of information provided during interviews and discovery of subtle, unarticulated aspects of local plant knowledge (Albuquerque *et al.* 2014).

Plant collection and identification

Voucher specimens were deposited in the Herbarium of the Agricultural Research Center of Hormozgan Province, where the majority of samples were already preserved in the existing collections. The permanent collection numbers (QR codes) presented in Table 1 correspond to the specimens held at this herbarium. Additional specimens not represented in the existing collections were obtained from local herbal markets, attari shops, and direct field collection, and subsequently deposited in the same herbarium. Identification was conducted using authoritative floristic references including Flora Iranica (Rechinger 1963-2015), Flora of Iran (Ghahreman 1978-2007), Flora of Turkey (Davis 1965-1988), Flora of Iraq (Townsend & Guest 1985), and regional floristic works (Ghazanfar 1994, 2006). Scientific names were verified and updated using World Flora Online (WFO 2024) and International Plant Names Index (IPNI 2024) and confirmed by the research supervisor and botanical specialists at the Agricultural Research Center.

Quantitative ethnobotanical analysis

To evaluate patterns of medicinal plant use and the relative importance of recorded species, four standard quantitative ethnobotanical indices were calculated: Use Value (UV), Relative Frequency of Citation (RFC), Informant Consensus Factor (ICF), and Fidelity Level (FL). These indices were selected based on their widespread application and validation in ethnobotanical research (Phillips & Gentry 1993, Trotter & Logan 1986, Heinrich *et al.* 1998, Albuquerque *et al.* 2014).

Use Value (UV)

The Use Value index, originally developed by Phillips and Gentry (1993), was calculated to assess the overall relative importance of each plant species based on the diversity of its reported uses. The UV was computed using the formula:

$$UV = \sum U_i / N$$

where U_i represents the total number of use reports for a given species by each informant, and N is the total number of informants who mentioned that species. This index ranges from 0 (no use reported) upward, with higher values indicating greater versatility and cultural importance of a species within the community (Phillips & Gentry 1993, Tardío & Pardo-de-Santayana 2008).

Relative Frequency of Citation (RFC)

The Relative Frequency of Citation index was calculated to assess the general recognition and prevalence of each species among informants (Tardío & Pardo-de-Santayana 2008). The RFC was computed as:

$$RFC = FC / N$$

where FC is the number of informants who mentioned the use of a given species, and N is the total number of informants (150 in this study). RFC values range from 0 to 1, with higher values indicating species that are more widely known and cited by community members, reflecting cultural salience and commercial importance (Motahhari *et al.* 2022, Jalali *et al.* 2026).

Informant Consensus Factor (ICF)

The Informant Consensus Factor was calculated to assess the degree of agreement among informants regarding the use of plants for specific therapeutic categories (Trotter & Logan 1986, Heinrich *et al.* 1998). Diseases were first classified into therapeutic categories based on the International Classification of Diseases (ICD-11) and previous ethnobotanical studies (Cook 1995). The ICF was computed using the formula:

$$ICF = (Nur - N_t) / (Nur - 1)$$

where Nur is the total number of use reports for a given therapeutic category, and N_t is the number of plant species (taxa) used for that category. ICF values range from 0 to 1; values approaching 1 indicate high agreement among informants and a limited number of taxa used for treating a particular ailment, suggesting well-established and potentially effective remedies (Heinrich *et al.* 1998, Albuquerque *et al.* 2014). Lower ICF values reflect greater diversity of taxa used and more heterogeneous treatment practices.

Fidelity Level (FL)

The Fidelity Level index was calculated to determine the degree of specificity with which a plant species is used for a particular therapeutic purpose (Friedman *et al.* 1986, Alexiades 1996). The FL was computed using the formula:

$$FL (\%) = (N_p / N) \times 100$$

where N_p is the number of informants who reported using a particular species for a specific ailment, and N is the total number of informants who mentioned the same species for any ailment. This index was calculated only for species with a minimum of five total use reports to ensure statistical reliability (Tardío & Pardo-de-Santayana 2008). Higher FL values indicate stronger fidelity of a species to a specific therapeutic application, suggesting more specialized and potentially efficacious uses (Friedman *et al.* 1986, Amiri & Joharchi 2013).

Statistical analysis

Statistical analyses were performed to investigate relationships between socio-demographic variables and ethnobotanical knowledge, and to test the study hypotheses. Data were analyzed using SPSS version 26 (IBM Corp., Armonk, NY, USA) and R version 4.3.1 (R Core Team 2023).

Descriptive statistics

Descriptive statistics, including means, standard deviations, frequencies, and percentages, were calculated to summarize demographic characteristics of participants and the distribution of quantitative ethnobotanical indices.

Inferential statistics

Prior to parametric analyses, the normality of data distribution was assessed using the Kolmogorov-Smirnov test. Based on these results, appropriate parametric or non-parametric tests were selected. Independent samples t-tests were used to compare mean knowledge scores (number of plant species known) between two independent groups (e.g., gender, region). One-way analysis of variance (ANOVA) was employed to compare means across three or more groups (e.g., education levels, ethnicity), with post-hoc Tukey HSD tests for pairwise comparisons. When data violated normality assumptions, the non-parametric Mann-Whitney U test (for two-group comparisons) and Kruskal-Wallis test (for multi-group comparisons) were applied. Pearson correlation coefficients were calculated to examine relationships between continuous variables (e.g., age and knowledge score). Chi-square tests were used to examine associations between categorical variables (e.g., ethnicity and primary sources of plant knowledge). The level of statistical significance was set at $P < 0.05$ for all tests. To control for family-wise error rate in multiple comparisons, Bonferroni correction was applied where appropriate.

Ethical considerations

All ethical principles and participant rights were carefully observed throughout the research process (Albuquerque *et al.* 2014, Cunningham 2001). Prior informed consent was obtained from each participant before interviews commenced, with the study objectives, data usage, and confidentiality procedures explained in simple language. Participants were assured of their right to withdraw from the study at any point without consequences. All personal identification information remained confidential, with only coded identifiers used in analysis and reporting. The research was conducted with awareness of the Nagoya Protocol (2010) on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits, ensuring that any future commercial use of research results would be subject to the rights of local communities. A commitment was made to return research findings to local communities through village councils and health centers.

Results

Species diversity and taxonomic composition

A total of 173 plant species belonging to 134 genera and 48 families were documented through interviews with 150 local informants across Bandar Abbas and Qeshm Island. The complete inventory of recorded species, including scientific names, families, plant parts used, therapeutic applications, and quantitative indices (UV, RFC, FL), is presented in Table 1.

The most represented families were Asteraceae with 18 species (10.4% of total), Lamiaceae with 17 species (9.8%), Fabaceae with 15 species (8.7%), Apocynaceae with 10 species (5.8%), and Poaceae with 10 species (5.8%). Boraginaceae contributed 9 species (5.2%), Amaranthaceae 8 species (4.6%), Malvaceae 7 species (4.0%), and Euphorbiaceae 6 species (3.5%). Together, the three most diverse families (Asteraceae, Lamiaceae, and Fabaceae) accounted for approximately 29% of all recorded species, reflecting both ecological abundance and pharmacological versatility of these families in the warm and arid climate of southern Iran (Fig. 2).

Table 1. The recorded species from Bandar Abbas and Qeshm, including scientific names, families, plant parts used, therapeutic applications, and quantitative indices.

Scientific Name	Family	Local Name(s)	Voucher number	Plant Part Used	Uses	UV	RFC	FL (%)
<i>Blepharis ciliaris</i> (L.) P.L. Burt	Acanthaceae	Jujadu	2768	Leaves, seeds, roots	Diarrhea, boils, hemorrhoids	0.65	0.42	58.3
<i>Avicennia marina</i> (Forssk.) Vierh.	Acanthaceae	Hara	6056	Stem, bark, leaves	Livestock fodder, leprosy treatment, skin diseases	1.76	0.96	90.2
<i>Adiantum capillus-veneris</i> L.	Adiantaceae	Gis-e pari	1546	Leaves, stem	Anti-diabetic, anticonvulsant, analgesic, cholesterol reduction, antifungal	0.82	0.54	62.5
<i>Mesembryanthemum nodiflorum</i> L.	Aizoaceae	Hushlang, Misk, Khayzaran	2687	Leaves, stem	Skin diseases, toothache relief	0.59	0.38	55.2
<i>Aerva javanica</i> (Burm.f.) Juss. ex Schult.	Amaranthaceae	Athak, Porzo	1932	Leaves	Purulent wound treatment	0.48	0.31	50.0
<i>Bienertia cycloptera</i> Bunge	Amaranthaceae	Semsil, Andere	5936	Leaves	Blood lipids and blood sugar regulation	0.71	0.44	60.5
<i>Chenopodium album</i> L.	Amaranthaceae	Gostagh	6093	Leaves	Blood purification, anemia relief, antimicrobial, anti-parasitic	0.75	0.47	63.8
<i>Chenopodium murale</i> L.	Amaranthaceae	Gostagh, Gosteh	6096	Leaves	Constipation relief, laxative, anti-worm	0.68	0.41	57.1
<i>Cornulaca monacantha</i> Delile	Amaranthaceae	Chavon, Kharroneh	5572	Whole plant	Snake/scorpion bites, wounds, insect stings	0.35	0.22	48.6
<i>Haloxylon salicornicum</i> Bunge ex Boiss.	Amaranthaceae	Trat, Zar	5926	Leaves, stem	Fever, wounds, allergies	0.52	0.33	52.3
<i>Salsola baryosma</i> (Schult.) Dandy	Amaranthaceae	Shur, Misk	5903	Whole plant	Diuretic, laxative	0.38	0.24	46.7
<i>Suaeda fruticose</i> Forssk.	Amaranthaceae	Jar, Kakel Maseil	5910	Leaves	Kidney pain relief, skin itching	0.62	0.39	56.8
<i>Mangifera indica</i> L.	Anacardiaceae	Anbe, Amba	H1004	Fruit, kernel, leaves	Stomach pain, colic, diabetes	0.55	0.35	54.2
<i>Pistacia atlantica</i> Desf.	Anacardiaceae	Bene, Gon	1348	Leaves, flowers, gum	Antimicrobial, antibacterial, blood sugar reduction, cholesterol reduction	1.18	0.73	74.2
<i>Pistacia khinjuk</i> Stocks	Anacardiaceae	Kasur, Kasurdang	1523	Leaves, seeds, gum	Antimicrobial, antibacterial, blood sugar reduction, cholesterol reduction	1.05	0.65	68.5
<i>Calotropis procera</i> (Aiton) W.T.Aiton	Apocynaceae	Karag	1444	Leaves, latex	Scorpion/snake bites, bloody diarrhea, wound healing, skin diseases	1.67	0.94	87.5
<i>Nerium oleander</i> L.	Apocynaceae	Gish, Dafla	6563	Leaves, latex	Joint pain, inflammation, scorpion stings (external use only)	0.88	0.56	64.2

<i>Rhazya stricta</i> Decne.	Apocynaceae	Khashbarg, Ivar, Ashurak	4517	Latex, flowers, fruit	Toothache, eye inflammation, sunburn	0.72	0.45	61.8
<i>Caudanthera edulis</i> (Edgew.) Meve & Liede	Apocynaceae	Deghabis, Hotak	2089	Fruit	Blood sugar reduction, blood lipid reduction, anti-asthma, anti-diarrheal	0.85	0.52	63.5
<i>Apteranthes tuberculata</i> (N.E.Br.) Meve & Liede	Apocynaceae	Magh-e Mar, Marangush	2090	Succulent stem	Intestinal parasites	0.45	0.28	49.8
<i>Leptadenia pyrotechnica</i> (Forssk.) Decne.	Apocynaceae	Garishhak, Shahm-e Nar	1997	Stem, latex	Immune system strengthening	0.58	0.36	55.6
<i>Vincetoxicum spirale</i> (Forssk.) D.Z.Li	Apocynaceae	Shahm	2453	Roots, latex, flowers	Wound healing, burns, skin inflammation, bruises	0.62	0.38	57.9
<i>Pergularia tomentosa</i> L.	Apocynaceae	Keshto Zakhm	1995	Leaves	Wound healing	0.41	0.26	47.5
<i>Periploca aphylla</i> Decne.	Apocynaceae	Gishandar	1996	Leaves, flowers, latex	Flatulence relief, carminative, skin inflammation	0.78	0.49	62.1
<i>Tecomella undulata</i> (Sm.) Seem.	Bignoniaceae	Anar-e Abo Jahl	4237	Branches, leaves, flowers	Syphilis, eczema, jaundice, hepatitis	0.65	0.40	56.8
<i>Anchusa azurea</i> Mill.	Boraginaceae	Gavzaban-e Kuhi	H1001	Flowers	Sedative, cholesterol reduction, diuretic, lung/heart tonic	0.72	0.44	60.5
<i>Anchusa strigosa</i> Banks & Sol.	Boraginaceae	Dar-e Azar	39694	Aerial parts	Sedative, cold treatment	0.58	0.35	54.2
<i>Cordia crenata</i> Delile	Boraginaceae	Lim, Chasb	139	Fruit	Blood pressure regulation, blood glucose regulation, skin health, cough/sore throat	0.82	0.50	63.8
<i>Cordia dichotoma</i> G.Forst.	Boraginaceae	Anbo, Puhil, Lampij	5457	Fruit	Not specified	0.25	0.15	35.0
<i>Cordia myxa</i> L.	Boraginaceae	Sepestan	38204	Fruit	Laxative, toothache relief, anti-cough, demulcent	0.55	0.35	65.5
<i>Heliotropium bacciferum</i> Forssk.	Boraginaceae	Dafrak, Mis-e Pareh	5841	Aerial parts	Fever reduction, anti-diabetic, antimicrobial	0.62	0.38	57.1
<i>Heliotropium europaeum</i> L.	Boraginaceae	Kalhemo, Balghando	5971	Leaves, branches, flowers	Kidney stone removal, muscle pain reduction	0.55	0.34	53.5
<i>Trichodesma africanum</i> (L.) Sm.	Boraginaceae	Charmahang	3973	Leaves, roots	Joint pain relief	0.48	0.30	50.0
<i>Moltkiopsis ciliata</i> (Forssk.) I.M.Johnst.	Boraginaceae	Shen-e Sangdaneh	37995	Aerial parts	Livestock fodder	0.32	0.20	42.5
<i>Capparis spinosa</i> var. <i>mucronifolia</i> (Boiss.) Hedge & Lamond	Capparaceae	Kurzeh	6084	Fruit	Joint pain, knee pain, wound healing	0.38	0.24	46.7
<i>Capparis cartilaginea</i> Decne	Capparaceae	Kurzeh-e Barg-e Pahn	2025	Leaves, fruit	Joint pain, knee pain, wound healing	0.45	0.28	49.8
<i>Capparis spinosa</i> L.	Capparaceae	Leh, Dahak	2249	Fruit, seeds	Diuretic, antihypertensive, anti-diabetic, gout/ rheumatism	0.28	0.18	38.5

<i>Cleome brachycarpa</i> Vah Ex DC.	Capparaceae	Rozgardesh, Belpa, Golzi	3071	Whole plant	Inflammation regulation, rheumatic pain, chest infections, eczema	0.55	0.35	54.2
<i>Acanthophyllum squarrosum</i> Boiss.	Caryophyllaceae	Azarbo	39200	Leaves, flowers	Emmenagogue, kidney stone removal, wound healing	0.48	0.31	50.0
<i>Acanthophyllum bracteatum</i> Boiss.	Caryophyllaceae	Ashnun	39699	Roots	Anti-inflammatory, sciatica treatment	0.42	0.27	47.5
<i>Sphaerocoma hookeri</i> subsp. <i>aucheri</i> (Boiss.) Kool & Thulin	Caryophyllaceae	Darehneh	1246	Aerial parts	Livestock fodder	0.25	0.16	36.8
<i>Terminalia catappa</i> L.	Combretaceae	Gar-e Zangi	39549	Fruit, kernel	Intestinal disorders, dyspepsia, abdominal pain	0.52	0.33	52.3
<i>Achillea eriophora</i> DC.	Asteraceae	Bonjarash, Sar-zard	499	Leaves, flowers	Antipyretic, blood pressure reduction, cold/rhinitis	0.78	0.48	62.5
<i>Achillea wilhelmsii</i> K.Koch	Asteraceae	Sar-zard	6430	Leaves, flowers	Skin problems (acne, eczema, warts), anti-inflammatory	0.72	0.45	60.5
<i>Artemisia aucheri</i> Boiss.	Asteraceae	Darim-e Kuhi	6757	Leaves	Sleep improvement, digestive regulation, heart rhythm	0.65	0.41	58.3
<i>Artemisia scoparia</i> Waldst. & Kit.	Asteraceae	Selbeko, Mulang	5431	Leaves, stem	Fever, malaria	0.55	0.35	54.2
<i>Artemisia sieberi</i> Besser	Asteraceae	Darim	6043	Leaves, flowers	Appetite stimulant, infected wounds, boils, acne	1.02	0.64	66.7
<i>Carthamus oxyacanthus</i> M.Bieb.	Asteraceae	Hask, Ask-e Bash	6412	Leaves	Kidney pain	0.45	0.29	49.8
<i>Centaurea bruguierana</i> (DC.) Hand.-Mazz	Asteraceae	Baleh Bard, Badavard	4104	Leaves, flowers	Anti-cough, anti-jaundice, antipyretic, cholagogue	0.52	0.34	52.3
<i>Cichorium intybus</i> L.	Asteraceae	Kashni, Kasni	1211	Leaves, flowers	Liver disorders, gall bladder function, palpitations	1.35	0.79	76.1
<i>Erigeron canadensis</i> L.	Asteraceae	-	1816	Aerial parts	Hemostatic, astringent, diarrhea	0.38	0.24	46.7
<i>Eruca sativa</i> Mill.	Asteraceae	Kahkz	4642	Whole plant	Immune system strengthening, eye/heart/bone health	0.62	0.40	57.1
<i>Echinops aucheri</i> Boiss.	Asteraceae	Shekar-e Kuh	39411	Aerial parts	Cold, laxative	0.32	0.20	42.5
<i>Pulicaria undulata</i> (L.) C.A.Mey.	Asteraceae	Parz, Tehreh	385	Leaves	Suppository for hemorrhoids	0.35	0.22	45.8
<i>Iphiona aucheri</i> (Boiss.) Anderb.	Asteraceae	Halamuk, Kelmoru	6035	Leaves	Snakebite treatment	0.38	0.24	47.5
<i>Launaea procumbens</i> (Roxb.) Ramayya & Rajagopal	Asteraceae	Ben-e Maghi, Nuneko	3525	Leaves	Skin health and rejuvenation	0.22	0.14	33.3
<i>Launaea nudicaulis</i> (L.) Hook.f.	Asteraceae	Talkhak	1222	Leaves	Wound healing, digestive and respiratory problems	0.20	0.12	30.0
<i>Matricaria chamomilla</i> L.	Asteraceae	Babuneh, Babunk	3526	Flowers	Internal/external inflammation reduction, muscle pain	1.44	0.84	80.3

<i>Pulicaria glaucescens</i> (Boiss.) Jaub. & Spach	Asteraceae	Mangeri, Mangero	39281	Leaves	Wound healing, abdominal pain	0.45	0.28	49.8
<i>Pseudopodospermum papposum</i> (DC.) Zaika, Sukhor. & N.Kilian	Asteraceae	Kombalu	6856	Tuber	Laxative, anti-inflammatory, anti-diabetic	0.52	0.33	52.3
<i>Convolvulus leptocladus</i> Boiss.	Convolvulaceae	Kalatu	4211	Roots	Constipation, asthma	0.48	0.30	50.0
<i>Convolvulus spinosus</i> Burm.f.	Convolvulaceae	-	4268	Whole plant	Decongestant, skin protection, intestinal cleansing	0.42	0.26	47.5
<i>Cressa cretica</i> L.	Convolvulaceae	Sourgho	1971	Whole plant	Expectorant, appetite stimulant, anti-constipation, hematopoietic	0.58	0.36	55.6
<i>Cuprella homalocarpa</i> (Fisch. & C.A.Mey.) Salmerón-Sánchez, Mota & Fuertes	Brassicaceae	-	6375	Seeds	Anti-cough, laxative, anti-inflammatory	0.38	0.24	46.7
<i>Anastatica hierochuntica</i> L.	Brassicaceae	Dast-e Sarv	5028	Aerial parts	Jaundice, childbirth facilitation, hemorrhoids, corns	0.55	0.35	54.2
<i>Capsella bursa-pastoris</i> (L.) Medik.	Brassicaceae	Lusero	3804	Fruit	Cholesterol reduction, decongestant, anti-inflammatory, Alzheimer's prevention	0.52	0.33	52.3
<i>Coincya tournefortii</i> Gouan) Alcaraz, T.E.Díaz, Rivas Mart. & Sánchez-Gómez	Brassicaceae	Khardal-e Sahra	38121	Seeds	Antibacterial, digestive improvement, constipation, cough	0.45	0.28	49.8
<i>Citrullus colocynthis</i> (L.) Schrad.	Cucurbitaceae	Khiyar-e Zahrk	5063	Fruit, seeds	Blood sugar reduction, blood lipid reduction, antimicrobial	1.51	0.86	84.9
<i>Juniperus excelsa</i> M.Bieb.	Cupressaceae	Ors, Gaz-e Kuh	1206	Leaves, fruit	Appetite stimulant, anti-parasitic	0.48	0.30	50.0
<i>Ephedra pachyclada</i> Boiss.	Ephedraceae	Tabu, Jaf	1343	Stem, leaves	Toothache, stomach upset, burns	0.42	0.26	47.5
<i>Andrachne aspera</i> Spreng.	Euphorbiaceae	Dar-e Marn	6516	Stem	Eye pain	0.35	0.22	45.8
<i>Euphorbia indica</i> Lam.	Euphorbiaceae	Kayak	6496	Leaves, stem	Diarrhea	0.38	0.24	46.7
<i>Euphorbia larica</i> Boiss.	Euphorbiaceae	Parkh, Shir-e Shirik	6494	Latex	Skin problems, intestinal parasites	0.45	0.28	49.8
<i>Euphorbia osyridea</i> Boiss.	Euphorbiaceae	Rutask	37958	Roots	Constipation	0.32	0.20	42.5
<i>Euphorbia granulata</i> Forssk.	Euphorbiaceae	-	1487	Leaves	Antipyretic, anti-parasitic	0.38	0.24	46.7
<i>Ricinus communis</i> L.	Euphorbiaceae	Marpik, Kento, Mariyeh	1486	Seeds (oil)	Skin massage, arthritis symptoms, constipation, intestinal cleanser	0.72	0.44	60.5

<i>Prosopis cineraria</i> (L.) Druce	Fabaceae	Kahur	1476	Leaves, fruit pulp	Bronchitis, asthma, skin spots, rheumatism, scorpion stings	1.62	0.93	77.2
<i>Senna alexandrina</i> Mill.	Fabaceae	Kosen, Hishi	5982	Leaves	Menstrual cycle regulation, hemorrhoids, intestinal cleansing, liver detoxification	0.95	0.58	65.5
<i>Glaucium flavum</i> Crantz	Fabaceae	Kalatin	37950	Seeds	Diabetes improvement, analgesic, decongestant, anti-cough	0.78	0.48	62.5
<i>Alhagi maurorum</i> Medik.	Fabaceae	Khar-e Shotor, Ador, Aru	6710	Leaves, flowers	Antipyretic, hemostatic, kidney stones, digestive disorders	1.39	0.81	79.7
<i>Astragalus fasciculifolius</i> Boiss.	Fabaceae	Ganjar, Gennis	6553	Gum	Laxative, joint pain, hypertension	0.85	0.52	63.5
<i>Astragalus mucronifolius</i> Boiss.	Fabaceae	Ganjar-e Khari	6253	Roots	Muscle bruises, back pain	0.62	0.38	57.9
<i>Hippocrepis unisiliquosa</i> L.	Fabaceae	-	6250	Aerial parts	Diuretic, kidney health, skin repair	0.55	0.35	54.2
<i>Scorpiurus muricatus</i> L.	Fabaceae	Huvok, Hvarko	6239	Leaves	Laxative, burns, abdominal wounds	0.48	0.30	50.0
<i>Taverniera sparteae</i> DC.	Fabaceae	Lati, Harsh-e Nar	6235	Stems	Bone fracture treatment	0.35	0.22	45.8
<i>Tephrosia persica</i> Boiss.	Fabaceae	Madkink, Balbalango	6228	Leaves	Liver diseases, bloody diarrhea, tetanus	0.28	0.18	38.5
<i>Sophora mollis</i> (Royle ex Benth.) Baker	Fabaceae	Kalkhak, Talkhak	3815	Roots, leaves	Anti-constipation, stomach disorders	0.52	0.33	52.3
<i>Vachellia nilotica</i> (L.) P.J.H.Hurter & Mabb.	Fabaceae	Kart	2705	Wood, fruit	Livestock fodder, timber	0.45	0.28	49.8
<i>Vachellia flava</i> (Forssk.) Kyal. & Boatwr.	Fabaceae	Taj, Chach, Chegard	6499	Leaves	Gingivitis, dental plaque reduction	0.55	0.35	54.2
<i>Albizia lebbeck</i> (L.) Benth.	Fabaceae	Gol-e Abrisham	4431	Flowers	Muscle pain, anthelmintic, blood sugar reduction	0.72	0.44	60.5
<i>Centaurium pulchellum</i> (Sw.) Druce	Gentianaceae	-	6433	Leaves, flowers	Kidney pain, jaundice, scarlet fever	0.48	0.30	50.0
<i>Myriophyllum verticillatum</i> L.	Haloragaceae	-	H1009	Whole plant	Constipation, heart rhythm regulation, lung infections	0.35	0.22	45.8
<i>Gontscharovia popovii</i> (B.Fedtsch. & Gontsch.) Boriss.	Lamiaceae	Oshan-e Ostoku	6061	Leaves	Treatment of fever	0.42	0.26	47.5
<i>Dracocephalum royleanum</i> Benth.	Lamiaceae	Balangu	2011	Seeds	Sedative, anti-anxiety, bloody diarrhea	0.55	0.35	54.2
<i>Lavandula coronopifolia</i> Poir.	Lamiaceae	Ostokhodus	1285	Leaves, flowers, stem	Colic, rhinitis, joint pain	0.78	0.48	62.5

<i>Mentha longifolia</i> (L.) L.	Lamiaceae	Pudan, Padeh	1212	Leaves, roots	Digestive problems	0.45	0.28	49.8
<i>Micromeria persica</i> Boiss.	Lamiaceae	Oshan-e Ostoku	6317	Leaves, flowers	Flatulence, cold, fever, joint pain	0.52	0.33	52.3
<i>Moluccella aucheri</i> (Boiss.) Scheen	Lamiaceae	Mesvak-e Juje Tighi	39273	Roots	Anti-inflammatory, oral/dental diseases, antifungal	0.48	0.30	50.0
<i>Rydingia persica</i> (Burm.f.) Scheen	Lamiaceae	Gol-e Gedar, Gajgar	1937	Flowers, leaves, thorns	Joint pain, constipation, parasites, fever, cough, headache	0.85	0.52	63.5
<i>Salvia aegyptiaca</i> L.	Lamiaceae	Sharbati, Berehi	6314	Seeds	Digestive health, blood sugar reduction	0.65	0.41	58.3
<i>Salvia majdae</i> (Rech.f. & Wendelbo) Sytsma	Lamiaceae	Mur-e Khosh	1952	Leaves	Antimicrobial, anti-inflammatory, anticonvulsant, analgesic	0.72	0.45	60.5
<i>Salvia mirzayanii</i> Rech.f. & Esfand.	Lamiaceae	Mur-e Talkh, Mur-e Porzo	6313	Leaves	Diarrhea, abdominal pain, poisoning, joint pain	1.12	0.75	71.9
<i>Salvia sharifii</i> Rech.f. & Esfand.	Lamiaceae	Boruz, Boruj, Baberiz	6322	Seeds	Wounds, diarrhea, chest pain, body cooling	0.62	0.38	57.9
<i>Stachys inflata</i> Benth.	Lamiaceae	Mur-e Khari	1261	Leaves	Abdominal pain	0.38	0.24	46.7
<i>Teucrium orientale</i> L.	Lamiaceae	Gol-e Mash	2747	Flowers, leaves	Cold, digestive system, diarrhea	0.55	0.35	54.2
<i>Teucrium polium</i> L.	Lamiaceae	Kalpure, Krishk, Kalporgh	1538	Leaves, flowers, seeds	Expectorant, cough, bronchitis, respiratory infections	1.47	0.87	81.1
<i>Teucrium stocksianum</i> Boiss.	Lamiaceae	Krishk-e Azad, Krishk-e Kuhi	1947	Leaves	Menstrual pain relief, antispasmodic	0.58	0.36	55.6
<i>Zataria multiflora</i> Boiss.	Lamiaceae	Oshan	2742	Leaves	Antibacterial, antifungal, gastrointestinal spasms, menstrual spasms	1.08	0.71	68.3
<i>Asphodelus tenuifolius</i> Cav.	Asphodelaceae	Pi-e Mavvok, Mokl	2317	Seeds	Internal wound disinfection, dry cough relief	0.48	0.30	50.0
<i>Abutilon fruticosum</i> Guill. & Perr.	Malvaceae	Garshm	1401	Leaves, flowers, seeds	Lowering blood sugar	0.32	0.20	42.5
<i>Abutilon hirtum</i> (Lam.) Sweet	Malvaceae	Sharbjan	1966	Leaves, flowers, seeds	Anti-inflammatory, anti-diabetic, diuretic and wound healing	0.30	0.18	40.0
<i>Abutilon pannosum</i> (G.Forst.) Schltdl.	Malvaceae	Kharmalchuk	6268	Leaves, flowers, seeds	Treatment of kidney and lung problems	0.28	0.16	38.5
<i>Corchorus trilocularis</i> L.	Malvaceae	Jut	5042	Leaves	Tea and soup thickener	0.35	0.22	45.8

<i>Grewia tenax</i> (Forssk.) Fiori	Malvaceae	Putoru	1566	Stems	Treatment of diarrhea, anemia, fever, jaundice, and swelling	0.25	0.15	35.0
<i>Malva neglecta</i> Wallr.	Malvaceae	Zazagh, Shelki, Tuleh	6271	Seeds, leaves	Digestive/respiratory improvement, antipyretic, anti-cough	1.02	0.67	66.7
<i>Malva parviflora</i> L.	Malvaceae	Zazagh, Shelk	3339	Seeds, leaves	Digestive/respiratory improvement, antipyretic, anti-cough	0.95	0.60	65.2
<i>Cebatha pendula</i> (Forssk.) Kuntze	Menispermaceae	Zamur, Zamer	1088	Roots, vegetative parts	Bloody diarrhea	0.45	0.28	49.8
<i>Ficus carica</i> L.	Moraceae	Anjir	3902	Latex, fruit	Laxative, diarrhea improvement, asthma, blood pressure/cholesterol reduction	1.15	0.69	69.5
<i>Moringa oleifera</i> Lam.	Moringaceae	Gaz-e Rohni	3590	Leaves, bark, roots	Fodder production, surface boils, skin inflammation	0.62	0.38	57.9
<i>Myrtus communis</i> L.	Myrtaceae	Mort, Murd	5701	Leaves	Anti-parasitic, mouth ulcers, herpes, thrush	0.55	0.35	54.2
<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	Jam, Jambu	H1013	Leaves, fruit, kernel	Blood sugar regulation, digestive improvement, cardiovascular health, bone/joint health	0.78	0.48	62.5
<i>Boerhavia diffusa</i> L.	Nyctaginaceae	Shurang	1204	Leaves, flowers, seeds	Insomnia, sedative, headache	0.52	0.33	52.3
<i>Olea europaea</i> subsp. <i>cuspidata</i> (Wall. & G. Don) Cif.	Oleaceae	Zeytun-e Kuhi, Heber	484	Leaves	Blood pressure reduction	0.55	0.35	54.2
<i>Nannorrhops ritchieana</i> (Griff.) Aitch.	Palmae	Daz, Raz	2144	Whole plant	Traditional house construction	0.28	0.18	38.5
<i>Phoenix dactylifera</i> L.	Palmae	Magh	H1005	Leaves, flowers, kernel	Infection control, diabetes prevention, diarrhea, anemia	1.22	0.72	75.4
<i>Fumaria parviflora</i> Lam.	Papaveraceae	Shahtereh	3803	Leaves, stem	Skin diseases	0.48	0.30	50.0
<i>Plantago amplexicaulis</i> Cav.	Plantaginaceae	Lajneh, Siahdaneh	3392	Seeds	Cough, infection	0.52	0.33	52.3
<i>Plantago ovata</i> Forssk.	Plantaginaceae	Tokhm-e Sefid	6104	Seeds	Antipyretic, cholesterol/blood sugar/uric acid reduction, laxative	1.05	0.62	66.0
<i>Plantago arenaria</i> Waldst. & Kit.	Plantaginaceae	Espi-e Hush	1149	Leaves	Antipyretic, cholesterol/blood sugar/uric acid reduction, laxative	0.95	0.58	65.2
<i>Aeluropus lagopoides</i> (L.) Thwaites	Poaceae	Buni	3077	Aerial parts	Livestock fodder	0.25	0.16	36.8

<i>Halopyrum mucronatum</i> (L.) Stapf	Poaceae	Gandomi	3939	Aerial parts	Livestock fodder	0.22	0.14	33.3
<i>Sporobolus ioclados</i> (Trin.) Nees	Poaceae	Bazr-e Andaz	6018	Aerial parts	Livestock fodder	0.20	0.12	30.0
<i>Cenchrus pennisetiformis</i> Hochst. & Steud.	Poaceae	-	5998	Aerial parts	Livestock fodder	0.22	0.14	33.3
<i>Phragmites australis</i> (Cav.) Trin. ex Steud.	Poaceae	Ni	3061	Roots	Anti-inflammatory, digestive strengthening	0.52	0.33	52.3
<i>Arundo donax</i> L.	Poaceae	Karizo	H1021	Leaves	Back pain	0.38	0.24	46.7
<i>Chloris virgata</i> Sw.	Poaceae	-	5466	Leaves	Regulates menstruation, reduces swelling and is a diuretic	0.18	0.10	25.0
<i>Cymbopogon jwarancusa</i> subsp. <i>olivieri</i> (Boiss.) Soó	Poaceae	Naghard, Pasham	6163	Leaves	Strong antibacterial, anti-worm, anti-flatulent	0.62	0.38	57.9
<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Mur	38078	Whole plant	Kidney diseases, gastrointestinal diseases, wound healing	0.72	0.44	60.5
<i>Erodium cicutarium</i> (L.) L'Hér. ex Aiton	Poaceae	Aspandku	3527	Roots	Hemostatic, uterine bleeding, wound washing, typhoid fever	0.55	0.35	54.2
<i>Pteropyrum aucheri</i> Jaub. & Spach	Polygonaceae	Seydaf, Parand	6291	Leaves, flowers, stem, roots	Wound healing, joint pain	0.48	0.30	50.0
<i>Rheum ribes</i> L.	Polygonaceae	Asperk, Rihvok	3589	Roots	Anti-inflammatory, laxative, respiratory facilitation, sore throat	0.65	0.41	58.3
<i>Rumex vesicarius</i> L.	Polygonaceae	Torshak, Hemaz	1026	Fruit	Skin rashes, digestive health	1.02	0.65	70.9
<i>Rumex dentatus</i> L.	Polygonaceae	Nazdulat	2455	Leaves	Stomach disorders, digestion, lipid/blood pressure reduction	0.65	0.40	58.3
<i>Portulaca oleracea</i> L.	Portulacaceae	Khorfeh, Pom-e Park	1893	Seeds, leaves	Bloody diarrhea, constipation, dry cough	0.78	0.48	62.5
<i>Lysimachia arvensis</i> (L.) U.Manns & Anderb.	Primulaceae	Anaghalis	6333	Aerial parts	Vascular decongestant, antivenom for snakebites	0.52	0.33	52.3
<i>Dionysia revoluta</i> Boiss.	Primulaceae	Esfand-e Mohammadi	6337	Aerial parts	Wounds, bruises, abdominal pain, air disinfection	0.48	0.30	50.0
<i>Ochradiscus aucheri</i> (Boiss.) S.Blanco & C.E.Wetzel	Resedaceae	Sham	39367	Branches, fruit	Abdominal pain, neck pain, chest pain	0.42	0.26	47.5
<i>Reseda aucheri</i> Boiss.	Resedaceae	Don-e Ashtru, Dom-e Rubahi	5083	Leaves	Bee/wasp stings, scorpion stings	0.38	0.24	46.7
<i>Ziziphus nummularia</i> (Burm.f.) Wight & Arn.	Rhamnaceae	Ramlik	1480	Leaves, fruit	Stomach ulcers, intestinal inflammation	0.55	0.35	54.2

<i>Ziziphus spina-christi</i> (L.) Desf.	Rhamnaceae	Konar	5044	Roots, leaves, fruit	Wound healing, hair growth promotion, digestive improvement	1.59	0.92	82.1
<i>Rhizophora mucronata</i> Poir.	Rhizophoraceae	Chandl, Kentla	3099	Bark, stem, leaves, roots	Chronic bronchitis, anti-diarrheal	0.62	0.38	57.9
<i>Prunus lycioides</i> (Spach) C.K.Schneid.	Rosaceae	Kutur	872	Leaves, roots	Headache, burns	0.45	0.28	49.8
<i>Prunus scoparia</i> (Spach) C.K.Schneid.	Rosaceae	Alvak	276	Branches, gum, fruit	Dyspnea, headache	0.52	0.33	52.3
<i>Cotoneaster kotschy</i> (Klotzsch) G.Klotz	Rosaceae	Shir-e Khesht	6201	Fruit	Laxative, purgative for febrile patients	0.42	0.26	47.5
<i>Plocama aucheri</i> (Guill.) M.Backlund & Thulin	Rubiaceae	Tusu, Kerts	888	Leaves, branches, flowers	Toothache, joint pain, diarrhea	0.48	0.30	50.0
<i>Haplophyllum tuberculatum</i> (Forssk.) A.Juss.	Rutaceae	Saragna, Ganavak	5955	Leaves, stem, flowers	Headache, earache, joint pain	0.55	0.35	54.2
<i>Populus euphratica</i> Olivier	Salicaceae	Padeh, Bid	39714	Leaves	Fodder production, timber, paper production	0.32	0.20	42.5
<i>Salvadora persica</i> L.	Salvadoraceae	Choj, Rak	2556	Leaves, roots	Antimicrobial, wound healing, anti-cavity, anti-worm, gonorrhea	1.53	0.89	82.9
<i>Dodonaea viscosa</i> Jacq.	Sapindaceae	Shahf, Pateshk	231	Leaves	Cough, influenza, croup, diphtheria, skin rashes	0.58	0.36	55.6
<i>Lycium shawii</i> Roem. & Schult.	Solanaceae	Dehir, Zirk	6463	Branches, leaves, fruit	Hemostatic, antibacterial, cough relief	0.65	0.41	58.3
<i>Solanum incanum</i> L.	Solanaceae	Gol-e Galanjik, Limu-e Turgi	38003	Seeds, fruit	Skin infections, burns, wound healing	0.72	0.44	60.5
<i>Solanum nigrum</i> L.	Solanaceae	Razak, Macham-e Chul	6529	Fruit	Antipyretic, hemostatic, analgesic	0.62	0.38	57.9
<i>Withania somnifera</i> (L.) Dunal	Solanaceae	Kaknej	4187	Fruit	Vascular decongestant	0.48	0.30	50.0
<i>Tamarix mascatensis</i> Bunge	Tamaricaceae	Gazak, Gaz-e Rudkhaneh	38034	Leaves	Joint pain	0.42	0.26	47.5
<i>Daphne mucronata</i> Royle	Thymelaeaceae	Torbat, Zangum	1644	Bark, stem, leaves	Anti-inflammatory, psoriasis, wound healing	0.52	0.33	52.3
<i>Ammi majus</i> L.	Apiaceae	Gol-e Sefid	3541	Seeds	Anti-diabetic, antimicrobial	0.58	0.36	55.6
<i>Lagoecia cuminoides</i> L.	Apiaceae	Zireh-e Vahshi	6660	Seeds	Anticonvulsant, antispasmodic, muscle relaxant	0.52	0.33	52.3
<i>Elwendia persica</i> (Boiss.) Pimenov & Kljuykov	Apiaceae	Zireh	2389	Seeds	Digestive aid, detoxification, blood lipid reduction	0.65	0.41	58.3
<i>Ducrosia anethifolia</i> (DC.) Boiss.	Apiaceae	Milki, Bazpas, Miyil	39638	Leaves, flowers	Anemia, inflammation, flatulence	0.42	0.26	47.5

<i>Ferula assa-foetida</i> L.	Apiaceae	Angrezeh	2928	Leaves, seeds, gum	Anticonvulsant, hoarseness, laryngeal spasm, emmenagogue	0.25	0.15	35.0
<i>Phyla nodiflora</i> (L.) Greene	Verbenaceae	Lujuyi	39702	Aerial parts	Skin inflammation, rashes, itching relief	0.48	0.30	50.0
<i>Vitex agnus-castus</i> L.	Verbenaceae	Bangleh, Bangla	3143	Leaves, branches, fruit	Hemorrhoids, digestive function, menstrual regulation	0.72	0.44	60.5
<i>Zygophyllum bruguieri</i> DC.	Zygophyllaceae	Aru-e Kuhl	6633	Aerial parts, roots	Aphrodisiac, joint inflammation	0.55	0.35	54.2

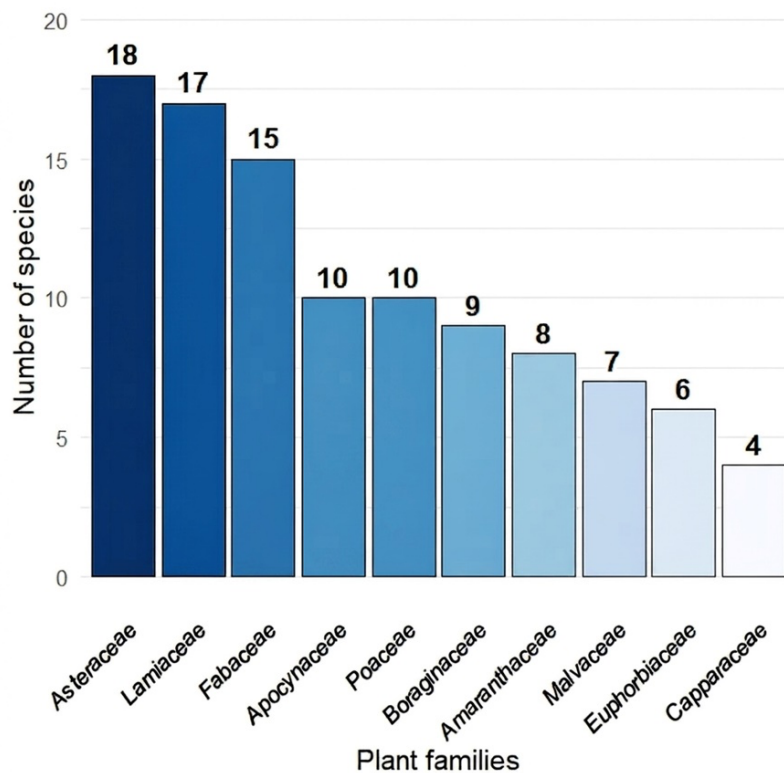


Figure 2. Family distribution of medicinal plant species recorded in Bandar Abbas and Qeshm Island (n = 173 species). Horizontal bars represent the number of species per family. Only families with three or more species are shown; remaining families are grouped as "Other."

Comparison of floristic composition between regions

Comparison of floristic composition between Bandar Abbas and Qeshm Island revealed notable differences. In Bandar Abbas, Asteraceae (16 species), Lamiaceae (16 species), and Fabaceae (11 species) were the most diverse families. In contrast, Qeshm Island exhibited lower overall diversity, with Asteraceae (6 species), Fabaceae (6 species), and Lamiaceae (5 species) being the most represented. A total of 20 families were shared between the two regions, indicating approximately 42% floristic similarity. Eight families were unique to Qeshm Island, while 20 families were exclusive to Bandar Abbas, reflecting the greater habitat heterogeneity of the mainland (from coastal plains to Geno Mountain elevations) compared to the island's more uniform environment (Fig. 3 and 4).

Use Value (UV)

The Use Value index was calculated for all 173 recorded species. The highest UV values were observed for *Avicennia marina* (1.76), *Calotropis procera* (1.67), *Prosopis cineraria* (1.62), *Ziziphus spina-christi* (1.59), *Salvadora persica* (1.53), *Citrullus colocynthis* (1.51), *Teucrium polium* (1.47), *Matricaria chamomilla* (1.44), *Alhagi maurorum* (1.39), and *Cichorium intybus* (1.35) (Fig. 5). These species, predominantly used for gastrointestinal, respiratory, and dermatological disorders alongside nutritional and fodder applications, represent the most versatile and culturally significant plants in the region.

Relative Frequency of Citation (RFC). The Relative Frequency of Citation index was calculated to assess the general recognition and prevalence of each species among the 150 informants. Fig. 6 presents the 20 species with the highest RFC values, ranging from 0.96 to 0.62. Species with RFC > 0.80 were known by more than 120 informants and represent the core of locally recognized medicinal flora: *Avicennia marina* (RFC = 0.96), *Calotropis procera* (RFC = 0.94), *Prosopis cineraria* (RFC = 0.93), *Ziziphus spina-christi* (RFC = 0.92), and *Salvadora persica* (RFC = 0.89). These species are not only widely recognized but also readily available and frequently recommended by herbalists.

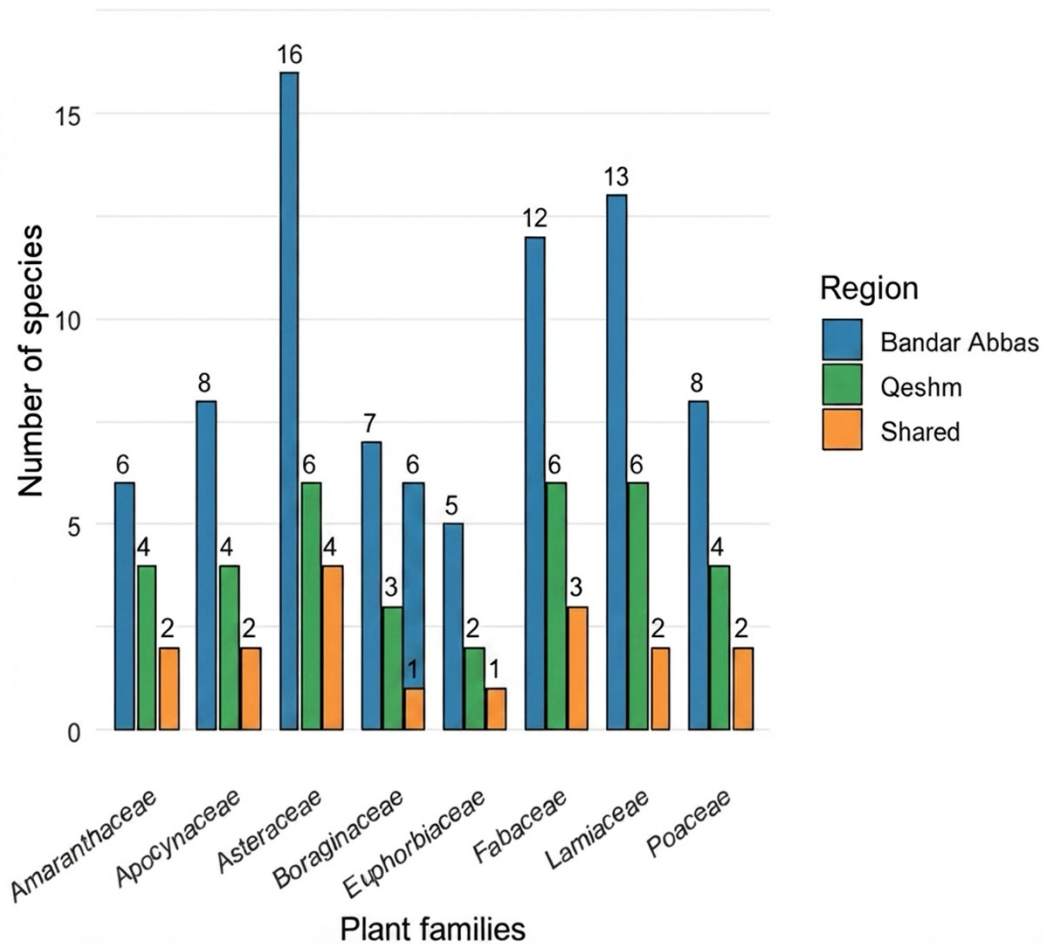


Figure 3. Comparison of the eight most diverse families between Bandar Abbas, Qeshm Island, and shared species. Blue bars represent species recorded in Bandar Abbas, green bars represent species recorded in Qeshm Island, and orange bars represent shared species between the two regions.

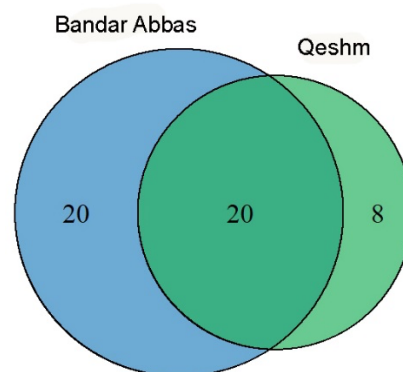


Figure 4. Venn diagram showing shared and unique families between Bandar Abbas and Qeshm Island. Numbers indicate the count of families exclusive to each region or shared between regions. Total families recorded across the study area: 48.

Informant Consensus Factor (ICF)

ICF values ranged from 0.79 to 0.86 across 10 therapeutic categories (Fig. 7). Gastrointestinal (0.86) and dermatological (0.85) disorders showed the highest consensus, followed by respiratory (0.84), renal/urinary (0.84), and endocrine/metabolic (0.82) conditions, indicating well-established remedies for these ailments. Gynecological disorders (0.79) exhibited lower consensus, reflecting greater treatment diversity.

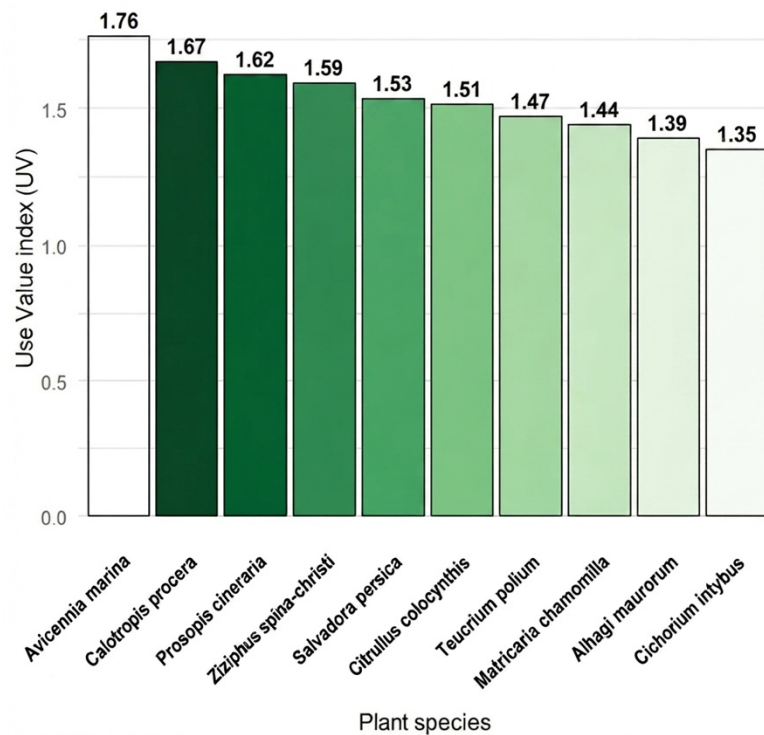


Figure 5. Top 10 plant species with highest Use Value (UV) in the study area. The horizontal axis shows scientific and Persian names; the vertical axis shows UV values. Higher UV values indicate greater versatility and cultural importance.

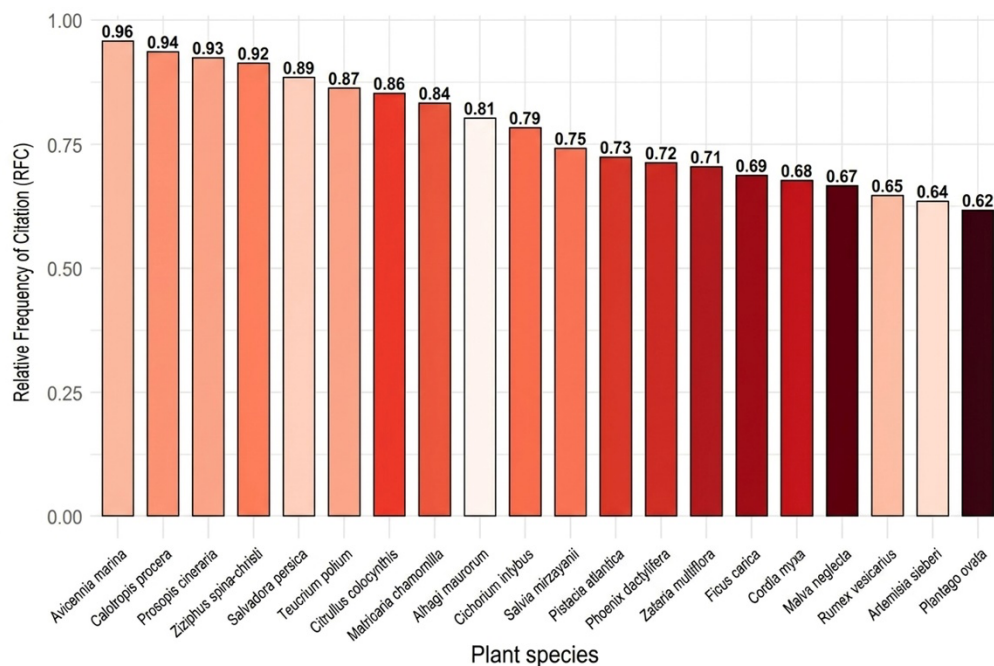


Figure 6. Top 20 plant species with highest Relative Frequency of Citation (RFC) in the study area. The horizontal axis shows scientific and Persian names; the vertical axis shows RFC values. Higher RFC values indicate greater recognition and prevalence within the community.

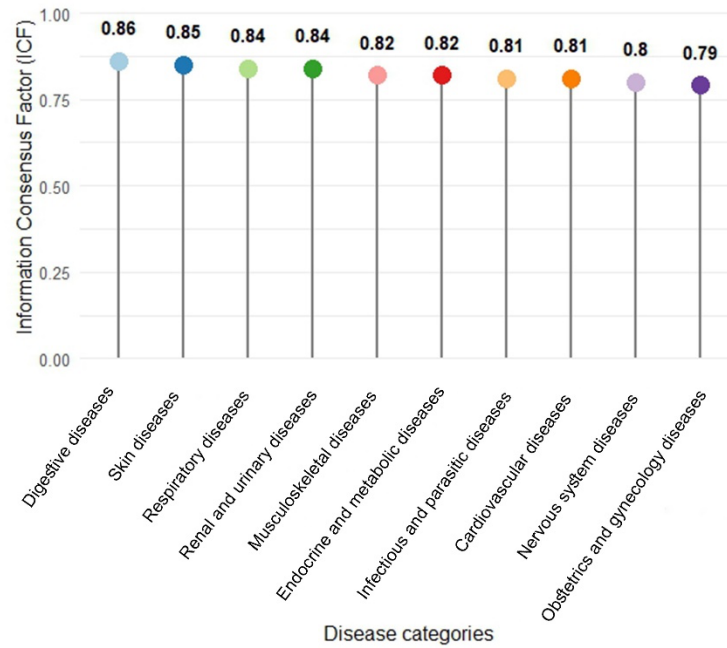


Figure 7. Informant Consensus Factor (ICF) by therapeutic category in the study area. The horizontal axis shows disease categories; the vertical axis shows ICF values. Values approaching 1 indicate high informant consensus.

Fidelity Level (FL)

FL values ranged from 90.2% to 63.5% among the top 20 species (Fig. 8). Highest fidelity was observed for *Avicennia marina* (90.2% for dermatological diseases), *Calotropis procera* (87.5% for scorpion/snake bites), *Citrullus colocynthis* (84.9% for blood sugar reduction), *Salvadora persica* (82.9% for dental health), and *Ziziphus spina-christi* (82.1% for wound healing), indicating strong cultural consensus on specific therapeutic applications.

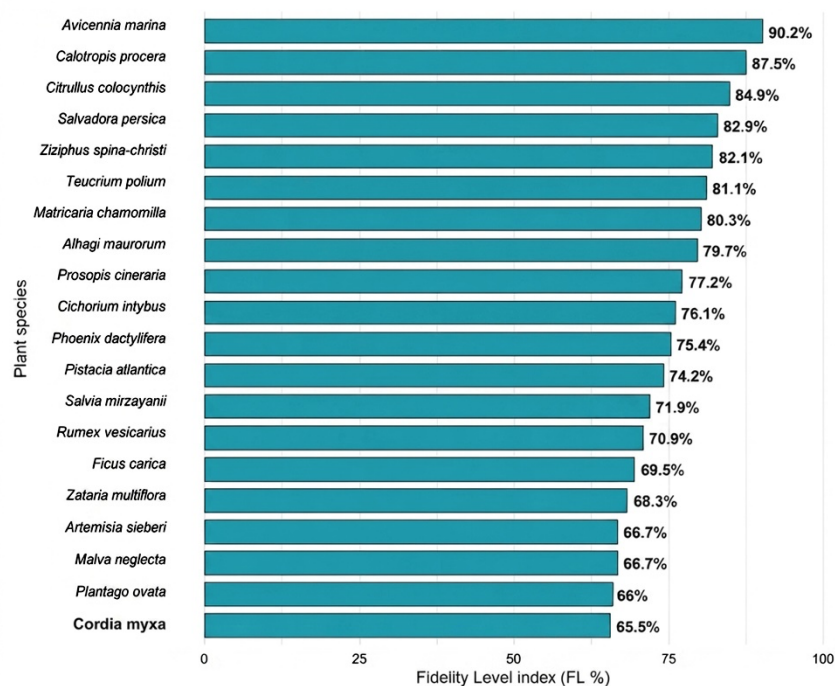


Figure 8. Top 20 plant species with highest Fidelity Level (FL) in the study area. The horizontal axis shows Persian names and target diseases; the vertical axis shows FL percentages. Higher FL values indicate stronger specificity to particular therapeutic applications.

Socio-demographic analysis of ethnobotanical knowledge

Statistical analysis (t-test, ANOVA, Pearson correlation) was performed to examine relationships between socio-demographic factors and ethnobotanical knowledge. Analysis of the average number of plant species known per individual across different demographic groups revealed significant patterns (Fig. 9). Gender: Women demonstrated significantly greater knowledge (mean = 11.2 species) compared to men (mean = 6.8 species, $P < 0.01$), reflecting their central role in household health management and traditional healthcare. Ethnicity: Baloch individuals possessed the highest mean knowledge (13.5 species), followed by Arabs (12.0 species), mixed Persians-Arabs (10.2 species), and Persians (8.5 species). This gradient suggests deeper ecological connections among non-Persian ethnic groups with stronger traditional lifestyles. Age: A direct positive relationship was observed between age and knowledge. Individuals over 70 years recognized a mean of 14.8 species, approximately three times more than the youngest age group (30-50 years) who recognized only 5.2 species. This represents a 65% decline in knowledge across generations and indicates severe intergenerational erosion. Education: An inverse relationship was documented between formal education and ethnobotanical knowledge. Illiterate individuals recognized a mean of 14.1 species, compared to 7.8 species for those with primary education, 5.2 species for secondary education, and 5.0 species for university graduates. This dramatic decline suggests that formal education systems have neither transmitted nor replaced traditional ecological knowledge effectively.

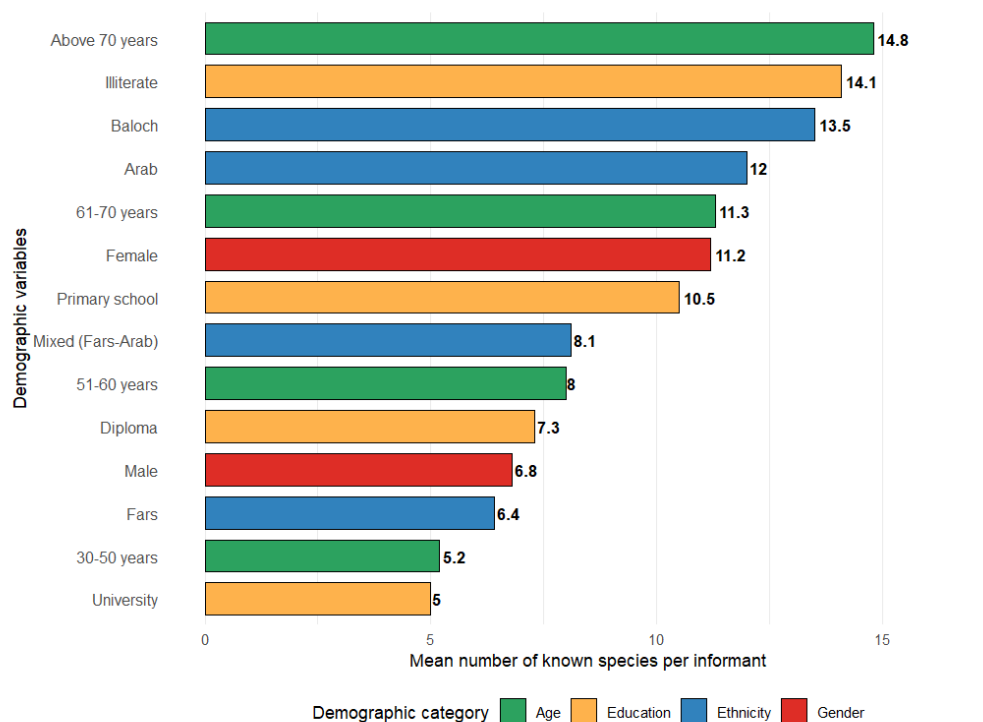


Figure 9. Mean number of plant species known per individual based on demographic factors (gender, ethnicity, age, and education). Data calculated from interviews with 150 informants across Bandar Abbas and Qeshm Island. Numbers at the end of bars represent the exact mean number of species mentioned by each individual in that demographic group. Different colors represent the four main demographic categories. Error bars indicate standard deviation.

Discussion

This study provides quantitative evidence suggesting a notable decline in indigenous plant knowledge across generations in Iran's coastal regions, based on the documentation of 173 plant species across 48 families and the analysis of socio-demographic factors influencing knowledge retention among 150 local informants in Bandar Abbas and Qeshm Island. The findings demonstrate that women, elderly individuals, ethnic minorities (Baloch and Arab), and those with lower formal education possess significantly greater ethnobotanical knowledge, while urbanization, formal education, and modernization have accelerated knowledge loss across generations. These results align with global patterns of traditional ecological knowledge erosion (Reyes-García *et al.* 2013, Vandebroek & Voeks 2019, Berkes 2018) and underscore the urgent need for biocultural conservation strategies in Iran's understudied coastal regions.

The species diversity documented (173 species, 134 genera, 48 families) reflects the rich ethnobotanical heritage of Hormozgan Province, comparable to findings from other Iranian studies (Safa *et al.* 2013, Hosseini *et al.* 2026). The predominance of Asteraceae (18 species), Lamiaceae (17 species), and Fabaceae (15 species) mirrors patterns observed across Iran and the broader Middle East (Ghorbani 2005, Mosaddegh *et al.* 2012, Amiri & Joharchi 2013, Motahhari *et al.* 2022, Jalali *et al.* 2026). The highest Use Values for *Avicennia marina* (1.76), *Calotropis procera* (1.67), and *Prosopis cineraria* (1.62) reflect their multifaceted roles in local livelihoods, extending beyond medicinal applications to include fuel, fodder, and artisanal uses (Garibaldi & Turner 2004). Similarly, *Phoenix dactylifera* (UV = 1.22) represents a quintessential cultural keystone species across the Persian Gulf region (Al-Alawi *et al.* 2017, Ghahremaninejad *et al.* 2026). The high ICF values for gastrointestinal (0.86) and dermatological (0.85) disorders align with findings from across Iran and neighboring countries (Hosseini *et al.* 2026, Alshaqhaa *et al.* 2025, Ullah *et al.* 2020).

The most striking finding is severe intergenerational knowledge erosion, with individuals over 70 years recognizing a mean of 14.8 species compared to only 5.2 species among the youngest age group (30-50 years), representing a 65% decline within approximately two generations. This pattern mirrors global trends (Reyes-García *et al.* 2013, Panyadee *et al.* 2023, Vandebroek & Voeks 2019). The inverse relationship between formal education and plant knowledge (14.1 species among illiterate individuals vs. 5.0 among university graduates) suggests that the Iranian educational system has neither transmitted traditional ecological knowledge nor effectively replaced it (Berkes 2018). Greater knowledge among women (11.2 vs. 6.8 species, $P < 0.01$) reflects their central role in household healthcare, consistent with patterns observed globally (Quave & Pieroni 2015). Significant differences between ethnic groups (Baloch: 13.5 species, Arabs: 12.0, Persians: 8.5) reveal that knowledge retention correlates with proximity to traditional livelihoods and cultural continuity. Comparison of Bandar Abbas and Qeshm Island reveals that urbanization has accelerated knowledge erosion in the urban context, supporting the hypothesis that modernization disrupts traditional knowledge systems (Berkes 2018, Vandebroek & Voeks 2019). The spatial availability of plant resources, as highlighted by Nazari and Bussmann (2026), likely contributes to this difference.

High FL values for *Avicennia marina* (90.2% for dermatological diseases), *Calotropis procera* (87.5% for scorpion/snake bites), and *Citrullus colocynthis* (84.9% for blood sugar reduction) indicate strong cultural consensus and suggest potentially efficacious remedies worthy of pharmacological investigation (Friedman *et al.* 1986, Heinrich *et al.* 1998, Newman & Cragg 2020). The findings have significant implications for biocultural conservation in Iran. The documented erosion, combined with the cultural and economic importance of key species, underscores the urgent need for integrated conservation strategies (Berkes 2018, Gavin *et al.* 2015). Participatory documentation programs, integration of traditional knowledge into school curricula, community empowerment, and sustainable economic development through eco-tourism and herbal products offer promising pathways (Cunningham 2001, Hamilton 2004).

Limitations include the cross-sectional design, focus on two regions, reliance on informant recall, and lack of phytochemical validation. Future research integrating ethnobotanical documentation with phytochemical screening, longitudinal monitoring of knowledge transmission, and comparative studies across ethnic groups could further illuminate these patterns and inform sustainable management strategies (Newman & Cragg 2020, Maffi & Woodley 2010). In conclusion, this study documents the rich ethnobotanical heritage of coastal Iran while providing alarming evidence of intergenerational knowledge erosion. Urgent biocultural conservation strategies are essential to safeguard this invaluable heritage for future generations and preserve the potential for future pharmaceutical discoveries embedded within this ancient knowledge system.

Conclusion

This study provides the first comprehensive quantitative ethnobotanical assessment of Iran's understudied coastal region, documenting 173 plant species from 48 families used by 150 informants in Bandar Abbas and Qeshm Island. The findings confirm severe intergenerational knowledge erosion, with a 65% decline in species knowledge between individuals over 70 years (14.8 species) and those aged 30–50 years (5.2 species), alongside significantly greater knowledge among women, the elderly, Baloch and Arab ethnic groups, and individuals with no formal education. High consensus for gastrointestinal (ICF=0.86) and dermatological (ICF=0.85) disorders, and strong fidelity for *Avicennia marina* (FL=90.2%), *Calotropis procera* (FL=87.5%), and *Citrullus colocynthis* (FL=84.9%), identify culturally validated remedies meriting pharmacological investigation. Urbanization, modernization, and formal education emerge as principal drivers of knowledge loss, rendering Hormozgan a priority area for urgent biocultural conservation. We recommend participatory documentation, integration of traditional knowledge into formal education, community empowerment, and sustainable economic valorization through eco-tourism and certified herbal products. Without immediate, community-centered action, this invaluable heritage—and the pharmaceutical potential embedded within it—may be lost entirely within the coming decades.

Declarations

List of abbreviations: UV: Use Value, RFC: Relative Frequency of Citation, ICF: Informant Consensus Factor, FL: Fidelity Level, ANOVA: Analysis of Variance, WFO: World Flora Online, IPNI: International Plant Names Index.

Ethics approval and consent to participate: Prior informed oral consent was obtained from all participants before conducting the interviews. The objectives of the study, data usage, and confidentiality of personal information were clearly explained to all informants, and their right to withdraw at any stage was guaranteed.

Consent for publication: Not applicable.

Availability of data and materials: All data generated or analyzed during this study are included within this published article (and its supplementary material/tables). Plant voucher specimens are deposited in the Herbarium of the Agricultural Research Center of Hormozgan Province.

Competing interests: The authors declare that they have no competing interests.

Funding: This research received no specific grant or funding from any funding agency in the public, commercial, or not-for-profit sectors.

Author contributions: RH conducted all field data collection, participant interviews, and botanical sample collection. GBK conceived and planned the study and provided scientific guidance throughout the research. Both authors contributed equally to the statistical analysis, data interpretation, and manuscript writing and editing. Both authors read and approved the final manuscript.

Acknowledgements

The authors express their sincere gratitude to Dr. Hamid Nazari from the Department of Biology, Bu-Ali Sina University, Hamedan, Iran, and Prof. Dr. Rainer W. Bussmann, head of the Botany and Mycology Department at the State Museum of Natural History in Karlsruhe, Germany, for their valuable advice, consultation, and scholarly guidance throughout this study. We also extend our heartfelt thanks to all local participants, key informants, traditional healers, and community elders in Bandar Abbas and Qeshm Island who generously shared their invaluable traditional knowledge. Special thanks are also due to Dr. Mohammad Amin Soltani and the staff of the Agricultural Research Center of Hormozgan Province for their support in plant specimen preservation and identification.

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